

## TECHNICAL DATA

# Fluke Calibration 9144 Metrology Well



## Key features

- Lightweight, portable, and fast
- Built-in two-channel readout for PRT, RTD, thermocouple, 4-20 mA current
- True reference thermometry with accuracy to  $\pm 0.01$  °C
- On-board automation and documentation
- Metrology performance in accuracy, stability, uniformity, and loading

## Product overview: Fluke Calibration 9144 Metrology Well

### Built-in features to address large workloads and common applications

Whether you need to calibrate 4-20 mA transmitters or a simple thermostatic switch, a Field Metrology Well is the right tool for the job. With three models covering the range of  $-25$  °C to  $660$  °C, this family of Metrology Wells calibrates a wide range of sensor types. The optional process version (models 914X-X-P) provides a built-in two-channel thermometer readout that measures PRTs, RTDs, thermocouples, and 4-20 mA transmitters which includes the 24 V loop supply to power the transmitter.

Each process version accepts an [ITS-90 reference PRT](#). The built-in readout accuracy ranges from  $\pm 0.01$  °C to  $\pm 0.07$  °C depending on the measured temperature. Reference PRTs for Field Metrology Wells contain individual calibration constants that reside in a memory chip located inside the sensor housing, so sensors may be used interchangeably. The second channel is user-selectable for 2-, 3-, or 4-wire RTDs, thermocouples, or 4-20 mA transmitters. For comparison calibration, don't hassle with carrying multiple instruments to the field. Field Metrology Wells do it all as a single instrument.

Traditionally, calibrations of temperature transmitters have been performed on the measurement electronics, while the sensor remained uncalibrated. Studies have shown, however, that typically 75% of the error in the transmitter system

(transmitter electronics and temperature sensor) is in the sensing element. Thus, it becomes important to calibrate the whole loop—both electronics and sensor.

The process versions of Field Metrology Wells have onboard non-volatile memory for documentation of up to 20 tests. Each test can be given a unique alphanumeric ID and will record block temperature, reference temperature, UUT values, error, date, and time. Each test can be easily viewed via the front panel. Use the [1586A Super-DAQ](#) to automate temperature sensor calibration with these Field Metrology Wells.

All Field Metrology Wells allow for two types of automated thermostatic switch test procedures—auto or manual setup. Auto setup requires the entry of only the nominal switch temperature. With this entry, it will run a 3-cycle calibration procedure and provide final results for the dead band temperature via the display. If you need to customize the ramp rate or run additional cycles, the manual setup allows you to program and run the procedure exactly how you would like. Both methods are fast and easy and make testing temperature switches a virtual joy!

### **Metrology performance for high-accuracy measurements**

Unlike traditional dry-wells, Field Metrology Wells maximize speed and portability without compromising the six key metrology performance criteria laid out by the EA: accuracy, stability, axial (vertical) uniformity, radial (well-to-well) uniformity, loading, and hysteresis. All criteria are important in ensuring accurate measurements in all calibration applications. Field Metrology Well displays are calibrated with high-quality traceable and accredited PRTs. Each device (process and non-process versions) comes with an IEC-17025 NVLAP-accredited calibration certificate, which is backed by a robust uncertainty analysis that considers temperature gradients, loading effects, and hysteresis. The 9142 and 9143 have a display accuracy of  $\pm 0.2\text{ }^{\circ}\text{C}$  over their full range, and the 9144 display accuracy ranges from  $\pm 0.35\text{ }^{\circ}\text{C}$  at  $420\text{ }^{\circ}\text{C}$  to  $\pm 0.5\text{ }^{\circ}\text{C}$  at  $\pm 660\text{ }^{\circ}\text{C}$ . Each calibration is backed with a 4:1 test uncertainty ratio.

New control technology guarantees excellent performance in extreme environmental conditions. The 9142 is stable to  $\pm 0.01\text{ }^{\circ}\text{C}$  over its full range and the mid-range 9143 is stable from  $\pm 0.02\text{ }^{\circ}\text{C}$  at  $33\text{ }^{\circ}\text{C}$  and  $\pm 0.03\text{ }^{\circ}\text{C}$  at  $350\text{ }^{\circ}\text{C}$ . Even at  $660\text{ }^{\circ}\text{C}$ , the 9144 is stable to  $\pm 0.05\text{ }^{\circ}\text{C}$ . But this is not all! Thermal block characteristics provide radial (well-to-well) uniformity performance to  $\pm 0.01\text{ }^{\circ}\text{C}$ . Dual-zone control helps these tools achieve axial uniformity to  $\pm 0.05\text{ }^{\circ}\text{C}$  at  $40\text{ mm}$  ( $1.6\text{ in.}$ ).

