

# TD1550 DC Energy Meters Verification Device



\* This is for your reference only, the configuration and details may vary depending on the application scenarios

## 1. Summary

**TD1550** is a platform device that can be used for the verification of DC energy meter and DC shunt. It consists of DC voltage standard source, DC current standard source, DC small-signal voltage standard source, DC voltmeter (option), multi position verification platform, verification software, etc. It can verify not only conventional DC electrical measuring instruments, but also DC shunt, direct and indirect connected DC energy meters.

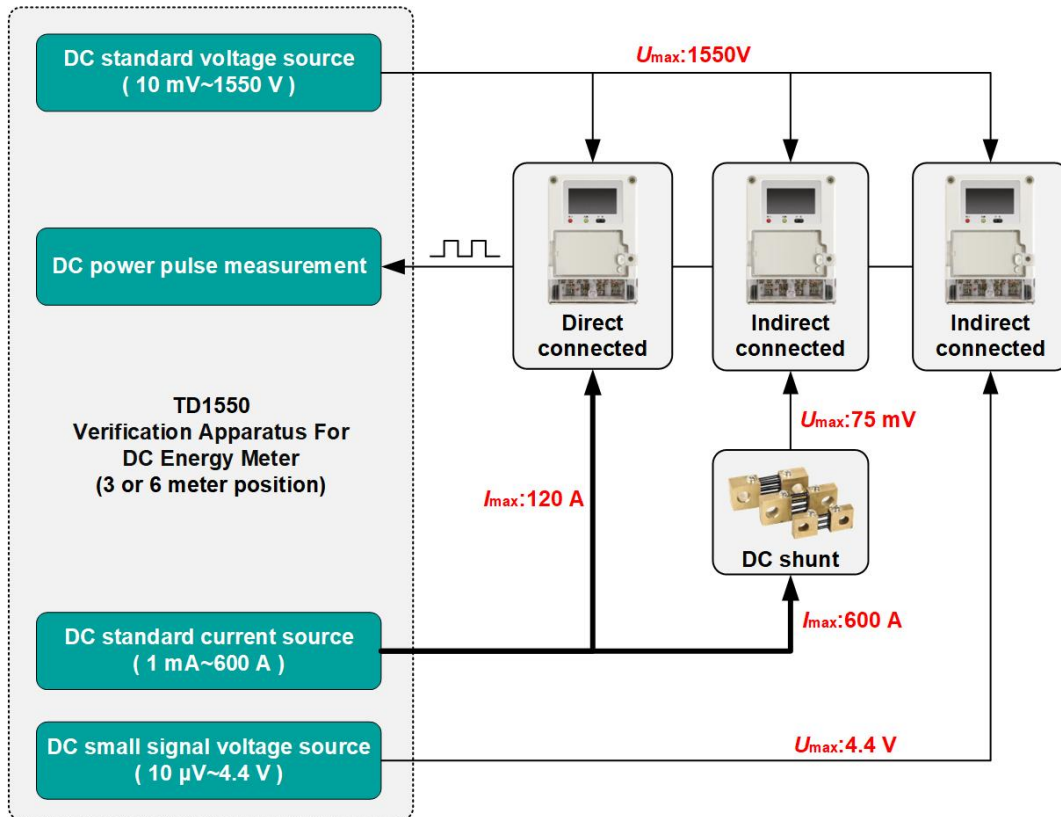
## 2. Features

- Accuracy: class 0.02, class 0.05
- DC standard voltage source: 10 mV~1150 V / 1550 V (option)
- DC standard current: 1 mA~600 A
- DC small-signal voltage source(four-line): 10  $\mu$ V~4.4 V
- Optional 3 or 6 meter position DC energy meter and DC shunt calibration stand
- Standard energy pulse input/output, used to detect the working error of energy meter
- Auxiliary power supply is used to supply power for electronic meters for measuring DC electrical energy(type A).
- Standard second pulse measurement is used to detect the daily timing error of the energy meter

