

TH1950 High-Precision Multi-function Calibrator



1. Overview

The TH1950 is a next-generation top-tier multifunction calibrator featuring an extended calibration range and higher accuracy. It provides high-performance AC/DC voltage and current outputs, and integrates highly stable standard resistors. The TH1950 is designed for calibrating various digital multimeters and other precision electrical measuring instruments. It is widely used in power utilities, electrical energy metrology, industrial manufacturing, and scientific research.

2. Reference Standard

- JJG 124-2005 *Verification Regulation of Amperemeters Voltmeters Wattmeters and Ohmmeters*
- JJF 1587-2016 *Calibration Specification for Multimeters*
- JJF 1638-2017 *Calibration Specification for Multifunction Standard Sources*

3. Features

- **Comprehensive Calibration Functions:** Suitable for calibrating handheld and benchtop digital multimeters, analog meters, data loggers, chart recorders, panel meters, and graphical multimeters.
- **Safe and Reliable Protection Circuits:** Equipped with comprehensive protection, including voltage short-circuit protection, current open-circuit protection, and over-temperature/overload protection. A specially designed overcurrent fuse allows easy replacement. These features effectively prevent damage caused by misoperation, minimizing user loss.
- **Excellent User Interaction:** Features a large high-definition color touchscreen capable of displaying multiple parameters simultaneously with clear and intuitive visuals. The capacitive touch panel ensures fast and responsive operation. Physical keys and a rotary knob are also provided, along with a calculator-style keypad for quick and accurate input, enhancing overall operational reliability.

4. Technical Specifications

4.1 DC Voltage

Range	Resolution	Output Range	Maximum Load [Source Internal Resistance]
200 mV	10 nV	$\pm(0 \sim 220.000\ 00\ \text{mV})$	[50 Ω]
2 V	100 nV	$\pm(0 \sim 2.200\ 000\ 0\ \text{V})$	50 mA
10 V	1 μV	$\pm(0 \sim 11.000\ 000\ \text{V})$	50 mA
20 V	1 μV	$\pm(0 \sim 22.000\ 000\ \text{V})$	50 mA
200 V	10 μV	$\pm(0 \sim 220.000\ 00\ \text{V})$	50 mA
1000 V	100 μV	$\pm(100.000\ 0\ \text{V} \sim 1100.000\ 0\ \text{V})$	20 mA

Range	Stability Tcal $\pm 1^\circ\text{C}$	Absolute Measurement Uncertainty(k=2) Tcal $\pm 5^\circ\text{C}$			
	24-hour	24-hour	90-day	180-day	1-year
	ppm*output + μV				
200 mV	0.3 + 0.3	4 + 0.4	6 + 0.4	6.5 + 0.4	7.5 + 0.4
2 V	0.3 + 1	3 + 0.7	3.5 + 0.7	4 + 0.7	5 + 0.7
10 V	0.3 + 2.5	2 + 2.5	2.5 + 2.5	3 + 2.5	3.5 + 2.5
20 V	0.4 + 5	2 + 4	2.5 + 4	3 + 4	3.5 + 4
200 V	0.5 + 40	3 + 40	3.5 + 40	4 + 40	5 + 40
1000 V	0.5 + 200	4 + 400	4.5 + 400	6 + 400	6.5 + 400

- Range switching: Manual / auto ranging
- Display resolution: 8-digit decimal
- Wiring mode: 2-wire or 4-wire
- Protection functions: Short-circuit protection, overload protection

4.2 AC Voltage

Range	Resolution	Output Range	Maximum Load [Source Internal Resistance]
2 mV	1 nV	0.200 000 mV ~ 2.200 000 mV	[50 Ω]
20 mV	10 nV	2.000 00 mV ~ 22.000 00 mV	[50 Ω]
200 mV	100 nV	20.000 0 mV ~ 220.000 0 mV	[50 Ω]
2 V	1 μV	0.200 000 V ~ 2.200 000 V	50 mA
20 V	10 μV	2.000 00 V ~ 22.000 00 V	50 mA
200 V	100 μV	20.000 0 V ~ 220.000 0 V	50 mA
1000 V	1 mV	100.000 V ~ 1100.000 V	6 mA

