Product Name	**GAOTek E1 Tester**
Product SKU	**GAOTek-EIT-188**
Product URL	https://gaotek.com/product/gaotek-e1-tester-29/

GAOTek E1 Tester

Contents

1. Product Introduction

This three-phase electric meter field calibrator is a portable device specially designed and developed for field calibration of single-phase, three-phase active and reactive induction as well as electronic electric meters and other kinds of electrical instruments. It is widely used in electric power, metallurgy, chemical industry, tobacco, textile, railway, shipping, property and other industries. It provides a convenient solution for the power measurement department to perform meter error calibration on site without power cut or removing the electric meter and for the power inspection department to verify the illegal acts of stealing electricity.

This meter is mainly used to calibrate the errors of electric energy meters, check whether the wiring of metering devices is correct, check the transformation ratio and polarity of current transformers used for metering, and measure the electric power quality of users (including voltageharmonics, current harmonics, total harmonic distortion, voltage balance, etc.).

2. Features

5-inch TFT LCD screen (resolution: 800×480)

- English and Chinese display.
- Accurate measurement of voltage, current, active power, reactive power, phase angle, power factor,frequency and other electric parameters. It can be used to calibrate three-phase three-wire,
- three-phase four-wire, single-phase active/reactive electric energy meters.
- Accurate measurement of primary current and secondary current, transformer ratio and angulardifference of low pressure CT
- Visual display of vector diagram of three-phase voltage and current. It has144 kinds of wrong wiring diagnosis functions (48 kinds of three-phase three-wire, 96 kinds of three-phase four-wire), along with an accurate and clear description of the error message. Corresponding correction coefficient would be given according to the error message.
- Support three ways for electric energy meter calibration : photoelectric, manual, pulse
- Support the running test of electric energy meter, and investigate and punish the stealing ofelectricity by changing nameplates and wheels.
- Barcode scanner can be used to scan the identification number and user information of the meterbeing measured.
- The real-time waveform of voltage and current of each phase can be displayed to judge whetherthe quality of voltage and current is good or not.

- 2~50 times harmonic detection can be carried out and display the content or amplitude of eachharmonic. The total harmonic distortion can be calculated automatically and displayed by histogram.
- Three - phase imbalance can be detected and displayed.
- It can store 9999 history data. Data can be exported through USB flash disk, or uploaded to PCthrough communication port.
- Accuracy of current, voltage, active power, active energy: level 0.05 (type A), level 0.1 (type B).
- Two modes are available: power adapter and battery powered. The built-in lithium battery can

work continuously for more than 8 hours.

1. It has RS232, USB Host, USB Device, LAN interface, WiFi(optional) and other communication interfaces.
2. Built-in micro printer for printing test data on site is available .

1. Panel Description

The instrument pane is shown in figure 1.1.

Figure1.1 The calibrator panel

The bottom left of the instrument panel is the LCD. The left side is the sampling pulse port, RS232communication port, LAN port, and USB Device. The right side is the keypad. USB Host is at the

lower right of the LCD, which can be inserted into the USB disk for data export and program upgrading.It supports 32G USB flash disk to the maximum.

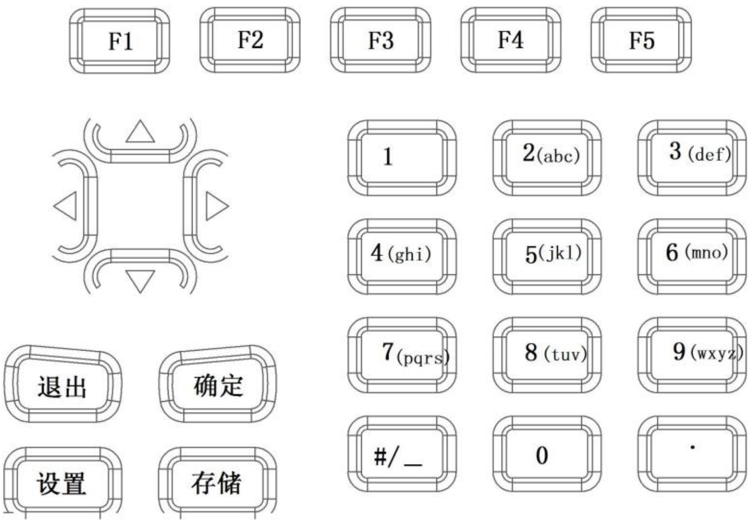
The upper left side of the panel is the terminals, including the voltage input terminals Ua, Ub, Uc and Un; current input terminals Ia+, Ia-, Ib+, Ib-, Ic+, Ic- (Ia+, Ib+, Ic+ are current inflow terminals, Ia-,Ib-, Ic- are current outflow terminals; split-core current transformer interfaces (A phase clamp, B phase clamp, C phase clamp); On the upper right is the printer, and above the printer are the ground terminal, DC5V charging port and the instrument operating switch.

The ground terminal is connected to the earth to prevent electric shock and shield interferencesduring measurement.

The instrument must be charged in time to avoid deep discharge of the battery, which will affect the battery life. If possible, charge it on a daily basis (it is better to charge once a month if you do not use it for a long time). The red charging indicator will light up during charging and when the battery isfully charged, the indicator will go out. It takes at least six hours for the battery to be fully charged.

The LCD consumes power quickly. If you do not press the keys for 15 minutes, the LCD brightness will automatically adjust to the darkest. Press any key to restore the original brightness.

2. Keys Operation



The keypad is shown in figure 1.2

Figure 1.2 The keypad

The instrument keypad has 25 keys, which are: store, set, up, down, left, right, enter, ESC, number1, number 2 (ABC), number 3 (DEF), number 4 (GHI), number 5 (JKL), number 6 (MNO), number 7 (PQRS), number 8 (TUV), number 9 (WXYZ), 0, decimal point, #, and auxiliary function keys F1, F2, F3, F4 and F5.

The functions of each key are as follows:

Up, down, left, right: cursor movement keys. In the main menu, it is used to move the cursor to point to a certain menu function and then press "enter" to enter the corresponding functions. In the parametersetting interface, the up and down keys are used to switch the current options, and the left and right keys are used to adjust the value.

Enter: Press this key in the main menu to enter the selected function. In addition, when entering certain

parameters, they key is used to start and end the input.

ESC: Back key. For non-parameter input, press this key to directly return to the previous menu. Itwill not work for parameter input.

Store: It is used to store test results as records in the "History data" interface.

Set: Press this key in the main menu to directly enter the "Parameter setting" interface

Number (character) key: it is used for parameter setting input (number or character input). Similar tothe input mode of mobile phones, continuous press allows the character to be input to switch between numbers and letters.

Decimal point: Used to enter the decimal point when setting parameters.

＃: When entering a number, this key represents minus '-'.

F1、F2、F3、F4、F5： Auxiliary function keys (shortcut keys). It is used to quickly enter the auxiliaryfunction interface or achieve the corresponding function. In some function interfaces such as theelectrical test, vector analysis, and waveform display interfaces, F1 is generally used to achieve the screen locking and unlocking. F4 is used for test results printing in some function interfaces.

3. Interface Operation

1. Main menu interface

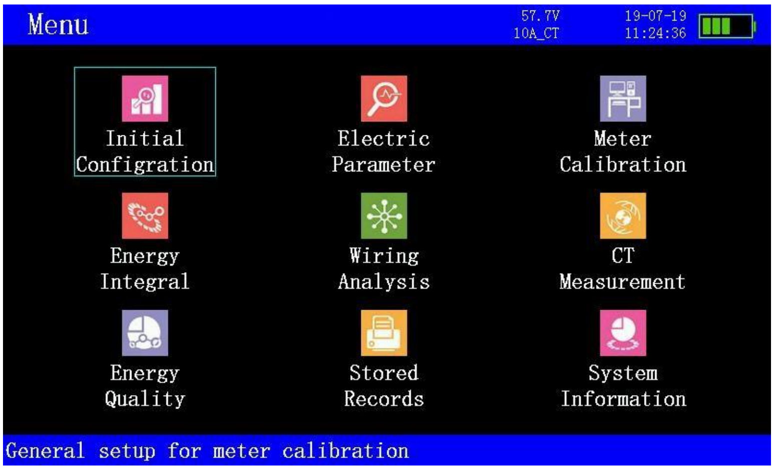


Figure 2.1 main menu interface

The main menu interface is the main function selection interface of the instrument. There are 9 sub-interfaces to choose from, including parameter setting, electrical testing, electric meter calibration,running test, wiring diagnosis, transformation ratio test, electric power quality, history data and system information. You can move the cursor by pressing ▲ / ▼ / ◀ / ▶ to select the interface you want to enter and then press 确定(“enter”). In this interface, press 设置 (“set”) to quickly enter the parametersetting interface.

The leftmost end of the first line of all interfaces displays the title of the current interface, and theright end of the first line displays the current voltage, current range status, date and time, and current electric quantity.

During the process of operation, there will be prompt messages displayed in the middle of the firstline. There are mainly three situations. First, when the interface is locked, "lock" will be displayed.

