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Attention

1. When the instrument is not in use, please turn off the power immediately!
2. The rechargeable battery is a consumable part. Pay attention to maintenance. During use, the effective capacity of the rechargeable battery will gradually decrease with time, thus shortening the effective use time. In order to maximize the battery life, please pay attention to the following maintenance measures:
   - If you do not use the instrument for a long time, please charge it regularly and the battery should be charged at least once every three months;
   - Use of lossy electricity is strictly forbidden. Loss of electricity will severely shorten the battery life and even cause the battery to be discarded. When the instrument is out of charge, it should be immediately turned off for charging. Avoid battery failure due to long battery discharge time.
   - Charging indicator description:
     - The light is red when charging; the light turns green when the battery is full.
3. for safe and correct operation, please read the manual carefully

I. Overview

Zinc Oxide Arrester Tester is a special instrument for on-site and laboratory detection of lightning arrester’s electrical parameters, widely used in on-line monitoring of zinc oxide surge arresters (online test) and laboratory (offline maintenance) test. Meet the People’s Republic of China power industry standard "DL474.5-92 field insulation test implementation guidelines - arrester test" to the surgery. The instrument uses microcomputers for sampling, control and other advanced technologies to measure the full current, third harmonic, resistive current, resistive current peak, capacitive current, active power, etc. of zinc oxide surge arresters at power frequency voltages. And display the voltage, current waveform and printout test data. Large-screen liquid crystal display, English menu prompt operation, so that the human-machine exchange function is stronger, while providing on-site waveform display. This instrument has the characteristics of simple wiring, high measurement accuracy, and strong reliability. The instrument is small in size, light in weight, and has an integrated design for easy carrying and field operations.

II. technical parameters and features

1. Features
   - This machine adopts 800×480 dot matrix 65K true color large-screen LCD, full English menu operation, easy to use, display data clear and easy to read.
（2）高精度采样、处理电路，采用先进的傅里叶谐波分析技术，数据更可靠。
（3）仪器采用特制高精度传感器，直接采集输入电压和电流信号。
（4）带谐波含量测试功能，单相或多相同时测量。
（5）电阻性电流基波峰值输出功能。
（6）仪器内置非易失性存储器，可存储测试数据、波形、谐波和其他大量记录。
（7）仪器配备USB接口，可存储任意组测试记录（容量由USB盘大小决定）。
（8）仪器电压测试线带保险，防止接错。
（9）仪器电压和电流插头带有防插错功能。
（10）仪器内置高精度实时时钟，日期和时间校准。
（11）仪器内置高速微热敏打印机，打印测量数据。
（12）仪器配备充电电池，可连续工作6小时，日历时钟，断电存储，USB盘存储，微打印机。

### 2. 技术参数

<table>
<thead>
<tr>
<th>物理量</th>
<th>范围</th>
<th>精度</th>
</tr>
</thead>
<tbody>
<tr>
<td>全电流</td>
<td>0-20mA</td>
<td>±(×5%+5uA)</td>
</tr>
<tr>
<td>电阻电流</td>
<td>0-20mA</td>
<td>±(×5%+5uA)</td>
</tr>
<tr>
<td>电容电流</td>
<td>0-20mA</td>
<td>±(×5%+5uA)</td>
</tr>
<tr>
<td>电流谐波</td>
<td>0-20mA</td>
<td>±(×10%+10uA)</td>
</tr>
<tr>
<td>参考电压</td>
<td>Max100V RMS</td>
<td>±(×5%+0.5V)</td>
</tr>
<tr>
<td>电压谐波</td>
<td>Max100V RMS</td>
<td>±(10%)</td>
</tr>
</tbody>
</table>

（2）工作温度：-10 °C ~ 40 °C
（3）环境湿度：≤ 85% 无凝结
（4）存储温度：-20 °C ~ 50 °C
(5) Overall dimensions: $320 \times 260 \times 135 \text{(mm)}$

(6) the instrument weight: 5kg (does not include the test line and cable box)

**III Menu and Structure**

**Figure 1**

1. Current input terminal
2. Voltage input
3. Charging input
4. Switch (power off)
5. Printer
6. Ground terminal
7. USB interface
8. LCD monitor
9. Wireless port
10. Key
IV Operation

1. Connect the test line, open the instrument power, the display interface as shown in Figure 2

![Figure 2](image1)

2. Zinc oxide test method

   After a few seconds, the interface in Figure 2 automatically enters the parameter setting interface, as shown in Figure 3

![Figure 3](image2)
**Start test:** Press the "Confirm" key to start the measurement regardless of the cursor position.

