

SyntriX AHF™

480V TECHNICAL REFERENCE MANUAL



MTE LLC

SAFETY INSTRUCTIONS

Thank you for choosing SyntriX Active Harmonic Filter (AHF) module. Please read the safety instructions carefully before using them and ensure that the unit is operated according to the instructions in this manual. The safety instructions contain important information, which ensure that you can safely and properly use the product and prevent personal injury or property damage. Please keep this manual accessible near the unit so that users can easily reference this information.

This manual uses the following illustrations and symbols to highlight important safety information. Please ensure that you are very familiar with these procedures and follow these instructions carefully.



DANGER

Failure to comply with the instructions or improper operation may cause serious electric injury and can be fatal.



WARNING

Failure to comply with the instructions or improper operation may cause wound.



CAUTION

Failure to comply with the instructions or improper operation may cause personal injury and/or damage to the equipment.

SAFETY PRECAUTIONS



DANGER

Do not expose it to where rain or moisture is heavy, and keep it away from combustible liquid, gas or explosive.



DANGER

To avoid high voltage risks, the discharge time of DC capacitors should be above 4 hours. Make sure the operation is performed after full discharge.



WARNING

Installation must be done by well-trained and qualified personnel in a controllable environment.



WARNING

Any maintenance work must be carried out by qualified technical personnel; all power must be cut off before maintenance.



Reserve enough space around the equipment, to maintain good ventilation and easy access for maintenance and operation.



CAUTION

Read the user manual carefully before connecting the power and keep it easily accessible for future reference.

WIRING PRECAUTIONS

WARNING



This single AHF has a leakage current from 150mA to 1000mA. Before connecting the power supply, the user must make sure the equipment is properly grounded.

When choosing RCCB or RCD equipment, the leakage current of the module should be considered.

The RCCB chosen should not be sensitive to the unidirectional DC pulse (Class A) and the transient pulse.

Please note that the leakage current of the load will also flow through RCCB or RCD; the grounding of the device must meet the local electrical regulations



WARNING

Compensation capacity and current-carrying capacity must be taken into full consideration for wiring.



CAUTION

The cables connected to the power terminals must be connected to a circuit breaker or other protective devices and the capacity of protective devices should match the capacity of Active Harmonic Filter.

PRECAUTIONS FOR USE



CAUTION

The AHF is used to mitigate power harmonics, improve power factors, and compensate three-phase unbalance. The capacity of AHF should be selected in accordance with harmonic content.



The AHF must be used with external current transformers.



CAUTION

To ensure AHF has good reliability and to avoid overheating, do not block or cover the air inlet/outlet.



CAUTION

No corrosive gas and conductive dust is allowed in the working environment.



CAUTION

The working temperature should be -10 $^{\circ}$ C and 40 $^{\circ}$ C. AHF may derate if beyond this range;

STORAGE PRECAUTIONS



CAUTION

Seal AHF with its original packing materials in case of damage caused by rat invasion.



CAUTION



CAUTION

Improper storage conditions, such as humidity, will cause moisture and mildew on PCB and other components; halogen gas will corrode electrolytic capacitors; sulfur-containing gas will corrode copper and other semiconductors and resistance components;



CAUTION

If the module is not used for > 3 months, it should not be opened (sealed bag) or should be resealed with a sealed bag after opening; the temperature for long-term storage should not exceed 40 °C.



After 1-3 years of storage in a sealed environment with a temperature not exceeding 40 $^{\circ}$ C, the first time you turn on the power without turning it on, keep it on for more than 1 hour to activate the internal electrolytic capacitor.

CAUTION



If the module is not sealed, depending on the harsh environment (humidity, temperature, halogen, sulfur, ammonia, salt spray), more than 3 months, the internal components of the module have been corroded or mildewed or damp, when the module is powered on, the risk of damaging the module(s).

Note: the module itself cannot work in halogen, sulfur, ammonia, and heavy salt spray environments, such as seaside, chemical plants, conductive dust, etc..



CAUTION

Normal temperature (such as normal indoor environment, temperature < 40 $^{\circ}$ C, humidity < 70%), more than 6 months to 1 year, according to the first power-on method;



CAUTION

High temperature, humidity is not too high ($40\sim70$ °C, such as arid desert areas), PCB is not moldy, etc. After more than 3 months, power up the unit like an initial power up.



CAUTION

If the humidity is high for a short period of time (1~2 weeks), check that there is no mildew, and that the PCBs are dry.



CAUTION

Unsealed storage creates a high risk of severe module damage.

PRE-INSTALLATION NOTICE



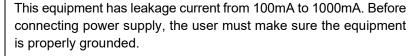
CAUTION

The installation, assembly and power on of the module must be operated by qualified personnel or supervised by qualified personnel on-site.



CAUTION

Before wiring or connecting terminals, as a precaution, make sure that the input of the SyntriX AHF has been turned off to avoid accidents.





When choosing RCCB or RCD equipment, the leakage current of the module should be considered.

The RCCB chosen should not be sensitive to the unidirectional DC pulse (Class A) and the transient pulse.

Please note that the leakage current of the load will also flow through RCCB or RCD; the grounding of the device must meet National Electrical Code (NEC) or other local regulations



CAUTION

MTE SyntriX AHF should be installed in a clean, well-ventilated indoor environment.

ENVIRONMENT REQUIREMENTS

Before proceeding, it is important to take note of the preconditions required for the environment.

ATTENTION

For rack mount units, cold air enters AHF through the front of the module and hot air is discharged through the rear grid of the module.



For wall mount units cold air enters through the bottom of the module and hot air is discharged through the top of the module.

Do not block the ventilation holes on either side and clean the front side every 3 months to prevent blockage by dust.



ATTENTION

The ambient temperature at the time of installation must be -10 $^{\circ}$ C \sim 40 $^{\circ}$ C, or derate.



ATTENTION

Ensure that there is no dust or corrosive/explosive gases in the installation environment.



ATTENTION

The AHF MUST NOT be installed in an environment with strong magnetic fields, nuclear radiation or high-power RF noise.



ATTENTION

The relative humidity in the environment should be lower than 95%. The presence of steam or condensation may result in permanent damage to the device or endanger personal safety.



ATTENTION

The installation altitude should be lower than 1500m. If it is over 1500m, the equipment must be derated 1% per 100m increase in altitude.



ATTENTION

Avoid severe physical shock, violent impact and large angle tilting in the installation process as this may cause damage and operational failure of the unit.



ATTENTION

During installation, leave sufficient operating space for cooling, maintenance and operation.

Warranty

The warranty period for all SyntriX AHF™ active harmonic filter units is the shorter of:

Twenty-four (24) months from the date of shipment from MTE

Note: Current transformers (CTs) are not covered under the SyntriX AHF™ warranty. For additional information on warranty terms, reference MTE Terms & Conditions of Sale.

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UNDERSTANDING THE SYNTRIX PART NUMBER

MTE has launched a simplified product naming system to streamline the ordering process for customers due to the wide variety of products we offer.

For example: MTE SyntriX AHF 100 represents the MTE SyntriX AHF series, with a module capacity of 100A. It is suitable for use in 480V three-phase four-wire low-voltage systems. The module is a wall- mounted type with a 4.3-inch Human-Machine Interface screen.

** Contact MTE for support if adjustment is needed

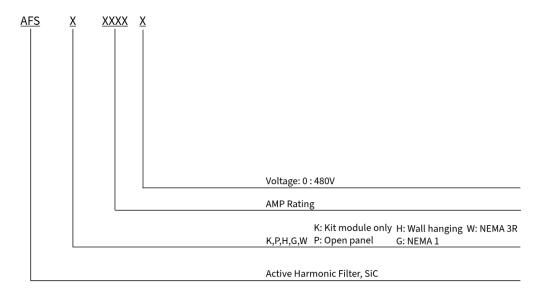


Figure 3 Product Naming Introduction

The detailed MTE available product list please check the table below:

Table 1 Available MTE SyntriX AHF

| AHF Capacity | System Wiring | Installation Type | Nominal Voltage | |
|--------------|---------------|-----------------------|-----------------|--|
| FOA | 3P3W | Wall mounted with LCD | 480V | |
| 50A | | Rack mounted with LED | | |
| | | Wall mounted with LCD | 400)/ | |
| 75A | 3P3W | Rack mounted with LED | 480V | |
| 4004 | 3P3W | Wall mounted with LCD | 400)/ | |
| 100A | | Rack mounted with LED | 480V | |
| 1504 | 25011 | Wall mounted with LCD | 490)/ | |
| 150A | 3P3W | Rack mounted with LED | 480V | |

L Products are certified to UL-61800-5-1 via NRTL Intertek (ETL)

CHAPER I PRODUCT DESCRIPTION

1.1 Product Introduction

MTE SyntriX AHF supports compensating harmonics, reactive power, and three-phase unbalancing.

1.1.1 HARMONIC MITIGATION

Active Harmonic Filter with harmonic compensation function is designed to mitigate unwanted harmonics in electrical systems. It detects and cancels out harmonics in real-time, improving power quality and minimizing equipment damage. It is commonly used in industrial and commercial applications to comply with standards and enhance system performance.

1.1.2 POWER FACTOR CORRECTION

Active Harmonic Filter with power factor correction function are designed to improve power factor in electrical systems. Power factor is a measure of how efficiently electrical power is being utilized. A low power factor can result in increased energy losses, reduced system efficiency, and additional costs.

Active Harmonic Filter with power factor compensation work by actively detecting the power factor and injecting or absorbing reactive power as needed to bring the power factor closer to unity (1.0). By doing so, they help avoid users avoid the penalty, optimize power usage, reduce energy wastage, and enhance system performance.

1.1.3 THREE-PHASE UNBALANCING COMPENSATION

MTE SyntriX AHF compensates three-phase unbalancing by balancing the load across all three phases. This helps to improve the efficiency of the system, prevent overloading, and reduce voltage fluctuations, ensuring stable and reliable operation of the electrical equipment.

1.2 PRODUCT FEATURES

Modular Design: MTE SyntriX AHF has a modular design, allowing easy installation and future expansion. Additional modules can be added to create a bigger compensation system.

High Adaptability: Suitable for the site with poor and unstable power supply, wide operation voltage range, operation voltage upper limit is up to 480V, and lower limit is 228V (For 400V module).

High Performance: MTE SyntriX AHF has a high level of accuracy, with a compensation rate of up to 97%, ensuring that harmonic currents are effectively eliminated.

Advanced Algorithm: MTE SyntriX AHF can perform self-learning of system impedance, preventing system from resonance.

User-friendly Interface: MTE SyntriX AHF features a user-friendly interface that allows users to easily set parameters and monitor the performance of the system.

Compact Size: MTE SyntriX AHF extreme compact size allows for easy installation and saves on valuable space in electrical rooms.

THVD Compensation: MTE SyntriX AHF has unique No-CT technology to compensate THVD less than 3%.

Auto Fine-Tuning: The automatic fine-tuning automatically adjusts THID<5% and the whole process can be completed within half minute.

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1.3 WORKING PRINCIPLE

MTE SyntriX AHF is a device that is used to eliminate harmonic current generated in electrical systems.

The working principle of MTE SyntriX AHF involves the use of an external Current Transformer (CT) to detect the load current. The detected current is then processed by a Digital Signal Processor (DSP), which identifies whether the load current has any harmonic components or not.

If harmonic current is detected, the DSP calculates the harmonic content and sends a signal to the SiC Mosfet to generate compensating current. The compensating current has the same magnitude as the harmonic current but flows in the opposite direction, thereby canceling out the harmonic current. This process helps to ensure that the electrical system operates within acceptable limits and reduces the risk of damage to equipment caused by harmonic distortion.

MTE SyntriX AHF works by using advanced signal processing techniques to identify and eliminate harmonic current in electrical systems, which helps to ensure the smooth operation of electrical equipment and improves the overall efficiency of electrical systems.

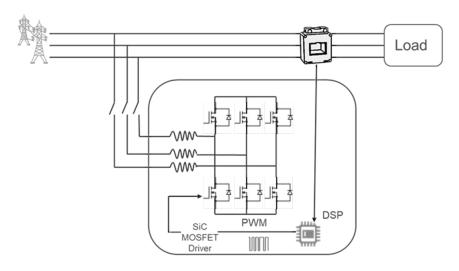


Figure 1-1 MTE SyntriX AHF operation principle

1.4 PRODUCT DETAILS

PRODUCT DRAWINGS

MTE Active Harmonic Filter is divided into two types according to installation method. One is wall mounted type, which can be hung on the wall. The other is an open panel mounted type and can be installed in a cabinet. Please consult MTE product engineer for details of the cabinet.

Please refer to Fig. 1-6 for the appearance and size of SyntriX AHF 480V 150A rack-style type.

Note: MTE SyntriX AHF series, the standard wall mount comes with an integrated HMI, the standard rack mount is with LED lights.

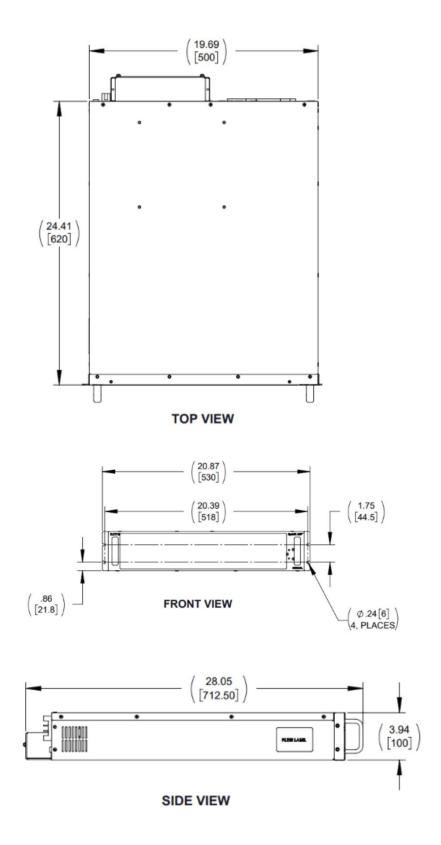


Figure 1-6 MTE SyntriX AHF 480V 150A rack-style

1.4.1 WIRING TERMINAL

The wiring terminal is located at the rear side of the module, including the power terminal, CT terminal and communication terminal.

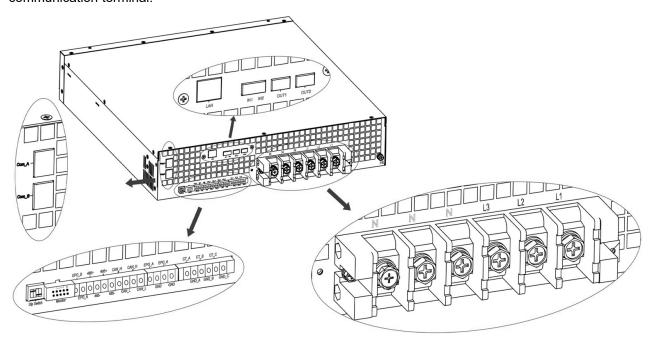


Figure 1-6 MTE SyntriX AHF Terminal

Table 1-1 MTE SyntriX AHF Terminal Definition

| | COM_A | 422 communication port used for multiple module parallel | | |
|-----------------|------------|--|--|--|
| | COM_B | 422 communication port used for multiple module paraller | | |
| | Dip Switch | Communication address setting | | |
| | Monitor | 7-inch HMI connecting port | | |
| | EPO_B | EDO button connecting part | | |
| | EPO_A | EPO button connecting port | | |
| Cignal tarminal | 485+ | | | |
| Signal terminal | 485- | 485 communication port used for communication between | | |
| | 485+ | module | | |
| | 485- | | | |
| | CAN_H | | | |
| | CAN_L | CAN communication port used when SVGD or 422 | | |
| | CAN_H | communication is needed | | |
| | CAN_L | | | |

| | EPO_A | | | |
|----------------|-----------------|---|--|--|
| | GND | | | |
| | EPO_A | To parallel the EPO signal of each module | | |
| | GND | | | |
| | CT_A | Connected to S1 of phase L1 CT | | |
| | GND_A | Connected to S2 of phase L1 CT | | |
| | CT_B | Connected to S1 of phase L2 CT | | |
| | GND_B | Connected to S2 of phase L2 CT | | |
| | CT_C | Connected to S1 of phase L3 CT | | |
| | GND_C | Connected to S2 of phase L3 CT | | |
| | LAN (optional) | | | |
| | IN1 (optional) | Dry contact heard terminals (antional) including 1 Etherns | | |
| | IN2 (optional) | Dry contact board terminals (optional), including 1 Ethernet port, 2 input dry contact and 2 output dry contacts, the detailed introduction places refer to Appendix III. | | |
| | OUT1 (optional) | introduction please refer to Appendix III. | | |
| | OUT2 (optional) | | | |
| | N | | | |
| | N | | | |
| | N | Power cable connection | | |
| Power terminal | L3 | | | |
| | L2 | | | |
| | L1 | | | |
| | PE | The grounding terminal of a device is an important component that ensures electrical safety. | | |

CHAPTER II INSTALLATION AND WIRING

2.1 Pre-Installation Notice



CAUTION

The installation, assembly and power on of the module must be operated by qualified personnel or supervised by qualified personnel on-site.



CAUTION

Before wiring or connecting terminals, make sure that the input of the SyntriX AHF has been turned off to avoid accidents.

CAUTION



This equipment has leakage current from 100mA to 1000mA. Before connecting power supply, the user must make sure the equipment is properly grounded.

When choosing RCCB or RCD equipment, the leakage current of the module should be considered.

The RCCB chosen should not be sensitive to the unidirectional DC pulse (Class A) and the transient pulse.

Please note that the leakage current of the load will also flow through RCCB or RCD; the grounding of the device must meet the local electrical regulations



CAUTION

MTE SyntriX AHF should be installed in a clean, well-ventilated indoor environment.

2.2 ENVIRONMENT REQUIREMENTS



ATTENTION

The cold air enters AHF through the front grid of the module and hot air is discharged through the rear grid of the module. Do not block the ventilation holes on either side and clean the front side every 3 months to prevent blockage by dust.

Before proceeding, it is important to take note of the preconditions required for the environment.



ATTENTION

The ambient temperature at the time of installation must be -10 $^{\circ}$ C ~40 $^{\circ}$ C.



ATTENTION

Ensure that there is no dust (can be conductive) or corrosive/explosive gases in the installation environment.



ATTENTION

The AHF MUST NOT be installed in an environment with strong magnetic fields, nuclear radiation or high-power RF noise.



ATTENTION

The relative humidity in the environment should be lower than 95%. The presence of steam or condensation may result in permanent damage to the device or endanger personal safety.



ATTENTION

The installation altitude should be lower than 1500m. If it is over 1500m, the equipment must be derated 1% per 100m increase in altitude.



ATTENTION

Avoid severe physical shock, violent impact and large angle tilting in the installation process as this may cause damage and operational failure of the unit.



ATTENTION

During installation, leave sufficient operating space for cooling, maintenance and operation.

2.3 INSTALLATION



NOTICE

All the modules have dust-proof stickers to protect the module from the dust while storing. The dust-proof stickers must be removed before the module is installed at site.

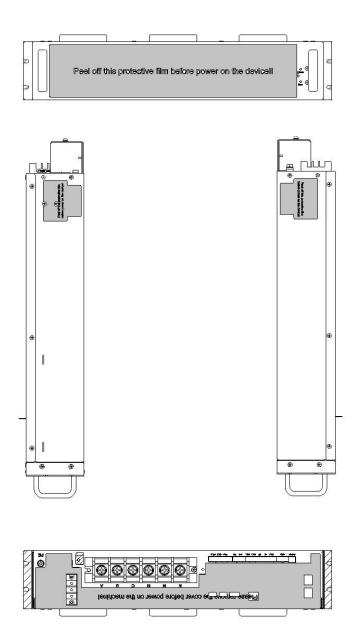


Figure 2-1 Dust-proof sticker

2.3.1 WALL-MOUNTED



NOTICE

For the wall-mount module, the distance from top side of the unit to the ceiling should be at least 20 inches, and the bottom side should be at least 32 inches from the floor.

For the wall mount module, the fixing screws are located at the top and bottom of the module. The module must be fixed vertically to a wall or support.

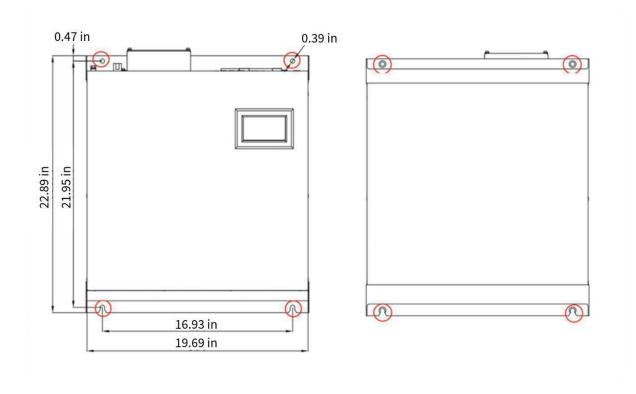


Figure 2- 2 Front Side

Figure 2-3 Rear Side

2.3.2 RACK-STYLE

There are four screws on the module that need to be installed for fixation, with a diameter of thread with a major diameter of 0.25 inches to be suitable for the cabinet, switch gear.

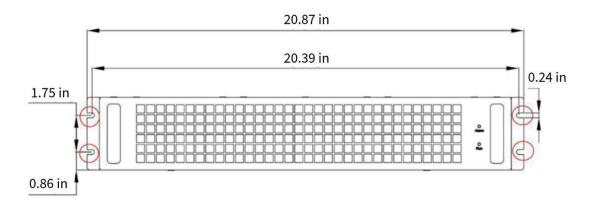


Figure 2-4 Rack-style Rear side

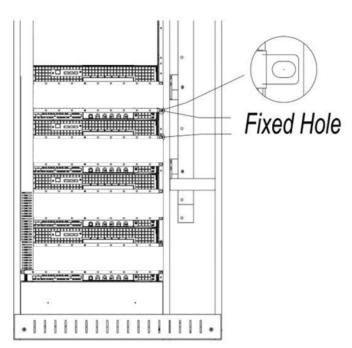


Figure 2- 5 Cabinet Fixed Hole

2.4 CONNECTION

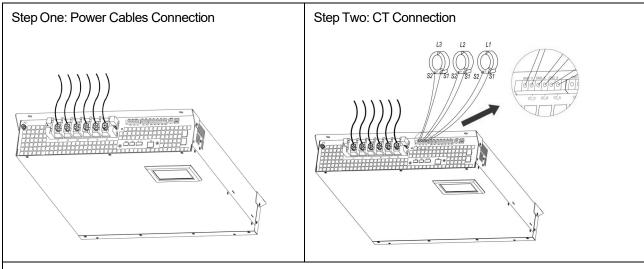


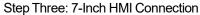
DANGER

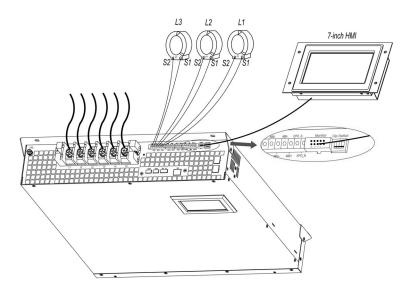
Before connecting the cables or electronics, please be sure to cut off the input power of the AHF device to avoid accidents.