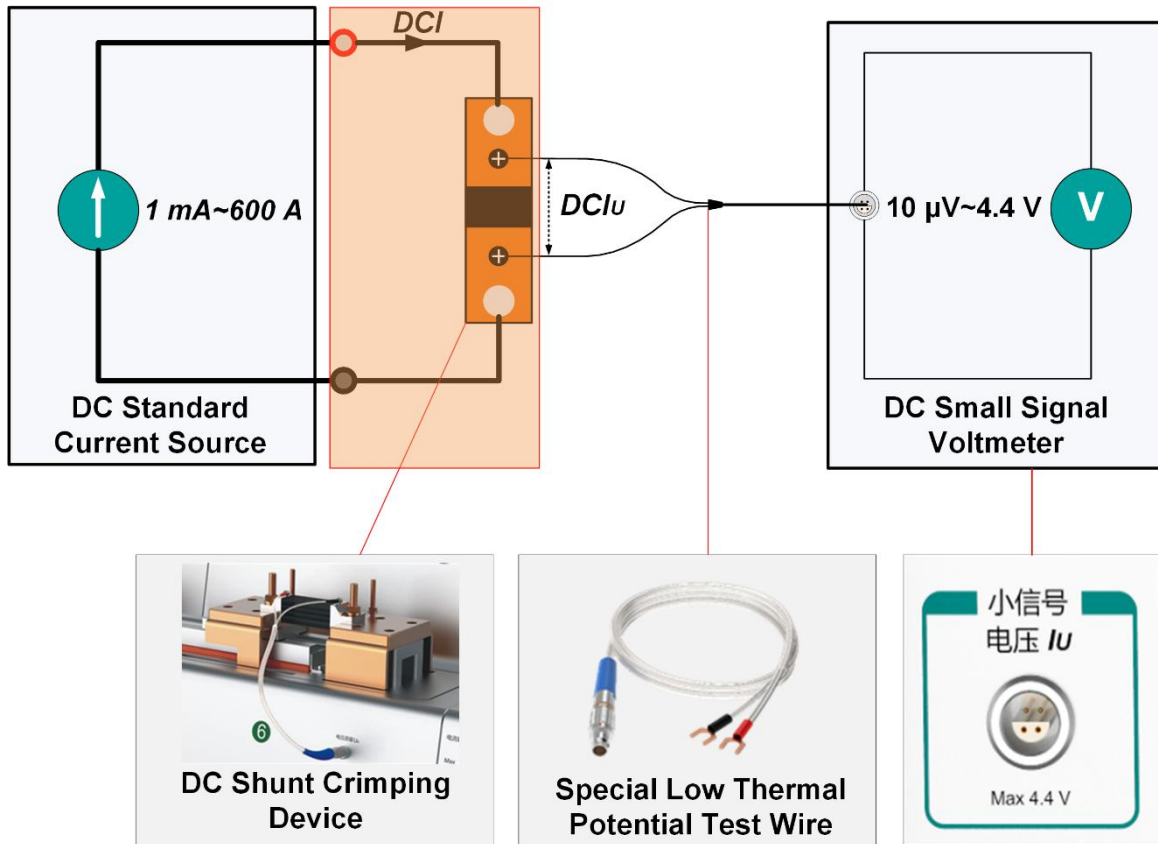
- Mobile measurement and control station, which can observe or control the output through the LCD touch screen
- DC shunt manual/automatic crimping device (option), used for DC shunt verification.

