

Dear Client

Thank you for Purchasing our **TAG-8000 Wireless HV Phase Tester**. Please read the manual in detail prior to first use, which will help you use the equipment skillfully.



Our aim is to improve and perfect the company's products continually, so there may be slight differences between your purchase equipment and its instruction manual. You can find the changes in the appendix. Sorry for the inconvenience. If you have further questions, welcome to contact with our service department.



The input/output terminals and the test column may bring voltage, when you plug/draw the test wire or power outlet, they will cause electric spark. PLEASE

CAUTION RISK OF ELECTRICAL SHOCK!

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◆ **SERIOUS COMMITMENT**

All products of our company carry one year limited warranty from the date of shipment. If any such product proves defective during this warranty period we will maintain it for free. Meanwhile we implement lifetime service. Except otherwise agreed by contract.

◆ **SAFETY REQUIREMENTS**

Please read the following safety precautions carefully to avoid body injury and prevent the product or other relevant subassembly to damage. In order to avoid possible danger, this product can only be used within the prescribed scope.

Only qualified technician can carry out maintenance or repair work.

--To avoid fire and personal injury:

Use Proper Power Cord

Only use the power wire supplied by the product or meet the specification of this produce.

Connect and Disconnect Correctly

When the test wire is connected to the live terminal, please do not connect or disconnect the test wire.

Grounding

The product is grounded through the power wire; besides, the

ground pole of the shell must be grounded. To prevent electric shock, the grounding conductor must be connected to the ground.

Make sure the product has been grounded correctly before connecting with the input/output port.

Pay Attention to the Ratings of All Terminals

To prevent the fire hazard or electric shock, please be care of all ratings and labels/marks of this product. Before connecting, please read the instruction manual to acquire information about the ratings.

Do Not Operate without Covers

Do not operate this product when covers or panels removed.

Use Proper Fuse

Only use the fuse with type and rating specified for the product.

Avoid Touching Bare Circuit and Charged Metal

Do not touch the bare connection points and parts of energized equipment.

Do Not Operate with Suspicious Failures

If you encounter operating failure, do not continue. Please contact with our maintenance staff.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in Explosive Atmospheres.

Ensure Product Surfaces Clean and Dry.

— **Security Terms**

Warning: indicates that death or severe personal injury may result if proper precautions are not taken

Caution: indicates that property damage may result if proper precautions are not taken.

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◆ **Product Introduction**

Remote wireless high-voltage phase detector (Hereinafter referred to as "instrument") It is used for long distance (apart from 300 meters to 800 kilometers) to check whether the high voltage phase is in phase and whether the phase sequence color is marked correctly . It can also be used for short distance grid connection or loop network core phase. The instrument is suitable for live working of 5V-220kV transmission line and live working of secondary side, It has high voltage power test function.

The instrument adopts wireless transmission technology, which is safe and reliable in operation and convenient to use, and overcomes many shortcomings of the wired phase detector. And using GPS timing technology, two (or more) instruments can be separated by hundreds of kilometers of nuclear phase。

◆ **Working Principle**

The instrument is composed of A and B machines. A and B machines can be used separately for short-range nuclear phase. In the short-range nuclear phase, the X and Y transmitters send the measured data to the receiving host by radio. The receiving host calculates the phase difference between the two lines based on the transmitter data to

determine the phase difference.。

Both machines can be used for remote phase verification. When the remote phase detector is used, two Y transmitters send the measurement data to two receiving hosts respectively. The host is measured synchronously after timing by GPS. The phase difference between the two hosts is calculated as the phase difference between the two lines to judge the same and different phases of the two lines.。

◆ **Safety Precautions**

- 1、 During the field test, the operation shall be carried out according to the safe distance standard for high voltage test of the power department.。
- 2、 The standard configuration of the insulation rod is 3 meters, and the corresponding voltage level is $\leq 220\text{kV}$. If the measured line voltage is higher than 220kV, please use an insulation rod with a length of more than 3 meters.。
- 3、 During nuclear phase operation, do not hold the position beyond the handle of the insulation rod.。

Note: The transmitter uses a 3.7V rechargeable lithium battery, please do not replace other batteries.。

