

**FLUKE®**

**Calibration**

# Fluke Calibration products and services

Short form catalog



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Product group:

- Electrical
- RF
- Temperature
- Humidity
- Pressure
- Flow
- Software

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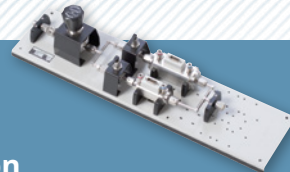
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# Electrical calibration

Electrical calibration refers to the process of verifying the performance of, or adjusting, any instrument that measures, sources, or tests electrical parameters. This discipline is usually referred to as dc and low frequency AC electrical metrology. Principal parameters include voltage, current, resistance, inductance, capacitance, time and frequency. Other parameters, including electrical power and phase, are also in this segment of metrology. Ratiometric comparisons of similar parameters are often performed to compare a known parameter to an unknown similar parameter.

Electrical calibration involves the use of precise devices that evaluate the performance of key properties for other devices called devices

under test (DUTs). Because these precise devices have thoroughly known performance characteristics compared to the DUT, performance evaluation and/or calibration adjustment of the DUT to identify or minimize errors is possible. Typically, the performance of such precision devices should be four or more times better than the DUT.

These precision devices fall into two broad categories. Electrical signal sources are often referred to as either calibrators or standards. Precision measurement devices are often classified as reference digital multimeters, measurement standards, or ratio bridges.

## Product highlights



*5730A Multifunction Calibrator*

### The new gold standard in electrical calibration

The 5730A High Performance Multifunction Calibrator is the culmination of years of engineering development, customer research and industrial design, to bring to market the new gold standard in multifunction calibration. Like its predecessors, the 5700A and 5720A calibrators, the 5730A calibrates a wide range of digital multimeters, up to long-scale 8.5-digit DMMs, as well as a wide-range RF multimeters. This new model features improved specifications that will help you increase test uncertainty ratios (TURs) and improve test confidence.

- 6.5 inch VGA capacitive touchscreen with full color graphical user interface
- Menus and functions displayed in choice of nine languages
- Visual Connection Management™ terminals guide cable connections
- Extended operational reliability through the use of modern analog and digital components and state-of-the-art circuit board technologies
- Artifact Calibration—the process of using just three external standards—10 V, 1  $\Omega$  and 10 k  $\Omega$ , to automatically adjust the entire instrument—optimizes performance to the best specified performance
- Cal Check—a process that tests all function and ranges for any drift since the most recent calibration—provides ongoing confidence in performance. Any output drift is measured and evaluated it with respect to specification.
- Compatible with 52120A and 5725A amplifiers
- Full MET/CAL® compatibility with 5700A and 5720A procedures (MET/CAL versions 7.3 and above)
- 30 MHz and 50 MHz wideband output options available



*5560A High-Performance Multi-Product Calibrator*

### Most comprehensive workload coverage, latest technology, intuitive redesigned front panel, MET/CAL compatibility and much more

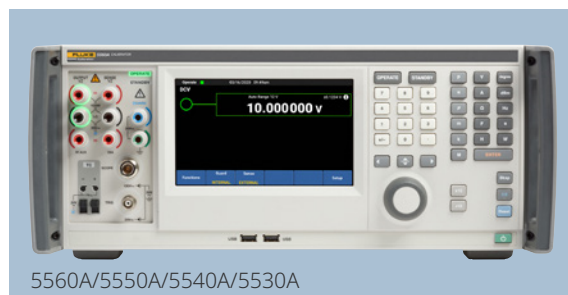
The 5560A calibrates the most popular benchtop 6.5-digit multimeters with better than 4:1 test uncertainty ratio (TUR), and clamp meters to 1500 A. Technical improvements include 30 A continuous current output with no duty cycle and synthesized inductance functionality. These improvements enable you to calibrate modern and full-functional benchtop multimeters and clamp meters. A large variety of thermocouple types and a new thermocouple connector enables easier connection and broadens the temperature workload coverage. The workload is expanded even further when the 5560A is used with a 52120A amplifier and appropriate coil to increase the current output to 6000 A, for calibrating high-current devices such as Rogowski coils.

- 4:1 test TUR for most popular 6.5-digit multimeters
- 30 A continuous current output extends AC/DC measurement ranges
- Calibrate meters that measure AC/DC voltage, resistance and capacitance
- Ranging optimized to better match your existing digital multimeter workload
- New optional 1-, 2-, 10-turn and redesigned 50-turn current coils expand workload coverage even further
- 17.8 centimeter (7-inch) color touch screen with new graphical user interface provides an intuitive calibration experience
- Optional DMM AUTOCAL Adapter to calibrate digital multimeters with minimal-to-no lead changes
- Visual Connection Management output terminals guide connections, preventing connection errors
- Reverse power protection prevents costly operator errors