**Operation Description:** Press the "Left and Right" keys to move the cursor to select the menu item; the "→" key moves the cursor forward; the "←" key moves the cursor in reverse. Press the "Select" button to enter the menu item and press the "Back" button to exit the menu item.

(1) **Setting of parameters:**

◆ **Numerical input:** Press "Select" to enter the menu item, press "↑, ↓" to change the input digit value; press "←, →" to select the input digit; press "Return" to exit the menu item.

◆ **Parameter selection:** Press "←, →" to move the cursor to this menu item, press "↑, ↓" to change the input item.

(2) **Function menu selection and execution:**

◆ **Data browsing:** Press the "Left" and "Left" keys to move the cursor to select the "Data processing" menu, and then press the "Select" key to enter the data browsing interface.

◆ **System setting:** Press the "Left" and "Left" keys to move the cursor to select the "System setting" menu, and then press the "Select" key to enter the system setting interface.

◆ **Factory setting:** Press the "Left" and "Left" keys to move the cursor to select the "Factory Setting" menu, and then press the "Select" key to enter the factory setting interface.

(3) **Parameter description:**

a) **Line number:** For storage or printing, it is recommended to set before measurement.

b) **Measurement method:** Press "←, →" key to select "Wired/Wireless/No PT".

   i. Wired measurement method: The voltage input is passed through the voltage test line and the crocodile clips the secondary terminal of the PT, and the other end is connected to the instrument 6-pin air carrier (voltage input terminal). Or access through a voltage extension cable.
ii. Wireless measurement method: voltage input through the voltage test line. Alligator clamps the PT secondary terminal, and the other end connects to the wireless module 6-pin air carrier (voltage input terminal).

iii. No PT measurement mode: no voltage signal, only current signal.

Regardless of the measurement method, the current connection mode is the same. The alligator clips of the ABC three-phase current connection are respectively connected to the measured zinc oxide.

c) PT transformation ratio: The PT quadratic method can set a voltage transformation ratio \( Ku \), which is “multiplied” with the amplitude of the reference voltage input by the instrument, affecting the voltage-related data. The appropriate PT ratio can be set in wired or wireless mode to directly display the bus voltage.

d) Compensation angle: It is divided into "disable compensation, manual compensation, automatic edge compensation". When the compensation angle is set to 0 degrees, the compensation is disabled; when the compensation angle is set to more than 360 degrees, it is an automatic edge compensation; when the compensation angle is set to a value between 0 DEG and 360 DEG, it is the current measurement angle compensation value.

e) Reference Phase: ABC

ABC indicates that three-phase voltage is used as a reference (star connection), that is, voltage and current are connected.

f) Phase to be measured: Press "←, →" key to cycle through phase A / phase B / phase C /3 phase.

◆ **Single-phase measurement**: Phase A/phase B/phase C represents single-phase measurements:

A-phase measurement: yellow clamp input voltage and current;
B-phase measurement: green clamp input voltage and current;
C-phase measurement: red clamp input voltage current;

Note: The wireless single-phase measurement is fixed at phase A.

◆ Three-phase measurement: ABC means three-phase simultaneous measurement, and ABC (yellow-green-red) leads input three-phase voltage current respectively.
Compensation angle description:

Disable compensation: Indicates that the compensation angle is 0.

**Note 1:** The compensation angle is always "added" to the current voltage angle. For example, if the compensation angle is 1° and the current actually leads the voltage by 80°, then the compensation current will lead the voltage by 81°. The instrument assumes that the three-phase alternating current is "positive phase sequence", that is, A ahead B 120°, and B ahead C 120°. For a reversed-phase system, the A and C phases of the reference signal and current should all be used upside down.

Manual compensation: The instrument defines the angle between 0 and 359.99°. All angles can be added or subtracted by 360°. For example, 120° and -240° or 180° and -180° respectively indicate the same angle. Note: There must be a basis for the compensation angle. To compensate for the effect of phase B MOA on the AC phase, A plus B does not change C to reduce the angle.