◆ Technical Parameters

1. Phase difference accuracy: error $\leq 5^\circ$.
2. Frequency accuracy: $\pm 0.1\text{Hz}$.
3. The measurement range of the cross-voltage is $0.22\text{kV} \sim 220\text{kV}$.
4. The maximum transmission visual distance between the transmitter and the receiving host is about 100 meters.
5. In the remote nuclear phase, the distance between the two GPS hosts is $0.3\text{km} \sim 800\text{km}$.
6. Human voice prompts for measurement results and operation steps.
7. The 3.2-inch color screen displays the phase difference, frequency, vector diagram and in-phase of two lines at the same time
The results show the number of GPS satellites, GPS timing status and time and other information.
8. Automatic shutdown without operation for 1 hour.
9. The transmitter and receiver are equipped with built-in rechargeable lithium batteries and 5V charger.
10. The main engine is equipped with 18650 lithium battery, with a battery capacity of 2500mAH. Transmitter built-in 14430 Lithium battery, battery capacity of 450mAH.
11. Leakage current during high voltage measurement is $<10\mu\text{A}$.

12. The transmitter's working power consumption is $< 0.1\text{w}$, and the receiver's working power consumption is $< 0.3\text{w}$.

13. Working environment: humidity $\leq 95\%RH$ at $-35^{\circ}\text{C}---$ $+45^{\circ}\text{C}$.

14. Machine weight: about 3.6kg.

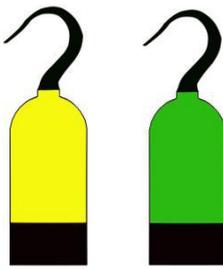
15. Package size of the instrument: length 56cm* width 26cm* height 13cm.

◆ Instrument Introduction

1、 Appearance of the instrument

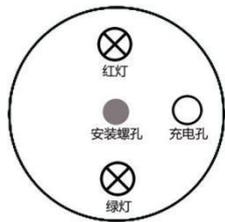
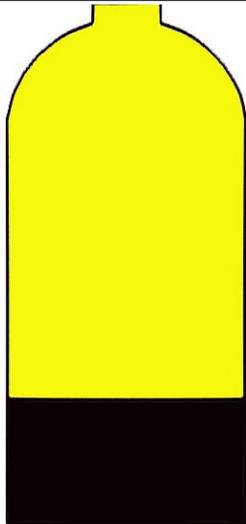


Component description:

| | | |
|---|---|--|
|  <p>Receiving host</p> |  <p>Launcher X/Y</p> |  <p>Collector X/Y</p> |
|  <p>Insulation rod</p> |  <p>Charger</p> |  <p>Accessory box</p> |

2、Instrument Operation Introduction

| | |
|---|--|
|  <p>(Receiving host)</p> | <p>Indicator light:</p> <ul style="list-style-type: none"> (a) (A) Out of phase red light is on: the two lines are out of phase. (b) (B) The same phase green light is on: the two lines are in phase. (c) (C) Charging red light is on: charging. (d) Charging green light is on: fully charged. <p>Key:</p> <ul style="list-style-type: none"> (1) Long press to turn on or off. (2) Short press to switch between short-range measurement mode, phase sequence measurement mode and remote measurement mode. <p>Supplement:</p> <ul style="list-style-type: none"> 1) There is a power indicator in the upper right corner; 2) There is a charging interface jack at the bottom. |
|---|--|



(Launcher)

Indicator light:

During measurement: red light and green light flash alternately.

Charging: red light is charging, green light is full.

Buzzer:

In case of contact with high voltage live line, the buzzer will sound, indicating that the line is live.

When starting, 3 beeps indicate that the power is sufficient, 2 beeps indicate that the power is available, and all beeps indicate that the power is insufficient. Please charge in time.

Mounting screw hole:

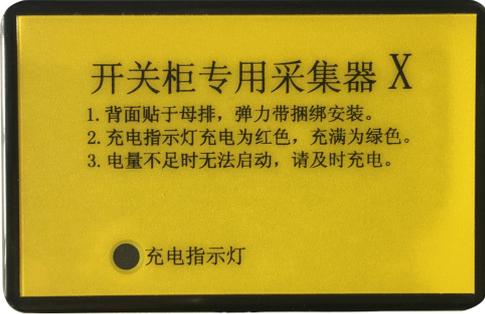
It is connected with the telescopic insulating rod.

Charging hole:

When charging: connect the charger.

During self inspection: connect the test wire ground terminal.