Range	Frequency (Hz)	Stability Tcal±1℃	Absolute Measurement Uncertainty(k=2) Tcal±5℃			
		24-hour	24-hour	90-day	180-day	1-year
		ppm*output + μV				
2 mV	10~20	0 + 5	200 + 4	220 + 4	230 + 4	240 + 4
	20~40	0 + 5	80 + 4	85 + 4	87 + 4	90 + 4
	40~20k	0 + 2	70 + 4	75 + 4	77 + 4	80 + 4
	20k~50k	0 + 2	170 + 4	180 + 4	190 + 4	200 + 4
	50k~100k	0 + 3	400 + 5	460 + 5	480 + 5	500 + 5
	100k~300k	0 + 3	800 + 10	900 + 10	1000 + 10	1050 + 10
	300k~500k	0 + 5	1100 + 20	1200 + 20	1300 + 20	1400 + 20
	500k~1M	0 + 5	2400 + 20	2500 + 20	2600 + 20	2700 + 20
20 mV	10~20	0 + 5	200 + 4	220 + 4	230 + 4	240 + 4
	20~40	0 + 5	80 + 4	85 + 4	87 + 4	90 + 4
	40~20k	0 + 2	70 + 4	75 + 4	77 + 4	80 + 4
	20k~50k	0 + 2	170 + 4	180 + 4	190 + 4	200 + 4
	50k~100k	0 + 3	400 + 5	460 + 5	480 + 5	500 + 5
	100k~300k	0 + 5	800 + 10	900 + 10	1000 + 10	1050 + 10
	300k~500k	0 + 10	1100 + 20	1200 + 20	1300 + 20	1400 + 20
	500k~1M	0 + 15	2400 + 20	2500 + 20	2600 + 20	2700 + 20

200 mV	10~20	150 + 20	200 + 12	220 + 12	230 + 12	240 + 12
	20~40	80 + 15	80 + 7	85 + 7	87 + 7	90 + 7
	40~20k	12 + 2	54 + 7	55 + 7	56 + 7	57 + 7
	20k~50k	10 + 2	105 + 7	110 + 7	115 + 7	120 + 7
	50k~100k	10 + 2	296 + 17	298 + 17	303 + 17	310 + 17
	100k~300k	20 + 4	535 + 20	583 + 20	600 + 20	655 + 20
	300k~500k	100 + 10	1100 + 25	1200 + 25	1300 + 25	1400 + 25
	500k~1M	200 + 20	2400 + 45	2500 + 45	2600 + 45	2700 + 45
2 V	10~20	150 + 20	200 + 40	220 + 40	230 + 40	240 + 40
	20~40	80 + 15	75 + 15	80 + 15	85 + 15	90 + 15
	40~20k	12 + 4	37 + 8	39 + 8	40 + 8	42 + 8
	20k~50k	15 + 5	61 + 10	63 + 10	65 + 10	67 + 10
	50k~100k	15 + 5	79 + 30	81 + 30	82 + 30	85 + 30
	100k~300k	30 + 10	276 + 80	300 + 80	314 + 80	336 + 80
	300k~500k	70 + 20	800 + 200	900 + 200	950 + 200	1000 + 200
	500k~1M	150 + 50	1300 + 300	1500 + 300	1600 + 300	1700 + 300
20 V	10~20	150 + 20	200 + 400	220 + 400	230 + 400	240 + 400
	20~40	80 + 15	75 + 150	80 + 150	85 + 150	90 + 150
	40~20k	12 + 8	37 + 50	39 + 50	40 + 50	42 + 50
	20k~50k	15 + 10	61 + 100	63 + 100	65 + 100	67 + 100
	50k~100k	15 + 10	78 + 200	80 + 200	81 + 200	83 + 200
	100k~300k	30 + 15	238 + 600	243 + 600	249 + 600	254 + 600
	300k~500k	70 + 100	800 + 2000	900 + 2000	900 + 2000	1000 + 2000
	500k~1M	150 + 100	1200 + 3200	1300 + 3200	1400 + 3200	1500 + 3200
Range	Frequency (Hz)	ppm*output + mV				
200 V ^[1]	10~20	150 + 0.2	200 + 4	220 + 4	230 + 4	240 + 4
	20~40	80 + 0.15	75 + 1.5	80 + 1.5	85 + 1.5	90 + 1.5
	40~20k	12 + 0.08	45 + 0.6	47 + 0.6	50 + 0.6	52 + 0.6
	20k~50k	15 + 0.1	70 + 1	75 + 1	77 + 1	80 + 1