2.4.1 SINGLE WALL MOUNTED

Table 2-1 Installation Steps of MTE Single Wall-mounted Module



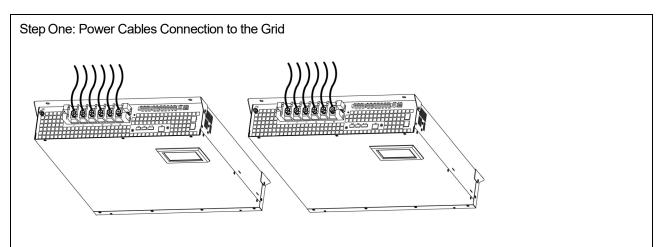




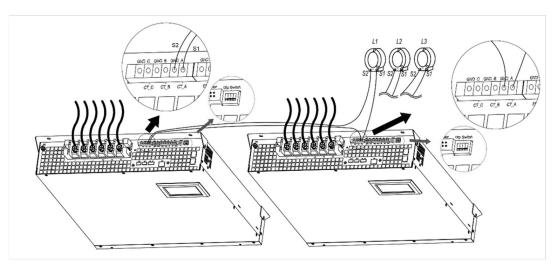
Note: If user needs to use the 7-inch Human-machine interface (HMI) to control the module, follow STEP THREE;

2.4.2 MULTIPLE WALL MOUNTED

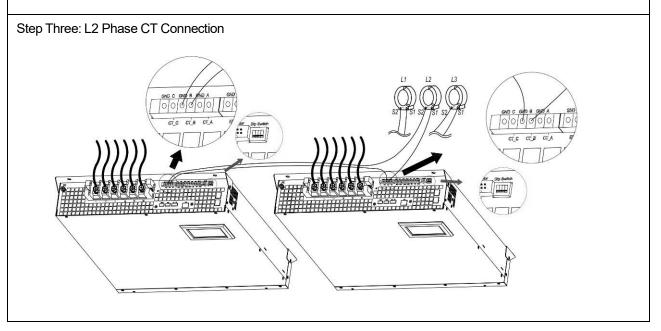
Table 2-2 Installation Steps of MTE Multiple Wall-mounted Modules

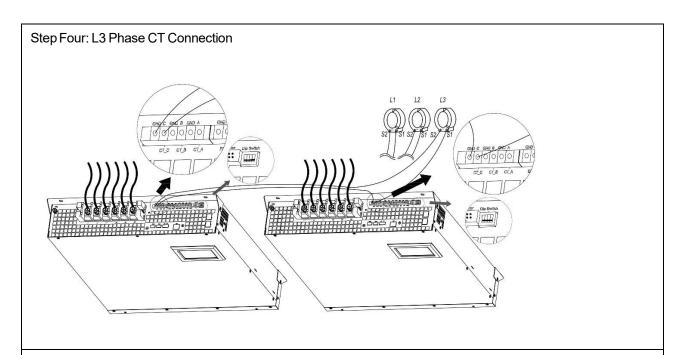


Step Two: L1 Phase CT Connection

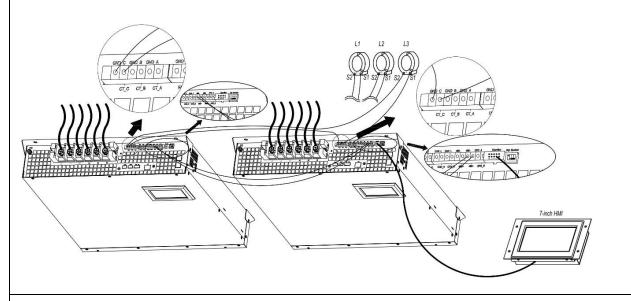


Note: For two modules the Line Side of the CT goes to A+ on the first Module, and GND_A on the first module goes to A+ on the second module, GND_A on the second module goes to the Load side of the CT.





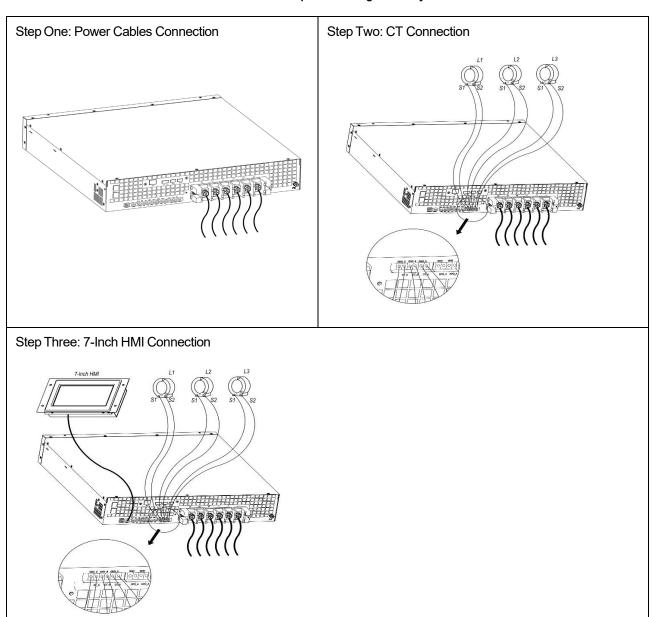
Step Five: 7-Inch HMI Connection



Note: For the 7-inch Human-Machine Interface (HMI) use monitor connection.

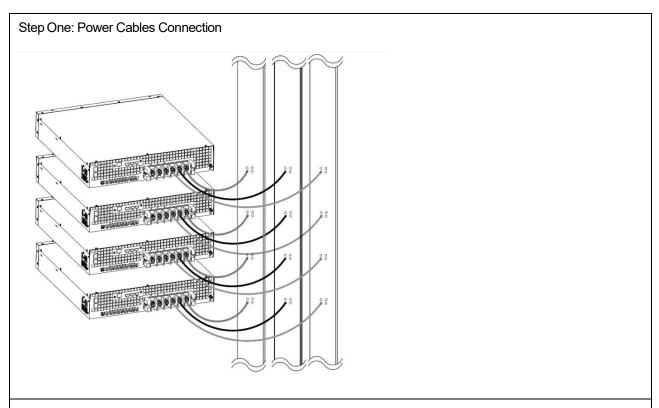
2.4.3 SINGLE RACK MOUNTED

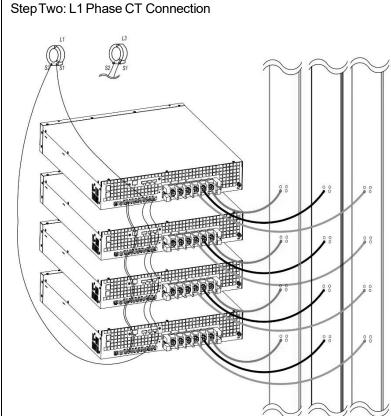
Table 2-3 Installation Steps of MTE Single Rack-style Module

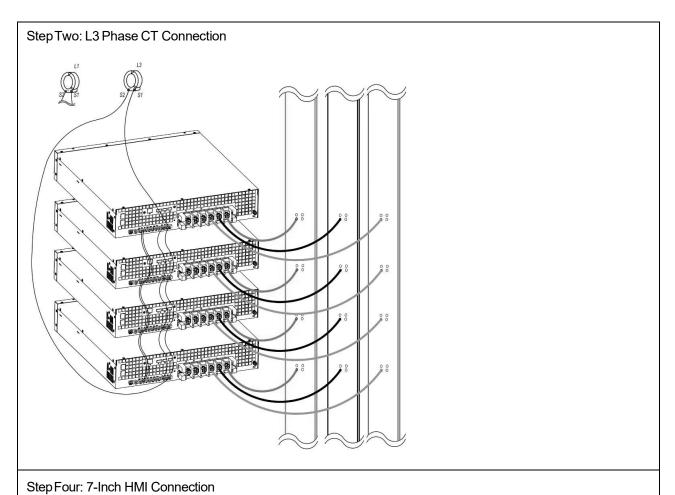


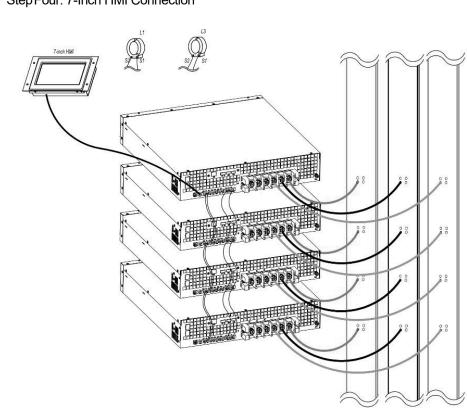
2.4.4 MULTIPLE RACK MOUNTED

Table 2-4 Installation Steps of MTE Multiple Rack-style Modules









2.5 CABLE

2.5.1 Power Cable



CAUTION

For 3P3W system only needs to connect L1, L2 and L3;

Power cables are electrical cables that are used to transmit electrical power from a power source to a device or equipment. They are typically made of copper or aluminum conductors and are insulated to prevent electrical shock and short circuits. Power cables come in various sizes and configurations, depending on the amount of power that needs to be transmitted and the distance between the power source and the device or equipment.

2.5.1.1 POWER CABLE SELECTION

If you need a clear power cable selection, please refer to Appendix VIII 'CABLE SIZING', where we have recommended the appropriate sizes for you. You can use this as a reference to select the proper power cable for your specific application.

2.5.1.2 CT CABLE CONNECTION



CAUTION

An open circuit of CT secondary polarity is not allowed.



NOTICE

MTE module supports 3P3W according to circuit calculation, the 3P3W system only needs two CTs connect to L1 and L3.



NOTICE

To ensure current sharing between the modules, such mode of connection requires the same Cable length from S1 and S2 to the two module signal interfaces. Generally, the parallel cable should not be more than 15m in length. If the parallel operation cable with a length of over 30m is required, please see the introduction of Appendix VII 'CT VA BURDEN'.

2.5.1.3 SINGLE MODULE

CT CONNECTION IS ON THE SUPPLY SIDE [Closed Loop Configuration]

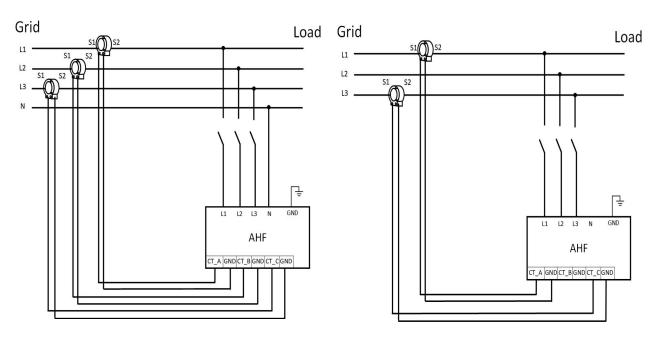
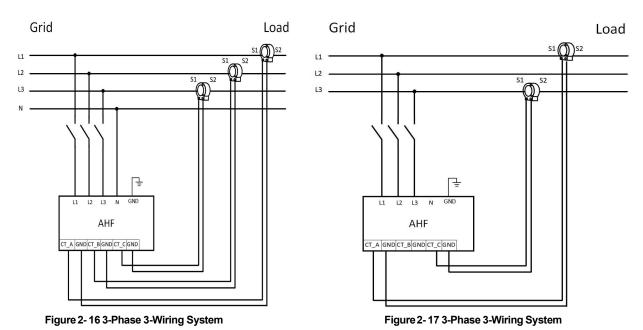


Figure 2-14 3-Phase 3-Wiring System

Figure 2-15 3-Phase 3-Wiring System

CT CONNECTION IS ON THE VFD SIDE [Open Loop Configuration]



2.5.1.4 MULTIPLE MODULES

CT CONNECTION IS ON THE SUPPLY SIDE [Closed Loop configuration]

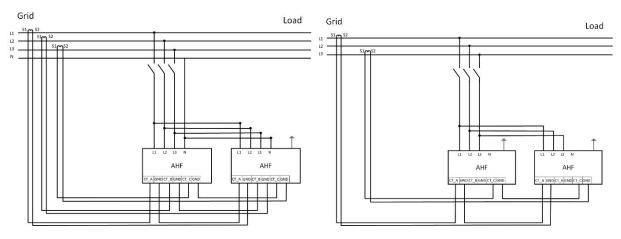


Figure 2-18 3-Phase 3-Wiring System

Figure 2- 19 3-Phase 3-Wiring System

CT CONNECTION IS ONTHE VFD SIDE [Open Loop Configuration]

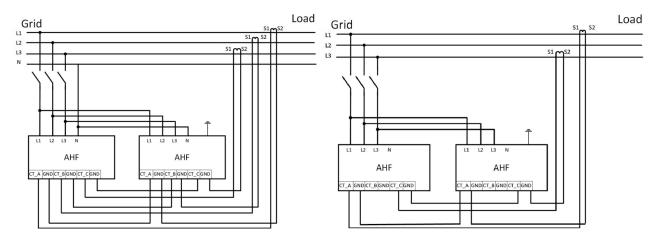


Figure 2- 20 3-Phase 3-Wiring System

Figure 2- 3-Phase 3-Wiring System

2.5.1.5 CABINET



CAUTION

An open circuit of CT secondary side when there is load current exists is forbidden.



NOTICE

MTE module supports 3P3W according to circuit calculation, for 3P3W system only needs two CTs connect at L1 and L3.



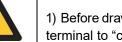
NOTICE

Once external CT is installed at the power distribution, CT secondary side terminal must be short-circuited and disconnected after CT secondary side cable is connected to the corresponding terminal. Users need to configure this short circuit device by themselves when connecting CT. Make sure that all secondary side GND ends of three-phase L1re short-circuited and connected to AHF PE line before CT is connected to the system, so as to ensure the safety of operator.



NOTICE

The following procedures need to be taken when the device needs maintenance:



- 1) Before drawing out the module, push gliding slab 3, 8 and 13 of CT terminal to "connecting" state.
- 2) After installing the new module, push gliding slab 3, 8 and 13 of CT terminal to "breaking" state.

Figure 2-22 CT terminal structure (For three phase four wiring system)

CT CONNECTION IS ON THE VFDSIDE [Open Loop Configuration]

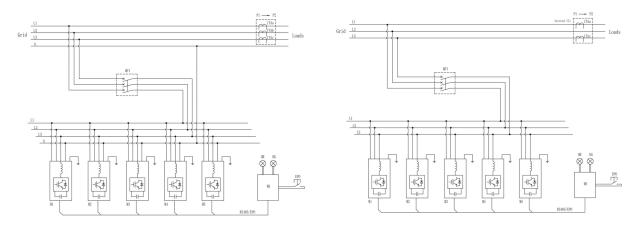


Figure 2-23 3-Phase 4-Wiring System

Figure 2-24 3-Phase 3-Wiring System

CT CONNECTION IS ON THE SUPPLY SIDE [Closed Loop Configuration]

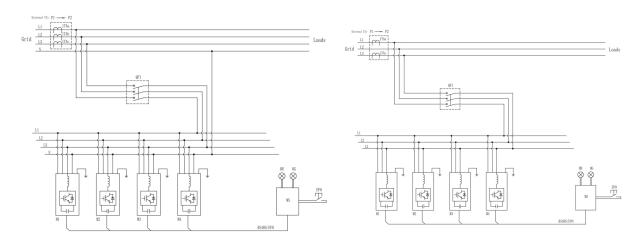


Figure 2- 25 3-Phase 4-Wiring System

Figure 2- 26 3-Phase 3-Wiring System

2.5.2 COMMUNICATION CONNECTION

The MTE 7-inch HMI is designed for centralized control of MTE modules, the HMI provides a clear and detailed display of the status and performance of the modules, allowing for easy monitoring and management of the system, which only needs the function that connect the J22 as the module.

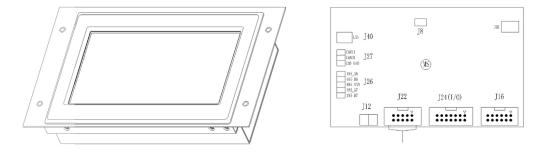


Figure 2-28 7-inch HMI

Note: The more introduction of MTE 7-inch HMI please refer as Appendix X.

2.5.3 485 COMMUNICATION CABLE



NOTICE

When you parallel the rack mounted modules you need to utilize the RS485 link between modules.

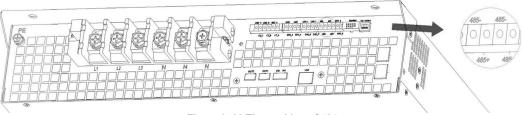


Figure 2-29 The position of 485

Note: The function of 485 is to communicate between modules and 7-inch HMI. 485 communication cable connect as parallel.

2.5.4 CAN COMMUNICATION CABLE



NOTICE

When paralleling the rack mounted modules, connect the communication cable, which allows communication between the modules.

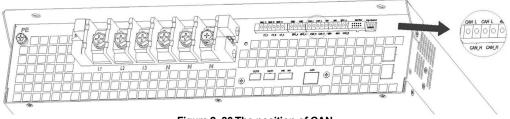


Figure 2-30 The position of CAN

Note: The function of CAN, which is to communicate between modules.

2.5.5 DIP SWITCH

The dip switch is on the rear side of the module and is used when using 7-inch HMI to control rack-style LED modules, which to identify the individual modules by giving them an address via the dip switch.



Figure 2-31 The position of DIP SWITCH

The dip switch is located by contacts SW1, SW2, SW3 and SW4. They're two statuses of the dip switch, 0 and 1.

Table 2-7 The definition of dip switch

| Status | Description |
|--------|--|
| 0 | When dip switch down, "0" stands for "off" |
| 1 | When dip switch up, "1" stands for "on" |

The relationship between the dip switch and the machine number is expressed in binary, as shown in Table 2-8 below:

Table 2-8

| SW1 | SW2 | SW3 | SW4 | Machine Number |
|-----|-----|-----|-----|-------------------|
| 0 | 0 | 0 | 0 | 1 |
| 1 | 0 | 0 | 0 | 2 |
| 0 | 1 | 0 | 0 | 3 |
| 1 | 1 | 0 | 0 | 4 |
| 0 | 0 | 1 | 0 | 5 |
| 1 | 0 | 1 | 0 | 6 |
| 0 | 1 | 1 | 0 | 7 |
| 1 | 1 | 1 | 0 | 8 |

| SW1 | SW2 | SW3 | SW4 | Machine Number |
|-----|-----|-----|-----|-------------------|
| 0 | 0 | 0 | 1 | 9 |
| 1 | 0 | 0 | 1 | 10 |
| 0 | 1 | 0 | 1 | 11 |
| 1 | 1 | 0 | 1 | 12 |
| 0 | 0 | 1 | 1 | 13 |
| 1 | 0 | 1 | 1 | 14 |
| 0 | 1 | 1 | 1 | 15 |
| 1 | 1 | 1 | 1 | 16 |

For example, if there are three 100A AHF rack-style connections, the dip switch should be: $\frac{1}{2} \left(\frac{1}{2} \right) = \frac{1}{2} \left(\frac{1}{2} \right) \left($

Table 2-9 Dip Switch Setting

| No. | Dip Switch |
|-------------------|------------|
| | • |
| The first module | 0000 |
| | 4000 |
| The second module | 1000 |
| | |
| The third module | 0100 |
| | 0.00 |

CHAPTER III COMMISSIONING

3.1 4.3-INCH HMI INTRODUCTION

For the 4.3-inch HMI, only on the wall-mounted module.

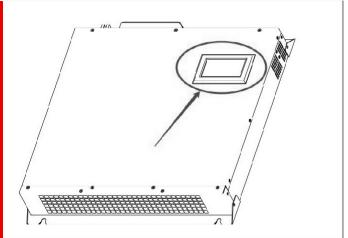


Figure 3-1 The position of 4.3-inch HMI

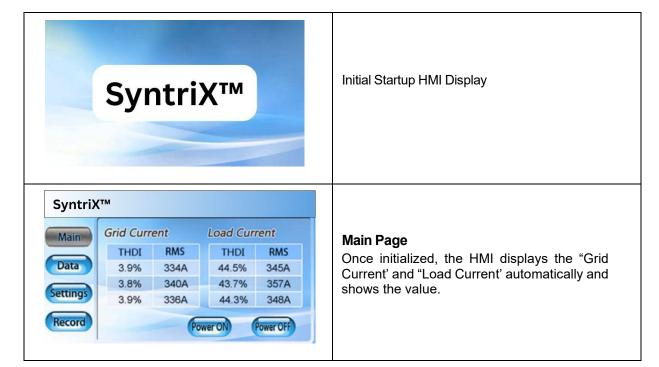


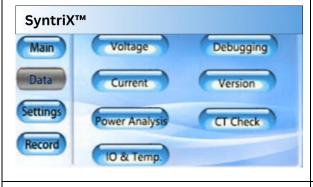
NOTICE

Ensure and connections are correct, safe and follow the manufacturer's instructions.

MTE 4.3-inch HMI is fully touchscreen, color visualizing and intelligent monitoring system. It provides real-time monitoring of power distribution systems, helping users to quickly identify and diagnose any issues that may arise.

Note: HMI screens may vary depending on firmware.





Data Page

When the user chooses the 'Data Page' the MTE HMI shows more power quality data 'Voltage', 'Current', 'Power Analysis', 'IO & Temp.', 'Debugging', 'Version' and 'CT Check'.



Setting Page

After completing the physical installation, it is necessary to enter the settings interface to configure the parameters. Once the settings are complete, it is important to check the compensation performance of the module. *The Default passcodes are 080808 (Basic) and 654321(Advanced)*.



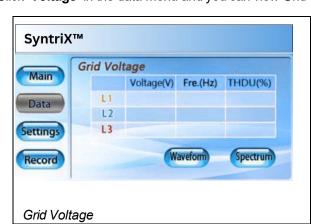
Record Page

When the module triggers an alarm, the MTE 4.3- inch HMI will record and display the information in real-time on the monitor. The specific issue causing the fault will be displayed, making it easier for users to diagnose and resolve the problem. This feature helps to improve the efficiency of power management and reduce downtime caused by equipment failures.

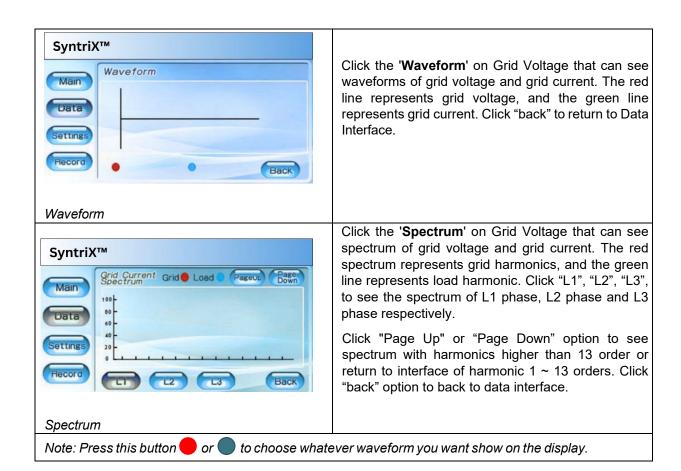
3.1.1 DATA INTERFACE

The Data interface screen allows you to view Voltage, Current, and Power Analysis in real time. The following functions are available: IO & Temp, Debugging, Version and CT Check.

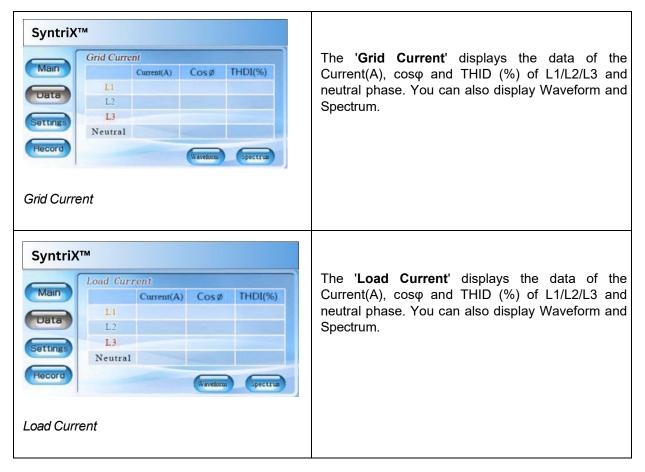
Click 'Voltage' in the data menu and you can view Grid Voltage, Waveform and Spectrum in real time.

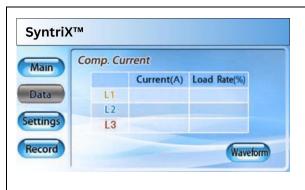


The 'Grid Voltage' displays the data of Voltage(V), Fre.(Hz) and THvD(%) of L1/L2/L3 phase.



Click 'Current' option in the data menu that can be real-time see the data of Grid Current, Load Current and Comp. Current.

