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1523/1524 Reference Thermometers

Measure, graph and record three sensor types with one tool

- High accuracy
- PRTs: up to ± 0.011 °C
- Thermocouples: up to ± 0.24 °C
- Precision thermistors: ± 0.002 °C

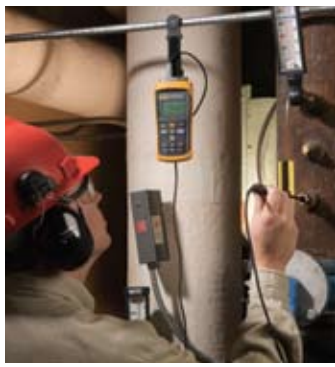
Two models
- 1523: Single channel standard model with memory for 25 readings
- 1524: Two channels; memory for logging 15,000 measurements; real-time clock for time and date stamps

Technical Data

Finally, a reference thermometer as versatile as you are

The new 1523/24 Reference Thermometers from Fluke's Hart Scientific division measure, graph, and record PRTs, thermocouples, and thermistors. These new thermometer readouts deliver high accuracy, wide measurement range, logging, and trending, all in a handheld tool you can take anywhere.

The 1523/24 lets you handle field applications, laboratory measurements, and data logging with ease. And with the dual channel measurement capabilities of the model 1524, you can do twice the work in half the time.



Make accurate, consistent measurement...anywhere

You need accuracy for compliance, product yields, energy savings, and consistent results. The 1523/24 uses current reversal, a technique used in high-end instruments that eliminates thermal EMFs, for precision temperature measurements. Specifications are guaranteed from –10 °C to 60 °C ambient. Special precision resistors and a highly stable reference voltage source keep 1523/24 accuracy virtually insensitive to environmental temperature.

Like all Fluke handheld tools, the 1523/24 Reference Thermometers endure rigorous testing in temperature extremes and under harsh conditions of vibration, so you can take it with confidence anywhere you need to go. An optional magnetic hanger allows you to hang the thermometer for easy viewing while freeing your hands to focus on the job.

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Two models let you make the best choice for your application

Monitor trends in the lab or in the field

See trends graphically on the 1523/24 thermometer's 128x64–backlit LCD display. You can change the graph's resolution at the touch of a button. Now it is easy to see when the temperature is stable (without statistics or long delays) or to monitor processes over time to verify correct operation.

Hold readings on the display at the touch of a button, or document up to 25 readings and associated statistics for easy retrieval. Statistics include the average maximum and minimum values, and the standard deviation. View them through the display or by uploading it to a PC via RS–232 connection and 9940 I/O TookKit software, included free. To monitor and log more data over time, use a PC and optional Log*Ware* II software.

RS–232–to–USB adapters are available for those who prefer USB connectors. Battery power lasts at least 20 hours on three AA batteries, or use the dc power adapter for extended periods of measurement. Power saving features can be enabled or disabled for longer battery life or greater convenience.

INFO–CON connectors ensure correct temperature conversion

Inside the INFO–CON, a memory chip keeps calibration information for the attached probe. Simply plugging in the probe uploads the information to the readout. The connector transfers this information to the 1523/24 automatically, ensuring the correct temperature conversion for accurate, hassle–free measurements.

Probes may be locked by password to specific channels and readouts for security or for system calibration traceability. Plug any thermocouple with mini–thermocouple jacks into an optional universal thermocouple adapter for convenient measurement. Each thermocouple adapter or standard connector supports reference junction compensation (RJC) with its own internal precision thermistor.

1523 single-channel thermometer

1 External power adapter connection, for continuous use without changing batteries. Alternatively, 3 AA batteries will last more than 20 hours in the field.
2 Sensor connector (PRT, thermocouple, or thermistor)
4 RS–232 serial interface connector. For PC communications, uploading and downloading data from memory and from the probe INFO–CON connectors.

The 1523 Reference Thermometers are versatile single–channel thermometers that measure, graph and record three sensor types with one tool. Support for PRTs/RTDs, thermocouples, and thermistors provide flexibility to choose the right probe for the job.

