

# **OPERATION MANUAL**

## **TH1953/TH1963/A**

### **5/6 <sup>1</sup>/<sub>2</sub> Digit Multimeter**

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**Changzhou Tonghui Electronic Co., Ltd.**

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## Chapter 1 Overview

Thank you for purchasing and using our products. Before using this instrument, please check the items in the section "1.5 Unpacking and Inspection" in this chapter of this manual. If there is any discrepancy, please contact us as soon as possible to protect your rights. If you still have questions after reading this manual, please contact your local dealer or call our engineers directly for further consultation.

### 1.1 General

The TH1953/TH1963/A is a highly accurate, stable and fast five / six and a half digit ( $6 \frac{1}{2}$ ) digital multi-meter. The instrument has a series of excellent performances such as the fastest reading rate up to 1000 times/second, 0.0035% basic DC voltage accuracy and 0.0100% basic resistance accuracy.

The TH1953 has a wide measuring range:

- DC voltage 1V to 1000V
- AC voltage 1V to 750V,1000V Peak
- DC current 1A to 10A
- AC current 1A to 10A
- Two-wire and four-wire resistance measurement 0.1m $\Omega$  to 120M $\Omega$
- Frequency 3Hz to 300kHz

The TH1963 has a wide measuring range:

- DC voltage 0.1 $\mu$ V to 1000V
- AC voltage 0.1 $\mu$ V to 750V,1000V Peak
- DC current 10nA to 10A
- AC current 10nA to 10A
- Two-wire and four-wire resistance measurement 0.01m $\Omega$  to 120M $\Omega$
- Frequency 2Hz to 1MHz

In addition to the above, the TH1963 has some additional features:

- Functions: Period, dB, dBm, continuity test function, diode test, math operation (mX+b), and percentage calculation.
- Programming language and control interface: The machine provides SCPI programming control language and three control interfaces USB Device, RS-232C, LAN, IEEE-488/GPIB (optional) and Handler (optional) for your use.
- Readings and Instrument Settings: Up to 10,000 readings can be stored in local mode.
- Complete calibration: The machine can be calibrated from the front panel or

from the remote-control interface.

## 1.2 Conditions of Use

### 1.2.1 Power Supply

Power supply voltage: 110V/220V  $\pm$ 10%

Power supply frequency: 50Hz/60Hz  $\pm$ 5%

Power consumption:  $\leq$ 30VA

### 1.2.2 Ambient Temperature and Humidity

Normal working temperature: 0°C~40°C, humidity  $\leq$ 90%RH

## 1.3 Volume and Weight

Volume (W×H×D): 225mm×100mm×355mm

Weight: about 2.5kg

## 1.4 Safety Markings and Precautions



小心

Indicates that the user must refer to the operating instructions in the manual before operating.



警告

Indicates that a relatively high voltage may be applied to the terminals, so be aware of this and avoid direct contact with personnel.



Indicates grounding.

Where there is a WARNING mark in this manual, it indicates a high-pressure hazard that may cause injury or even death to the user. Therefore, it is expected that the user reads each procedure in this manual carefully before operation to ensure his/her safety.

The CAUTION mark in this manual is to remind the operator that failure to use the instrument in accordance with the operating instructions is likely to cause damage to the instrument, and that repair and replacement of damage caused by such negligence is not covered by the manufacturer's warranty.

## 1.5 Unpacking and Inspection

- The instrument has been carefully inspected for body parts and electrical characteristics before leaving the factory. After unpacking, please inspect the unit for any visible damage caused by shipping. If there is any damage, please notify the shipping organization immediately and arrange for a replacement. In addition, please keep the manufacturer's carton in case you need to move the unit again in the future.

After the user receives the instrument, please open the box to check and verify the

items (refer to Chapter 10 complete set), if missing, please contact our company or the distribution department immediately.

**Note:** The IEEE-488 interface and Handler interface of this instrument are optional and need to be purchased separately. And these two interfaces cannot be installed at the same time.

## 1.6 Symbol

The following symbols are on the panel or nameplate of each instrument:

- Manufacturer's name or trademark
- Product name and model
- Product number
- Manufacture of measuring instruments license mark and number
- Test end flag

## Chapter 2 Specification Features

### Technical Description

- Technical indicator assumptions
- One year calibration cycle.
- Operating temperature environment: at 18°C ~ 28°C.
- Calibration temperature  $T_{CAL} = 23\text{ °C}$ .
- Calibrate after 60 minutes of power-up and warm-up.
- Expression of accuracy:  $\pm(\% \text{ reading} + \% \text{ range})^{[1]}$ .
- Operating humidity environment:  $\leq 80\%RH$  at 0°C ~ 18°C ( $\leq 70\%RH$  when resistance range  $\geq 10M$ ),  $\leq 70\%RH$  at 28°C ~ 40°C.

## 2.1 Specifications

### 2.1.1 DC Voltage Specifications

Range	Resolution <sup>[4]</sup>	24 hours <sup>[3]</sup> $T_{CAL} \pm 1\text{ °C}$	90 days $T_{CAL} \pm 5\text{ °C}$	1 year $T_{CAL} \pm 5\text{ °C}$	Temperature Coefficient/ °C <sup>[2]</sup>
<b>TH1953</b>					
100.0000mV <sup>[5]</sup>		0.005 + 0.005	0.007 + 0.005	0.012 + 0.008	0.0005 + 0.0005
1.000000V		0.005 + 0.004	0.007 + 0.004	0.010 + 0.004	0.0005 + 0.0001
10.00000V		0.005 + 0.004	0.007 + 0.004	0.010 + 0.004	0.0005 + 0.0001
100.0000V		0.005 + 0.004	0.007 + 0.004	0.010 + 0.004	0.0005 + 0.0001
1000.000V <sup>[6]</sup>		0.005 + 0.004	0.007 + 0.004	0.010 + 0.004	0.0005 + 0.0001
<b>TH1963</b>					
100.0000mV <sup>[5]</sup>	0.1uV	0.0030+ 0.0030	0.0040 + 0.0035	0.0050 + 0.0035	0.0005 + 0.0005
1.000000V	1uV	0.0020+ 0.0006	0.0030 + 0.0007	0.0040 + 0.0007	0.0005 + 0.0001
10.00000V	10uV	0.0015+ 0.0004	0.0020 + 0.0005	0.0035 + 0.0005	0.0005 + 0.0001
100.0000V	100uV	0.0020+ 0.0006	0.0035 + 0.0006	0.0045 + 0.0006	0.0005 + 0.0001
1000.000V <sup>[6]</sup>	1mV	0.0020+ 0.0006	0.0035+ 0.0010	0.0045+ 0.0010	0.0005 + 0.0001
<b>TH1963A</b>					
100.0000mV	0.1uV	0.0040+0.0060	0.0070+0.0065	0.0090+0.0065	0.0005 + 0.0005
1.000000V	1uV	0.0030+0.0009	0.0060+0.0010	0.0080+0.0010	0.0005 + 0.0001
10.00000V	10uV	0.0025+0.0004	0.0050+0.0005	0.0075+0.0005	0.0005 + 0.0001
100.0000V	100uV	0.0030+0.0006	0.0065+0.0006	0.0085+0.0006	0.0005 + 0.0001
1000.000V <sup>[6]</sup>	1mV	0.0030+0.0006	0.0065+0.0010	0.0085+0.0010	0.0005 + 0.0001

### 2.1.2 DC Current Specifications

Range	Internal Resistance Voltage Drop	Minimum Resolution	24 hours $T_{CAL} \pm 1\text{ }^{\circ}\text{C}$	90 days $T_{CAL} \pm 5\text{ }^{\circ}\text{C}$	1 year $T_{CAL} \pm 5\text{ }^{\circ}\text{C}$	Temperature Coefficient/ $^{\circ}\text{C}$
<b>TH1953</b>						
100uA	< 0.011V		0.010+0.006 <sup>[3]</sup>	0.040+0.006	0.050+0.008	0.0020+0.0005 <sup>[2]</sup>
1mA	< 0.011V		0.010+0.006 <sup>[3]</sup>	0.030+0.006	0.050+0.008	0.0020+0.0005 <sup>[2]</sup>
10mA	< 0.05V		0.010+0.006 <sup>[3]</sup>	0.030+0.005	0.050+0.008	0.0020+0.0005 <sup>[2]</sup>
100mA	< 0.5V		0.010+0.006 <sup>[3]</sup>	0.030+0.005	0.050+0.004	0.0020+0.0005 <sup>[2]</sup>
1A	< 0.7V		0.050+0.006 <sup>[3]</sup>	0.080+0.010	0.100+0.004	0.0050+0.0010 <sup>[2]</sup>
3A <sup>[6]</sup>	< 2.0V		0.180+0.020 <sup>[3]</sup>	0.200+0.020	0.200+0.020	0.0050+0.0020 <sup>[2]</sup>
10A <sup>[6][16]</sup>	< 0.5V		0.050+0.010 <sup>[3]</sup>	0.120+0.010	0.250+0.004	0.0050+0.0010 <sup>[2]</sup>
<b>TH1963</b>						
100uA	< 0.011V	0.1nA	0.010 + 0.006	0.040 + 0.006	0.050 + 0.006	0.0020+ 0.0005
1mA	< 0.011V	1nA	0.007 + 0.006	0.030 + 0.006	0.050 + 0.006	0.0020+ 0.0005
10mA	< 0.05V	10nA	0.007 + 0.006	0.030 + 0.006	0.050 + 0.006	0.0020+ 0.0005
100mA	< 0.5V	100nA	0.010 + 0.004	0.030 + 0.005	0.050 + 0.005	0.0020+ 0.0005
1A	< 0.7V	1uA	0.050 + 0.006	0.080 + 0.010	0.100 + 0.010	0.0050+ 0.0010
3A	< 2.0V	1uA	0.180 + 0.020	0.200 + 0.020	0.200 + 0.020	0.0050+ 0.0020
10A	< 0.5V	10uA	0.050 + 0.010	0.120 + 0.010	0.120 + 0.010	0.0050+ 0.0010
<b>TH1963A</b>						
100uA	< 0.011V		0.010+0.006	0.040+0.006	0.050+0.006	0.0020+0.0005
1mA	< 0.011V		0.010+0.006	0.030+0.006	0.050+0.006	0.0020+0.0005
10mA	< 0.05V		0.010+0.006	0.030+0.006	0.050+0.006	0.0020+0.0005
100mA	< 0.5V		0.010+0.004	0.030+0.005	0.050+0.005	0.0020+0.0005
1A	< 0.7V		0.050+0.006	0.080+0.010	0.100+0.010	0.0050+0.0010
3A	< 2.0V		0.180+0.020	0.200+0.020	0.200+0.020	0.0050+0.0020
10A	< 0.5V		0.050+0.010	0.120+0.010	0.120+0.010	0.0050+0.0010

### 2.1.3 DC Resistance Specifications <sup>[7]</sup> <sup>[8]</sup>

Range	Test Current	Resolution	24 hours $T_{CAL} \pm 1\text{ }^{\circ}\text{C}$	90 days $T_{CAL} \pm 5\text{ }^{\circ}\text{C}$	1 year $T_{CAL} \pm 5\text{ }^{\circ}\text{C}$	Temperature Coefficient/ $^{\circ}\text{C}$
<b>TH1963</b>						
10.00000Ω	10mA	10uΩ	0.0050 + 0.0040	0.0100 + 0.0060	0.0120+ 0.0080	0.0008 + 0.0005
100.0000 Ω	10mA	0.1mΩ	0.0030 + 0.0020	0.0080 + 0.0030	0.0100+ 0.0040	0.0006 + 0.0005
1.000000kΩ	1mA	1mΩ	0.0020 + 0.0005	0.0080 + 0.0010	0.0100+ 0.0010	0.0006 + 0.0001
10.00000kΩ	100uA	10mΩ	0.0020 + 0.0005	0.0080 + 0.0010	0.0100+ 0.0010	0.0006 + 0.0001
100.0000kΩ	10uA	100mΩ	0.0020 + 0.0005	0.0080 + 0.0010	0.0100+ 0.0010	0.0006 + 0.0001
1.000000MΩ	5uA	1Ω	0.0020 + 0.0010	0.0080 + 0.0010	0.0100+ 0.0010	0.0010 + 0.0002
10.00000MΩ	500nA	10Ω	0.0150 + 0.0010	0.0200 + 0.0010	0.0400+ 0.0010	0.0030 + 0.0004
100.0000MΩ	500nA //10M	100Ω	0.3000 + 0.0100	0.8000 + 0.0100	0.8000+ 0.0100	0.1500 + 0.0002
<b>TH1963A</b>						

10.00000Ω	10mA		0.0050+0.0070	0.011+ 0.010	0.015+ 0.010	0.0008+0.0005
100.0000 Ω	10mA		0.0040+0.0060	0.011+ 0.007	0.014+ 0.007	0.0006+0.0005
1.000000kΩ	1mA		0.0030+0.0008	0.011+ 0.001	0.014+ 0.001	0.0006+0.0001
10.00000kΩ	100uA		0.0030+0.0005	0.011+ 0.001	0.014+ 0.001	0.0006+0.0001
100.0000kΩ	10uA		0.0030+0.0005	0.011+ 0.001	0.014+ 0.001	0.0006+0.0001
1.000000MΩ	5uA		0.0030+0.0010	0.011+ 0.001	0.014+ 0.001	0.0010+0.0002
10.00000MΩ	500nA		0.015+0.001	0.020+ 0.001	0.040+ 0.001	0.0030+0.0004
100.0000MΩ	500nA //10M		0.300+0.010	0.800+ 0.010	0.800+ 0.010	0.1500+0.0002

### 2.1.4 Continuity (Conductivity) Test Specifications

Function	Range	Test Current	24 hours TCAL ±1 °C	90 days TCAL ±5 °C	1 year TCAL ±5 °C	Temperature Coefficient/ °C
<b>TH1953</b>						
Contiguity	1kΩ	1mA	0.050 + 0.020	0.080 + 0.020	0.100+ 0.020	0.0010+ 0.0020
<b>TH1963/A</b>						
Contiguity	1kΩ	1mA	0.002 + 0.030	0.008 + 0.030	0.010+ 0.030	0.0010+ 0.0020

### 2.1.5 Diode test specifications

Function	Range	Test Current	24 hours T <sub>CAL</sub> ±1 °C	90 days T <sub>CAL</sub> ±5 °C	1 year T <sub>CAL</sub> ±5 °C	Temperature Coefficient/ °C
<b>TH1953</b>						
Thyristor [12]	5V	1mA	0.050 + 0.020	0.080 + 0.020	0.100+ 0.020	0.0010+ 0.0020
<b>TH1963/A</b>						
Thyristor [12]	5V	1mA	0.002 + 0.030	0.008 + 0.030	0.010+ 0.030	0.0010+ 0.0020

### 2.1.6 Temperature Test Specifications

Temperature	
TH1953/1963/A	
PT100 (DIN/ IEC 751)	Probe accuracy + 0.05 °C
5 kΩ thermistor	Probe accuracy + 0.10 °C

### 2.1.7 Capacitance Test Count Specifications

Range	24 hours TCAL ±1 °C	90 days TCAL ±5 °C	1 year TCAL ±5 °C	Temperature Coefficient/ °
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				C
TH1953				
1.0000nF			1.0+0.5	0.02
10.000nF			0.5+0.1	0.02
100.00nF			0.5+0.1	0.02
1.0000uF			0.5+0.1	0.02
10.000uF			0.5+0.1	0.02
100.00uF			0.5+0.1	0.02
1.0000mF			0.5+0.1	0.02
10.000mF			1.0+0.5	0.02
TH1963				
1.0000nF	0.5+0.10	0.5+0.40	1.0+0.50	0.02+0.001
10.000nF	0.2+0.05	0.5+0.10	0.5+0.10	0.02+0.001
100.00nF	0.2+0.05	0.5+0.10	0.5+0.10	0.02+0.001
1.0000uF	0.2+0.05	0.5+0.05	0.5+0.10	0.02+0.001
10.000uF	0.2+0.05	0.5+0.05	0.5+0.10	0.02+0.001
100.00uF	0.2+0.05	0.5+0.05	0.5+0.10	0.02+0.001
1.0000mF	0.2+0.05	0.5+0.05	0.5+0.10	0.02+0.001
10.000mF	0.5+0.20	0.5+0.30	1.0+0.50	0.02+0.001
TH1963A				
1.0000nF			1.0+0.50	0.02
10.000nF			0.5+0.10	0.02
100.00nF			0.5+0.10	0.02
1.0000uF			0.5+0.10	0.02
10.000uF			0.5+0.10	0.02
100.00uF			0.5+0.10	0.02
1.0000mF			0.5+0.10	0.02
10.000mF			1.0+0.50	0.02

### 2.1.8 AC Voltage Test Specifications [6] [9] [10]

Frequency/Range	24 hours TCAL ±1 °C	90 days TCAL ±5 °C	1 year TCAL ±5 °C	Temperature coefficient/ °C
TH1953				
3 Hz - 5 Hz	1.00+0.02 <sup>[3]</sup>	1.00+0.03	1.00+0.03	0.100 + 0.003 <sup>[2]</sup>
5 Hz - 10 Hz	0.38+0.02 <sup>[3]</sup>	0.38+0.03	0.38+0.03	0.035 + 0.003 <sup>[2]</sup>
10Hz - 20kHz	0.07+0.02 <sup>[3]</sup>	0.08+0.03	0.09+0.03	0.005 + 0.003 <sup>[2]</sup>
20kHz - 50kHz	0.13+0.04 <sup>[3]</sup>	0.14+0.05	0.15+0.05	0.011 + 0.005 <sup>[2]</sup>
50kHz - 100kHz	0.58+0.08 <sup>[3]</sup>	0.63+0.08	0.63+0.08	0.060 + 0.008 <sup>[2]</sup>
100kHz - 300kHz	4.00+0.50 <sup>[3]</sup>	4.00+0.50	4.00+0.50	0.200 + 0.020 <sup>[2]</sup>
TH1963				
3 Hz - 5 Hz	1.00+0.02	1.00+0.02	1.00+0.03	1.00+0.03
5 Hz - 10 Hz	0.35+0.02	0.35+0.03	0.35+0.03	0.35+0.03
10Hz - 20kHz	0.04+0.02	0.05+0.03	0.06+0.03	0.05+0.03

20kHz - 50kHz	0.10+0.04	0.11+0.05	0.12+0.05	0.11+0.05
50kHz - 100kHz	0.55+0.08	0.60+0.08	0.60+0.08	0.60+0.08
100kHz - 300kHz	4.00+0.50	4.00+0.50	4.00+0.50	0.200+0.020
<b>TH1963A</b>				
3 Hz - 5 Hz	1.00+0.02	1.00+0.03	1.00+0.03	0.100+0.003
5 Hz - 10 Hz	0.38+0.02	0.38+0.03	0.38+0.03	0.035+0.003
10Hz - 20kHz	0.06+0.02	0.07+0.03	0.09+0.03	0.005+0.003
20kHz - 50kHz	0.13+0.04	0.14+0.05	0.15+0.05	0.011+0.005
50kHz - 100kHz	0.58+0.08	0.63+0.08	0.63+0.08	0.060+0.008
100kHz - 300kHz	4.00+0.50	4.00+0.50	4.00+0.50	0.200+0.020

### 2.1.9 AC Current Specifications <sup>[6] [10] [11]</sup>

<b>TH1953/1963/A</b>					
Frequency/Range		24 hours TCAL ± 1 °C	90 days TCAL ± 5 °C	1 year TCAL ± 5 °C	Temperature Coefficient/ °C
Range	Voltage Drop				
100µA, 1mA, 10mA and 100mA	< 0.011 V, < 0.11 V, < 0.05 V, < 0.5 V				
3Hz-5kHz		0.10+0.04	0.10+0.04	0.10+0.04	0.015+0.006
5kHz -10kHz		0.10+0.04	0.10+0.04	0.10+0.04	0.030+0.006
1A Range	<0.7V				
3Hz-5kHz		0.10+0.04	0.10+0.04	0.10+0.04	0.015+0.006
5kHz -10kHz		0.10+0.04	0.10+0.04	0.10+0.04	0.030+0.006
3A Range	<2.0V				
3Hz-5kHz		0.23+0.04	0.23+0.04	0.23+0.04	0.015+0.006
5kHz -10kHz		0.23+0.04	0.23+0.04	0.23+0.04	0.030+0.006
10A Range					
3Hz-5kHz		0.15+0.04	0.15+0.04	0.15+0.04	0.015+0.006
5kHz -10kHz		0.15+0.04	0.15+0.04	0.15+0.04	0.030+0.006

### 2.1.10 Frequency Test Count Specifications [13] [14]

Frequency/Range	24 hours TCAL ± 1 °C	90 days TCAL ± 5 °C	1 year TCAL ± 5 °C	2 year TCAL ± 5 °C	Temperature Coefficient/° C
<b>TH1953</b>					
3Hz-10Hz	0.100	0.100	0.100	0.100	0.0002
10Hz-100Hz	0.030	0.030	0.030	0.035	0.0002
100Hz-1kHz	0.003	0.010	0.012	0.017	0.0002
1kHz-300kHz	0.002	0.008	0.012	0.017	0.0002
方波 <sup>[15]</sup>	0.001	0.008	0.012	0.017	0.0002
<b>TH1963</b>					
3Hz-10Hz	0.100	0.100	0.100	0.100	0.0002
10Hz-100Hz	0.030	0.030	0.030	0.035	0.0002

100Hz-1kHz	0.003	0.008	0.010	0.015	0.0002
1kHz-300kHz	0.002	0.006	0.010	0.015	0.0002
Square Wave <sup>[15]</sup>	0.001	0.006	0.010	0.015	0.0002
TH1963/A					
3Hz-10Hz	0.100	0.100	0.100	0.100	0.0002
10Hz-100Hz	0.030	0.030	0.030	0.035	0.0002
100Hz-1kHz	0.003	0.010	0.012	0.017	0.0002
1kHz-300kHz	0.002	0.008	0.012	0.017	0.0002
Square Wave <sup>[15]</sup>	0.001	0.008	0.012	0.017	0.0002

Additional Selection Errors			
Frequency	1 second	0.1 second	0.01 second
2-10Hz	0	0.200	0.200
10-100 Hz	0	0.060	0.200
100Hz-1kHz	0	0.020	0.200
1-300kHz	0	0.004	0.030
Square Wave <sup>[15]</sup>	0	0	0

[1]. For DC: The specifications are valid after 60 minutes warm-up, with the integration time set to 10 or 100 NPLC, and auto-zero enabled. For AC: Specifications valid after 60 minutes warm-up, slow AC filtering, sine wave.