When testing: connect the ground wire.

| | |
|---|--|
|  <p>开关柜专用采集器 X</p> <p>1. 背面贴于母排，弹力带捆绑安装。 2. 充电指示灯充电为红色，充满为绿色。 3. 电量不足时无法启动，请及时充电。</p> <p>● 充电指示灯</p> <p>Switchgear collector</p> | <p>Indicator: When charging: The charging indicator is red and green when fully charged.</p> <p>Buzzer: When it comes into contact with the high-voltage live line, it will beep every 4 seconds, indicating that the line is live and the collector is started.</p> <p>Elastic band: Attach the collector to the busbar and bundle it with an elastic band.</p> <p>Charging hole: Connect the charger while charging.</p> |
|---|--|

3、Instrument self-test method

Connect the transmitter to the self-test test line as shown in the figure below. The transmitter starts, the buzzer sounds, and the red and green indicator lights flash alternately. The receiving host is turned on, and the corresponding transmitter information is displayed in the short-range nuclear phase mode, then the transmitter and the host are working normally.



Reminder:

1. when self checking, the distance between two transmitters and receiving host should be more than 0.5m. When the distance is less than 0.2m, only one transmitter may be connected and the host computer

displays two transmitter information. This phenomenon is normal and does not affect the use of the instrument. When both transmitters are powered on, the instrument display is not affected by the short distance.

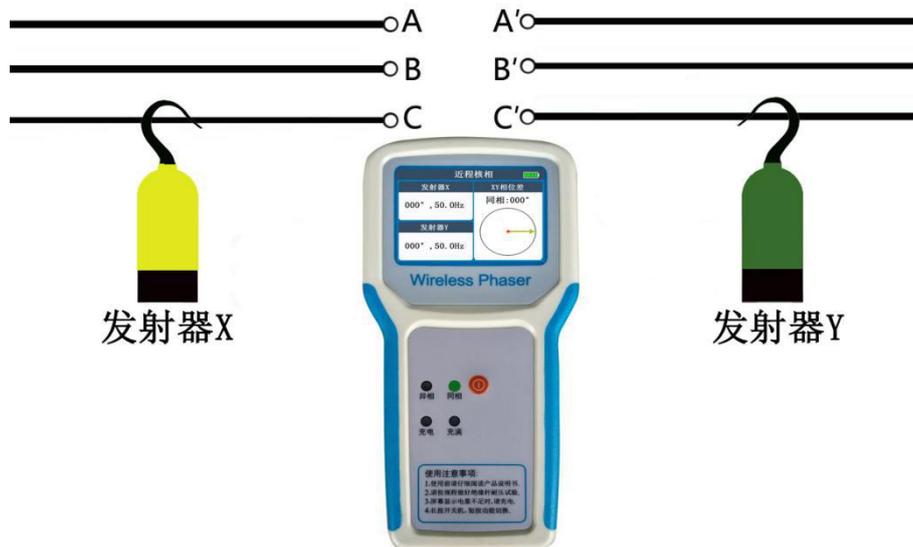
2. there is a 2m resistor in the self-test line, and when people contact the alligator clamp during the test, they will not get electric shock.

3. When the self-test phase difference is about 180 degrees, reverse the plug of any self-test line, then the phase difference becomes about 0 degrees, and vice versa.

◆ **Short-range phase detector**

1. Phase detection of high voltage transmission line (high voltage phase detection)

Connect the X and Y transmitters to the insulation rods and connect them to the high-voltage line at the same time. After the receiving host is turned on and selects the short-range nuclear phase mode, the nuclear phase results can be displayed and reported. The schematic diagram is as follows:



2.High voltage switchgear live display nuclear phase (low voltage high voltage phase detection)

Replace the hooks of the X and Y transmitters with pointed terminals, and insert the live display, then insert the DC end of the ground wire into the transmitter grounding hole (also the charging hole), the alligator clip is grounded, and the receiving host powers on to select the short-range nuclear phase mode, then the measurement can be carried out.

Use the transmitter as shown in the figure below:

