Dear Client,

Thank you for purchasing our HTXL-Y Transmission Line Parameter Test Set. 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!

## 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.

# Contents

I. overview7	
II. Main Technical Parameters11	
III. Panel Description12	
3.1. Emergency stop button	
3.2. System reset button13	
3.3. USB interface	
3.4. LCD touch display14	
3.5. Test power output ( a, b, c ) jack14	
( Current measuring terminal )14	
3.6. Voltage measurement input (UA, UB, UC ) jack ( Voltage measurement terminal ) $14$	ł
3.7. Power input socket(AC220V)15	
3.8. Input power switch15	
3.9. Printer	
3.10. Grounding terminal16	
IV. Instructions for Use16	
4.1. Main menu	
4.2. Line setting	
4.3. Project testing17	
4.4. Time setting22	
4.5. Historical data23	
※ Data query23	
※ U disk backup	
4.6. Induction test	

4.7. Parameter verification27	
V. Reference Wiring	
5.1. Induced voltage test wiring (as shown in the figure below)	
5.2. Induced current test wiring (as shown in the figure below)	
5.4. Zero sequence impedance wiring diagram ( the following figure ) or according to	the positive
sequence impedance wiring	
5.5. Line mutual inductance wiring $(as shown in the following figure)31$	
5.7. zero sequence capacitor connection ( as shown in the figure below ) or in accord	ance with the
positive sequence capacitor connection33	
5.8. Coupling capacitor wiring ( as shown in the following figure )	

## I. overview

Different frequency line parameter tester is a high-precision testing instrument for testing power frequency parameters of various high-voltage transmission lines ( overhead, cable and overhead cable hybrid ) on site. The instrument is of an integrated structure, with a built-in variable frequency power supply module and a variable frequency voltage regulating output power supply. The frequency can be changed to 45Hz and 55Hz. Digital filtering technology is adopted to avoid the interference of power frequency electric field to the test and fundamentally solve the difficult problem of accurate measurement under strong electric field interference. At the same time, it is applicable to the occasions where the generator is used for power supply detection after all power outages.

With the development of power grid and the shortage of land for line corridors, it is more and more common to erect multiple circuits on the same pole. The coupling between power transmission lines is getting closer and closer. The interference is getting stronger and stronger during the power frequency parameter testing of power transmission lines, which seriously affects the accuracy of testing and the safety of testing instruments and equipment. To solve this problem, we have developed a new generation of testing system for different frequency parameters of power transmission lines, which integrates frequency conversion testing power supply, precision measurement module, high-speed digital processing chip and unique national

patent technology anti-induced voltage circuit. Effectively eliminates the influence of strong interference, ensures the safety of instruments and equipment, and can measure power frequency parameters of transmission lines extremely conveniently, quickly and accurately.

## The instrument mainly has the following characteristics:

#### Integrated structure, small volume and light weight

The interior of the instrument is highly integrated, and nearly a truck of equipment and equipment in the traditional measurement method are all integrated into an integrated main chassis; It is the smallest volume and lightest weight among the same products in China. It provides a simple and convenient test method for the test.

#### Access to power is simple and convenient.

All the measuring processes of the instrument only need to be connected with the mains supply voltage of 220V, thus solving the inconvenience of connecting the field voltage of 380V in the existing measuring method.

#### Super anti-induction voltage capability

The unique patented technology ( patent number: 201020687669.X ) anti-induction voltage circuit is adopted inside the instrument to ensure that the instrument can withstand higher induction voltage ( the anti-induction current

can reach 80A) and can work normally under high induction voltage of 30,000 volts.

#### Frequency Conversion Technology, Accurate Measurement

The anti-interference ability is strong. The internal variable frequency power supply module of the instrument provides the instrument measurement output power supply, the frequency can be changed to 45Hz and 55Hz, and the digital filtering technology is adopted, thus effectively avoiding various power frequency interference signals on site and enabling the instrument to realize high - precision, accurate and reliable measurement.

#### High speed processor

Accurate and fast, the instrument uses a professional fast digital signal processor as the processing core, which greatly improves the operation and processing capability of the instrument on the premise of ensuring the accuracy of measurement data.

#### Simple operation

The external connection is simple, and the positive sequence impedance, zero sequence impedance, positive sequence capacitance and zero sequence capacitance can be completely measured only by once accessing the down lead of the tested line at the testing end; The invention solves the problems of complicated test wiring switching, anti - interference, stability, precision and the

like existing in the existing test methods; To avoid the injury of the experimental personnel caused by the induced voltage when the wiring is changed.