Second, when the data is saved successfully, "save successfully" will be displayed (if it fails, "save failed" will be displayed; if the storage is full, "overwrite record" will be displayed); Third, USB Hostdetects insertion of USB disk, the "USB" will be displayed.

Figure2.2 shows the three kinds of prompt messages on the interface of electric power quality andelectrical test respectively

Figure2.2 First line prompt messages

The last line of all interfaces has the corresponding prompt message, which is the correspondingdescription or the prompt for the key operation.

2. Parameter setting interface

Figure 2.3 Parameter setting interface

Parameter setting is the interface that must be set before the instrument is used. A total of 12parameters can be set. The set parameters will not be lost after restarting.

Select by pressing the cursor movement key▲/▼, among which PT ratio, CT ratio, meter constant, the number of turns, frequency division coefficient, meter number, calibration personnel anduser name can be edited after pressing 确定(enter) key. After selecting grade of electric meter, wiring mode, input mode, current input by the arrows, press the cursor ▲/▼ to select movement keyssettings.

Press 存储(store) to save the set parameters to the history.

PT ratio: the ratio of the potential transformer, which can be set from 1.00 to 9999.99.

When conducting the high-voltage metering test, the voltage at the secondary side of PT is measured and used to input the PT ratio connected to the high-voltage meter. Therefore, when measuring data at the [primary] side in the electrical test interface, the voltage at the primary side canbe directly converted by multiplying this parameter.

CT ratio: the ratio of current transformer, which can be set from 1.00 to 9999.99.There are two situations:

First, when conducting the high-voltage metering test, the current at the secondary side of CT is measured and used to input the CT ratio connected to the high-voltage meter. Therefore, when measuring data at the [primary] side in the electrical test interface, the current at the primary side can bedirectly converted by multiplying this parameter. Reset to 1 in calibration.

Second, when conducting the low-voltage meter sampling from the primary side of CT for meter calibration or running test, it is used to input the CT ratio connected to the meter, so as to complete thenormal calibration and running test.

In the process of calibration, if the input current of the calibrated electric meter is the same as thatcollected by this instrument, then set it to 1.

Meter constant: Refers to the standard electric energy pulse constant of the electric energy meterbeing measured. It represents the number of turns (or pulses) of the aluminum dial when the electric energy meter consumes 1kWh, which is usually clearly written on the nameplate of the meter. The set range is from 1.00 to 100000.00.

The number of turns: refers to the calibration interval, that is, the number of turns (pulses) for theelectric energy meter to calculate an error. The set range is from 1 to 9999. Only integers can be set.

Grade of electric meter: record the grade of accuracy of the currently calibrated electric meter.

This instrument can calibrate meters with accuracy grade of 0.2, 0.5, 1.0, 2.0, 0.2s and 0.5s.

Frequency division coefficient: the frequency division coefficient of the pulse constant of the calibrated electric meter, which can divide the frequency of the number of pulses sent by the meter. Theset range is from 1 to 9999. Only integers can be set.

When the sampling pulse input is greater than 1Hz, frequency division is recommended.

Wiring mode: the type of the meter being measured can be divided into five modes: single-phase active, three-wire active, three-wire reactive, four-wire active and four-wire reactive. If a reactive powermeter is being chosen, calibrate the reactive pulse input during electric meter calibration and accumulate reactive energy during running test.

Input mode: refers to the pulse sampling mode of the meter being measured, including directinput, pulse (photoelectric) mode and manual mode.

Current input: refers to the sampling mode of current and the selection of current range under different sampling modes. There are 1 kind of internal input and 10 kinds of external input, respectively10A [internal], 10A [standard clamp], 30A [standard clamp], 100A [standard clamp], 500A [standard clamp], 1000A [standard clamp], 2000A [standard clamp], user1 [user], user2 [user], user3 [user], and user4 [user].

The internal input is a 10A range.

There are 6 kinds of standard clamps for external input: 10A, 30A, 100A, 500A, 1000A and 2000A.

Users can choose up to 4 configurations.

The advantage of the clamp is that the field wiring is convenient and there is no need to disconnectthe current loop. But the accuracy is low.

Meter number: number of the electric energy meter, which is composed of 12 digits, letters orChinese characters (1 Chinese character takes 2 digits).

Calibration personnel: the name of the calibration personnel, which is composed of 12 digits,letters or Chinese characters (1 Chinese character takes 2 digits).

User name: user name is composed of 12 digits, letters or Chinese characters (1 Chinese charactertakes 2 digits).

3. Electrical test interface

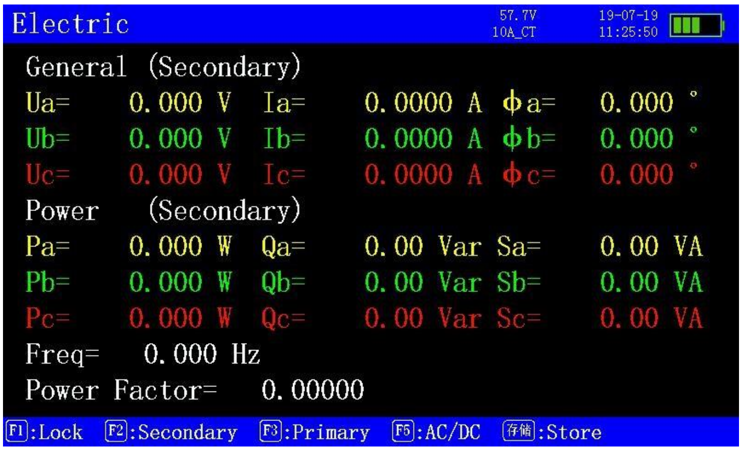


Figure. 2.4 Electrical test interface (AC)

The electrical test interface is shown in the figure above, which is capable of AC and DC data measurement. The second side measurement of AC measurement is the most commonly used. It can measure and display voltage (U), current (I), impedance angle (ϕ), active power (P), reactive power (Q),apparent power (S), frequency and power factor.

Press [F3] to switch to the primary side display. The voltage and current will be multiplied by the

PT and CT ratio in the parameter setting respectively to convert and display the data of the primary sideof the transformer. The rest of the relevant calculations will also change with it.

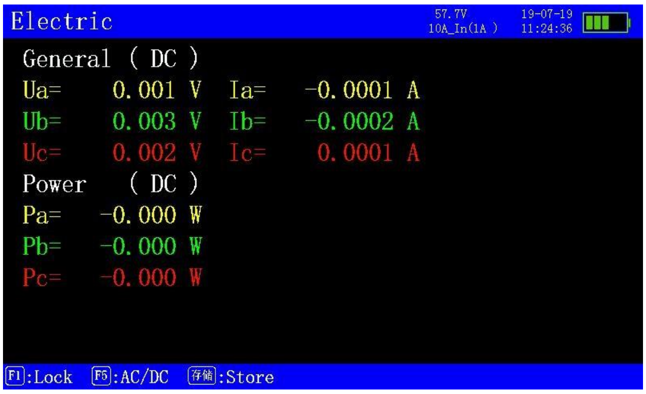


Figure. 2.5 Electrical test interface (DC)

Press [F5] to switch to the DC measurement interface, as shown in figure 2.5. At this time voltage measurement and direct current input can measure and display DC voltage, current and active power. Ifthe current clamp is used to measure the current, the direct current and power will not be displayed, because the current clamp cannot measure direct current.

Press [F1] to lock the data display, and press again to unlock it.

Press [存储] (store) to save the current data. Only in this interface can the data of primary side measurement or DC measurement be saved. In addition, it is important to note that only the interface display is locked, the background data is still being calculated. The data stored in the locked state is thereal-time data calculated in the background.

4. Electric Meter Calibration Interface

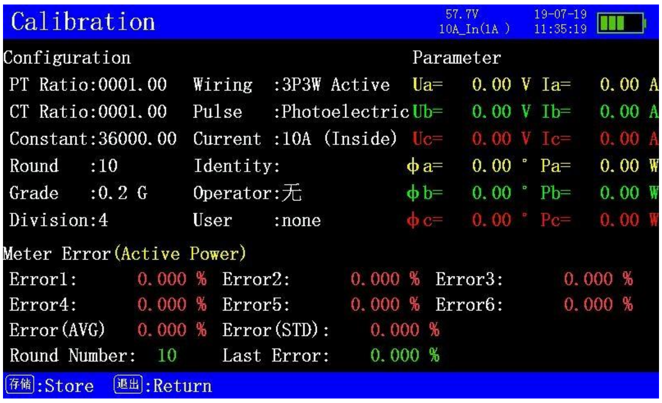


Figure 2.6 Electric meter calibration interface

The electric meter calibration interface is shown in the figure above, which consists of three parts,namely, meter calibration parameters, electric parameter measurement and electric meter error.

The meter calibration parameters in the parameter setting interface must be set correctly during thecalibration, otherwise it will affect the test results.

Electric parameter measurement refers to the measurement of AC voltage, current, impedanceangle and active power.

The electric meter error is the main display content of the calibration, which can display the latest6 errors as well as the average and standard deviation of these 6 errors. The current number of turns is an inverted count display of the number of turns set during calibration. When the set number of turns and pulse are detected, the primary error will be calculated and displayed.

Press 存储 (store) to save the data.