[2]. Outside of the TCAL  $\pm 5$  °C range, each 1 °C change in temperature increases the factor by 1.

[3]. Relevant calibration standards.

[4]. Minimum data change that can be displayed.

[5]. Full scale accuracy, NULL (clear) operation is required for better accuracy.

[6]. DC 1000V, AC 750V, AC current 3A and DC current 3A can only be tested at 5% of over-range.

[7]. For resistance measurements, resistance values greater than 100 k $\Omega$  are best tested using shielded lines. This is because cutting the magnetic field will generate induced currents, and the test current for large resistors is relatively small, which will cause the signal-to-noise ratio to be smaller, and thus the test will be unstable.

[8]. The specifications apply to 4-wire or 2-wire (operational bias clearing) resistance measurements. The 2-wire resistance measurement adds an additional 0.2 $\Omega$  of error when clearing is not activated.

[9]. Specifications are valid for sine wave inputs  $>0.3\%$  of range and greater than 1 mVrms. 750-ACV range is limited to 8 x Volt-Hz.

[10]. Low frequency performance: Three filter settings are provided: 3 Hz, 20 Hz, and 200 Hz. Frequencies above the filter settings are specified without additional error.

[11]. Technical specifications are valid for sine wave inputs >1% of range and >10µA AC. 10A range is available on the front-end connector only.

[12]. The specifications apply to the voltage measured at the input. a 1mA test current is typical. Changes in the current source will cause the voltage drop across the diode junction to change.

[13]. Unless otherwise stated, the specifications are valid after a 60-minute warm-up period and with a sine wave input. Specifications apply to 1s selective time (7 digits). Signal greater than 10% of selected range.

[14]. For sine and square wave inputs >100 mV, multiply % of reading error by 10 for 10 mV to 100 mV inputs.

[15] The square wave input is specified as 10Hz-300kHz.

[16] Test high current sampling resistor will heat up and cause resistance changes, so high current is not suitable for long time loading, generally do not exceed 30 seconds.

## 2.2 Additional Specifications

Display of readings and measuring speed

### (TH1953) DC resistance, DC voltage<sup>[1]</sup>

Point Time	Default Bits <sup>[2]</sup>	Readings/Second <sup>[3]</sup>	System Speed <sup>[4]</sup>	Additional Error
100PLC/2s(1.67s)	5 1/2	0.5(0.6)	0.5(0.6)	0
10PLC/200ms(167ms)	5 1/2	5(6)	5(6)	0
1PLC/20ms(16.7ms)	4 1/2	45(55)	45(55)	0.001% range
0.2PLC/4ms	3 1/2	300	50	0.001% range <sup>[5]</sup>
0.02PLC/400µs	3 1/2	1000	50	0.01% range <sup>[5]</sup>

### (TH1963/A) DC resistance, DC voltage, DC current<sup>[1]</sup>

Point Time	Default Bits <sup>[2]</sup>	Readings/Second <sup>[3]</sup>	System Speed <sup>[4]</sup>	Additional Error
100 PLC/2s (1.67s)	6 1/2	0.5 (0.6)	0.5 (0.6)	0
10PLC/200ms (167ms)	6 1/2	5(6)	5(6)	0
1PLC/20ms (16.7ms)	5 1/2	45 (55)	45 (55)	0.001% range

0.2PLC/4ms	4 1/2	200	50	0.001% range <sup>[5]</sup>
0.02PLC/400μs	4 1/2	1000	50	0.01% range <sup>[5]</sup>

**(TH1953/1963/A) DC current**

Point Time	Default Bits <sup>[2]</sup>	Readings/Second <sup>[3]</sup>	System Speed <sup>[4]</sup>	Additional Error
100PLC/2s(1.67s)	5 1/2	0.5(0.6)	0.5(0.6)	0
10PLC/200ms(167ms)	5 1/2	5(6)	5(6)	0
1PLC/20ms(16.7ms)	4 1/2	45(55)	45(55)	0.001% range
0.2PLC/4ms	3 1/2	200	50	0.001% range <sup>[5]</sup>
0.02PLC/400μs	3 1/2	1000	50	0.01% range <sup>[5]</sup>

**AC voltage, AC current<sup>[2][3]</sup>**

Full scale display	Default display	Readings/second	Speed
1199999	119999	7 seconds/reading <sup>[6]</sup>	Slow
1199999	119999	1 <sup>[6]</sup>	Medium
1199999	119999	1.6 <sup>[6]</sup>	Fast
1199999	119999	10	Fast <sup>[7]</sup>
1199999	119999	50	Fast <sup>[8]</sup>

[1]. 60-Hz and 50-Hz operating reading rate, turn off auto-zero, within fixed range.

[2]. The number of display digits in the case of automatic display digits, or the number of display digits that will not change depending on the test speed if fixed digits is selected.

[3]. The average speed of successive ADC samples until the data is sent to the display.

[4]. Read data through commands.

[5]. Increase DCV by 20 μV; increase resistance by 20 mΩ. Increase DCA by 0.2 μA and increase range error by a factor of 10 for 100 μA, 10 mA range.

[6]. Read the stabilized data. The actual ADC sampling speed is faster than the stabilization speed.

[7]. For external triggering or remote operation, use the default stabilized delay (auto delay).

[8]. Use the default maximum value, set the delay to fail.

## Chapter 3 Instructions for Use

When using this instrument for the first time, you should first familiarize yourself with the functions of the front panel buttons and symbols. We have written this chapter to enable you to better familiarize yourself with the use of this multimeter.

### 3.1 Front Panel Menu Reference

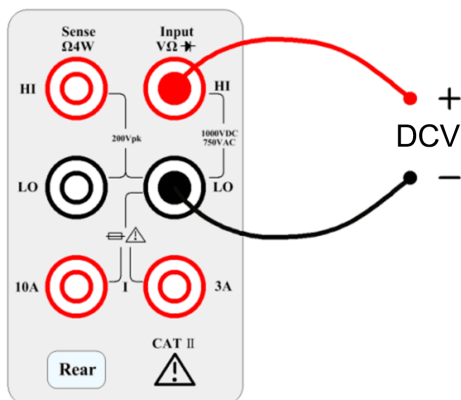
Keys	Application
DCV (DCI)	Configure DC voltage measurement, including DC proportional measurement Range: 100mV, 1V, 10V, 100V, 1000V Default auto range adjustment NPLC: {0.02, 0.2, 1, 10, 100} default 10PLC Auto-zero: off or on (default on) Input impedance: 10M or HighZ (>1G) DC Ratio: off (default) or on
Shift+DCV(DCI)	Configure DC current measurement Range: 3A terminal (100uA, 1mA, 10mA, 100mA, 1A, 3A) Auto range (default) 10A port 10A range NPLC: {0.02, 0.2, 1, 10, 100} default 10PLC Default auto range adjustment NPLC: {0.02, 0.2, 1, 10, 100} default 10PLC Auto-zero: off or on (default on)
ACV (ACI)	Configuration of ACV AC voltage Range: Auto (default), 100mV, 1V, 10V, 100V, 750V Filter: 3Hz (slow) 20Hz (medium, slow) 200Hz (fast, medium, slow) Default: 20 Hz filter, medium test speed
Shift+ACV(ACI)	Configure AC current measurement Test terminals: 3A 10A Range: 3A terminal (100uA, 1mA, 10mA, 100mA, 1A, 3A) Auto range (default) 10A port 10A range Filter: 3Hz (slow) 20Hz (medium, slow) 200Hz (fast, medium, slow) Default: 20 Hz filter, medium test speed
$\Omega$ 2W ( $\Omega$ 4W)	Configure two-wire resistance testing Range: Auto range (default) {10 $\Omega$ , 100 $\Omega$ , 1k $\Omega$ , 10k $\Omega$ , 100k $\Omega$ , 1M $\Omega$ , 10M $\Omega$ , 100M $\Omega$ } NPLC: {0.02, 0.2, 1, 10, 100} default 10PLC Auto-zero: off or on (default on)
Shift+ $\Omega$ 2W( $\Omega$ 4W)	Configure four-wire resistance testing

	<p>Range: Auto range (default) {10Ω, 100Ω, 1kΩ, 10kΩ, 100kΩ, 1MΩ, 10MΩ, 100MΩ}</p> <p>NPLC: {0.02, 0.2, 1, 10, 100} default 10PLC</p>
Freq (Temp)	<p>Configure frequency and period measurement</p> <p>Filter: 3Hz, 20Hz, 200Hz</p> <p>Gating time: 10ms, 100ms (default), 1s</p>
Shift+Freq (Temp)	<p>Configure Temperature Test</p> <p>Probe type: 2-wire test (default) or 4-wire test</p> <p>R0:resistance at 0°C, default 100Ω</p> <p>NPLC: {0.02, 0.2, 1, 10, 100} default 10PLC</p> <p>Units: °C, °F, K</p>
Count (diode)	<p>Conduction (continuity) configuration</p> <p>Test range 1kΩ</p> <p>Test current 1mA</p> <p>Buzzer: On (default) or Off</p> <p>Gate Valve: default 10Ω, can be set additionally</p>
Shift+Cont (diode)	<p>Diode configuration</p> <p>Test voltage range 0~5V</p> <p>Test current 1mA</p> <p>Buzzer: On (default) or Off</p>
CAP(MATH)	<p>Capacitance measurement configuration</p> <p>Range: Auto (default) {1nF, 10F, 100nF, 1uF, 10uF, 100uF, 1mF, 10mF}</p>
Shift+CAP(MATH)	<p>Math nulling calculation (NULL), you can set the parameter</p> <p>dB/dBm arithmetic</p> <p>Smoothing</p> <p>Scal: Mx+b, Percent</p> <p>Statistics</p> <p>Limit</p>
NULL(PrtSch)	<p>Mathematical zeroing calculations, where the value is the currently measured data.</p>
Shift+NULL(PrtSch)	<p>Print the image and save the current display screen</p>
R/S	<p>Run or Stop</p>
Trigger	<p>Single trigger</p>
Menu	<p>Menu settings</p> <p>Display: Display settings</p> <p>Acquire:</p> <p>Utility:</p>

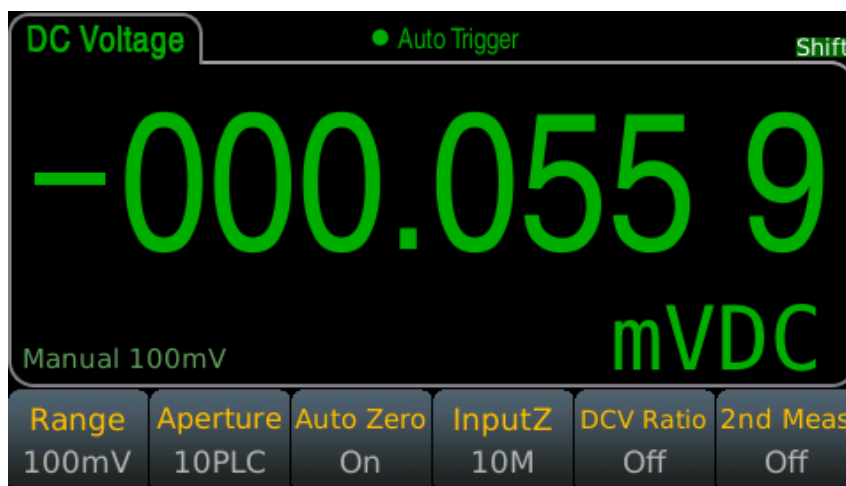
## 3.2 Measurement

### 3.2.1 DC Voltage

**Step 1:** Connect the input terminals correctly as shown in the figure below.



**Step 2:** Enter the measurement interface, press the [DCV] button on the front panel to enter the DCV measurement function.

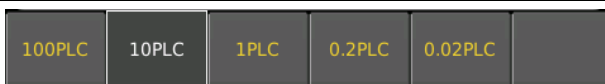


**Step 3:** Range selection, press Range to select the range. Auto range (Auto) automatically selects the appropriate range for measurement according to the size of the input signal. Auto range is adjusted upward to 120% of the current range and downward to 10% of the current range.



**Step 4:** Set the integration time.

The setting of the integration time affects the measurement speed and accuracy. The longer the integration time, the higher the accuracy but the slower the measurement speed. 1PLC, 10PLC, and 100PLC provide suppression of power supply noise. Selecting 100PLC will provide the best noise suppression, but it will be slow.



**Step 5: Auto Zero**

Auto-zeroing gives more accurate results but requires more test time. With auto-zero enabled, the internal offset of the multimeter is measured after each measurement of the input signal. The offset is then subtracted from the previous reading. This avoids the influence of offset voltages on the input circuitry of the digital multimeter on the accuracy of the measurement. With auto-zero, the digital multimeter measures the offset once and subtracts the offset from all subsequent measurements. Each time you change the function, range, or integration time, the digital multimeter makes a new offset measurement.

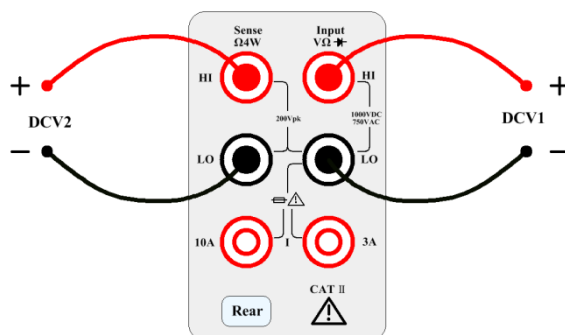
The red color marks the current auto-zeroing on, if you need OFF state just press the corresponding button, it will change from ON to OFF. The default state is ON.

**Step 6: Input Z Internal Resistance Selection**

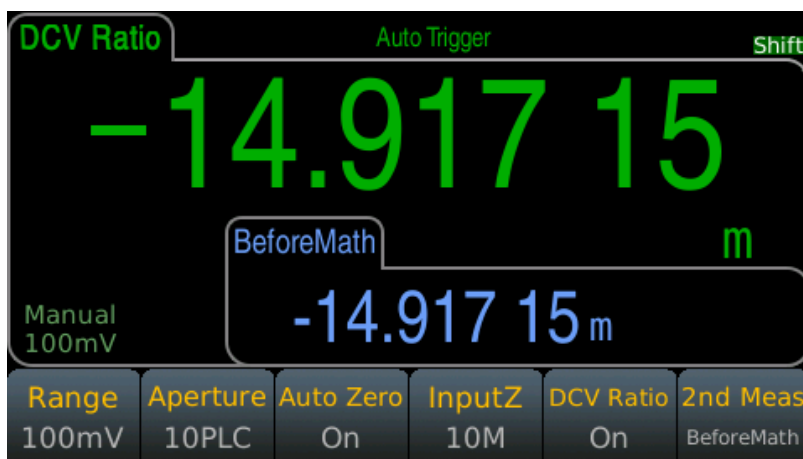
Select the data input impedance. The input impedance can be Auto or 10MΩ. Auto mode selects high impedance (HighZ) for 100mV, 1V, and 10V ranges. 100V and 1000V ranges internal resistance is a fixed 10MΩ.

**3.2.2 DCV Ratio**

**Step 1:** Connect the input terminals correctly.



**Step 2:** Turn on the DCV Ratio function.



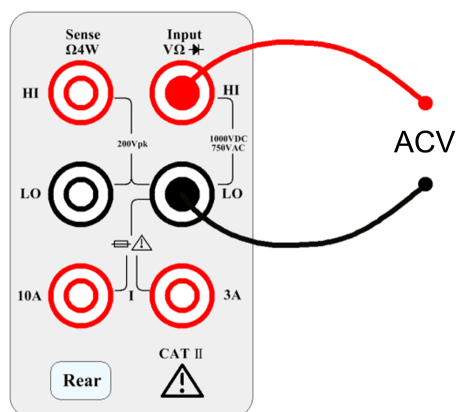
### 3.2.3 AC Voltage

This section describes how to configure AC voltage measurements.

Select the default delay to give the correct first reading for most measurements. For the most accurate measurements, the corresponding RC time constant must stabilize to 1/50th of the input AC signal level.

Signals greater than 300 V (RMS) or 1 A (RMS) cause self-heating of the signal conditioning element. These errors are included in the specifications of the instrument. Internal temperature variations caused by self-heating may cause additional errors in other functions or ranges. The additional errors typically disappear within a few minutes. For example, a 100mVAC signal with a 10 VDC bias. 10 VDC bias should stabilize at 1/50th of 100mVAC or 1/50th of 2mVDC. Sufficient additional delay should be given to allow the signal to stabilize after connecting the signal to the ACV input of the digital multimeter or after selecting the ACV function if the signal is already connected. If the DC bias remains constant, subsequent measurements can be made with complete accuracy without additional stabilization delays.

**Step 1:** Configure the test leads as follows.



**Step 2:** Press the [ACV] button on the front panel to enter the ACV test interface.



**Step 3:** Range Adjustment

Press Range and select the range. Auto range (Auto) automatically selects the

appropriate range for measurement based on the size of the input signal. Auto range is adjusted upward to 110% of the current range and downward to 10% of the current range.



**Step 4. AC Filter Selection**

The instrument offers a choice of 3Hz, 20Hz and 200Hz filters. The filter you choose should be smaller than the frequency of your test signal. In order to get stable data faster, it is better to choose a filter close to the test frequency of your input signal. For example, if your input signal is 300Hz, you can get the fastest stabilized data by selecting a 200Hz filter.