# Selection guide

|                                                | Multi-Product Calibrators                                                         |                                                                                   |                                                                                   |                                                                                   | Multifunction Calibrator                                                           | Oscilloscope Calibrator                                                             | Electrical Tester Calibrator                                                        | Temperature/ Pressure Calibrator                                                    |
|------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                                |  |  |  |  |  |  |  |  |
| Workload                                       | 5530A                                                                             | 5540A                                                                             | 5550A                                                                             | 5560A                                                                             | 5730A                                                                              | 9500C                                                                               | 5322A                                                                               | 7526A                                                                               |
| <b>DMMs</b>                                    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Basic DC V accuracy at 99 %                    | 31 ppm                                                                            | 31 ppm                                                                            | 11 ppm                                                                            | 8 ppm                                                                             | 4.5 ppm                                                                            | n/a                                                                                 | 1000 ppm                                                                            | 40 ppm                                                                              |
| Analog / Panel Meters                          | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                  |                                                                                     | V DC and V AC                                                                       | V DC, I DC and R                                                                    |
| 3.5 digits (typ. ± 0.3 % DC V)                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                  |                                                                                     | V DC and V AC                                                                       | V DC and V AC                                                                       |
| 4.5 digits (typ. ± 0.025 % DC V)               | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| 5.5 digits (typ. ± 0.015 % DC V)               |                                                                                   |                                                                                   | ✓                                                                                 | ✓                                                                                 | ✓                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| 6.5 digits (typ. ± 0.0030 % DC V)              |                                                                                   |                                                                                   |                                                                                   | ✓                                                                                 | ✓                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| 7.5 digits (typ. ± 12 ppm DC V)                |                                                                                   |                                                                                   |                                                                                   |                                                                                   | ✓                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| 8.5 digits (typ. ± 3.9 ppm DC V)               |                                                                                   |                                                                                   |                                                                                   |                                                                                   | ✓                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| <b>Temperature/Pressure</b>                    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| RTD simulate                                   | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     | ✓                                                                                   |
| RTD measure                                    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     | ✓                                                                                   |
| Thermocouple simulate                          | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     | ✓                                                                                   |
| Thermocouple measure                           | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     | ✓                                                                                   |
| Pressure modules                               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     | ✓                                                                                   |
| <b>Oscilloscopes</b>                           |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
|                                                | 1 Channel                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                    | 1 to 5 Channels                                                                     |                                                                                     |                                                                                     |
| Up to 600 MHz                                  |                                                                                   | 600 MHz Opt                                                                       | 600 MHz Opt                                                                       | 600 MHz Opt                                                                       |                                                                                    | 9540C Head opt                                                                      |                                                                                     |                                                                                     |
| Up to 1.1 GHz                                  |                                                                                   |                                                                                   | 1.1 GHz Opt                                                                       | 1.1 GHz Opt                                                                       |                                                                                    | 9540C Head opt                                                                      |                                                                                     |                                                                                     |
| Up to 2.1 GHz                                  |                                                                                   |                                                                                   |                                                                                   | 2.1 GHz Opt                                                                       |                                                                                    | 9540C Head opt                                                                      |                                                                                     |                                                                                     |
| Up to 4.2 GHz                                  |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    | 9540C Head opt                                                                      |                                                                                     |                                                                                     |
| <b>Safety Testers</b>                          |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Hipot                                          |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| Megohm meters                                  |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| Installation                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| PATs                                           |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| Continuity                                     |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| Loop impedance                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| Leakage current                                |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| Ground bond                                    |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| RCD/GFCI                                       |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| Medical safety                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     | ✓                                                                                   |                                                                                     |
| <b>Power/Energy</b>                            |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Wattmeters                                     | ✓                                                                                 |                                                                                   | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Harmonic analyzers                             |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Flicker meters                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Phase angle meters                             | ✓                                                                                 |                                                                                   | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Power analyzers                                | ✓                                                                                 |                                                                                   | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Power recorders                                | ✓                                                                                 |                                                                                   | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Secondary energy standards                     |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Watt-hour/energy meters                        | ✓                                                                                 |                                                                                   | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| <b>Other</b>                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Clamp meters                                   | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| LCR meters                                     | RC only                                                                           | RC only                                                                           | LRC                                                                               | LRC                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Process calibrators                            | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Data acquisition                               | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Non sine waveforms                             | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| RF millivolt meters                            |                                                                                   |                                                                                   |                                                                                   |                                                                                   | 30 and 50 MHz WB opt                                                               |                                                                                     |                                                                                     |                                                                                     |
| Extend current to 120A AC, 100A DC with 52120A | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                  |                                                                                     |                                                                                     | Manual Only                                                                         |
| <b>MET/CAL Compatible</b>                      | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                 | ✓                                                                                  | ✓                                                                                   | ✓                                                                                   | ✓                                                                                   |

## DC/LF electrical calibrators



### 5560A, 5550A, 5540A and 5530A Multi-Product Calibrators

**5560A:** The next generation high-performing calibrator supporting the widest workload coverage. The 5560A High-Performance Multi-Product Calibrator defines a new class of high-performance multi-product calibrator, providing the broadest electrical workload coverage and highest accuracy for calibrating the most demanding modern workloads.

**5550A:** Optimized for your multimeter workload. The 5550A Performance Multi-Product Calibrator expands upon the capabilities of the 5522A. Adding new calibration ranges optimized to better match your existing digital multimeter workload in a modern, ruggedized instrument with an intuitive graphical interface.

**5540A:** The 5540A Multi-Product Calibrator extends the capabilities of the 5502A with better performance suited for on-site or mobile calibration.

**5530A:** The 5530A Basic Multi-Product Calibrator offers analog performance identical to the 5540A without capabilities to address Oscilloscopes. The addition of power extends workload to more "industrial" devices than the 5540A.



### 5730A Multifunction Calibrator

The new gold standard in electrical calibration.

- The next generation high-performance multifunction calibrator
- Support instruments of up to 8.5 digits in measurement performance
- Artifact Calibration permits the lowest cost of support and highest confidence in performance
- New internal printed circuit boards with upgraded digital technology
- 6.5 inch VGA capacitive touchscreen with full color graphical user interface
- Menus and functions displayed in choice of nine languages



## Specialty calibrators



5725A



52120A

### 5725A Amplifier

The Fluke 5725A Amplifier is a companion to the 57XX Series calibrators.

- Extends the calibrators' alternating volt-hertz product to 1100 V at 30 kHz and 750 V at 100 kHz
- Increases maximum direct and alternating current to 11 A

### 52120A Transconductance Amplifier

Tests and calibrates power standards, power and energy meters, PQ analyzers, high-current clamp meters and Rogowski coils. Delivers:

- 120 A stand-alone
- 240 A or 360 A with parallel operation
- 3000 A or 6000 A with accessory coils
- Industry-leading amplifier accuracy:
  - 100  $\mu$ A/A DC to 850 Hz
  - 120  $\mu$ A/A DC and 260  $\mu$ A/A AC in stand-alone operation
- Frequency capability, DC to 10 kHz



7526A

### 7526A Precision Process Calibrator

A process calibrator with versatility, precision and value, combined into a single benchtop tool.