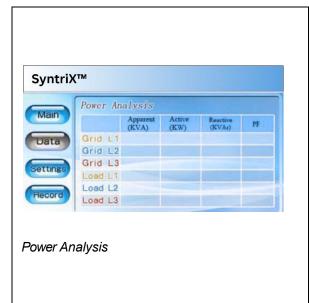




Comp. Current (Compensated Current)

The 'Comp. Current' displays the output Current (A) and Load Rate (%) of L1/L2/L3 phase. You can also display Waveform and Spectrum.

Click '**Power'** option in the data menu that can be real-time see the data of Apparent (KVA), Active (KW), Reactive (KVAr) and PF of Grid L1/L2/L3 and Load L1/L2/L3.



'Apparent'

The combination of reactive power and true power is called apparent power, and it is the product of a circuit's voltage and current, without reference to phase angle.

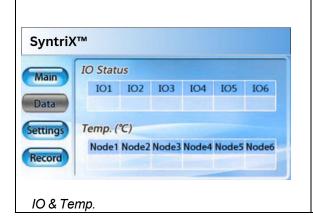
'Active'

The power which is consumed or utilized in an AC Circuit is called True power or Active power or Real power, 'Reactive'.

'Reactive'

Reactive power is the resultant power in watts of an AC circuit when the current waveform is out of phase with the waveform of the voltage, usually by 90 °C if the load is purely reactive and is the result of either capacitive or inductive loads.

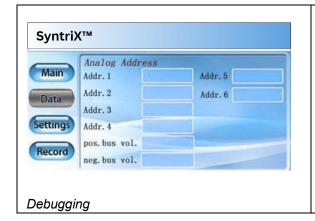
Click 'IO & Temp.' option in the data menu that can be real-time. See the data on IO Status and Temp. (Celsius).



The 'IO1~IO6' are used to monitor IO status information, red means disconnect, green means connected.

The 'Node1~Node6' are used to monitor machine inter L1/L2/L3 SIC MOSFETs temperature, except for the 300A module, which displays six temperature value, other models display the first three values, 'Node4/5/6' are reserved.

Click the 'Debugging' option in the data menu that can be real-time see the data of Analog Address.



The 'Addr. 1/2/3/4/5/6' are used when the module has some alarms and needs to enter correspond address to check the module operation whether right or not.

The 'Pos./Neg. bus vol.' are used to seeing the value of voltage on different buses.

The 'Controller Para. P/Q/R' are used for MTE interfactory test.

Click '**Version**' option in the data menu that can be real-time see the data of Software Version, System Model and Expiry Days.

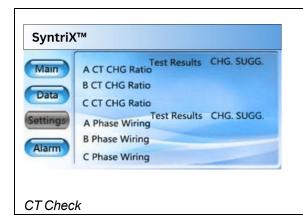


The 'Software Version "M' means the version of monitor, 'D' means the version of U1 board, 'K' and 'T 207' used for R&D of MTE.

The 'System Model' refers to the information of the module, including the type, capacity, wiring etc. of the module.

The 'Expiry Days' is factory set for trial versions.

Click 'CT Check' in the data menu that can check the CT wiring well or not.



MTE's CT check function is designed to improve the efficiency and convenience of CT installations for customers. CT (current transformer) is an important component in power systems that measures the current flowing through a circuit. However, incorrect installation or malfunctioning of CT can result in inaccurate measurements and potential safety hazards.

3.1.2 PARAMETER SETTING INTRODUCTION

The "**General Settings**" can be accessed using the '080808' password and is suitable in most applications for system commissioning by the user.

Table 3-1

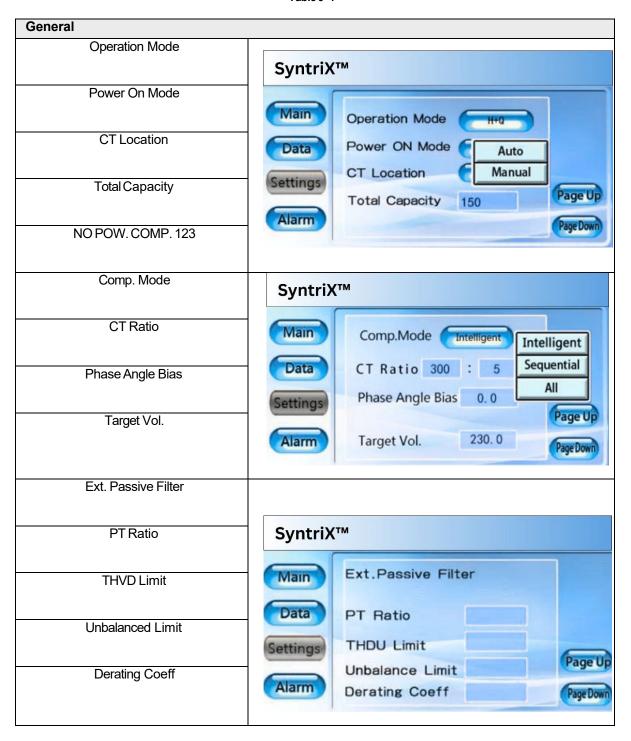


Table 3- 2 Parameter Introduction

| Parameter | Meaning and Function of Parameter | Options | Default setting | Unit |
|-------------------|---|--|-------------------------------|-------|
| | There are 13 working modes applicable to AHF | | | |
| | H: Harmonic compensation | Harmonic | | |
| | Q: Reactive power compensation | Comp. | | |
| | B: Balance compensation | H+Q+B | | |
| | Auto-aging: The module outputs current according to the set | Q+B+H | | |
| | compensation rate, which tests whether the module can output normally. | H+Q | | |
| | (Only factory of MTE testing. Users shall be forbidden to use.) | H+B | | |
| Operation | Mixed mode: Used for mixed solution, AHF+SVG | B+H | Harmonic Comp. | N/A |
| Mode | (Refer to document <one ahf&svg="" centralized="" control="" hmi="" hybrid="" system="" to=""> attached for further explanation.)</one> | H+Q+B Q+H | Сопр. | |
| | | B+H+Q | | |
| | For example: H+Q means harmonic compensation first, then | Auto-aging | | |
| | compensate for the reactive power if there is enough capacity reserved. | Q+H+B | | |
| | H+Q+B means harmonic compensation first, then compensate the | B+H+Q | | |
| | reactive power, after that, remaining capacity will be used for three- phase unbalance compensation. | Mixed Mode | | |
| Da | Manual: It needs to be started by artificial execution in the monitoring interface. | Manual | | 21/2 |
| Power on mode | Auto: In automatic mode, once the system is connected to power, the machine will automatically turn on and start working. | Auto. | Manual | N/A |
| | Supply side: CT installation position is closer to the grid transformer side than the power access point of the module. | | | |
| | Load side: CT installation position is closer to the load side "Supp | | | |
| CT location | than the power access point of the module. | | According to actual condition | N/A |
| | Note: If there is LC or capacitor bank in the system, please consult the engineer of MTE and provide single line diagram. | "Load side" | actual condition | |
| Total Capacity | Total Capacity setting is the total capacity of the system, either single module or combination of multiple modules. | >0 | According to actual capacity | Amps |
| Comp. Mode | Intelligent compensation: Using intelligent Fourier algorithm, the rated capacity can be compensated within five minutes, effectively avoiding resonance. Sequential compensation: Using Fourier algorithm can quickly | Intelligent | Intelligent | |
| ivioue | compensate for the harmonics of the order to rated capacity. | Sequential All | compensation | N/A |
| | All compensation: Quickly compensate for all harmonics. (not recommended) | | | |
| CT ratio | The setting value needs to correspond to the actual ratio of external CT. The secondary for CT only can be 5, the setting range: 50~30000. | 0~30000 | According to | |
| | Note: ① 500 means 500:5, another as the same. ② If the CT ratio is 1000:1, then it should be set as "5000". | 0 ~30000 According to actual condition | | Value |

| | Fundamental wave angle bias calibrates when the compensated performance is not good. | | | |
|--|--|----------|----------------------|-------|
| Phase Angle Bias | The phase angle adjustment needs to be adjusted according to the actual situation on site, normally try from -1~-0.1, then 0.1~1 (accuracy is 0.01), to check whether the compensation effect is better. | -180~180 | 0 | o |
| | Note: No need to modify, if needed for change, please contact MTE engineer. | | | |
| | This function relates to Grid Vol. Adjust, if Grid Vol. Adjust function is Disabled, this function is invalid. | | | |
| Target Vol. | When the actual phase voltage exceeds the target voltage setting range, the module does the voltage regulation via generating reactive power into the system. | 220/230 | Actual phase voltage | VL-N |
| Note: Please contact MTE engineering before changing this parameter. | | | | |
| | This function is only supported by AHF and ASVG. | | | |
| Ext. Passive Filter | When AHF/ASVG works with external passive filters together to compensate for specific harmonic orders only use | 3~51 | 11 | Value |
| | When the module is connected to the power grid through a transformer, an external transformer ratio should be set. | | | |
| | For example: 400V systems the ratio is 1:1 (setting = 1.0); | | | |
| PT ratio | For step-up transformer is 11000V, then set the ratio as 11000/400 | 0.1~90 | 1.0 | Value |
| | = 27.5. (setting=27.5) | | | |
| | Note: ① Only used in medium and high voltage. ② Consulting MTE engineers before changes are made. | | | |
| | Modules can work under the setting limit of THVD. If THVD exceeds the value set by the customer, an alarm will appear in HMI. | | | |
| THVDLimit (%) | | 0~50 | 0.0 | Value |
| (70) | Note: ① For marine application, they have a limitation of THVD and required if the THVD is more than certain value, the AHF/ASVG should give an alarm. ② Not used for SVG. | | | |
| Unbalanced Limit (%) | Module can work under the setting limit of unbalanced. If unbalanced exceed the value set by the customer an alarm will appear in HMI. | 0~1 | 0.0 | Value |
| | Limit the biggest output of the module. | | | |
| Derating Coeff | For example, input 0.9 means the biggest capacity of the machine is 90% of its rated capacity. | 0~1 | 1.0 | Value |
| | Note: Do not change it without the guidance of MTE engineer. | | | |
| | | | | |

3.1.2.1 PARAMETER SETTING

The table below are parameters needed to set up MTE 4.3-inch HMI.

Table 3-3 Parameter setting in HMI

| Operation Mode | _ |
|----------------|---|
| Total Capacity | |
| Comp. Rate | |
| Comp. Mode | |
| CT Ratio | |
| Power On Mode | |
| CT Location | |

Take AHF 150A for example, assuming AHF is used for harmonic compensation, and the CT ratio on site is 300:5. In this case, the parameters should be set to:

Table 3-4 Case demonstration

| Setting | Setting parameters |
|----------------|--------------------|
| Operation Mode | Harmonic comp. |
| Total Capacity | 150 |
| Comp. Rate | 1.0 |
| Comp. Mode | Intelligent |
| CT Ratio | 300 |
| Power On Mode | Manual or Auto |
| CT Location | Based on site |

3.1.3 RECORD INTRODUCTIONS

Click "Record" on the main menu to enter the record interface.



Active

MTE's monitoring system has a comprehensive alarm function that displays all real-time alarm information in a user-friendly manner. This feature captures and reports critical events such as system faults, voltage abnormalities, communication disruptions, and other related issues. Users can easily customize alarm thresholds and notification settings through the system configuration, ensuring that they receive alerts of significant events without being bombarded with irrelevant information. The monitoring system's intuitive design ensures that users can quickly access and analyze data when a potential issue occurs, promoting proactivity in addressing any performance or efficiency concerns and ultimately reducing downtime and maintenance costs.



History

MTE's historical alarm function in monitoring displays all alarms that have occurred since the system was installed, with a maximum record of 500 alarms. This feature allows users to review past alarms and identify any recurring issues or patterns. It is a useful tool for troubleshooting and improving system performance.



Operation

The operation record function in MTE monitoring system records all the operations performed on the system, making it easy to trace back and review. This feature ensures that all actions taken on the system are documented, providing a comprehensive audit trail for future reference.

3.2 7-INCH HMI INTRODUCTION

MTE 7-inch HMI is typically used to control enclosed modules, making management more convenient. It features a full touch screen and a colorful visual display for monitoring.

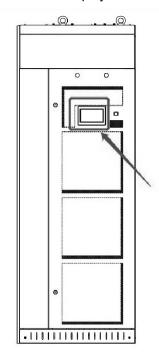
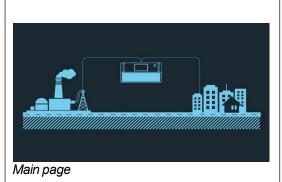


Figure 3-2 Example position of 7-inch HMI



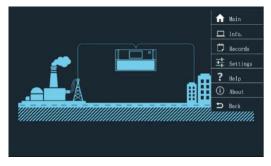
NOTICE

Ensure and connections are correct, safe and follow the manufacturer's instructions.



When the module connected with power that the HMI will initialize.

In main page, user can see the performance directly.

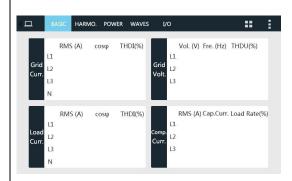


Main Screen with drop-down selection

There are 7 options in MTE 7-inch HMI, 'Main', 'Info.', 'Records', 'Settings', 'Help', 'About' and 'Back'

Note: click on to get a drop-down selection

3.2.1 'INFO' ILLUSTRATE



Basic Interface

The 'BASIC' can be real-time observe the data of RMS(A), PF, THID(%), Vol.(V), Fre. (Hz) and THVD(%) of Grid Current, Grid Voltage and Load Current, and RMS(A) and Load rate(%) of Compensate Current.

"Grid Curr." means the current after compensation. For example, PF in Grid Curr. refers to the compensated PF value

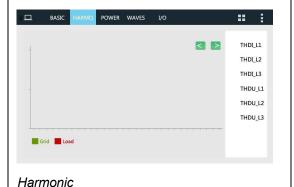
"Grid Volt." means the voltage of module power access point.

"Load Curr." means the current before compensation. For example, THID (%) in Load Curr. refers to the before compensated THID (%) value.

"Comp Curr." means the current outputted from module.

"RMS": root mean square of current.

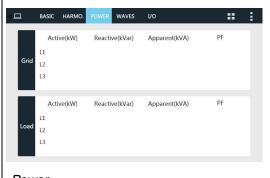
"Lode Rate": Ratio of Comp power to rated power of Module.



The 'HARMO.' can be real-time observed in each phase voltage and current harmonic of grid side and load side.

'**Grid'** (the green cylinder) represents the grid harmonic spectrum (after compensation).

'Load' (the red cylinder) represents harmonic spectrum of the load side (before compensation).



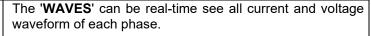
The 'POWER' can be real-time to get the information of Active(kW), Reactive(kW), Apparent(kW) and cosφ of Grid side and Load side.

'Grid side' means after compensation. For example, cosφ in Grid Side refers to the compensated cosφ value.

'Load side' means before compensation.

Noted: This cos\(\phi\) is real PF, not including the reactive power.

Power



Display four kinds of waveforms, Comp. I L1/L2/L3, Grid I L1/L2/L3, Grid V L1/L2/L3 and Load I L1/L2/L3. Click



menu, select the waveform displayed in the color.

'Comp. I L1/L2/L3' refers to the L1/L2/L3 phase compensates for the current waveform, each time choose one phase.

'Grid. I L1/L2/L3' refers to the L1/L2/L3 phase current waveform after compensating, each time choose one phase.

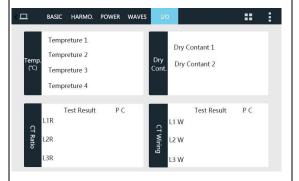
'Grid. V L1/L2/L3' refers to the L1/L2/L3 phase voltage waveform after compensating, each time choose one phase.

'Load. I L1/L2/L3' refers to the L1/L2/L3 phase current waveform before compensating, each time choose one phase.



Waves

1/0



The 'I/O' can be real-time observe module's inner highest temperature of L1/L2/L3 phase and Air inlet.

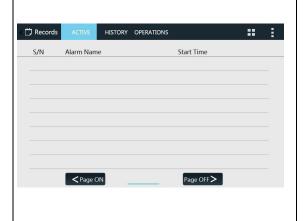
Temperature 1/2/3' means module inner highest temperature of L1/L2/L3 phase (dry contact is useless).

'**Temperature 4**' means the temperature of the Air inlet. (This function is only for PRO version module)

'Dry Content 1/2' means the state of the dry contact is normal when the dry contact board is externally connected.

3.2.2 RECORD INTRODUCTION

Click "Record" on the main menu to enter the record interface.



Active

MTE's monitoring system has a comprehensive alarm function that displays all real-time alarm information in a user-friendly manner. This feature captures and reports critical events such as system faults, voltage abnormalities, communication disruptions, and other related issues. Users can easily customize alarm thresholds and notification settings through the system configuration, ensuring that they receive alerts of significant events without being bombarded with irrelevant information. The monitoring system's intuitive design ensures that users can quickly access and analyze data when a potential issue occurs, promoting proactivity in addressing any performance or efficiency concerns and ultimately reducing downtime and maintenance costs.



History

MTE's historical alarm function in monitoring displays all alarms that have occurred since the system was installed, with a maximum record of 500 alarms. This feature allows users to review past alarms and identify any recurring issues or patterns. It is a useful tool for troubleshooting and improving system performance.



Operation

The operation record function in MTE monitoring system records all the operations performed on the system, making it easy to trace back and review. This feature ensures that all actions taken on the system are documented, providing a comprehensive audit trail for future reference.

3.2.3 PARAMETER SETTING INTRODUCTION



The "General Settings" can be accessed using the '080808' password and is suitable in most applications for system commissioning by the user.

Table 3-5

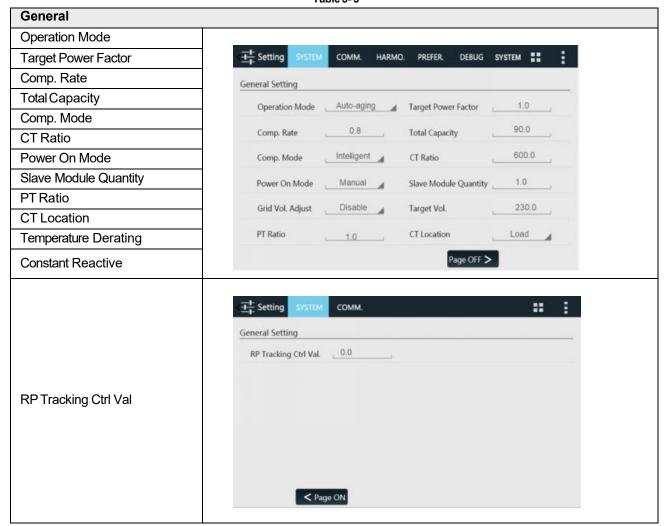


Table 3-6 Parameter Introduction

| Parameter | Meaning and Function of Parameter Options | | Default setting | Unit |
|---------------------------------------|--|-------------------------------|--|-------|
| | There are 13 working modes applicable to AHF H: Harmonic compensation Q: Reactive power compensation | | | |
| | B: Balance compensation | Q+H | | |
| | Auto-aging: The module outputs current according to the set compensation rate, and tests whether the module can output normally. | H+Q Q+H+B H+Q+B | | |
| | Only for factory testing. Users not able to use. | Q+B+H | According to | N/A |
| Operation | Mixed mode: Used for mixed solution, AHF+SVG | Auto-aging | customer's need | |
| Mode | (Refer to document <one ahf&svg="" centralized="" control="" hmi="" hybrid="" system="" to=""> attached for further explanation.)</one> | B+H H+B+Q | neeu | |
| | For example: H+Q means harmonic compensation first, then compensate for the reactive power if there is enough capacity reserved. | B+H+Q H+B | | |
| | H+Q+B means harmonic compensation first, then compensate the reactive power, after that, remaining capacity will be used for three-phase unbalance compensation. | B+Q+H Mixed Mode | | |
| Target Power Factor | Set the target value of the grid side power factor. The setting range: -1~1. | [-1, 1] | 1.0 | соsф |
| Total Capacity | Total Capacity setting is the total capacity of the system, either single module or combination of multiple modules. | >0 | According to actual capacity | Amps |
| Comp. Mode | Intelligent compensation: Using intelligent Fourier algorithm, the rated capacity can be compensated within five minutes, effectively avoiding resonance. | Intelligent Sequential All | Intelligent | |
| , , , , , , , , , , , , , , , , , , , | Sequential compensation: Using Fourier algorithm can quickly compensate for the harmonics of the order to rated capacity. All compensation: Quickly compensate for all harmonics. (not recommended) | Coquontiai 7 iii | compensation | N/A |
| CT ratio | The setting value needs to correspond to the actual ratio of external CT. The secondary for CT only can be 5, the setting range: 50~30000. Note: ① 500 means 500:5, another as the same. ② If the CT | 0~30000 | According to actual condition | Value |
| Power on mode | ratio is 1000:1, then it should be set as "5000". Manual: It needs to be started by artificial execution in the monitoring interface. Auto: In automatic mode, once the system is connected to power, the machine will automatically on and start working. | Manual Auto. | Manual | N/A |
| | Setting the total number of modules in parallel, which are controlled by a single 7inch HMI. | | | |
| Slave module quantity | HMI is master, all the modules are slave modules. Note: Previous manuals and info were 8, the latest one can up to 16 modules, but the response time will be lower than before if 16 pcs of modules are connected, normally we still recommend 8 modules controlled by one HMI, we will keep improving this function. | 1~16 | The value of the number of parallel modules | Value |

| PT ratio CT location | When the module is connected to the power grid through a transformer, an external transformer ratio should be set. For example: 400V systems the ratio is 1:1 (setting = 1.0); For step-up transformer is 11000V, then set the ratio as 11000/400 = 27.5. (setting=27.5) Note: ① Only used in medium and high voltage. ② Consulting MTE engineers before changes are made. Source side: CT installation position is closer to the grid transformer side than the power access point of the module. VFD side: CT installation position is closer to the load side than the power access point of the module. Users can choose source or load side to install CT. | 0.1~90 : Source side Load side | 1.0 According to actual condition | Value N/A |
|-----------------------|--|---|------------------------------------|--------------|
| Temperature derating | Disable: When the overheat protection sensors of the module detect the temperature of SiC MOSFETs more than 95°C, the output won't be derated. Enable: The module derating capacity is judged by detecting the SiC MOSFET temperature. When the temperature exceeds 95°C and the duration reaches ten minutes, the module will automatically derating 10% of rated capacity. If the temperature still exceeds 95°C and the duration reaches ten minutes, the module will automatically derated 10% capacity based on the capacity of last derated. By analogy, the maximum derating capacity of the module is 50%, but when the temperature is less than 85°C, the module will automatically back to the original rated capacity. Take AHF 150A as example, when the temperature of the SiC MOSFET reach 95°C and lasts 10 minutes, it will reduce 10% capacity, then the AHF capacity is 135A. AHF will detect the temperature again, if the temperature is still rising and lasts time is 10 minutes, it will reduce 10% capacity is 120A. If temperature reduce to 85°C after derating, the AHF capacity will return to 150A. | Disable Enable | Enable | N/A |

| Constant reactive | This function is only used for SVG. This function could make SVG generate constant reactive power to the grid. No need for CT, because its output reactive power is constant. | [-3000, 3000] (+) Inductive (-) Capacitive | 0.0 | kvar |
|-----------------------------|--|--|-----|------|
| RP Tracking Ctrl. Val | RP Tracking Ctrl Val means "Reactive Power Tracking Control Value". This parameter can be set to output either a constant inductive or capacitive reactive power into the system, before the system will perform its normal reactive power compensation function, as required by the load. This function can be used to compensate for the reactive power generated by the SVG itself or to compensate for magnetizing reactive power required by the upstream transformer, typically when the utility meter the client on the primary side of transformer, but SVG system is installed on the secondary side. A transformer magnetizing current should be inductive, so to compensate for the inductive reactive power, the RP Tracking Ctrl Val should be set to output capacitive reactive power. (Under normal operation, and if value is set at "0.0" the SVG will compensate for the reactive power required by the load. If the target for cos phi is set at 0.99 for the LV side, the cos phi might be 0.97 on the MV side where the client is metered. The RP Tracking Ctrl Val setting will allow SVG to output a constant cos phi to compensate for the additional reactive power required by the transformer, before performing its normal Reactive power compensation.) The setting therefore improves the Power Factor at the metered point with lower kVA demand and reactive energy charges. (For example: A value of -7.5 will output 7.5kVAr of Capacitive Reactive Power into the system constantly before the SVG compensate for the reactive power required by the load) | [-3000, 3000] (+) Inductive (-) Capacitive | 0.0 | kvar |

3.2.4 PARAMETER SETTING

The table below are parameters needed to set up MTE 7-inch HMI;

Table 3-7 Parameter setting in HMI

| Operation Mode | |
|-----------------------|--|
| Total Capacity | |
| Comp. Rate | |
| Comp. Mode | |
| CT Ratio | |
| Power On Mode | |
| Slave Module Quantity | |
| CT Location | |

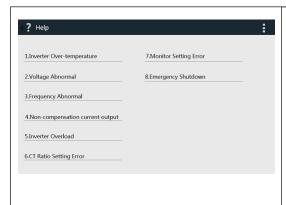
Take one 500A AHF system for example. Assuming this system contains five AHF 100A modules and uses 7-inch HMI for monitoring. The CT ratio is 3000:5.