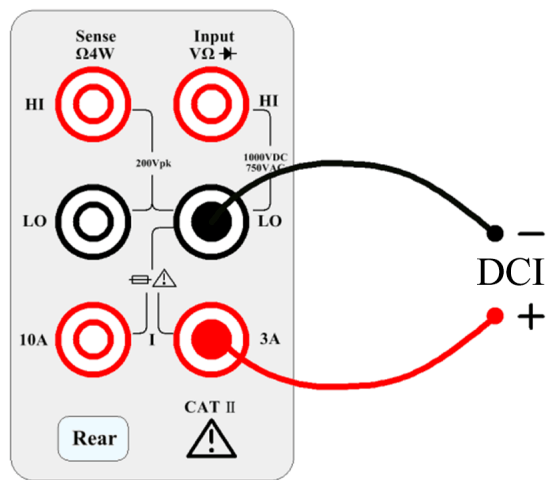
**Step 5. Selection of speed**

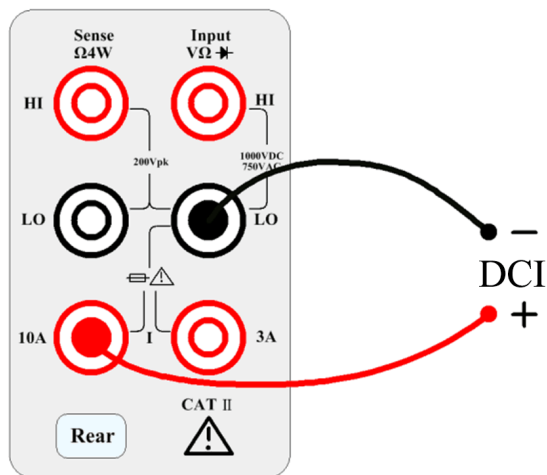
Filters	Slow	Medium	Fast
3Hz	√	-	-
20Hz	√	√	-
200Hz	√	√	√

Different filters have different test speeds, so choosing the appropriate measurement speed for the filter can result in more accurate test results or faster test speeds.

**3.2.4 DC Current**

Step 1: Configure the test leads as follows.





Step 2: Press shift button on the front panel and then press [DCV] to select the DCI function and enter the DCI measurement interface.

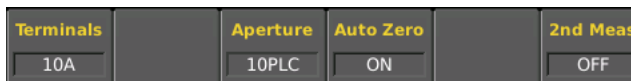
**Step 3: Select Range**

Terminals Select the input terminals for the test signal. If 10A input terminal is selected, there is only one range of 10A, if 3A input terminal is selected, there are multiple ranges, and only at this time you can select the auto range test.

The ranges that can be selected by selecting the 3A input terminal are as follows:



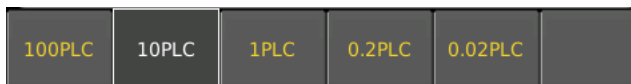
The ranges that can be selected by selecting the 10A input terminal are as follows:



If the 3A terminal is selected for the test configuration, there are several ranges to choose from, including 100uA, 1mA, 10mA, 100mA, 1A, 3A, or autoranging, as required.

**Step 4: Setting the integration time**

The setting of the integration time affects the measurement speed and accuracy. The longer the integration time, the higher the accuracy but the slower the measurement speed. 1PLC, 10PLC, and 100PLC provide suppression of power supply noise. Selecting 100PLC will provide the best noise suppression, but it will be slow.



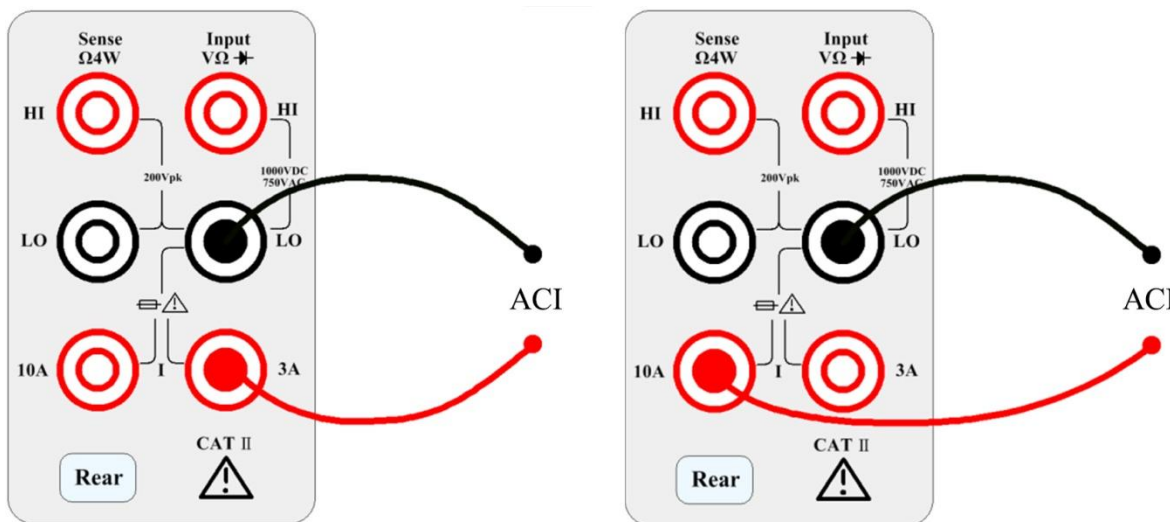
**Step 5: Auto Zero**

Terminals	Range	Aperture	Auto Zero		2nd Meas
3A	Auto	10PLC	OFF		OFF

Select whether to turn on auto-zeroing. Auto-zeroing gives more accurate test results but requires more test time. With auto-zero enabled, the internal offset of the multimeter is measured after each measurement of the input signal. The offset is then subtracted from the previous reading. This avoids the influence of offset voltages on the input circuitry of the digital multimeter on the accuracy of the measurement. With auto-zero, the digital multimeter measures the offset once and subtracts the offset from all subsequent measurements. Each time you change the function, range, or integration time, the digital multimeter makes a new offset measurement.

### 3.2.5 AC Current

**Step 1:** Configure the test leads as follows.



**Step 2:** Press the [shift+ACV] button on the front panel to enter the ACI test interface.



**Step 3: Range Adjustment**

Press Range and select the range. Auto range (Auto) automatically selects the appropriate range for measurement based on the size of the input signal. Auto range is adjusted upward to 110% of the current range and downward to 10% of the current range.



**Step 4: AC Filter Selection**

The instrument offers a choice of 3Hz, 20Hz and 200Hz filters. The filter you choose should be smaller than the frequency of your test signal. In order to get stable data faster, it is better to choose a filter close to the test frequency of your input signal. For example, if your input signal is 300Hz, you can get the fastest stabilized data by selecting a 200Hz filter.

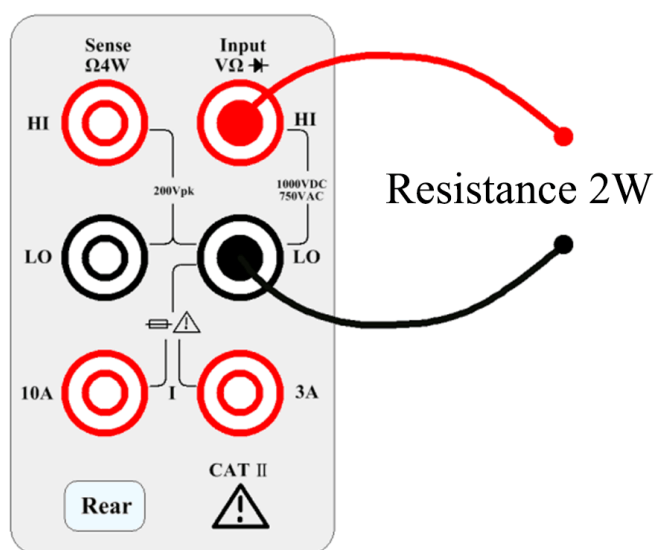
**Step 5: Speed Selection**

Filters	Slow	Medium	Fast
3Hz	√	-	-
20Hz	√	√	-
200Hz	√	√	√

Different filters have different test speeds, so choosing the appropriate measurement speed for the filter can result in more accurate test results or faster test speeds.

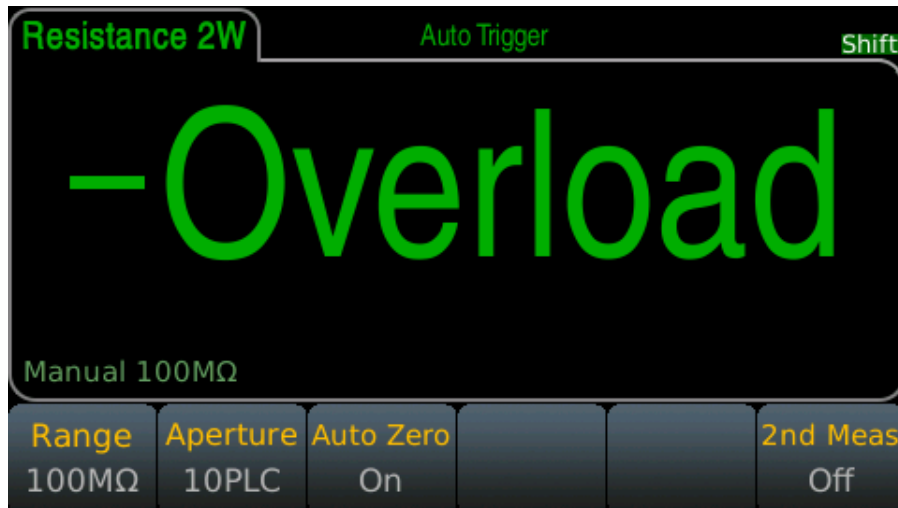
**3.2.6 Two-wire Resistance**

**Step 1:** Configure the test leads as follows.

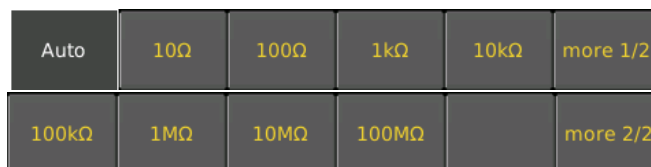


**Step 2:** Press the [**Ω2W**] button on the front panel to enter the two-wire resistance

test interface.



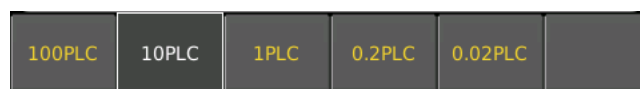
**Step 3: Range Selection**



Press Range and select the range. Auto range (Auto) automatically selects the appropriate range for measurement based on the size of the input signal. Auto range is adjusted upward to 110% of the current range and downward to 10% of the current range.

**Step 4: Setting the Integration Time**

The setting of the integration time affects the measurement speed and accuracy. The longer the integration time, the higher the accuracy but the slower the measurement speed. 1PLC, 10PLC, and 100PLC provide suppression of power supply noise. Selecting 100PLC will provide the best noise suppression, but it will be slow.



**Step 5: Auto Zero**

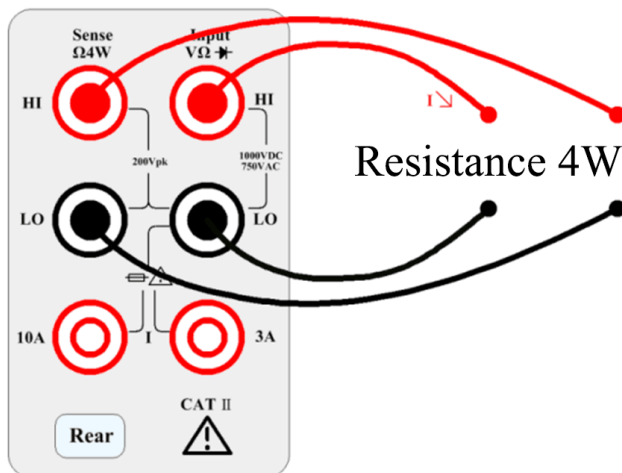


Auto-zeroing gives more accurate results but requires more test time. With auto-zero enabled, the internal offset of the multimeter is measured after each measurement of the input signal. The offset is then subtracted from the previous reading. This avoids the influence of offset voltages on the input circuitry of the digital multimeter on the accuracy of the measurement. With auto-zero, the digital multimeter measures the offset once and subtracts the offset from all subsequent measurements. Each time you change the function, range, or integration time, the digital multimeter

makes a new offset measurement.

### 3.2.7 Four-wire Resistance

**Step 1:** Configure the test leads as shown at right.



**Step 2:** Press the [Shift]+[Ω2W] buttons on the front panel to enter the four-wire resistance test interface.



**Step 3:** Range Selection

Auto	10Ω	100Ω	1kΩ	10kΩ	more 1/2
100kΩ	1MΩ	10MΩ	100MΩ		more 2/2

Press Range and select the range. Auto range (Auto) automatically selects the appropriate range for measurement based on the size of the input signal. Auto range is adjusted upward to 110% of the current range and downward to 10% of the current range.

**Step 4:** Setting the Integration Time

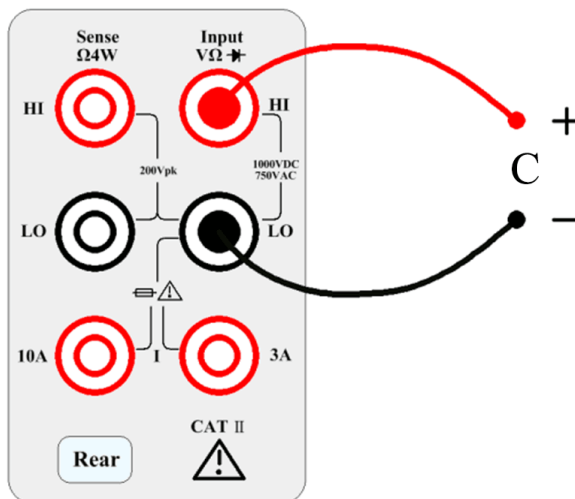
The setting of the integration time affects the measurement speed and accuracy.

The longer the integration time, the higher the accuracy but the slower the measurement speed. 1PLC, 10PLC, and 100PLC provide suppression of power supply noise. Selecting 100PLC will provide the best noise suppression, but it will be slow.

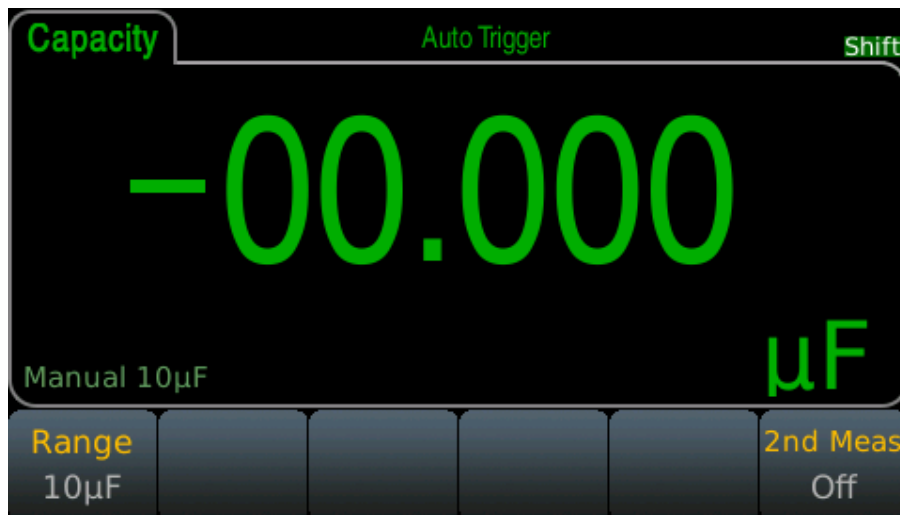


### 3.2.8 Capacitance Test

**Step 1:** Configure the test leads as shown at right.



**Step 2:** Press the button  $\leftarrow$  on the front panel to enter the capacitance test interface.



**Step 3:** Range Selection



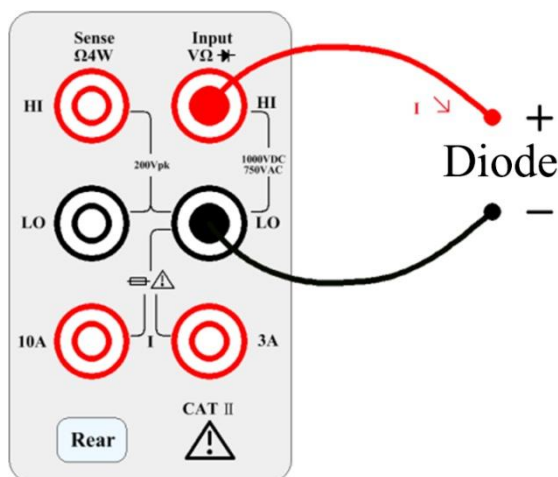
Press Range and select the range. Auto range (Auto) automatically selects the

appropriate range for measurement based on the size of the input signal. Auto range is adjusted upward to 110% of the current range and downward to 10% of the current range.

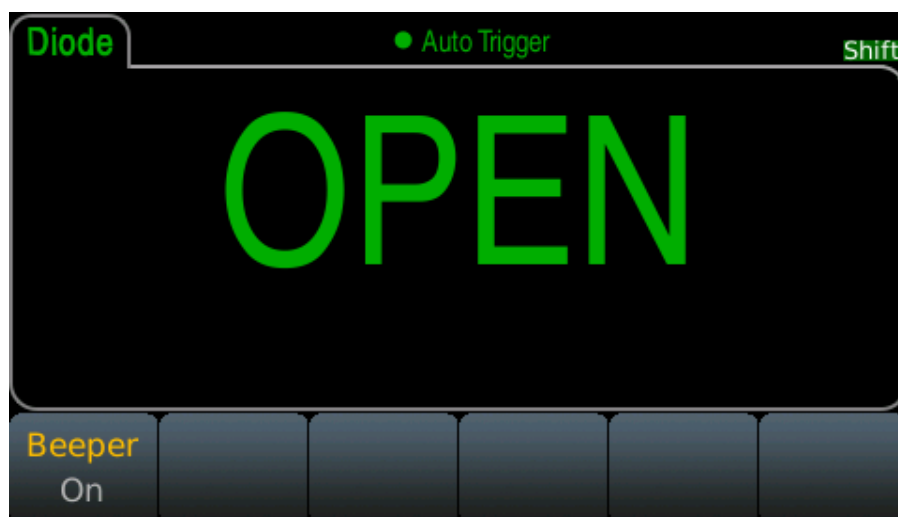
### 3.2.9 Diodes

This section describes how to configure the diode test from the front panel. The range and resolution are fixed, and the range is 10 VDC (with a 1mA current source output).

**Step 1:** Configure the test leads as shown at right.



**Step 2:** Press [Shift]+[Cont] to enter the diode test interface.



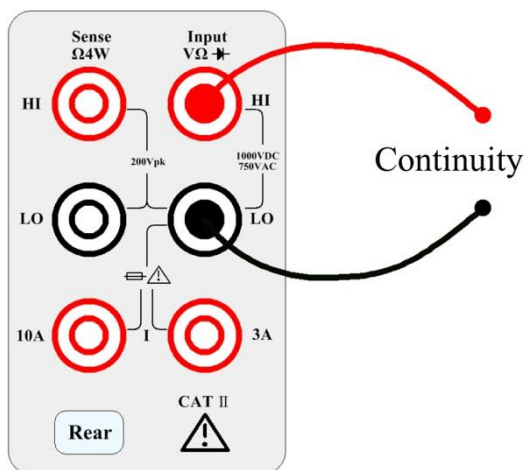
Beeper is the on/off menu for the beeper, if ON is displayed it means the beeper is on. The instrument beeps (if beeping is enabled) when switching to a 0.3 V to 0.8 V thresholds. 0 to 5 V voltages are displayed on the front panel. OPEN is displayed on the front panel when the measured on-state voltage is greater than 5 V. The instrument beeps (if beeping is enabled) when the conversion is from 0.3 V to 0.8 V thresholds.

**Note:** Generally, the diode conduction voltage is between 0.3 and 0.8, so the choice here is to beep only when it is between 0.3V and 0.8V.

