

EAGLOTEST

S320A

**HIGH VOLTAGE PHASE
SEQUENCE INDICATOR**



USER MANUAL

CATALOG

Safety Warnings	1
Introduction	3
Specification	4
Structure	8
Operation	9
4.1 Basic Operation	9
4.2 Testing	10
Battery Management	17
Packing List	18

SECTION 1

Safety Warnings

- Danger! Users of this equipment must be trained, certified/ licensed, and evaluated by accredited organizations.
- High Voltage! Dangerous! Operators must undergo strict training and obtain the relevant national high-voltage operation certification before using this instrument for on-site testing.
- The operator must fully understand the manual instructions and be proficient in operating the instrument before conducting on-site testing.
- When the voltage of the tested circuit exceeds 600V, an insulated rod must be used.
- It is strictly prohibited to use this instrument to contact test bare conductors or busbars exceeding 35kV (bare conductors or busbars with a voltage of 35kV or below, or single-core cables with a safe insulating outer layer under 220kV, can be tested).
- Non-contact phase detection: The detector gradually approaches the conductor for phase detection without touching the conductor.
- Before the first use, an insulation resistance test should be performed on the insulated rod, and only a qualified insulated rod should be used.
- Please use the specially designated insulated rod to connect this instrument.
- After connecting the instrument with the telescopic insulated rod, handle it with care to avoid damage from impact with the ground.

SECTION 1

- Do not store or place the instrument in areas with high temperature, humidity, condensation, or direct sunlight for extended periods.
- If the instrument is not used for a long time, please periodically charge the battery or remove the battery.
- Battery replacement: Pay attention to polarity. If the battery cannot be replaced, please contact the manufacturer.
- The disassembly and maintenance of this instrument must be performed by authorized personnel, and regular maintenance should be carried out.
- If the instrument or other components are damaged, usage should be prohibited.
- If continuing to use the instrument presents a danger due to a fault with the instrument, stop using it immediately and seal it for processing by an authorized institution.
- It is recommended that the insulated rod undergo an insulation strength test at least once a year.

SALES OFFICE

Email: sales@eaglotest.com

Tel: +86 020 31529626

Add: Building 4, No.18 Keyuan Road,
Baiyun District, Guangzhou, Guangdong, China

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SECTION 2

Introduction

S320A high voltage wireless sequence comparator can be used for electrical inspection, high voltage tester, phase sequence testing, and transformer phase detection, etc.

Features

- Composed of a wireless receiver, detector, and insulating rod.
- The receiver uses a 3.5-inch true-color LCD screen, which displays the results of phase sequence, phase angle, voltage, frequency, and vector diagram at the same time.
- Voice feedback function, suggest “X” signal and “Y” signal is normal, in-phase, and out-of-phase.
- The distance between the two power cables on an open field can be up to 160m.
- Detect phase sequences for cables from 1V to 550kV.
- Testing Method
- For bare wires of 35kV and below, the **direct contact method** can be used;
- For bare wires above 35kV, using the **non-contact method**. The non-contact method is a much safer option when dealing with high voltage lines, by slowly approaching the cables using the receivers, it can detect phases without direct contact.

SECTION 3

Specification

Functions	High and Low Voltage Wireless Voice Phase Sequence Detection, Frequency, Phase, Phase Sequence, and Voltage Testing
Power	Receiver: DC 7.4V 3000mAH Rechargeable lithium battery Detector: DC 3.7V 1200mAH Rechargeable lithium battery
Transmission Method	315MHz, 433MHz Wireless Transmission
Phase Detection Distance	Up to 160m
Display	3.5-inch LCD
Measurement Range	Detectable Range of Phase Sequence: 1V ~ 550kV
	Phase Angle: 0.0° ~ 360.0°
	Voltage: 1kV ~ 35kV
	Frequency: 50Hz ~ 60Hz
Smallest Detectable Unit	0.1°; 0.1Hz; 1V
Accuracy (23°C±5°C , Below 80%RH)	Phase Angle: ≤±10°
	Voltage: ±15%±5dgt (1kV ~ 35kV, High-voltage overhead line, the deviation for other applications ±25%±5dgt)
	Frequency: ≤±2Hz