In this case, before module power on, the quick commission should be:

Table 3-8 Case demonstration

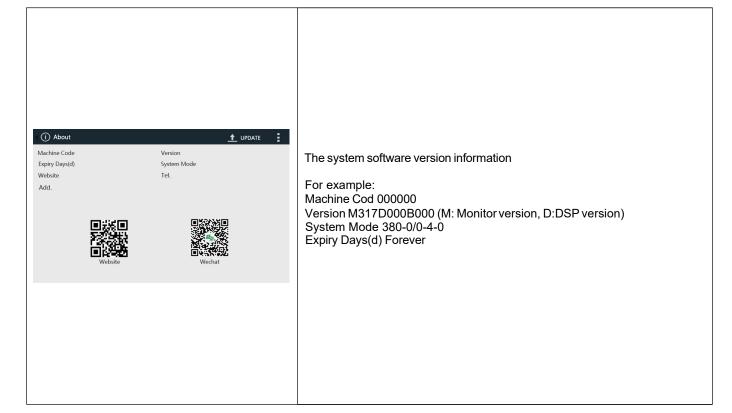
| Setting | Setting parameters |
|-----------------------|--------------------|
| Operation Mode | Harmonic comp. |
| Total Capacity | 500 |
| Comp. Rate | 1.0 |
| Comp. Mode | Intelligent |
| CT Ratio | 3000 |
| Power On Mode | Manual or Auto |
| Slave Module Quantity | 5 |
| CT Location | Based on site |

3.2.5 HELP



There are eight common types of alarms, for detailed explanations, please refer to Appendix X.

3.2.6 ABOUT



3.3 MODE TWO INSTALLATION

01 WALL-MOUNTED LCD MODULES

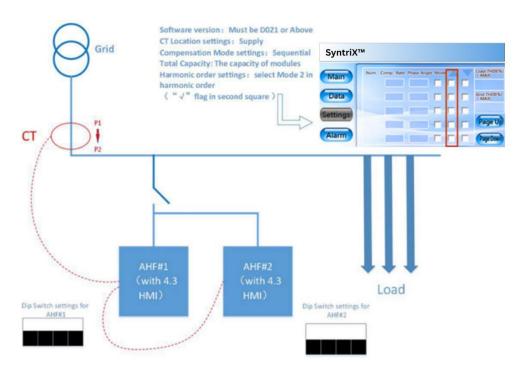


Figure 3-3 Wiring and parameters setting (Wall-mounted LCD modules)

02 WALL-MOUNTED LCD MODULES WITH 7-INCH HMI

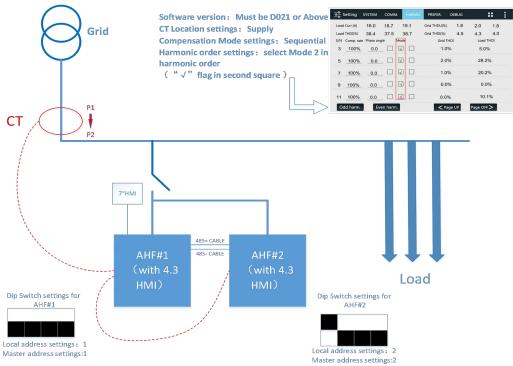


Figure 3- 4 Wiring and parameters setting (Wall-mounted LCD modules with 7-inch HMI)

Form: SyntriX-TRM-E June 2025 Rev 01

Software version: Must be D021 or Above System 18.0 18.7 18.1 CT Location settings: Supply Grid Load THDI(%) 38.4 37.5 38.7 Grid THDI(%) 4.5 4.3 Compensation Mode settings: Sequential SN Comprise Phase angle 3 100% 0.0 1 5.0% 1.0% Harmonic order settings: select Mode 2 in _0.0_ 🗆 🖾 🗆 5 100% 2.0% 28.2% harmonic order ("√" flag in second square) 0.0 _0.0_ □ 🖫 □ 0.0 10.1% < Page UP Page OFF> P1 Odd harm. CT 7"HMI 485+ CABLE 485- CABLE AHF#1 AHF#2 Load Dip Switch settings for Dip Switch settings for AHF#1 Local address settings: 1 Master address settings:1 Master address settings:2

03 WALL-MOUNTED LED MODULES WITH 7-INCH HMI

Figure 3-5 Wiring and parameters setting (Wall-mounted LED modules with 7-inch HMI)

APPENDIX I

MTE SYNTRIX AHF SPECIFICATION

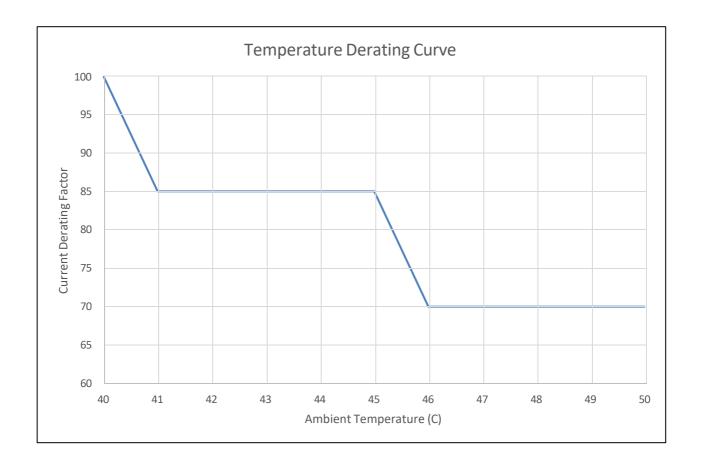
| Items MTE SyntriX AHF | | | | |
|------------------------------------|---|---|--|--|
| Rating 50A, 75A, 100A, 150A | | | | |
| Function | Harmonic, reactive power and three-phase unbalance compensation | | | |
| | System parameters | | | |
| Nominal voltage 480V (-10% ~ +10%) | | | | |
| Nominal frequency | 60HZ, auto-sensing (Range: 45Hz \sim 62.5 | Hz) | | |
| Parallel quantities | 16 Modules | | | |
| Efficiency | ≥99% | | | |
| Connection type | 3 Phase 3 Wire | | | |
| | Performance indicators | | | |
| Control algorithm | FFT, intelligent FFT, and instantaneous rea | active power | | |
| Compensation Order | 2nd to 50th, selectable for each order, amp | | | |
| Advanced control algorithm | Resonance suppression, compensation por connection for THVD compensation | erformance software auto-tuning, no CT | | |
| Compensation Rate | >97% | | | |
| Even harmonic compensation rate | > 95% | | | |
| Fast response time | <50us | | | |
| Full response Time | < 5ms | | | |
| Target power factor | Adjustable from -1 to +1 | | | |
| Switching frequency | Average 40kHz | | | |
| Noise level | <60dB | | | |
| Communications ports | RS485 and Ethernet port (RJ45) / option | | | |
| Communications protocols | Modbus RTU | | | |
| Module display interface | 4.3-inch HMI (wall hanging), 7-inch HMI (ce modules | , | | |
| Protection function | Over-voltage protection, under-voltage pro over-compensation protection, and so on | | | |
| Mounting type | Wall-mounted/Rack-style | | | |
| Dimensions (W x D x H in) | Rack Style: 3.9" x 28.1" x 21.9" | Wall Hanging: 27.1" x 3.9" x 20.1" | | |
| Net weight | 77 lbs. | | | |
| Storage temperature | -40°C~70°C | | | |
| OperatingAmbient temperature | -10°C∼40°C (may derate capacity if ambient temperature exceeds 40°C) | | | |
| Relative humidity | 5% to 95%, non-condensing | | | |
| Altitude | ≤1500m, 1500-4000m, capacity is derating | g 1% for every 100m altitude increased. | | |
| Protection class | IP20 is wall hanging | | | |
| Certification | Complies with UL-61800-5-1 via NRTL Intel | rtek (ETL) | | |

Table A- 2 Shipping Weight

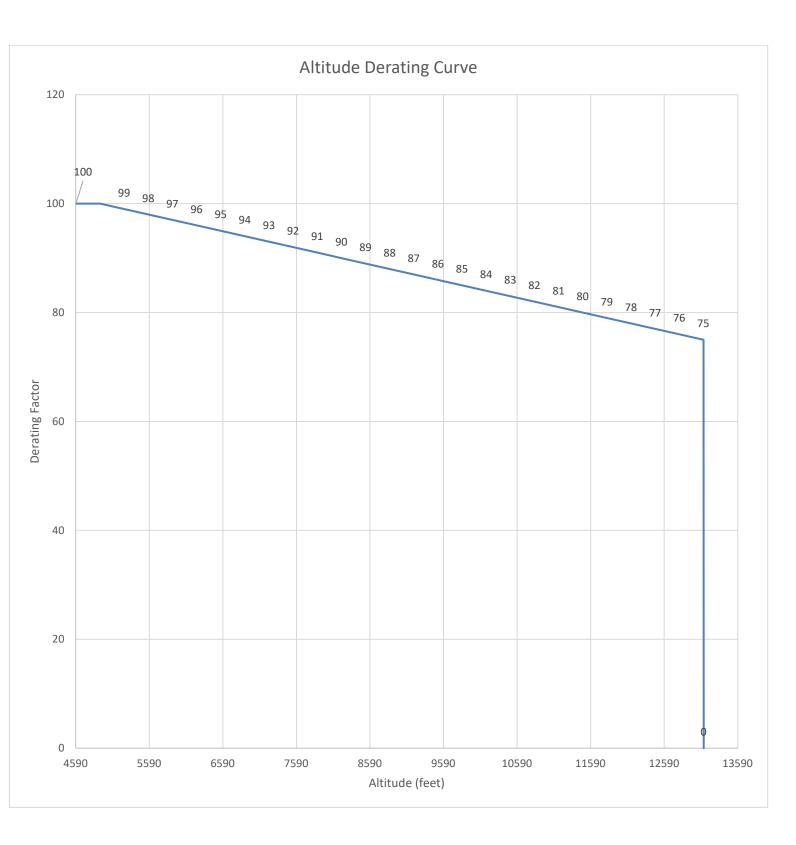
| Shipping Module | Weight |
|----------------------|--------|
| MTE SyntriX AHF 150A | 78 lbs |

| | Maximum Output (Amps RMS)* | Typical Watt Dissipation @ Rated Current (Watts) | Rack Mount Dimensions (in) (H x W x D) | Wall Mount Dimensions (in) (H x W x D) | Weight (Ibs) | Typical FLA (@40% THID)+ | Typical FLA (@30% THID)+ |
|---|-------------------------------------|---|--|--|-----------------|-----------------------------|-----------------------------|
| ſ | 50 | 831 | 3.94 x 20.39 x 28.05 | 27.62 x 19.69 x 4.06 | 80 | 135 | 175 |
| | 75 | 1247 | 3.94 x 20.39 x 28.05 | 27.62 x 19.69 x 4.06 | 80 | 200 | 260 |
| | 100 | 1662 | 3.94 x 20.39 x 28.05 | 27.62 x 19.69 x 4.06 | 80 | 270 | 350 |
| ſ | 150 | 2490 | 3.94 x 20.39 x 28.05 | 27.62 x 19.69 x 4.06 | 80 | 400 | 520 |

$$II_{CC} = \frac{11111111}{\sqrt{1 + TTTTITT^2}} * II_{FFFFFFF}$$



^{*}Current listed as compensating current, not load current or FLA +Calculation of compensation current can be done utilizing FLA and THID using the following equation TTTTIITT



APPENDIX II HUMAN MACHINE INTERFACE

7-INCH HMI INTERFACE & DIMENSIONS

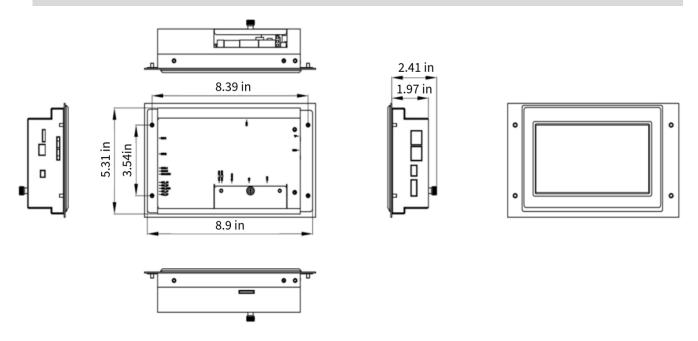


Figure A- 1 Dimensions of MTE 7-inch HMI

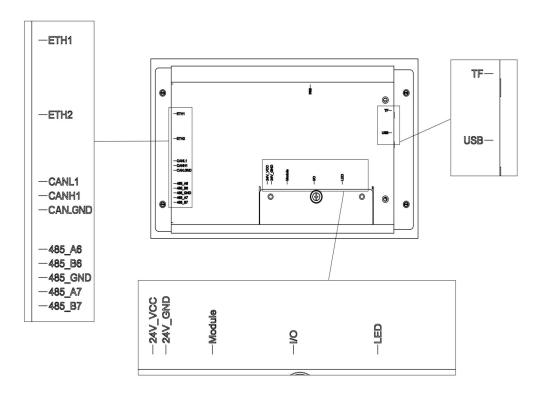


Figure A- 2 Structure of MTE 7-inch HMI

Table A-2 Introduction of MTE 7-inch HMI

| Item | Function | Note |
|---------|--|---|
| Eth1 | Used as Ethernet communication | Ontional |
| Eth2 | Osed as Ethernet communication | Optional |
| CAN_L1 | | |
| CAN_H1 | Used as CAN communication | |
| CAN_GND | | |
| 485_A6 | | |
| 485_B6 | | |
| 485_GND | Used as 485 communications | |
| 485_A7 | | |
| 485_B7 | | |
| 24V_VCC | 24V DC power supply (+) | |
| 24V_GND | 24V DC power supply (-) | |
| MODULE | Used as connecting with AHF module | The module supplies power to the HMI through this port, eliminating the need for a 24V power supply |
| I/O | Used as dry connect to power on/off module remotely and see the status of module | |
| LED | Used as connecting with RUN LED/ALARM LED/EPO button | |
| USB | Used as upgrading the software of HMI CPU via USB drive | |
| TF | Used as upgrading the software of HMI screen via micro-SD | |

Module 40 IN ALARM-C LED 30 IN NORMAL-C LED*

MTE 7-INCH HMI RECORDING AND DOWNLOAD FUNCTION

| Item | Description | | | |
|--------------|--------------------------------------|--|--|--|
| НМІ | 7" Touchscreen display | | | |
| Module Cable | 6 wire module to HMI interface 10 ft | | | |
| LED Cable | 6 wire connection to EPO and LEDs | | | |
| EPO Button | NO/NC EPO Switch YJ-LA16 | | | |
| LED Green | 6V AC/DC Green LED AD16-22DS | | | |
| LED Red | 6V AC/DC Red LED AD16-22DS | | | |

^{*}Green LED solid when actively filtering

The data recording and downloading function of MTE Electric 7inch HMI, which can be accessed from two interfaces. The first part shows the data recorded automatically by HMI, mainly historical alarms and data, and the other interface is the data and setting information collected manually by users.

04 Records Download

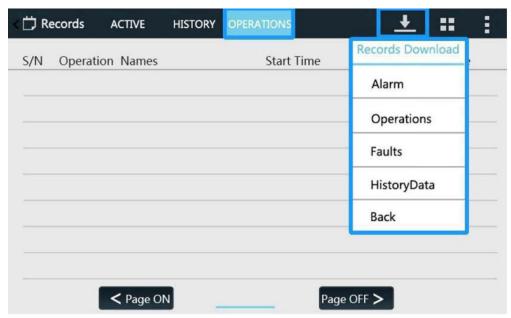


Figure A- 3 MTE 7-inch HMI Records Download

Alarms, Operations, Faults, History data

Alarm records (historical equipment alarm information) and operation records (historical manual setting records) can be exported 500 records each.

Fault point information: HMI automatically record module's fault information for MTE R&D analysis (including hardware and software faults: inverter, relay, capacitor, hall, soft start, auxiliary power supply, etc.; Info includes load current/compensation current/positive and negative bus voltage/temperature, etc.)

Historical data: HMI automatically record 20, 000 analog data (analog data include: L1/L2/L3 three-phase grid current, three-phase grid voltage, three-phase grid THID, three-phase grid THDV, three-phase grid PF, three phase grid frequency, three-phase grid active/reactive/ apparent power; L1/L2/L3 three-phase load current, three-phase load voltage, three-phase load THID, three-phase load THDV, three-phase load PF, three-phase load frequency; L1/L2/L3 three-phase compensation current, three-phase compensation load rate, temperature, etc.), record more than 20, 000 new data collected by monitoring and automatically overwrite old data.

05 Data Record & Export

When customers need to record system grid current, voltage, power factor, harmonic distortion rate and other data and monitoring settings, information can be collected and exported through the following monitoring interface.

Step 1: Setting-PREFER. -Data Record



Figure A- 4 MTE 7-inch HMI Setting-PREFER. -Data Record

Step 2: Data Record-Start Recording

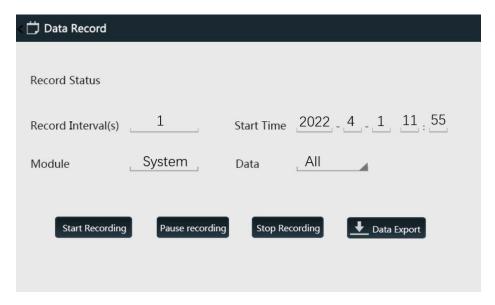


Figure A-5 MTE 7-inch HMI Data Record-Start Recording

Record Interval(s): 1 (1 second, default setting)

Setting range: 1~70 (1 second to 70 seconds record interval), can be manually set by the customer. The minimum interval time is 1 second, the maximum interval time is 70 seconds to record a record. A total of 8, 640 pieces of data will be recorded. If the record interval is set as 1, then it takes 2.4hours to complete the recording. If the record interval is set as 10, then it takes 24hours to complete the recording. If the record interval is set as 70, then it can record the data for one week.

The recording data will be stored in the HMI; the previous data will be overwritten after the next recording is restarted

Start Time: It can be set manually by the customer, and the current time will be displayed by default. Customers can choose to start data collection from the current time, or set a specific collection demand time

Module: Module (#1~ #16)/System, can select records for individual modules or data records for the entire system.

Data: All/Only Analog/Only Setting; "All": including analog data and setting parameters

Data recorded can be classified into two categories: analog (current, voltage, PF, THID, etc.) and setting parameters.

Analog data include: L1/L2/L3 three-phase grid current, three-phase grid voltage, three-phase grid THID, three-phase grid THVD, three-phase grid PF, three phase grid frequency, three-phase grid active/reactive/apparent power; L1/L2/L3 three-phase load current, three-phase load voltage, three-phase load THID, three-phase load THVD, three-phase load PF, three-phase load frequency; L1/L2/L3 three-phase compensation current, three-phase compensation load rate, temperature, etc.

Setting parameters include: all settings accessible with 080808 password (operation mode, target power factor, compensation rate, total capacity, CT transformation ratio, phase angle offset, compensation rate of various harmonics, etc.).

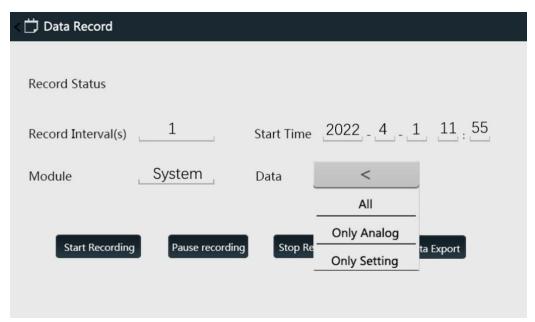


Figure A-6 MTE 7-inch HMI Data Record Setting

Step 3: Insert the USB into the HMI

Insert the USB flash drive on the side of the monitor.

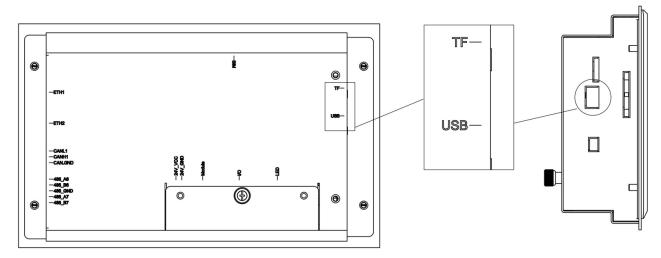


Figure A-7 MTE 7-inch HMI USB Port

Start Recording, Pause Recording, Stop Recording, Data Export

Click "Start Recording", then the HMI will start recording the data of certain module or the entire system. Recording start time can be preset via the interface, click "Start Recording" to start recording, customers can temporarily stop recording or directly terminate data recording.

Step 4: Data Export

Data record is presented in the form of Excel table, which can be exported by U disk.

Click "Export Data" to save the corresponding data in the USB flash drive in Excel format. After exporting the data, the monitoring will automatically clear the stored data in the register.



Figure A-8 MTE 7-inch HMI PO Record Data

| ID Re | cordTimeCom | mState Module | Grid | Curr. LGri | d Curr.Grid | Curr.Grid | Curr. Grid | Curr. Grid | Curr.Gri | d Curr. Gr | id Curr.Gri | d Curr. Gr | id Curr.Gr | id Volt. |
|-------|-------------|---------------|------|------------|-------------|-----------|------------|------------|----------|------------|-------------|------------|------------|----------|
| 1 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 2 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 3 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 4 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 5 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 6 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 7 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 8 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 9 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 10 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |
| 11 20 | 22-04-01 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | -1 | 130. 1 | 124 | 125. 5 | 0.1 |

Figure A-9 MTE 7-inch HMI Data Export

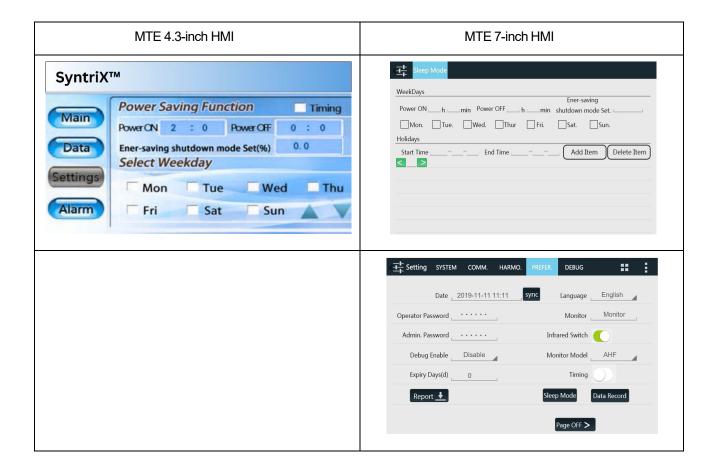
MTE HMI HOLIDAY FUNCTION

The power saving function can help user manage the working day and hour of the module according to the specific requirement of the site.

Another mode is energy saving shutdown mode, it could be set to power off the module when the load rate of the AHF is lower than certain percentage.