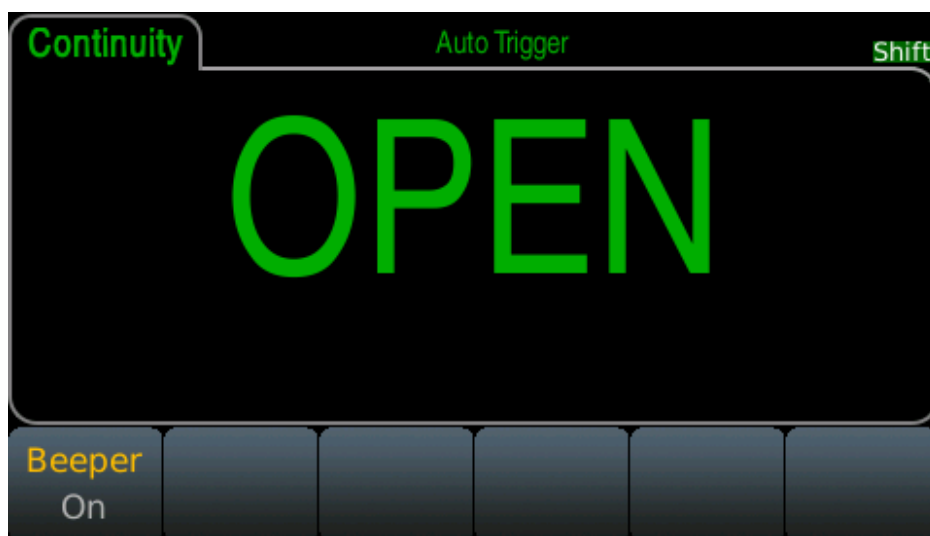
### 3.2.10 Continuity

This section describes how to configure the continuity test from the front panel.

**Step 1:** Configure the test leads as shown below.



**Step 2:** Press [Cont] on the front panel to open a menu that specifies whether the digital multimeter will beep to indicate continuity.



Continuity is measured as follows:

$\leq 10\Omega$  displays the measured resistance and beeps (if the buzzer is enabled).

$10\Omega$  to  $1.2\text{ k}\Omega$  display the measured resistance without beeping

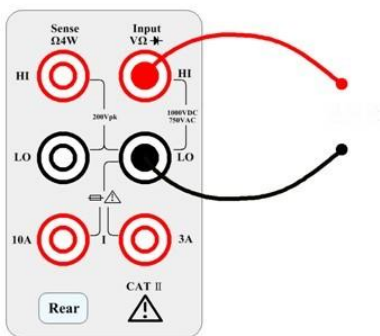
$>1.2\text{ k}\Omega$  display OPEN, no beeping.

### 3.2.11 Temperature testing

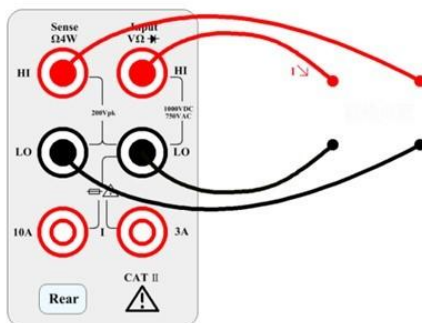
This section describes how to configure 2-wire and 4-wire temperature measurement from the front panel.

**Step 1:** Configure the test leads as follows:

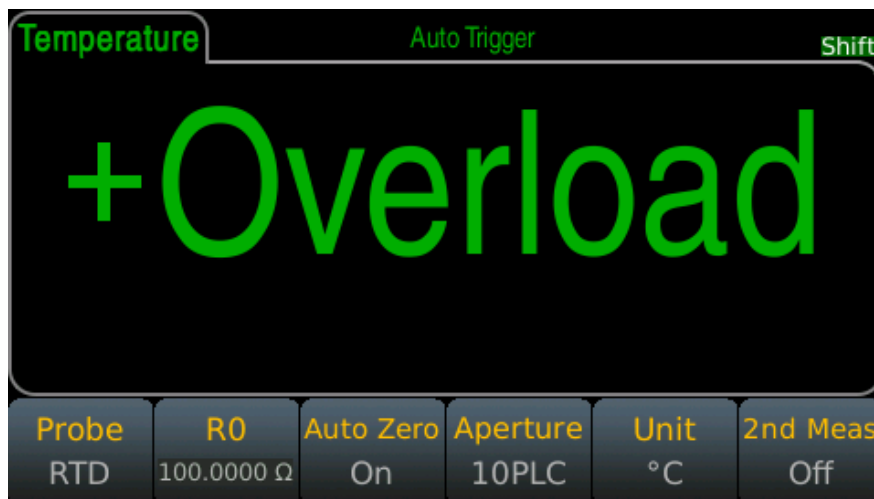
2-line temperature:



4-line temperature:



**Step 2:** Press [Temp] on the front panel. The following menu will appear. Note that the Auto Zero softkey is only available for 2-wire measurements.



**Step 3:** Press Probe and select the probe type. If you choose to use an RTD, this menu will have a softkey specifying the resistance of the RTD at 0 degrees Celsius (R0).

**Step 4:** Specify whether you want to use Auto Zero. Automatic zeroing provides the most accurate measurements but requires more time to perform a zero measurement.

With auto-zero enabled, the digital multimeter internally measures the offset after each measurement. That measurement is then subtracted from the previous reading.

This prevents offset voltage on the digital multimeter (DMM) input circuitry from affecting measurement accuracy. With auto-zero disabled, the DMM measures the offset once and subtracts the offset from all subsequent parameter measurements. Each time you change the function, range, or integration time, the digital multimeter makes a new offset measurement.

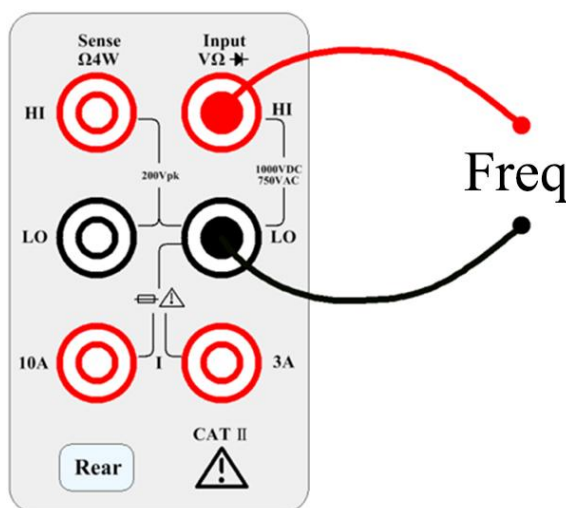
**Step 5:** Press Aperture and select the number of power line cycles (PLC) to use for measurement. Only 1, 10, and 100 PLCs provide normal mode (line frequency noise) rejection. Selecting 100 PLC provides the best noise rejection and resolution, but the slowest measurement speed.

**Step 6:** Use the Units softkey to display the Celsius, Fahrenheit, or Kelvin temperature.

### 3.2.12 Frequency Measurement

This section describes how to configure frequency and period measurements from the front panel.

**Step 1:** Configure the test leads as follows.



**Step 2:** Press the [Freq] button to enter frequency measurement.

Use the Type softkey to select either frequency or period measurements. Under Type, Freq displays frequency measurements and Period displays period measurements.

Type	Range	AC Filter	Gate Time	2nd meas
Freq	Auto	>20Hz	100ms	BeforeMath

**Step 3:** Range Adjustment

Press Range and select the range. Auto range (Auto) automatically selects the appropriate range for measurement based on the size of the input signal. Auto range is adjusted upward to 110% of the current range and downward to 10% of the current range.



**Step 4: AC Filter Selection**

The instrument offers a choice of 3Hz, 20Hz and 200Hz filters. The filter you choose should be smaller than the frequency of your test signal. In order to get stable data faster, it is better to choose a filter close to the test frequency of your input signal. For example, if your input signal is 300Hz, you can get the fastest stabilized data by selecting a 200Hz filter.

**Step 5: Speed Selection**

Filters	Slow	Medium	Fast
3Hz	√	-	-
20Hz	√	√	-
200Hz	√	√	√

Different filters have different test speeds, so choosing the appropriate measurement speed for the filter can result in more accurate test results or faster test speeds.

**Step 6: Second Display**



OFF does not show the second display.

BeforeMath displays the raw data before the math calculation.

AC Voltage displays the measured voltage.

Period displays the period during the frequency measurement.

Frequency displays the frequency during the period measurement.

## Chapter 4 Display Settings

Menu→Display to enter the display setting interface

### 4.1 Display Mode Selection

The display mode is numeric by default. It can be switched by Menu→Display→Display. This product provides four modes for selection: numerical value, bar graph, trend graph, and histogram.

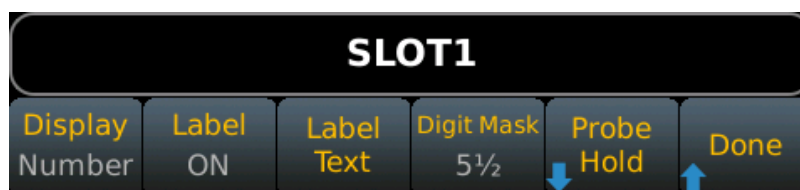
#### 4.1.1 Numerical Value

Default display mode shows the measured value.



##### 4.1.1.1 Label

Add a text label with customizable label content to mark the current DMM. Open via Menu→Display→Label. Edit via Menu→Display→Label Text.



##### 4.1.1.2 Digits

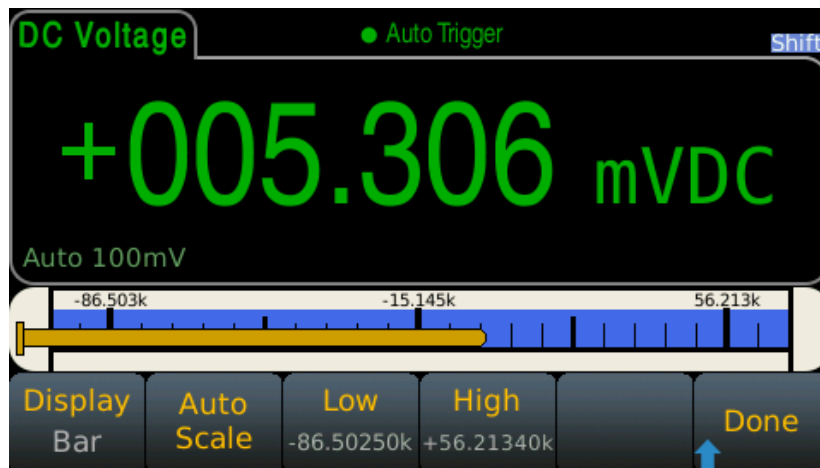
Set via Menu→Display→Digit Mask to modify the precision of the currently displayed value. If set to Auto, the number of digits is automatically adjusted according to the measurement speed.

##### 4.1.1.3 Probe Hold

Set via Menu→Display→ProbeHold. When it is turned on, the measurement data will be judged, and if the difference between the maximum and minimum values of the measurement data is less than the set ratio, it will enter the hold state and record the data; otherwise it will exit the hold state.

## 4.1.2 Bar Graph

Bar graph mode is used to display the position of the current measured value within the set interval.

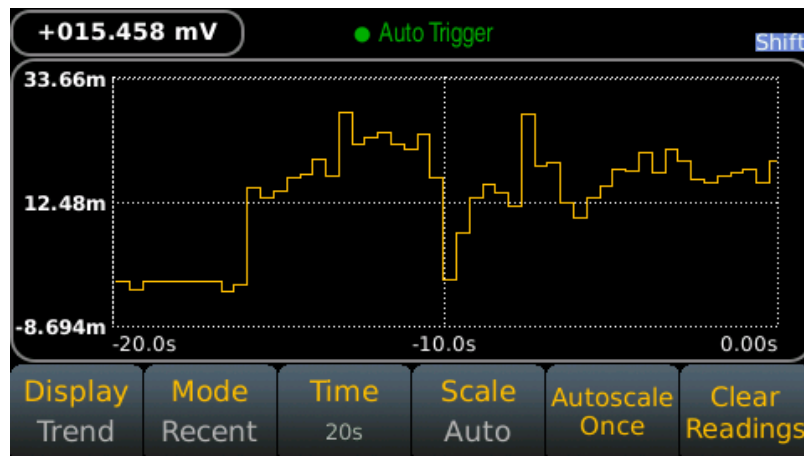


### 4.1.2.1 Interval Setting

Set to auto scale by Menu→Display→AutoScale. The maximum value of the measured value is taken as the maximum and minimum value of the bar graph interval. The interval can also be set manually by Menu→Display→Low and Menu→Display→High.

## 4.1.3 Trend Graph

Trend graph mode is used to display the trend of the measured values.



### 4.1.3.1 Mode Setting

Set via Menu→Display→Mode. Set the trend graph display data as all measurement data or current time measurement data. If the mode is current, set the time period via Menu→Display→Time.

### 4.1.3.2 Calibration Setting

Set via Menu→Display→Scale. Set the vertical coordinate of the trend graph.

## 4.1.4 Histogram

Histogram mode is used to display the distribution of measured values.



### 4.1.4.1 Column Count Settings

Set via Menu→Display→Bins. Set the number of histogram bars.

### 4.1.4.2 Gaussian Curve Settings

Set via Menu→Display→GaussCurve. Set the Gaussian curve display on or off.

## Chapter 5 Mathematical Operation

Shift+CAP to enter the settings interface of math operations.



### 5.1 Null Operation (Null)

The Null operation means that a reference value is subtracted from the measured value. When the Null function is used, the instrument takes the current reading as the reference value, and all subsequent readings are subtracted from the actual input value.

Display reading = actual reading - reference value

Different reference values can be set for different measurement functions; however, once the reference value is set, it is the same for all ranges under that function.

Using the Null function does not increase the maximum allowable input signal for that range.

### 5.2 Statistics

Record the minimum (Min), maximum (Max), peak to peak (P-P), average (Average), standard deviation (Std dev) and total number of samples in the current reading buffer.

The readout buffer can hold up to 10,000 pieces of data. When the readout buffer overflows, the oldest data will be discarded. Changing any parameter that affects the measurement will empty the reading buffer.

### 5.3 Limits

Limit tests allow the user to perform Pass, and Fail tests, i.e. binning. By setting the upper and lower limit values, the measurements obtained are in the HI, IN, or LO intervals. Example:

Low Limit = 580; High Limit = 600. a reading of 0.59 kΩ is 590Ω (IN).

### 5.4 dB Operation

Each dB measurement is the difference between the input signal and the stored reference (both converted to dBm):

dB = reading in dBm - reference in dBm

The relative value must be between -200 and +200 dBm (default 0). You can

measure this value by pressing **Measure Ref Value** or enter a specified value.

## 5.5 dBm Operation

The dBm function is a logarithmic expression that compares the amount of power passed to the reference resistor, relative to 1 mW:

$$\text{dBm} = 10 \times \log_{10} (\text{reading}^2 / \text{reference resistance} / 1 \text{ mW})$$

## 5.6 mX+b Operation

This math function provides the following calculation of the on-screen reading (X):

$$Y = mX + b$$

Where: X is the general display reading on the display.

m and b are parameters that have user input.

Y is the result displayed on the screen after the calculation.

## 5.7 Percent Operation

The Percent calculation is based on the reference value you set and will be performed as follows:

$$\text{Percent} = \frac{\text{input} - \text{reference}}{\text{reference}} \times 100\%$$

Where: Input is the general display reading shown on the screen

Reference is a parameter entered by the user

Percent is the displayed calculation result

## Chapter 6 Interfaces

### 6.1 RS-232 Interface

The serial communication standard that is widely used today is the RS-232 standard, which can also be called the asynchronous serial communication standard and is used to realize data communication between computers and computers, and between computers and peripherals. RS for the "Recommended Standard" (Recommended Standard) acronym, 232 is the standard number, the standard is the U.S. Electronic Industries Association (EIA) in 1969 formally announced the standard, which provides for one bit of data each time by a data line transmission.

Most serial port configurations are usually not strictly based on the RS-232 standard; Use 25-pole connectors at each port (IMB AT uses 9-pole connectors). The most commonly used RS-232 signals are shown in the table:

Code	Notation	25-pole connector pin number	9-pole connector pin number
Request Sent	RTS	4	7
Clear Send	CTS	5	8
Data Setup Ready	DSR	6	6
Data Carrier Detection	DCD	8	1
Data Terminal Ready	DTR	20	4
Send Data	TXD	2	3
Receive Data	RXD	3	2
Grounding	GND	7	5

As with most serial ports in the world, the instrument's serial interface is not strictly based on the RS-232 standard, but only a minimal subset is provided. The table below:

Code	Notation	Connector Pin Number
Send Data	TXD	3
Receive Data	RXD	2
Grounding	GND	5

This is the easiest and cheapest way to communicate using the serial port.

**Note:** The serial port pin definitions of this instrument are the same as those of the connector for a standard 9-pole RS232C.



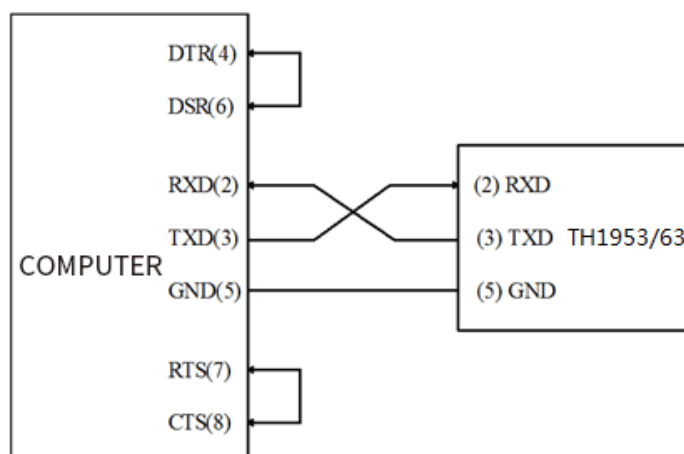
### Rear Panel Connector

Direct connection is possible using a standard 9-pole DB-type hole plug.

**警告**: To avoid electrical shock, turn off the power when plugging and unplugging the connectors; do not short the output terminals or short with the chassis at will to avoid damaging the device.

## 6.1.1 RS-232 Operation

(1). RS232 is connected to the computer as shown in the figure:



RS-232 Connection Diagram

As can be seen from the above figure, the pin definition of this instrument is the same as that of the 9-pole connector serial interface pin definition used by IMB AT-compatible machines. Users can use a two-core shielded cable to make their own three-wire connection cable as shown in the diagram (the length should be less than 1.5m) or purchase the serial interface cable between the computer and the instrument from our company.

When making your own connecting cable, note that you should short pins 4 and 6 and pins 7 and 8 on the computer connector.

(2). Data format for sending and receiving

TH1963/A uses a full-duplex asynchronous communication transmission method containing a start bit and a stop bit. The RS-232 data transmission format is: 8-bit (bit) data bits, 1-bit (bit) stop bit, no parity bit (bit), and the terminating character is <LF>

(line feed character, ASCII code 10).

### (3). Select Baud rate (Baud rate)

The baud rate is the rate at which the TH1963/A communicates with the computer; select an appropriate baud rate:

- 115200
- 57600
- 38400
- 19200
- 9600
- 4800

Note: The factory default baud rate is 9600.

When the user selects a baud rate, first make sure that the programmable controller (generally referred to as a computer) you connect to the TH1963/A can support the baud rate you select.

### (4). Follow these steps to configure the serial communications

Press Menu to enter the menu options, then select the Utility option to enter the utility setting interface, then select I/O config to enter the port configuration interface. Select the RS232 option to configure RS232 communication.

Select the Baudrate option to set the baud rate.

Select Data bits to select the data bits.

Parity selects the parity method, no parity bit by default.

Stop bits sets the stop bits, default 1 bit.

### (5). Software protocols

Since hardware communication checks are not used in the RS-232C interface, to minimize possible data loss or data errors in communication, this instrument uses character return for software contact. Refer to the following when preparing the computer communication software:

- Command string syntax and format are described in Chapter 6, "Command Reference".
- Commands sent by the host are transmitted in ASCII code and terminated with <LF> (i.e., line feed, ASCII code 10), and the instrument starts executing the command string after receiving the terminator.

