

<http://www.tds-1300.com>

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TDS-T SERIES
Integrated Low Voltage Reactive
Power Compensation Device
Instruction Manual



Jiangsu Modern Electric Technology Co., Ltd.

ATTENTION POINTS

First of all, thank you very much for choosing TDS series Integrated Low Voltage Reactive Power Compensation Device.

Please read the following notes carefully before installing, maintaining and using this product.

This manual is for the use of personnel responsible for installation, maintenance and operation.

■ If the product is to be installed in the capacitor cabinet (compensation cabinet), the earthing switch or molded-case circuit breaker with high breaking capacity is required to be used;

■ To install this product, you shall refer to the relevant steps in the instruction manual of this product, then select the multi-core copper wire with appropriate cross-sectional area according to the total capacity of the product, and connect the wire in accordance with the step requirements. It is strictly forbidden to dip tin or pour tin on the cable terminal;

■ The voltage and current phase-sequence of this product and controller (if a controller is configured) must be correct. When the controller input is three-phase four wire system, it is necessary to connect the null line;

■ When tightening the screw of power cord, the torque must be controlled within 5-7 (N.m).

■ For the controller is equipped with two RS485 communication ports, the product communication line shall be connected to the downstream RS485 port;

■ The current signal of the sampling current transformer must be the total current of the incoming cabinet, and the position cannot be wrong, as shown in the figure below;

■ Before the product is formally powered on, all wiring terminals must be fastened (Warning: transportation vibration may cause screw loosening);

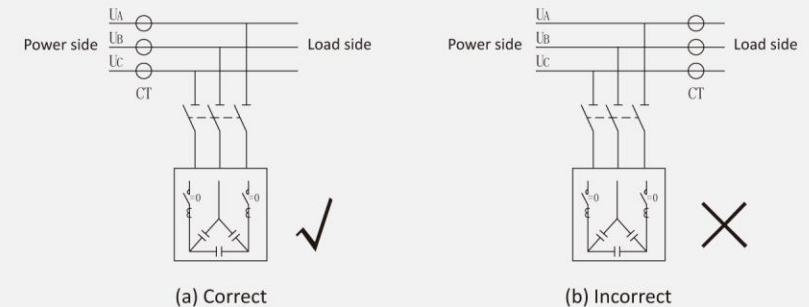
■ Before the product is put into operation, please refer to the relevant steps in the instruction manual to check that the communication between the products and between the products and the controller (if the controller is configured) is normal, further, the power factor and other measurement data displayed by the product are consistent with the actual situation (including the main and auxiliary cabinets);

■ After the product is formally put into operation for one month, and no more than three months, all the terminals and connectors inside the electrical cabinet shall be tightened again, because the cable joint is affected by the current Joule effect, the change in its microstructure may affect the tightness of the screw.

ATTENTION POINTS

■ The operating environment and power supply conditions of the product shall comply with the requirements of the product. The product can not be used in the occasions with large harmonics.

■ During the normal operation of the product, please do not touch the metal part of the product or the exposed live parts, otherwise there will be a risk of electric shock.



If you have any queries during installation and maintenance, please contact us via:

xdbgs@tds-1300.com

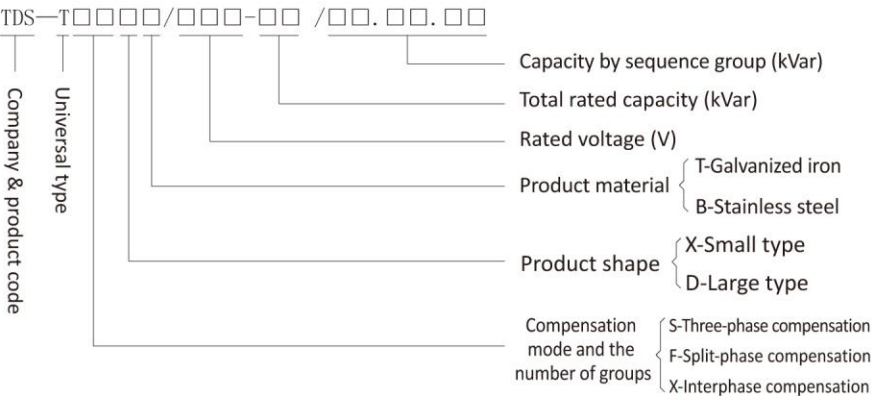
modernelectric-wendy@hotmail.com

or call 0086-513-80112040.