### **Automation and documentation make each unit a turnkey solution**

So you now have a precision calibration instrument that has field-ready characteristics, accredited metrology performance, built-in two-channel thermometry, and automation— what else could you ask for? How about all this and a turnkey solution that will automate and document the results?

The process versions of Field Metrology Wells have onboard non-volatile memory for documentation of up to 20 tests. Each test can be given a unique alphanumeric ID and will record block temperature, reference temperature, UUT values, error, date, and time. Each test can be easily viewed via the front panel or exported using Model 9930 Interface-it software, which is included with each shipment. Interface-it allows you to pull the raw data into a calibration report or an ASCII file. Each test can be easily viewed via the front panel. Use the [1586A Super-DAQ](#) to automate temperature sensor calibration with these Field Metrology Wells.

### **Operation is as easy as 1-2-3**

You'll find Field Metrology Wells intuitive and easy to use. Each unit is equipped with a large, easy-to-read LCD display, function keys, and menu navigation buttons. Its "SET PT." button makes it straightforward and simple to set the block temperature. Each product has a stability indicator that visually and audibly tells you the Field Metrology Wells is stable to the selectable criteria. Each unit offers preprogrammed calibration routines stored in memory for easy recall, and all inputs are easily accessible via the front panel of the instrument. Never buy a temperature calibration tool from a company that only dabbles in metrology (or doesn't even know the word). Metrology Wells from Fluke are designed and manufactured by the same people who equip the calibration laboratories of the world's leading temperature scientists. These are the people around the world who decide what a Kelvin is! We know a thing or two more about temperature calibration than the vast majority of the world's dry-well suppliers. Yes, they can connect a piece of metal to a heater and a control sensor. But we invite you to compare all our specs against the few that they publish. (And by the way, we meet our specs!).

### **Small dry wells for big field applications**

The 9142, 9143, 9144 Field Metrology Wells extend high performance to the industrial process environment by maximizing portability, speed, and functionality with little compromise to metrology performance.

Field Metrology Wells are packed with functionality and are remarkably easy to use. They are lightweight, small, and quick to reach temperature set points, yet they are stable, uniform, and accurate. These industrial temperature loop calibrators are perfect for performing transmitter loop calibrations, comparison calibrations, or simple checks of thermocouple sensors. With the “process” option, there is no need to carry additional tools into the field. This optional built-in two-channel readout reads resistance, voltage, and 4–20 mA current with 24 volt loop power. It also has on-board automation and documentation. Combined, the three models (9142, 9143, and 9144—each with a “process” option) cover the wide range of –25 °C to 660 °C.

### High performance for the industrial environment

Field Metrology Wells are designed for the industrial process environment and fast speed to temperature. They weigh less than 8.2 kg (18 lb) and have a small footprint, which makes them easy to transport.

Field environment conditions are typically unstable, having wide temperature variations. Each Field Metrology Well has a built-in gradient-temperature compensation (patent pending) that adjusts control characteristics to ensure stable performance in unstable environments. In fact, all specifications are guaranteed over the environmental range of 13 °C to 33 °C.

## Specifications: Fluke Calibration 9144 Metrology Well

| Base Unit Specifications                                                   |                                                            |
|----------------------------------------------------------------------------|------------------------------------------------------------|
| Temperature range at 23°C                                                  | 50°C to 660°C (122°F to 1220°F)                            |
| Display accuracy                                                           | ±0.35°C at 50°C<br>±0.35°C at 420°C<br>±0.5°C at 660°C     |
| Stability                                                                  | ±0.03°C at 50°C<br>±0.04°C at 420°C<br>±0.05°C at 660°C    |
| Axial uniformity at 40 mm (1.6 in)                                         | ±0.05°C at 50°C<br>±0.35°C at 420°C<br>±0.5°C at 660°C     |
| Radial uniformity                                                          | ±0.02°C at 50°C<br>±0.05°C at 420°C<br>±0.10°C at 660°C    |
| Loading effect (with a 6.35 mm reference probe and three 6.35 mm probes)   | ±0.015°C at 50°C<br>±0.025°C at 420°C<br>±0.035°C at 660°C |
| Hysteresis                                                                 | 0.1                                                        |
| Operating conditions                                                       | 0°C to 50°C, 0% to 90% RH (non-condensing)                 |
| Environmental conditions (for all specifications except temperature range) | 13°C to 33°C                                               |
| Immersion (well) depth                                                     | 150 mm (5.9 in)                                            |
| Insert OD                                                                  | 24.4 mm (0.96 in)                                          |
| Heating time                                                               | 15 min: 50°C to 660°C                                      |