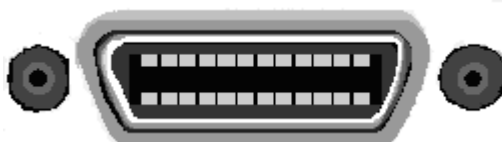
- Every time the instrument receives a character, it immediately sends the character back to the host, and the host should continue to send the next character after receiving this return character. If the return character is not received, the possible factors are:
  - Serial port connection failure: check whether the instrument has opened the RS232 interface function, whether the baud rate is correctly selected.
  - The instrument is executing a bus command and is temporarily unable to respond to serial reception. At this point, the last character sent is ignored by the instrument, and the host should resend the unreturned character if the command string is to be complete.
- This instrument sends information to the host computer only in the following two cases:
  - Command character normally received from the host, send back with that character.
  - Execute query commands and send query results to the host.
- Once the instrument executes the query command, it will send the query result immediately, regardless of whether the current command has been fully executed. Therefore, there can be multiple queries in a command string, but the host must have the corresponding number of read operations. This protocol recommends only one query in a command string.
- The query result is delivered as a string standardized in ASCII code, terminated by <LF> (i.e., line feed, ASCII code 10).
- When the instrument sends the query result, it is sent continuously (interval is about 1ms), and the host should be in the state of receiving data, otherwise it may cause data loss.
- After the host generates a query, it should ensure that it reads the empty query result (receiving <LF> to indicate the end) to avoid conflicts between the query and the return. Similarly, the host should read empty return characters before reading the query result.
- For some bus commands that take a long time to complete, such as reset, the host should actively wait or synchronize the execution of the previous command by responding to the user's keyboard input confirmation to avoid the next command being ignored or errors during the command execution.
- The communication software compiled with DOS application software should be run in a pure DOS environment that supports serial ports. If it is run under WINDOWS, errors may occur due to different management of serial ports.

## 6.2 Handler Interface

Many instruments are used in industrial control, in order to better use with the control signal, so increase the Handler interface to facilitate the use of instruments in the production line.

Because the space is limited, the same interface GPIB interface is used, and the same interface terminals are used.

12 1



24 13

Pin	Name	Function	Pin	Name	Function
1	PASS	Test OK.	13	START	External start signal
2	FALL	Test results are incorrect	14	EOC	Test end signal
3	HI0	Test results are on the large side	15	Front	Front panel indication signal
4	IN0	Test results are just right	16	Rear	Rear panel indication signal
5	LO0	Test results are on the small side	17	EXT_VCC	External power
6	PASS0	Test OK	18	EXT_VCC	External power
7	FALL0	Test failure	19	EXT_GND	External power ground
8	HI1	Test results are on the large side	20	EXT_GND	External power ground
9	IN1	Test results are just right.	21	VDD	Output power
10	LO1	Test results are on the small side	22	VDD	Output power
11	PASS1	Test OK	23	EGND	Connect to the earth
12	FALL1	test failure	24	EGND	Connect to the earth

The Handler interface trigger only makes sense when the Limit function is turned on.

IN means the test result is between the set upper and lower limits; LO means the test result is less than the lower limit; HI means the test result is greater than the upper limit.

PASS0, FALL0, IN0, LO0, HI0 indicate the test results of the front panel, and PASS1, FALL1, IN1, LO1, HI1 indicate the test results of the rear panel. When

selecting the front panel, the label of the rear panel has no meaning, and similarly when selecting the rear panel, the label of the front panel has no meaning.

Front indicates that the test is currently being performed on the front panel.

Rear indicates that the test is currently being performed on the rear panel.

EXT\_VCC, EXT\_GND are the external power supply high and low terminals.

VDD is the internal supply voltage, which is about 5V, but not very powerful. The relationship between the output current  $I_O$  and the output voltage  $V_O$  is approximately:

$$I_O = \frac{5V - V_O}{50\Omega}$$

Therefore, this voltage signal cannot be used as a strong drive signal. If strong driving capability is required, it is recommended to use an external power supply.

EOC indicates the end of the test, and the output signal is meaningful only when the test is over.

START triggers signal. You need the line to set the trigger condition and then trigger it.

PASS and FAIL output signals can be adjusted, i.e., select high level output, low level output, high pulse output or low pulse output.



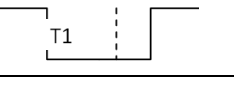
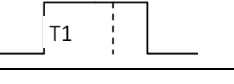
This adjustable state is good to meet the different needs of customers.

### 6.2.1 Handler Settings

Step 1: Set the instrument trigger mode.

The trigger method is set to external trigger. This is the only time you can use Handler for triggering.

Step 2: Set the trigger method of the external trigger.

Edge trigger	Rising edge trigger		T1 Trigger time, keep high level after rising edge is greater than trigger time before you can trigger
	Falling edge trigger		T1 Trigger time, keep high level after falling edge is greater than trigger time before you can trigger
Pulse width trigger	Low pulse width trigger		T1 trigger time, pulse width must be greater than the width of T1 to trigger the test
	High pulse width trigger		T1 trigger time, pulse width must be greater than the width of T1 to trigger the test

Difference between edge trigger and pulse width triggering: Edge trigger only needs the corresponding edge, and then delay a period of time more than greater than the set delay to trigger the measurement. Pulse width trigger requires the first edge to be delayed for a period of time greater than the set delay, and then an opposite edge signal to trigger the test.

### Step 3: Trigger Time

The trigger time here is the trigger time that the high and low levels need to be held, and the test will be triggered only if such trigger time is satisfied, and the default trigger time is 10 $\mu$ s. The advantage of this is that some noise interference can be eliminated.

### Step 4: Set the output logic of PASS and FALL

First determine whether PASS is valid when IN, or when LO or HI, the default is IN state small valid. Secondly determine the state when valid, is it keep high or keep low, or high and low pulse, the default is high valid.

**Note:** The output states of PASS0, FALL0, IN0, LO0, HI0, PASS1, FALL1, IN1, LO1, HI1, are not settable and are active high by default.

### Step 5: EOC Trigger Logic

EOC, if active low, goes high when the test is initiated and low when the test is completed.

EOC, if active high, goes low when the test is initiated and goes high when the test is completed.

### Step 6: Open the Handler interface.

### Step 7: Set Limit function, Handler will output only if limit function is turned on.

## 6.3 USB Interface

The full name of USB is Universal Serial Bus. USB is an external bus standard used to standardize the connection and communication between computers and external devices. Generally, USB has only four lines, as shown in the table below:

Code	Notation	Color	Pin
Power supply	VCC	Red	1
Data low-end	Data-	White	2
Data high-end	Data+	Green	3
Grounding	GND	Black	4

The USB of this instrument has two front and back, the back one is used as a communication interface, that is, the instrument is used as a device (Device). The USB port on the front panel is used to read the USB disk, this is to have the instrument as a host.

### USB Device

The communication USB connector on the rear of this instrument uses a square

type of socket with the pinout sequence shown below:



**Rear panel USB port**

This unit uses a USB-B type interface and can communicate via a standard square USB interface cable.

**警告**: To avoid electrical shock, turn off the power when plugging and unplugging the connectors; do not short the output terminals or short with the chassis at will to avoid damaging the device.

### 6.3.1 USB Host

The instrument acts as a host to read and write the data in the USB flash disk.

**Menu**→**Functions**→**Manage Files** to enter the file management interface.

## 6.4 LAN Interface

You may need to set several parameters to establish network communication using the LAN interface. First, you will need to establish an IP address. The default IP for the instrument is 192.168.1.241 and the default port number is 45454. You may need the help of your network administrator in establishing communication with the LAN interface.

**Menu**→**Functions**→**Port Configuration**→**Network Ports** To access the LAN settings menu, you can select **Change** to change the LAN settings. or use the **Restore Defaults** function to set the LAN to default values. You can also turn **WLAN** on and off. If you need to use the WALN function, please insert the wireless card first.

Some LAN configuration items can only be set with SCPI commands. Refer to SYSTEM Subsystem-I/O Configuration for all LAN configuration commands.

## 6.5 GPIB Interface

This section describes the GPIB bus standard, connection methods, and some settings for the instrument.

### 6.5.1 GPIB Bus

GPIB (IEEE-488) General Parallel Bus Interface is an international standard for intelligent instrument bus interface, IEEE is the acronym of the Institute of Electrical

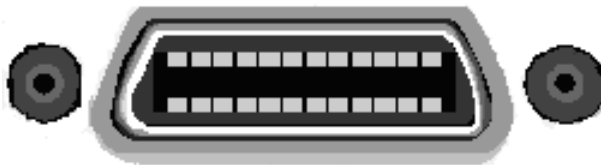
and Electronics Engineers, 488 is the standard number. Through the interface can be connected to the computer or other intelligent equipment to communicate with other test instruments can be easily composed of automatic test system. Multiple test instruments can be connected to the same bus at the same time. In this instrument, the instrument adopts IEEE488.2 standard, and the GPIB interface is optional by the user. The control command system is open, the user can use the computer operation interface provided by the product or can be programmed according to this control command system to achieve the purpose. The control command system supports most of the functions of the instrument, that is to say, the operation of almost all functions of the instrument can be achieved on the control computer to realize the remote control of the instrument.

The following points should be noted when using the GPIB system of this instrument:

1. The cable length of each connected test instrument in a bus system should not exceed 2 meters, and the total cable length of all connected test instruments should not exceed 20 meters.

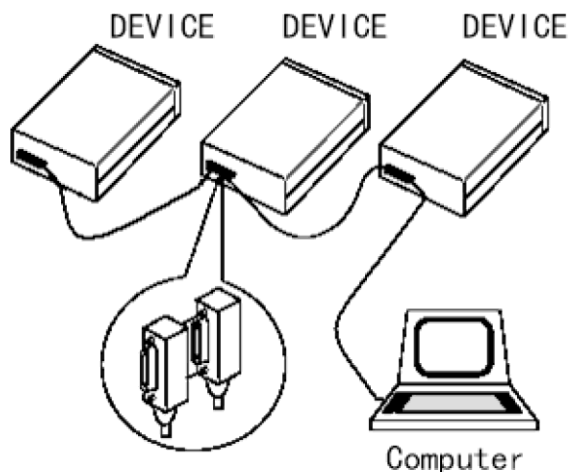
2. Up to 15 test instruments can be connected to the same bus at the same time.

3. There are no restrictions on how the cables can be connected together, but it is recommended that no more than four back connectors be stacked on a single test instrument.



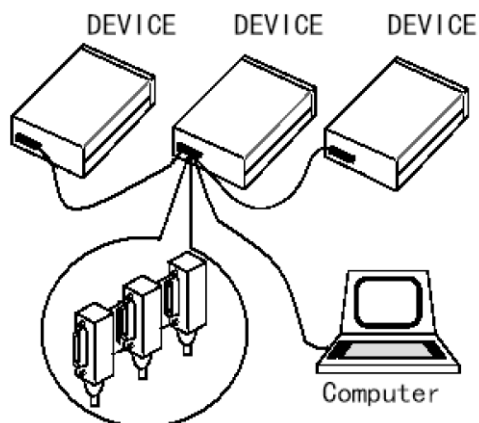
Rear Panel GPIB Interface

(1) GPIB cable connection method I:



Dual Back Connector Stacking

(2) GPIB cable connection method II:



Triple Back Connector Stacking

GPIB interface function

The instrument provides most of the general GPIB functions except for the controller, see the table below:

Nickname	Function
SH1	Supports all data source contact functions
AH1	Supports all fiducial contact functions
T5	Basic talk function, talk-only function, talk canceled at MLA, no serial rolls call support
L4	Basic listen function, listen canceled at MTA, no listen-only function
RL1	Remote/local functions
DC1	Device clear function
DT1	Device trigger function

C0	No controller function
E1	Open collector drive

### 6.5.2 Setting the GPIB Address

The instrument's GPIB is addressed as a single address with no subaddresses; the TH1963 is shipped with a default GPIB address of 8. Users can set their own GPIB addresses (0 to 30), and the address values can be automatically stored in non-volatile memory. In a GPIB bus system, it is not allowed to assign the same address as other devices or controllers (computers).

### 6.5.3 General Purpose Bus Commands

General bus commands (like DCL) are those that have the same meaning regardless of the machine. General commands and auxiliary descriptions:

Command	Command Description	Description of controls for the TH1963 multi-meter
REM	REMOTE 8	Enables the instrument to enter remote control mode
IFC	ABORT 8	Resets the instrument interface to the idle state
LLO	LOCAL LOCKOUT	Block local messages and make all keys on the panel inoperable
GTL	LOCAL 8	The instrument returns to local control with the keys on the panel active
DCL	CLEAR	Clear all instrument input and output buffers
SDC	CLEAR 8	Clear the TH1951's input and output buffers
GET	TRIGGER 8	Trigger the instrument once, the instrument measures and sends the measurement result to the output buffer
SPE, SPD	SROLL 8	Serial roll call command

See Chapter 9: SCPI Command Reference for details of the general-purpose bus commands (SCPI).

### 6.5.4 Setting through the interface

Menu→Utility→I/O Config→GPIB to enter the GPIB setting interface.

## Chapter 7 File Settings

Menu→Utility→Save/Recall to enter the Load and Save settings screen.

Menu→Utility→Manage Files to enter the file management setting interface.

### 7.1 Save Data

Menu→Utility→Save/Recall→Save Readings to enter the data saving interface.

Only support setting the save path to the usb path.

Select files or folders by controlling the up and down arrow keys and open or close folders by using the left and right arrow keys.

#### (1). File Format

File format supports .csv, .dat, .txt three formats.

#### (2). Save Mode

Choose to create a new file or overwrite an existing file.

#### (3). Save Data

After entering the file name in the pop-up prompt box and confirming it, the DMM enters the save data mode and the measurement data will be saved to the specified file in real time. If the data file is too large, the DMM will segment the data.

#### (4). Stop Saving Data

Exit save data mode.

### 7.2 Save Settings

Menu→Utility→Save/Recall→Save Settings to enter the save settings interface.

#### (1). File Format

File format supports .sta, .prf two formats.

#### (2). Save Mode

Choose to create a new file or overwrite an existing file.

#### (3). Save Settings

Save all DMM setup parameters to the specified setup file according to the settings.

### 7.3 Load Settings

Menu→Utility→Save/Recall→Recall Settings to load the specified settings file.

### 7.4 Power-on Setup

Menu→Utility→Save/Recall→Power On to select the power on setting and select

the setting parameter loaded by DMM at power on.

(1) Last

Load the setup parameters related to the DMM at the time of the last shutdown.

(2) User Defined

Load the specified settings file.

(3) Factory Default

Load factory settings.

## Chapter 8 System Settings

Menu→Utility→System to enter the system setting interface.

### 8.1 Set Language

Menu→Utility→System→User Settings→Language to switch the language.

DMM supports dynamic switching between Chinese and English.

### 8.2 Set Date/Time

Menu→Utility→System→Date Time to set the date and time.

**Note:** Since the system uses unix timestamps internally, the valid range of the year in the date is 1970-2038. Seconds setting is not supported in the menu, if you need to be precise to the second, you can use the command `SYST:TIME<hour>,<minute>,<second>` to set it.

### 8.3 Set the Buzzer and Brightness

Menu→Utility→System→User Settings to enter the setting menu to set the sound and brightness. (Beeper and Key Click are independent of each other and do not affect each other.)

To prevent the screen from going all black, the minimum value for brightness is 20. In addition, the brightness can be quickly adjusted with shift + up and down keys.

### 8.4 Set the Format of the Digital Display

Menu→Utility→System→User Settings→Number to set the digital display format.

To support the common numeric formats to Europe and the US, the DMM has the option of choosing a decimal point and a separator type. The decimal point can be set to '.' (Period) or ',' (Comma). The separator can be Space, ',' or '.' (On), or no separator (None).

### 8.5 Firmware Upgrade

Menu→Utility→System→User Settings→Firmware Update

Upgrade the DMM by using the provided upgrade tool. The specified files need to be copied to the root directory of the USB flash drive.

Insert the USB flash drive into the DMM and wait until the DMM recognizes it and prompts USB Connected. After that, select the corresponding function to upgrade. After the upgrade is completed and a prompt appears, please restart the DMM to apply the upgraded program.

## Chapter 9 SCPI Command Reference

### 9.1 SCPI Language Introduction

SCPI (Standard Commands for Programmable Instruments) is an ASCII-based instrument programming language for test and measurement instruments. SCPI commands are organized in a hierarchical structure, also known as a tree system. Related commands are grouped together in a common node or root, thus forming a subsystem. The following section of the SENSE subsystem illustrates this.

```
SENSe:VOLTage:DC:RANGe {<range>|MIN|MAX|DEF}
```

SENSe is the root-level keyword of the command, VOLTage is the second-level keyword, and DC is the third-level keyword. A colon (:) separates consecutive keywords.

#### 9.1.1 Grammatical Convention

The command syntax format is as follows:

```
VOLTage:DC:RANGe{<range>|MIN|MAX|DEF}
```

Most commands (and some parameters) are a mix of upper- and lower-case letters. Upper case letters indicate abbreviations of commands and make program lines shorter. For better program readability, use long form commands.

For example, consider the keyword VOLTage from the previous article. You can type VOLT or VOLTage, combining upper- and lower-case letters at will. Thus, VolTaGe, volt, and Volt are all acceptable. Other formats (such as VOL and VOLTAG) will produce errors.

Curly braces ( { } ) contain parameter options. The curly brackets are not sent with the command string.

Vertical lines ( | ) separates parameter selections. For example, {<range>|MIN|MAX|DEF} in the above command instructs you to specify a numeric range parameter or "MIN", "MAX", or "DEF". The bar graph is not sent with the command string.

The pointed brackets ( < > ) indicate that a value must be assigned to the parameter within the brackets. For example, the syntax statement above indicates the *< range >* parameter in pointed brackets. The pointed brackets are not sent with the command string. A value must be specified for this parameter (e.g., "VOLT:DC:RANG 10") unless you select one of the other options shown in the syntax (e.g., "VOLT:DC:RANG MIN").

Optional parameters are enclosed in square brackets ( [ ] ). The square brackets are not sent with the command string. If you do not specify a value for an optional parameter, the instrument will use the default value.

### 9.1.2 Command Separator

A colon (:) separates consecutive keywords. Spaces must be inserted to separate parameters from command keywords. If a command requires more than one parameter, a comma separates adjacent parameters:

```
CONF:VOLT:DC 10
```

A semicolon (;) separates two commands in the same subsystem and minimizes input. For example, the following string:

```
TRIG:SOUR EXT;COUNT 10
```

Equivalent to the following two commands:

```
TRIG:SOUR EXT
```

```
TRIG:COUNT 10
```

Use a colon and a semicolon to link commands from different subsystems. For example, in the following example, not using a colon and a semicolon would generate an error:

```
TRIG:COUN MIN;;SAMP:COUN MIN
```

### 9.1.3 Use the MIN, MAX, and DEF Parameters

You can replace many command parameters with "MIN" or "MAX". In some cases, you can also use the "DEF" substitution. For example, refer to the following example:

```
VOLTage:DC:RANGe {<range>|MIN|MAX|DEF}
```

Instead of selecting a specific value for the *<Range >* parameter, use the MIN parameter to set the range to the minimum value, the MAX parameter to set the range to the maximum value, or the DEF parameter to set the range to the default value.

### 9.1.4 Query Parameter Settings

To query the current value of most parameters, you can add a question mark (?) to this command. For example, the following example sets the trigger count to 10 measurements:

```
TRIG:COUN 10
```

Then the count value can be queried by sending:

```
TRIG:COUN?
```

You can also query the minimum or maximum count allowed, as shown below:

```
TRIG:COUN? MIN
```

```
TRIG:COUN? MAX
```

## 9.1.5 Parameter Type

The SCPI language defines several data formats used for program messages and response messages.

### 9.1.5.1 Numerical Parameter

Commands that require numeric parameters accept all commonly used decimal numeric representations, including optional symbols, decimal points, and scientific notation. Special values for numeric parameters, such as MIN, MAX, and DEF, are also accepted. In addition, units (e.g., M, k, m, or u) can be added to numeric parameters. If a command accepts only certain specific values, the instrument automatically rounds the input numeric parameters to the acceptable values. The following command requests a range value for a numeric parameter:

```
VOLTage:DC:RANGe {<range>|MIN|MAX|DEF}
```

Since the SCPI parser is not case sensitive, there will be some confusion about the letter 'M' (or 'm'). To avoid confusion, use 'MA' for billion. Use 'u' for 'µ'.