1524 two-channel thermometer

1 External power adapter connection
2 Channel 1 sensor connector (PRT, thermocouple, and thermistor)
3 Channel 2 sensor connector (PRT, and thermistor)
4 RS–232 serial interface connector

The new 1524 Reference Thermometers help you do twice the work in half the time. Two channels and three sensor types and high–speed measurement make you more productive and make model 1524 the one reference thermometer you need to own. It has all the features of the 1523, and it's a data logger too. A real–time clock and memory for 15,000 time and date stamped measurements mean everything you are going to need is in this package. Log up to three times per second, or once every hour or other options in between. Download the data to a PC for analysis when you need it.

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Specifications

	1523	1524
Input channels	1	2
Resolution	PRTs and thermistors: 0.001° thermocouples: 0.01°	
Logging	25 readings with statistics	25 readings with statistics15,000 time and date stamped
Sample interval (normal)	1 second	1 second (simultaneous measurement)
Typical sample interval (fast mode)*	0.3 seconds	
Sensor types	PRTs, RTDs, thermistors, and thermocouples	
Thermocouple types	C, E, J, K, L, M, N, T, U, B, R, S	
Statistics	Maximum, minimum, average, standard deviation	
Trending	Scale: ± 10 °C (18 °F), ± 1 °C (1.8 °F), ± 0.1°C (0.18 °F), ± 0.01°C (0.018 °F), 10 minutes of real-time data	
Power requirements	3 AA alkaline batteries, 12 V dc universal power supply	
Size (HxWxD)	96 mm x 200 mm x 47 mm (3.75 in x 7.9 in x 1.86 in)	
Weight	0.65 kg (1.4 lb)	
Computer interface	RS-232, 9940 I/O ToolKit software included	
Safety	EN61010-1:2001, CAN/CSA C22.2 No. 61010.1-04	
Environmental conditions for best accuracy: 13 °C to 33 °C (55.4 °F to 91.4 °F)		
Millivolt range and accuracy	−10 mV to 75 mV, ± (0.005 % + 5 µV)	
Internal reference junction compensation	± 0.2 °C (± 0.36 °F)	
Resistance range and accuracy	0 Ω to 400 Ω ± (0.004 % + 0.002 Ω) 200 Ω to 50 kΩ ± (0.01 % + 0.5 Ω) 50 kΩ to 500 kΩ ± (0.03 %)	
Temperature coefficient, voltage: −10 °C to 13 °C , +33 °C to 60 °C (14 °F to 55.4 °F, 91.4 °F to 140 °F)	± (0.001 %/°C + 1 mV/°C)	
Temperature coefficient, resistance: −10 °C to 13 °C , +33 °C to 60 °C (14 °F to 55.4 °F, 91.4 °F to 140 °F)	0.0008 %/°C + 0.0004 Ω (0 Ω to 400 Ω) 0.002 %/°C + 0.1 Ω (0 Ω to 50 kΩ) 0.06 %/°C + 0.1 Ω (50 kΩ to 500 kΩ)	
Excitation current, resistance	1 mA (0 Ω to 400 Ω) 10 µA (0 Ω to 50 kΩ) 2 µA (50 kΩ to 500 kΩ)	

*See technical manual for sample interval details by sensor type and number of inputs.

Equivalent temperature accuracies for selected sensors derived from primary specifications (Ω, mV)

Temperature, thermocouples

Type	Range	Measure accuracies
K	−200 °C to 0 °C (-328 °F to 32 °F)	± 0.61 °C (± 1.10 °F)
	0 °C to 1370 °C (32 °F to 2498 °F)	± 0.24 °C (± 0.43 °F)
R	−20 °C to 0 °C (4 °F to 32 °F)	± 1.09 °C (± 1.96 °F)
	0 °C to 500 °C (32 °F to 932 °F)	± 0.97 °C (± 1.71 °F)
	500 °C to 1750 °C (932 °F to 3182 °F)	± 0.49 °C (± 0.88 °F)
S	−20 °C to 0 °C (4 °F to 32 °F)	± 1.05 °C (± 1.89 °F)
	0 °C to 500 °C (32 °F to 932 °F)	± 0.95 °C (± 1.71°F)
	500 °C to 1750 °C (932 °F to 3182 °F)	± 0.56 °C (± 1.01 °F)
	Accuracies are based on internal reference junction compensation. Refer to technical manual for greatly improved accuracies using external reference junctions.	