	50k~100k	15 + 0.1	120 + 2.5	130 + 2.5	140 + 2.5	150 + 2.5
	100k~300k	30 + 0.4	700 + 16	800 + 16	850 + 16	900 + 16
	300k~500k	100 + 10	4000 + 40	4200 + 40	4300 + 40	4400 + 40
	500k~1M	200 + 20	6000 + 80	7000 + 80	7500 + 80	8000 + 80
1000V ^[2]	15~50	150 + 0.5	240 + 16	260 + 16	280 + 16	300 + 16
	50~1k	20 + 0.5	55 + 3.5	60 + 3.5	65 + 3.5	70 + 3.5
[1] Voltage – frequency product $\leq 22 \text{ V} \cdot \text{MHz}$						
[2] Maximum output: 250 V at 15–50 Hz						

- Range switching: Manual / auto ranging
- Display resolution: 7-digit decimal
- Protection functions: Short-circuit protection, overload protection

4.3 Resistance

Nominal Value	Stability $T_{cal}\pm 1^{\circ}\text{C}$	Absolute Measurement Uncertainty($k=2$) $T_{cal}\pm 5^{\circ}\text{C}$			
	24-hour	24-hour	90-day	180-day	1-year
	ppm				
0 Ω	—	40 $\mu\Omega$	40 $\mu\Omega$	40 $\mu\Omega$	40 $\mu\Omega$
1 Ω	32	70	80	85	95
1.9 Ω	25	70	80	85	95
10 Ω	5	20	21	22	23
19 Ω	4	20	21	22	23
100 Ω	2	8	9	9.5	10
190 Ω	2	8	9	9.5	10
1 k Ω	2	5.5	5.7	6	6.5
1.9 k Ω	2	5.5	5.7	6	6.5
10 k Ω	2	5	5.5	6	6.5
19 k Ω	2	5	5.5	6	6.5
100 k Ω	2	5.5	7.5	8	8.5
190 k Ω	2	6	7	8	8.5
1 M Ω	2.5	10	11	12	13
1.9 M Ω	3.5	12	13.5	15	18
10 M Ω	10	27	31	34	40
19 M Ω	20	35	39	42	47
100 M Ω	50	85	95	100	100

4.4 DC Current

Range	Resolution	Output Range	Maximum Load Voltage
200 μ A	100 pA	$\pm(0 \sim 220.000\ 0\ \mu\text{A})$	10 V
2 mA	1 nA	$\pm(0 \sim 2.200\ 000\ \text{mA})$	10 V
20 mA	10 nA	$\pm(0 \sim 22.000\ 00\ \text{mA})$	10 V
200 mA	100 nA	$\pm(0 \sim 220.000\ 0\ \text{mA})$	10 V
2 A	1 μ A	$\pm(0 \sim 2.200\ 000\ \text{A})$	3 V

Range	Stability Tcal $\pm 1^{\circ}\text{C}$	Absolute Measurement Uncertainty(k=2) Tcal $\pm 5^{\circ}\text{C}$			
	24-hour	24-hour	90-day	180-day	1-year
	ppm*output + nA				
200 μ A	5 + 1	32 + 6	35 + 6	37 + 6	40 + 6
2 mA	5 + 5	25 + 7	30 + 7	33 + 7	35 + 7
20 mA	5 + 50	25 + 40	30 + 40	33 + 40	35 + 40
200 mA	8 + 300	35 + 700	40 + 700	42 + 700	45 + 700
2 A	9 + 7000	50 + 12000	60 + 12000	70 + 12000	80 + 12000

- Range switching: Manual / auto ranging
- Display resolution: 7-digit decimal
- Protection functions: Open circuit protection, overload protection

4.5 AC Current

Range	Resolution	Output Range	Maximum Load Voltage (rms)	Maximum Inductive Load
200 μ A	100 pA	9.000 0 μ A ~ 220.000 0 μ A	7 V	400 μ H
2 mA	1 nA	0.200 000 mA ~ 2.200 000 mA	7 V	400 μ H
20 mA	10 nA	2.000 00 mA ~ 22.000 00 mA	7 V	400 μ H
200 mA	100 nA	20.000 0 mA ~ 220.000 0 mA	7 V	400 μ H
2 A	1 μ A	0.200 000 V ~ 2.200 000 A	1.4 V	400 μ H ^[1]

● [1] 20 μ H when output current > 1 A.