5. Running test interface

Figure 2.7 Running test interface

The running test interface begins accumulates electric energy from the moment of entering the interface, and automatically starts running after entering the interface. When the 确定 (enter) key is pressed, the data is cleared and it starts running again. Running test of the electric meter can be carriedout under this interface. Compared with the meter marker, it can prevent stealing electricity by changing nameplates or gears.

Press F1 to lock the display (the electric energy continues to accumulate), and press again to unlock it.

If the wiring mode of parameter setting is single-wire active, three-wire active, or four-wire active,the accumulative electric energy here is the active energy and the unit is kWh. If three-wire reactive or four-wire reactive are selected, the accumulative electric energy here is reactive energy and the unit is kVarh.

The settings in the parameter setting interface must be set correctly before the running test,otherwise it will affect the test results.

6. Wiring Diagnosis Interface

Wiring diagnosis interface is divided into two modes: three-phase three-wire and three-phase four-wire, which need to be selected in the wiring mode of the parameter setting interface. Three-phaseload balance is the premise of making a correct wiring diagnosis.

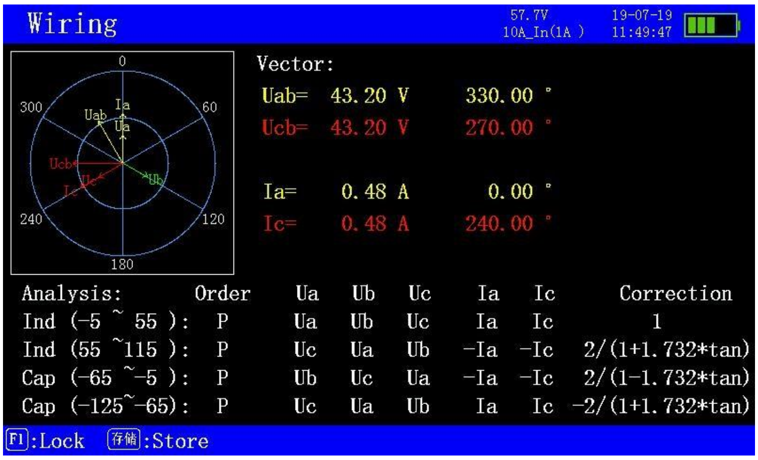


Figure 2.8 Wiring diagnosis interface (three-phase three-wire)

The wiring diagnosis interface of three-phase three-wire is shown in figure 2.8. Three-phase three-wire wiring diagnosis has 48 situations in total. 2 voltage parameters Uab and Ucb, 2 current

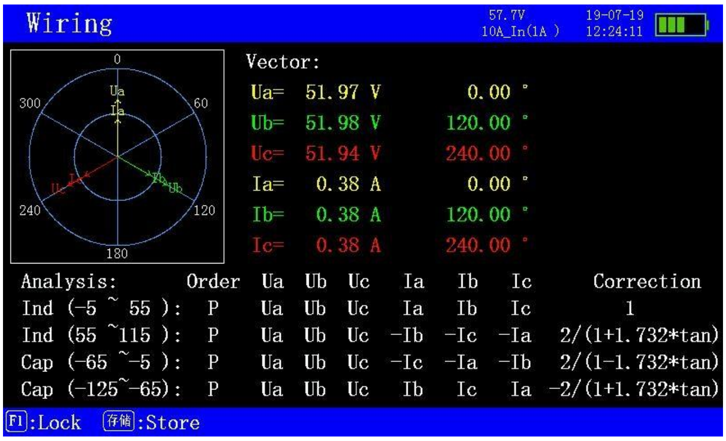
parameters Ia and Ic, and 3 voltage parameters Ua, Ub and Uc calculated by vector will be displayed in the above vector coordinates. The upper right test data will show the amplitudes of Uab, Ucb, Ia, Ic andthe phase angles of each parameter with Ua as the reference.

The bottom of the screen shows the analysis of the wiring results, including: voltage phase sequence, wiring diagnosis, wrong wiring correction coefficient. According to the different power included angles under different load conditions, it can be divided into 4 angle ranges(inductive -5 ~ 55,inductive 55 ~ 115, capacitive -5 ~ -65, capacitive -65 ~ -125) to analyze the results of 48 wiring modes.

The figure above shows the vector diagram when all wiring is correct under standard resistive load.

Since the power included angle of pure resistive load is 0°, which falls into the range of -5 ~ 55, we need to look at the result of the first line inductive (-5 ~ 55) of the wiring analysis, and the results of theother three lines of the analysis are invalid. "Positive sequence" in the wiring diagnosis interface indicates that the voltage is in positive phase sequence. If it is in reverse phase sequence, "reverse sequence" should be displayed. "Ua Ub Uc" means that "Ua Ub Uc" voltage wiring is being correctly connected to the corresponding positions. “Ia Ic" means that "Ia Ic" current wiring is being correctly connected to the corresponding positions. "-" means reverse polarity. The absence of this sign means correct polarity. Here there is no “-” sign, which indicates correct polarity. If the correction coefficient is "1", it means that the wiring is correct. The measured value of electric energy does not need to be corrected. If the wiring is not correct, specific compensation coefficient will be given (Depend on the type of wiring error, it may be numerical value or it may be a formula. The tan in the formula is the abbreviation of tangent(ϕ). ϕis the average power factor angle under the correct measurement month).

Please refer to the attached file for specific result analysis of the wiring



diagnosis.

Figure 2.9 Wiring diagnosis interface (three-phase four-wire)

The wiring diagnosis interface of three-wire and four-wire is shown in figure 2.9. Three-phasefour-wire wiring diagnosis has 96 situations in total.

Wiring diagnosis can only be made under the condition of three-phase load balance, otherwise final confirmation shall be made according to the phase sequence and the actual load characteristics.

3 voltage parameters Ua、Ub、Uc and 3 current parameters Ia、Ib、Ic will be displayed in the above

vector coordinates. The upper right test data will show the amplitudes of Ua、 Ub、 Uc、 Ia、 Ib、 Ic andthe phase angles of each parameter with Ua as the reference.

The bottom of the screen shows the analysis of the wiring results, including: voltage phase sequence, wiring diagnosis, error wiring correction coefficient. According to the different power included angles under different load conditions, it can be divided into 4 angle ranges(inductive -5 ~ 55,inductive 55 ~ 115, capacitive -5 ~ -65, capacitive -65 ~ -125) to analyze the results of 96 wiring modes.

The figure above shows the vector diagram when all wiring is correct under standard resistive load.

Since the power included angle of pure resistive load is 0°, which falls into the range of -5 ~ 55, we need to look at the result of the first line inductive (-5 ~ 55) of the wiring analysis, and the results of theother three lines of the analysis are invalid. "Positive sequence" in the wiring diagnosis interface indicates that the voltage is in positive phase sequence. If it is in reverse phase sequence, "reverse sequence" should be displayed. "Ua Ub Uc" means that "Ua Ub Uc" voltage wiring is being correctly connected to the corresponding positions. “Ia Ib Ic " means that " Ia Ib Ic " current wiring is being correctly connected to the corresponding positions. "-" means reverse polarity. The absence of this signmeans correct polarity. Here there is no “-” sign, which indicates correct polarity. If the correction coefficient is "1", it means that the wiring is correct. The measured value of electric energy does not need to be corrected. If the wiring is not correct, specific compensation coefficient will be given (Depend on the type of wiring error, it may be numerical value or it may be a formula. The tan in the formula is the abbreviation of tangent(ϕ). ϕis the average power factor angle under the correct measurement month).

Please refer to the attached file for specific result analysis of the wiring diagnosis.Press F1 to lock the display, and press again to unlock it.

Press 存储 (store) to save the data. It is important to note that only the interface display is locked,

the background data is still being calculated. The data stored in the locked state is the real-time datacalculated in the background.

7. Transformation Ratio Test Interface

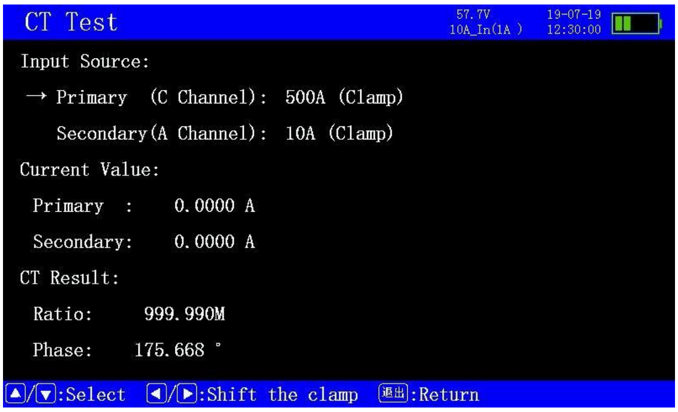


Figure 2.10 Transformation ratio test interface

The transformer ratio test interface is shown in figure 2.10. It is used to detect the transformer ratio of current transformer used for low-voltage metering.