### 3. Applications

#### ☆ Verification of DC Energy Meter

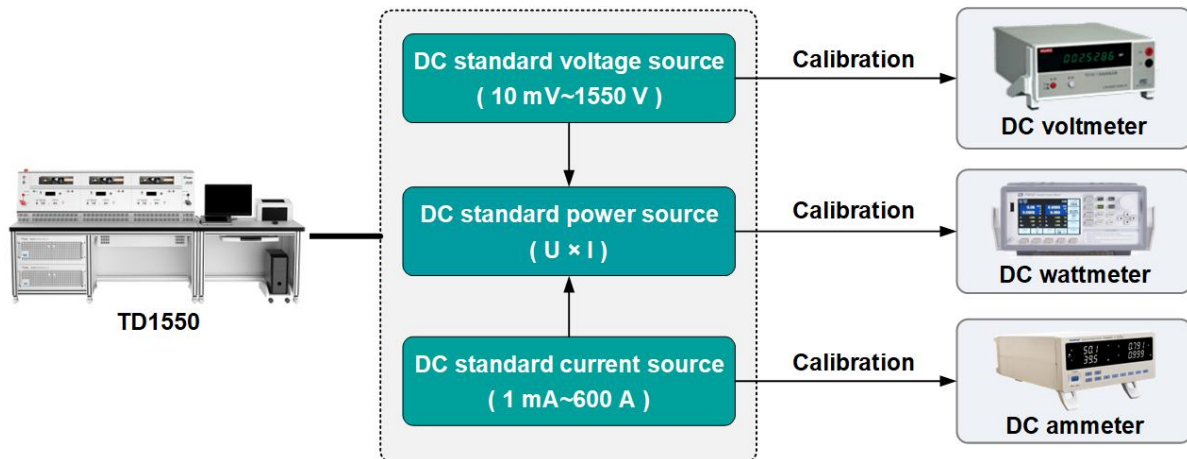


- Application scenario 1:** The maximum DC voltage output is 1550 V, meeting the requirements of 1.15  $U_n$  voltage test of 1 kV energy meter; The maximum DC current output is 600 A, meeting the requirements of 1.2  $I_n$  current test of 100 A watt hour meter. With the power pulse measurement function, the test of direct connected DC energy meters.
- Application scenario 2:** The instrument has 10  $\mu$  V~4.4 V four wire small-signal voltage source, with 1550 V DC voltage source and energy pulse measurement function, can carry out relevant testing work of indirect connected DC energy meters.
- Application scenario 3:** The instrument supports 600 A maximum current output option, with 1550 V DC voltage source and energy pulse measurement function, and can carry out relevant tests on the whole of indirect connected DC energy meters and DC shunt.

**☆Verification of DC Shunt (option)**


- **DC High Current Standard Source:** the maximum output is 600 A, which can be used as the primary current input of the DC shunt.
- **DC Small-signal Voltmeter:** support voltage input range is 10 μV~4.4 V, which can measure the secondary output voltage of the shunt
- **DC Shunt Manual Crimping Device (option):** manually compress the current terminal of the DC shunt and connect it with the current source to form a current loop.
- **Verification and Test of DC Shunt (option):** it can measure the resistance value and basic error of the shunt, and draw R(t) curve.





## ☆ Calibration of DC Electrical Measuring Instruments



- Calibration of DC Voltmeter and Ammeter:** the device has a built-in DC voltage standard source with an output range of 10 mV ~ 1550 V and a DC current standard source with an output range of 1 mA ~ 600 A. The voltage and current accuracy of the class 0.02 device reaches class 0.01, which is applicable to the calibration of DC voltmeter or ammeter of class 0.05 and below.
- Calibration of DC Watt-meter:** a virtual power standard source composed of independent DC voltage and DC current output. The accuracy of a class 0.02 device reaches class 0.02, which is applicable to the calibration of DC power meters of class 0.1 and below.

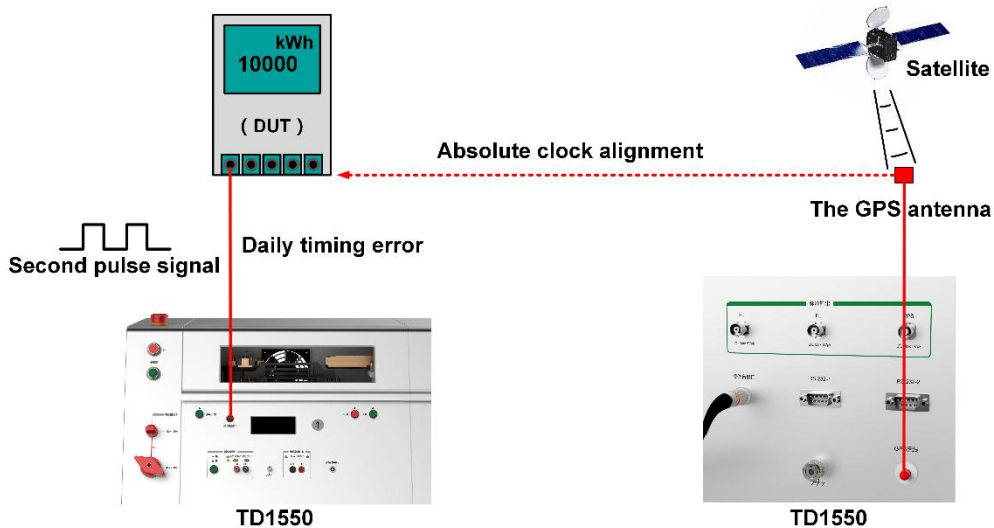
## 4. Characteristics

### ☆Wide output / Measurement Range

|                  |   |
|------------------|---|
| DCV              | 10 mV  1550 V |
| DCI              | 1 mA  600 A   |
| DCI <sub>v</sub> | 10 μV  4.4 V   |
| R measurement    | 200 nΩ  200 mΩ |