Automatic edge compensation: When measuring three-phase MOA, phase A and phase C must be phase B to phase B due to phase-to-phase interference.

The direction of deviation, the general offset angle of about 2° ~ 4°, which led to A-phase resistive current increases, C phase change is small or even negative.

The principle of automatic edge compensation (side-phase compensation) is assuming that the influence of B relative to A and C is symmetrical, the angle $\Phi_{ca}$ of Ic leading Ia is measured, the phase A compensation $\Phi_{0a}=\frac{(\Phi_{ca}-120°)}{2}$, and the C phase compensation $\Phi_{0c}=\frac{-(\Phi_{ca}-120°)}{2}$. This method actually averages the A, C phase resistive currents and may also obscure the problem. Therefore, it is still recommended to evaluate raw data without side compensation.

The disturbance at the scene may be complex. If reasonable compensation cannot be achieved, it is advisable to record the original data without compensation and examine the trend of the data.
Enter the relevant parameters and press the "Confirm" key to measure. If the phase to be measured is three-phase, the measurement interface is shown in Figure 5.

The instrument enters the measurement interface. AD collects the data and displays it. Press the "Cancel" key to display the next screen test data (see Figure 6). Press the "Confirm" key to lock the screen (lock the test data). Press the "Cancel" button in the lock screen state to re-measure; press the "Print" button to print in the lock screen state; press the "Save" button to store the test data (if a U disk is inserted and a record is stored in the U disk again); Press "Back" to return to the main menu screen.
If the phase to be measured is single-phase, the measurement interface is shown in Figure 7.

**Parameter Description:** Here is a single-phase full-data screen to explain the meaning of the data.

**U:** Reference voltage rms value. The three-phase voltage is distinguished by the
subscript a/b/c. It contains only fundamental and 3, 5, 7 harmonics. The PT ratio has been multiplied by U. The PT ratio of the bus is set and the bus voltage will be displayed.

U357% or U3U5U7: The 3rd, 5th, and 7th harmonics of the voltage account for the relative content of the voltage fundamental in %.

Ix: full current rms. The three-phase currents are distinguished by the subscript a/b/c. It contains only fundamental waves and 3rd, 5th, and 7th harmonics.

Ixp: Full current peak, which is the peak of Ix.

Ir: The effective value of the resistive current. It contains only resistive current fundamental and resistive currents 3, 5, and 7 harmonics.

Irp: Resistive current peak, which is the peak of Ir.

Ir1p: Resistive current fundamental peak. Ir1p = lx1p sinΦ

Ic1p: Capacitive current fundamental peak. Ic1p = lx1p cosΦ

The MOA total current contains both the higher harmonics generated by the non-linearity of the MOA and the higher harmonics generated by the harmonics of the bus voltage. Compared with Irp Ir1p is more stable and real. Therefore, it is recommended to use Ir1p as a resistive current indicator.

Φ is the current lead voltage angle, which already contains compensation angle Φ0.

Note: (1) Φ exceeds 90° Ir1p is negative, exceeding 180° Ic1p is also negative.

(2) If the Ix waveform is flat-topped, Ic1p can be greater than Ixp.

P1: Fundamental power consumption. P1 is equal to the product of the effective value of the fundamental current of the resistive current and the effective value of the fundamental voltage of the voltage.

Note: Ku should be set to PT ratio to obtain MOA power consumption under operating voltage.

Cx: MOA capacitance. The formula is as follows: Cx=Ic1/(2πfU1)

Ic1 is the effective value of the capacitive current, U1 is the effective value of the fundamental voltage, and f is the frequency of the grid.

Ir3p, Ir5p, Ir7p: 3, 5, 7 times resistive current harmonic peaks.

Note: Ir3p, Ir5p, Ir7p are related to the harmonic algorithm. Therefore, the Ir, Irp, and resistive current waveforms are all subject to Harmonic algorithm effects. See the
checkout section for details.