|                                                                                       |                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling time                                                                          | 25 min: 660°C to 100°C<br>35 min: 660°C to 50°C                                                                                                                                                                                                                                                        |
| Resolution                                                                            | 0.01°                                                                                                                                                                                                                                                                                                  |
| Display                                                                               | LCD, °C or °F user-selectable                                                                                                                                                                                                                                                                          |
| Size (H x W x D)                                                                      | 290 x 185 x 295 mm (11.4 x 7.3 x 11.6 in)                                                                                                                                                                                                                                                              |
| Weight                                                                                | 7.7 kg (17 lb)                                                                                                                                                                                                                                                                                         |
| Power requirements                                                                    | 100 V to 115 V (±10%), 50/60 Hz, 1400 W 230 V (±10%), 50/60 Hz, 1800 W                                                                                                                                                                                                                                 |
| Computer interface                                                                    | RS-232 interface                                                                                                                                                                                                                                                                                       |
| Calibration                                                                           | NVLAP accredited calibration included                                                                                                                                                                                                                                                                  |
| Automation                                                                            | Use the 1586A Super-DAQ to automate temperature sensor calibration                                                                                                                                                                                                                                     |
| <b>-P Specifications</b>                                                              |                                                                                                                                                                                                                                                                                                        |
| Built-in reference thermometer readout accuracy (4-wire reference probe) <sup>1</sup> | ±0.010°C at -25°C<br>±0.015°C at 0°C<br>±0.020°C at 50°C<br>±0.025°C at 150°C<br>±0.030°C at 200°C<br>±0.040°C at 350°C<br>±0.050°C at 420°C<br>±0.070°C at 660°C                                                                                                                                      |
| Reference resistance range                                                            | 0 ohms to 400 ohms                                                                                                                                                                                                                                                                                     |
| Reference resistance accuracy <sup>2</sup>                                            | 0 ohms to 42 ohms: ±0.0025 ohms 42 ohms to 400 ohms: ±60 ppm of reading                                                                                                                                                                                                                                |
| Reference characterizations                                                           | ITS-90, CVD, IEC-751, Resistance                                                                                                                                                                                                                                                                       |
| Reference measurement capability                                                      | 4-wire                                                                                                                                                                                                                                                                                                 |
| Reference probe connection                                                            | 6-pin Din with Infocon Technology                                                                                                                                                                                                                                                                      |
| Built-in RTD thermometer readout accuracy                                             | NI-120: ±0.015°C at 0°C<br>PT-100 (385): ±0.02°C at 0°C<br>PT-100 (3926): ±0.02°C at 0°C<br>PT-100 (JIS): ±0.02°C at 0°C                                                                                                                                                                               |
| RTD resistance range                                                                  | 0 ohms to 400 ohms                                                                                                                                                                                                                                                                                     |
| RTD resistance accuracy <sup>2</sup>                                                  | 25 ohms to 400 ohms: ±80 ppm of reading<br>0 ohms to 25 ohms: ±0.002 ohms                                                                                                                                                                                                                              |
| RTD characterizations                                                                 | PT-100 (385),(JIS),(3926), NI-120, Resistance                                                                                                                                                                                                                                                          |
| RTD measurement capability                                                            | 4-wire RTD (2-,3-wire RTD w/ Jumpers only)                                                                                                                                                                                                                                                             |
| RTD connection                                                                        | 4 terminal input                                                                                                                                                                                                                                                                                       |
| Built-in TC thermometer readout accuracy                                              | Type J: ±0.7°C at 660°C<br>Type K: ±0.8°C at 660°C<br>Type T: ±0.8°C at 400°C<br>Type E: ±0.7°C at 660°C<br>Type R: ±1.4°C at 660°C<br>Type S: ±1.5°C at 660°C<br>Type M: ±1.4°C at 660°C<br>Type L: ±0.7°C at 660°C<br>Type U: ±0.75°C at 600°C<br>Type N: ±0.9°C at 660°C<br>Type C: ±1.1°C at 660°C |

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| TC millivolt range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | –10 mV to 75 mV                   |
| Voltage accuracy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0.025% of reading + 0.01 mV       |
| Internal cold junction compensation accuracy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ±0.35°C (ambient of 13°C to 33°C) |
| TC connection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Small connectors                  |
| Built-in mA readout accuracy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.02% of reading + 2 mV           |
| mA range                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Cal 4-22 mA, Spec 4-24 mA         |
| mA connection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2 terminal input                  |
| Loop power function                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 24 V DC loop power                |
| Built-in electronics temperature Coefficient (0°C to 13°C, 33°C to 50°C)                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ±0.005% of range per°C            |
| <p>1. The temperature range may be limited by the reference probe connected to the readout. The Built-In Reference Thermometer Readout Accuracy does not include the sensor probe accuracy. It does not include the probe uncertainty or probe characterization errors.</p> <p>2. Measurement accuracy specifications apply within the operating range and assume 4-wires for PRTs. With 3-wire RTDs add 0.05 ohms to the measurement accuracy plus the maximum possible difference between the resistances of the lead wires.</p> |                                   |