Range	Frequency (Hz)	Stability Tcal $\pm$ 1 $^{\circ}$ C	Absolute Measurement Uncertainty(k=2) Tcal $\pm$ 5 $^{\circ}$ C			
		24-hour	24-hour	90-day	180-day	1-year
		ppm*output + nA				
200 μ A	10~20	150 + 5	210 + 16	230 + 16	240 + 16	250 + 16
	20~40	80 + 5	130 + 10	140 + 10	150 + 10	160 + 10
	40~1k	30 + 3	96 + 8	99 + 8	101 + 8	103 + 8
	1k~5k	50 + 20	240 + 12	250 + 12	270 + 12	280 + 12
	5k~10k	400 + 100	800 + 65	900 + 65	1000 + 65	1100 + 65
2 mA	10~20	150 + 5	210 + 40	230 + 40	240 + 40	250 + 40
	20~40	80 + 5	130 + 35	140 + 35	150 + 35	160 + 35
	40~1k	30 + 3	96 + 35	99 + 35	101 + 35	103 + 35
	1k~5k	50 + 20	170 + 110	180 + 110	190 + 110	200 + 110
	5k~10k	400 + 100	800 + 650	900 + 650	1000 + 650	1100 + 650
20 mA	10~20	150 + 50	210 + 400	230 + 400	240 + 400	250 + 400
	20~40	80 + 50	130 + 350	140 + 350	150 + 350	160 + 350
	40~1k	30 + 30	96 + 350	99 + 350	101 + 350	103 + 350
	1k~5k	50 + 500	170 + 550	180 + 550	190 + 550	200 + 550
	5k~10k	400 + 1000	800 + 5000	900 + 5000	1000 + 5000	1100 + 5000
Range	Frequency (Hz)	ppm*output + μ A				
200 mA	10~20	150 + 0.5	210 + 4	230 + 4	240 + 4	250 + 4

	20~40	80 + 0.5	130 + 3.5	140 + 3.5	150 + 3.5	160 + 3.5
	40~1k	30 + 0.3	96 + 2.5	99 + 2.5	101 + 2.5	103 + 2.5
	1k~5k	50 + 3	170 + 3.5	180 + 3.5	190 + 3.5	200 + 3.5
	5k~10k	400 + 5	800 + 10	900 + 10	1000 + 10	1100 + 10
2 A	20~1k	50 + 5	214 + 35	224 + 35	234 + 35	244 + 35
	1k~5k	80 + 20	350 + 80	390 + 80	420 + 80	450 + 80
	5k~10k	800 + 50	5000 + 160	6000 + 160	6500 + 160	7000 + 160

- Range switching: Manual / auto ranging
- Display resolution: 7-digit decimal
- Protection functions: Short-circuit protection, overload protection

4.6 AC Frequency

Output Range ^[1]	Resolution	Absolute Measurement Uncertainty (k=2)
10.000 00 Hz ~ 99.999 99 Hz	10 μHz	0.005%
100.000 0 Hz ~ 999.999 9 Hz	0.1 mHz	0.005%
1.000 000 kHz ~ 9.999 999 kHz	1 mHz	0.005%
10.000 00 kHz ~ 99.999 99 kHz	10 mHz	0.005%
100.000 0 kHz ~ 999.999 9 kHz	0.1 Hz	0.005%
1.000 000 MHz	1 Hz	0.005%

● [1] Output mode: AC voltage or AC current

5. General Specifications

Power Supply	AC (220±22) V, (50±3) Hz
Warm-Up Time	The warm-up time is twice the previous warm-up time, up to a maximum of 30 minutes.
Temperature Performance	Operating temperature: 0°C~50°C Calibration temperature: 15°C~35°C Storage temperature: -40°C~75°C
Humidity Performance	Operating humidity: <80% @ ≤ 30°C, <70% @ ≤ 40°C, <40% @ ≤ 50°C. Storage humidity: <95%, non-condensing.
Altitude	≤2000 m
Communication Interface	RS232×1, USB×1, LAN×1
Dimensions	432 mm (W) * 517 mm (D) * 222 mm (H)
Weight	Approx. 29 kg