### 9.1.5.2 Discrete Parameter

Discrete parameters are used to set a finite number of parameter values (e.g. IMMEDIATE, EXTERNAL, or BUS). Like command keywords, they can have short and long formats. A mix of upper- and lower-case letters can be used. The query response always returns the short format in all upper-case letters. The following example requires discrete parameters to be used for temperature units:

```
UNIT:TEMPerature {C|F|K}
```

### 9.1.5.3 Boolean Parameter

The Boolean parameter represents a true or false binary condition. For a false condition, the instrument will accept "OFF" or "0". For a true condition, the instrument will accept "ON" or "1". When querying for a boolean setting, the instrument will return "0" or "1". The following examples require the use of boolean parameters:

```
DISPlay:STATe {ON|1|OFF|0}
```

### 9.1.5.4 ASCII String Parameters

The string parameter can contain virtually all ASCII character sets. Strings must begin and end with paired quotes; either single or double quotes can be used. The quote separator can also be used as part of the string by typing it twice and not adding any characters in between. The following command uses the string parameter:

```
DISPlay:TEXT <quoted string>
```

For example, the following example displays the message "WAITING..." on the front panel of the instrument (without the quotation marks).

```
DISP:TEXT "WAITING..."
```

The same information can also be displayed in single quotes using the example below.

```
DISP:TEXT 'WAITING...'
```

## 9.2 Subsystem Commands

### 9.2.1 CONFigure Subsystem

The CONFigure command is the easiest way to configure measurements. Just like the MEASure? query, these commands use the default measurement configuration values. However, these commands do not automatically start the measurement, so the measurement properties can be modified before starting the measurement.

Default Measurement Configuration for the CONFigure Command

Measured Parameter	Default Setting
AC input filter (bandwidth)	20 Hz (medium speed filter)
Auto-zero	Off if the resolution setting causes NPLC to be less than 1, On if the resolution setting causes NPLC to be greater than or equal to 1
Range	AUTO (including voltage ranges for frequency and period measurements)
Number of samples per trigger	1 sample
Trigger number	1 trigger
Trigger delay	Auto delay
Trigger source	Immediately
Trigger slope	NEGative
Math function	Disabled. No other parameters have been changed.
Empty state per function	Disabled

### 9.2.1.1 CONFigure?

Description: **Return a quoted string indicating the current function, range, and resolution.**

Syntax: CONFigure?

Parameters: (none)

Examples: conf?  
Typical return: DCI,1.00000000E-04,1.00000000E-09

### 9.2.1.2 CONFigure:VLOTage:DC

Description: **Configure the instrument for DC voltage measurements, setting all measurement parameters and trigger parameters to default values.**

Syntax: CONFigure[:VOLTage]:DC [{<range>|AUTO|MIN|MAX|DEF}]

Parameters: <range>:{100m|1|10|100|1000}. Default value: AUTO

Examples: CONF:VOLT:DC 100

### 9.2.1.3 CONFigure:VLOTage:AC

Description: **Configure the instrument for AC voltage measurements, setting all measurement parameters and trigger parameters to default values**

Syntax: CONFigure[:VOLTage]:AC [{<range>|AUTO|MIN|MAX|DEF}]

Parameters: <range>:{100m|1|10|100|750}. Default value: AUTO

Examples: CONF:VOLT:AC 100

### 9.2.1.4 CONFigure:CURREnt:DC

Description: **Configure the instrument for DC current measurements, setting all measurement parameters and trigger parameters to default values.**

Syntax: CONFigure:CURREnt:DC [{<range>|AUTO|MIN|MAX|DEF}]

Parameters: <range>:{100  $\mu$ A|1 mA|10 mA|100 mA|1 A|3 A|10 A}. Default value: AUTO

Examples: CONF:CURREnt:DC 100m

### 9.2.1.5 CONFigure:CURRent:AC

Description: **Configure the instrument for AC current measurements, setting all measurement parameters and trigger parameters to default values.**

Syntax: CONFigure:CURRent:AC [{<range>|AUTO|MIN|MAX|DEF}]

Parameters: <range>:{100  $\mu$ A|1 mA|10 mA|100 mA|1 A|3 A|10 A}. Default value: AUTO

Examples: CONF:CURR:AC 100m

### 9.2.1.6 CONFigure:CONTInuity

Description: **Configure the instrument for on-state measurements, setting all measurement parameters and trigger parameters to default values.**

Syntax: CONFigure:CONTInuity

Parameters: (none)

Examples: CONF:CONT

### 9.2.1.7 CONFigure:DIODE

Description: **Configure the instrument for diode measurements, setting all measurement parameters and trigger parameters to default values.**

Syntax: CONFigure:DIODE

Parameters: (none)

Examples: CONF:DIOD

### 9.2.1.8 CONFigure:RESistance

Description: **Configure the instrument for 2-wire resistance measurements, setting all measurement parameters and trigger parameters to default values.**

Syntax: CONFigure:RESistance [{<range>|AUTO|MIN|MAX|DEF}]

Parameters: <range>: {10|100|1k|10k|100k|1MA|10MA|100MA} Default: AUTO

Examples: CONF:RES 10MA

### 9.2.1.9 CONFigure:FRESistance

Description: **Configure the instrument for four-wire resistance measurements, setting all**

**measurement and trigger parameters to default values.**

Syntax:	CONFigure:FRESistance [{<range> AUTO MIN MAX DEF}]
Parameters:	<range>: {10 100 1k 10k 100k 1MA 10MA 100MA} Default: AUTO
Examples:	CONF:FRES 10MA

## 9.2.1.10 CONFigure:FREQuency

Description: **Configure the instrument for frequency measurements, setting all measurement parameters and trigger parameters to default values.**

Syntax:	CONFigure:FREQuency [{<range> MIN MAX DEF}]
Parameters:	<range>: {100m 1 10 100 750} Default: AUTO
Examples:	CONF:FREQ 10

## 9.2.1.11 CONFigure:PERiod

Description: **Configure the instrument for period measurements, setting all measurement parameters and trigger parameters to default values.**

Syntax:	CONFigure:PERiod [{<range> MIN MAX DEF}]
Parameters:	<range>: {100m 1 10 100 750} Default: AUTO
Examples:	CONF:PER 10MA

## 9.2.1.12 CONFigure:TEMPerature

Description: **Configure the instrument for temperature measurement, setting all measurement parameters and trigger parameters to default values.**

Syntax:	CONFigure:TEMPerature [{FRTD RTD FTHermistor THERmistor}]
Parameters:	<probe_type>:FRTD RTD FTHermistor THERmistor.
Examples:	CONF:TEMP RTD

## 9.2.1.13 CONFigure:CAPacitance

Description: **Configure the instrument for capacitance measurements, setting all measurement parameters and trigger parameters to default values.**

Syntax:	CONFigure:CAPacitance [{<range> AUTO MIN MAX DEF}]
---------	----------------------------------------------------

Parameters: <range>:{1n|10n|100n|1u|10u|100u|1m|10m}. Default value: AUTO

Examples: CONF:CAP 10u

## 9.2.2 MEASure Subsystem

With the MEASure? query, functions and ranges can be selected with a single command. All other parameters are set to default values (see table 7.3.1).

The following example configures a DC voltage measurement, internally triggers the instrument to take a measurement, and reads the result. The default range (auto range adjustment) and resolution (10 PLC) are used for the measurement.

```
MEAS:VOLT:DC?
```

Typical response: +4.23450000E-03

The following example configures the instrument to make a 2-wire resistance measurement, triggers the instrument to make the measurement, and reads the result. Select the 1 k $\Omega$  range.

```
MEAS:RES? 1000
```

Typical response: +3.27150000E+02

### 9.2.2.1 MEASure:VOLTage:{AC|DC}?

**Description:** Configure the instrument to make AC or DC voltage measurements and trigger the measurement immediately, sending the results to the user. All other measurement parameters and trigger parameters are set to default values.

**Syntax:** MEASure:VOLTage:{AC|DC}? [{<range>|AUTO|MIN|MAX|DEF}]

Parameters: AC: <range>:{100m|1|10|100|750}. Default value: AUTO

Parameters: DC: <range>:{100m|1|10|100|1000}. Default value: AUTO

Examples: MEAS:VOLT:DC? 100

Typical response: +8.53210000E+1

### 9.2.2.2 MEASure:CURREnt:{AC|DC}?

**Description:** Configure the instrument to make AC or DC current measurements and trigger the measurement immediately, sending the results to the user. All other measurement parameters and trigger parameters are set to default values.

**Syntax:** MEASure:CURREnt:{AC|DC}? [{<range>|AUTO|MIN|MAX|DEF}]

Parameters: <range>:{100u|1m|10m|100m|1|3|10}. Default value: AUTO

Examples:	MEAS:CURR:DC? 10 Typical response: +8.53210000E+01
-----------	-------------------------------------------------------

### 9.2.2.3 MEASure:CONTInuity?

Description:	<b>Configure the instrument to perform on-state measurements and trigger the measurement immediately, sending the results to the user. All other measurement parameters and trigger parameters are set to default values.</b>
--------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Syntax:	MEASure:CONTInuity?
---------	---------------------

Parameters:	(none)
-------------	--------

Examples:	MEAS:CONT? Typical response: +8.53210000E+00
-----------	-------------------------------------------------

### 9.2.2.4 MEASure:DIODe?

Description:	<b>Configure the instrument for diode measurement and trigger the measurement immediately, sending the result to the user. All other measurement parameters and trigger parameters are set to default values.</b>
--------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Syntax:	MEASure:DIODe?
---------	----------------

Parameters:	(none)
-------------	--------

Examples:	MEAS:DIODe? Typical response: +8.53210000E+00
-----------	--------------------------------------------------

### 9.2.2.5 MEASure:{RESistance|FRESistance}?

Description:	<b>Configure the instrument to make 2-wire resistance (RESistance) or 4-wire resistance (FRESistance) measurements and trigger the measurement immediately, sending the results to the user. All other measurement parameters and trigger parameters are set to default values.</b>
--------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Syntax:	MEASure: {RESistance FRESistance}? [ {<range> AUTO MIN MAX DEF} ]
---------	-------------------------------------------------------------------

Parameters:	<range>: {10 100 1k 10k 100k 1MA 10MA 100MA }. Default value: AUTO
-------------	--------------------------------------------------------------------

Examples:	MEAS:FRES? 100 Typical response: +8.53210000E+01
-----------	-----------------------------------------------------

### 9.2.2.6 MEASure:{FREQuency|PERiod}?

**Description:** Configure the instrument to make frequency or period measurements and trigger the measurement immediately, sending the results to the user. All other measurement parameters and trigger parameters are set to default values.

**Syntax:** MEASure: {FREQuency|PERiod}? [{<range>|AUTO|MIN|MAX|DEF}]

**Parameters:** <range>:{100m|1|10|100|750}. Default value: AUTO

**Examples:**  
MEAS:FREQ? 10  
Typical response: +1.4527800E-04

### 9.2.2.7 MEASure:TEMPerature?

**Description:** Configure the instrument to take a temperature measurement and trigger the measurement immediately, sending the result to the user. All other measurement parameters and trigger parameters are set to default values.

**Syntax:** MEASure: TEMPerature? [{FRTD|RTD|FTHermistor|THERmistor}]

**Parameters:** <probe\_type>:FRTD|RTD|FTHermistor|THERmistor.

**Examples:**  
MEAS:TEMP?  
Typical response: +8.53210000E+1

### 9.2.2.8 MEASure:CAPacitance?

**Description:** Configure the instrument to perform a capacitance measurement and trigger the measurement immediately, sending the result to the user. All other measurement parameters and trigger parameters are set to default values.

**Syntax:** MEASure: CAPacitance? [{<range>|AUTO|MIN|MAX|DEF}]

**Parameters:** <range>:{1n|10n|100n|1u|10u|100u|1m|10m}. Default value: AUTO

**Examples:**  
MEAS:CAP?  
Typical response: +8.53210000E-06

## 9.2.3 TRIGger Subsystem

### 9.2.3.1 ABORt

**Description:** Terminate the measurement in progress and return the instrument to the triggered idle state.

Syntax:	ABORt
Parameters:	(none)
Examples:	Terminate the measurement in progress: ABORt

### 9.2.3.2 INITiate

Change the status of the trigger system from "Idle" to "Waiting for Trigger", and then clear the previous set of measurement results from the readout memory. Measurement is started when the specified trigger conditions are met after receiving the INIT command.

**Description:** You can store up to 10,000 measurements in the reading memory of the 1963/1953. If the readout memory overflows, the new measurements will overwrite the oldest ones, always retaining the most recent measurement.

To retrieve measurements from the readout memory, use the FETCh?

Syntax:	INITiate
Parameters:	(none)
Examples:	Return five DC voltage measurements and use a software trigger to start the measurement:  CONF:VOLT:DC 10 TRIG:SOUR BUS SAMP:COUN 5 INIT *FETC? FETC?

### 9.2.3.3 FETCh?

Wait for the measurement to complete and send all the results to the user.

The FETCh? query does not erase measurements from the readout memory. You can send the query multiple times to retrieve the same data.

**Description:** When the measurement configuration is changed, or any of the following commands are executed, the instrument clears all measurements from the reading memory: INITiate , MEASure:<function>? , MEASure:<function>? READ? READ? \*RST \*RST? SYSTem:PRESet SYSTem:PRESet.

Syntax:	FETCh?
Parameters:	(none)
Examples:	Combine CONFigure and INITiate with FETCh?. The INITiate command places the instrument in a "wait-to-trigger" state, triggers a measurement when the rear panel <b>Ext Trig</b>

input is pulsed (low by default), and sends the measurement result to the user. The FETCh? query copies the measurement result from the reading memory to the output buffer of the instrument.

CONF:VOLT:DC 10

TRIG:SOUR EXT

SAMP:COUN 4

INIT

FETC?

Typical response: -4.98748741E-01,-4.35163427E-01,-4.33118686E-01,-3.48109378E-01

### 9.2.3.4 R?

Description: **Read and erase all measurements from the reading memory.**

Syntax: R?

Parameters: (none)

R?

Examples: Typical Response:  
4|-4.98748741E-01,-4.35163427E-01,-4.33118686E-01,-3.48109378E-01

### 9.2.3.5 READ?

Description: **Start a new set of measurements, wait for all measurements to complete and transmit all available measurements. Sending READ? is the same as sending INITiate ;. FETCh? is similar to sending INITiate ;; FETCh?.**

Syntax: READ?

Parameters: (none)

Examples: Remove the measurement from the reading memory:  
READ?

Typical response: -4.98748741E-01,-4.35163427E-01,-4.33118686E-01,-3.48109378E-01

### 9.2.3.6 TRIGger:COUNT

Description: **Set the number of triggers accepted by the instrument, when the number of triggers reaches the set value, the instrument will return to the "idle" state and will not be triggered again.**

Syntax: TRIGger:COUNT {<count>|MIN|MAX|DEF|INFinity}  
TRIGger:COUNT? [{MIN|MAX|DEF}]

Parameters: <count>:1-1,000,000 or INFinuity. Default value:1

Return ten sets of five DC voltage measurements, using an external trigger to initiate each set:

Examples: CONF:VOLT:DC  
SAMP:COUN 5  
TRIG:COUN 10  
TRIG:SOUR EXT  
READ?

Typical response: +1.00520000E+01, ...(50 measurements)

### 9.2.3.7 TRIGger:SOURce

Select a trigger source for a measurement.

**IMMediate:** The trigger signal is always present. When the instrument is placed in the "Waiting for Trigger" state, the trigger signal will be emitted immediately.

Description: **BUS:** When the DMM is in "Wait Bus Trigger", send "\*TRG" through the remote interface to trigger the instrument.

**EXTernal:** When the DMM is in "Wait External Trigger", the instrument will be triggered by sending a TTL pulse to the Ext Trig interface on the rear panel.

Syntax: TRIGger:SOURce {IMMediate|EXTernal|BUS}  
TRIGger:SOURce?

Parameters: Trigger Source Type

Return ten sets of five DC voltage measurements, using an external trigger to initiate each set:

Examples: CONF:VOLT:DC  
SAMP:COUN 5  
TRIG:COUN 10  
TRIG:SOUR EXT  
READ?

Typical response: +1.00520000E+01, ...(50 measurements)

### 9.2.3.8 TRIGger:DELay

Set the wait time between when the instrument receives the trigger signal and when it starts measurement.

Description: If you configure more than one measurement for each trigger of the instrument ( SAMPLE:COUNt >1), a delay will be inserted between two neighboring measurements

**after the trigger.**

**Setting a specific trigger delay will disable the automatic trigger delay ( TRIGger:DELAy:AUTO OFF ).**

Syntax: TRIGger:DELAy {<seconds>|MIN|MAX|DEF}  
TRIGger:DELAy? [{MIN|MAX|DEF}]

Parameters: Required delay time

Return five DC voltage measurements. Each measurement is preceded by a 2 second delay.

Examples: CONF:VOLT:DC 10  
SAMP:COUN 5  
TRIG:DEL 2  
READ?

Typical response: +4.27230000E+00, +4.27150000E+00, +4.27190000E+00,  
+4.27170000E+00, +4.27200000E+00

### 9.2.3.9 TRIGger:DELAy:AUTO

**Disable or enable the automatic trigger delay. If enabled, the instrument sets the delay based on function, range, and integration time or bandwidth.**

Description: **Default.**

**By default, the TRIGger:DELAy:AUTO is ON.**

Syntax: TRIGger:DELAy:AUTO {ON|1|OFF|0}  
TRIGger:DELAy:AUTO?

Parameters: {ON|1|OFF|0}

Return five DC voltage measurements. There is an automatic delay between each measurement.

Examples: CONF:VOLT:DC 10  
SAMP:COUN 5  
READ?

Typical response: +4.27230000E+00, +4.27150000E+00, +4.27190000E+00,  
+4.27170000E+00, +4.27200000E+00

### 9.2.3.10 SAMPLe:COUNt

**Specify the number of measurements (number of samples) used for each trigger of the instrument.**

Description:

**You can combine a specified sample count with a trigger count ( TRIGger:COUNt ), the total number of measurements returned is the product of the sample count and the**

**trigger count before returning to the "idle" trigger state.**

Syntax:           SAMPle:COUNT {<count>|MIN|MAX|DEF}  
SAMPle:COUNT? [{MIN|MAX|DEF}]

Parameters:       Number of samples per trigger

Return ten sets of four resistance measurements, using an external trigger to start each measurement set:

Examples:        Conf:Res 1e6  
                  SAMP:COUNT 4  
                  TRIG:COUNT 10  
                  TRIG:SOUR EXT  
                  READ?

Typical response: +1.00520000E+06, ...(40 measurements)

## 9.2.4 [SENSE:]VOLTage Subsystem

This subsystem is configured for AC voltage measurement and DC voltage measurement.

### 9.2.4.1 [SENSE:]VOLTage:AC:BANDwidth

**Set the AC filter cutoff frequency for AC voltage measurements.**

Description:     **The instrument uses three different AC filters that allow you to optimize low frequency accuracy or reduce AC stabilization time after changing the input signal amplitude. Based on the cutoff frequency specified by this command, the instrument selects a slow (3 Hz), medium (20 Hz), or fast (200 Hz) filter. Specify the lowest frequency you wish to encounter. Lower frequencies result in longer stabilization times!**

Syntax:           [SENSE:]VOLTage:AC:BANDwidth {<filter>|MIN|MAX}  
[SENSE:]VOLTage:AC:BANDwidth? [{MIN|MAX|DEF}]

Parameters:       <filter>:{3|20|200}. Default value: 20

Examples:         VOLT:AC:BAND 200

### 9.2.4.2 [SENSE:]VOLTage:AC:SPEED

**Set the measurement speed for AC voltage measurement.**

Description:     **Measurement speed is limited by the filter cutoff frequency. 3Hz filters support only slow (SLOW), 20Hz filters support slow (SLOW) and medium (MEDIUM), and 200Hz filters support slow (SLOW), medium (MEDIUM), and fast (FAST).**

Syntax:           [SENSE:]VOLTage:AC:SPEED {<speed>|MIN|MAX}  
[SENSE:]VOLTage:AC:SPEED? [{MIN|MAX|DEF}]

Parameters: <speed>:{SLOW|MEDIUM|FAST}. Default value: MEDIUM

Examples: VOLT:AC:SPEE SLOW

### 9.2.4.3 [SENSe:]VOLTage:AC:SECOndary

**Select the auxiliary measurement function for AC voltage measurement.**

Description: **To read auxiliary measurements, use the DATA2?**

Syntax: [SENSe:]VOLTage:AC:SECOndary {OFF|BEFOREmath|FREQUENCY}  
[SENSe:]VOLTage:AC:SECOndary?