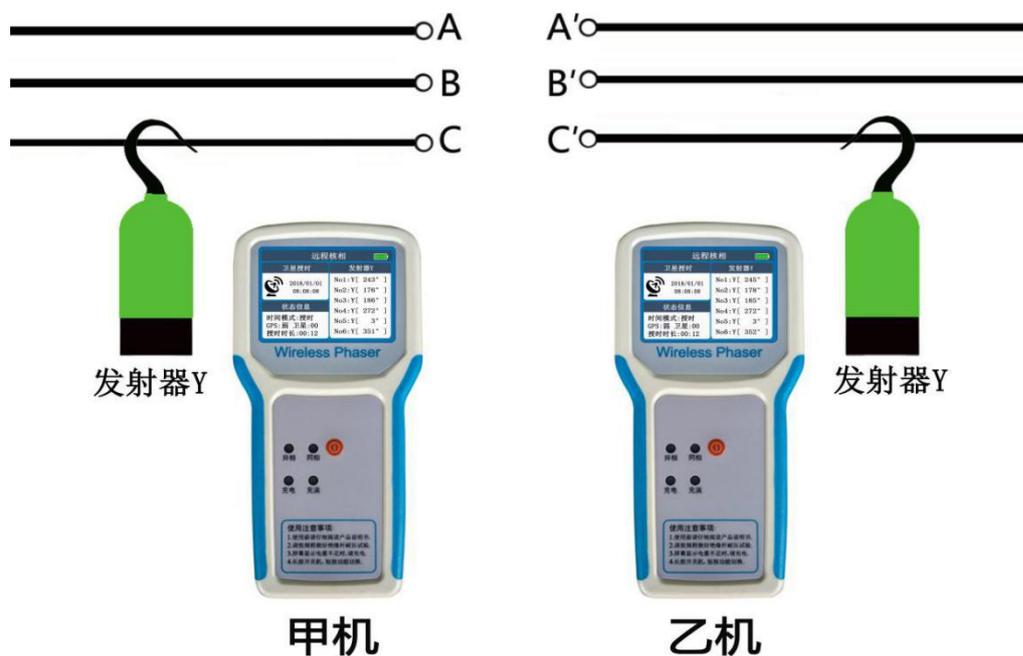


Reminder: Because the main function of the live display is to show

whether the switch cabinet is live or not, it is not a standard nuclear phase point, and the live displays of different manufacturers, different periods and different standards will have different degrees of phase shifting problems, and the corresponding relationship between the live displays L1, L2, L3 and the bus is not necessarily correct. If the nuclear phase result is abnormal, the nuclear phase should be carried out on the primary line.

◆ Remote Phase Detection

Use two instruments at the same time for remote nuclear phase, the schematic diagram is as follows:



First turn on the two receiving hosts, switch to remote nuclear phase mode, and complete the timing in the place where there is a GPS signal, until the voice broadcast transmitter has no signal. Then the Y

transmitter will be contacted with the live line under test. At this time, the two receiving hosts will record a set of data every 10 seconds, No1 to No6 are the data of 0s, 10s, 20s, 30s, 40s and 50s per minute respectively.

Compare the data of the same number of A and B to judge the same and different phase. The display interface is as follows:

| 远程核相 | | 发射器Y | |
|--|---------|----------------|----------------|
|  2018/01/01 08:08:08 | 卫星授时 | | No1: Y[245°] |
| | 状态信息 | | No2: Y[178°] |
| | 时间模式:授时 | | No3: Y[185°] |
| GPS:弱 卫星:00 | | No4: Y[272°] | No5: Y[3°] |
| 授时时长:00:12 | | No6: Y[352°] | |

A machine

| 远程核相 | | 发射器Y | |
|--|---------|----------------|----------------|
|  2018/01/01 08:08:08 | 卫星授时 | | No1: Y[243°] |
| | 状态信息 | | No2: Y[176°] |
| | 时间模式:授时 | | No3: Y[186°] |
| GPS:弱 卫星:00 | | No4: Y[272°] | No5: Y[3°] |
| 授时时长:00:12 | | No6: Y[351°] | |

B machine

Reminder:

(1) if there is no GPS signal at the test site (such as the underground power distribution room), it is necessary to first connect the receiving host to the GPS satellite signal in the outdoor place where there is GPS signal, and then get the place without GPS signal for measurement, and the host will automatically switch to the time service mode. At this time, the host uses the internal clock, whose accuracy is worse than the GPS clock, and the error will accumulate. Please complete the test within 30 minutes of time service, otherwise, it is necessary to reconnect the GPS signal to calibrate the clock to ensure the test accuracy.

(2) if the two units(A and B machine) measure in a short distance (less than 300m apart), the wireless signals of the two transmitters will interfere with each other, which may invalidate the measurement results。

◆ **Result judgment and analysis**

The results are judged by the national standard A standard, the same phase is bounded by 30° . When the phase difference is $\geq \pm 30^\circ$, it is out of phase. The voice prompt "out of phase", the screen displays "out of phase", and the out of phase indicator is on. The phase difference $< \pm 30^\circ$ is the same phase, the voice prompts "in phase", the screen displays "in phase", and the phase indicator is on. All phase difference results refer to X, and the degree is the phase in which Y is ahead of X.

Tip: When the frequencies of the two lines are not the same, you need to use a quasi-synchronous parallel device to control the frequency phase of the generator so that the phase and frequency of the generator are consistent with the main network before the grid-connected power transmission. See Appendix B for Quasi-Synchronous and Self-Synchronous Operations。

◆ **Maintenance**

1. When not in use for a long time, please fully charge before storing.
2. This product should not be stored in a humid, hot, and dusty

environment.