The primary current is connected with C-phase clamp. Pressto be used for C-phase.

to switch the clamp

The second current is connected with A-phase clamp. Pressbe used for A-phase.

meters to switch the clamp

meters to

User can choose different clamp meters according to the actual current of the transformer to be measured, and if possible, choose the closest current range without exceeding the limit. Note: the clampmeter must correspond with the selection of current range in parameter setting, otherwise it will affect the test results. For example, C-phase shall be connected to a100A clamp. If a 10A clamp is used, it willlead to measurement error.

The screen also displays the measured primary current, measured secondary current, the tested transformation ratio and tested included angle (the included angle can be used to determine whether theprimary side and the secondary side of the CT have the same polarity and the same phase. If the included angle is about 0°, it indicates that the primary and secondary sides of the CT are of the same polarity and in the same phase. If the included angle is about 180°, it indicates that the primary and secondary sides of the CT are in the same phase but the polarity is reversed. If the included angle is about 60°, 120°, 240° or 300°, it indicates that both phase and polarity may be reversed.

8. Electric Power Quality Interface

Figure 2.11 Electric power quality - real-time waveform interface

The real-time waveform interface of electric power quality is shown in FIG. 2.11. This interfacecan display waveforms of 6 channels at most at the same time, including Ua, Ub, Uc, Ia, Ib and Ic. Itcan display the effective value of 6 channels and show the maximum positive voltage, minimum negative voltage, and frequency.

Press to lock the display, and press again to unlock it.

Press to enter the electric power setting interface, you can select the channel to turn on or offthe display, and set the time axis and trigger.

Press F3 to switch to the harmonic analysis interface of electric power quality. This key is usedto switch back and forth among different function interfaces of electric power quality.

Press ◀ / ▶ to switch back and forth among different time axis displays of the waveform. Onegrid of time can be switch among 5ms, 10ms, 20ms, 30ms, and one screen of time can be switched among 20ms, 40ms, 80ms, 120ms.

Press ▲ / ▼ to switch to the trigger level. It can be adjusted from -100%~100% Long press thekey to adjust.

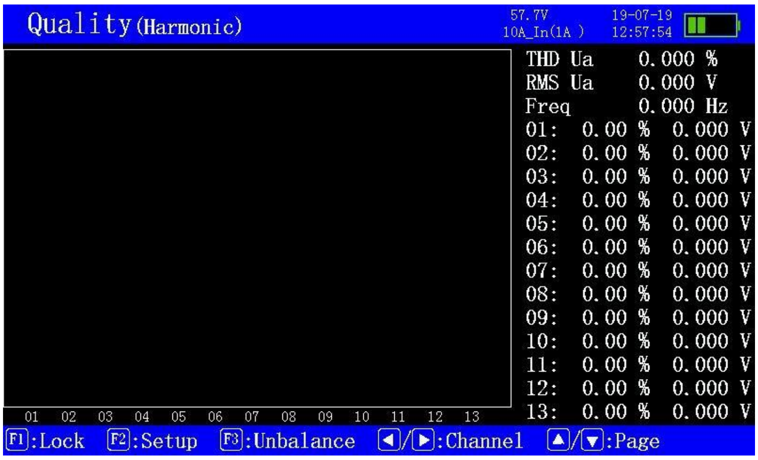


Figure 2.12 Electric power quality-harmonic analysis interface

The harmonic analysis interface of the electric power quality interface is shown in FIG. 2.12. Theinterface displays the harmonic content distribution of phase voltage or phase current in the form of histograms, and displays harmonic distortion and each harmonic content value, and display the total harmonic distortion, effective value and frequency.

The frequency of harmonic analysis is required to be within the range of 40Hz~65Hz. Noharmonic analysis will be performed outside this range.

Press F1 to lock the display, and press again to unlock it.

Press F2 to enter the electric power setting interface, you can set the waveform channel to be analyzed, the calculation formula of THD, and the maximum number of times of harmonic analysis.

THD formulas can be divided into two types: fundamental wave as denominator (IEC formula), orsquare and square root of the total harmonic contents as denominator (CSA formula).

The number of times of harmonic analysis can be set to a maximum of 50 times and a minimum of2 times

Press F3 to switch to the electric power quality imbalance interface. This key is used to switchback and forth among different function interfaces of electric power quality.

Press ◀/▶ to switch the channel to be analyzed. It can be switched back and forth among Ua,Ub, Uc, Ia, Ib, Ic.

Press ▲/▼ to switch the number of harmonics to be displayed. One screen can display up to 13harmonics, and the histogram can also display only 13 harmonics. Turn the page to display other harmonics.

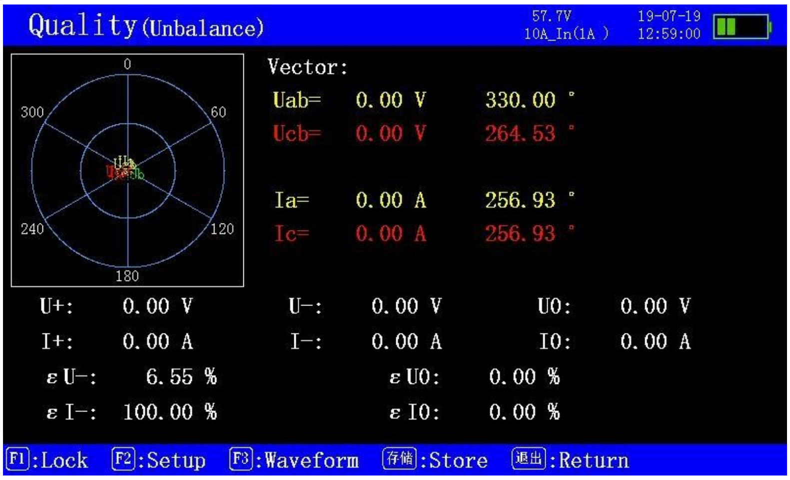


Figure 2.13 Electric power quality-imbalance interface

The electric power quality imbalance interface is shown in figure 2.13. The vector analysis diagram and vector data display are the same as the interface of wiring analysis, and there are also changes of three-phase three-wire and three-phase four-wire.

The bottom displays the positive-sequence component, negative-sequence component and zero-sequence component of voltage and current, as well as the negative-sequence imbalance andzero-sequence imbalance.

Press F1 to lock the display, and press again to unlock it.

Press F2 to enter the electric power setting, and the relevant measurement settings of electricpower quality can be carried out.

Press F3 to switch to the real-time waveform interface of power quality. This key is used to switchback and forth among different functional interfaces of electric power quality.

Press 存储 (store) to save the current data. It is important to note that only the interface display islocked, the background data is still being calculated. The data stored in the locked state is the real-time data calculated in the background.

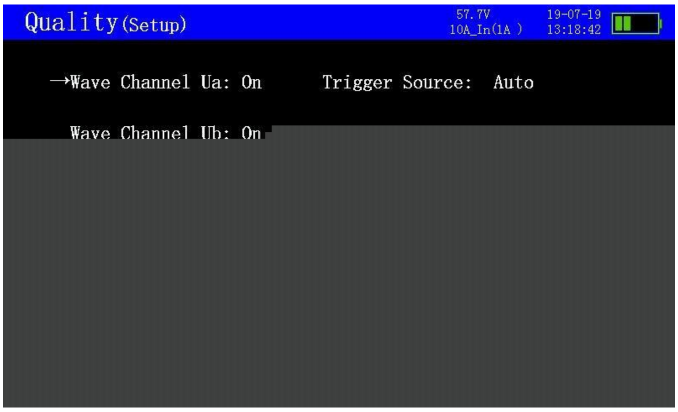


Figure 2.14 Electric power quality- power setting interface

The power setting interface of electric power quality is shown in the figure 2.14. The interface isused for the relevant settings of the electric power quality measurement.

Press the cursor movement keys ▲ / ▼ / ◀ / ▶ to select the target option.Press (enter) to set the selected target.

Press (exit) to return to the function interfaces (waveform, harmonic, or imbalance) of electricpower quality.

The column on the left corresponds to 6 channels of voltage and current, which are used to selectthe waveform channels to turn on or off the real-time waveform interface display.

Waveform trigger source can be selected among Ua, Ub, Uc, Ia, Ib, Ic or automatic. When automatic is selected, the channel with the maximum effective value is automatically selected as thetrigger source.

Closed channels will not enter the trigger source option. If the trigger source is set to a specific waveform channel, but the waveform channel is turned off, the trigger source then becomes automatic.

Waveform trigger level is the trigger level for the trigger source.

Waveform is rising edge triggerand can be set from -100% to100%.

Waveform observation time is a parameter of one grid of the time axis, which can be switched among 5ms, 10ms, 20ms and 30ms. The time of one screen can be switched among 20ms, 40ms, 80msand 120ms.

The harmonic THD formula is the distortion factor formula. There are 2 kinds: 1/ fundamentalwave (IEC) or 1/ total wave (CSA).

The highest number of times of harmonics is the maximum number of times of harmonic analysis,which can be set to a maximum of 50 times and a minimum of 2 times

Among these settings, the harmonic THD formula and the setting of the highest number of timesof harmonics will be saved, that is, the settings will remain when restarting; Other settings in this interface will restore the default settings when restarting.