- Click 'timing' to enable the power saving function.
- Enter the power on time and power off time. Note: the power on and time power off time cannot be set to 0:0 at the same time, or this weekday and holiday function will not work.
- Select the weekday. Only during the weekday can the module be powered automatically.
- Select the holiday date. During the holiday, the module cannot be powered automatically.

Another mode available is set to power off the module when the load rate of the AHF is lower than the chosen percentage.



MTE 7-INCH HMI HIGHER LEVEL PASSWORD PARAMETER INTRODUCTION

Table A-3 MTE 7-inch HMI higher level password parameter introduction

| Parameter | Meaning and Function of Parameter | Options | Default setting | Unit |
|---------------------|---|-------------------|--------------------|------|
| Capacitive Comp. | This function is not used for AHF; it can realize capacitive reactive power compensation. Enable: then module can do bi-directional reactive power compensation. Disable: Module can only do inductive reactive power compensation | Enable Disable | Enable | N/A |
| LVRT | Enable: If supply voltage drops below 90% of voltage lower limit for more than 2s that module will stop working. Disable: The module only works in its entire voltage tolerance range. Once lower than voltage limit, module will stop working. For example, AHF 400V (Its voltage range is 228~456V) that means when you choose "Enable" to work, when the voltage drops the voltage lower voltage(228V) 90% (below 205, 2V), the time lasts 2s or more, the AHF will stop working automatically, but within 205, 2V, the AHF is still working. If "Disable" is selected, the AHF will stop working when the voltage reaches the lower limit (228V). Note: ① The voltage lower the compensation performance will be worse. ②Please contact engineer of MTE before changing this parameter. | Enable Disable | Disable | N/A |
| Grid Vol. Adjust | This function is not used for AHF. Grid Voltage Adjust is bind with Target Voltage and Voltage Upper/Lower Limit (%). If Grid Voltage Adjust function is Disabled, the settings for the upper voltage and lower voltage limit are invalid. Set the voltage target value. When the system voltage falls below or exceeds the target voltage range, the machine outputs reactive or perceived power to compensate for the voltage. Used with "Target Vol", "Vol. Upper Limit (%)", "Vol. Lower Limit (%)" settings. To stable the system voltage within certain range by outputting inductive/capacitive reactive power; this function is not commonly used, if there're sites the voltage fluctuates when there's big motor's starting, then we can configure with SVG to regulate the voltage. Note: Please contact the engineer of MTE before changing this parameter. | Enable Disable | Disable | N/A |

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| Target Vol. | This function relates to Grid Vol. Adjust, if Grid Vol. Adjust function is Disabled, this function is invalid. When the actual phase voltage exceeds the target voltage setting range, the module does the voltage regulation via generating reactive power into the system. Note: Please contact MTE engineers before changing this parameter. | 220/230 | 277 | V _L N |
|--------------------------|---|-----------------------|-------------------------------------|----------------------------|
| Voltage Class | Input actual rate voltage. Set as actual rate voltage of module. Note: Not every machine has these voltage options, please refer to the product specifications for details. | 440/480 | According to actual condition | VActual rate voltage |
| Freq Range | Input frequency. Set as the actual rated frequency of the module. Note: when the system frequency is out of range, the module will give alarm and automatically switch off. | 50/60 | 60Hz | Hz |
| PLL | PLL: Phase-Locked Loop Lock the phase angle of the grid and default enabling. Note: Do not change it without the guidance of MTE engineer. | Enable Disable | Enable | N/A |
| Ext. Passive Filter | When AHF works with external passive filters together to compensate for specific harmonic orders only use | 3~51 | 11 | Value |
| DYN11/DYN12/ YYN | When the module is connected to the system by a transformer, select the actual type of transformer. Currently, the module supports 3 types of transformers. | DYN11 DYN12 YYN | YYN | N/A |
| InputCurrent Abnormal | Enable: The equipment will give an alarm and stop outputting current when its input-current goes wrong. Disable: The equipment will keep outputting current when its input-current goes wrong. For this function, it can prompt the engineer to see whether there is resonance. If the abnormal current alarm occurs, the machine can return to normal within a few seconds. However, if three consecutive abnormal current alarms occur within three minutes, the alarm needs to be manually cleared before the machine can continue to operate normally, otherwise the machine will remain in the alarm state Note: Do not change it without the guidance of MTE engineer. | Enable Disable | Enable | N/A |

| CT Secondary Correct | This setting requires that the connection mode between the CT signal interface and the module be set as "serial" or "parallel". It is recommended that CT signal interfaces between modules be connected in series. Series connections will allow all modules to see the same current for compensation. | Series Parallel | Series | N/A |
|-------------------------------------|--|--------------------|--------|-------|
| L1/L2/L3_load_ THID _config. | When the load THID of L1/L2/L3 phase shown in the HMI is different than the load THID of L1/L2/L3 phase measured by the power quality detector. Coefficient = Actual load THID of L1/L2/L3 phase value on power quality detector / Load THID of L1/L2/L3 phase value on HMI. | >0 | 1.0 | Value |
| L1/L2/L3_grid_ THVD _config. | When the Grid THVD of L1/L2/L3 phase shown in the HMI is different from the Grid THVD of L1/L2/L3 phase measured by the power quality detector. Coefficient = Actual Grid THVD of L1/L2/L3 phase value on power quality detector / Grid THVD of L1/L2/L3 phase value on HMI. | | 1.0 | Value |
| L1/L2/L3_grid_ THID _config. | For factory HMI calibration, customers are forbidden to change it. Only when the customer must replace a 4.3inch HMI, then the customer may have to re-calibrate these settings by themselves if they do not keep a record of the calibration data before. E.g. If the external power quality analyzer shows the grid THID is 10%, while MTE HMI shows 12%, you can change the setting of "L1/L2/L3_grid_THID_config." to 10/12=0.83 to calibrate MTE HMI. | >0 | 1.0 | Value |
| Ener-saving shutdownmode set. | The module will power off automatically when the load rate is lower than certain value. For this function has a return difference logic that means when the load rate is more than the sum of current load rate you set and return difference value (the value is 3), the machine will power on automatically. | | 0.0 | Value |
| | Note, o means mode is switched oil of disabled. | | | |

| Fan gear | It is for maximum speed adjusted of fan. 1 is 100% speed, 0.9 is 90% speed. | 0.5~1 | 1.0 | Value |
|-------------------------|---|--------------------------|-------------------------------|-------|
| | Generally, this setting is not changed, but when the customer feels that the machine is noisy, you can contact the engineer of MTE to adjust it. | | 0 | |
| Network Config. | Setting the network structure of the module. It must be the same as the actual structure of system. | 3P3W 3P4W | According to actual condition | N/A |
| | This function is used in the case of multiple machines in parallel (PRO version). | | | |
| HostModule Number | In the monitoring group, one module will be selected as the Host, and the other machines will be the Slaves, and the Slaves are responsible for receiving commands. Fill in the Number of the Host, the Host will display information such as the total current. The Slaves will only display their own compensation current etc. | According to | According to | |
| | When paralleling, you only need to connect the CT to the Host. Both the CT installation of source side and the load side supporting. | actual condition | actual condition | Value |
| | Note: If only a machine, input 1 only. | | | |
| | Only for PRO series module, when there're multiple modules, and customers want to use one set of CT on grid side, then we must set host and slave modules. Detail setting refers to attached< PRO module CT "close loop" design Description> | | | |
| | Functions designed for Marine applications. | | | |
| THVDLimited (%) | Connected with the options of "Marine Filter" mode, only when "Marine Filter" mode is Enabled, this function can be used. | | | |
| | Modules can work under the setting limit of THVD. If THVD exceeds the value set by the customer, an alarm will appear in HMI. | 0~15% (15%at most) | 0.0 | Value |
| | Note: This setting is designed for marine application requirements, no use in common scenes. For marine application, they have a limitation of THVD and required if the THVD is more than a certain value, the harmonic filter should give an alarm. | | | |
| | Functions designed for Marine applications. | | | |
| Unbalanced Limit (%) | Connected with the options of "Marine Filter" mode, only when "Marine Filter" mode is Enabled, this function can be used. | 0~15% (15%at most) | 0.0 | Value |
| (10) | Module can work under the setting limit of unbalanced. If unbalanced exceed the value set by the customer an alarm will appear in HMI. | | | |

| | | 1 | | | |
|--------------------------------------|--|-------------------|-----------|--------------|--|
| | Limit the biggest output of the machine. | | | | |
| 5 5 . | For example, input 0.9 means the biggest capacity of the machine is 90% of its rated capacity. | | | | |
| Derating Factor | | 0~1 | 1.0 | Value | |
| | Note: Do not change it without the guidance of MTE engineer. | | | | |
| | Only used by R&D of MTE | Enable | Disable | N/A | |
| Test Mode | Note: Prohibit change. | Disable | Disable | IN/A | |
| | Used for Marine situation. | | | | |
| Marine Filter | Connected with THVD Limited (%) and Unbalanced Limit (%), which need be set when the function is enabled | Enable Disable | Disable | N/A | |
| | Note: Do not change it without the guidance of MTE engineer. | Biodbio | | | |
| AllowedOver | For standard 480V modules, when the SiC MOSFET temperature is higher than 100°C, the module will give an "over-temperature" alarm and powered off automatically, and when the temperature is less than 60°C and lasts for 5mins, the module will automatically on. | | | | |
| Temp. | For some applications, the customer does not want the module power on automatically when it's cooling down, they claim if the alarm is given repeatedly, manual operation will be required. | 1-10 | 3 | Value | |
| | "3" means if the module is given "over-temperature" alarm three times within 24hours, the module will not automatically on even when the temperature is less than 60 ℃ and lasts for 5mins. | | | | |
| Controller | Reserved functions temporarily closed. | Enable | District. | N1/A | |
| Algorithm | In the past it was for R&D only, which would be deleted from the interface. | Disable | Disable | N/A | |
| | Connected with Grid Vol. Adjust, which can only be used if "Grid Vol. Adjust" is Enabled. | | | | |
| Vol.UpperLimit (%) | Set the voltage upper limit. When the system voltage is above the voltage limit, the machine will compensate for the voltage. | 0~20 (%) | 7 | Value (%) | |
| | Connected with Grid Vol. Adjust, which can only be used if "Grid Vol. Adjust" is Enabled. | -20~0 | 40 | Value | |
| Vol.Lower Limit (%) | Set the voltage lower limit. When the system voltage is below the voltage limit, the machine will compensate for the voltage. | (%) | -10 | (%) | |
| | Harmonic compensation rate setting of L1/L2/L3 phase. | | | | |
| L1/L2/L3 Harmonic Compensation | Sometimes, if there's a certain phase THID is not good, except adjusting the compensation rate of each harmonic order, customer can also modify the compensation rate of each phase. | 0~1.1 | 1 | Value | |
| | Note: No need to modify, if want to change, please contact MTE engineer. | | | | |
| | | | | | |

| L1/L2/L3 phase _angle_bias | The setting here refers to the phase angle adjustment of the output compensated current to achieve the consistency between the phase Angle of the compensated current and the phase angle of the harmonic current and achieve better compensation effect. | | | |
|-------------------------------|---|----------|---|---|
| | The phase angle adjustment needs to be adjusted according to the actual situation on site, normally try from -1~-0.1, then 0.1~1 (accuracy is 0.01), to check whether the compensation effect is better. | -180~180 | 0 | o |
| | Note: No need to modify, if want to change, please contact a MTE engineer. | | | |

MTE 4.3-INCH HMI HIGHER LEVEL PASSWORD PARAMETER INTRODUCTION

Table A- 4 MTE 4.3-inch HMI higher level password parameter introduction

| Parameter | Meaning and Function of Parameter | Options | Default setting | Unit |
|-------------------------|---|---|----------------------------|-----------------------|
| Network Config. | Set the network structure of module. It should be the same as the actual network structure of system. | 3P3W | According to customer need | N/A |
| Voltage Class | Input actual rate voltage. Set as actual rate voltage of module. Note: Not every machine has these voltage options, please refer to the product specifications for details. | 440/480 | According to customer need | V Actual rate voltage |
| RPTracking Ctrl. Val | RP Tracking Ctrl Val means "Reactive Power Tracking Control Value". This parameter can be set to output either a constant inductive or capacitive reactive power into the system, before the system will perform its normal reactive power compensation function, as required by the load. This function can be used to compensate for the reactive power generated by the SVG itself or to compensate for magnetizing reactive power required by the upstream transformer, typically when the utility meter the client on the primary side of transformer, but SVG system is installed on the secondary side. A transformer magnetizing current should be inductive, so to compensate for the inductive reactive power, the RP Tracking Ctrl Val should be set to output capacitive reactive power. (Under normal operation, and if value is set at "0.0" the SVG will compensate for the reactive power required by the load. If the target for cos phi is set at 0.99 for the LV side, the cos phi might be 0.97 on the MV side where the client is metered. The RP Tracking Ctrl Val setting will allow SVG to output a constant cos phi to compensate for the additional reactive power required by the transformer, before performing its normal Reactive power compensation.) The setting therefore, improves the Power Factor at the metered point with lower kVA demand and reactive energy charges. (For example: A value of -7.5 will output 7.5kVAr of Capacitive Reactive Power into the system constantly before the SVG compensate for the reactive power required by the load) | [-3000, 3000] (+) Inductive (-) Capacitive | 0.0 | kvar |
| AllowedOver Temp. | For standard 480V modules, when the SiC MOSFET temperature is higher than 100°C, the module will give an "over-temperature" alarm and powered off automatically, and when the temperature is less than 60°C and lasts for 5mins, the module will automatically on. For some applications, the customer does not want the module power automatically when it's cooling down, they claim if the alarm is given repeatedly, manual operation will be required. | 1-10 | 3 | Value |

| | "3" means if the module is given "over-temperature" alarm three times within 24hours, the module will not automatically on even when the temperature is less than 60 ℃ and lasts for 5mins. | | | |
|--------------------------|--|-------------------------------------|---|-------|
| Controller Parameter | Reserved functions temporarily closed. Note: In the past it's for R&D only, will be deleted from the interface. | Enable Disable | Disable | N/A |
| Variable 1/2/3/4/5/6 | Different setting values correspond to different internal variables of DS. Note: Prohibit change. | >0 | 0 | Value |
| Test Mode | Only used by R&D of MTE Note: Prohibit change. | Enable Disable | Disable | N/A |
| Hybrid Parameter | Optimize the problem that the voltage zero-cross compensation effect is not good. Can set two parameters: 38 and 40, 38 is closed, 40 is open Note: Prohibit change. | 38 40 | 40 | Value |
| Slave module quantity | Setting the total number of modules in parallel, which are controlled by single 7inch HMI. HMI is master, all the modules are slave modules. Note: Previous manuals and info were 8, the latest one can up to 16 modules, but the response time will be lower than before if 16 pcs of modules are connected, normally we still recommend 8 modules controlled by one HMI, we will keep improving this function. | 1~16 | Thevalue of the numberof parallel modules | Value |
| Host Number | This function is used in the case of multiple machines in parallel (PRO version). In the monitoring group, one module will be selected as the Host, and the other machines will be the Slaves, and the Slaves are responsible for receiving commands. Fill in the Number of the Host, the Host will display information such as the total current. The Slaves will only display their own compensation current etc. When paralleling, you only need to connect the CT to the Host. Both the CT installation of source side and the load side supporting. Note: If only a machine, input 1 only. Only for PRO series module, when there are multiple modules and users want to use one set of CT on grid side, then we must set host and slave modules. Detail setting refers to attached< PRO module CT "close loop" design Description> | According to actual condition | According to actual condition | Value |
| Controller Algorithm | Reserved functions temporarily closed. In the past it was for R&D only, which would be deleted from the interface. | Enable Disable | Disable | N/A |
| Apparent capacity (kva) | Transformer parameter. Note: Do not change it without the guidance of MTE engineer. | >0 | 2000 | Value |

| ULL | Transformer parameter. Note: Do not change it without the guidance of MTE engineer. | >0 | 400 | Value |
|--|---|-------------------|---------|-------|
| Rated | Transformer parameter. | >0 | 50 | Value |
| Short circuit impedance | Note: Do not change it without the guidance of MTE engineer. For No-CT technology Note: Do not change it without the guidance of MTE engineer. | >0 | 6 | Value |
| uk(%) Control bandwidth | For No-CT technology Note: Do not change it without the guidance of MTE engineer. | >0 | 0.1 | Value |
| Oscilloscope enable | For No-CT technology Note: Do not change it without the guidance of MTE engineer. | >0 | Disable | N/A |
| L1/L2/L3 Inductor Cur.Config. | It is used to calibrate the machine's output current value. In the autoaging mode, choose inductive current or capacitive current output, then take an average. | | 0.0 | Value |
| L1/L2/L3 CT Current Config. | Note: Prohibit change. Make the load current that is sampled by the main control DSP corresponds to the actual load current by calibration. Note: Prohibit change. | >0 | 0.0 | Value |
| L1/L2/L3 Inverter Current Config. | Make the actual current of the inverter corresponds to the DSP value given by calibration. Note: Prohibit change. | | 0.0 | Value |
| L1/L2/L3 InputVoltage Config. | Make the grid voltage value that is sampled by the main control DSP corresponds to the actual grid voltage by calibration. Note: Prohibit change. | >0 | 0.0 | Value |
| InputFre. Rank | Setting the input-frequency of equipment. The value should correspond to actual system frequency. 50Hz/60Hz are available. | 50HZ 60HZ | 60HZ | N/A |
| PLL | PLL: Phase-Locked Loop Lock the phase angle of the grid and default enabling. Note: Do not change it without the guidance of MTE engineer. | Enable Disable | Enable | N/A |
| InputCurr. Abnormal | Enable: The equipment will give an alarm and stop outputting current when its input-current goes wrong. Disable: The equipment will keep outputting current when its input-current goes wrong. For this function, it can prompt the engineer to see whether there is resonance. If the abnormal current alarm occurs, the machine can return to normal within a few seconds. However, if three consecutive abnormal current alarms occur within three minutes, the alarm needs to be manually cleared before the machine can continue to operate normally, otherwise the machine will remain in the alarm state Note: Do not change it without the guidance of MTE engineer. | Enable Disable | Enable | N/A |

| DYN11/ DYN12/YYN | The setting value should correspond to actual connecting value of the external transformer which connected between module and grid. Note: Do not change it without the guidance of MTE engineer. | YYN DYN11 DYN12 | According to actual condition | N/A |
|------------------------------------|--|-----------------------|-------------------------------------|-------|
| CTCorrect Enable | Calibrated load current, used in P1 version only. | | | |
| Expiry Days | Originally designed as a way of disabling the module after a certain number of days of operation. When days of use expires, the module will automatically jump to the expiration prompt interface, which cannot be used normally. Only be used after entering the registration code (the registration code is provided by MTE Engineering) Note: Do not change it without the guidance of MTE engineer. | | 0 | Value |
| OutCurr.CT Ratio | The specific settings are just for other large-capacity models. | | 300 | Value |
| LVRT | LVRT: Low Voltage Ride Through Enable: If supply voltage drops below 90% of voltage lower limit for more than 2s that module will stop working. Disable: The module only works in its entire voltage tolerance range. Once lower than voltage limit, module will stop working. For example, AHF 400V (Its voltage range is 228~456V) that means when you choose "Enable" to work, when the voltage drops the voltage lower voltage(228V) 90% (below 205, 2V), the time lasts 2s or more, the AHF will stop working automatically, but within 205, 2V, the AHF still working. If "Disable" is selected, the AHF will stop working when the voltage reaches the lower limit (228V). Note: ① The lower the voltage the worse compensation performance will be. ②Please contact engineer of MTE before changing this | | Disable | N/A |
| Fan gear | parameter. It is for maximum speed adjusted of fan. 1 is 100% speed, 0.9 is 90% speed. Generally, this setting is not changed, but when the customer feels that the machine is noisy, you can contact the engineer of MTE to adjust it. | | 1.0 | Value |
| L1/L2/L3_gri d_THVD _config. | adjust it. When the Grid THVD of L1/L2/L3 phase shown in the HMI is different from the Grid THVD of L1/L2/L3 phase measured by the power quality detector. Coefficient = Actual Grid THVD of L1/L2/L3 phase value on power quality detector / Grid THVD of L1/L2/L3 phase value on HMI. | | 1.0 | Value |

| L1/L2/L3_ grid_THID _config. | For factory HMI calibration, customers are forbidden to change it. Only when a customer must replace a 4.3inch HMI, then the customer may have to re-calibrate these settings by themselves if they do not keep a record of the calibration data before. E.g. If the external power quality analyzer shows the grid THID is 10%, while MTE HMI shows 12%, you can change the setting of "L1/L2/L3_grid_THID_config." to 10/12=0.83 to calibrate MTE HMI. | >0 | 1.0 | Value |
|------------------------------------|--|--------------------|-------------------------------------|-------|
| L1/L2/L3_ load_THID _config. | When the load THID of L1/L2/L3 phase shown in the HMI is different than the load THID of L1/L2/L3 phase measured by the power quality detector. Coefficient = Actual load THID of L1/L2/L3 phase value on power quality detector / Load THID of L1/L2/L3 phase value on HMI. | >0 | 1.0 | Value |
| Product model | Use to choose the corresponding product for the screen. | AHF SVG ASVG | According to actual condition | N/A |
| Clear alarm | Clear all alarm history record | Clear | According to actual condition | N/A |
| Product models adapt | Automatically choose the corresponding product for the screen. | Disable Enable | Disable | N/A |

APPENDIX III DRY CONTACT BOARD INTRODUCTION

INTERFACE & DIMENSIONS

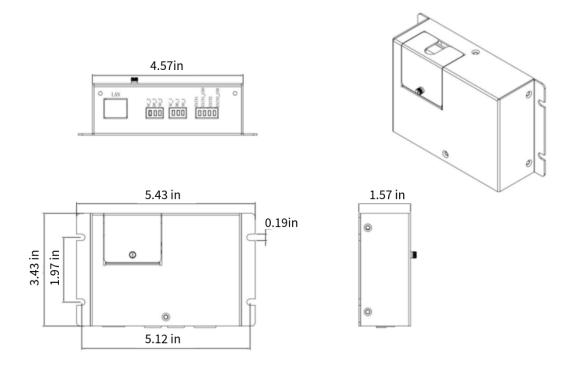


Figure A- 38 Dimensions of Dry Contact Board

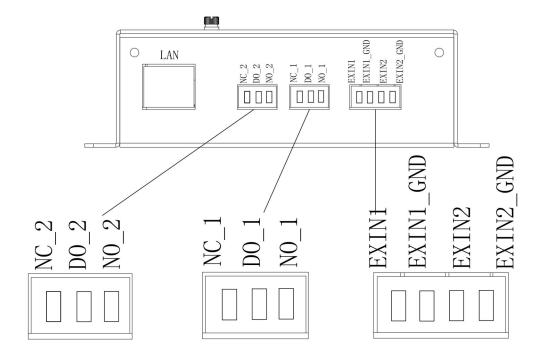


Figure A-39 Structure of Dry Contact Board

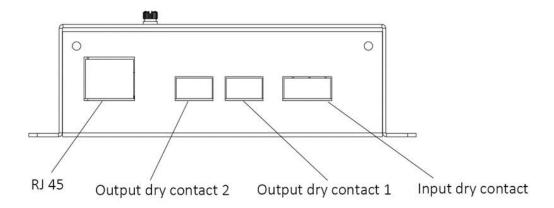


Figure A-40 Structure of Dry Contact Board Simplified

MTE dry contact board is an optional accessory which offers 2 additional functions:

- Providing Ethernet port enables users to build MODBUS TCP communication between the module and external system.
- Providing 2 input dry contacts and 2 output dry contacts. Users could use dry contact to monitor the working status and alarm status through output dry contact and use input dry contact to control the module to power on or power off.

RJ45 ETHERNET PORT

MTE offers Modbus protocol and RJ45 Ethernet port. The user can access the module to the user LAN through the network cable, then establish communication between the user Ethernet monitoring system and the module based on Modbus.