- Simulates and measures nine RTD and thirteen thermocouple types
- Accurately measures pressure up to 10 000 PSI (69 MPa) when combined with Fluke 700 Pressure Modules
- Sources and measures dc voltage to within 0.004% of reading, dc resistance up to 4k $\Omega$ , and dc current from 0 mA to 100 mA
- Combine with MET/CAL software for increased efficiency, calibration throughput, and automation.



5322A

### 5322A Electrical Safety Tester Calibrator

Calibrate all major types of electrical safety testers with just one calibrator.

- Calibrate insulation resistance testers; leakage current testers; multifunction installation testers; portable appliance testers (PATs); continuity testers, earth (ground) resistance testers and many more types of electrical safety testers
- Complies with new regulatory standards up to four times faster than traditional methods
- Compatible with MET/CAL software



## Oscilloscope calibrators



### 9500C High-Performance Oscilloscope Calibrator

A dedicated family of modern oscilloscope calibrators offering accuracy, reliability and efficiency for workloads below 4 GHz.

#### Efficient

- The only commercially available multi-channel oscilloscope calibration system
- Faster throughput
- Fully automated
- Simultaneous output
- Double bandwidth with a dedicated scope calibrator over a multi-product calibrator

#### Effective

- More accurate signal to test a wide range of signals and frequencies
- High signal purity
- High bandwidth
- 4 channels plus trigger
- Leveled sine waves up to 4 GHz
- Confidence in your oscilloscope accuracy for a range of applications
- Expand your calibration abilities with performance and flexibility using Active Head Technology™ generating calibration signals right at the oscilloscope input

#### Productive

- Easy-to-use updated user interface
- Updated serviceability
- Improved reliability with removed mechanical components and replaceable parts



### 55XX Series Oscilloscope Calibration Options

Options for the 5540A, 5550A, and 5560A calibrators add capabilities to calibrate your digital and analog oscilloscopes with any of three different ranges of bandwidths.

- Leveled sine wave generator with optional bandwidths of 600 MHz, 1.1 GHz and 2.1 GHz for verifying oscilloscope bandwidth.
- DC and square wave voltage generators for calibrating voltage gain
- Horizontal time base calibration functions
- Edge is less than 175 ps for verifying dynamic response
- Fast edge risetime pulse generator (< 1 ns) for checking pulse response

## Precision multimeters



### 8588A Reference Multimeter

The world's most stable digitizing reference multimeter.

- 8.5 digit resolution, exceptional linearity and low noise and stability
- Guaranteed 3.5  $\mu$ V/V 1 year accuracy (99 %) analog performance without self-calibration
- AC rms measurement performance that is ten times faster, two times less noisy, and more sensitive for low level signals than other instruments in this class

- 0 to 10 s aperture setting allows industry's widest flexibility to control data capture window
- Intuitive menu structure and graphical display that enables instantaneous visualization of trend plot, statistical analysis, histogram and FFT
- GPIB, USBTMC, Ethernet allows industry standard selection of remote interface

### 8558A 8.5 Digit Multimeter

The industry's fastest direct 5 mega-samples-per-second digitizing for system automation in labs and manufacturing test environments.

- Digitizes at 5 MS/s, 18-bit resolution into memory for capturing complex, fast changing waveforms
- Up to 20 MHz bandwidth for voltage and 4 MHz for current retains high bandwidth content of the signal measured

- 4.5 digit data delivered to a PC at 100 kilo-readings/s



### 8808A Digital Multimeter

Versatile multimeter for manufacturing, development and service applications.

- 5.5 digit resolution
- Basic V dc accuracy of 0.015%
- Dual display, showing two different measurements at once
- Ultra low-burden current measurement mode

# Electrical standards



## 732C/734C DC Reference Standards

The simple way to maintain and disseminate 10 V, 1.0 V and 0.1 V.

- A primary standard for traceability of dc voltage to better than 1  $\mu\text{V/V}$
- Eliminates the need for external dividers
- Complete mechanical and electrical independence of each of its four 732C standards
- Battery powered for easy shipping

## 5790B AC Measurement Standard

Easiest way to make precision AC measurements.

- AC voltage measurement uncertainties as low as  $\pm 24 \mu\text{V/V}$
- Works with A40B shunts for making precise absolute and relative current measurements without requiring manual current value calculations
- 30 MHz and 50 MHz wideband range options
- Statistics and peak-to-peak waveform functions
- Intuitive graphical interface
- Visual Connection Management™ terminals that light up to show the active terminals



## A40B Series Precision Current Shunts

Precision, low inductance shunts for DC and AC current metrology.

- Simplifies calibration/verification of precision calibrators and current sources
- Shunts sized for current from 1 mA to 100 A
- Usable from DC to 100 kHz
- Ultra low phase shift to support power quality instrument metrology

## 742A Resistance Standard

High accuracy working standard for on-site resistance calibration.

- Small and rugged standard resistors with six-month stabilities to 2.5  $\mu\text{V/V}$
- Open air use so no oil or air baths required
- 18 °C to 28 °C operating range
- Standard values from 1  $\Omega$  to 100 M $\Omega$



## 920R GNSS-controlled Rubidium Frequency Standard

The 920R GNSS-controlled Rubidium Frequency Standard offers a multi-output frequency reference with near-cesium stability, achieved through GNSS control. It includes seven standard outputs—five 10 MHz, one 5 MHz, and one 1 pps.

Users can expand the outputs with up to four additional options, plus a programmable 100 MHz pulse output.