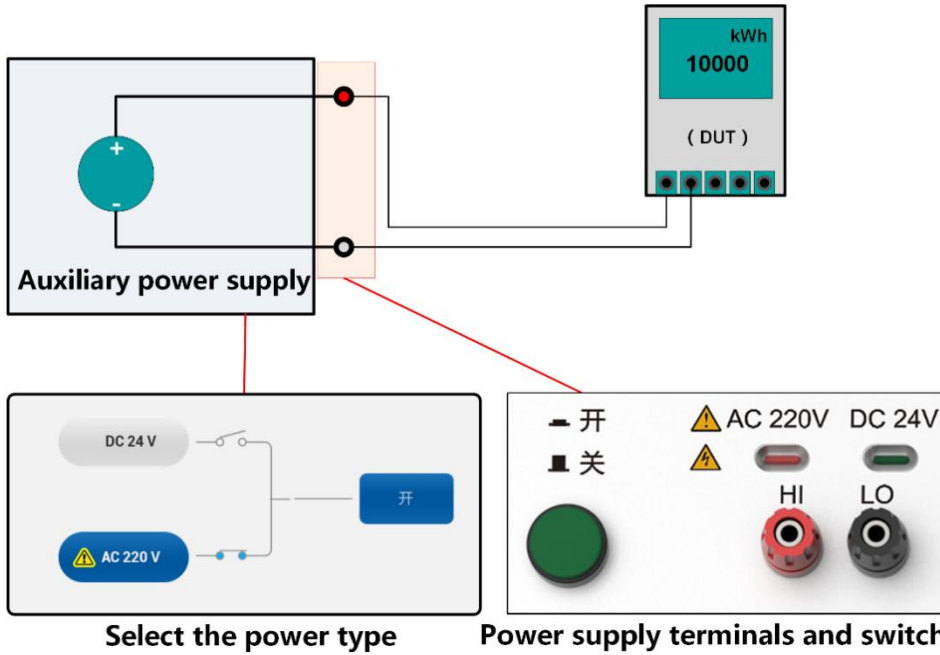
- The maximum output of its DC standard voltage source is 1550 V, and the maximum output of its DC standard current source is 600 A; The output range of the DC standard small-signal voltage source used for the verification of indirect connected DC energy meters reaches  $\pm (10 \mu V \sim 4.4 V)$
- The maximum DC voltage measurement of the instrument can reach 4.4 V, and the maximum DC resistance measurement can reach 200 mΩ.

### ☆ Clock Check Function



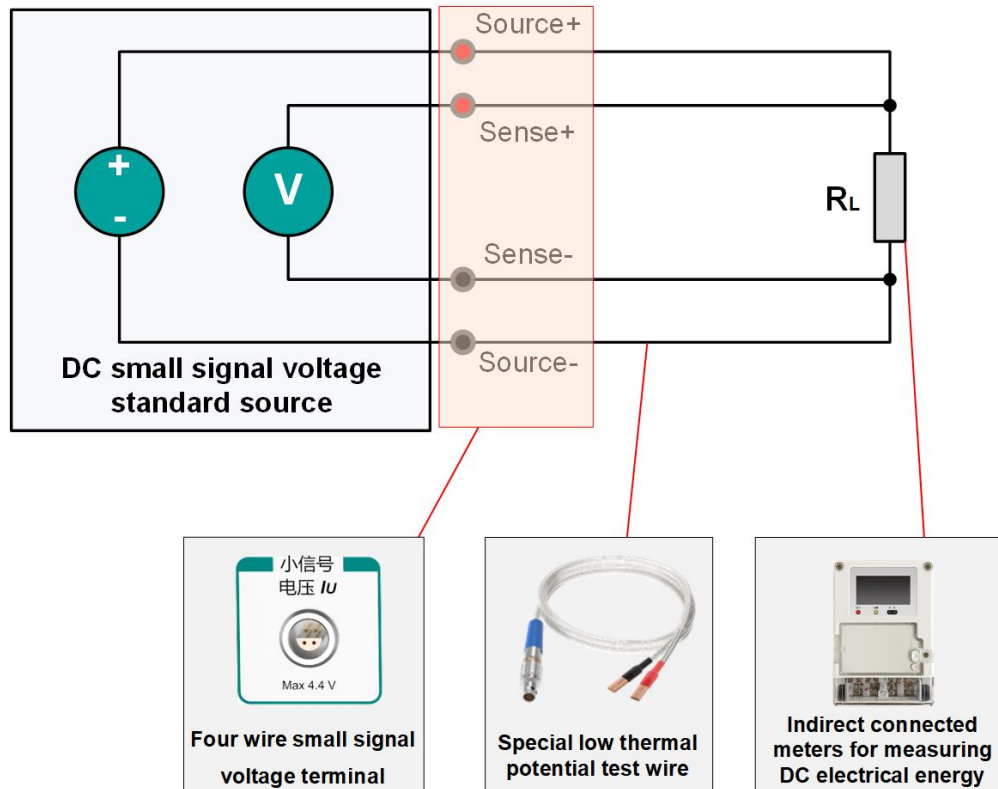
- Built in clock module with precision up to 0.2 ppm, which can measure the second pulse signal for daily timing error test
- Built in GPS module and antenna can receive GPS standard clock signal.