SECTION 3

Phase Sequence Indication	In Phase: $-30^{\circ} \sim 30^{\circ}$; Out of Phase: $90^{\circ} \sim 150^{\circ}$ and $210^{\circ} \sim 270^{\circ}$
Voice Feedback	In Phase, Out of Phase, X Signal Normal, Y Signal Normal
Insulating Rod	Extended 3m; Retracted 0.6m
Saved Data Sets	9999 Sets
Detection Method	Contact Method: bare wires below 35kV, or wires with safety insulation coatings below 220kV, the receiver can be in direct contact with the cable, however, the insulation rod must be used.
	Non-contact Method: Please use the non-contact method for bare wires above 35kV or circuits above 110kV. The insulation rod must be used as well
	Auxiliary ground wire measurement: When the cable is below 100V, the measurement result may be unstable, an auxiliary ground wire will be needed to connect to the grounding to enhance the signal
Voltage Test	There will be a beeping sound on the detector
Automatic Range Shift	The measurement range will be changed automatically based on the circuits being tested.
Sampling Rate	2 times / second
Dimensions	Detector: 145mm×60mm×50mm
	Receiver: 207mm×101mm×45mm
Backlight Brightness	Press the Up and Down arrow to adjust the brightness of the backlight
Power Amplifier	The detector will automatically amplify the power, based on

SECTION 3

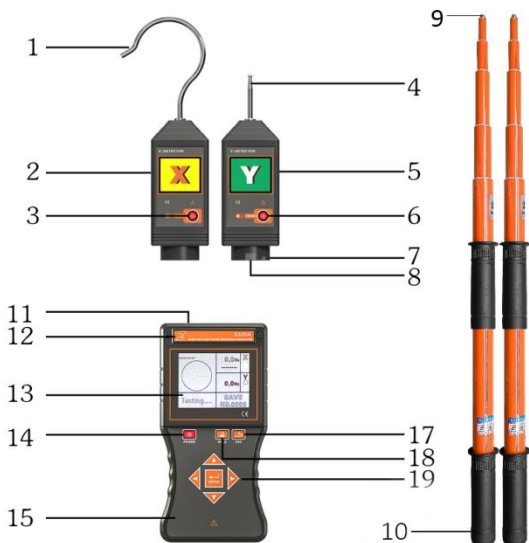
	the strength signal of the electric field. This can be useful for environments where the cables are densely arranged.
Hold Function	In the test, mode press the HOLD button to hold the data , press the HOLD button to cancel it.
Exit	Press the ESC button to return to the previous page.
View Data	Press the ENTER button to view the saved data, and press the arrow buttons to view previous data.
No Signal	When the receiver is not connected to the detector, a“---- ”symbol will be displayed
Auto Shutdown	The instrument will automatically shut down after 15 minutes of idling.
Battery	When the battery is low: Detector: Slow blinking indicates low battery, please charge it when possible. Receiver: A low battery symbol will be displayed on the screen, please charge it when possible.
Rated Current	Detector: 35mA max; Receiver: 300mA max
Weight	Detector: 342g (with battery)
	Receiver: 450g (with battery)
	Insulating Rod: 0.5 kg
	Gross weight: 5.61kg (with instrument's case)
Ideal Working Conditions	-10℃ ~ 40℃; below 80%Rh

SECTION 3

Ideal Storage Conditions	-10℃ ~ 60℃; below 70%Rh
Interference	Please avoid strong electromagnetic fields, avoid 433MHz, and 315MHz
Dielectric Strength	Insulating Rod: AC 110kV/RMS (Fully extended, the measurement from two ends)
	Detector: 2000V/RMS (two ends of the housing)
	Receiver: 2000V/RMS (two ends of the housing)
Structure	Leakage Proof type II, IP63
Safety Standards	Compliance with the standards of GB13398 - 92, GB311.1 - 311.6 - 8, 3DL408 - 91, and the standard of Live working-portable phase comparators for use on voltage from 1kV to 35 kV A.C. DL/T971-2005
	Compliance with the IEC61481 - A2: 2004; IEC 61243 - 1 ed.2: 2003 standards.