# RF calibration

RF and microwave calibration refers to the process of verifying the performance of, or adjusting/deriving corrections for, any instrument or component that will be used in the measurement or testing of RF and microwave parameters. This discipline is usually referred to as RF and microwave metrology. Principal parameters include RF voltage, RF power, impedance, modulation, distortion, time, frequency and phase. High dynamic range ratiometric comparisons are often performed and results are expressed in the logarithmic dB form.

As with any other calibration, RF and microwave calibration compares a device or unit under test (DUT or UUT) to a traceably calibrated standard or reference device. The process typically involves comparing a measuring DUT to a reference source; a sourcing DUT with a measuring reference; or quite commonly a measuring DUT with a measuring reference, using a stable but unknown source.

In each case, the uncertainty or stability of the reference should significantly exceed the specified performance of the device or device under test. RF metrologists typically look for performance margins of 4:1, however, test uncertainty ratios lower than this usual target are more frequently encountered in RF than in other calibration disciplines. Conversion from logarithmic (dB) to linear units is recommended practice when combining uncertainty contributions and considering test uncertainty ratios.

Precision devices that are commonly used in RF and microwave calibration fall broadly into four categories:

**Sourcing instruments.** Reference signals and/or modulation sources, frequency references, pulse or arbitrary waveform generators, reference attenuators.

**Measuring instruments.** Power sensors, spectrum analyzers, measuring receivers, oscilloscopes, RF voltmeters, frequency counters.

**Source-measure instruments.** Vector or scalar network analyzers.

## Precision components

- Power splitters, power dividers or couplers, attenuating pads
- Inter-series, polarity or sacrificial cables and adapters
- Short, open, load or sliding terminators
- Reflection bridges or directional couplers

## RF references



### 96270A 27 GHz Low Phase Noise Reference Source

The simplest, most accurate and cost effective single instrument for calibrating spectrum analyzers, RF power sensors and more.

- Self-characterization lets you avoid calculating correction factors for each component in the signal delivery system
- What you set is what you get. Accurate signal delivery direct to the DUT input up to 27 GHz
- Covers a broad range of RF calibration workload
- Reduces the number of instruments and interconnections required for your RF calibration system
- Integrated 300 MHz frequency counter and dual power meter readout eliminate need for additional instruments
- Calibration-specific interface simplifies technician tasks
- Simplifies uncertainty calculations
- Lowers RF system maintenance costs
- With automation, reduces spectrum analyzer calibration times by as much as 50 % over manual methods
- Directly replaces and emulates legacy HP3335A, HP8662A, HP8663A, HP8340A, and HP8360B generators



### 96040A Low Phase Noise Reference Source

Simplify your RF calibration system by replacing many of the instruments and accessories that make up your current system.

- Covers a broad range of RF calibration workload
- Reduces the number of instruments and interconnections required for your RF calibration system
- What you set is what you get. Accurate signal delivery direct to the DUT input
- Integrated 50 MHz frequency counter eliminates need for an additional instrument
- Calibration-specific interface simplifies technician tasks
- Simplifies uncertainty calculations by delivering known signals direct to the device under test (DUT)
- Lowers RF system maintenance costs
- With automation, reduces spectrum analyzer calibration times by as much as 50 % over manual methods
- Directly replaces and emulates legacy HP3335A, HP8662A, and HP8663A generators

# Temperature calibration

Temperature calibration refers to the calibration of any device used in a system that measures temperature. Most importantly, this usually means the temperature sensor, itself, which is typically a platinum resistance thermometer (PRT or PT-100), thermistor, or thermocouple. Readings from these thermometers are made by thermometer readout devices which measure their electrical outputs and convert them to temperature according to the International Temperature Scale of 1990 (ITS-90).

Thermometers are typically calibrated by placing them in a stable temperature environment (heat source) and comparing their output to that of a calibrated reference thermometer or standard thermometer.

Fluke Calibration provides three general categories of heat sources: industrial heat sources (dry-well calibrators, portable calibration baths, Micro-Baths, etc.) for field use; fluid baths and thermocouple furnaces for laboratory use; and fixed-point cells for primary calibrations. Fluke Calibration also offers a variety of reference thermometers, including SPRTs, and thermometer readout instruments.

In addition, Fluke Calibration provides laboratory and field solutions for calibrating the electronics used in temperature measurement circuits.

## Product highlights



6109A/7109A Portable Calibration Baths

### Four times more calibration throughput with twice the accuracy of Micro-Baths and dry-block calibrators

Now there are portable calibration baths (6109A and 7109A) designed with the process manufacturing professional in mind. Process manufacturing plants for pharmaceuticals, biotechnology, and food production utilize many sanitary temperature sensors that require regular calibration. Production must stop during temperature sensor calibration. Therefore, more calibration throughput means less plant downtime.

The Fluke Calibration 6109A and 7109A Portable Calibration Baths are liquid baths that let process industry professionals calibrate four times more sanitary sensors per batch in less time and with twice the accuracy of other portable baths in this class. Larger than Micro-Baths, up to four tri-clamp sanitary sensors fit easily into these baths for calibration at  $\pm 0.1^\circ\text{C}$  temperature display accuracy. Calibrate up to four tri-clamp sanitary sensors at the same time.

- Wide temperature ranges cover most process applications
  - **6109A:  $35^\circ\text{C}$  to  $250^\circ\text{C}$**
  - **7109A:  $-25^\circ\text{C}$  to  $140^\circ\text{C}$**
- Excellent display accuracy of  $\pm 0.1^\circ\text{C}$  provides 4:1 test uncertainty ratio for critical applications
- Stainless steel casing withstands harsh sterilizing chemicals and is rust proof
- NVLAP-accredited calibration included standard



1586A Super-DAQ Precision Temperature Scanner

### The most accurate, flexible temperature data acquisition system

The 1586A is ideal for benchtop calibration of temperature sensors in secondary calibration labs, as well as temperature data acquisition applications in industries such as pharmaceutical, bio-technology, aerospace, food and energy where accurate temperature measurements are critical.