Accuracies of selected readout/probe combinations (±°C)

Temperature	5616-12	5615-6	5627A-12	5610-9
-200 °C (-328 °F)	0.014	0.025	0.027	n/a
0 °C (32 °F)	0.021	0.021	0.049	0.009
100 °C (212 °F)	0.027	0.028	0.065	0.009
300 °C (572 °F)	0.040	0.043	0.103	n/a
420 °C (788 °F)	0.050	n/a	0.130	n/a
	Includes readout accuracy, probe calibration, and probe drift			

Ordering Information

1523* Reference Thermometer, Handheld, 1 Channel
1524* Reference Thermometer, Handheld, 2 Channel, Data Logger
1523-P1 1523 Bundled with 5616 PRT [−200 °C to 420 °C (-328 °F to 788 °F), NIST Traceable Calibration, 100 ohm, 6.35 mm x 305 mm (1/4 in x 12 in)], Universal TC INFO-CON Connector, TPAK, and Case
1523-P2 1523 Bundled with 5628 PRT [−200 °C to 660 °C (-328 °F to 1220 °F), Accredited Calibration, 25 ohm, 6.35 mm x 305 mm (1/4 in x 12 in)], Universal TC INFO-CON Connector, TPAK, and Case
1523-P3 1523 Bundled with 5627A PRT [−200 °C to 420 °C (-328 °F to 788 °F), Accredited Calibration, 100 ohm, 6.35 mm x 305 mm (1/4 in x 12 in)], Universal TC INFO-CON Connector, TPAK, and Case
1524-P1 1524 Bundled, with 5616 PRT, Universal TC INFO-CON Connector, TPAK, and Case
1524-P2 1524 Bundled with 5628 PRT, Universal TC INFO-CON Connector, TPAK, and Case
1524-P3 1524 Bundled with 5627A PRT, Universal TC INFO-CON Connector, TPAK, and Case

*Requires an optional probe

Calibration options

1523-CAL 1523 Accredited Calibration
1524-CAL 1524 Accredited Calibration
1929-2 System Verification, PRT with Readout, Accredited
1929-5 System Verification, Thermistor with Readout, Accredited
1930 System Calibration, PRT with Readout, Accredited
1935 System Calibration, Thermistor with Readout, Accredited
1925-A Accredited Thermistor Calibration, 0 °C to 100 °C (23 °F to 212 °F)

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Recommended accessories

A wide array of accessories is available to help you maximize productivity, but the following are essential for most users.

Calibrated Temperature Sensors

TPAK Magnetic Hanger

Probe and Readout Case

Universal Thermocouple Adapter

Universal RTD Adapter

Included accessories

NIST traceable certificate of calibration, users guide, CD-ROM (contains technical manual), 12 V dc universal power supply, RS-232 cable, 9940 I/O ToolKit software

Optional accessories

5610-9-P	Probe, Precision Thermistor, Stainless Steel, 3.18 mm x 228.6 mm (1/8 in x 9 in), 0 °C to 100 °C (32 °F to 212 °F), NIST traceable calibration
5615-6-P	Probe, PRT, 100 ohm, 4.76 mm x 152.4 mm (3/16 in x 6 in), –200 °C to 300 °C (-328 °F to 572 °F), Accredited Calibration
5609-9BND-P	Probe, PRT, 25 ohm, 6.35 mm x 305 mm (1/4 in x 12 in), 90° bend at 9 inches, –200 °C to 660 °C (-328 °F to 1220 °F), Requires Calibration (i.e. 1924-4-7)
FLK80P1	80PK-1, Probe, Thermocouple, Beaded Type K
FLK80P3	80PK-3A, Probe, Thermocouple, Surface Measurement Type K
9935-S	Software, Log*Ware* II, Single User
1523-CASE	Case, 1523/1524 Readout and Probe Carrying
FLUKETPAK	TPAK, Meter Hanging Kit
2373-LPRT	Adapter, Lemo to Mini Grabbers (4-wire)
2373-LTC	Adapter, Lemo to Universal TC (TC)
2384-P	INFO-CON Connector, PRT (Gray Cap), Spare
2384-T	INFO-CON Connector, TC (Blue Cap), Spare

