TH1950 High Precision Multi-function Calibrator

1. Summary

TH1950 is a new generation of top-level multi-function calibrator with a wider calibration range and higher calibration accuracy. It can output AC and DC voltage and current signals with excellent performance and has built-in high-stability standard resistors. It can calibrate various series of digital multimeters and other precision electrical measuring instruments, and is widely used in power grids, measurement and testing, industrial manufacturing, scientific research and other fields.

2. Features

- **Rich Calibration Functions**: It can be used to calibrate digital multimeters, analog pointer meters, data loggers, chart recorders, panel meters and graphic multimeters, etc.
- **Original Device Calibration Technology:** By using measurement standards: TH0100 Advanced DC Voltage Reference Standard and TH0320 Reference Resistance Standard, all functions and ranges can be fully calibrated, greatly saving testing time and periodic calibration costs.
- **Safety Protection Circuit:** It has safety circuit protection functions, including voltage short circuit protection, current open circuit protection, overheating and overload protection, etc. The specially designed overcurrent fuse can also be easily replaced.
- **Excellent Interaction Performance:** High-definition large-size color touch screen, which can display multiple sets of parameters and information at the same time, and the selected capacitive touch screen makes operation sensitive and convenient, equipped with physical operation buttons and a rotary encoder, the calculator-style keyboard makes inputting values easier and faster.

3. Specification

3.1 DCV

Range	Resolution	Output Range	Maximum Load [Source Internal Resistance]
200 mV	10 nV	±(0 ~ 220.000 00 mV)	[50 Ω]
2 V	100 nV	±(0 ~ 2.200 000 0 V)	50 mA
10 V	1 μV	±(0 ~ 11.000 000 V)	50 mA
20 V	1 μV	±(0 ~ 22.000 000 V)	50 mA
200 V	10 μV	±(0 ~ 220.000 00 V)	50 mA
1000 V	100 μV	±(100.000 0 V ~ 1100.000 0 V)	20 mA

Range	Stability Tcal±1°C	Absolute Measurement Uncertainty (k=2) Tcal±5°C			
	24 Hours	24 Hours	90 Days	180 Days	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 / automatic
- Display digits: 8 decimal digits
- Wiring method: two-wire or four-wire
- Protection functions: short circuit protection, overload protection

3.2 ACV

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°C	Absolute Measurement Uncertainty (k=2) Tcal±5°C			
		24 Hours	24 Hours	90 Days	180 Days	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	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
1000 V	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

- Range switching: manual/automatic
- Display digits: 7 decimal digits
- Protection functions: short circuit protection, overload protection

3.3 Resistance

Nominal Value	Stability Tcal±1°C	Absolute Measurement Uncertainty (k=2) Tcal±5°C			
	24 Hours	24 Hours	90 Days	180 Days	1 Year
	ppm				
0 Ω	—	40 μΩ	40 μΩ	40 μΩ	40 μΩ
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 kΩ	2	5.5	5.7	6	6.5
1.9 kΩ	2	5.5	5.7	6	6.5
10 kΩ	2	5	5.5	6	6.5
19 kΩ	2	5	5.5	6	6.5
100 kΩ	2	5.5	7.5	8	8.5
190 kΩ	2	6	7	8	8.5
1 MΩ	2.5	10	11	12	13
1.9 MΩ	3.5	12	13.5	15	18
10 MΩ	10	27	31	34	40
19 MΩ	20	35	39	42	47
100 MΩ	50	85	95	100	100

3.4 DCI

Range	Resolution	Output Range	Maximum Load Voltage
200 μA	100 pA	±(0 ~ 220.000 0 μA)	10 V
2 mA	1 nA	±(0 ~ 2.200 000 mA)	10 V
20 mA	10 nA	±(0 ~ 22.000 00 mA)	10 V
200 mA	100 nA	±(0 ~ 220.000 0 mA)	10 V
2 A	1 μA	±(0 ~ 2.200 000 A)	3 V

Range	Stability Tcal±1°C	Absolute Measurement Uncertainty (k=2) Tcal±5°C			
	24 Hours	24 Hours	90 Days	180 Days	1 Year
	ppm*Output + nA				
200 μA	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 / automatic
- Display digits: 7 decimal digits
- Protection functions: open circuit protection, overload protection

3.5 ACI

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

- [1] 20 μH for output current greater than 1 A.

Range	Frequency (Hz)	Stability Tcal±1°C	Absolute Measurement Uncertainty (k=2) Tcal±5°C			
		24 Hours	24 Hours	90 Days	180 Days	1 Year
		ppm*Output + nA				
200 μA	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	ppm*Output + μA				

	(Hz)					
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 / automatic
- Display digits: 7 decimal digits
- Protection functions: short circuit protection, overload protection

3.6 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: ACV or ACI

4. General Specification

Power Supply	AC (220±22) V, (50±3) Hz
Preheat Time	2 times the last preheating time, up to 30 minutes.
Temperature Performance	Working temperature: 0° C~50° C Calibration temperature: 15° C~35° C Storage temperature: -40° C~75° C
Humidity Performance	Working humidity: <80% @ ≤30° C, <70% @ ≤40° C, <40% @ ≤50° C. Storage humidity: <95%, no condensation.
Altitude	≤2000 m
Communication Interface	RS232×1、USB×1、LAN×1