SECTION 3

Structure



- | | |
|-----------------------------------|-------------------------|
| 1.Hook | 11.Charger Port |
| 2.X Detector | 12.Product Model |
| 3.X Detector Power Button | 13.LCD |
| 4.Probe | 14.POWER Button |
| 5.Y Detector | 15.Receiver |
| 6.Y Detector Power Button | 16.Antenna |
| 7.Charger Port | 17.ESC Button |
| 8.Insulation Rod Attachment Point | 18.HOLD Button |
| 9.Insulation Rod Attachment Screw | 19.Arrow & Enter Button |
| 10.Insulation Rod Handle | |

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SECTION 4

Operation

4.1 Basic Operation

Both the receiver and the detector are turned on and off by pressing the POWER button. After the detector is turned on, the LED indicator lights up and the instrument enters the test mode. If the LED flashes slowly after booting up, the detector battery is low and it needs to be charged. The LED will flash relatively quicker when charging. The instrument will shut down automatically when idled for 15 minutes. Press the POWER button to stop the automatic shutdown. To adjust the brightness of the receiver's LCD, press the Up and Down arrow keys when the instrument is turned on. The receiver will also shut down automatically after idling for 15 minutes. Likewise, press the POWER button to stop the process.

Press the **HOLD key** to hold and store the data. When the data is locked, the HOLD symbol will be displayed. The instrument can store up to 9999 sets of data. Press the arrow keys to move the cursor or view the data, and press the left and right arrow keys to select the step value +1, -1, +10, -10, +100, -100, and press the ENTER key to confirm and view the stored data. Press the ESC key to exit the current directory and return to the testing page.

To delete data, use the arrow buttons to select "Yes" and press ENTER to delete data. Once the data is deleted, it cannot be recovered. Please operate with caution.

SECTION 4

4.2 Testing

	High voltage, extremely dangerous! It must be operated by trained and authorized personnel. The operator must strictly abide by the safety rules, otherwise, there is a danger of electric shock, causing personal injury or casualties.
	Please use the non-contact method for the phase detection of bare wires above 35kV. The detector can be gradually approached to the wires, otherwise, there is a danger of electric shock, causing personal injury or casualties.

Contact Detection Method

When the bare wire voltage is lower than 35kV, or a wire with a safe insulating sheath below 110kV, the detector's probe can be in contact with the wire. When the voltage is extremely low e.g. lower than 60V, only the contact detection method will be effective. During phase detection, the detector automatically adjusts the electric field through a power amplifier, which will enhance or weakens the signal based on the strength of the electric field, which can be convenient for phase detection in places with dense lines.

Non-contact Detection Method

When the bare wire voltage is higher than 35kV, use the detector to gradually approach the wire (without touching the wire), and when the detector senses the electric field, it emits a "beep-beep-beep" sound to indicate that the detection has been completed.

SECTION 4

Calibration:

Before going to the field, a laboratory test can be done first to ensure the equipment are functioning properly. First, insert the plug of the self-calibration line into the 220V power socket, and then connect the two alligator clips of the self-calibration line to the probe or probe hook of the XY receiver respectively, and it should show the phase it is in. If it shows otherwise, the plug of the self-calibration line may be plugged in in reverse, just pull it out and plug it correctly and it should show the correct result.