#### Mass data storage

The inside of the instrument is equipped with calendar chip and large-capacity memory, which can save the test results in chronological order, check the historical records at any time and print them out.

#### Scientific and Advanced Data Management

The instrument data can be exported through U disk, and can be viewed and managed on any PC and made into work report.

#### Full touch super large liquid crystal display

The operation is simple. The instrument is equipped with a high-end full-touch LCD screen. The Chinese menu shows all the operation steps of the super-large display interface. Each step is very clear. The operator can use it without additional professional training. The whole process of measurement can be completed with one touch. It is currently a very ideal intelligent measuring device.

#### **Operational safety protection**

The function of detecting grounding is specially designed inside the instrument to judge whether the instrument is well grounded on site. If the grounding is not connected, or not connected, the instrument will automatically judge, prohibit the operation of users, ensure personal safety and protect the

use of the instrument.

## **II. Main Technical Parameters**

1	Utilization Conditions	-20°C~50°C RH<80%		
2	Anti-interference Principle	Frequency variation method		
3	Power Supply	AC220V±10%	Generator ≧3KW	
4		Max.output voltage	AC300V	
		Voltage accuracy	0.5%	
	Power Output	Current accuracy	0.5%	
		Max.output current	8A	
		Output frequency	45Hz、55Hz	
4		Capacitance	0.01~30µF	
	Measurement	Impedance	0.01~400Ω	
	Range	Impedance angle	-180°~+180°	
6	Measurement	Capacitance 0.0001µF		
	Resolution	Impedance 0.0001Ω		
		Impedance angle	0.0001°	
7		If Capacitance: ≥1µF,	±1%Reading	
		±0.01µF;		
	Measurement	<1µF, ±2%Reading		
	Accuracy	±0.01µF;		
		If resistance : $\geq 1\Omega$ , $\pm 1\%$ Reading $\pm 0.01\Omega$ ;		
		$< 1\Omega, \pm 2\%$ Reading		
		$\pm 0.01\Omega;$		
		Impedance angle: $\pm 0.2^{\circ}$ (voltage > 1.0V);		
0	Interference Current	±0.3 (VC	$mage.0.2v^{-1.0v};$	
0	Registered to			
9	Induced Voltage	JURV		
10	Outline Dimensions	550 (L) ×430 (W) ×	530 (H)	
11	Memory Size	200 groups Support I	I Disk Data Storage	
12	Weight	67 Ka		
14	weight i			

## **III. Panel Description**



Figure 3 - 1 Indicator Diagram of Instrument Panel

- 1. Emergency stop button
- 2. System reset button
- 3. USB interface
- 4. LCD touch display
- 5. Test the power output ( a, b, c ) jack
  - (Current measuring terminal)
- 6. Voltage measurement input ( UA, UB, UC ) jack
  - (Voltage measurement terminal) (High allocation terminal)
- 7. Power input socket (AC220V)
- 8. Input power switch
- 9. Printer
- 10. Grounding terminal

## 3.1. Emergency stop button

Installation position: as shown in figure 3 - 1 -1.

Power function: disconnect the test output power supply and ground all external wiring; When encountering unexpected events during the test, press this key to turn off all output power supplies and ground all wiring in an emergency and quick manner under the condition of continuously turning on the input power supply to ensure safe use.

## 3.2. System reset button

Installation position: as shown in figure 3 - 1 -2.

Function: Provide reset of central processing unit inside the instrument; Note: This reset key resets all control devices inside the instrument, instead of directly operating the output to disconnect. Therefore, if there is an emergency in the measurement process, please press the emergency stop key first to quickly disconnect the output.

## 3.3. USB interface

```
Installation position: as shown in fig. 3 - 1 -3
```

Functions: the USB stick insertion port automatically imports all measurement data stored in the instrument into the USB stick and generates a file for storage, which is provided to users to view the data and generate a report file under the computer operating system;

Note: When the U disk is inserted into the USB interface of the instrument and data transmission starts, it is strictly prohibited to pull out the U disk in the

middle, otherwise data transmission errors may be caused and the U disk may be seriously damaged.

## 3.4. LCD touch display

Installation position: as shown in Figure 3 - 1 -4

Function: Large screen displays each step of operation in Chinese. The user only needs to touch the corresponding place lightly to complete the whole measurement process automatically.

Note: Touch LCD screen is a precision accessory. It should be protected from long-term sun exposure or heavy objects squeezing and sharp objects scratching. When operating the LCD screen, the operation accuracy can be improved by using a pencil head or other pen-shaped plastic objects.