☆ Auxiliary Power Supply



- Each meter position has built-in auxiliary power supply, which can provide DC 24 V or AC 220 V power supply for electronic meters for measuring DC electrical energy (type A).

### ☆Four Wire Small-signal Voltage Source



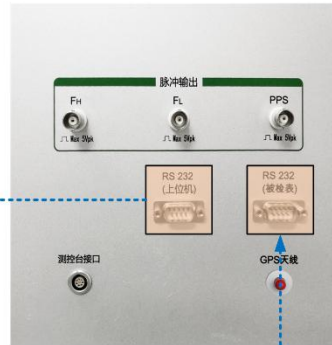
- Four Wire Small-signal Voltage Source:** Precise output  $\pm (10 \mu V \sim 4.4 V)$  small-signal voltage signal is used as the current input of indirect access DC watt hour meter (the specification of shunt can be set and displayed according to its primary current).



☆Professional Test Software



Computer and special test software



RS232

RS232

Communication interface



DUT

- With RS232 communication interface, software functions can be customized according to customer needs

## 5. Specifications

### 5.1 DC Voltage Output

| Range         | Resolution | Short Term Stability<br>(% / min) |             | Accuracy (k=2)<br>(ppm of reading + ppm of<br>range) <sup>[1]</sup> |                | Maximum<br>Burden<br>Current<br>(mA) | Ripple<br>(%) |
|---------------|------------|-----------------------------------|-------------|---|----------------|--------------------------------------|---------------|
|               |            | Class 0.05                        | Class 0.02  | Class 0.05  | Class 0.02     |                                      |               |
| 100 mV        | 1 $\mu$ V  | 0.005                             | 3.5 $\mu$ V | 120 + 80  | 60 + 5 $\mu$ V | 200                                  | < 1.0         |
| 300 mV        | 1 $\mu$ V  | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 200                                  | < 1.0         |
| 1 V           | 10 $\mu$ V | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 200                                  | < 1.0         |
| 3 V           | 10 $\mu$ V | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 200                                  | < 1.0         |
| 10 V          | 0.1 mV     | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 200                                  | < 1.0         |
| 30 V          | 0.1 mV     | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 200                                  | < 1.0         |
| 100 V         | 1 mV       | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 200                                  | < 1.0         |
| 300 V         | 1 mV       | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 60                                   | < 1.0         |
| 600 V         | 1 mV       | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 30                                   | < 1.0         |
| 1000 V        | 10 mV      | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 15                                   | < 1.0         |
| 1500 V<br>[2] | 10 mV      | 0.005                             | 0.002       | 120 + 80  | 60 + 40        | 10                                   | < 1.0         |

Note [1] : (ppm = parts per million) (e.g., 10ppm = 0.001%).

[2]: 1500V range is an option.

- Output range: 10 mV~1150 V, 6-bit display
- 1500 V voltage output option can be selected to expand the voltage output range to 10 mV ~ 1550 V
- Protection function: Short circuit protection, overload protection

**5.2 DC Current Output [3]**

| Range  | Resolution  | Short term stability<br>(% / min) |            | Accuracy (k=2)<br>(ppm of reading + ppm<br>of range) |            | Maximum<br>Burden<br>Voltage<br>(V) | Ripple<br>(%) |
|--------|-------------|-----------------------------------|------------|--|------------|-------------------------------------|---------------|
|        |             | Class 0.05                        | Class 0.02 | Class 0.05   | Class 0.02 |                                     |               |
| 10 mA  | 0.1 $\mu$ A | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 12                                  | < 0.5         |
| 20 mA  | 0.1 $\mu$ A | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 12                                  | < 0.5         |
| 50 mA  | 0.1 $\mu$ A | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 12                                  | < 0.5         |
| 100 mA | 1 $\mu$ A   | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 12                                  | < 0.5         |
| 200 mA | 1 $\mu$ A   | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 12                                  | < 0.5         |
| 500 mA | 1 $\mu$ A   | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 0.5         |
| 1 A    | 10 $\mu$ A  | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 0.5         |
| 2 A    | 10 $\mu$ A  | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 0.5         |
| 5 A    | 10 $\mu$ A  | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 0.5         |
| 10 A   | 0.1 mA      | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 0.5         |
| 20 A   | 0.1 mA      | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 0.5         |
| 50 A   | 0.1 mA      | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 1.0         |
| 100 A  | 1 mA        | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 1.0         |
| 200 A  | 1 mA        | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 1.0         |
| 500 A  | 1 mA        | 0.005                             | 0.003      | 120 + 80   | 60 + 40    | 3                                   | < 1.0         |