Low-voltage Phase Detection:

The phase detection on the secondary switch gears belongs to the low-voltage phase, and the voltage is generally lower than 100V. To ensure the accuracy of phase detection, the spring-like auxiliary test line can be used to increase the accuracy. The alligator clip of the spring-like auxiliary test line is clipped to the ground wire, and the other end of the spring-like auxiliary test line is inserted into the charging hole of the detector. The probe end of the detector is inserted into the phase indicator of the secondary switchgear. When the wire voltage is higher than 100V, do not use the spring-like auxiliary test wire.

Determining Phase Sequence:

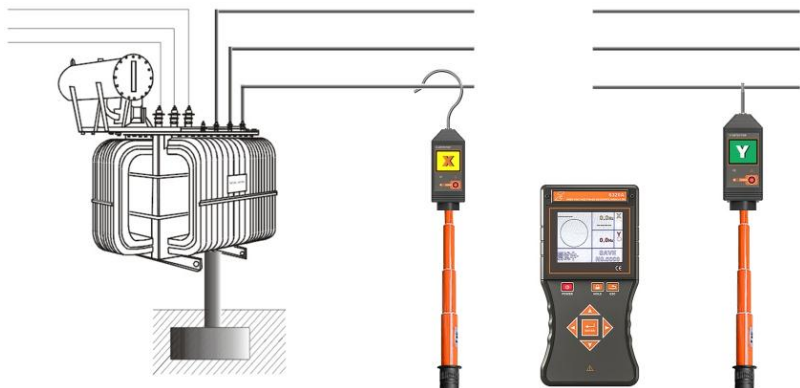
Based on the data of the X&Y detector, the positive phase sequence is usually about 120°, and the negative is about 240°.

	During the test, when the wire voltage is higher than 100V, it is
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SECTION 4



prohibited to use the spring-like auxiliary test wire, also it is strictly prohibited to hook 2 bare wires with the same hook at the same time, this will cause the short circuit of the 2 bare wires, which is extremely dangerous.



Three-Phase Four-Wire (Phase When The Three-Phase Load Is Balanced)

Phase Sequence	Phase Angle	Phase Sequence	Phase Angle
Ua-Ub	120°	Ia-Ib	120°
Ub-Uc	120°	Ib-Ic	120°
Uc-Ua	120°	Ic-Ia	120°
Ua-Uc	240°	Ia-Ic	240°

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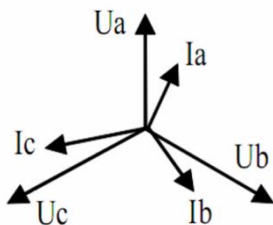
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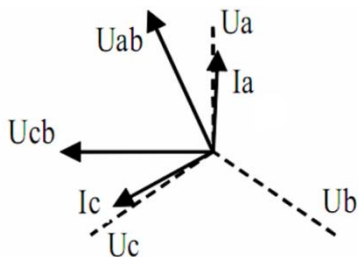
Three-Phase Three-Wire (When The Three-Phase Load Is Balanced)

Phase Sequence	Phase Angle	Phase Sequence	Phase Angle
Uab-Ucb	300°	Ia-Ic	240°
Uab-Ia	30°	Ucb-Ic	330°

Three-phase four-wire vector diagram and three-phase three-wire vector diagram



3-Phase 4-Wire Vector Graph



3-Phase 3-Wire Vector Graph

On-site Phase Detection Examples

Phase Detection Of High Voltage Bare Conductor Above 35kv

Please use the non-contact method for high voltage bare conductors above 35kv. Connect the detector to the insulating rod, and the have the insulating rod is fully extended. It is not necessary to install the probe hook onto the detector. User should hold onto the insulating rod, and slowly move the detector towards the wire without having to be in contact. The detector can detect the electric field without having to touch the wires.