You can store up to 9999 history data. In some operation interfaces, data can be stored by pressing 存储(store). When the data is saved successfully, "save successfully" will be displayed; If it fails, "save failed" will be displayed. If you continue to store a new history data after 9999 records havebeen saved, the record will be overwritten, and the newly saved record will display "overwrite record". The new data will be saved to the item 9999, and the original item 0001 will disappear.

Each record include three parts of information, which can be displayed by three interfacesrespectively and switched by pressing .

Figure 2.15 History data interface - parameter data

As shown in figure 2.15, when the record is saved, the interface of recorded parameter data candisplay the relevant parameter settings of the instrument and the date and time of the record.

In this interface, press F2 to apply the parameter setting of this history record to the parametersetting of the current device, that is, to recall the parameter setting of this record.

Press F3 to check the currently recorded electrical test data. This key is used to switch amongdifferent information of a single history record.

Press F5 to delete this history record.

Long press ▲ / ▼ to switch a single record.

Press / to quickly switch records. Long press the key to switch 50 records at a time.

Figure 2.16 History data interface – electrical data

As shown in figure 2.16, the interface of recorded electrical data can display the currently recorded electrical measurement data, which are voltage, current, impedance angle, active power, reactive power,apparent power, frequency and power factor in the electrical measurement. It can also display the metererror data in meter calibration, including the latest 6 measurement error, average error and standard deviation, and the current number of turns and errors when recording.

Press F3 to check the currently recorded vector test data. This key is used to switch amongdifferent information of a single history record.

Press F5 to delete this history record.

Long press ▲/▼ to switch a single record.

Press ▼/ to quickly switch records. Long press the key to switch 50 records at a time.

Figure 2.17 History data interface - vector data

As shown in figure 2.17, the interface of recorded vector data shows the vector diagram and vectordata, the three-phase imbalanced data, and the wiring analysis data.

Press F3 to check the currently recorded parameter settings. This key is used to switch amongdifferent information of a single history record.

Press F5 to delete this history record.

Long press ▲/▼ to switch a single record.

Press ▼/ to quickly switch records. Long press the key to switch 50 records at a time.

10. System Information interface

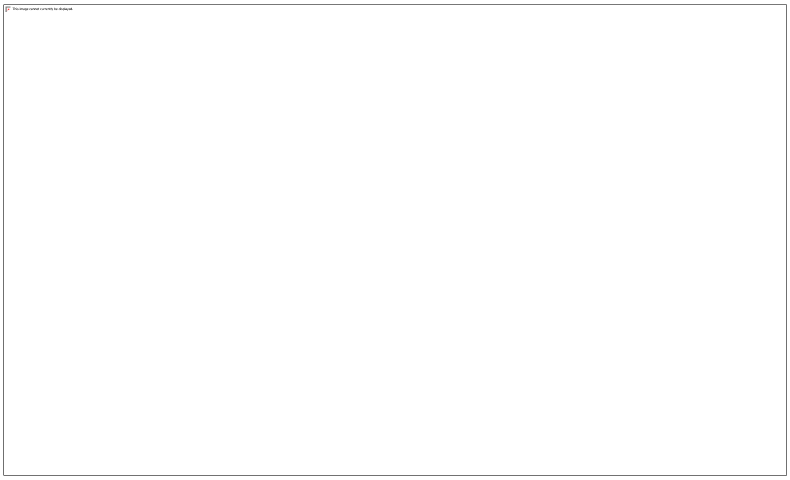


Figure 2.18 System information interface

The system information interface is shown in figure 2.18, which is the display and relevant settingsof the system information. There are 3 panel non-operational options and 9 panel operational options.

Press / to select the item you want to modify, and press 确定(enter) or / to modify i

Hardware version number, software version number and product serial number are the fixedinformation of the device, which can only be set and modified through RS232 serial port.

Network mode refers to the selection of LAN or WIFI. WIFI is optional.

The system language is the display language of the device. Select it by the arrows and press / to switch to Chinese or English.

Brightness refers to the LCD brightness of the device. Select it by the arrows and press 确定 (Enter) to adjust the brightness from 0%~100%。

The date and time is the real date and time of the device. Select it by the arrows and press 确定 (Enter) to set the year from 2017 to 2117.

Communication baud rate is the baud rate of RS232 serial communication. Select it by the arrows

and press / to switch to 9600 or 115200.

System program upgrade needs to be carried out together with USB flash disk. The USB flash diskstores the ET610.HEX file needed for program upgrade. Insert the USB flash drive, and press 确定 (Enter) to recall the upgrade file. After that, restart the instrument to complete the program upgrade.

The upgrading of picture and text library needs to be carried out together with USB flash disk. The USB flash disk stores files about the pictures and texts of the instrument. Press 确定 (Enter) to recallthe relevant files.

The operation of exporting history records needs to be carried out together with the USB flash disk.

Press 确定 (Enter) for data export and enter the export file name, up to 7 bytes. Lowercase will automatically be capitalized. Duplication of name will lead to export failure. The export file is a singlefile in TXT format, which stores all the history data.

Other operations cannot be carried out when the system program upgrade, picture and text upgradeand history records export are being carried out. Do not pull out the USB flash drive, or turn off the power, so as to avoid damage to the USB flash disk or instrument.

11. Print Setup

In the interface of electrical test, electric meter calibration and wiring diagnosis, press F4 to printthe real-time data. In the history data interface, press F4 to print the history data.

Printing will greatly increase the power consumption, and a sudden drop in power will appear, andrecover after the end of the printing. When the battery is lower than 2 grids, it will send out a prompt that the battery is too low to print.

According to the wiring mode and AC/DC conditions, there are three kinds of print data: DC print data, three-phase three-wire print data and non-three phase three wire print data, as shown in figure 2.19below.

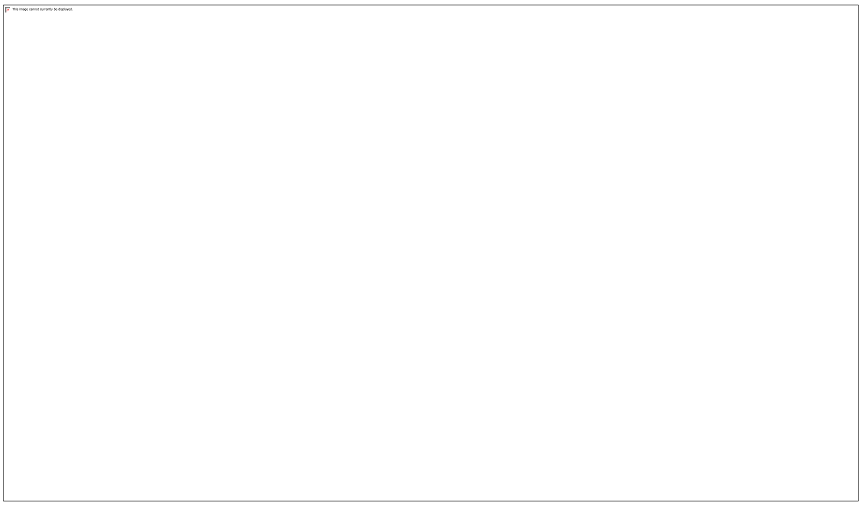


Figure 2.19 Print data

Dc data will only be printed when DC is selected on the electrical measurement interface or when the history data is DC.

The three-phase third-wire data and non-three-phase third-wire data in AC data should be determined by parameter setting. When the parameters are set as third-wire active power and third-wirereactive power, they are three-phase third-wire data; when the parameters are set as single-phase activepower, four-wire active power and four-wire reactive power, they are non-three-phase third-wire data.

12. Network Mode

In the system information interface, select the first option and press “enter” to enter the networkmode selection interface. LAN or WIFI can be selected. WIFI is optional. Although the instrument without configuration can be set up, it will always fail to connect.

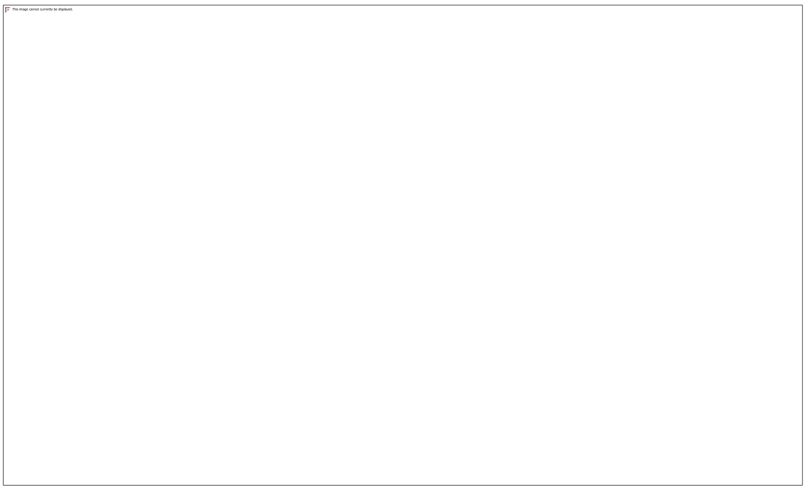


Figure 2.20 System information –LAN network mode

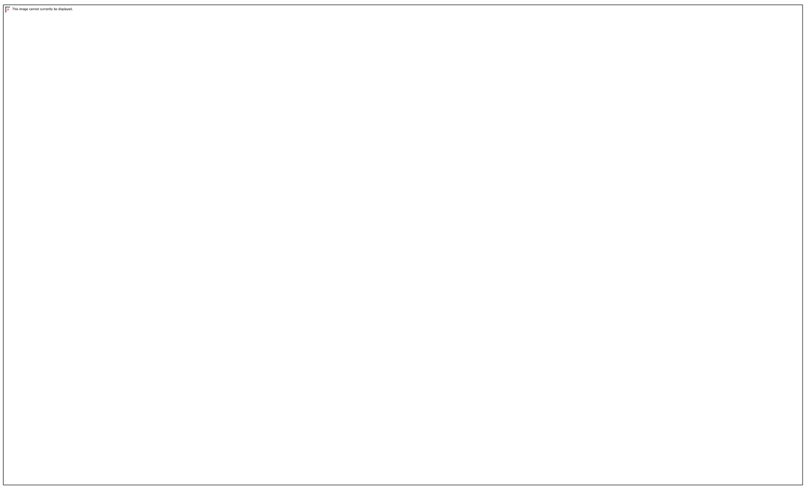


Figure 2.21 System information –WIFI network mode

LAN ports are standard and connect to TCP/IP ports on the panel for communication.