Note: [3] As the current input of the direct connected DC energy meters, or the current input of the external shunt of the indirect connected DC energy meters;

- Output range: 1 mA~600 A, 6-bit display
- Protection function: open circuit protection, overload protection

### 5.3 DC small-signal Voltage Output<sup>[4]</sup>

| Range  | Resolution  | Short Term Stability (% / min) | Accuracy (k=2) (ppm of reading + ppm of range) | Maximum Burden Current (mA) | Ripple (%) |
|--------|-------------|--------------------------------|--|-----------------------------|------------|
| 1 mV   | 10 nV       | 0.1 $\mu$ Vrms                 | 120 + 0.3 $\mu$ V                              | —                           | < 0.2      |
| 3 mV   | 10 nV       | 0.3 $\mu$ Vrms                 | 120 + 1 $\mu$ V                                | —                           | < 0.2      |
| 10 mV  | 0.1 $\mu$ V | 1 $\mu$ Vrms                   | 120 + 3 $\mu$ V                                | —                           | < 0.2      |
| 30 mV  | 0.1 $\mu$ V | 0.002                          | 120 + 80                                       | —                           | < 0.2      |
| 100 mV | 1 $\mu$ V   | 0.002                          | 120 + 80                                       | —                           | < 0.2      |
| 300 mV | 1 $\mu$ V   | 0.002                          | 120 + 80                                       | $\leq 10$                   | < 0.2      |
| 1 V    | 10 $\mu$ V  | 0.002                          | 120 + 80                                       | $\leq 10$                   | < 0.2      |
| 4 V    | 10 $\mu$ V  | 0.002                          | 120 + 80                                       | $\leq 10$                   | < 0.2      |

Note: [4] When the indirect connected DC energy meters is verified separately, it can be used as its current input (corresponding to the shunt voltage)

- Output range:  $\pm (10 \mu\text{V} \sim 4.4 \text{ V})$ , 6-bit display
- The specification and current voltage ratio of the shunt can be set, and the output value can be displayed according to the voltage or current converted by the shunts.

## 5.4 DC Shunts Verification

### 5.4.1 DC Voltage Measurement

| Range  | Resolution        | Accuracy (k=2)<br>(ppm of reading + ppm of<br>range or $\mu\text{V}$ ) | temperature coefficient<br>$\pm \text{ppm} \cdot \text{RD} / ^\circ\text{C} @ 15^\circ\text{C} \sim 30^\circ\text{C}$ |
|--------|-------------------|--|---|
| 1 mV   | 10 nV             | 120 + 2 $\mu\text{V}$  | 30  |
| 3 mV   | 10 nV             | 120 + 2 $\mu\text{V}$  | 30  |
| 10 mV  | 0.1 $\mu\text{V}$ | 120 + 2 $\mu\text{V}$  | 10  |
| 30 mV  | 0.1 $\mu\text{V}$ | 120 + 80   | 10  |
| 100 mV | 1 $\mu\text{V}$   | 120 + 80   | 10  |
| 300 mV | 1 $\mu\text{V}$   | 120 + 80   | 5   |
| 1 V    | 10 $\mu\text{V}$  | 120 + 80   | 5   |
| 4 V    | 10 $\mu\text{V}$  | 120 + 80   | 5   |

- Output range:  $\pm (10 \mu\text{V} \sim 4.4 \text{ V})$ , 6-bit display, Manual/automatic range switching
- Input resistance:  $>1\text{G}\Omega$ ; Input protection:  $\pm 50\text{Vpk}$ , continuity.