1. Overview

TDS series integrated low voltage reactive power compensation device is based on the low voltage power capacitor, with the latest technological achievements, such as microelectronic software & hardware technology, microsensor technology, micro network technology and others adopted in it, which enables it to hold such functions as zero-crossing switching, protection, measurement, online connection, self diagnosis etc., so as to realize the intelligent and integrated low voltage reactive power compensation; moreover, the product can be flexibly used for low voltage reactive power compensation and voltage raising in various occasions where harmonic content in the power grid does not exceed the standard, thus featuring concise structure, simple production performance improvement, ease of use.

2. Product Model



(Figures after letters are the number of corresponding compensansation groups.)

3. Product Appearance and Installation Size

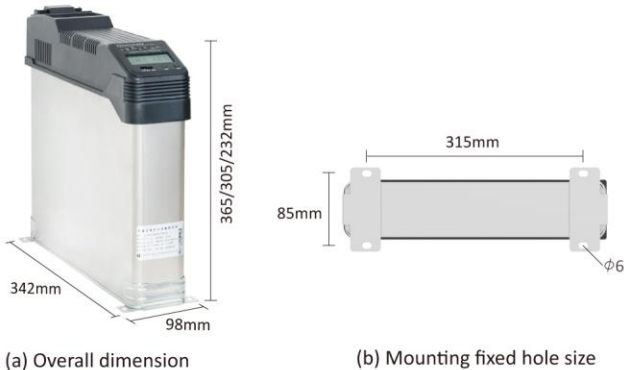


Figure 3-1 Overall Dimension and Mounting Fixed Hole Size of X-type Product

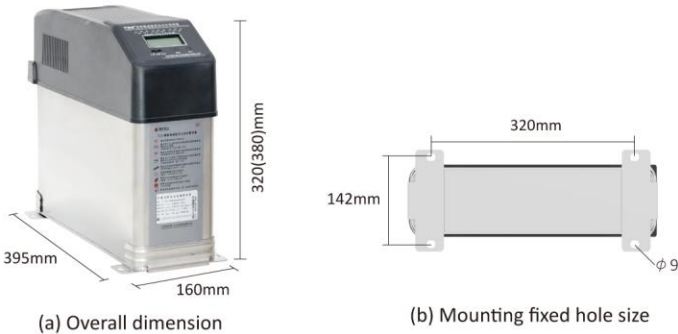


Figure 3-2 Overall Dimension and Mounting Fixed Hole Size (Maximum dimension) of D-type Product

4. Wiring Terminal Layout and Electrical Symbol

Control mode	Wiring terminal layout	Control mode	Wiring terminal layout	Control mode	Wiring terminal layout
Three-phase control double three-phase compensation		Split-phase control double split-phase compensation		Hybrid Control	
Three-phase control three three-phase compensation		Split-phase control single split-phase compensation			

Notes:

- 1) HL1-HL3 respectively correspond to the states of the first group to the third group of three-phase compensation capacitors in the product;
- 2) HLa1-HLc1 and HLa2-HLc2 respectively correspond to the states of the first group and the second group of split-phase compensation capacitors in the product;
- 3) In the use of the product, the output terminals 5, 6, 7, 8, 9 and 10 of the indicator light shall not be short-connected to each other;
- 4) When multiple units are used, the plug-in shall be inserted in place to prevent suspending.
- 5) The fixed screw hole of the product is also used for the grounding point.

External indicator output terminals, they're terminal 5-10 from left to right.