The network communication carried out by the instrument is UDP transmission, which requires thesettings of local IP, local gateway, subnet mask, local port, remote IP and remote port.

There is no relevant LAN network settings on the device, which need to be realized through cableand upper computer.document of "communication protocol for electric energy meters".

WIFI network settings can be carried out directly on the device. After the setting is completed, press [F1] to connect, or configure the connection when the instrument restarts. If it is set to WIFI, the router WIFI will be actively connected every time it is started, and the name and password of the routershould be set manually. Therefore, devices without WIFI should be set to LAN to reduce the time spentin automatically checking WIFI when starting up.

4. How To Use

The instrument has different wiring modes for different electric meters. Only in the correct wiringmode can the correct measurement be made.

1. Three-phase three-wire measuring principle

Figure 3.1 Three-phase three-wire measuring principle

The measuring principle of three-phase three-wire is shown in figure 3.1. Three-phase three-wire measurement refers to the use of two power components to achieve the measurement of three-phase lines. It is equivalent to connecting, respectively, two ammeters (in series in phase A and phase C), twovoltmeters (in parallel between AB and between CB respectively) and two power meters (the current coils are in series in phase A and phase C, and the voltage coils are in parallel between AB and CB) in the circuit.

There is no neutral wire in three-phase three-wire and its three-phase loads must be balancedloads.

2. Three-phase four-wire measuring principle

Figure 3.2 Three-phase four-wire measuring principle

The measuring principle of three-phase four-wire is shown in figure 3.2. Three-phase four-wire measurement refers to the use of three power components to achieve the measurement of three-phaselines. It is equivalent to connecting, respectively, three ammeters (respectively in series in phase A, phase B and phase C), three voltmeters (respectively in parallel between AN, BN and CN) and threepower meters (the current coils are in series in phase A, phase B and phase C respectively, and the voltage coils are in parallel between AN, BN and CN respectively) in the circuit.

Its three-phase load is not necessarily a balanced load, and the current and voltage measurement of each phase can be isolated as single-phase measurement.

3. Three-phase Three-wire Clamp Meter Input

Figure 3.3 Wiring of three-phase three-wire clamp meter input

As shown in figure 3.3, it is the schematic diagram of wiring of three-phase three-wire high voltage meter through clamp meter. The wiring mode of three-phase three-wire clamp meter of the device requires the use of the voltage input ports Ua, Uc and Un, as well as A phase clamp input and Cphase clamp input.

First connect the yellow, green and red plungers at the head end of the voltage line to the corresponding voltage terminals A, N and C on the instrument panel (i.e., connect the yellow plunger tothe voltage terminal Ua, the green plunger to the voltage terminal Un, the red plunger to the voltage terminal Uc. Ub terminal needs not to be connected). The yellow, green and red crocodile clips at the end of the voltage line are connected, according to their colors, to the corresponding A, B and C

three-phase voltage lines at the end of the measured meter. Then insert the split-core current transformer of phase A and C into the corresponding interface, and clamp the current line of the corresponding phase with the split-core current transformer. (Note: the polarity must be connectedcorrectly. There are clear indications of arrows on the side of the split-core current transformer to indicate the direction of current.)

Turn on the instrument switch, first set the corresponding parameters in the "parameter setting"screen correctly according to the parameters of the meter being measured, and then enter the corresponding interface for testing.

4. Three-phase three-wire direct input

Figure 3.4 Wiring of three-phase three-wire direct current input

As shown in figure 3.4, it is the schematic diagram of direct wiring of three-phase three-wire highvoltage meter. The three-phase three-wire direct wiring mode of the device requires the use of the voltage input ports Ua, Uc and Un, as well as the direct current input ports Ia+、Ia-、Ic+ and Ic- of channels A and C.

First connect the yellow, green and red plungers at the head end of the voltage line to the corresponding voltage terminals A, N and C on the instrument panel (i.e., connect the yellow plunger tothe voltage terminal Ua, the green plunger to the voltage terminal Un, the red plunger to the voltage terminal Uc. Ub terminal needs not to be connected). The yellow, green and red crocodile clips at the end of the voltage line are connected, according to their colors, to the corresponding A, B and C

three-phase voltage lines at the end of the measured meter. Connect the plungers of phase A and phase C at the head end of the current line to the corresponding current terminal on the instrument panel according to the color (except the B phase line). The terminal marked with polarity end is connected tothe positive end of current, and the negative end of current is connected to the unmarked terminal. Thecrocodile clip (or inserter) at the end of the current line is connected to both sides of the terminal row (I+ is connected to the side away from the meter, I- is connected to the side near the meter), and then open the connecting piece of the terminal row.

Turn on the instrument switch, first set the corresponding parameters in the "parameter setting"screen correctly according to the parameters of the meter being measured, and then enter the corresponding interface for testing.

This kind of wiring mode with terminal row is very rare nowadays. For those without terminal row, only the clamp meter wiring mode can be adopted.

5. Three-phase four-wire clamp meter Input

Figure 3.5 Wiring of three-phase four-wire clamp meter input

As shown in figure 3.5, the wiring mode of three-phase four-wire clamp meter of the device requires the use of the voltage input ports Ua, Ub, Uc and Un, and the clamp input of phase A,B and C.

First connect the plungers at the head end of the voltage line to the corresponding voltage terminals A, B, C and N on the instrument panel according to the color. The crocodile clips at the end of the voltage line are connected to the corresponding A, B, C and N phase voltage lines at the end of the measured meter. Then insert the split-core current transformer of each phase into the interface with corresponding mark, and clamp the current line of the corresponding phase with the split-core current transformer. (Note: the polarity must be connected correctly. There are clear indications of arrows on the side of the split-core current transformer to indicate the direction of current.)

Turn on the instrument switch, first set the corresponding parameters in the "parameter setting"screen correctly according to the parameters of the meter being measured, and then enter the corresponding interface for testing.

6. Three-phase four-wire direct input

Figure 3.6 Wiring of three-phase four-wire direct current input

As shown in figure 3.6, the three-phase three-wire direct wiring mode of the device requires the use of the voltage input ports Ua, Ub, Uc and Un, as well as the direct current input ports Ia+, Ia-, Ib+,Ib-, Ic+ and Ic- of channels A, B and C.

First connect the plungers at the head end of the voltage line to the corresponding voltage terminals A, B, C and N on the instrument panel according to the colors. The crocodile clips at the end of the voltage line are connected to the corresponding A, B, C and N phase voltage lines at the end of the measured meter. Connect the plungers at the head end of the current line to the corresponding current terminal on the instrument panel according to the color. The terminal with mark is connected tothe positive end of current, and the negative end of current is connected to the unmarked terminal. Thecrocodile clip (or inserter) at the end of the current line is connected to both sides of the terminal row (I+ is connected to the side away from the meter, I- is connected to the side near the meter), and then open the connecting piece of the terminal row.

Turn on the instrument switch, first set the corresponding parameters in the "parameter setting"screen correctly according to the parameters of the meter being measured, and then enter the corresponding interface for testing.

The direct current input mode can achieve the highest test accuracy, but the wiring is rather cumbersome.

7. Single-phase wiring

The single-phase wiring is the same as the three-phase four-wire wiring. Connect the voltage andcurrent lines to the voltage and current terminals of the same phase of the instrument (due to simple wiring, no wiring diagram is given here).

8. Electric meter pulse signal input

In the process of electric meter calibration, it is necessary to obtain the electric energy pulse signals of the measured electric meter. There are three ways to obtain the signal: photoelectric sampler,manual switch, special pulse test line; Different kinds of electric meters can be tested in different ways.The following gives several common ways to obtain electric energy pulses of electric meter.