## 3.5. Test power output ( a, b, c ) jack

## (Current measuring terminal)

Installation position: as shown in figure 3 -1-5.

Function: including 3 terminals A ( yellow ), B ( green ) and C( red ), providing instrument The tester tests the output power supply.

Note: This output terminal has a large current output during the test. It is forbidden to touch the metal part of the terminal with hands to prevent electric shock.

# 3.6. Voltage measurement input (UA, UB, UC) jack (Voltage measurement terminal)

Installation position: as shown in figure 3 -1-6

Function: including UA ( yellow ), UB ( green ) and UC ( red ) terminals,

providing input voltage for instrument test;

Note: It is forbidden to touch the metal part of the terminal with hands during the test to prevent electric shock;

## 3.7. Power input socket (AC220V)

Installation position: as shown in figure 3 -1-7

Power function: use standard high-power special socket to connect with commercial power or generator;

Note: The power cord plug is a large-sized socket, which may not be plugged into the general triangular socket. You can extend the wiring by using the wiring board attached to the instrument.

## 3.8. Input power switch

Installation position: as shown in figure 3 –1-8

Function: Turn on this switch, and the instrument will be powered on to enter

the working state. Turn off this switch and all power supply systems inside the

instrument at the same time. In case of emergency, turn off this switch

immediately and unplug the input power cord.

Note: This switch is an air switch with leakage protection. In case of back-end leakage, this switch will automatically turn off. The switch can be closed after checking the wiring again.

## 3.9. Printer

Installation position: as shown in fig. 3 - 1 -9.

Function: When printable data is displayed, move the cursor to the "Print" item and press the confirmation key to print.

Note: The printer is a fully automatic thermal printer with 55mm wide printing paper. When replacing the printing paper, please use the special printing paper for the thermal printer. First, press the button protruding from the lower part of the printer, and the printer cover plate will pop up automatically. Then, put the printing paper into the printing paper bin in sequence and leave some parts outside. Finally, close the printer cover plate.

## 3.10. Grounding terminal

Installation position: as shown in figure 3 - 1 -10.

Function: instrument protection grounding and operation safety grounding; Note: The instrument has its own grounding protection device, which shall be connected to a reliable grounding network during testing.

## **IV. Instructions for Use**

## 4.1. Main menu

Make sure that the ground wire of the instrument is connected well, then connect AC220V power supply and close the power switch, and the main menu interface will be displayed (as shown in Figure 4-1). The display in Jiugong format has an independent display area for each item. Users can easily enter the next level of specific operation menu by touching the corresponding item lightly. The whole process is simple and clear. The complicated key operation is saved.





## 4.2. Line setting

First, enter the line length setting interface from the main interface ( as shown in Figure 4 - 2 ); The whole setup item has 12 analog keys, of which the right two are the save and exit keys, the following are the number keys of 0 - 9, click the line length input box, and then click the required number settings. If the input is wrong, repeat the operation, make sure it is correct, and click < save > to save and exit.

## 4.3. Project testing

The main interface (as shown in Figure 4-1) shows six test items at a glance, namely impedance test, line mutual inductance, capacitance test, coupling capacitance, induction test and parameter verification. Under the condition that the user correctly connects the external wiring of the instrument according to the wiring prompt, the user can enter the next-level start test menu (as shown in fig. 4-3) by clicking on the corresponding item, confirm that the

wiring is correct again, start the test by clicking on the start button, or return to the main interface by clicking on the exit button.



Figure 4 - 2

POSITIVE	SEQUENCE	CAPACITANCE	(C1)	TEST:
ESC			Ĩ	RUN
	Fiaur	e 4 – 3		

In order to better ensure measurement accuracy and measurement safety, the instrument will first detect and analyze external interference signals. (as shown in fig. 4-4) of course, the high-end professional chip fast processor is used inside the instrument to process. compared with the user, the whole interference detection process is only 10 seconds. the user need not worry at all. this process will take up too much time and lead to too long test process.





After the interference detection is completed, the instrument immediately starts the frequency conversion output device; First, convert the frequency to 45Hz so that the output terminal can output 200 volts or 4 amperes of current quickly and smoothly. The whole process instrument adopts real-time monitoring to ensure stable and reliable output. After successful boosting or current raising, maintain a voltage of 200 volts or a current of 4 amperes, and then carry out detection and analysis under 45Hz (as shown in Figures 4-5 and 4-8). After 45Hz detection and analysis is completed, the instrument automatically converts to 55Hz for detection and analysis under 55Hz (as shown in Figures 4-6 and 4-9). Finally, through high-precision processing by the central processing unit inside the instrument, various test results and data are obtained and displayed. the test results (as shown in figs. 4-7 and 4-10) are the data showing the test process, i.e. the data shown in figs. 4-4, 4-5 and 4-6

are displayed together, and the user can view and print them at his own choice. All data of the whole test process are detected and displayed in real time, and users can observe and monitor the changes in the whole test process intuitively.