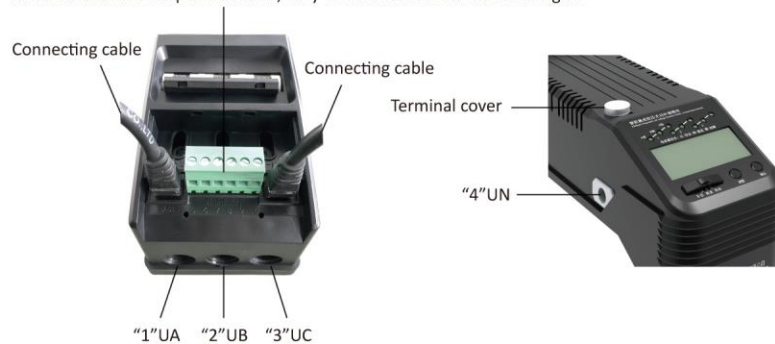


Figure 4-1 Wiring terminals and connector position of X-type product

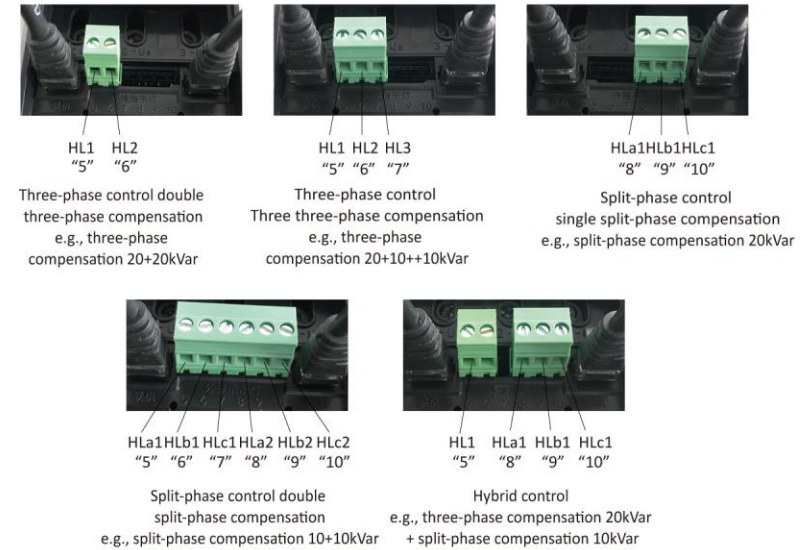


Figure 4-2 External indicators position for different specifications of X-type product

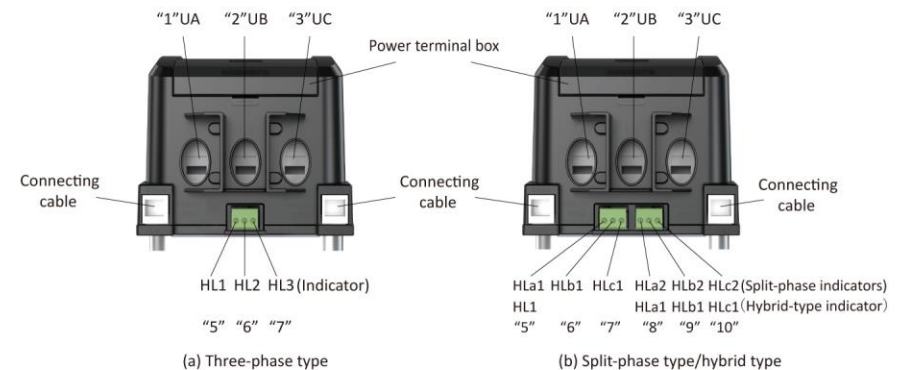


Figure 4-3 Wiring terminals and plug-in position for D-type plug-in product



Figure 4-4 Null line terminal position of D-type split-phase product

5. Electrical Connection

5.1 Power Supply connection

The multi-core copper conductor with appropriate cross-sectional area shall be selected according to the total capacity of the product. The multi-core copper conductor with standard of BVR16mm² cross-sectional area shall be used for the X-type product with total capacity of 30kvar or above, while the multi-core copper conductor with standard of BVR10mm² cross-sectional area shall be used for other specifications. The standard BVR 35mm² cross-sectional area of multi-core copper conductor shall be suitable for D-type products with a total capacity of more than 40kvar, and the standard of BVR 16mm² cross-sectional area of multi-core copper conductor shall be appropriate for other specifications. Making of power line end is shown in Figure 5-1 below. Select the cold pressing connector of matching specifications to cover the stripped copper wire, and press it firmly with wire pressing pliers (more pressing can be allowed, and tin filling in the copper wire is strictly prohibited). When connecting the power line, the screw shall be tightened. At the same time, the phase sequence of UA, UB and UC shall be correct, and the split-phase compensation product shall be connected to the null line UN, otherwise the product will be damaged.