1. For mechanical electric meter, pulse can be automatically obtained by photoelectric sampler.

Set the photoelectric sampler to the luminous state (switch by pressing the red button on the square boxin the middle of the photoelectric sampler line). Aim the light beam from the three light-emitting diodesat the center of the aluminum plate of the calibrated meter and adjust the position of the photoelectric sampler relative to the dial plate. Meanwhile, adjust the knob in the center of the square box in the middle of the photoelectric sampler line according to the sensitivity to black spots to change the sampling sensitivity, so as to prevent mis-sampling and sampling omissions, and finally reach the state of normal sampling.

2. For mechanical electric meter, pulse can also be obtained manually by manual switch. Operator holds the manual switch with his thumb lightly placed on the manual switch button, and his eyes look at the aluminum plate. When the black spot on the aluminum plate turns to the central scale on the front of the meter, press the button quickly. At this time, the instrument records the starting point of the calibration interval. The operator keeps observing the rotation of the aluminum plate. When the number of times of black spot arrival reaches the set number of turns for calibration, the operator quickly presses the button again to complete the calibration, and the instrument will automatically calculate the meter error. Human factors involved in pulse sampling will lead to the instability of error,which could be eliminated by appropriately increasing the number of turns for calibration.

3. For electronic electric meter, pulse can be automatically obtained by photoelectric sampler. Set the photoelectric sampler to non-luminous state (switch by pressing the red button on the square box inthe middle of the photoelectric sampler line). Aim the receiver (located in the center of three

light-emitting diodes) of the photoelectric sampler at the pulse lamp of the measured meter and adjustthe position of the photoelectric sampler relative to the dial plate. Meanwhile, adjust the knob in the center of the square box in the middle of the photoelectric sampler line according to the sensitivity to the pulse lamp to change the sampling sensitivity, so as to prevent mis-sampling and sampling omissions, and finally reach the state of normal sampling.

4. For electronic electric meter, pulse can also be automatically obtained by special pulse test line. The instrument is randomly equipped with a special pulse test line with 4 crocodile clips at the top,respectively marked with: VCC (auxiliary power supply, red), TEST-IN (signal input PL, green),

FL-OUT (standard pulse output FL, yellow), GND (ground, black). There are two output modes of theelectric energy pulse: active output and passive output.

Sampling with crocodile clips marked with "TEST-IN" and "GND" when the pulse signal of themeasured meter is in active output mode. The crocodile clip marked "TEST-IN" is connected to the terminal marked with "active positive (reactive positive)" of the terminal row of the measured meter,and the crocodile clip marked with "GND" is connected to the terminal marked with "active negative(reactive negative)" or "common terminal" of the terminal row of the measured meter.

When the pulse signal of the measured meter is in passive output mode, the connection is the sameas the active pulse output. The crocodile clip marked "TEST-IN" is connected to the terminal marked with "active positive (reactive positive)", and the crocodile clip marked with "GND" is connected to theterminal marked with "active negative (reactive negative)" or "common terminal". Both are connected in the same way, because the " TEST-IN " end of the instrument has pulled up the VCC in the internal circuit of the instrument, which can provide the energy of passive pulse output.

Note：There are generally two kinds of passive pulse output of electric meters, namely, relay contact output and photoelectric coupling output. This is a non-voltage contact output, the electronic switch contact, which, when closed or opened, outputs a pulse. The energy of the passive pulse comes from the outside, so an external power supply is needed.

When the frequency of input pulse is within 1Hz~1KHz, the frequency divider should be turned onin parameter setting to make the frequency of input sampling pulse less than 1Hz, or to increase the number of turns. Otherwise, the calibration error of the meter will be inaccurate.

9. How to use the pulse test line when the instrument is sent for inspection

According to the requirements of metrological verification regulations, the electric meter field calibrator should be verified when leaving the factory and rechecked regularly after being put into use. The standard electric energy pulse output from the calibrator is detected with standard equipment at thetime of inspection. The standard power pulse of this tester is output by the crocodile clips marked with FL and GND of the special pulse test line (see "4.2 standard electric energy pulse constant" for details).

Note: only in the "electric meter calibration", "running test", "main menu" three interfaces can standard electric energy pulse be output.

5. Technical Parameters

1. General parameters

Item	Technical Parameters		
Voltage (AC& DC)	Range		0～750V
	Auto gear		57.7V、100V、220V、380V、750V
Current (AC& DC)	Direct Input	Range	0～10A
		Auto gear	1A、5A、10A
	Split-core current transformer(AC)	Optional transformer (6)	10A、30A、100A、500A、1000A、2000A
		User-defined transformer （4 ）	The gear of the current clamp can be selected according to customer's requirements
	Voltage: type A ± 0.05%, type B ±0.1%		
	Current: direct input type A ± 0.05%, type B ±0.1%, split-core current		

	transformer ± 0.5%
	Active power: direct input type A ± 0.05%, type B ±0.1%, split-core current transformer ± 0.5%
Calibration Accuracy	Reactive power: direct input ± 0.3%, split-core current transformer ± 1.0%
	Active electric energy: direct input type A ± 0.05%, type B ±0.1%, split-core current transformer ± 0.5%
	Reactive electric energy: direct input ± 0.3%, split-core current transformer ± 1.0%
Frequency measurement	Range: 10 ~ 100Hz; Resolution: 0.001Hz; Accuracy: ±0.01Hz
Phase measurement	Range: 0 ~ 359.999°; Error: + / - 0.05 °
Electric energy pulse input	Maximum pulse input frequency 1kHz; Constant range 1~100000; frequency division coefficient 1~9999

Harmonics measurement （2～50 times）	Accuracy of fundamental voltage and current amplitude ± 0.2%, accuracy of fundamental voltage and current phase difference ±0.1°, accuracy of harmonic voltage and current inclusion rate ± 0.2%, total harmonic distortion ± 0.2%
Three-phase imbalance	±0.2％

2. Standard electric energy pulse constant

Standard electric energy pulse constant: 10A Direct current input（FL）

$= 3.6\times10^{4}(r/kW\cdot h)$;

Split-core current transformer constant (FL): $(3.6\times(10/I_e))\times10^{4}(r/kW\cdot h)$, I_e is the rated current.

3. General technical specifications

Power supply: battery-powered, or 5V/3A power adapter (charging)

Display: 5-inch TFT LCD screen with resolution of 800×480

Interface: standard -- RS232, Usb Host, Usb Device, LAN, optional -- WiFi, micro printer

Size: 300×270×165 (length × width × height)

Weight: 2.8 Kg

Operating temperature: -25℃~ 55℃, relative humidity: 15% ~ 85%

6. Appendix

1. Notes

1. When high measurement accuracy is required, it is better to measure with internal transformer. When connecting the current transformer, it is necessary to ensure that the secondary side of the current transformer is not open circuit.

2. The split-core current transformer is a high precision measuring transformer. It must be handled with care to avoid collision and damage, or it will affect the test accuracy. The incisionsurface of the clamp meter should be kept bright and clean, and do not polluted by other sundries, so as to ensure that the clamp meter close well.

3. Please enter the correct setting parameters before the test starts, otherwise the data results maybe biased or wrong.

4. When using a clamp meter to clamp the primary aluminum row, make sure that the clamp meter incision core does not touch the aluminum row, otherwise, it may be very dangerous andwould damage the clamp meter and the instrument.

5. The measurement error of phase angle will increase when the signal is weak. If the high measurement accuracy of the phase angle is required, the voltage signal should be greater than

10V, the direct current signal should be greater than 0.05A, and the measuring current signal of the current clamp should be greater than 0.1A. The phase angle error of current clamp is largerthan the direct current input.

1. Combination keys

1. When starting up, press 设置+F1 simultaneously to enter the entrance to calibration interface, and then enter the correct password to enter the calibration interface. The calibration interface isonly used by the manufacturer during the factory calibration. Users shall not care about it.
2. When you insert the USB flash disk, press + simultaneously to take a screenshot. It takes 30 seconds to take a screenshot, and the interface is still. A successful screenshot will generate an 800*480 pixel BMP image in the USB flash disk. This function is not officially recommended as ittakes too long to take a screenshot.

1. Sampling pulse interface schematic diagram

Sampling pulse interface is shown in figure 5.1. Pin number is clearly marked on the terminal andcan be corresponded one to one.

Figure 5.1 Sampling pulse interface schematic diagram

2. Pins of direct pulse test line

The direct pulse test line has 4 crocodile clips in different colors: red, black, green and yellow. Redis VCC, black is GND, yellow is FL(pulse output), and green is PL(pulse input).

3. USB flash disk file format

The operations of system program upgrade, picture and text upgrade in the system information can be carried out after storing files with a specific format and filename in a USB flash disk. These files areprovided by the manufacturer and users shall not care about it.

When exporting the history record, a new ET610REC folder will be created in the USB flash disk,and TXT file will be generated in the folder.