Parameters: {OFF|BEFOREmath|FREQUENCY}

Examples: VOLT:AC:SEC FREQ

### 9.2.4.4 [SENSe:]VOLTage:{AC|DC}:RANGe

Description: **Fixed range selection for AC and DC voltage measurements**

Syntax: [SENSe:]VOLTage:{AC|DC}:RANGe {<range>|MIN|MAX}  
[SENSe:]VOLTage:{AC|DC}:RANGe? [{MIN|MAX|DEF}]

Parameters: AC:<range>:{100m|1|10|100|750}. Default value: 10

DC: <range>:{100m|1|10|100|1000}. Default value: 1000

Examples: VOLT:AC:RANG 10

### 9.2.4.5 [SENSe:]VOLTage:{AC|DC}:RANGe:AUTO

**Enable or disable auto-ranging for AC and DC voltage measurements.**

Description: **Auto-adjustment range can be adjusted down to less than 10% of range and up to more than 120% of range.**

Syntax: [SENSe:]VOLTage:{AC|DC}:RANGe:AUTO {ON|OFF}  
[SENSe:]VOLTage:{AC|DC}:RANGe:AUTO?

Parameters: {ON|1|OFF|0}

Examples: VOLT:AC:RANG:AUTO ON

### 9.2.4.6 [SENSe:]VOLTage[:DC]:NPLC

Description: **Set the integration time expressed as the number of power line cycles (PLC) for DC voltage measurements.**

**The integration time is the period during which the instrument's analog-to-digital (A/D) converter takes a sample of the input signal for the measurement. Longer integration times give higher measurement resolution, but slower measurements.**

Syntax: [SENSe:]VOLTage[:DC]:NPLC {<plc>|MIN|MAX}  
[SENSe:]VOLTage[:DC]:NPLC? [{MIN|MAX|DEF}]

Parameters: <plc>:{0.02|0.2|1|10|100}

Examples: VOLT:NPLC 10

#### 9.2.4.7 [SENSe:]VOLTage[:DC]:IMPedance:AUTO

Description: **Enable or disable automatic input impedance mode for DC voltage measurements.**

Syntax: [SENSe:]VOLTage[:DC]:IMPedance:AUTO {ON|OFF}  
[SENSe:]VOLTage[:DC]:IMPedance:AUTO?

Parameters: {ON|1|OFF|0}

Examples: VOLT:IMP:AUTO ON

#### 9.2.4.8 [SENSe:]VOLTage[:DC]:ZERO:AUTO

**Enable or disable auto-zero mode for DC voltages.**

Description: **ON:** After each measurement, the DMM internally measures the offset. This measurement is then subtracted from the previous reading. This prevents offset voltages on the DMM input circuitry from affecting the accuracy of the measurement.

**OFF:** The instrument takes the last measured zero measurement and subtracts it from each measurement. Whenever you change the function, range, or integration time, it takes a new zero reading.

Syntax: [SENSe:]VOLTage[:DC]:ZERO:AUTO {ON|OFF}  
[SENSe:]VOLTage[:DC]:ZERO:AUTO?

Parameters: {ON|1|OFF|0}

Examples: VOLT:ZERO:AUTO ON

#### 9.2.4.9 [SENSe:]VOLTage[:DC]:SECOndary

Description: **Select an auxiliary measurement function for DC voltage measurements.**  
**To read auxiliary measurements, use the DATA2?**

Syntax: [SENSe:]VOLTage:AC:SECOndary {OFF|BEFOREmath }  
[SENSe:]VOLTage:AC:SECOndary?

Parameters: {OFF|BEForemath }

Examples: VOLT:DC:SEC BEF

## 9.2.5 [SENSe:]CURRent Subsystem

### 9.2.5.1 [SENSe:]CURRent:AC:BANDwidth

**Set the AC filter cutoff frequency for AC current measurements.**

**Description:** The instrument uses three different AC filters that allow you to optimize low frequency accuracy or reduce AC stabilization time after changing the input signal amplitude. Based on the cutoff frequency specified by this command, the instrument selects a slow (3 Hz), medium (20 Hz), or fast (200 Hz) filter. Specify the lowest frequency you wish to encounter. Lower frequencies result in longer stabilization times.

Syntax: [SENSe:]CURRent:AC:BANDwidth {<filter>|MIN|MAX}  
[SENSe:]CURRent:AC:BANDwidth? [{MIN|MAX|DEF}]

Parameters: <filter>:{3|20|200}. Default value: 20

Examples: CURR:AC:BAND 200

### 9.2.5.2 [SENSe:]CURRent:AC:SPEED

**Set the measurement speed for AC current measurement.**

**Description:** Measurement speed is limited by the filter cutoff frequency. 3Hz filters support only slow (SLOW), 20Hz filters support slow (SLOW) and medium (MEDium), and 200Hz filters support slow (SLOW), medium (MEDium), and fast (FAST).

Syntax: [SENSe:] CURRent:AC:SPEED {<speed>|MIN|MAX}  
[SENSe:] CURRent:AC:SPEED? [{MIN|MAX|DEF}]

Parameters: <speed>:{SLOW|MEDium|FAST}. Default value: MEDium

Examples: CURR:AC:SPEE SLOW

### 9.2.5.3 [SENSe:]CURRent:AC:SECOndary

**Select an auxiliary measurement function for AC current measurements.**

**Description:** To read auxiliary measurements, use the DATA2?

Syntax: [SENSe:]CURRent:AC:SECOndary {OFF|BEForemath|FREQuency}  
[SENSe:]CURRent:AC:SECOndary?

Parameters: {OFF|BEForemath|FREQuency}

Examples: CURR:AC:SEC BEF

### 9.2.5.4 [SENSe:]CURRent:{AC|DC}:RANGe

**Select a fixed range for AC and DC current measurements. Select a fixed measurement range for AC or DC current measurements on the 3 A terminals. For digital multimeters with a 10 A range, you cannot use this command to select a 10 A range. Please use command 7.3.5.5 instead.**

**Description:**

**Syntax:** [SENSe:] CURRent:{AC|DC}:RANGe {<range>|MIN|MAX}  
[SENSe:] CURRent:{AC|DC}:RANGe? [{MIN|MAX|DEF}]

**Parameters:** <range>:{100u|1m|10m|100m|1|3}. Default value: AUTO

**Examples:** CURRent:AC:RANG 100m

### 9.2.5.5 [SENSe:]CURRent:{AC|DC}:RANGe:AUTO

#### Automatic ranging for AC and DC current measurements

**Description:** Auto-adjustment range can be adjusted down to less than 10% of range and up to more than 120% of range.

**Syntax:** [SENSe:] CURRent:{AC|DC}:RANGe:AUTO {ON|OFF}  
[SENSe:] CURRent:{AC|DC}:RANGe:AUTO?

**Parameters:** {ON|1|OFF|0}

**Examples:** CURR:AC:RANG:AUTO ON

### 9.2.5.6 [SENSe:]CURRent:{AC|DC}:TERMinals

#### Enable or disable auto-ranging for AC and DC current measurements.

**Description:** Auto-adjustment range can be adjusted down to less than 10% of range and up to more than 120% of range.

**Syntax:** [SENSe:] CURRent:{AC|DC}:TERMinals {3|10}  
[SENSe:] CURRent:{AC|DC}:TERMinals?

**Parameters:** {3|10}

**Examples:** CURR:AC:TERM 10

### 9.2.5.7 [SENSe:]CURRent[:DC]:NPLC

**Description:** Set the integration time, expressed as the number of power line cycles (PLC), for DC current measurements. The integration time is the period during which the instrument's analog-to-digital (A/D) converter takes a sample of the input signal for the measurement.

**Longer integration times give higher measurement resolution, but slower measurements.**

Syntax: [SENSe:] CURRent[:DC]:NPLC {<plc>|MIN|MAX}  
[SENSe:] CURRent[:DC]:NPLC? [{MIN|MAX|DEF}]

Parameters: <plc>:{0.02|0.2|1|10|100}

Examples: CURR:NPLC 1

**9.2.5.8 [SENSe:]CURRent:DC:SECondary****Select an auxiliary measurement function for DC current measurements.**

Description: **To read auxiliary measurements, use the DATA2?**

Syntax: [SENSe:]CURRent:DC:SECondary {OFF|BEForemath }  
[SENSe:]CURRent:DC:SECondary?

Parameters: {OFF|BEForemath}

Examples: CURR:DC:SEC BEF

**9.2.5.9 [SENSe:]CURRent[:DC]:ZERO:AUTO****Enable or disable auto-zero mode for DC current.**

Description: **ON: After each measurement, the DMM internally measures the offset. This measurement is then subtracted from the previous reading. This prevents offset voltages on the DMM input circuitry from affecting the accuracy of the measurement.**

**OFF: The instrument takes the last measured zero measurement and subtracts it from each measurement. Whenever you change the function, range, or integration time, it takes a new zero reading.**

Syntax: [SENSe:] CURRent [:DC]:ZERO:AUTO {ON|OFF}  
[SENSe:] CURRent [:DC]:ZERO:AUTO?

Parameters: {ON|1|OFF|0}

Examples: CURR:ZERO:AUTO ON

**9.2.6 [SENSe:]{RESistance|FRESistance} Subsystem****9.2.6.1 [SENSe:]{RESistance|FRESistance}:RANGe**

Description: **Set the fixed range for 2-wire or 4-wire resistors.**

Syntax: [SENSe:] {RESistance|FRESistance}:RANGe {<range>|MIN|MAX}  
[SENSe:] {RESistance|FRESistance}:RANGe? [{MIN|MAX|DEF}]

Parameters: <range>:{10|100|1k|10k|100k|1MA|10MA|100MA }

Examples: RES:RANG 10MA

## 9.2.6.2 [SENSe:]{RESistance|FRESistance}:RANGe:AU

TO

**Enable or disable auto-ranging for 2-wire resistance or 4-wire resistance measurements.**

Description: **Auto-adjustment range can be adjusted down to less than 10% of range and up to more than 120% of range.**

Syntax: [SENSe:] {RESistance|FRESistance}:RANGe:AUTO {ON|OFF}  
[SENSe:] {RESistance|FRESistance}:RANGe:AUTO?

Parameters: {ON|1|OFF|0}

Examples: RES:RANG:AUTO ON

## 9.2.6.3 [SENSe:]{RESistance|FRESistance}:NPLC

Description: **Set the integration time, expressed as the number of power line cycles (PLC), for 2-wire resistance or 4-wire resistance measurements. The integration time is the period during which the instrument's analog-to-digital (A/D) converter takes a sample of the input signal for the measurement. Longer integration times give higher measurement resolution, but slower measurements.**

Syntax: [SENSe:] {RESistance|FRESistance}:NPLC <plc>{MIN|MAX}  
[SENSe:] {RESistance|FRESistance}:NPLC? [{MIN|MAX|DEF}]

Parameters: <plc>:{0.02|0.2|1|10|100}

Examples: RES:NPLC 1

## 9.2.6.4 [SENSe:]{RESistance|FRESistance}:SECOndary

Description: **Select an auxiliary measurement function for resistance measurements. This parameter is shared between 2-wire and 4-wire resistors.**

**To read auxiliary measurements, use the DATA2?**

Syntax: [SENSe:] {RESistance|FRESistance}:SECOndary {OFF|BEFOREmath }  
[SENSe:] {RESistance|FRESistance}:SECOndary?

Parameters: {OFF|BEFOREmath }

Examples: RES:SEC BEF

## 9.2.6.5 [SENSe:]RESistance:ZERO:AUTO

Description: **Enable or disable auto-zero mode for 2-wire resistors.**

**ON:** After each measurement, the DMM internally measures the offset. This measurement is then subtracted from the previous reading. This prevents offset voltages on the DMM input circuitry from affecting the accuracy of the measurement.

**OFF:** The instrument takes the last measured zero measurement and subtracts it from each measurement. Whenever you change the function, range, or integration time, it takes a new zero reading.

Syntax: [SENSe:] RESistance:ZERO:AUTO {ON|OFF}  
[SENSe:] RESistance ZERO:AUTO?

Parameters: {ON|1|OFF|0}

Examples: RES:ZERO:AUTO ON

## 9.2.7 [SENSe:]{FREQuency|PERiod} Subsystem

### 9.2.7.1 [SENSe:]{FREQuency|PERiod}:VOLTage:RAN

Ge

**Select the fixed ranges for frequency and period measurements.**

Description: **This parameter is shared between frequency and period.**

Syntax: [SENSe:] {FREQuency|PERiod}:VOLTage:RANGe {<range>|MIN|MAX}  
[SENSe:] {FREQuency|PERiod}:VOLTage:RANGe? [{MIN|MAX|DEF}]

Parameters: <range>:{100m|1|10|100|750}

Examples: FREQ:RANG 10

### 9.2.7.2 [SENSe:]{FREQuency|PERiod}:VOLTage:RAN

Ge:AUTO

**Enable or disable auto-ranging for frequency and period measurements.**

Description: **This parameter is shared between frequency and period.**

**Auto-adjustment range can be adjusted down to less than 10% of range and up to more than 120% of range.**

Syntax: [SENSe:] {FREQuency|PERiod}:VOLTage:RANGe:AUTO {ON|OFF}  
[SENSe:] {FREQuency|PERiod}:VOLTage:RANGe:AUTO?

Parameters: {ON|1|OFF|0}

Examples: FREQ:RANG:AUTO ON

### 9.2.7.3 [SENSe:]{FREQuency|PERiod}:RANGe:LOWer

Set the AC bandwidth used to detect signals during frequency and period measurements.

This parameter is shared between frequency and period.

**Description:** The instrument uses three different AC filters that allow you to optimize low frequency accuracy or reduce AC stabilization time after changing the input signal amplitude. Based on the cutoff frequency specified by this command, the instrument selects a slow (3 Hz), medium (20 Hz), or fast (200 Hz) filter. Specify the lowest frequency you wish to encounter. Lower frequencies result in longer stabilization times.

**Syntax:** [SENSe:] {FREQuency|PERiod}:RANGe:LOWer {<filter>|MIN|MAX}  
[SENSe:] {FREQuency|PERiod}:RANGe:LOWer? [{MIN|MAX|DEF}]

**Parameters:** <filter>:{3|20|200}. Default value: 20

**Examples:** FREQ:RANG:LOW 200

### 9.2.7.4 [SENSe:]{FREQuency|PERiod}:APERture

Set the aperture time (gating time) for frequency and period measurements.

This parameter is shared between frequency and period.

**Description:**

The larger the aperture time, the higher the measurement accuracy and the lower the measurement speed.

**Syntax:** [SENSe:] {FREQuency|PERiod}:APERture {<seconds>|MIN|MAX}  
[SENSe:] {FREQuency|PERiod}:APERture? [{MIN|MAX|DEF}]

**Parameters:** <seconds>:{10m|100m|1}

**Examples:** FREQ:APER 100m

### 9.2.7.5 [SENSe:]FREQuency:SECOndary

Select an auxiliary measurement function for frequency measurements.

**Description:**

To read auxiliary measurements, use the DATA2?

**Syntax:** [SENSe:]FREQuency:SECOndary {OFF|BEFOremath|ACV|PERiod}  
[SENSe:]FREQuency:SECOndary?

**Parameters:** {OFF|BEFOremath|ACV|PERiod }

**Examples:** FREQ BEF

### 9.2.7.6 [SENSe:]PERiod:SECondary

**Select an auxiliary measurement function for the period measurement.**

Description: **To read auxiliary measurements, use the DATA2?**

Syntax: [SENSe:] PERiod:SECondary {OFF|BEForemath|ACV|FREQuency}  
[SENSe:] PERiod:SECondary?

Parameters: {OFF|BEForemath|ACV| FREQuency }

Examples: PER BEF

## 9.2.8 [SENSe:]TEMPerture Subsystem

### 9.2.8.1 [SENSe:]TEMPerture:NPLC

**Set the integration time expressed in power line period counts (PLC) for temperature measurements.**

Description: **The integration time is the period during which the instrument's analog-to-digital (A/D) converter takes a sample of the input signal for the measurement. Longer integration times give higher measurement resolution, but slower measurements.**

Syntax: [SENSe:] TEMPerture:NPLC {<plc>|MIN|MAX}  
[SENSe:] TEMPerture:NPLC? [{MIN|MAX|DEF}]

Parameters: <plc>:{0.02|0.2|1|10|100}

Examples: TEMP:NPLC 10

### 9.2.8.2 [SENSe:]TEMPerture:TRANsducer:{FRTD|RTD}:RESistance

Description: **Select the nominal resistance ( $R_0$ ) for 2-wire and 4-wire RTD measurements.  $R_0$  is a nominal RTD resistance at 0 °C.**

Syntax: [SENSe:]TEMPerture:TRANsducer:{FRTD|RTD}:RESistance {<reference>|MIN|MAX}  
[SENSe:]TEMPerture:TRANsducer:{FRTD|RTD}:RESistance? [{MIN|MAX|DEF}]

Parameters: <reference>:set resistance value

Examples: TEMP:TRAN:RTD:RES 10

### 9.2.8.3 [SENSe:]TEMPerture:TRANsducer:TYPE

Description: **Select probe type sensors for temperature measurement. Supported probes are 2-wire and 4-wire RTDs, 2-wire and 4-wire thermistors**

Syntax: [SENSe:]TEMPerture:TRANsducer:TYPE {FRTD|RTD|FThermistor|ThERmistor}

---



---

```
[SENSe:]TEMPerature:TRANsducer:TYPE?
```

Parameters: {FRTD|RTD|FTHermistor|THERmistor}

Examples: TEMP:TRAN:TYPE RTD

---

#### 9.2.8.4 [SENSe:]TEMPerture:SECOndary

---

**Select an auxiliary measurement function for temperature measurement.**

Description: **To read auxiliary measurements, use the DATA2?.**

```
[SENSe:] TEMPerture:SECOndary {OFF|BEForemath|RESistor}
[SENSe:] TEMPerture:SECOndary?
```

Parameters: {OFF|BEForemath|RESistor}

Examples: TEMP BEF

---

#### 9.2.8.5 [SENSe:]TEMPerture:ZERO:AUTO

---

**Enable or disable auto-zero mode for temperature measurements.**

Description: **ON: After each measurement, the DMM internally measures the offset. This measurement is then subtracted from the previous reading. This prevents offset voltages on the DMM input circuitry from affecting the accuracy of the measurement.**

**OFF: The instrument takes the last measured zero measurement and subtracts it from each measurement. Whenever you change the function, range, or integration time, it takes a new zero reading.**

```
[SENSe:] TEMPerture:ZERO:AUTO {ON|OFF}
[SENSe:] TEMPerture:ZERO:AUTO?
```

Parameters: {ON|1|OFF|0}

Examples: TEMP:ZERO:AUTO ON

---

#### 9.2.8.6 UNIT:TEMPerture

---

Description: **Set the units used for temperature measurement ( °C, °F or Kelvin)**

```
UNIT:TEMPerature {C|F|K}
UNIT:TEMPerature?
```

Parameters: {C|F|K}

---

Examples:	UNIT:TEMP F
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## 9.2.9 [SENSe:]CAPacitance Subsystem

### 9.2.9.1 [SENSe:]CAPacitance:RANGe

Description:	<b>Select a fixed range for capacitance measurements.</b>
--------------	-----------------------------------------------------------

Syntax:	[SENSe:] CAPacitance:RANGe {<range> MIN MAX} [SENSe:] CAPacitance:RANGe? [{MIN MAX DEF}]
---------	---------------------------------------------------------------------------------------------

Parameters:	<range>:{1n 10n 100n 1u  10u 100u 1m 10m}
-------------	-------------------------------------------