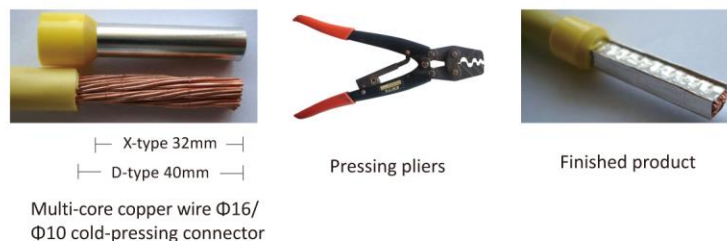


Figure 5-1 Making of power line end

5.2 Signal Wire Connection

According to the accessories table 8-3, select the appropriate type of plug-in cable to connect all capacitors, as shown in Figure 5-2. Finally, select the 100-type plug-in cable to connect the first or last capacitor with the cored secondary current transformer (the cored secondary current transformer is used to detect the output current of the primary current transformer in the incoming cabinet, and convert the 0-5A current signal into voltage signal).



Figure 5-2 Connection of signal cable

Notes:

(1) If there is a controller, 300-type plug-in cable shall be selected to connect the first or last capacitor with the controller. The orange white wire at one end of the cable is connected to the "A" end of the controller RS-485 port, and the orange wire is connected to the "B" end of the controller RS-485 port. At this time, the cored secondary current transformer can not be used.

(2) If there is no external controller, please pay attention to the mark of the cored hole on the transformer when connecting the cored secondary current transformer. When there is a split phase capacitor, the output lines (0-5A) of A, B and C three-phase current transformer in the incoming cabinet shall respectively pass through the split-phase cored secondary current transformer (as shown in Figure 8-1), and correspond to the phase sequence of A, B and C. If there are only three-phase compensation capacitor, the output line (0-5A) of B-phase current transformer in the incoming cabinet shall be passed through the middle hole of three-phase cored secondary current transformer (as shown in Figure 8-1).

5.3 Indicator Connection

When there is a need to connect the status indicator, the appropriate voltage level of the status indicator shall be selected according to the capacitor model. The three-phase compensation capacitor terminals HL1, HL2 and HL3 are respectively connected with three indicator lights, and the other end of the light shall be connected with the power supply UB, and the AC380V indicator light is selected; the split-phase compensation capacitor

terminals HLa1, HLB1, HLC1, HLa2, HLB2 and HLC2 are respectively connected with six indicator lights, and the other end of the light shall be connected with the null line UN, and the AC220V indicator light is selected (Connections between the indicator light terminals of the product cannot be short circuited, and it is strictly forbidden to share one indicator light).

Multi-core copper wire with cross-sectional area of $(0.75-1) \text{ mm}^2$ is used for the



Figure 5-3 Making of indicator light wire end

5.4 Grounding Wire

The grounding point of the product is on the base of the product. Single-stranded copper wire with a cross-sectional area of not less than 4 mm^2 is used for grounding wire. The grounding terminal of the product shall be reliably connected with the external grounding terminal.

6. Inspection and Test

6.1 Basic Parameter check

6.1.1 After wiring is finished and confirmed to be correct, check whether there is a short circuit between each phase of three-phase power line as well as between each phase and the shell with a multimeter. Turn the toggle switch on the panel to "Auto" and close the switch. The indicator light on the panel shows green, and press the key to view the measured data displayed by the capacitor.