OUTPUT DRY CONTACT 2

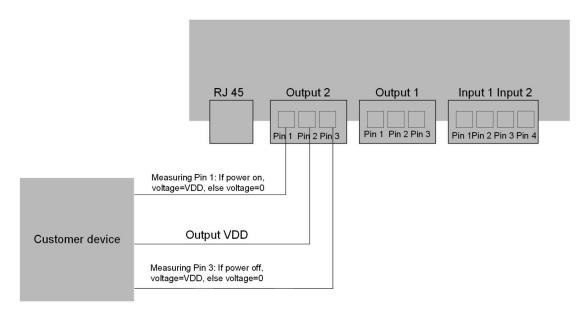


Figure A-41 Dry contact output 2

This dry contact is used to monitor the on/off status of the module.

As shown in figure 3, Pin 2 always output high level: VDD. Pin 1 and Pin 3 have two level: high level "VDD" and low level "0".

To monitor the module power status, there is need to measure the output level of Pin 1 and Pin 3.

- If module power is on, Pin 1 output high level: VDD, else output low level: 0.
- If module power is off, Pin 3 output high level: VDD, else output low level: 0.

The user can use the voltage level change of the Pin1 and Pin 3 to design peripheral circuit to monitor the on/off status of the module.

OUTPUT DRY CONTACT 1 RJ 45 Output 2 Output 1 Input 1 Input 2 Pin 1 Pin 2 Pin 3 Pin 4 Measuring Pin 1: If no alarm, voltage=VDD, else voltage=0 Output VDD Measuring Pin 3: If alarm, voltage=VDD, else voltage=0

Figure A-42 Dry contact output 1

This dry contact is used to monitor whether the module has an alarm or not.

As shown in figure 4, Pin 2 always output high level: VDD. Pin 1 and Pin 3 have two level: high level "VDD" and low level "0".

- If the module has no alarm, Pin 1 output high level: VDD, else output low level: 0.
- If module has an alarm, Pin 3 output high level: VDD, else output low level: 0.

The user can use the level change of the Pin1 and Pin 3 to design peripheral circuit to monitor whether the module has an alarm or not.

The maximal allowable DC current in the output end is 8A, the maximum DC voltage is 28V and the maximum AC voltage is 277V.

INPUT DRY CONTACT

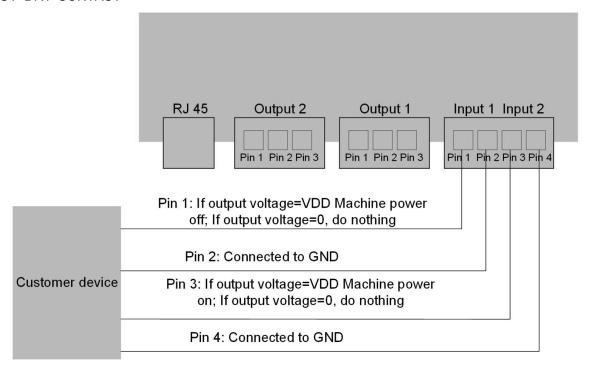


Figure A-43 Dry contact input

As shown in figure 5, there are four input ports. Pin 2 and Pin 4 are connected to GND.

- If input high level "VDD" to Pin 1, the module will turn off. If input low level "0" to Pin 1, the module will do nothing.
- If input high level "VDD" to Pin 3, the module will turn on. If input low level "0" to Pin 3, the module will do nothing.

The high-level range: DC 7V~36V, ideal range is DC 10V~20V.

DRY CONTACT BOARD INSTALL POSITION

For AHF SyntriX series module, the dry contact board space is reserved at the rear side of the module.

The red circle below is the position of dry contact board installed in MTE SyntriX AHF

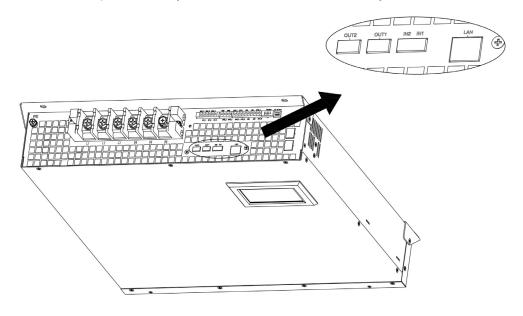


Figure A-44 AHF wall-mounted SyntriX AHF dry contact board position

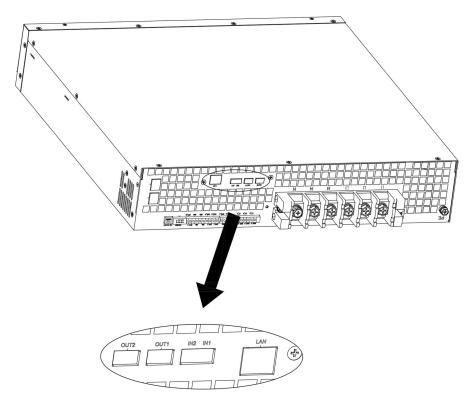


Figure A-45 AHF rack-style SyntriX AHF dry contact board position

DRY CONTACT BOARD CONNECTION GUIDANCE

CONNECT TO SINGLE LCD MODULE

Dry contact board and LCD control board both have a black 14-pin port and a white 10-pin port.

The black 14-pin port is used to connect the dry contact signal between two boards. If customers need the dry contact function, they must connect two ports through one 14-pin cable.

The white 10-pin port is used to connect the RJ45 Ethernet port between two boards. If customers need to use the RJ45 Ethernet port on the dry contact board, they must connect two ports through one 10-pin cable. MTE will send customers the 14-pin cable and the 10-pin cable if required.



Figure A-46 Connection to 4.3-inch LCD panel

CONNECT TO 7-INCH HMI

The 7-inch HMI has the Ethernet port itself; it is no need to use the RJ45 Ethernet port of the dry connect board. When connecting dry contact board to 7-inch HMI, just connect the black 14-pin terminal of the dry connect board to the J24 port on the 7-inch HMI.



Figure A- 47 Connection to 7-inch HMI

When the dry contact board works with 7-inch HMI, usually the dry contact board is installed outside the module.



Figure A-48 Dry Contact Board Optional

APPENDIX IV MODBUS

MODBUS PROTOCAL OUTLINE

Protocol Overview

MODBUS is an application layer protocol and widely used in industrial control. This protocol describes the MODBUS communication protocol implemented in SyntriX product family. Communication uses response mode, the host sends request, then the slave executes request and response.

Application Scope

This protocol applies to SyntriX series product, for DSP module data exchange with monitor and for monitor data exchange with background software.

Reference Standard

MODBUS RTU communication protocol standards

Based level communication protocol

Asynchronous serial protocol UART

Physical interface

Two-wire RS485 interface

Data transfer rate

Optional between 9600/19200/38400bps, default is 19200bps.

Character format

The transfer mode is asynchronous mode; half duplex mode; start bit contains 1 bit; data bit contains 8 bits; stop bit contains 1 bit; no check.

DATA TYPE

Integer

Integer storage format is 2 bytes. When transmitting, high bytes D15~D8 go first, and then low bytes D7~D0.

Float

The floating-point storage format is four bytes, using IEEE32 bit standard Floating-point format (Standard C language format). First transmit high bytes D31~D24, second D23~D16, third D15~D8, last transmit low bytes D7~D0.

COMMUNICATION

Communication applies Master-Slave mode, monitor as the host and DSP module as the slave; or backstage software as the host, monitor as the slave.

After the host sends the request, it will wait for the slave to reply within 100ms. If there is no reply after the timeout or an error response is received, the communication process will be considered as failure.

APPLICATION LAYER PACKET/FRAME FORMAT DEFINITION

Data Verification

Data verification uses 16 bits (2byte) cyclic redundancy check (CRC). All information will be involved in verification. The contents of CRC are obtained by the lengthy detection method of loop on the message contents. The CRC content is appended to the end of the message, first in low bytes and then in high bytes. For the specific CRC check, please refer to the Appendix II.

Function Code Supported by device

| Function Code | Function Description |
|---------------|--|
| 02 | Read status information and alarming information of the device |
| 03, 04 | Read analog data, waveform, histogram, and information of manufacturer |
| 16 | Set parameter into device |

Function Code 02

Request Frame:

| Format Address | | Function Code | Status Bit Start Address | | Status Quantity | | Chaole |
|----------------|---------|-----------------------|--------------------------|-----|-----------------|-----|--------|
| Format Addre | Address | Address Function Code | High | Low | High | Low | Check |
| Byte | 1 | 1 | 1 | 1 | 1 | 1 | 2 |

The address range of the device is $0 \sim 247$, and the default address is 1. 0xFF is the broadcast address.

Response Frame:

| Format | Address | Function Code | Byte Quantity | Data | Check |
|--------|---------|---------------|---------------|------|-------|
| Byte | 1 | 1 | 1 | | 2 |

Byte Quantity = Status Quantity /8 + (State Quantity% 8 == 0? 0: 1) For

example, to get all 61 status and alarm analog data:

- TX: 01 02 00 00 00 3D B9 DB
- RX:01 02 08 00 00 00 00 00 00 00 00 C4 12

Function Code 03, 04

Request Frame:

| Format Address | | Register Start Address | | Register Quantity | | Charle | |
|----------------|---------|------------------------|------|-------------------|------|--------|-------|
| | Address | Function Code | High | Low | High | Low | Check |
| Byte | 1 | 1 | 1 | 1 | 1 | 1 | 2 |

Response Frame:

| Format | Address | Function Code | Byte Quantity | Data | Check |
|--------|---------|---------------|---------------|------|-------|
| Byte | 1 | 1 | 1 | | 2 |

Byte Quantity = Register Quantity * 2

For example, to get the first frame data (50 analog data):

- Tx: 01 04 00 00 00 64 F1 E1
- Rx: 01 04 C8 xx xxxx... CRCL CRCH

xx means feedback data. CRCL: check code (low bytes). CRCH: check code (high bytes)

Function Code 16

Request Frame:

| Format Address | | | Register Start Address | | Register Quantity | | Data Bytes | Data | Check |
|----------------|---------------|------|------------------------|------|-------------------|------------|------------|-------|-------|
| Format Address | Function Code | High | Low | High | Low | Data bytes | Dala | CHECK | |
| Byte | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 2 |

Response Frame:

| Format Address | Addross | Ellipotion Code | Register Start Address | | Register Quantity | | Chook |
|----------------|---------|-----------------|------------------------|-----|-------------------|-----|-------|
| | Address | | High | Low | High | Low | Check |
| Byte | 1 | 1 | 1 | 1 | 1 | 1 | 2 |

For example:

To set the operation mode as "Constant Q"

Tx:01 10 20 1c00 02 04 41 40 00 00 7E DF

Rx:01 10 20 1c 00 02 8B CE

Set the Constant reactive as 300 (300kvar inductive power output)

Tx:01 10 20 54 00 02 04 43 96 00 00 9B 09

Rx:01 10 20 54 00 02 0B D8

Error Code

Request Frame:

| Format | Address | Function Code | Fault Code | Check |
|--------|---------|---------------|------------|-------|
| Byte | 1 | 1 | 1 | 2 |

Error Code= Function Code + 0x80

Fault Code

01 Function Code Error

02 Address Error

03 Data Error

04 Device Failure

05 Confirm

06 Busy

REQUEST/RESPONSE INFORMATION DETAILS

ACQUIRE STATUS INFORMATION AND ALARMING INFORMATION OF THE DEVICE

Function Code = 02 Status Start Address = 0x0000

Table A-6Acquire status information and alarming information of the device

| Status Address | Byte | Description | Remark | Data Attribute |
|-------------------|------|----------------------------|--|----------------|
| 0x0000 | 1 | Initialize flag | 0: No Initialization, 1: Initialization | |
| 0x0001 | 1 | Running status | 0: Standby 1: Run | |
| 0x0002 | 1 | Reserved | | |
| 0x0003 | 1 | Reserved | | |
| 0x0004 | 1 | Reserved | | |
| 0x0005 | 1 | Reserved | | |
| 0x0006 | 1 | Reserved | | |
| 0x0007 | 1 | Reserved | | |
| 8000x0 | 1 | Reserved | | |
| 0x0009 | 1 | Reserved | | |
| 0x000A | 1 | Reserved | | |
| 0x000B | 1 | Reserved | | |
| 0x000C | 1 | Reserved | | |
| 0x000D | 1 | Reserved | | |
| 0x000E | 1 | Reserved | | |
| 0x000F | 1 | Reserved | | |
| 0x0010 | 1 | Dry contact output 1 | 0: Low level 1: High level | |
| 0x0011 | 1 | Dry contact output 2 | 0: Low level 1: High level | |
| 0x0012 | 1 | Dry contact output 3 | 0: Low level 1: High level | |
| 0x0013 | 1 | Dry contact output 4 | 0: Low level 1: High level | |
| 0x0014 | 1 | Dry contact output 5 | 0: Low level 1: High level | |
| 0x0015 | 1 | Dry contact output 6 | 0: Low level 1: High level | |
| 0x0016 | 1 | Dry contact output 7 | 0: Low level 1: High level | |
| 0x0017 | 1 | Dry contact output 8 | 0: Low level 1: High level | |
| 0x0018 | 1 | Lightning arrester failure | 0: Normal 1: Abnormal | |
| 0x0019 | 1 | Reserved | | |
| 0x001A | 1 | Reserved | | |
| 0x001B | 1 | Reserved | | |
| 0x001C | 1 | Reserved | | |
| 0x001D | 1 | Reserved | | |
| 0x001E | 1 | Reserved | | |
| 0x001F | 1 | Reserved | | |
| 0x0020 | 1 | Reserved | | |
| 0x0021 | 1 | Reserved | | |
| 0x0021 | 1 1 | Reserved | | |
| 0x0023 | 1 | Reserved | | |
| 0x0024 | 1 1 | Reserved | | |

| 0x0025 | 1 | Reserved | |
|--------|---|---|--------------------------|
| 0x0026 | 1 | Reserved | |
| 0x0027 | 1 | Reserved | |
| 0x0028 | 1 | Inverters short-circuit failure | 0: Normal 1: Abnormal |
| 0x0029 | 1 | Output current abnormal | 0: Normal 1: Abnormal |
| 0x002A | 1 | Auxiliary power failure | 0: Normal 1: Abnormal |
| 0x002B | 1 | Fuse failure | 0: Normal 1: Abnormal |
| 0x002C | 1 | Fan failure | 0: Normal 1: Abnormal |
| 0x002D | 1 | Inverter over-temperature | 0: Normal 1: Abnormal |
| 0x002E | 1 | CT ratio setting failure | 0: Normal 1: Abnormal |
| 0x002F | 1 | Inverter overload failure | 0: Normal 1: Abnormal |
| 0x0030 | 1 | System failure | 0: Normal 1: Abnormal |
| 0x0031 | 1 | Input frequency abnormal | 0: Normal 1: Abnormal |
| 0x0032 | 1 | Input voltage abnormal | 0: Normal 1: Abnormal |
| 0x0033 | 1 | Input phase reverse | 0: Normal 1: Abnormal |
| 0x0034 | 1 | Control software compatibility failure | 0: Normal 1: Abnormal |
| 0x0035 | 1 | Controller parameter setting failure | 0: Normal 1: Abnormal |
| 0x0036 | 1 | Monitoring parameter setting failure | 0: Normal 1: Abnormal |
| 0x0037 | 1 | Capacity reading failure | 0: Normal 1: Abnormal |
| 0x0038 | 1 | Emergency stop | 0: Normal 1: Abnormal |
| 0x0039 | 1 | Busbar differential abnormal | 0: Normal 1: Abnormal |
| 0x003A | 1 | CT current zero point calibration failure | 0: Normal 1: Abnormal |
| 0x003B | 1 | Module communication failure | 0: Normal 1: Abnormal |
| 0x003C | 1 | Module software compatibility failure | 0: Normal 1: Abnormal |
| 0x003D | 1 | Capacitor over-current | 0: Normal 1: Abnormal |
| 0x003E | 1 | Soft-starter failure | 0: Normal 1: Abnormal |
| 0x003F | 1 | Sync signal failure | 0: Normal 1: Abnormal |
| 0x0040 | 1 | Grid voltage sampling failure | 0: Normal 1: Abnormal |
| 0x0041 | 1 | Hall censor failure | 0: Normal 1: Abnormal |
| 0x0042 | 1 | Busbar sampling failure | 0: Normal 1: Abnormal |
| 0x0043 | 1 | Air switch abnormal disconnect | 0: Normal 1: Abnormal |
| 0x0044 | 1 | Electric operating mechanism failed to connect | 0: Normal 1: Abnormal |
| 0x0045 | 1 | Electric operating mechanism failed to disconnect | 0: Normal 1: Abnormal |

| 0x0046 | 1 | Output current unbalance | 0: Normal 1: Abnormal |
|--------|---|---------------------------|--------------------------|
| 0x0047 | 1 | Harmonics exceed limits | 0: Normal 1: Abnormal |
| 0x0048 | 1 | Cooling system failure | 0: Normal 1: Abnormal |
| 0x0049 | 1 | 422 Communication failure | 0: Normal 1: Abnormal |
| 0x004A | 1 | CAN communication failure | 0: Normal 1: Abnormal |

ACQUIRE ANALOG DATA

Function Code = 03, 04 Register Start Address= 0x0000

Table A-7 Acquire analog data

| Register Address | Byte | Description | Unit | Data Attribute |
|------------------|------|------------------------|-------------------------|----------------|
| 0x0000 | 4 | L1 Load Current | Α | |
| 0x0002 | 4 | L2 Load Current | Α | |
| 0x0004 | 4 | L3 Load Current | Α | |
| 0x0006 | 4 | L1 Load THID | % | |
| 0x0008 | 4 | L2 Load THID | % | |
| 0x000A | 4 | L3 Load THID | % | |
| 0x000C | 4 | L1 Load Power Factor | | |
| 0x000E | 4 | L2 Load Power Factor | | |
| 0x0010 | 4 | L3 Load Power Factor | | |
| 0x0012 | 4 | L1 Inductor Current | Α | |
| 0x0014 | 4 | L2 Inductor Current | Α | |
| 0x0016 | 4 | L3 Inductor Current | Α | |
| 0x0018 | 4 | L1 Grid Apparent Power | kVA | |
| 0x001A | 4 | L2 Grid Apparent Power | kVA | |
| 0x001C | 4 | L3 Grid Apparent Power | kVA | |
| 0x001E | 4 | L1 Active Power | kW | |
| 0x0020 | 4 | L2 Active Power | kW | |
| 0x0022 | 4 | L3 Active Power | kW | |
| 0x0024 | 4 | N Line Grid Current | Α | |
| 0x0026 | 4 | N Line Load Current | Α | |
| 0x0028 | 4 | L1 Grid Current | Α | |
| 0x002A | 4 | L2 Grid Current | Α | |
| 0x002C | 4 | L3 Grid Current | Α | |
| 0x002E | 4 | L1 Grid THID | % | |
| 0x0030 | 4 | L2 Grid THID | % | |
| 0x0032 | 4 | L3 Grid THID | % | |
| 0x0034 | 4 | L1 Grid Power Factor | | |
| 0x0036 | 4 | L2 Grid Power Factor | | |
| 0x0038 | 4 | L3 Grid Power Factor | | |
| 0x003A | 4 | Temperature1 | $^{\circ}$ C | |
| 0x003C | 4 | Temperature2 | $^{\circ}\! \mathbb{C}$ | |
| 0x003E | 4 | Temperature3 | $^{\circ}$ | |
| 0x0040 | 4 | L1 Grid Reactive Power | kVar | |
| 0x0042 | 4 | L2 Grid Reactive Power | kVar | |
| 0x0044 | 4 | L3 Grid Reactive Power | kVar | |
| 0x0046 | 4 | L1 Grid COSPHI | | |
| 0x0048 | 4 | L2 Grid COSPHI | | |
| 0x004A | 4 | L3 Grid COSPHI | | |
| 0x004C | 4 | L1 Load Reactive Power | kVar | |
| 0x004E | 4 | L2 Load Reactive Power | kVar | |

| 0x0050 | 4 | L3 Load Reactive Power | kVar | |
|--------|---|------------------------------|-------|--|
| 0x0052 | 4 | L1 Comp Current | A | |
| 0x0054 | 4 | L2 Comp Current | A | |
| 0x0056 | 4 | L3 Comp Current | A | |
| 0x0058 | 4 | L1 Comp Current Load Rate | % | |
| 0x005A | 4 | L2 Comp Current Load Rate | % | |
| 0x005C | 4 | L3 Comp Current Load Rate | % | |
| 0x005E | 4 | Temperature 4 | °C | |
| 0x0060 | 4 | Temperature5 | °C | |
| 0x0062 | 4 | Temperature6 | °C | |
| 0x0064 | 4 | L1 Load Apparent Power | kVA | |
| 0x0066 | 4 | L2 Load Apparent Power | kVA | |
| 0x0068 | 4 | L3 Load Apparent Power | kVA | |
| 0x006A | 4 | L1 Load Active Power | kW | |
| 0x006C | 4 | L2 Load Active Power | kW | |
| 0x006E | 4 | L3 Load Active Power | kW | |
| 0x0070 | 4 | L1 Load COSPHI | | |
| 0x0072 | 4 | L2 Load COSPHI | | |
| 0x0074 | 4 | L3 Load COSPHI | | |
| 0x0076 | 4 | L1 Grid Voltage | V | |
| 0x0078 | 4 | L2 Grid Voltage | V | |
| 0x007A | 4 | L3 Grid Voltage | V | |
| 0x007C | 4 | L1 Grid Frequency | Hz | |
| 0x007E | 4 | L2 Grid Frequency | Hz | |
| 0x0080 | 4 | L3 Grid Frequency | Hz | |
| 0x0082 | 4 | L1 Grid THVD | % | |
| 0x0084 | 4 | L2 Grid THVD | % | |
| 0x0086 | 4 | L3 Grid THVD | % | |
| 0x0088 | 4 | Config Variable 1 | | |
| 0x008A | 4 | Config Variable2 | | |
| 0x008C | 4 | Config Variable3 | | |
| 0x008E | 4 | Config Variable4 | | |
| 0x0090 | 4 | Config Variable5 | | |
| 0x0092 | 4 | Config Variable6 | | |
| 0x0094 | 4 | Operation Time | Sec | |
| 0x0096 | 4 | Over 50% Load Operation Time | Sec | |
| 00000 | 4 | Below50%Load | 0 | |
| 0x0098 | 4 | Operation Time | Sec | |
| 0x009A | 4 | Positive DC Bus Voltage | V | |
| 0x009C | 4 | Negative DC Bus Voltage | V | |
| 0x009E | 4 | Inductor Temperature | °C | |
| 0x00A0 | 4 | Capacitance Current | 0.01A | |

READ THE WAVEFORM DATA OF THE DEVICE(WAVEFORM)

Function Code = 03, 04 Register Start Address = 0x0500

A complete waveform consists of 128 points. A byte represents the value of a point. 128 points are needed to draw a complete waveform. Data is transferred from low to high, where the first byte represents the first point, and so on.

Table A-8 Read the waveform data of the device

| Register Address | Byte | Description | Remark | Data Attribute |
|------------------|------|--------------------------|--------|----------------|
| 0x0500 | 128 | L1 Grid Voltage Waveform | | |
| 0x0540 | 128 | L2 Grid Voltage Waveform | | |
| 0x0580 | 128 | L3 Grid Voltage Waveform | | |
| 0x05C0 | 128 | L1 Load Current Waveform | | |
| 0x0600 | 128 | L2 Load Current Waveform | | |
| 0x0640 | 128 | L3 Load Current Waveform | | |
| 0x0680 | 128 | L1 Comp Current Waveform | | |
| 0x06C0 | 128 | L2 Comp Current Waveform | | |
| 0x0700 | 128 | L3 Comp Current Waveform | | |
| 0x0740 | 128 | L1 Grid Current Waveform | | |
| 0x0780 | 128 | L2 Grid Current Waveform | | |
| 0x07C0 | 128 | L3 Grid Current Waveform | | |

READ THE WAVEFORM DATA OF THE DEVICE (HISTOGRAM)

Function Code = 03, 04 Register Start Address = 0x0B00

A complete histogram consists of 60 points, one byte representing the value of one point, and only needs to be transmitted once. Data is transferred from low to high, where the first byte represents the first point, and so on.