## 5.4.2 DC Resistance Measurement

| Test Current | Voltage Range | Measuring Range Of Resistance               | Accuracy (k=2)<br>@ Full Scale Voltage Value <sup>[5]</sup> |            |
|--------------|---------------|---|---|------------|
|              |               |   | Class 0.05  | Class 0.02 |
| 5 A          | 1 mV          | 20.0000 $\mu\Omega$ ~ 200.000 $\mu\Omega$   | 0.232%  | 0.222%     |
|              | 10 mV         | 200.000 $\mu\Omega$ ~ 2.00000 m $\Omega$    | 0.052%  | 0.042%     |
|              | 100 mV        | 2.000 00 m $\Omega$ ~ 20.000 0 m $\Omega$   | 0.04%   | 0.03%      |
|              | 1 V           | 20.000 0 m $\Omega$ ~ 200.000 m $\Omega$    | 0.04%   | 0.03%      |
| 10 A         | 1 mV          | 10.000 0 $\mu\Omega$ ~ 100.000 $\mu\Omega$  | 0.232%  | 0.222%     |
|              | 10 mV         | 100.000 $\mu\Omega$ ~ 1.000 00 m $\Omega$   | 0.052%  | 0.042%     |
|              | 100 mV        | 1.000 00 m $\Omega$ ~ 10.000 0 m $\Omega$   | 0.04%   | 0.03%      |
|              | 1 V           | 10.000 0 m $\Omega$ ~ 100.000 m $\Omega$    | 0.04%   | 0.03%      |
| 20 A         | 1 mV          | 5.000 00 $\mu\Omega$ ~ 50.000 0 $\mu\Omega$ | 0.232%  | 0.222%     |
|              | 10 mV         | 50.000 0 $\mu\Omega$ ~ 500.000 $\mu\Omega$  | 0.052%  | 0.042%     |
|              | 100 mV        | 500.000 $\mu\Omega$ ~ 5.000 00 m $\Omega$   | 0.04%   | 0.03%      |
|              | 1 V           | 5.000 00 m $\Omega$ ~ 50.000 0 m $\Omega$   | 0.04%   | 0.03%      |
| 50 A         | 1 mV          | 2.000 00 $\mu\Omega$ ~ 20.000 0 $\mu\Omega$ | 0.232%  | 0.222%     |
|              | 10 mV         | 20.000 0 $\mu\Omega$ ~ 200.000 $\mu\Omega$  | 0.052%  | 0.042%     |
|              | 100 mV        | 200.000 $\mu\Omega$ ~ 2.000 00 m $\Omega$   | 0.04%   | 0.03%      |
|              | 1 V           | 2.000 00 m $\Omega$ ~ 20.000 0 m $\Omega$   | 0.04%   | 0.03%      |
| 100 A        | 1 mV          | 1.000 00 $\mu\Omega$ ~ 10.000 0 $\mu\Omega$ | 0.232%  | 0.222%     |
|              | 10 mV         | 10.000 0 $\mu\Omega$ ~ 100.000 $\mu\Omega$  | 0.052%  | 0.042%     |
|              | 100 mV        | 100.000 $\mu\Omega$ ~ 1.000 00 m $\Omega$   | 0.04%   | 0.03%      |
|              | 1 V           | 1.000 00 m $\Omega$ ~ 10.000 0 m $\Omega$   | 0.04%   | 0.03%      |
| 200 A        | 1 mV          | 500.000 n $\Omega$ ~ 5.000 00 $\mu\Omega$   | 0.232%  | 0.222%     |
|              | 10 mV         | 5.000 00 $\mu\Omega$ ~ 50.000 0 $\mu\Omega$ | 0.052%  | 0.042%     |
|              | 100 mV        | 50.000 0 $\mu\Omega$ ~ 500.000 $\mu\Omega$  | 0.04%   | 0.03%      |
|              | 1 V           | 500.000 $\mu\Omega$ ~ 5.000 00 m $\Omega$   | 0.04%   | 0.03%      |

|       |        |                         |        |        |
|-------|--------|-------------------------|--------|--------|
| 500 A | 1 mV   | 200.000 nΩ~2.000 00 μΩ  | 0.232% | 0.222% |
|       | 10 mV  | 2.000 00 μΩ~20.000 0 μΩ | 0.052% | 0.042% |
|       | 100 mV | 20.000 0 μΩ~200.000 μΩ  | 0.04%  | 0.03%  |
|       | 1 V    | 200.000 μΩ~2.000 00 mΩ  | 0.04%  | 0.03%  |

Note [5]: The uncertainty of resistance measurement corresponding to other voltage values= $(\Delta U/U_0 + \Delta I/I_0)$ ,  $U_0$  and  $I_0$  are the reading values of current voltage and current respectively,  $\Delta U$  and  $\Delta I$  are the absolute error values of current measured voltage and current respectively

- Measuring range of resistance: 200.000 nΩ~4.00000 Ω, 6-bit display, Minimum resolution: 1 pΩ
- The current test point can be set through the number keys, and the voltage range: manual/automatic switching
- After loading the test current, the R (t) change curve can be tested

### 5.5 Daily timing error

- Annual measurement uncertainty of device standard clock:  $2 \times 10^{-7}$
- Daily timing error supports two error display modes: s/d and ppm/ppb