Φ: The current leads the voltage angle, which already contains the compensation angle Φ0. The instrument gives the conclusion in the table below:

<table>
<thead>
<tr>
<th>result</th>
<th>inferior</th>
<th>Low</th>
<th>Middle</th>
<th>Good</th>
<th>Best</th>
<th>interference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Φ</td>
<td>0~74.99°</td>
<td>75~76.99°</td>
<td>77~79.99°</td>
<td>80~82.99°</td>
<td>83~87.99°</td>
<td>≥88°</td>
</tr>
</tbody>
</table>

Note 1: The waveform displayed by the instrument is the collected gear signal, so do not use the waveform amplitude to determine the size of the data.

Note 2: No PT measurement, fixed UI angle = 83.5 degrees, easy to calculate resistive current.

V Measurement wiring

1. wiring points
   1) Ground the instrument host.
   2) Take full current: Single-phase MOA is connected to A (yellow) channel, and the three phases are connected to A (yellow) B (green) C (red).
   3) Take reference voltage: ABC, corresponding to A (yellow) B (green) C (red).
   4) There is a fuse on the wire connecting the PT voltage. Do not replace it with fuses or wires of other specifications.
   5) The instrument can only be used for low voltage and low current tests. All leads must be kept away from high voltage.

2. wired transmission wiring diagram (see Figure 8)
Three-phase measurement wiring transmission wiring diagram

**Three-phase measurement:** Three-phase cable voltage, plus extension cable connection is to connect the opposite connector of the extension cable between “host” and “voltage PT connector”.

**Single-phase measurement:** (main wiring and three-phase measurement wiring are the same, the wiring of the test product is the phase of which phase is connected, which is not measured.) The detailed wiring of each phase is as follows:

(1) Phase A measurement, the current and voltage lines on the green, red wire clip on the wire hanging, only the corresponding phase A yellow clip.

(2) B-phase measurement, the wiring clips on the yellow and red wires of the current and voltage lines are left open, and only the corresponding clips of the green phase B phase are connected.

(3) Phase C measurement: The wiring clips on the yellow and green conductors of the current and voltage lines are left unconnected, and only the corresponding clips of the red phase of phase C are connected.

3. **wireless transmission wiring diagram**

Three-phase wireless measurement wiring is shown in the figure below (see Figure 9)

The three-phase wireless measurement wiring is shown in the figure below (see Figure 9):
Figure 9 Three-phase measurement wireless transmission wiring diagram.

Single-phase wireless measurement (mainframe and wireless module wiring and three-phase wireless measurement is the same, the difference between the sample wiring is the instrument fixed with A-phase voltage measurement, BC suspended phase), single-phase detailed wiring is as follows:

Voltage wiring: the clip of the yellow line of the A phase of the voltage line, and the voltage BC is suspended.

Current connection: The current line A corresponds to the clip of the yellow line, and the current BC is not connected.

4. no PT wiring schematic (see Figure 10)
VI system setting and menu operation method

In the interface of Figure 3, press “Select or Return” to move “Select Block” to select “System Setup” function button, and then press “Enter” to enter the system setup interface, as shown in Figure 11.

In the interface of Figure 3, press "Select or Return" to move the "Selection Block" to select the "Factory Settings" function button, and then press "Enter" to enter the factory setting display interface.

In the interface of Figure 3, press “Select or Return” to move “Select Block” to select “Data View” function button, and then press “Enter” to enter the data browsing display interface, as shown in Figure 12.

1. the system settings: for date and time settings, LCD backlight adjustment, as shown in Figure 11 below:

Among them, the [Harmonic Angle Measurement] item is used to set whether the harmonic angle measurement is valid or invalid. Press the Select key to select it, and then press “←→” to select “Active” and “Invalid”.

Figure 10
Harmonic angle measurement is effective: Measure harmonic effective values and harmonic angles.

Harmonic angle measurement is invalid: only the fundamental wave effective value and angle are measured. The default harmonic angle is 0 degree.

Figure 11

2. factory settings: for manufacturer parameter settings, the user can not operate.

3. data browsing: used to view the test data, as shown in Figure 12 below:

Figure 12
The display mode is the same as the test interface.

1. Press the "up and down" key to view the test data one by one; "left and right" key to jump back and forward after 10 groups of data to view.

2. Press the "Print" button to print the current display data.

3. Press "Save" to save the data to USB flash drive.