Table A-9 Read the waveform data of the device

| Register Address | Byte | Description | Remark | Data Attribute |
|------------------|------|------------------------|--------|----------------|
| 0x0B00 | 80 | L1 Grid THVD Histogram | | |
| 0x0B28 | 80 | L2 Grid THVD Histogram | | |
| 0x0B50 | 80 | L3 Grid THVD Histogram | | |
| 0x0B78 | 80 | L1 Load THID Histogram | | |
| 0x0BA0 | 80 | L2 Load THID Histogram | | |
| 0x0BC8 | 80 | L3 Load THID Histogram | | |
| 0x0BF0 | 80 | L1 Grid THID Histogram | | |
| 0x0C18 | 80 | L2 Grid THID Histogram | | |
| 0x0C40 | 80 | L3 Grid THID Histogram | | |

ACQUIRE INFORMATION OF MANUFACTURER

Function Code = 03, 04 Register Start Address = 0x1000

Table A- 10 Acquire Information of Manufacturer

| Register Address | Byte | Description | Remark |
|---------------------|------|------------------|---|
| 0x1000 | 2 | Protocol Version | In decimal form E.g. 100 means V100 protocol. |
| 0x1001 | 2 | Software Version | In decimal form The upper 12bits represent main version lower 4 bits represent branch version. E.g. 0x0641means that main version is 100 and branch version is 01 |
| 0x1002 | 2 | Device Address | 1~247 |
| 0x1003 | 2 | Reserved | |

READ INFORMATION OF MONITOR MANUFACTURER

Function Code 03, 04 Register Start Address = 0x1200

Table A-11 Read Information of Monitor Manufacturer

| Register Address | Byte | Name | Remark | | |
|---------------------|------|---------------------|---|--|--|
| 0x1200 | 2 | Protocol Version | In decimal form E.g. 100 means V100 protocol. | | |
| 0x1201 | 2 | Software Version | In decimal form The upper 12bits represent main version lower 4 bits represent branch version. E.g. 0x0641means that main version is 100 and branch version is 01 | | |
| 0x1202 | 2 | Device Address | 1~247 | | |
| 0x1203 | 2 | Reserved | | | |
| 0x1204 | 2 | Drycontact input | From low to high, every bit respectively represents dry contact input 1, dry contact input 2 and so on. 1: High level 0: Low level | | |
| 0x1205 | 2 | Drycontact output | From low to high, every bit respectively represents dry contact output 1, dry contact output 2 and so on. 1: High level 0: Low level | | |

ACQUIRE PARAMETERS OF DEVICE (GENERAL SETTINGS)

Function Code = 03, 04 Register Start Address = 0x2000

Table A-12 Acquire Parameters of Device (General Settings)

| Register | Byte | Description | Remark |
|----------|------|---|--|
| Address | Dyte | | remark |
| | | Initialization | [1-10] |
| 0x2000 | 4 | Number of Slave | Default: 1 |
| 0x2002 | 4 | CT ratio | [0, 30000] Default: 300 (Issue DSP module restart) |
| 0x2004 | 4 | External transformer ratio | [0.1, 75] Default: 1.0 (Issue DSP module restart) |
| 0x2006 | 4 | Parallel Machine Capacity | [10, 30000] Default: 25 (Issue DSP module restart) |
| 0x2008 | 4 | Reserved | |
| 0x200A | 4 | Reserved | |
| 0x200C | 4 | Harmonic Compensation Rate setting | [0.01, 1] Default: 1 |
| 0x200E | 4 | Target Power Factor setting | [-1, 1] Default: 1 |
| 0x2010 | 4 | Reserved | |
| 0x2012 | 4 | Reserved | |
| 0x2014 | 4 | Reserved | |
| 0x2016 | 4 | Reserved | |
| 0x2018 | 4 | Reserved | |
| 0x201A | 4 | Reserved | |
| 0x201C | 4 | Working Mode | Default: 0 (Harmonic Compensation) For details, please refer to Appendix II. |
| 0x201E | 4 | Power On Mode | 0: Auto 1: Manual Default: 1 |
| 0x2020 | 4 | Compensation Mode | 0: Intelligent 1: Sequential 2: All Default: 1 (Issue DSP module restart) |
| 0x2022 | 4 | CT location | 0: Grid 1: Load Default: 1 (Issue DSP module restart) |
| 0x2024 | 4 | Three-phase three-wire/ Three-phase four-wire system | 0: 3P4W 1: 3P3W Default: 0 (Issue DSP module restart) |
| 0x2026 | 4 | Reserved | |
| 0x2028 | 4 | CT Secondary Wiring | 0: Series 1: Parallel Default: 0 (Issue DSP module restart) |
| 0x202A | 4 | Reserved | |
| 0x202C | 4 | Inductance Current Calibration Process | Capacitive Current Calibration Inductive Current Calibration Default: 0 (Issue DSP module restart) |

| | | | 0: 50Hz |
|---------|---|--|---------------------------------|
| 0x202E | 4 | Input Frequency Level | 1: 60Hz |
| | | | Default: 60Hz |
| | | | 1: Disable |
| 0x2030 | 4 | PPL Enable | 0: Enable |
| | | | Default: 1 |
| | | | 1: Disable |
| 0x2032 | 4 | Input Current Abnormal Enable | 0: Enable |
| | | · | Default: 1 |
| 0x2034 | 4 | Reserved | |
| | | | 1: Disable |
| 0x2036 | 4 | Temperature Derating Enable | 0: Enable |
| | | | Default: 1 |
| | | Consolitive Reactive Review Commencetion | 1: Disable |
| 0x2038 | 4 | Capacitive Reactive Power Compensation | 0: Enable |
| | | Enable | Default: 1 |
| 0x203A | 4 | Reserved | |
| 0x203C | 4 | Reserved | |
| | | | 1: Disable |
| 0x203E | 4 | Grid Voltage Adjustment Enable | 0: Enable |
| | | | Default: 1 |
| 0x2040 | 4 | Reserved | |
| 0x2042 | 4 | Reserved | |
| 0x2044 | 4 | Reserved | |
| | | | [100V, 700V] |
| 0x2046 | 4 | Target voltage | Default: 277V |
| 0,2010 | | Target Voltage | Accuracy: 0.1 |
| 0x2048 | 4 | Reserved | |
| 0x204A | 4 | Reserved | |
| 0x204C | 4 | Reserved | |
| | | | |
| 0x204E | 4 | Reserved | |
| 0x2050 | 4 | Reserved | |
| | | | |
| 0x2052 | 4 | Reserved | 1,0000 0, 0000 01 |
| | | | [-3000.0, 3000.0] Default: 1 |
| 0x2054 | 4 | Constant reactive | |
| | | | Accuracy: 0.1 |
| 0x2056 | 4 | Voltage Upper Limit (%) | [0, 20%] Default: 7% |
| | | g () | |
| 0x2058 | 4 | Voltage Lower Limit (%) | [-20%, 0] |
| | | , , , | Default: 10% |
| 0x205A | 4 | Reserved | |
| | | | [0, 50] |
| 0x205C | 4 | THVD Limit (%) | Default: 0 |
| | | | Advanced |
| | | | [0, 1] |
| 0x205E | 4 | Unbalance Limit | Default: 0 |
| | | | Advanced |
| | | | [-3000.0, 3000.0] |
| 0x2060 | 4 | Reactive Power Tracking Control Value | Default: 0 |
| 0,12000 | | Treadure Ferrei Traditing Control Value | Accuracy:0.1 |
| | | | Generally |
| 0x2062 | 4 | Reserved | |
| 0x2064 | 4 | Reserved | |
| 0x2066 | 4 | Reserved | |
| 0x2068 | 4 | Reserved | |
| | | | [0.0, 100.0] (0 means disable) |
| 0x206A | 4 | Low Load Energy-saving Shutdown Mode | Default: 0 |
| | | | Accuracy: 0.1 |
| 0x206C | 4 | Reserved | |
| 0x206E | 4 | Reserved | |
| | | | |

ACQUIRE PARAMETERS OF DEVICE (PARAMETER OF PHASE ANGLE OFFSET)

Function Code = 03, 04 Register start address = 0x2500

Table A-13 Acquire Parameters of Device (Parameter of Phase Angle Offset)

| Register Address | Byte | Name | Remark |
|------------------|------|----------------------------------|---|
| 3 | 1 7 | Initialization | |
| 0x2500 | 4 | Fundamental phase angle offset | [-40, 40] Accuracy: 0.1 Default: 0 |
| 0x2502 | 4 | 3rd Harmonic phase angle offset | [-180, 180] Accuracy: 0.1 Default: 0 |
| 0x2504 | 4 | 5th Harmonic phase angle offset | [-180, 180] Accuracy: 0.1 Default: 0 |
| 0x2506 | 4 | 7th Harmonic phase angle offset | [-180, 180] Accuracy: 0.1 Default: 0 |
| 0x2508 | 4 | 9th Harmonic phase angle offset | [-180, 180] Accuracy: 0.1 Default: 0 |
| 0x250A | 4 | 11th Harmonic phase angle offset | [-180, 180] Accuracy: 0.1 Default: 0 |
| 0x250C | 4 | 13th Harmonic phase angle offset | [-180, 180] Accuracy: 0.1 Default: 0 |
| 0x250E | 4 | L1 phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2510 | 4 | L2 phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2512 | 4 | L3 phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2514 | 4 | 2se Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2516 | 4 | 4th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2518 | 4 | 6th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x251A | 4 | 8th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x251C | 4 | 10th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x251E | 4 | 12th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2520 | 4 | 14th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2522 | 4 | 15th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |

| | 1 | T | [-180, 180] |
|--------|---|----------------------------------|---|
| 0x2524 | 4 | 16th Harmonic phase angle offset | Accuracy: 0.01 Default: 0 |
| 0x2526 | 4 | 17th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2528 | 4 | 18th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 |
| 0.2020 | 7 | Tott Harmonic phase angle onset | Default: 0 [-180, 180] |
| 0x252A | 4 | 19th Harmonic phase angle offset | Accuracy: 0.01 Default: 0 |
| 0x252C | 4 | 20th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x252E | 4 | 21st Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2530 | 4 | 22nd Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2532 | 4 | 23rd Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2534 | 4 | 24th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2536 | 4 | 25th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2538 | 4 | 26th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x253A | 4 | 27th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x253C | 4 | 28th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x253E | 4 | 29th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2540 | 4 | 30th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2542 | 4 | 31th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2544 | 4 | 32th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2546 | 4 | 33th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x2548 | 4 | 34th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| 0x254A | 4 | 35th Harmonic phase angle offset | [-180, 180] Accuracy: 0.01 Default: 0 |
| | | | [-180, 180] |
| 0x254C | 4 | 36th Harmonic phase angle offset | Accuracy: 0.01 |
| | | | Default: 0 |

| 0x254E 4 37th Harmonic phase angle offset Accuracy: 0.01 Default: 0 0x2550 4 38th Harmonic phase angle offset [-180, 180] Accuracy: 0.01 Default: 0 0x2552 4 39th Harmonic phase angle offset Accuracy: 0.01 Default: 0 0x2554 4 40th Harmonic phase angle offset [-180, 180] Accuracy: 0.01 Default: 0 0x2556 4 41th Harmonic phase angle offset Accuracy: 0.01 Default: 0 0x2558 4 42th Harmonic phase angle offset Accuracy: 0.01 Accuracy: 0.01 | |
|--|--|
| 0x2550 4 38th Harmonic phase angle offset [-180, 180] | |
| Default: 0 [-180, 180] Accuracy: 0.01 Default: 0 | |
| 0x2552 4 39th Harmonic phase angle offset [-180, 180] | |
| 0x2552 4 39th Harmonic phase angle offset Accuracy: 0.01 Default: 0 0x2554 4 40th Harmonic phase angle offset [-180, 180] Accuracy: 0.01 Default: 0 0x2556 4 41th Harmonic phase angle offset Accuracy: 0.01 Default: 0 [-180, 180] Accuracy: 0.01 Default: 0 | |
| Default: 0 0x2554 4 40th Harmonic phase angle offset 0x2556 4 41th Harmonic phase angle offset 0x2556 Default: 0 [-180, 180] Accuracy: 0.01 Default: 0 [-180, 180] Accuracy: 0.01 Default: 0 [-180, 180] | |
| 0x2554 4 40th Harmonic phase angle offset Accuracy: 0.01 Default: 0 0x2556 4 41th Harmonic phase angle offset [-180, 180] Accuracy: 0.01 Default: 0 0x2556 1 1 1 0x2556 2 1 1 0x2556 3 1 1 0x2556 4 4 4 4 0x2556 4 4 4 4 4 0x2556 4 </td <td></td> | |
| Default: 0 0x2556 4 41th Harmonic phase angle offset Accuracy: 0.01 Default: 0 [-180, 180] Accuracy: 0.01 Default: 0 [-180, 180] | |
| 0x2556 4 41th Harmonic phase angle offset [-180, 180] Accuracy: 0.01 Default: 0 [-180, 180] | |
| Default: 0 [-180, 180] | |
| [-180, 180] | |
| | |
| | |
| Default: 0 | |
| [-180, 180] | |
| 0x255A 4 43th Harmonic phase angle offset Accuracy: 0.01 Default: 0 | |
| [-180, 180] | |
| 0x255C 4 44th Harmonic phase angle offset Accuracy: 0.01 | |
| Default: 0 | |
| 0x255E 4 45th Harmonic phase angle offset [-180, 180] Accuracy: 0.01 | |
| 0x255E 4 45th Harmonic phase angle offset Accuracy: 0.01 Default: 0 | |
| [-180, 180] | |
| 0x2560 4 46th Harmonic phase angle offset Accuracy: 0.01 | |
| Default: 0 | |
| 0x2562 4 47th Harmonic phase angle offset Accuracy: 0.01 | |
| Default: 0 | |
| [-180, 180] | |
| 0x2564 4 48th Harmonic phase angle offset Accuracy: 0.01 Default: 0 | |
| [-180, 180] | |
| 0x2566 4 49th Harmonic phase angle offset Accuracy: 0.01 | |
| Default: 0 | |
| 0x2568 4 50th Harmonic phase angle offset Accuracy: 0.01 | |
| Default: 0 | |

ACQUIRE PARAMETERS OF DEVICE (HARMONIC COMPENSATION PARAMETERS)

Function Code = 03, 04 Register start address = 0x2A00

Table A-14 Acquire Parameters of Device (Harmonic Compensation Parameters)

| Register Address | Byte | Name | Remark |
|------------------|------|-----------------------------------|------------------------|
| Initialization | | | |
| 0x2A00 | 4 | 2nd Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A02 | 4 | 3rd Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A04 | 4 | 4th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A06 | 4 | 5th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A08 | 4 | 6th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A0A | 4 | 7th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A0C | 4 | 8th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A0E | 4 | 9th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A10 | 4 | 10th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A12 | 4 | 11th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A14 | 4 | 12th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A16 | 4 | 13th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A18 | 4 | 14th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A1A | 4 | 15th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A1C | 4 | 16th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A1E | 4 | 17th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A20 | 4 | 18th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A22 | 4 | 19th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A24 | 4 | 20th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A26 | 4 | 21st Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A28 | 4 | 22nd Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A2A | 4 | 23rd Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A2C | 4 | 24th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A2E | 4 | 25th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A30 | 4 | 26th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A32 | 4 | 27th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A34 | 4 | 28th Harmonic compensation degree | [0, 110] Default: 0 |

| | 1 | 1 | L TO . 4.403 |
|------------------|---|-----------------------------------|------------------------|
| 0x2A36 | 4 | 29th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A38 | 4 | 30th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A3A | 4 | 31st Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A3C | 4 | 32nd Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A3E | 4 | 33rd Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A40 | 4 | 34th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A42 | 4 | 35th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A44 | 4 | 36th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A46 | 4 | 37th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A48 | 4 | 38th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A4A | 4 | 39th Harmonic compensation degree | [0, 110] |
| 0x2A4C | 4 | 40th Harmonic compensation degree | Default: 0 [0, 110] |
| 0x2A4E | 4 | 41st Harmonic compensation degree | Default: 0 [0, 110] |
| 0x2A50 | 4 | 42nd Harmonic compensation degree | Default: 0 [0, 110] |
| 0x2A52 | 4 | 43rd Harmonic compensation degree | Default: 0 [0, 110] |
| 0x2A54 | 4 | · · · · · · | Default: 0 [0, 110] |
| | | 44th Harmonic compensation degree | Default: 0 [0, 110] |
| 0x2A56 | 4 | 45th Harmonic compensation degree | Default: 0 [0, 110] |
| 0x2A58 | 4 | 46th Harmonic compensation degree | Default: 0 |
| 0x2A5A | 4 | 47th Harmonic compensation degree | Default: 0 |
| 0x2A5C | 4 | 48th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A5E | 4 | 49th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A60 | 4 | 50th Harmonic compensation degree | [0, 110] Default: 0 |
| 0x2A62 | 4 | Reserved | |
| 0x2A64 | 4 | Reserved | |
| 0x2A66 | 4 | Reserved | |
| 0x2A68 | 4 | Reserved | |
| 0x2A6A | 4 | Reserved | |
| 0x2A6C | 4 | Reserved | |
| 0x2A6E | 4 | Reserved | |
| 0x2A70 | 4 | Reserved | |
| 0x2A72 | 4 | Reserved | |
| 0.0474 | | | |
| 0x2A74 0x2A76 | 4 | Reserved Reserved | |

ACQUIRE PARAMETERS OF DEVICE (NO INITIALIZATION)

Function Code = 03, 04
Register start address = 0x2C00
End address = 0x30ff

Table A-15 Acquire Parameters of Device (No Initialization)

| Register address | Byte | Name | Remark | | |
|-------------------|------|-----------------------------------|--------------------------------------|--|--|
| No initialization | | | | | |
| 0x2C00 | 4 | L1 Input Voltage Calibration | Greater than 0 | | |
| 0x2C02 | 4 | L2 Input Voltage Calibration | Greater than 0 | | |
| 0x2C04 | 4 | L3 Input Voltage Calibration | Greater than 0 | | |
| 0x2C06 | 4 | Reserved | | | |
| 0x2C08 | 4 | L1 Inductance Current Calibration | Greater than 0 | | |
| 0x2C0A | 4 | L2 Inductance Current Calibration | Greater than 0 | | |
| 0x2C0C | 4 | L3 Inductance Current Calibration | Greater than 0 | | |
| 0x2C0E | 4 | L1 CT Current Calibration | Greater than 0 | | |
| 0x2C10 | 4 | L2 CT Current Calibration | Greater than 0 | | |
| 0x2C12 | 4 | L3 CT Current Calibration | Greater than 0 | | |
| 0x2C14 | 4 | L1 Inverter Current Calibration | Greater than 0 | | |
| 0x2C16 | 4 | L2 Inverter Current Calibration | Greater than 0 | | |
| 0x2C18 | 4 | L3 Inverter Current Calibration | Greater than 0 | | |
| 0x2C1A | 4 | Clear Fault | Pass 1 | | |
| 0x2C1C | 4 | CT Zero Point Calibration Enable | Pass 1 (Issue DSP module restart) | | |
| 0x2C1E | 4 | Power On | Pass 1 | | |
| 0x2C20 | 4 | Power Off | Pass 1 | | |
| 0x2c22 | 4 | Reserved | | | |
| 0x2c24 | 4 | Reserved | | | |
| 0x2c26 | 4 | Reserved | | | |

READ THE PARAMETERS OF THE DEVICE (EACH HARMONIC COMPENSATION MODE)

A mode is composed of three parameters. The value of each bit represents whether the mode is selected for the first harmonic. 1 means selection, 0 means no selection.

 ${\bf Table\,A-16\,Read\,the\,parameters\,of\,the\,device\,(each\,harmonic\,compensation\,mode)}$

| Register address | Byte | Name | Remark |
|------------------|------|--|------------------|
| Initialization | | | |
| 0x3200 | 4 | 2se~24th harmonic compensation mode 1 | Default 0x7FFFFF |
| 0x3202 | 4 | 25th~47th harmonic compensation mode 1 | Default 0x7FFFFF |
| 0x3204 | 4 | 48th~61th harmonic compensation mode 1 | Default 0x7 |
| 0x3206 | 4 | 2se~24th harmonic compensation mode 2 | Default 0 |
| 0x3208 | 4 | 25th~47th harmonic compensation mode 2 | Default 0 |
| 0x320A | 4 | 48th~61th harmonic compensation mode 2 | Default 0 |
| 0x320C | 4 | 2se~24th harmonic compensation mode 3 | Default 0 |
| 0x320E | 4 | 25th~47th harmonic compensation mode 3 | Default 0 |
| 0x3210 | 4 | 48th~61th harmonic compensation mode 3 | Default 0 |

SETTING PARAMETERS OF DEVICE

The parameter setting value is a floating-point number. It is represented by 4 bytes. Therefore, the function code 16 is used to set a single parameter and a plurality of parameters, including general parameters, phase angle offset parameters, harmonic compensation parameters, and no initialization parameters.

ACQUIRE FAULT RECORD

Function Code: 03, 04

Register start address = 0xf000

MTE MODBUS APPLICATION

MODBUS is an application layer protocol and is widely used in industrial control. MTE provides both MODBUS RTU and TCP/IP communication. RTU is realized by RS485 interface and TCP/IP by Ethernet port. Using Modbus, customers can realize the following functions:

- Acquire the status and alarm information.
- Acquire data like analog value, waveform, histogram, and manufacturer information.
- Set the parameters of the device. For more details, please refer to the MTE Modbus protocol.

Physical Connection

The following instructions are on establishing connection between PC and modules via MODBUS

MODBUS TCP/IP

For 7-inch HMI, the Ethernet port is on the side of it. Ethernet connection has two types:

*7-Inch HMI is required for ethernet connection on wall hanging units

1 Monitor connects with PC directly via ethernet cable

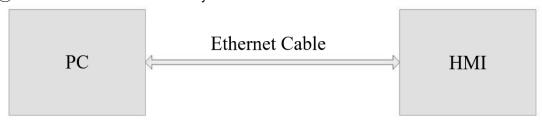


Figure A-49 Monitor connects with PC directly via ethernet cable

1. Make sure the ethernet cable is firmly connected with the monitor. After the Ethernet cable is successfully connected, the green LED.



Figure A-50 Connecting

- 2. Set the IP address and Subnet Mask manually on the monitor. Make sure they are on the same network segment as the PC.
- 3. Ping the address.
- 4. After successfully pinging the address, use the software modbuspoll for debugging. To establish the

connection, the IP address should be the one of monitor and the

2 Monitor connects with PC via router

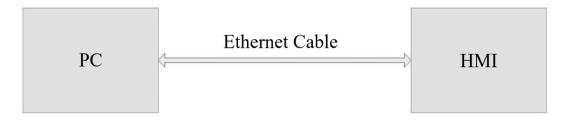


Figure A-51 Monitor connects with PC via router

- 1. Make sure the ethernet cable is firmly connected with the monitor. After the ethernet cable is successfully connected, the green LED light on the port will flicker.
- 2. The router will assign IP address to PC automatically. Set the IP address, mask and gateway manually on the monitor and make sure they are on the same Network segment as the ones of PC.
- 3. Ping the address.
- 4. After successfully pinging the address, use the software modbuspoll for debugging. To establish the connection, the IP address should be the one of monitor and the port should be 1025.

MODBUS RTU

RS485 is a standard function for all MTE products. For single units, RS485 interfaces are on the back side. For the 7-inch HMI, they're on the right side, and 485_A7 and 485_B7 are for remote control.