3. The insulation rod should be subjected to a withstand voltage test before the first use, and an annual withstand voltage test.

◆ Factory configuration list

| Item Name | Number of single machines | Number of whole set |
|--------------------------------------|----------------------------------|----------------------------|
| Aluminum alloy case | 1pcs | 2pcs |
| Receiving host | 1pcs | 2pcs |
| Launcher X、 Y | 2pairs | 4pairs |
| Switchgear collector | 1pair | 2pairs |
| Telescopic insulation rod (3 meters) | 2pcs | 4pcs |
| Pointed terminal | 2pcs | 4pcs |
| Charger(5V/1A) | 2pcs | 4pcs |
| Self-test Line | 2pcs | 4pcs |
| Ground wire | 2pcs | 4pcs |
| Manual | 1pcs | |
| Fctory inspection report | 1pcs | |
| Certificate | 1pcs | |

Reminder:

(1) The pointed terminal is a replacement for the hook on the transmitter

head.

- (2) There is a resistance inside the self-testing test line, and people will not get an electric shock when they touch the crocodile clip during the self-test of the mains.
- (3) The grounding wire is a straight-through wire, which is only used in low-voltage (voltage <math><1\text{kV}</math>) occasions.◦

◆ **After-sales service**

1. Within one month from the date of sale of the instrument, if there is any quality problem, replace the new instrument free of charge.
2. All quality problems of the instrument within 1 years shall be repaired by our company free of charge.
3. If the instrument has been used for more than 1 years, our company shall be responsible for long-term maintenance and properly charge material fees.
4. If the instrument fails, please send it back to our company for repair. Do not disassemble the instrument by yourself, otherwise our company will not be responsible for the self damage.◦

Appendix A

Supplementary description of insulating rod parameters

The insulating telescopic pole (material) is selected from the moisture-proof insulation pipe produced by the military industry. It conforms to the IEC / 1C78 standard and has the characteristics of moisture resistance, high pressure resistance, impact resistance, and bending resistance. The material characteristics are shown in the table below.

Table 1 Mechanical and electrical characteristics of insulated rods

| project | unit | Index |
|----------------------------------|--------|---------------------|
| Martin-type heat resistance | °C | >200 |
| Impact resistance (longitudinal) | MPa/cm | >147 |
| Bending resistance | MPa | >343 |
| Surface resistance coefficient | Ω | >10x10 ¹ |
| Volume resistance coefficient | Ω/cm | >10x10 ³ |

Table II withstand voltage test parameters of insulating rod

| Voltage (kV) | Length(m) | Power frequency withstand voltage (kV) | | Time (min) | Result |
|--------------|-----------|--|------------|------------|-----------|
| | | Standard | Test value | | |
| 6-10 | 1.5 | 44 | 44 | 1~5 | qualified |
| 35 | 2.4 | 80 | 80 | 1~5 | qualified |
| 66~110 | 2.8 | 254 | 254 | 1~5 | qualified |
| 220 | 3.0 | 440 | 440 | 1~5 | qualified |

The product complies with the national GB13398-92, GB311.1-311.6-8, 3DL408-91 standards and the newly issued national power industry standard "General Technical Conditions for Portable Nuclear Phase Apparatus for Live Working 1kV ~ 110kV DL / T971-2005".

Appendix B

The synchronous mode of generator grid connection is divided into quasi synchronous mode and self synchronous mode

The quasi-synchronous juxtaposition is to add the excitation of the generator that is not put into the system, and adjust its voltage and frequency. When the parallel conditions are met (that is, the voltage, frequency, and phase are the same), put the generator into the system. When the generator's outlet switch is closed, the circulating current in the generator's stator circuit will be zero, which will not produce the impact of current and electromagnetic torque. The quasi-synchronous period is long, but the impact is small. Large generators should use quasi-synchronous method.

From the same period in parallel, first turn the wheel generator set. When the speed rises slightly below the rated speed of the set, the circuit breaker is closed. At this time, the power system sends three-phase impulse current to the stator winding of the generator to form a rotating magnetic supercurrent. Then the excitation system sends DC current to the rotor windings of the generator to generate a magnetic super current, which causes the power system to pull the generator into synchronous operation. In the parallel process, the generator has suffered some damage due to the inrush current. This is a disadvantage from the same period.

Advantages The juxtaposition process is relatively fast. Short parallel time since the same period, suitable for grid connection of small hydropower.