- 1) Voltage UAC (three-phase) or UA, UB, UC (split-phase) values are consistent with the actual distribution voltage;
- 2) The sampling current Ib (three-phase) or Ia, Ib, Ic (split phase) multiplied by the transformation ratio of the sampling current transformer in the incoming cabinet shall be consistent with the current of the incoming cabinet, and this inspection can be omitted when it is connected with a controller or is a voltage controlled product;
- 3) $\cos \Phi$ value is consistent with the actual power factor of distribution, and this inspection can be omitted when connected with a controller or voltage controlled product;
- 4) The values of tC1 and tC2 are the internal temperature of the capacitor (close to the shell temperature of the capacitor).

6.1.2 when multiple products are used, the plug-in cable shall be connected automatically to form a queue. Press the key on the panel to switch the screen to the following figure:



Figure 6-1 on-line interface under automatic control mode

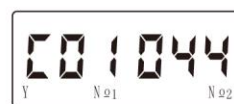


Figure 6-2 on-line interface with a controller

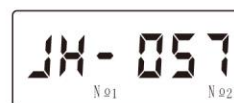


Figure 6-3 on-line interface without communication

057 in Figure 6-1 is the communication address of the capacitor, "JH1" indicates that it is the first one in the automatic on-line queue (If it exceeds 9, such as 15, J15 will be displayed), indicating that the capacitor has been on-line normally;

When there is a controller, as shown in Figure 6-2, "044" represents the communication address of the capacitor, "C01" shows that it is the first one in the on-line queue of the controller, and indicates that the on-line between the controller and the capacitor is normal.

"057" in Figure 6-3 indicates the communication address of the capacitor, and "JH-" signifies that the capacitor is not working online. Check whether the connecting cable is positioned in place.

6.2 Switching Test

6.2.1 Manual Test

Turn the toggle switch on the panel to "Manual", and the panel displays C1A 20.0, which means that C1 is a split phase 20kvar capacitor. At this time, the A-phase of C1 can be manually switched on and off. Press the "Enter (Confirm)" key to put it into operation, and the A-phase light of C1 on the panel displays red, indicating that the A-phase of C1 has been put into operation. Press the "Enter (Confirm)" key again, and the A-phase of C1 is switch off, and the A-phase light displays green; press the "Adjust" key, then display C1B 20.0, it can switch B-phase of C1, sharing the same operation steps as A phase of C1, and the operation steps of switching C phase are similar to that of phase a of C1.

When the toggle switch is turned to "Manual", C1 20.0 is displayed, indicating that C1 is a three-phase 20kvar capacitor. At this time, C1 can be manually switched on and off. Press the "Enter (Confirm)" key to switch on, and the three-phase lights of C1 on the panel will display red at the same time, indicating that C1 has been switched on. Press the "Enter (Confirm)" key again, C1 will be switch off, and the three-phase light will display green at the same time. Press the "Adjust" key to switch to the next group, and the switching steps are same as C1.

After the test, the toggle switch shall be turned back to the "Auto" position.

6.2.2 Automatic Control Test

During the automatic control test, the toggle switch on the panel shall be turned to the "Auto" position.

6.2.2.1 When there is an external controller, the product shall execute the control instruction of the external controller, and operate the external controller to make it send the on/off instruction of the control capacitor, and the product shall execute it accurately.

6.2.2.2 When there is no external controller, the product will carry out automatic control according to the reactive power vacancy, and switch on and off the capacitor to make the reactive power (power factor) get the best control. If the debugging equipment is available, the debugging equipment can be operated to change the reactive parameters. The product shall automatically control the switch-on and switch-off of the capacitor according to the reactive power vacancy.

In the case of no debugging equipment, a simple test device can be made as shown in the dotted box in Figure 6-4 below. In the figure, C is a single-phase low-voltage power capacitor with capacity of about 20kvar, TA1 is a current transformer with common transformation ratio of 50/5, TA2 is a cored secondary current transformer, QF is a miniature circuit breaker. When QF is closed, the power factor displayed by the product is about 0.5, the capacitors in the product will be put into operation automatically in sequence; when QF is opened, the capacitors in the product will exit in sequence, so as to confirm by this whether the automatic control function of the product is normal or not.