Figure 4 – 5



Positive sequence capacitor 55Hz test in this figure

Figure 4 - 6



Figure 4 - 7



Figure 4 – 8



Test Results of Positive Sequence Capacitance in this Figure Z1: Total Impedance V: Test Voltage R1: Total Resistance I: Test Current X1: Total Reactance Φ: Test Angle Y1: Total Admittance Km: Line Length G1: total conductance B1: Total susceptance C1: Total Capacitance B1/ Km: Kilometres C1/ Km: kilometer capacitance

Positive sequence impedance 45Hz

test in this figure

Positive sequence impedance 55Hz test in this figure



Figure 4 - 9

Figure 4 - 10

Test Results of Positive Sequence Impedance in this Figure Z1: Total Impedance V: Test Voltage R1: Total Resistance I: Test Current X1: Total Reactance Φ: Test Angle L1: Total Inductance Km: Line Length Z1/ Km: kilometer impedance R1/ Km: kilometer resistance X1/ Km: kilometer reactance L1/ Km: kilometer inductance

The testing process of zero sequence impedance, zero sequence capacitance, coupling capacitance and line mutual inductance is the same as that of positive sequence capacitance and positive sequence impedance, in which the data displayed is only phase B. The results displayed after testing are the same as those of positive sequence capacitance and positive sequence and positive sequence impedance. Please refer to the reference wiring for specific wiring.

## 4.4. Time setting

Enter the time setting submenu directly from the " time setting" pane on the main menu ( as shown in fig. 4 - 11 ). As shown in the figure, the 4 analog key settings correspond

to add, exit SET TIME/DATE r 2018 - 10 - 20 09 : 18 a corrected, INSAVE ESC

subtract, save and respectively. Click and time to be and then click the add-subtract key to modify. After the user completes the adjustment, press the save key to save and exit.

Figure 4 - 11

## 4.5. Historical data

## **※** Data query

Open the instrument and enter the lower-level operation menu ( as shown in Figure 4 - 12 ) from the " Historical Data" box at the bottom of the main interface. Click the first " Data Query" to enter the query interface ( as shown in Figure 4 - 13 ). There are a total of 200 groups of data from the zero group to the ninety-ninth group for users to consult. Pagination display, each page shows ten test items, and each group shows the date, time and specific item name. Users can very clearly look up the data results they want to see. A slight touch on the column of data you want to look up can smoothly enter the



data results to view, can choose to print.

Figure 4 - 12

	DATE	TIME	Km	TEST	
00	2018-10-20	10:28	10.0	Z0	-
01	2018-10-20	10:24	10.0	Z1	
02	2018-10-20	10:19	10.0	Z1	
03	2018-10-20	10:13	10.0	Z1	
04	2018-10-20	10:06	10.0	C1	
05	2018-10-20	09:59	10.0	CO	
06	2018-10-20	09:52	10.0	Cm	
07	2018-10-20	09:47	10.0	Zm	-
80	2018-10-20	09:41	10.0	C1	ESC
09	2018-10-20	09:33	10.0	CO	

Figure 4 - 13

This figure is a data query For the data to be viewed, click directly to enter, and the display is the same as the interface after the test

#### **※ U disk backup**

After entering the " historical data" option, you can see the display interface as shown in figure 4 - 12. the user can enter the u disk operation field by gently pressing the " u disk backup" column ( as shown in figure 4 - 14 ). According to the prompt on the screen, the user only needs to insert the USB flash disk into the USB socket at the lower right of the instrument panel to display the data transmission interface ( as shown in fig. 4 - 14 ). how many groups of data have been transmitted is clear at a glance, which is very convenient. Users need to pay special attention to the fact that the U disk is in a high-speed read-write state during this process, and it is not allowed to pull out the U disk or cut off the power of the instrument in the middle of the process. If it is serious, it can cause the U disk to burn down. Wait until the data transmission is completed, and the prompt message " file saved successfully" appears on the display before pulling out the U disk.



Figure 4 - 14

## 4.6. Induction test

Before testing the induced voltage and current, the test side of the line must hang a grounding wire first, and the wiring can be started only after the grounding is confirmed to be safe, so as to ensure the operation safety of the wiring personnel, and carefully read the reference wiring during testing.