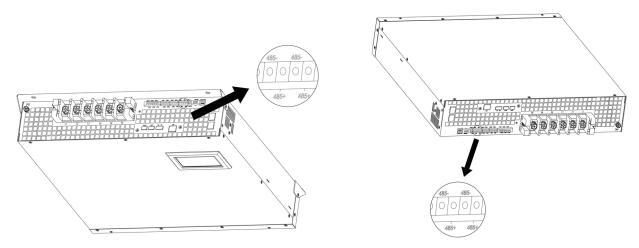


Figure A- 52 Single Module Unit

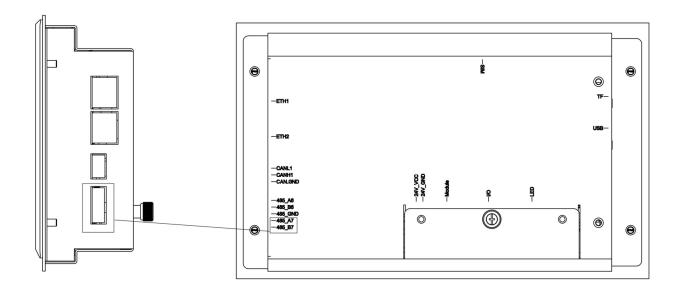


Figure A- 53 7-inch HMI

If it were to connect with PC, an adapter is needed, like 485 to 232 adapter or 485 to USB adapter. Monitor connects with PC via adapter.

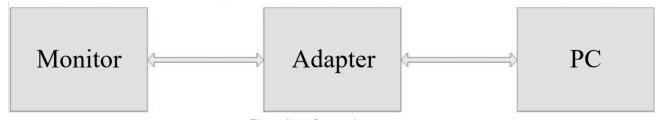


Figure A- 54 Connecting

- 1. Make sure devices are firmly connected.
- 2. Set the Baud rate on the monitor.
- 3. Use instruments like modbuspoll for commission. The Baud rate should match the one set on the monitor. The port should match the one the unit is connected to, which is shown

APPENDIX VI CABINET DESIGNING INSTRUCTIONS

CABINET COMPONENT LIST

When users need to design their own cabinets, below is a list of additional components needed:

Table A-21 Cabinet component list

| Item | Number | Note |
|-------------------|---------------------|--------------------|
| power cable | According to design | |
| 485 cable | According to design | |
| CT cable | According to design | |
| СТ | 3 | Available from MTE |
| CT Terminals bar | 1 | |
| EPO Button | 1 | |
| Indicator (Red) | 1 | |
| Indicator (Green) | 1 | |
| new7-inch HMI | 1 | Available from MTE |
| SyntriX Module(s) | Max. is 16 | |
| MCCB(Breaker) | 1 | |

For others, customers can choose to buy on their own or from MTE.

CABINET VENTILATION DESIGN

When users need to design their own cabinets, please reference MTE cabinet design.

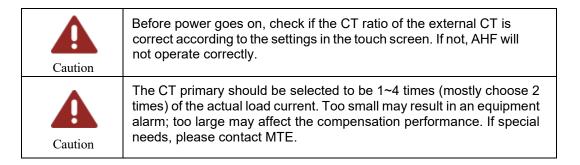
APPENDIX VII CURRENT TRANSFOMER

As one of external components of AHF, the current transformer (CT) plays a key role in the normal operation of AHF, so the selection of external CT is extremely important. In 3-phase 3-wire system, three CTs are required, each installed on phase L1, phase L2, and phase L3; while in 3-phase 4-wire system, three CTs are required, each installed on the circuits of phase L1, phase L2 and phase L3.

CT TYPE

AHF can use an external CT ratio between 50:5~30000:5. Practical CT ratio should be selected within this range in accordance with actual load current. The setting of the CT ratio can be programmed into AHF via the settings during the commissioning phase.

Split-core or Solid-core CTs are both suitable for use. The accuracy of current transformers should be higher than 0.2 (Solid-core) or 0.5 (Split-core). Lower °C of accuracy may affect the compensation accuracy.



CT CONNECTION ON SECONDARY SIDE

When connecting the secondary CT cables to AHF module, for A phase the S1 terminal of the CT is connected to the CT_A marked terminal on AHF and the S2 terminal of the CT is connected to the CT A GND marked terminal of AHF. This is duplicated for each phase.

CT SIZING

The CT ratio selection should be 1~4 times to maximum load current.

| MTE Part Number | CT Ratio | Rated Current (A) | Min FLA (A) 4X | Max FLA (A) 1.0X |
|-----------------|----------|----------------------|-------------------|---------------------|
| CTK-0200-01 | 200:5 | 200 | 50 | 200 |
| CTK-0300-01 | 300:5 | 300 | 75 | 300 |
| CTK-0400-01 | 400:5 | 400 | 100 | 400 |
| CTK-0600-01 | 600:5 | 600 | 150 | 600 |
| CTK-0800-01 | 800:5 | 800 | 200 | 800 |
| CTK-1000-01 | 1000:5 | 1000 | 250 | 1000 |
| CTK-1200-01 | 1200:5 | 1200 | 300 | 1200 |
| CTK-1600-01 | 1600:5 | 1600 | 400 | 1600 |
| CTK-2000-01 | 2000:5 | 2000 | 500 | 2000 |

- Part number includes 3 CTs
- All CTs include an 8 ft 16 AWG twisted pair cable
- Unless otherwise noted all CTs are 5A output

CT VA BURDEN

INSTRUCTION

Current transformers (CT) are used for measuring current and play a key role in the normal operation of MTE Active Harmonic Filter.

CT maintains an accurate ratio between the currents in its primary and secondary circuits over a defined range. The alternating current in the primary produces an alternating magnetic field in the core, which then induces an alternating current in the secondary.

CTs are specified by a specific current ratio from primary to secondary side. The rated secondary current is normally 1 or 5A. MTE AHF is compatible with CTs with secondary side current of 1A or 5A.

MECHANICAL STRUCTURE

There are two main types of CTs.

Solid core CTs form a permanently enclosed core. Installing a solid-core CT requires disconnecting the wire to get it through the CT core. The benefit is that they are usually less expensive and can be more accurate. They are most often used for new installations.

Split-core CTs have an "opening" in the core that allows the CT to be opened and placed around the conductor without interrupting the wiring. Split-core CTs can be more expensive, but more convenient.

CT RATIO

MTE AHF is compatible with CTs with secondary side current of 1A or 5A.

For the CT with secondary side current of 1A, the range of CT ratio MTE AHF can support is 10/1~6000/1.

For the CT with secondary side current of 5A, the range of CT ratio MTE AHF can support is50/1~30000/1.

CT BURDEN

CT burden is the total resistance of the secondary side. The maximum CT burden will vary depending on the CT turns ratio, the desired CT output and the rated current of the sensor. The value of CT burden is given in the specification of CT.

CT burden is commonly expressed in one of two ways:

The total impedance (Ω)

The total VA

CT CABLE

When choosing the length of CT cable, it's needed to consider the following

factors The total resistance of CT's secondary side (CT burden) (check CT

spec)

The resistance of CT cable (Calculate based on the cable diameter)

The resistance between the 2 pins of AHF CT port (MTE AHF/SVG is 4.3×10 3 VA)

When the total resistance of the two CT cables exceeds the CT burden, the accuracy of the CT will be reduced. The load on the conductor can be calculated by using the following formula to determine how far the conductor can be extended without affecting accuracy.

CONCLUSION

For the CT with the CT burden ≥ 5VA

If CT cable < 15m, 2.5mm², dual twisted pair CT cable is suggested.

If CT cable > 15m but < 30m, 4mm², dual twisted pair CT cable is suggested.

If CT cable > 30m, it is necessary to confirm whether the CT rated load is larger than the cable impedance.

CALCULATION

For the impedance calculation of the CT cable, please refer to the following calculation of the 100m CT cable

$$R = \rho \frac{L}{S}$$

For example, calculate the CT cable impedance by the formula below

R: the impedance of cable

ρ: copper resistivity L: cable length

S: cross-sectional area

L=100m, S=4mm², ρ =0.0172Ω·mm²/m,

so R=0.43

So, one round of CT cable impedance is $2*R=0.86\Omega$

The secondary side current of CT is 5A, but in fact the current should be less than 3.9A, otherwise AHF will show alarm because of AHF software setting.

So,
$$P = I^2R = 3.9^2 * 0.86 = 13.08VA$$

Since the CT is short-circuit inside the AHF, the impedance of AHF could be neglected.

Based on the calculation, as long as the CT burden is bigger than 13.08VA, then AHF could work normally.

THE VA BURDEN OF OUR AHF MODULE

Same as before calculation.

For our AHF/SVG module, L=20mm, S=2.5mm² ρ =0.0172 Ω • mm²/m, So R=1.4X10⁻⁴ Ω ,

2R=2.8X10⁻⁴ Ω So $P = I^2R = 3.9^2 * 2.8X10^{-4} \Omega = 4.3X10^{-3}V$.

CT SPECIAL APPLICATION INSTALLATION

When doing both harmonic mitigation and reactive power compensation with AHF and SVG equipment, please notice that AHF installation point should be closer to the Load side than SVG as below figure shows.

APPENDIX VIII CABLE SIZING

Table A-22MTE power cable sizing recommended table

| Rated Current | 100 | 150 | 200 | 250 | 300 | 400 | 500 | 550 | 600 | 750 | 900 |
|-------------------------------|--|--|------|------|------|-------|-------|-------|-------|-------|-------|
| Phase L1/L2/L3 mm2 | 35 | 50 | 95 | 120 | 70*2 | 95*2 | 120*2 | 150*2 | 185*2 | 240*2 | 185*3 |
| PhaseN mm2 | 35*3 | 50*3 | 150 | 185 | 95*2 | 120*2 | 150*2 | 185*2 | 240*2 | 185*3 | 240*3 |
| PEcable mm2 | 16 | 25 | 50 | 70 | 70 | 95 | 120 | 150 | 185 | 240 | 95*3 |
| Power terminal screw | M8 | M8 | M10 | M10 | M10 | M10 | M10 | M12 | M12 | M16 | M16 |
| Power cable tightening torque | 108~132(kgf.cm) | | | | | | | | | | |
| PE terminal screw | M8 | M8 | M8 | M8 | M8 | M8 | M8 | M8 | M8 | M8 | M8 |
| Rated currentof Breaker | 160A | 200A | 350A | 400A | 500A | 630A | 630A | 700A | 800A | 1000A | 1250A |
| CT cable | Below 1 | Below 15m: RVVSP 2*2.5 mm2; 15m-30m: RVVSP 2*4 mm2; above 30m: contact MTE | | | | | | | | | |
| Rangeof CT ratio | eof 50/5-20000/5 | | | | | | | | | | |
| Remark | Use AHF rated current as the current in this table, it provides the reference for power cable, neutral cable, PE cable and breaker sizing. This table is only for reference of power cable sizing. For some countries, there is more redundancy required when sizing the cable. In some Europe country, almost 70% redundancy need to be considered when choosing the current. For example, for AHF 150A module, some countries might require power cables that can sustain 264A current, so 95mm2 cable is required. If there is requirement for cable temperature, the specification of cable needs to be expanded. The power terminal screw and PE terminal screw dimension and power cable tightening torque could be found in the table. | | | | | | | | | | |

Note:

- The cable size selection of N phase should 3 times to phase if the zero-sequence harmonic as a main part of total harmonic current
- ♦ The CT ratio selection should be 1.5~4 times to maximum load current
- The Rated current selection of breakers should be 1.25 times or above to AHF rated capacity
- ♦ Accuracy class 0.5 or 0.2 of CT is sufficient for the module.
- ♦ The above 100A and 150A are only recommended for module cable selection, and the rest recommended for cabinet cable selection.

POWER ON STEPS



WARNING

Only after AHF is installed and commissioned by an engineer correctly and the external power switch has been closed, can the power on steps be executed.

These power on steps are applicable to AHF when it is at off-position. Operation steps are as follows:

- Supply power to AHF by closing the breaker between the grid and AHF.
- II. Close the breaker in the cabinet. The HMI starts to work. If the green running indicator light of the main cabinet flicks, it will indicate that AHF is normally energized. In case of any failure, the red alarm indicator on the cabinet will be on.
- When powered on and normal supply is established and if AHF has been set as 'Automatic power on' mode, the system AHF will power on automatically.
- IV. If it is set as 'manual power on' and after the monitoring screen has started upon the energizing process, click 'power on' in the menu. After a normal soft power is on, the system will switch on the power module.

POWER OFF STEPS



WARNING

To prevent personal injury and in case of cabinet maintenance or opening after shutdown, disconnect all input switches. Conduct relevant measures using a multimeter to ensure personal safety.

Click power off in the menu to stop system immediately and enter the 'stop' state.

Note: In a stop state, the internal system and terminal are still electrified (live). When the power is not disconnected, any maintenance or opening the cabinet is strictly prohibited.

AUTO POWER ON

In case of abnormal grid voltage or frequency, AHF will automatically stop compensating current output and enter standby state (standby mode will not operate in case of power outage).

When the following conditions are met, AHF will automatically re-run and recover output.

- The utility power has recovered to normal
- II. Auto-power on has been enabled in Settings-General-Start mode.
- III. Auto-power on delay is enabled (default: 10 sec)

Please note: If the auto power-on feature of AHF isn't enabled, the user needs to manually start AHF using the touch/monitor screen.

EMERGENCY STOP

In the case of an abnormal function or output of AHF, press the EPO button on the front panel to turn off the module (for cabinet solution). Immediately disconnect the circuit breaker or isolation switch between AHF and the grid to cut off the system input power.

After pressing EPO and finishing troubleshooting, if all tests appear OK, re-press the EPO button and click on the monitor screen, select 'Clear fault', and perform the startup operations if there is no alarm sounding.

APPENDIX X MTE INTELLIGENT FUNCTION

debugging, and the compensation effect is significant.

MTE MODE 2 & MODE 3

MODE 2 OVERVIEW

Automatic Phase Angle Adjustment. MTE's software algorithm can adjust the phase angle intelligently through software. Engineers no longer need to manually adjust the phase angle, the software can automatically adjust the phase angle to achieve optimal results, effectively saving the time of on-site

MODE 3 OVERVIEW

Resonance Suppression: Resonance management has always been a difficult problem in the process of harmonic compensation in the Power Quality industry, especially in the case of capacitor bank that need to be considered when compensating harmonics, and many manufacturers' filter solutions are helpless against resonance; MTE's software algorithm can effectively deal with this situation, and with the correct configuration and installation of CT, it can effectively compensate harmonics, and even if there is resonance in the system, MTE SYNTRIX series filter can effectively suppress it and compensate harmonics significantly with Mode2 function.

Sensorless voltage control: MTE's latest software algorithm in Mode3 support to control THVD with sensorless technology (without CT installation.)

MODE 2 INTRODUCTION

Hardware Requirement

--CT must be installed at Grid/Supply side (Close loop)

Software Requirement:

--Software Reversion must be D021 or above.

Settings in HMI:

The process below is the basic settings for mode 2 Function:

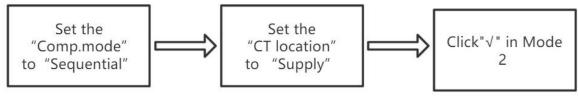


Figure A-73 MTE mode 2 operation steps

Comp.Mode Set to 'Sequential' → 'CT Location' Set to 'Supply'



Figure A-74 Comp.Mode set to 'Sequential'

Figure A- 75 CT Location set to "Supply"

Click"√" in Mode2

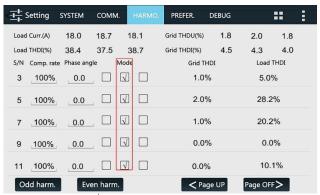


Figure A- 76 Click"√" in Mode2

After these settings, we can power on with Mode2 and the harmonic can be compensated significantly.

MODE3 INTRODUCTION

Below is the basic process of instruction for mode 3

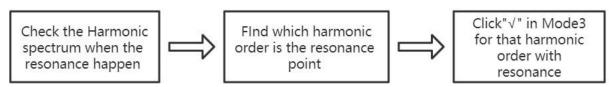


Figure A-77 MTE mode 3 operation steps

Settings instruction:

(1) Check the harmonic spectrum in the HMI, if we see the situation in the spectrum that some harmonic order doesn't exist at the beginning but suddenly comes up and the grid harmonic distortion is higher than load, then we can consider the resonance is existing in the system.



Figure A-78 Harmonic Spectrum

(2) Find the resonance point in the spectrum, it is normally the highest content of harmonic order. Take the photo below as an example, as we can see the highest harmonic content is in the 13th harmonic order, we can consider the resonance point is in 13th harmonic order.



Figure A-79 Resonance Point

(3) Click " $\sqrt{\ }$ " in the Mode3 for 13th harmonic order.

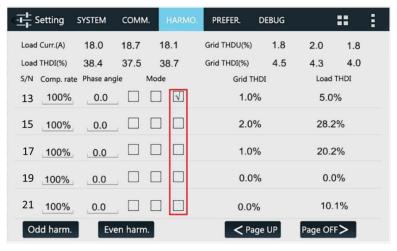


Figure A- 80 Click"√" in Mode3

(4) After clicking" $\sqrt{\ }$ " in Mode3 and power on the module, we can check the spectrum that the resonance is suppressed automatically.



Figure A-81 Compensation Performance

MTE MODE 2 & MODE 3 Q&A

Q: What is the Software version that has the above Mode2 & Mode3 function?

A: The software version must be D021 or above.

Q: Do these 2 Mode only can be used in SYNTRIX series?

A: For Mode2, if the software version of P2 series module is higher than D021, then the Mode includes the function, if not, please contact MTE to check if the module can be updated to D021 and use the function.

For Mode3, only Proseries module and SYNTRIX series module have sensorless voltage control functions.

Q: For Mode 2, can we use it when CT is installed at load side?

A: No, The CT must be located at supply side, and please set the "Comp.Mode" to "Sequential".

Q: Can Mode2 and Mode3 be used at the same time?

A: Yes, but we don't recommend to click" $\sqrt{}$ " in Mode3 for all harmonic order because it would affect the compensation performance, we recommend to click" $\sqrt{}$ " in Mode3 only for that harmonic order with resonance condition to get better compensation performance.

Q: For Mode 2 that only can be choosing 'Sequential' compensation mode?

A: Yes, when the customer chooses to use the mode two that the 'Compensation mode' must be 'Sequential' and 'CT Location' must be 'Supply;

MTE THVD COMPENSATION MODE (OPTIONAL FUNCTION)

WORKING PRINCIPLE INTRODUCE

THVD compensation mode does not need external CT. It analyzes the harmonic voltage content of the system by sampling the voltage through power cable. and then with the information of the system impedance, DSP will calculate how much compensation current need to inject to the grid to mitigate THVD of the system.

Applications: High THVD environment where the THVD exceeds the limits.

SIZING OF THVD MITIGATION APPLICATION

About the sizing pls contact MTE engineer with the information below:

- Apparent capacity (KVA)
- II. ULL: Rated line voltage at secondary side(V)
- III. Rated frequency (Hz)
- IV. Short Circuit Impedance uk (%)
- v. THVD and voltage RMS information of each order or harmonic voltage information of each order.

INSTRUCTION

Step 1:

Cable Wiring: Only need to connect 3P4W power cables, and CT cable cannot be connected.

Step 2:

HMI setting: other basic settings are same as standard module, only need to pay attention to below settings:

Harmonic compensation order interface: there are 3 columns for each order, each column represents one mode. The first column means mode 1, second column means mode 2 and third column means mode 3. Here for THVD mitigation mode 3 is required.

First check the third column of each harmonic order. Please note that only 10 columns can be selected, it is because AHF only can support compensating 10 different harmonics maximum in this mode, the user can choose 10 harmonic orders from 2nd to 50th.



Figure A-82 THVD compensation setting

Step 3:

Input transformer parameter setting: these parameters can be found on transformer nameplate.

- Apparent capacity (KVA)
- II. ULL: Rated voltage at secondly side
- III. Rated Frequency
- IV. Short Circuit Impedance uk (%)

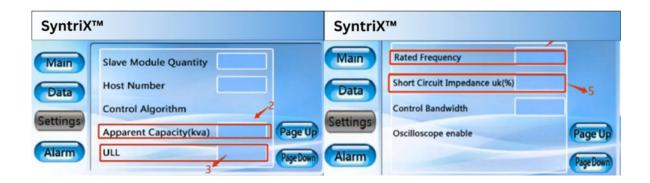


Figure A-83 THVD compensation setting

With this data, the AHF can compensate the THVD more accurately. If users don't have the exact data, it is ok not to enter any of them. Without default value the AHF is still able to compensate for the THVD.

Step 4:

Power on AHF

Note:

- The THVD mitigation function is effective only in condition that the AHF can power on normally. In some special condition that the THVD is too big that the AHF even cannot power on normally, the THVD cannot be mitigated. So before applying for the AHF is do the THVD mitigation, pls confirm with MTE engineer with the voltage waveform to make sure AHF can work in this environment.
- The THVD mitigation function is optional for SyntriX series AHF. When placing the order please state that the THVD mitigation function is required.

COMMON FAILURE TROUBLE SHOOTING

For common failures some failures and alarms can be solved by the user on site. If it can't be resolved, please contact MTE.

The failures caused by improper use, such as CT cable reverse, CT polarity error, power cable phase sequence error and parameter setting error, can be found by checking the data in the power on process. For poor compensation effect and no alarm information, please contact MTE.

Table A-23 MTE Common Fault Diagnosis

| Alarm | Common cause | Solution |
|---------------------------------|--|--|
| Inverters short-circuit fault | Short-circuit, the current is beyond the tolerant range of SIC MOSFET | Contact MTE engineer |
| Output current abnormal | The load current changes too fast Resonance | Check if the current load changes fast when the alarm appears. If so, use password '654321' to enter the setting, change 'Comp. mode' to sequential, change 'Input current abnormal' to 'Disable' If the alarm is caused by resonance, please refer to resonance debugging manual and contact MTE |
| Inverters overheat | The environmental temperature is high. Ventilation is blocked. Fan is broken. | Check if the ambient temperature is over 40°C Check the air flow way of module Check whether all fans are working. Check whether the setting parameter 'Temperature derating' is enable. |
| CT ratio setting error | The current load is bigger than the rated current of CT CT wiring is wrong | Check whether we choose the correct size of CTs. Check the CT cable wiring |
| Inverter overload | The module faulty alarm Resonance | Try to click 'Clear Alarm' on the HMI to see if the alarm will disappear If the alarm is caused by resonance, please refer to resonance debugging manual and contact MTE |
| Frequency abnormal | Input voltage frequency is beyond range [45Hz~62.5Hz] Frequency is over range. Faulty alarm | Check if the grid frequency is beyond the range: 45-62.5Hz Try to click 'Clear Alarm' on the HMI to see if the alarm will disappear |
| Input voltage abnormal | Voltage is beyond module tolerable range Wire connection error Fuse is broken | Check whether the voltage level is beyond the range of products. Check the connection of the power cable. If the voltage is normal and the cable connection is correct, please contact MTE engineer, it might need to check the internal fuse |
| Input phase sequence error | Phase sequence connects wrong | Check the power terminal connection |
| Monitor parameter setting fault | CT location is wrong Total capacity setting is wrong | Check if the CT location setting is correct Check if the total capacity setting is correct |
| Emergency shutdown | Emergency button is pressed down the emergency button is normal closed type The connection of EPO is not correct. False alarm of monitor. The module is broken | Check if the emergency button is pressed down Check if the emergency button is normal closed type, if so, please change to normal open type Try to click 'Clear Alarm' on the HMI to see if the alarm will disappear If all things are fine, please contact MTE engineer |
| Communication failure | RS485 cable connection is wrong Dip switch setting error | Check the cable connection of RS485 Check if the dip switch is correct |

| | communication parameter setting is not correct Slaver modules are too many, communication delay. If the product has WIFI module inside, check if the local address setting matches with dip switch setting | Check the communication setting parameters on HMI (Local address, baud rate) |
|---------------|--|---|
| Offline fault | The dip switch setting error Internal cable wiring is not connected well. | Check the dip switch, change it to correspond number. The setting of dip switch could be referred to user manual if the dip switch setting is correct, please contact MTE engineer. |

DOCUMENT REVISION

| Revision | Date | Revised Content |
|----------|------------|-----------------------------------|
| V1 | 2025/05/25 | Integrate user manual information |
| V2 | 2025/08/25 | Added the ETL module information |
| V3 | 2025/09/06 | Revised detailed information |

MTE reserves the right to make modification to the device or the unit specifications set out in the user manual without prior notice.