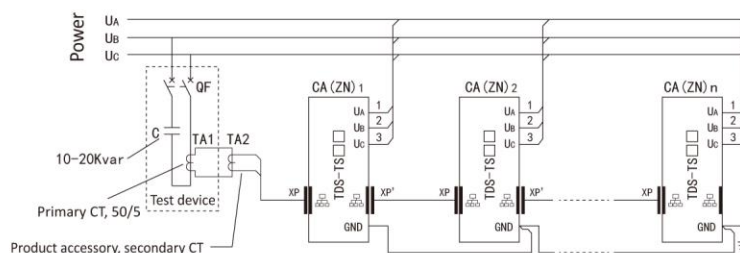


Figure 6-4 Automatic control test with a simple device

QF-Circuit breaker; C-Low voltage power capacitor; TA1-Primary CT; TA2-Secondary CT
CA(ZN)1~CA(ZN)n-Integrated low voltage reactive power compensation device

6.2.3 Simulation debugging (this function is used for on-site commissioning without actual capacitor switch-on conditions)

Before the product is powered on, turn the toggle switch on the panel to the "Manual" position, and then power on, the product will enter into the simulation debugging state, that is, when the system (on-line) test is carried out, the capacitor will not be switched on or off, and the test power supply will not be overloaded. The system (on-line) test can refer to 6.2.2.1 or 6.2.2.2.

After the capacitor enters the simulation debugging state, there will be "ZJ" flicker in the upper right corner of the LCD screen. After the simulation debugging is completed, the toggle switch shall be turned back to the "Auto" position.

6.3 On-site Inspection

After installation on site, the following 8-step inspection shall be carried out:

- (1) The phase sequence of UA, UB and UC of power supply shall be correct, the split-phase compensation products shall be connected to the null line UN, and the wiring terminals shall be fastened;
- (2) The sampling current shall be the total current of the incoming cabinet;
- (3) When there are only three-phase compensation products in the system, the B-phase current signal shall be taken;
- (4) When there is a split phase compensation product in the system, the A, B, C three-phase current signal shall be taken, and the A, B, C three-phase phase sequence cannot be wrongly connected;
- (5) The connector of signal line shall be positioned tightly and not loose;
- (6) After the product is powered on, checking of the basic parameters shall be made in according to 6.1;
- (7) Turn the toggle switch on the product panel to "Manual" for manual control, put the low-voltage power capacitor corresponding to the test into operation, observe the changes of distribution current, reactive power and power factor, then turn it back to "Auto" position after inspection;
- (8) The operation status of the product can be checked by the indicator light and LCD. If it is yellow, it indicates the protection action or self checking fault. The type of protection action is shown on the LCD, while the type of self checking fault is referred to table 7-3 according to the interface prompt.

7. Man-machine Interaction Panel

7.1 Panel

The panel of TDS Integrated Low Voltage Reactive Power Compensation Device is shown in Figure 7-1 below.



Figure 7-1 Panel layout of X-type product



Figure 7-2 Panel layout of D-type product

The panel indicator light, the corresponding A/B/C phase indicator lights in three-phase products indicate the working conditions, which changes synchronously; the red one corresponds to the capacitor operation while the green one corresponds to the capacitor exit. The working conditions of corresponding A/B/C phase indicator light of split phase products corresponds to the working conditions of each phase capacitor.

7.2 Data Interface

7.2.1 The data display interface of TDS integrated low voltage reactive power compensation device is shown in table 7-1 and table 7-2.

Table 7-1 Data display interface of three-phase product

No.	Interface	Notes	No.	Interface	Notes
1	382.098	Distribution AC phase voltage; distribution power factor, single digit "0" represents "lagging", "-" represents "leading".	5	030 00 1	Internal parameter
2	048 803	Distribution B phase secondary-side current; distribution reactive power	6	166 00 1	Automatically measured CT ratio
3	45.1473	Internal temperature inside capacitor	7	JH-057	Communication address of the product
4	000 000	Self-check fault, Fault type is as shown in Table 7-3.			