Open the instrument and enter the lower-level operation menu (as shown in Figure 4-15) from the "induction test" box on the left of the main interface. Determine whether the wiring on the opposite side of the line is suspended or grounded. Determine whether the opposite side is suspended. Click on the induction voltage to start the test. The tester records the induction voltage data in real time (as shown in Figure 4-16). Click to exit after recording. Make sure the opposite side is grounded, click the induced current to start the test, the tester records the induced current data in real time (as shown in Figure 4-17), and click Exit after recording.

	0	
	INDUCTION TE	ST
U-	IND	ESC
Ţ-	IND	
	Figure 4	– 15
U-IND:		
A 10.106Kv 8.	В С 602Kv 6.203Kv	This figure is an induced voltage test. Pay attention to the safety of wiring! The test line is suspended.
Figure	4 - 16	

I-IND:			
A 1.106A ESC	B 1.002A	C 1.203A	This figure is an induced current test. Pay attention to the safety of wiring! The test line is suspended.

#### Figure 4 - 17

**Special attention:** There is high voltage during induction test. therefore, the inspection instrument must be grounded reliably. insulating gloves should be used during operation. it is best not to touch the instrument at will. only the screen can be operated, and the wiring can be operated only when the grounding wire is safely hung.

## 4.7. Parameter verification

Open the instrument and enter the password input menu page from the " parameter verification" box at the bottom right of the main interface. this password is used for input by the inspection department. enter the lower-level operation menu correctly ( as shown in fig. 4 - 18 ), connect the test line, connect the dummy load, then click start, then click boost or buck and set the frequency, that is, manually adjust the output to check the authenticity of the data.

Please do not enter the startup setting casually by using the customer, so as not to damage the instrument due to incorrect operation. Therefore, the parameter verification password is generally not provided to users, but only to inspection departments.



Figure 4 - 18

## V. Reference Wiring

Before the test starts, hang a grounding wire or a closing knife on the line at the measuring end and connect the instrument grounding terminal at the upper left corner of the panel to the earth. Connect the test power output terminals IA, IB and IC to the line measurement test line (thick line). Finally, connect the voltage measurement terminals UA, UB and UC to the line test line (thin line). After the instrument test wiring is confirmed to be connected, remove the grounding wire or separate the grounding of the grounding knife to ensure the safety of equipment and operators. The yellow, green and red test lines should be suspended as far as possible to avoid the breakdown of the test lines by induced high voltage discharge.

The instrument test wiring is extremely simple, and the ordered parameter measurement can be completed only by connecting the test wiring once and matching the automatic control measurement mode of the instrument with the terminal-to-terminal wiring mode of the tested wiring, thus greatly improving the test efficiency and the operation safety.



5.1. Induced voltage test wiring (as shown in the figure below)

Figure 5-1. Induced voltage test wiring



## 5.2. Induced current test wiring (as shown in the figure below)



**5.3. Positive sequence impedance wiring** (as shown in the following figure) can also be used for zero sequence impedance wiring, and the wiring will be automatically switched inside the instrument.



Figure 5-3. Positive sequence impedance wiring

**5.4. Zero sequence impedance wiring diagram** ( the following figure ) **or according to the positive sequence impedance wiring**.



Figure 5 – 4. Zero sequence impedance wiring

**5.5. Line mutual inductance wiring** (as shown in the following figure)



Figure 5 - 5. Line mutual inductance connection

## 5.6. positive sequence capacitor connection (as shown in the

figure below ), zero sequence impedance can also use this connection

method of connection, the instrument will automatically switch wiring inside.



Figure 5 - 6. Positive sequence capacitor wiring

When connecting the instrument with the line under test, ensure that the measuring end of the line is reliably grounded (hang the grounding wire). After the test is completed, recover and take the grounding wire. The instrument is reliably connected to the ground, and pay attention to the completion of each test signal grounding line according to the wiring instruction diagram.

**5.7. zero sequence capacitor connection** (as shown in the figure below) or in accordance with the positive sequence capacitor connection.



Figure 5 – 7. Zero sequence capacitor wiring

## 5.8. Coupling capacitor wiring (as shown in the following figure)



Figure 5 – 8. Coupling capacitor wiring

In thunderstorm weather or thunderstorm weather along the route, measurement cannot be carried out to ensure the safety of operators and equipment.

The instrument test wiring is extremely simple, and the ordered parameter measurement can be completed only by connecting the test wiring once and matching the automatic control measurement mode of the instrument with the terminal-to-terminal wiring mode of the tested wiring, thus greatly improving the test efficiency and the operation safety.