- Flexible configuration for the benchtop or factory using the DAQ-STAQ Multiplexer or internal High-Capacity Module
- Measure thermocouples, PRTs, thermistors, dc V, dc I, and resistance
- Best-in-class temperature measurement accuracy:
  - **PRTs:  $\pm 0.005^\circ\text{C}$  (using DAQ-STAQ Multiplexer)**
  - **Thermocouples:  $\pm 0.29^\circ\text{C}$  (using DAQ-STAQ Multiplexer and internal CJC for type K at  $0^\circ\text{C}$ )**
  - **Thermistors:  $\pm 0.002^\circ\text{C}$**
- Connect up to 40 isolated inputs
- Scan speed of up to 10 channels per second
- Four modes of operation: Scan, Monitor, Measure, DMM
- Real-time color trending—chart up to four channels simultaneously
- Controls Fluke Calibration temperature sources such as dry-wells, furnaces or Micro-Baths for automated calibration routines
- MX + B scaling and channel offset zero function
- Built-in data security levels

# Selection guides

## Primary standards

| Model                                                    | RTPW   | Description                                        |
|----------------------------------------------------------|--------|----------------------------------------------------|
| <b>Standard platinum resistance thermometers (SPRTs)</b> |        |                                                    |
| 5681                                                     | 25.5 Ω | –200 °C to 670 °C, quartz sheath                   |
| 5683                                                     | 25.5 Ω | –200 °C to 480 °C, quartz sheath                   |
| 5684                                                     | 0.25 Ω | 0 °C to 1070 °C, quartz sheath                     |
| 5698                                                     | 25.5 Ω | –200 °C to 670 °C, working standard, quartz sheath |
| 5699                                                     | 25.5 Ω | –200 °C to 670 °C, high temperature, metal sheath  |
| 5686                                                     | 25.5 Ω | –260 °C to 232 °C, Metal sheath capsule SPRT       |

## ITS-90 fixed-point cells

| Model                                                   | Description                                    | Temperature |
|---------------------------------------------------------|------------------------------------------------|-------------|
| <b>Triple point of water cells</b>                      |                                                |             |
| 5901A-G                                                 | TPW Cell, 12 mm ID with handle, glass shell    | 0.01 °C     |
| 5901A-Q                                                 | TPW Cell, 12 mm ID with handle, quartz shell   | 0.01 °C     |
| 5901C-G                                                 | TPW Cell, 13.6 mm ID with handle, glass shell  | 0.01 °C     |
| 5901C-Q                                                 | TPW Cell, 13.6 mm ID with handle, quartz shell | 0.01 °C     |
| 5901D-G                                                 | TPW Cell, 12 mm ID, glass shell                | 0.01 °C     |
| 5901D-Q                                                 | TPW Cell, 12 mm ID, quartz shell               | 0.01 °C     |
| 5901B-G                                                 | TPW Cell, mini, glass shell                    | 0.01 °C     |
| <b>Standard size fixed-point cells</b>                  |                                                |             |
| 5900E                                                   | TP mercury, SST                                | –38.8344 °C |
| 5904                                                    | Freezing point of indium                       | 156.5985 °C |
| 5905                                                    | Freezing point of tin                          | 231.928 °C  |
| 5906                                                    | Freezing point of zinc                         | 419.527 °C  |
| 5907                                                    | Freezing point of aluminum                     | 660.323 °C  |
| 5908                                                    | Freezing point of silver                       | 961.78 °C   |
| 5909                                                    | Freezing point of copper                       | 1084.62 °C  |
| 5943                                                    | Melting point of gallium, SST                  | 29.7646 °C  |
| <b>Mini triple point of water and fixed-point cells</b> |                                                |             |
| 5901B                                                   | Mini triple point of water                     | 0.01 °C     |
| 5914A                                                   | Mini freezing point of indium                  | 156.5985 °C |
| 5915A                                                   | Mini freezing point of tin                     | 231.928 °C  |
| 5916A                                                   | Mini freezing point of zinc                    | 419.527 °C  |
| 5917A                                                   | Mini freezing point of aluminum                | 660.323 °C  |
| 5918A                                                   | Mini freezing point of silver                  | 961.78 °C   |
| 5919A                                                   | Mini freezing point of copper                  | 1084.62 °C  |
| 5944                                                    | Mini freezing point of indium, metal cased     | 156.5985 °C |
| 5945                                                    | Mini freezing point of tin, metal cased        | 231.928 °C  |
| 5946                                                    | Mini freezing point of zinc, metal cased       | 419.527 °C  |
| 5947                                                    | Mini freezing point of aluminum, metal cased   | 660.323 °C  |

| Model                                              | Features/use                                                                                                                                                           |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Maintenance apparatus</b>                       |                                                                                                                                                                        |
| 7341                                               | Maintains: triple point of mercury cell.<br>Comparisons: –45 °C to 150 °C.                                                                                             |
| 7512                                               | Maintains: triple point of water and gallium cells.<br>Comparisons: –10 °C to 110 °C.                                                                                  |
| 9210                                               | Maintains: mini triple point of water.<br>Comparisons: –10 °C to 125 °C.                                                                                               |
| 9230                                               | Maintains: stainless steel gallium cell.<br>Comparisons: 15 °C to 35 °C.                                                                                               |
| 9260                                               | Maintains: indium, tin, zinc, and aluminum cells.<br>Comparisons: 50 °C to 680 °C.                                                                                     |
| 9114                                               | Maintains: indium, tin, zinc, and aluminum cells.<br>Comparisons: 100 °C to 680 °C.                                                                                    |
| 9115A                                              | Maintains: aluminum and silver cells.<br>Comparisons: 550 °C to 1000 °C.                                                                                               |
| 9116A                                              | Maintains: aluminum, silver, gold, and copper cells.<br>Comparisons: 400 °C to 1100 °C.                                                                                |
| 9117                                               | Anneals SPRTs, HTPRTs, and thermocouples to 1100 °C.<br>Protects them against contamination from metal ions.                                                           |
| <b>Boiling point of liquid nitrogen comparator</b> |                                                                                                                                                                        |
| 7196B                                              | Affordable substitute for a triple point of argon system.<br>Provides for low-temperature comparison calibrations at approximately –196 °C with uncertainties of 2 mK. |
| <b>Triple point of argon system</b>                |                                                                                                                                                                        |
| 5960A                                              | Lowest uncertainty for any commercially available triple point of argon system.                                                                                        |
| <b>Standard resistors</b>                          |                                                                                                                                                                        |
| 742A                                               | Excellent performance without oil or air baths.<br>Values from 1 ohm to 19 megohm.                                                                                     |