4. Three-phase three-wire wrong wiring group comparison table

Table 5.1 Three-phase three-wire wrong wiring comparison tableCase 1: current in phase A and C is correct

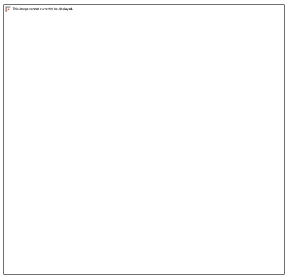
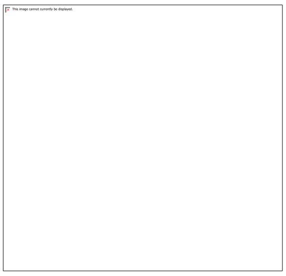
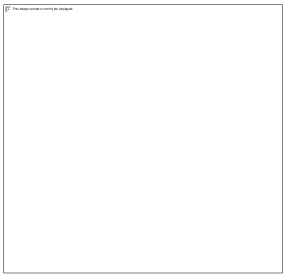
P Uab Ucb P Ia Ic	N Uac Ubc P Ia Ic	P Uca Uba P Ia Ic

N Uba Uca P Ia Ic	N Ucb Uab P Ia Ic	P Ubc Uac P Ia Ic
Phase A,B Voltage incorrectly connected to B,A	Phase A,C Voltage incorrectly connected to C,A	Phase A,B,C Voltage incorrectly connected to B,C,A

Case 2: A-phase current reverses

P Uab Ucb P -Ia Ic	N Uac Ubc P -Ia Ic	P Ubc Uac P -Ia Ic
Voltage A,B,C correct	Phase B,C Voltage incorrectly connected to C,B	Phase A,B,C Voltage incorrectly connected to B,C,A
N Ucb Uab P -Ia Ic	P Uca Uba P -Ia Ic	N Uba Uca P -Ia Ic
Phase A,C Voltage incorrectly connected to C,A	Phase A,B,C Voltage incorrectly connected to C,A,B	Phase A,B Voltage incorrectly connected to B,A

Case 3: C-phase current reverses

		
P Uab Ucb P Ia -Ic	N Uac Ubc P Ia -Ic	P Uca Uba P Ia -Ic

Voltage correct	Phase B,C Voltage incorrectly connected to C,B	Phase A,B,C Voltage incorrectly connected to C,A,B
N Uba Uca P Ia -Ic	N Ucb Uab P Ia -Ic	P Ubc Uac P Ia -Ic
Phase A,B Voltage incorrectly connected to B,A	Phase A,C Voltage incorrectly connected to C,A	Phase A,B,C Voltage incorrectly connected to B,C,A

Case 4: current in phase A and C is completely reversed

P Uab Ucb P -Ia -Ic	N Uac Ubc P -Ia -Ic	P Uca Uba P -Ia -Ic
Voltage correct	Phase B,C Voltage incorrectly connected to C,B	Phase A,B,C Voltage incorrectly connected to C,A,B
N Uba Uca P -Ia -Ic	N Ucb Uab P -Ia -Ic	P Ubc Uac P -Ia -Ic

Phase A,B Voltage incorrectly connected to B,A	Phase A,C Voltage incorrectly connected to C,A	Phase A,B,C Voltage incorrectly connected to B,C,A

Case 5: current in phase A and C is wrongly connected, but the polarity is correct

P Uab Ucb N Ic Ia	N Uac Ubc N Ic Ia	P Uca Uba N Ic Ia
Voltage correct	Phase B,C Voltage incorrectly connected to C,B	Phase A,B,C Voltage incorrectly connected to C,A,B
N Uba Uca N Ic Ia	N Ucb Uab N Ic Ia	P Ubc Uac N Ic Ia
Phase A,B Voltage incorrectly connected to B,A	Phase A,C Voltage incorrectly connected to C,A	Phase A,B,C Voltage incorrectly connected to B,C,A

Case 6: current in phase A and C is wrongly connected, and the A-phase current reverses

P Uab Ucb	N Uac Ubc	P Uca Uba

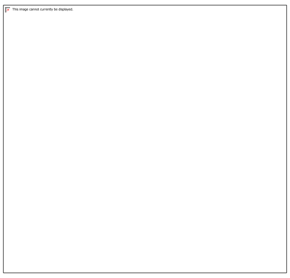
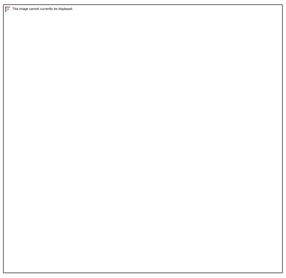
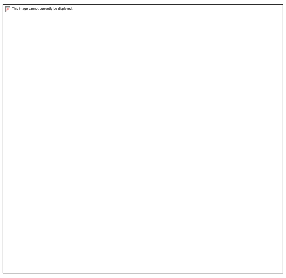
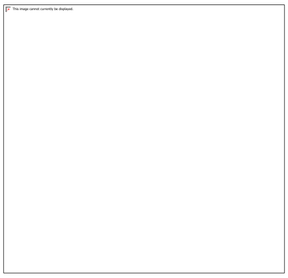
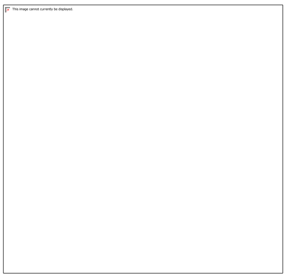
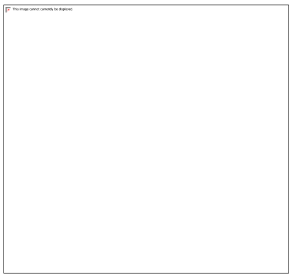
N -Ic Ia	N -Ic Ia	N -Ic Ia
Voltage correct	Phase B,C Voltage incorrectly connected to C,B	Phase A,B,C Voltage incorrectly connected to C,A,B
N Uba Uca N -Ic Ia	N Ucb Uab N -Ic Ia	P Ubc Uac N -Ic Ia
Phase A,B Voltage incorrectly connected to B,A	Phase A,C Voltage incorrectly connected to C,A	Phase A,B,C Voltage incorrectly connected to B,C,A

Case 7: current in phase A and C is wrongly connected, and the C-phase current reverses

P Uab Ucb N Ic -Ia	N Uac Ubc N Ic -Ia	P Uca Uba N Ic -Ia
Voltage correct	Phase B,C Voltage incorrectly connected to C,B	Phase A,B,C Voltage incorrectly connected to C,A,B

N Uba Uca N Ic -Ia	N Ucb Uab N Ic -Ia	P Ubc Uac N Ic -Ia
Phase A,B Voltage incorrectly connected to B,A	Phase A,C Voltage incorrectly connected to C,A	Phase A,B,C Voltage incorrectly connected to B,C,A

Case 8: current in phase A and C is wrongly connected, and both the current in phase A and C reverse.

		
P Uab Ucb N -Ic -Ia	N Uac Ubc N -Ic -Ia	P Uca Uba N -Ic -Ia
Voltage correct	Phase B,C Voltage incorrectly connected to C,B	Phase A,B,C Voltage incorrectly connected to C,A,B
		
N Uba Uca N -Ic -Ia	N Ucb Uab N -Ic -Ia	P Ubc Uac N -Ic -Ia
Phase A,B Voltage incorrectly connected to B,A	Phase A,C Voltage incorrectly connected to C,A	Phase A,B,C Voltage incorrectly connected to B,C,A

5. Three-phase four-wire wrong wiring group comparison table

The wrong wiring comparison table of positive phase sequence (ua-ub-

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uc) is shown in table 5.2:

Table 5.2 Three-phase four-wire wrong wiring comparison table (positive phase sequence)

The wrong wiring comparison table of reverse phase sequence (Ua-Uc-Ub)

is shown in table 5.3:

Table 5.3 Three-phase four-wire wrong wiring comparison table (reverse phase sequence)

6. Grade of accuracy of electric meter(China Standard Only)

There are four grades of accuracy for electric meters: 0.2, 0.2S, 0.5, 0.5S.

As for the meaning of the suffix 'S', take grades 0.5 and 0.5S as examples. Both grade 0.5 and grade 0.5S indicate that the error is within ±0.5%. The accuracy of 0.5S is higher than that of 0.5. Theone with S is a special current transformer, which requires a high precision within the load range of

1%-120%. Generally, 5 load points are taken to measure and the error should be less than the prescribedrange. High precision means that the S type can guarantee accuracy in a wider range of current, mainly refers to the minimum current. Generally, it is required to detect the error within the range of 0.02In~Imax, as shown In GB/T17215 and 15283. For the S type, it is required to detect the error within the range of 0.01In~Imax, as shown In GB17883-1999 0.2s0.5s AC(alternating current) static active electric meter. At present, only the detection range is specified in the national standard, and no specific load current point is specified.

A national outline for the type of electric meters is currently being drafted, which states roughly asfollows:

Balancing load 1: Imax, In, 0.5In, 0.05In, 0.01In 0.5L and 0.8C: Imax, In, 0.5In, 0.1In, 0.02In
Unbalanced load 1: Imax, In, 0.5In, 0.05In 0.5LImax, In, 0.5In, 0.1In

In fact, the error of the instrument at a small range may be a very large value. That is why it is usually advised to use about 2/3 of the full range when measuring the instrument. 0.5s requires that the relative error of each point should be at the 0.5 level, that is, the ratio of the error of each point to the measurement range of this point should reach 0.5%, rather than the ratio of the error of each point to thefull range should reach 0.5%. The former is 0.5S, and the latter is 0.5.

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