Examples:	CAP:RANG 100n
-----------	---------------

### 9.2.9.2 [SENSe:]CAPacitance:RANGe:AUTO

**Enable or disable auto-ranging for capacitance measurements.**

Description:	<b>Auto-adjustment range can be adjusted down to less than 10% of range and up to more than 120% of range.</b>
--------------	----------------------------------------------------------------------------------------------------------------

Syntax:	[SENSe:] CAPacitance:RANGe:AUTO {ON OFF} [SENSe:] CAPacitance:RANGe:AUTO?
---------	------------------------------------------------------------------------------

Parameters:	{ON 1 OFF 0}
-------------	--------------

Examples:	CAP:RANG:AUTO ON
-----------	------------------

### 9.2.9.3 [SENSe:]CAPacitance:SECOndary

**Select an auxiliary measurement function for capacitance measurements.**

Description:	<b>To read auxiliary measurements, use the DATA2?.</b>
--------------	--------------------------------------------------------

Syntax:	[SENSe:] CAPacitance:SECOndary {OFF BEForemath} [SENSe:] CAPacitance:SECOndary?
---------	------------------------------------------------------------------------------------

Parameters:	{OFF BEForemath}
-------------	------------------

Examples:	CAP BEF
-----------	---------

## 9.2.10 SYSTem Subsystem-I/O Configuration

### 9.2.10.1 SYSTem:COMMunicate:RS232:BAUDrate

Description:	<b>Set the serial port baud rate.</b>
--------------	---------------------------------------

Syntax:	SYSTem:COMMunicate:RS232:BAUDrate {4800 9600 19200 38400 57600 115200}
---------	------------------------------------------------------------------------

	<code>SYSTem:COMMunicate:RS232:BAUDrate?</code>
Parameters:	Supported baud rates:{4800 9600 19200 38400 57600 115200}
Examples:	<code>SYST:COMM:RS232:BAUD 9600</code>

### 9.2.10.2 SYSTem:COMMunicate:RS232:DATAbits

Description:	<b>Set the serial port data bits.</b>
Syntax:	<code>SYSTem:COMMunicate:RS232:DATAbits {7 8}</code> <code>SYSTem:COMMunicate:RS232: DATAbits?</code>
Parameters:	Supported data bits:{7 8}
Examples:	<code>SYST:COMM:RS232:DATA 8</code>

### 9.2.10.3 SYSTem:COMMunicate:RS232:PARity

Description:	<b>Set the serial port parity bit.</b>
Syntax:	<code>SYSTem:COMMunicate:RS232:PARity {EVEN ODD MARK SPACE NULL}</code> <code>SYSTem:COMMunicate:RS232:PARity?..</code>
Parameters:	Calibration mode:{EVEN ODD MARK SPACE NULL}
Examples:	<code>SYST:COMM:RS232:PAR NULL</code>

### 9.2.10.4 SYSTem:COMMunicate:RS232:STOPbits

Description:	<b>Set the serial port stop bit.</b>
Syntax:	<code>SYSTem:COMMunicate:RS232:STOPbits {1 2}</code> <code>SYSTem:COMMunicate:RS232:STOPbits?</code>
Parameters:	Serial port stop bit:{1 2}
Examples:	<code>SYST:COMM:RS232:STOP 1</code>

### 9.2.10.5 SYSTem:COMMunicate:LAN:DNS{1|2}

Description:	<b>Set the DNS server address.</b>
Syntax:	<code>SYSTem:COMMunicate:LAN:DNS{1 2} {&lt;address&gt;}</code>

---



---

SYSTem:COMMunicate:LAN:DNS{1|2}?

Parameters: address

Examples: SYST:COMM:LAN:DNS1 "192.168.1.4"

---

### 9.2.10.6 SYSTem:COMMunicate:LAN:GATeway

---

Description: **Set the instrument's default route.**

SYSTem:COMMunicate:LAN:GATeway {<address>}

Syntax: SYSTem:COMMunicate:LAN:GATeway?

Parameters: address

Examples: SYST:COMM:LAN:GAT "192.168.1.5"

---

### 9.2.10.7 SYSTem:COMMunicate:LAN:HOSTname

---

Description: **Set the hostname of the instrument.**

SYSTem:COMMunicate:LAN:HOSTname {<name>}

Syntax: SYSTem:COMMunicate:LAN:HOSTname?

Parameters: Defined hostname

Examples: SYST:COMM:LAN:HOST "LAB1-DMM"

---

### 9.2.10.8 SYSTem:COMMunicate:LAN:IPADdress

---

Description: **Set the IP address.**

SYSTem:COMMunicate:LAN:IPADdress "<address>"

Syntax: SYSTem:COMMunicate:LAN:IPADdress?

Parameters: IP address

Examples: SYST:COMM:LAN:IPAD "192.168.1.242"

---

### 9.2.10.9 SYSTem:COMMunicate:LAN:PORT

---

Description: **Set the port number for TCP communication on the network port.**

SYSTem:COMMunicate:LAN:PORT {<port>}

Syntax: SYSTem:COMMunicate:LAN:PORT?

---

---

Parameters: port number

Examples: SYST:COMM:LAN:PORT 45454

---

### 9.2.10.10 SYSTem:COMMunicate:LAN:SMASk

---

Description: **Set the subnet mask.**

Syntax: SYSTem:COMMunicate:LAN:SMASk {<smask>}

Syntax: SYSTem:COMMunicate:LAN:SMASk?

Parameters: subnet mask

Examples: SYST:COMM:LAN:SMAS 255.255.255.0

---

## 9.2.11 SYSTem Subsystem-general Commands

### 9.2.11.1 SYSTem:BEEPer[:IMMediate]

---

Description: **Send a single beep.**

Syntax: SYSTem:BEEPer[:IMMediate]

Parameters: (none)

Examples: SYST:BEEP

---

### 9.2.11.2 SYSTem:BEEPer:STATe

---

Description: **Disable or enable the buzzer to sound during continuity, diode or probe hold measurements or when the current panel or remote interface generates an error.**

Syntax: SYSTem:BEEPer:STATe {ON|1|OFF|0}

Syntax: SYSTem:BEEPer:STATe?

Parameters: {ON|1|OFF|0}

Examples: SYST:BEEP:STAT OFF

---

### 9.2.11.3 SYSTem:CLICk:STATe

---

Description: **Disable or enable key beeping when a front panel key or softkey is pressed.**

Syntax: SYSTem:CLICk:STAT {ON|1|OFF|0}

Syntax: SYSTem:CLICk:STAT?

Parameters: {ON|1|OFF|0}

---

Examples:	SYST:CLIC:STAT OFF
-----------	--------------------

#### 9.2.11.4 SYSTem:DATE

Description:	<b>Set the date of the instrument's real-time clock. Set the time with SYSTem:TIME. The unix 32-bit timestamp is used, and the maximum time cannot exceed 2038.</b>
--------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Syntax:	SYSTem:DATE <year>, <month>, <day> SYSTem:DATE?
---------	----------------------------------------------------

<year>:1970-2038

Parameters:	<month>:1-12
-------------	--------------

<day>:1-maximum number of days in the current month

Examples:	SYST:DATE 2018,5,29
-----------	---------------------

#### 9.2.11.5 SYSTem:TIME

Description:	<b>Set the time of the instrument's real-time clock. Set the date with SYSTem:DATE.</b>
--------------	-----------------------------------------------------------------------------------------

Syntax:	SYSTem:TIME <hour>, <minute>, <second> SYSTem:TIME?
---------	--------------------------------------------------------

<hour>:0-23

Parameters:	<minute>:0-59
-------------	---------------

<second>:0-59

Examples:	SYST:TIME 13,59,10
-----------	--------------------

#### 9.2.11.6 SYSTem:VERSion?

Description:	<b>Query the current software version.</b>
--------------	--------------------------------------------

Syntax:	SYSTem:VERSion?
---------	-----------------

Parameters:	(none)
-------------	--------

Examples:	SYST:VER? Typical return: "1.10"
-----------	-------------------------------------

### 9.2.12 DATA2 Subsystem

This subsystem is used to read auxiliary measurements.

---

---

Description: **Retrieve the auxiliary measurements.**

Syntax: DATA2?

Parameters: (none)

CONF:VOLT:DC 10  
VOLT:DC:SEC BEF  
READ?

Examples: Typical return: 1.70897747E-03

DATA2?

Typical return: 1.70897747E-03

---

### 9.2.13 NULL Subsystem

This subsystem is used to set up and control the nulling operation of the instrument.

VOLTage[:DC]	DC voltage
VOLTage:AC	AC current
CURRent:DC	DC current
CURRent:AC	AC current
RESistance	2-wire resistor
FRESistance	4-wire resistor
FREQuency	Frequency
Period	Period
TEMPerature	Temperature
CAPacitance	Capacitance

Value of <function>

#### 9.2.13.1 {<function>}:NULL:STATe

**Description:** Enable or disable empty functions for the function specified by <function>. For possible values of <function> see 7.3.12.

**Syntax:** {<function>}:NULL:STATe {ON|1|OFF|0}  
{<function>}:NULL:STATe?

**Parameters:** {ON|1|OFF|0}

**Examples:** VOLT:DC:NULL:STAT ON

#### 9.2.13.2 {<function>}:NULL:VALue

**Description:** Set a null value for the function specified by <function>, see 7.3.12 for possible values of <function>.

To use null values, the null state must be turned on ( {<function>}:NULL:STATe ON ).  
Specifying null disables automatic null selection ( {<function>}:NULL:VALue:AUTO OFF ).

**Syntax:** {<function>}:NULL:VALue {ON|1|OFF|0}

	{<function>}:NULL:VALue?
Parameters:	{ON 1 OFF 0}
Examples:	VOLT:DC:NULL:VAL 0.214

### 9.2.13.3 {<function>}:NULL:VALue:AUTO

**Enable or disable null values for functions specified by <function>, see 7.3.12 for possible values of <function>.**

**Description:** When the auto-reference selection is turned on, the first measurement made is used as the null value for all subsequent measurements.

**{<function>}:NULL:VALue has been set to this value. Automatic null selection will be disabled.**

Syntax:	{<function>}:NULL:VALue:AUTO {ON 1 OFF 0} {<function>}:NULL:VALue:AUTO?
Parameters:	{ON 1 OFF 0}
Examples:	VOLT:DC:NULL:VALUE:AUTO ON

## 9.2.14 CALCulate:SCALE Subsystem

This subsystem is mainly used to set up and control the math operations of the instrument.

### 9.2.14.1 CALCulate:SCALE:DB:REFERENCE

**Description:** Store the relative value in the dB relative register of the multimeter, which is used for the dB function in CALCulate:SCALE:FUNCTION. When the dB function is enabled, this value is subtracted from each voltage measurement after the measurement is converted to dBm.

Syntax:	CALCulate:SCALE:DB:REFERENCE {<reference>} CALCulate:SCALE:DB:REFERENCE?
Parameters:	
Examples:	CALC:SCAL:DB:REF -10.0

### 9.2.14.2 CALCulate:SCALE:DBM:REFERENCE

**Description:** Select the reference resistor to convert voltage measurements to dBm. This reference value affects the dBm and dB calibration functions.

Syntax:           CALCulate:SCALe:DBM:REFerence {<reference>}  
CALCulate:SCALe:DBM:REFerence?

Parameters:

Examples:        CALC:SCAL:DBM:REF 300

### 9.2.14.3 CALCulate:SCALe:FUNcTion

Select the operation to be performed by the calibration function.

**DB** performs a relative dB calculation. The result is the difference between the input signal and the stored relative reference value for DB (CALCulate:SCALe:DB:REFerence), both values are converted to dBm (dB = measurement in dBm - relative value in dBm). dB calibration is only available for ACV and DCV measurements.

Description:    The **DBM** performs a dBm calculation. The result is a logarithmic expression, calculated based on the power passed to the reference resistor (CALCulate:SCALe:DBM:REFerence) and relative to 1 mW.  
(dBm =  $10 \times \log_{10}$  (measurement result<sup>2</sup> / reference resistance/1 mW)). The dBm calibration applies only to ACV and DCV measurements.

The **PCT** performs a percentage change operation. The result is the percentage change of the measurement result from the reference value:

$$\text{Result} = ((\text{Measurement Result} - \text{Reference Value}) / \text{Reference Value}) * 100$$

**SCALE** performs the Mx+B operation. The result is the measurement result multiplied by the gain value **M** (CALCulate:SCALe:GAIN) + the offset value **B** (CALCulate:SCALe:OFFSet). The Mx+B calibration applies to all measurement functions except proportional, continuity and diode.

Syntax:           CALCulate:SCALe:FUNcTion {DB|DBM|PCT|SCALE}  
CALCulate:SCALe:FUNcTion?

Parameters:      Selected operations: {DB|DBM|PCT|SCALE}

Examples:        Enable the DB calibration function for the next measurement reference:  
CALC:SCAL:FUNC DB  
CALC:SCAL:STAT ON

### 9.2.14.4 CALCulate:SCALe:GAIN

Description:     Set the gain value *M* of the calibration function in CALCulate:SCALe:FUNcTion.

Syntax:           CALCulate:SCALe:GAIN {<gain>}  
CALCulate:SCALe:GAIN?

Parameters:      gain

Examples:	CALC:SCAL:GAIN 100
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### 9.2.14.5 CALCulate:SCALE:OFFSet

Description:	<b>Set the offset B of the calibration function in CALCulate:SCALE:FUNCTION.</b>
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Syntax:	CALCulate:SCALE:OFFSet {<offset>} CALCulate:SCALE:OFFSet?
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Parameters:	offset
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Examples:	CALC:SCAL:OFFSet 5
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### 9.2.14.6 CALCulate:SCALE:REFerence

Description:	<b>Set the reference value of the PCT function in CALCulate:SCALE:FUNCTION.</b>
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Syntax:	CALCulate:SCALE:REFerence {<reference>} CALCulate:SCALE:REFerence?
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Parameters:	reference
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Examples:	CALC:SCAL:REF 100
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### 9.2.14.7 CALCulate:SCALE:REFerence:AUTO

Description:	<b>Enable or disable automatic reference selection for dB calibration functions.</b>
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Syntax:	CALCulate:SCALE:REFerence:AUTO {ON 1 OFF 0} CALCulate:SCALE:REFerence:AUTO?
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Parameters:	{ON 1 OFF 0}
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Examples:	CALC:SCAL:REF:AUTO ON
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### 9.2.14.8 CALCulate:SCALE[:STATe]

Description:	<b>Enable or disable the calibration function.</b>
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Syntax:	CALCulate:SCALE[:STATe] {ON 1 OFF 0} CALCulate:SCALE[:STATe]?
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Parameters:	{ON 1 OFF 0}
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Examples:	CALC:SCAL:STAT ON
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## 9.2.15 CALCulate:LIMit Subsystem

This subsystem performs limit value testing of measurement results.

### 9.2.15.1 CALCulate:LIMit:LOWer[:DATA]

Description:	<b>Set the lower limit of the limit test.</b>
Syntax:	CALCulate:LIMit:LOWer[:DATA] <value> CALCulate:LIMit:LOWer[:DATA]?
Parameters:	<value>Set lower limit value
Examples:	CALC:LIM:LOW -50

### 9.2.15.2 CALCulate:LIMit:UPPer[:DATA]

Description:	<b>Set the upper limit of the limit test.</b>
Syntax:	CALCulate:LIMit:UPPer[:DATA] <value> CALCulate:LIMit:UPPer[:DATA]?
Parameters:	<value>Set upper limit value
Examples:	CALC:LIM:UPP 50

### 9.2.15.3 CALCulate:LIMit[:STATe]

Description:	<b>Enable or disable limit testing.</b>
Syntax:	CALCulate:LIMit [:STATe] {ON 1 OFF 0} CALCulate: LIMit [:STATe]?
Parameters:	{ON 1 OFF 0}
Examples:	CALC:LIM ON

### 9.2.15.4 CALCulate:LIMit:CLEar[:IMMediate]

Description:	<b>Clear the limit test results.</b>
Syntax:	CALCulate:LIMit:CLEar[:IMMediate]
Parameters:	(none)
Examples:	CALC:LIM:CLE

## 9.2.16 CALCulate:AVERage Subsystem

This subsystem calculates measurement statistics.

9.2.16.1 CALCulate:AVERage:ALL?

9.2.16.2 CALCulate:AVERage:AVERage?

9.2.16.3 CALCulate:AVERage:COUNT?

9.2.16.4 CALCulate:AVERage:MAXimum?

9.2.16.5 CALCulate:AVERage:MINimum?

9.2.16.6 CALCulate:AVERage:PTPeak?

9.2.16.7 CALCulate:AVERage:SDEVIation?

CALCulate:AVERage:ALL? The query returns the arithmetic mean (average), standard deviation, minimum, and maximum of all measurements taken since the statistics were last cleared.

CALCulate:AVERage:ALL? Counts and peak-to-peak statistics were not returned.

The other six queries listed above return a single value.

### 9.2.16.8 CALCulate:AVERage[:STATe]

Description: **Enable or disable statistical calculations.**

Syntax: CALCulate:AVERage[:STATe] {ON|1|OFF|0}

Syntax: CALCulate:AVERage[:STATe]?

Parameters: {ON|1|OFF|0}

Examples: CALC:AVER ON

### 9.2.16.9 CALCulate:AVERage:CLEar[:IMMEdiate]

Description: **Clear all calculated statistics: minimum, maximum, average, peak-to-peak, count and standard deviation.**

Syntax: CALCulate:AVERage:CLEar[:IMMEdiate]

Parameters: (none)

Examples:	CALC:AVER:CLE
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## 9.2.17 Other Commands

### 9.2.17.1 HANDshake

Description:	<b>Set the state of the handshake signal, when set to on, the DMM will return to the original command first after receiving any command.</b>
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Syntax:	HANDshake {ON OFF}
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Parameters:	{ON 1 OFF 0}
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Examples:	HANDshake on
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### 9.2.17.2 RETurn

Description:	<b>Set Auto Return Data, when set to on, the DMM will automatically send test data to the current communication port after each measurement is completed.</b>
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Syntax:	RETurn {ON OFF}
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Parameters:	{ON 1 OFF 0}
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Examples:	RETurn on
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## 9.3 SCPI Usage Routines

### DC Voltage Test Routine

\*IDN? // Return the instrument model number to ensure the link is successful.

CONF:VOLT:DC // Switch to DC voltage mode.

VOLT:DC:RANG 10 // Switch to 10V range.

VOLT:DC:NPLC 1 // Switch to 1plc.

READ? // Measure and get the return value.

READ? // Measure and get the return value.

READ? // Measure and get the return value.

CONF:RES // Switch to 2-wire resistor mode.

RES:RANG 10k // Switch to 10K range.

RES:NPLC 10 // Switch to 10plc.

READ? // Measure and get the return value.

READ? // Measure and get the return value.

READ? // Measure and get the return value.

**Note:** Please send line breaks at the end of each direct end, otherwise it may result in parsing error of the command

## Chapter 10 Packages & Warranty

### 10.1 Packages

Instruments should be shipped with the following items:

- One TH1953/1963/A digital multi-meter
- One pair of safety-compliant test pens (TH26036)
- One USB interface connection cable (TH26018)
- One power cord
- Two T500mAL fuses
- Two T3.15AL fuses
- One test report
- One warranty card
- Accessories ordered by the customer

When the user receives the instrument, please check the above contents when you open the box for inspection, if any missing, please contact our company or operation department immediately.

### 10.2 Warranty

Warranty period: The warranty period of one year shall be calculated from the date of shipment of the instrument purchased from the Company by the user unit, and from the date of shipment of the instrument purchased from the operating department. Warranty should be issued by the instrument warranty card. During the warranty period, if the instrument is damaged due to improper operation by the user, the maintenance cost shall be borne by the user. The company is responsible for the lifetime maintenance of the instrument.

The maintenance of this instrument requires professional and technical personnel to carry out maintenance; maintenance, please do not replace the internal components of the instrument without authorization; maintenance of the instrument, the need to re-measure the calibration, so as not to affect the accuracy of the test. Due to the user blind maintenance, replacement of instrument components caused by damage to the instrument is not covered by the warranty, the user should bear the maintenance costs.

Instruments should be protected from sunlight and moisture and should be used properly in the environment described in 1.2.2.

When the instrument is not used for a long period of time, it should be sealed in the factory box.