## Thermometer readouts

| Model                                  | Probe types                             | Accuracy at 0 °C                                                                                                                                                                                                                                                                          | Features                                                                                                                                                                 |
|----------------------------------------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Intrinsically safe thermometers        |                                         |                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
| 1551A Ex                               | 100 Ω thin-film RTD                     | −50 °C to 160 °C<br>(−58 °F to 320 °F)                                                                                                                                                                                                                                                    | Accuracy of ± 0.05 °C (± 0.09 °F) over full range.<br>Intrinsically safe (ATEX and IECEx compliant).<br>Two models to choose from (-50 °C to 160 °C or -80 °C to 300 °C) |
| 1552A Ex                               | 100 Ω wire-wound PRT                    | −80 °C to 300 °C<br>(−112 °F to 572 °F)                                                                                                                                                                                                                                                   |                                                                                                                                                                          |
| Precision digital thermometer readouts |                                         |                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
| Tweener                                |                                         |                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
| 1502A                                  | PRTs                                    | ± 0.006 °C                                                                                                                                                                                                                                                                                | Resolution of 0.001 °C and accuracy to match; uses ITS-90, IPTS-68, CVD, or DIN (IEC 751) conversions                                                                    |
| 1504                                   | Thermistors                             | ± 0.002 °C                                                                                                                                                                                                                                                                                | Reads thermistors from 0 to 500 KW; uses Steinhart-Hart and CVD                                                                                                          |
| Handheld                               |                                         |                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
| 1524                                   | PRTs, Thermistors, Thermocouples        | ± 0.015 °C (PRTs)                                                                                                                                                                                                                                                                         | Handheld reference thermometer same as 1523 but with inputs for two thermometers; logs up to 15,000 readings and stores 25 more on demand                                |
| Chub-E4                                |                                         |                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
| 1529                                   | PRTs, Thermistors, Thermocouples        | ± 0.006 °C (PRTs)                                                                                                                                                                                                                                                                         | Four channels can all be measured simultaneously; battery-powered; logs up to 8,000 readings; flexible display                                                           |
| Super-Thermometers                     |                                         |                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
| 1595A                                  | 1595A                                   | ± 0.000015 °C                                                                                                                                                                                                                                                                             | Ratio accuracy of 0.2 ppm; Ratio Self-Calibration; automated zero-power measurements can be extended with 10 or 20 additional channels with the 2590 Multiplexer         |
| 2590A                                  | Multiplexer Scanner for 1594A and 1595A | + 1ppm @ 0 to 400 Ω                                                                                                                                                                                                                                                                       | The 2590 is a 10 channel scanner Multiplexer; up to two scanners can be connected to the 1594A and 1595A Super-Thermometers for a total of 20 additional channels        |
| Multi-channel                          |                                         |                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
| 1586A                                  | PRTs, Thermistors, Thermocouples        | ± 0.005 °C (PRTs)                                                                                                                                                                                                                                                                         | Up to 40 channels with scan rate of 10 channels per second with scan rate of 10 channels per second                                                                      |
| 2560                                   | SPRTs, PRTs                             | ± 0.005 °C                                                                                                                                                                                                                                                                                | 2 channels of 25W or 100W PRTs                                                                                                                                           |
| 2561                                   | HTPRTs                                  | ± 0.013 °C                                                                                                                                                                                                                                                                                | 2 channels to 1200 °C                                                                                                                                                    |
| 2562                                   | PRTs                                    | ± 0.01 °C                                                                                                                                                                                                                                                                                 | 8 channels of 2-, 3-, or 4-wire RTDs                                                                                                                                     |
| 2563                                   | Thermistors                             | ± 0.0013 °C                                                                                                                                                                                                                                                                               | 2 channels of resolution to 0.0001 °C                                                                                                                                    |
| 2564                                   | Thermistors                             | ± 0.0025 °C                                                                                                                                                                                                                                                                               | 8 channels for data acquisition                                                                                                                                          |
| 2565                                   | Thermocouples                           | ± 0.05 °C                                                                                                                                                                                                                                                                                 | Reads most TC types with 0.0001 mV resolution                                                                                                                            |
| 2566                                   | Thermocouples                           | ± 0.1 °C                                                                                                                                                                                                                                                                                  | Reads any combination up to 12 channels of virtually any type of TC                                                                                                      |
| 2567                                   | 1000 Ω PRTs                             | ± 0.006 °C                                                                                                                                                                                                                                                                                | 2 channels of high-resistance PRTs                                                                                                                                       |
| 2568                                   | 1000 Ω PRTs                             | ± 0.01 °C                                                                                                                                                                                                                                                                                 | 8 channels of high-resistance PRTs                                                                                                                                       |
| Thermo-hygrometer                      |                                         |                                                                                                                                                                                                                                                                                           |                                                                                                                                                                          |
| 1620A                                  | The DewK Thermo-Hygrometer              | Two channels measure ambient temperature to ± 0.125 °C and %RH to ±1.5 %. Onboard memory holds up to two years of time/date-stamped readings. Visual and audio alarms. Detachable sensors contain their own calibration data for easy recalibrations. Ethernet and wireless capabilities. |                                                                                                                                                                          |