Table 7-2 Data display interface of split-phase product

No.	Interface	Notes	No.	Interface	Notes
1	UA-222	Distribution A phase voltage	10	A-480	Distribution A phase reactive power
2	UB-221	Distribution B phase voltage	11	b-30.1	Distribution B phase reactive power
3	UC-223	Distribution C phase voltage	12	C-400	Distribution C phase reactive power
4	A-0.94	Distribution A phase voltage; single digit "0" represents "lagging", "-" represents "leading".	13	413 425	Internal temperature inside capacitor
5	b-0.92	Distribution B phase voltage; single digit "0" represents "lagging", "-" represents "leading".	14	000 000	Self-check fault, Fault type is as shown in Table 7-3.
6	C-0.99	Distribution C phase voltage; single digit "0" represents "lagging", "-" represents "leading".	15	030 00 1	Internal parameter
7	IA-2.13	Distribution A phase secondary current	16	166 00 1	Automatically measured CT ratio
8	IB-2.10	Distribution B phase secondary current	17	JH-057	Communication address of the product
9	IC-2.17	Distribution C phase secondary current			

7.2.2 The protection action types displayed on LCD screen include overvoltage, undervoltage, overcurrent, over temperature imbalance, etc. the self-check fault types displayed are represented by codes, as shown in Table 7-3 below

Table 7-3 Display interface of self-check fault types

No.	Code	Shown in English	Notes	No.	Code	Shown in English	Notes
1	104--106	U.V.	under voltage protection	5	401--403	O.C.	Over current protection
2	107--109	O.V.	over voltage protection	6	404--406	PH.Failed	Phase imbalance protection Attenuation protection
3	20X	/	Relay closing fault	7	/	O.T.	over-temperature protection
4	30X	/	Relay opening fault	8	□□□	/	Reserved

8. Accessories

8.1 Cored Secondary Current Transformer

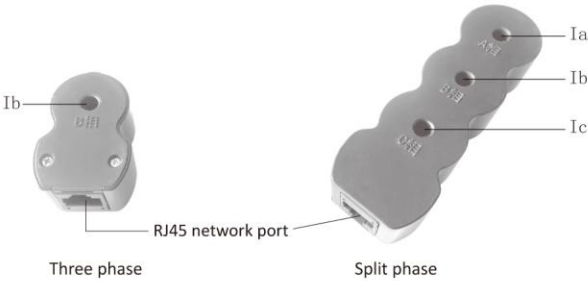


Figure 8-1 Cored secondary current transformer (secondary CT)

Remark: The shell of the cored secondary current transformer is gray.

8.2 Cold-pressing Connector of X-type Product

Table 8-1 Cold-pressing connector configuration

Qty. Specification Connector	Three-phase product Capacity (kVar)		Split-phase or hybrid product Capacity (kVar)		Remarks
	Capacity≥30	Capacity<30	Capacity≥30	Capacity<30	
LD3-16-38	3		3		16mm ² wire connector
LD3-10-38		3		3	10mm ² wire connector
LD3-10-18			1	1	10mm ² wire connector
LD3-1.5-8	3	3	6	6	0.75mm ² wire connector

8.3 Cold-pressing Connector of D-type Product

Table 8-2 Cold pressing connector configuration

Qty. Specification Connector	Three-phase product Capacity (kVar)		Split-phase or hybrid product Capacity (kVar)		Remarks
	Capacity>40	Capacity≤40	Capacity>20	Capacity≤20	
LD3-35-25	3				35mm ² wire connector
LD3-16-25		3	4	4	16mm ² wire connector
LD3-1.5-8	3	3	6	6	0.75mm ² wire connector

8.4 Plug-in cable

Table 8-3 Plug-in cable configuration

No.	Type	Length	Usage	Photo
1	25	25cm	Used for connection of two adjacent products	 The cable end connectors are same and the cable length are different to suit different applications.
2	100	100cm	Used for the connection between the upper and lower layers of products Used for connecting products with secondary current transformer	
3	250	250cm	Used for connecting products between main and auxiliary cabinets	
4	300	300cm	Used for the connection between the product and the controller	