SECTION 4

Phase Detection for Cables Below 35kV	The detector is connected to the insulating rod, and the insulating rod is fully extended. The detector can be hung on the line to be in contact with the cable.
Phase Detection for 380V/220V Power Mains	The top end of the detector can be in direct contact with the cables. It is not necessary to install the probe hook, and the insulating rod can be used depending on the height of the line from the ground.
Phase Detection for Cable Below 100V	The detector does not need to be connected to the insulating rod, the probe or the probe hook can be in contact with the wire. If the voltage is too low, plug the auxiliary test line into the detector's charging port, and clip the auxiliary line to the ground or the cabinet's door.
High Voltage Switchgear	The detector does not need to be connected to an insulating rod. Install the probe the onto the detector and insert it into the voltage indicator on the switchgear. If the voltage is too low, insert the auxiliary test line plug into the detector's charging port, and clamp the auxiliary test wire to the ground or the cabinet's door. (This method is phase detection for secondary circuits. Whether the phase sequence result is correct or not depends on whether the corresponding relationship between L1, L2, L3, and the bus is correct.)

SECTION 4

Switchgear PT, CT Secondary Phase Detection	The detector does not need to be connected to an insulating rod. Install the probe the onto the detector and insert it into the voltage indicator on the switchgear. If the voltage is too low, insert the auxiliary test line plug into the detector's charging port, and clamp the auxiliary test wire to the ground or the cabinet's door. (This method is phase detection for secondary circuits. Whether the phase sequence result is correct or not depends on whether the corresponding relationship between L1, L2, L3, and the bus is correct.)
10kV/35kV Enclosed High Voltage Switchgear T-Head Phase Detection	The XY detector is connected to the insulating rod, equipped with a probe, and the detector is attached to the T-head for phase detection. Generally, the probe does not need to be installed for this type of connection. The T-head type phase detection can be operated in the same manner.
Phase Sequence Check for Five- Proof Switchgear	The detector should not be connected to the insulating rod, and no probe or hook should be attached;De-energize the busbar of the switchgear to be tested or pull out the trolley;Place the detector on the busbar or the busbar of the trolley, and secure the detector with an elastic band to the busbar or busbar of the trolley;Power on the detector, then energize the switchgear to perform the phase sequence check.

SECTION 4

Phase Sequence Check Between Primary and Secondary of 10kV/35kV Transformer	Detector X is connected to the insulating rod and hook, mounted on the primary side (10kV/35kV terminal) of the transformer. Detector Y is connected to the insulating rod and hook, mounted on the secondary side (400V terminal) of the transformer to check the phase sequence.
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SECTION 5

Battery Management

- Please charge the battery when the battery is low and charge the battery every 3 months even if the equipment is not being used, this is to ensure the battery's proper function in the future.
- Warning! If the battery cover cannot be securely fit on the instrument, please do not use the instrument, as it is highly dangerous.
- Please be aware of any damages to the battery. Once the structural integrity of the battery is compromised or any internal parts of the battery are exposed, stop using the instrument immediately.
- Please be aware of batteries 'polarity when replacing the batteries, otherwise, it may damage the instrument.
- When the instrument is low in battery, please charge it for 6 hours when possible.
- When the battery requires replacement, please make sure the instrument is powered off, then loosen the screw of the battery cover to remove the cover. Place the new batteries in the instrument and once the new batteries are securely fit in the instrument with the correct polarity, close the battery cover plate, and tighten the screws.
- If the battery cannot be replaced, please contact Eaglotest.

SECTION 6

Packing List

Detector	2 (X, Y 1 each)
Receiver	1
Antenna(Built-in)	1
Insulating Rod	2
Aluminum Box	1
Hook, Probe	4 (2 Each)
USB Charger	2
Charger	3
Lithium Battery	3
Calibration Line	1
Spring-like Auxiliary Line	2
Manual, Warranty Card, Certificate of Conformity	1

Note:

- We are not responsible for other damages caused by the use of this product.
- The contents of this user manual do not justify the use of the product for special purpose.
- The Company reserves the right to modify the contents of the user manual. In the case of modification, no further notice will be given.

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