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Fluke Corporation,
Hart Scientific Division
799 E. Utah Valley Drive
American Fork, UT 84003-9775 U.S.A.
Tel: (801) 763-1600
Fax: (801) 763-1010
www.hartscientific.com

Fluke Europe B. V.,
Hart Scientific Division
PO Box 1186, 5602 BD
Eindhoven, The Netherlands
Tel: +31 (0) 40 2676 403
Fax: +31 (0) 40 2676 404
E-mail: hart.logistics@fluke.nl

All other countries:
Tel: +1 (801) 763-1600
Fax: +1 (801) 763-1010

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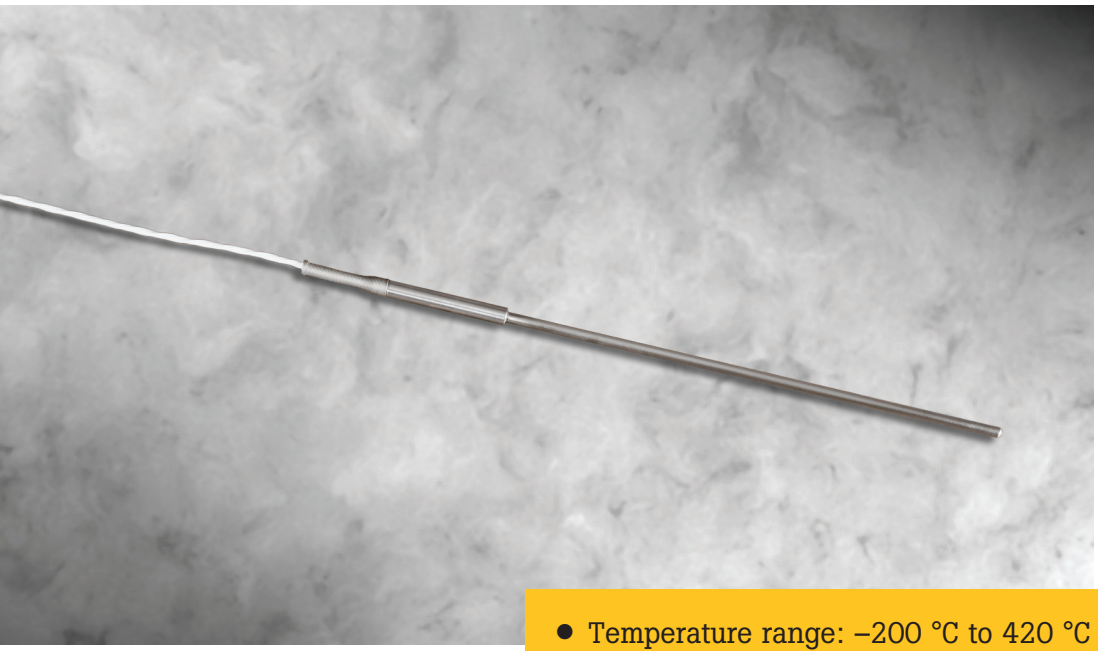
5616 Secondary Reference PRT

Technical Data



- Temperature range: –200 °C to 420 °C
- Excellent stability: ± 10 mK
- Reference-grade platinum sensing element
- NIST-traceable calibration included

You won't find another NIST-traceable reference temperature sensor that matches the accuracy and temperature range of the 5616 for the same price.

The 5616-12 is a 100-ohm platinum resistance thermometer (PRT) with excellent short-term repeatability and comes with an unaccredited NIST-traceable calibration.

The temperature range of the 5616 covers –200 °C to 420 °C, and its high-purity platinum element and durability make it great for calibrating in the lab or in the field. When choosing a reference with a platinum element, there are two things you want to look at carefully: the short-term repeatability and the long-term drift. When PRTs are thermally cycled over their temperature range as they would be during a calibration, their resistance at the triple point of water can move up and down within an expected range. Hart Scientific defines this range (called "short-term repeatability") as the repeatability at the triple point of water during three thermal cycles. 5616s are among the best performing in their class with short-term repeatability better than ± 0.010 °C (± 0.004 °C is typical). In addition, the 5616 is specified to drift no more than ±0.010 °C at the triple point of water when exposed up to its maximum temperature (420 °C) for 100 hours. These specifications are given at k=3 and therefore include a 99.8 % confidence level.