## Thermometer probes

| Model                                          | Range             | Size                                            | Basic Accuracy†                           |
|------------------------------------------------|-------------------|-------------------------------------------------|-------------------------------------------|
| <b>Platinum resistance thermometers (PRTs)</b> |                   |                                                 |                                           |
| <b>Secondary standard PRT</b>                  |                   |                                                 |                                           |
| 5608-9-X                                       | –200 °C to 500 °C | 229 mm x 3.18 mm (9 in x 0.125 in)              | Select from available calibration options |
| 5608-12-X                                      | –200 °C to 500 °C | 305 mm x 3.18 mm (12 in x 0.125 in)             |                                           |
| 5609-12-X                                      | –200 °C to 670 °C | 305 mm x 6.35 mm (12 in x 0.25 in)              |                                           |
| 5609-15-X                                      | –200 °C to 670 °C | 381 mm x 6.35 mm (15 in x 0.25 in)              |                                           |
| 5609-20-X                                      | –200 °C to 670 °C | 508 mm x 6.35 mm (20 in x 0.25 in)              |                                           |
| 5609-300-X                                     | –200 °C to 670 °C | 300 mm x 6 mm (11.81 in x 0.24 in)              |                                           |
| 5609-400-X                                     | –200 °C to 670 °C | 400 mm x 6 mm (15.75 in x 0.24 in)              |                                           |
| 5609-500-X                                     | –200 °C to 670 °C | 500 mm x 6 mm (19.69 in x 0.24 in)              |                                           |
| 5626                                           | –200 °C to 661 °C | 305 or 381 mm x 6.35 mm (12 or 15 in x 0.25 in) | ± 0.007 °C at 0 °C                        |
| 5628                                           | –200 °C to 661 °C | 305 or 381 mm x 6.35 mm (12 or 15 in x 0.25 in) | ± 0.006 °C at 0 °C                        |
| <b>Secondary reference PRT</b>                 |                   |                                                 |                                           |
| 5615-6                                         | –200 °C to 300 °C | 152 mm x 4.76 mm (6 in x 0.19 in)               | ± 0.013 °C at 0.010 °C                    |
| 5615-9                                         | –200 °C to 420 °C | 229 mm x 4.76 mm (9 in x 0.19 in)               | ± 0.013 °C at 0.010 °C                    |
| 5615-12                                        | –200 °C to 420 °C | 305 mm x 6.35 mm (12 in x 0.25 in)              | ± 0.013 °C at 0.010 °C                    |
| <b>Precision industrial PRT</b>                |                   |                                                 |                                           |
| 5627A-6                                        | –200 °C to 300 °C | 152 mm x 4.7 mm (6 in x 0.19 in)                | ± 0.05 °C at 0 °C                         |
| 5627A-9                                        | –200 °C to 300 °C | 229 mm x 4.7 mm (9 in x 0.19 in)                | ± 0.05 °C at 0 °C                         |
| 5627A-12                                       | –200 °C to 420 °C | 305 mm x 6.35 mm (12 in x 0.25 in)              | ± 0.05 °C at 0 °C                         |
| <b>Fast response PRT</b>                       |                   |                                                 |                                           |
| 5622-05                                        | –200 °C to 350 °C | 100 mm x 0.5 mm (3.94 in x 0.02 in)             | ± 0.04 °C at 0 °C                         |
| 5622-10                                        | –200 °C to 350 °C | 100 mm x 1.0 mm (3.94 in x 0.04 in)             | ± 0.04 °C at 0 °C                         |
| 5622-16                                        | –200 °C to 350 °C | 200 mm x 1.6 mm (7.87 in x 0.06 in)             | ± 0.04 °C at 0 °C                         |
| 5622-32                                        | –200 °C to 350 °C | 200 mm x 3.2 mm (7.87 in x 0.125 in)            | ± 0.04 °C at 0 °C                         |
| <b>Small diameter industrial PRTs</b>          |                   |                                                 |                                           |
| 5618B-6                                        | –200 °C to 300 °C | 152 mm x 3.2 mm (6 in x 0.125 in)               | ± 0.05 °C                                 |
| 5618B-9                                        | –200 °C to 500 °C | 229 mm x 3.2 mm (9 in x 0.125 in)               | ± 0.05 °C                                 |
| 5618B-12                                       | –200 °C to 500 °C | 305 mm x 3.2 mm (12 in x 0.125 in)              | ± 0.05 °C                                 |
| <b>Full immersion PRTs</b>                     |                   |                                                 |                                           |
| 5606 Immersion PRT                             | –200 °C to 160 °C | 50 mm x 3.2 mm (1.97 in x 0.125 in)             | ± 0.05 °C                                 |
| 5623B Freezer Probe                            | –100 °C to 156 °C | 152 mm x 6.35 mm (6 in x 0.25 in)               | ± 0.05 °C                                 |
| <b>High temperature PRT</b>                    |                   |                                                 |                                           |
| 5624                                           | 0 °C to 1000 °C   | 508 mm x 6.35 mm (20 in x 0.25 in)              | ± 0.055 °C                                |
| <b>Thermistors</b>                             |                   |                                                 |                                           |
| <b>Standards</b>                               |                   |                                                 |                                           |
| 5640                                           | 0 °C to 60 °C     | 229 mm x 6.35 mm (9 in x 0.25 in)               | ± 0.0015 °C                               |
| 5641                                           | 0 °C to 60 °C     | 114 mm x 3.2 mm (4.5 in x 0.125 in)             | ± 0.001 °C                                |
| 5642                                           | 0 °C to 60 °C     | 229 mm x 3.2 mm (9 in x 0.125 in)               | ± 0.001 °C                                |
| 5643                                           | 0 °C to 100 °C    | 114 mm x 3.2 mm (4.5 in x 0.125 in)             | ± 0.0025 °C                               |
| 5644                                           | 0 °C to 100 °C    | 229 mm x 3.2 mm (9 in x 0.125 in)               | ± 0.0025 °C                               |
| <b>Secondary probes</b>                        |                   |                                                 |                                           |
| 5610                                           | 0 °C to 100 °C    | 152 or 229 mm x 3.2 mm (6 or 9 in x 0.125 in)   | ± 0.01 °C                                 |
| 5611A                                          | 0 °C to 100 °C    | 1.5 mm (0.06 in) tip dia.                       | ± 0.01 °C                                 |
| 5611T                                          | 0 °C to 100 °C    | 28 mm x 3 mm (1.1 in x 0.12 in)                 | ± 0.01 °C                                 |
| 5665                                           | 0 °C to 100 °C    | 76 mm x 3.2 mm (3 in x 0.125 in)                | ± 0.01 °C                                 |
| <b>Thermocouples</b>                           |                   |                                                 |                                           |
| <b>Type R and S standards</b>                  |                   |                                                 |                                           |
| 5649/5650-20                                   | 0 °C to 1450 °C   | 508 mm x 6.35 mm (20 in x 0.25 in)              | ± 0.7 °C at 1100 °C                       |
| 5649/5650-20C                                  | 0 °C to 1450 °C   | 508 mm x 6.35 mm (20 in x 0.25 in)              | ± 0.7 °C at 1100 °C                       |
| 5649/5650-25                                   | 0 °C to 1450 °C   | 635 mm x 6.35 mm (25 in x 0.25 in)              | ± 0.7 °C at 1100 °C                       |
| 5649/5650-25C                                  | 0 °C to 1450 °C   | 635 mm x 6.35 mm (25 in x 0.25 in)              | ± 0.7 °C at 1100 °C                       |