## Ordering information



### Fluke 9144-A-156

Fluke Calibration 9144-A-156 Field Metrology Well  
Insert "E", metric misc. holes w/ 0.25-inch hole  
50°C to 660°C

Includes:

- Users manual
- Technical manual on CD
- Serial cable
- Report of calibration
- Insert removal tool

### Fluke 9144-B-156

Fluke Calibration 9144-B-156 Field Metrology Well  
Insert "B", imperial comparison holes  
50°C to 660°C

Includes:

- Users manual
- Technical manual on CD
- Serial cable
- Report of calibration
- Insert removal tool

### Fluke 9144-C-156

Fluke Calibration 9144-C-156 Field Metrology Well  
Insert "C", 0.25-inch holes

50°C to 660°C

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Includes:

- Users manual
- Technical manual on CD
- Serial cable
- Report of calibration
- Insert removal tool

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### **Fluke 9144-D-156**

Fluke Calibration 9144-D-156 Field Metrology Well

Insert "D", metric comparison holes

50°C to 660°C

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Includes:

- Users manual
- Technical manual on CD
- Serial cable
- Report of calibration
- Insert removal tool

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### **Fluke 9144-E-156**

Fluke Calibration 9144-E-156 Field Metrology Well

Insert "E", metric misc. holes w/ 0.25-inch hole

50°C to 660°C

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Includes:

- Users manual
- Technical manual on CD
- Serial cable
- Report of calibration
- Insert removal tool

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### **Fluke 9144-F-156**

Fluke Calibration 9144-F-156 Field Metrology Well

Insert "F", metric comparison misc. holes w/ 0.25-inch hole

50°C to 660°C

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Includes:

- Users manual
  - Technical manual on CD
  - Serial cable
  - Report of calibration
  - Insert removal tool
-

### **Fluke 9144-DW-156**

Fluke Calibration 9144-DW-156 Field Metrology Well

Insert "D", metric comparison holes

50°C to 660°C

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Includes:

- Users manual
- Technical manual on CD
- Serial cable
- Report of calibration
- Insert removal tool

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### **Fluke 9144-A-P-156**

Fluke Calibration 9144-A-P-156 Field Metrology Well

Insert "A", imperial misc. holes

50°C to 660°C, w/ process electronics

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Includes:

- Users manual
- Technical manual on CD
- Serial cable
- Report of calibration
- Test leads
- Insert removal tool
- 6-pin DIN connector for reference probe

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### **Fluke 9144-B-P-156**

Fluke Calibration 9144-B-P-156 Field Metrology Well

Insert "B", imperial comparison holes

50°C to 660°C, w/ process electronics

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Includes:

- Users manual
- Technical manual on CD
- Serial cable
- Report of calibration
- Test leads
- Insert removal tool
- 6-pin DIN connector for reference probe

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### **Fluke 9144-C-P-156**

Fluke Calibration 9144-C-P-156 Field Metrology Well

Insert "C", 0.25-inch holes

50°C to 660°C, w/ process electronics

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Includes:

- Users manual
  - Technical manual on CD
  - Serial cable
  - Report of calibration
  - Test leads
  - Insert removal tool
  - 6-pin DIN connector for reference probe
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### **Fluke 9144-D-P-156**

Fluke Calibration 9144-D-P-156 Field Metrology Well

Insert "D", metric comparison holes

50°C to 660°C, w/ process electronics

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Includes:

- Users manual
  - Technical manual on CD
  - Serial cable
  - Report of calibration
  - Test leads
  - Insert removal tool
  - 6-pin DIN connector for reference probe
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### **Fluke 9144-E-P-156**

Fluke Calibration 9144-E-P-156 Field Metrology Well

Insert "E", metric misc. holes w/ 0.25-inch hole

50°C to 660°C, w/ process electronics

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Includes:

- Users manual
  - Technical manual on CD
  - Serial cable
  - Report of calibration
  - Test leads
  - Insert removal tool
  - 6-pin DIN connector for reference probe
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### **Fluke 9144-F-P-156**

Fluke Calibration 9144-F-P-156 Field Metrology Well

Insert "F", metric comparison misc. holes w/ 0.25-inch hole

50°C to 660°C, w/ process electronics

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Includes:

- Users manual
- Technical manual on CD
- Serial cable
- Report of calibration
- Test leads
- Insert removal tool

- 6-pin DIN connector for reference probe
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### **Fluke 9144-DW-P-156**

Fluke Calibration 9144-DW-P-156 Field Metrology Well

Insert "D", metric comparison holes

50°C to 660°C, w/ process electronics

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Includes:

- Users manual
  - Technical manual on CD
  - Serial cable
  - Report of calibration
  - Test leads
  - Insert removal tool
  - 6-pin DIN connector for reference probe
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