### 5.6 DC Energy Index

|                    |                                 |   |
|--------------------|---------------------------------|---|
| DC<br>Power/Energy | Range                           | Combination of DC voltage and DC current (or DC small-signal voltage)   |
|                    | Accuracy                        | Uncertainty of voltage measurement+uncertainty of current measurement (or uncertainty of DC small-signal voltage measurement) |
| Energy Pulse       | Standard Energy<br>Pulse Output | High frequency full range value corresponds to 60 kHz;<br>Low frequency full range value corresponds to 6 Hz;                 |
|                    | Pulse Output<br>Frequency       | Output frequency jitter time<10 μ s   |
|                    | Standard Energy<br>Pulse Input  | Signal amplitude is 5V, TTL level;<br>Able to receive high-frequency pulses ≤ 150 kHz;  |

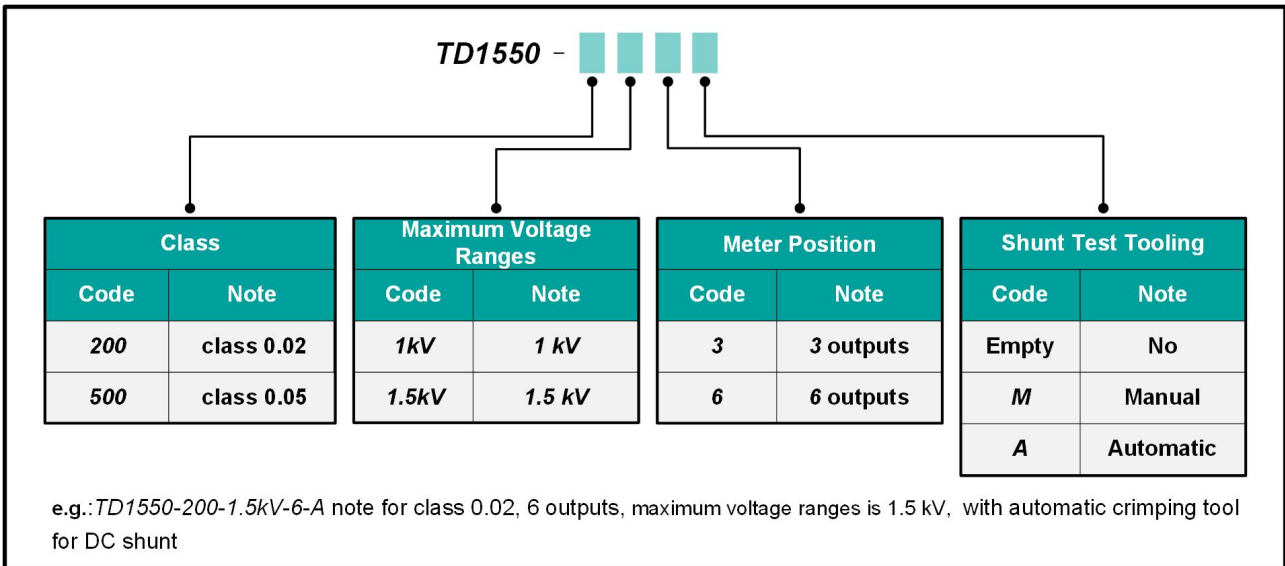
|  |                             |  |
|--|-----------------------------|--|
|  |                             | $FH=60 \text{ kHz} \times \text{Power value} \div \text{voltage range value} \div \text{current range value}$ $FL=60 \text{ kHz} \times \text{Power value} \div \text{voltage range value} \div \text{current range value} \div 10000$ |
|  | <b>Energy Error Display</b> | Automatic display, resolution 0.0001%  |



### 5.7 Auxiliary power supply

|                 |                        |                             |
|-----------------|------------------------|-----------------------------|
| DC Power Output | Output Voltage         | 24 V                        |
|                 | Maximum Burden Current | 120 mA / Meter Position     |
|                 | Protection Function    | Replaceable fuse protection |
| AC Power Output | Output Voltage         | 220 V                       |
|                 | Maximum Burden Current | 20 mA / Meter Position      |
|                 | Protection Function    | Replaceable fuse protection |

### 6. Ordering Information



## 7. General Specifications

|                     |  |
|---------------------|--|
| <b>Power Supply</b> | AC ( 220 ± 22 ) V, ( 50 ± 2 ) Hz;                      |
| <b>Temperature</b>  | Working temperature: 15 °C~30 °C;                      |
| <b>Performance</b>  | Storage temperature: -20 °C ~ 70 °C;                   |
| <b>Humidity</b>     | Working humidity: ( 20 % ~ 50% ) R·H, No condensation; |
| <b>Performance</b>  | Storage humidity: ( 15 % ~ 80% ) R·H, No condensation; |
| <b>Interface</b>    | RS232  |