The 5616's sealed INCONEL® 600 sheath is 298 mm (11.75 in) long and 6.35 mm (0.250 in) in diameter. The probe's Teflon®-jacketed cable is made of silver plated copper that ends with four-wire leads, which eliminate the effects of lead-wire resistance on measurements.

Use the 5616 with Hart's 1560 *Black Stack,* 1529 Chub-E4, or 1502A Tweener thermometer readouts.

Each sensor comes with a manufacturer's report of calibration. The report includes the expanded uncertainty (k=2) at seven calibration temperature points, ITS-90 calibration coefficients, and a temperature vs. resistance table presented in 1 °C increments.

Compare the 5616 to other Secondary Reference PRTs. You'll like its price, but you'll love its performance.

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Specifications

Parameter	Value
Temperature range	–200 °C to 420 °C
Nominal resistance at 0.01 °C	100 Ω ± 0.5 Ω
Temperature coefficient	0.003925 Ω/Ω/°C nominal
Accuracy[1]	See footnote
Short-term repeatability[2]	± 0.010 °C at 0.010 °C (see footnote)
Drift[3]	± 0.010 °C at 0.010 °C (see footnote)
Hysteresis	± 0.010 °C maximum
Sensor length	50.8 mm (2.0 in)
Sensor location	6.0 mm ± 2.5 mm from tip (0.24 in ± 0.10 in)
Sheath diameter tolerance	± 0.08 mm (± 0.003 in)
Sheath material	INCONEL® 600
Minimum insulation resistance	500 MΩ at 23 °C
Transition junction temperature range[4]	–50 °C to 150 °C (see footnote)
Transition junction dimensions	76.2 mm x 9.5 mm (3.00 in x 0.375 in)
Minimum immersion length[5] (< 5 mK error)	102 mm (4.0 in)
Maximum immersion length	254 mm (10 in)
Response time[5]	8 seconds typical
Self heating (in 0 °C bath)	60 mW/°C
Lead-wire cable type	Teflon®-jacketed cable, Teflon® insulated conductors, 24 AWG stranded, silver plated copper
Lead-wire length	182.9 cm ± 2.5 cm (72.0 in ± 1.0 in)
Lead-wire temperature range	–50 °C to 150 °C
Calibration	NIST-traceable calibration

[1]"Accuracy" is a difficult term when used to describe a resistance thermometer. The simplest way to derive basic "accuracy" is to combine the probe drift specification and calibration uncertainty with readout accuracy at a given temperature.
[2]Three thermal cycles from min to max temp, includes hysteresis, 99.8 % confidence
[3]After 100 hrs at max temp, 99.8 % confidence
[4]Temperatures outside this range will cause irreparable damage. For best performance, transition junction should not be too hot to touch.
[5]Per ASTM E 644

Calibration Uncertainty	
Temperature	**Expanded Uncertainty (k=2)**
–197 °C	0.012 °C
–80 °C	0.012 °C
–38 °C	0.011 °C
0 °C	0.009 °C
156 °C	0.011 °C
230 °C	0.013 °C
420 °C	0.021 °C

Note: Laboratories may periodically reevaluate their uncertainties. Calibration uncertainties depend on the calibration process, the standards used, and the instrument performance.

Ordering Information

5616-12-X Secondary Reference PRT, 6.35 mm x 298 mm (0.250 x 11.75 in), –200 to 420 °C

2601 Probe Carrying Case

X = termination. Specify "B" (bare wire), "D" (5-pin DIN for Tweener Thermometers), "G" (gold pins), "I" (INFO-CON for 1521 or 1522 Handheld Thermometers), "J" (banana plugs), "L" (mini spade lugs), "M" (mini banana plugs), or "S" (spade lugs).

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Fluke Corporation
Hart Scientific Division
799 E Utah Valley Drive
American Fork, UT 84003

Tel: 801.763.1600
Fax: 801.763.1010
E-Mail: info@hartscientific.com
www.hartscientific.com

Fluke Europe B. V.,
Hart Scientific Division
PO Box 1186, 5602 BD Eindhoven
The Netherlands
Tel: +31 (0)40 2675 403
Fax: +31 (0)40 2675 404
E-mail: Hart.Logistics@Fluke.NL

All other countries:
Tel: +1 801.763.1600
Fax: +1 801.763.1010

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