†“Basic Accuracy” includes calibration uncertainty and short-term repeatability. It does not include long-term drift.

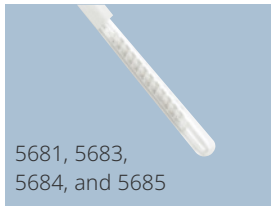
## Calibration baths

| Model                           | Range                                                                         | Stability                                                                                       | Depth            |
|---------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------|
| Compact calibration baths       |                                                                               |                                                                                                 |                  |
| 7340                            | –40 °C to 150 °C (–40 °F to 302 °F)                                           | ± 0.005 °C at –40 °C<br>± 0.005 °C at 25 °C                                                     | 234 mm (9.25 in) |
| 7380                            | –80 °C to 100 °C (–112 °F to 212 °F)                                          | ± 0.006 °C at –80 °C<br>± 0.010 °C at 0 °C                                                      | 178 mm (7 in)    |
| 6331                            | 35 °C to 300 °C (95 °F to 572 °F)                                             | ± 0.015 °C at 300 °C<br>± 0.005 °C at –20 °C                                                    | 457 mm (18 in)   |
| 7341                            | –45 °C to 150 °C (–49 °F to 302 °F)                                           | ± 0.005 °C at –40 °C<br>± 0.005 °C at 25 °C                                                     | 457 mm (18 in)   |
| 7381                            | –80 °C to 110 °C (–112 °F to 230 °F)                                          | ± 0.006 °C at –80 °C<br>± 0.005 °C at 0 °C                                                      | 457 mm (18 in)   |
| Standard size calibration baths |                                                                               |                                                                                                 |                  |
| 7080                            | –80 °C to 110 °C (–112 °F to 230 °F)                                          | ± 0.0025 °C at –80 °C<br>± 0.0015 °C at 25 °C                                                   | 305 mm (12 in)   |
| 7508                            | –5 °C to 110 °C (23 °F to 230 °F)                                             | ±0.0007 °C at 25 °C (water),<br>±0.001 °C at 25 °C (mineral oil)                                | 331 mm (13 in)   |
| 7512                            | –10 °C to 110 °C (14 °F to 230 °F)                                            | ±0.0008 °C at 0 °C (ethanol),<br>±0.0008 °C at 25 °C (water),<br>±0.003 °C at 100 °C (oil 5012) | 457 mm (18 in)   |
| 7511                            | –10 °C to 110 °C (14 °F to 230 °F)                                            | ±0.0008 °C at 0 °C (ethanol),<br>±0.0008 °C at 25 °C (water),<br>±0.003 °C at 100 °C (oil 5012) | 305 mm (12 in)   |
| 6020                            | 40 °C to 300 °C (104 °F to 572 °F)                                            | ± 0.005 °C at 300 °C<br>± 0.001 °C at 40 °C                                                     | 305 mm (12 in)   |
| 6050H                           | 180 °C to 550 °C (356 °F to 1022 °F)                                          | ± 0.007 °C at 500 °C<br>± 0.006 °C at –80 °C                                                    | 305 mm (12 in)   |
| Item                            | Description                                                                   |                                                                                                 |                  |
| Other                           |                                                                               |                                                                                                 |                  |
| Bath accessories                | Stands, rods, and clamps to suspend and support your probes and thermometers. |                                                                                                 |                  |
| Bath fluids                     | Silicone oils, salt, and cold fluids in convenient, small quantities.         |                                                                                                 |                  |

## Industrial temperature calibrators

| Model                             | Range                                 | Stability                                                                                 |
|-----------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------|
| <b>Field Metrology Wells</b>      |                                       |                                                                                           |
| 9190A                             | -95 °C to 140 °C (-139 °F to 284 °F)  | ± 0.015 °C                                                                                |
| 9142                              | -25 °C to 150 °C (-13 °F to 302 °F)   | ± 0.01 °C                                                                                 |
| 9143                              | 33 °C to 350 °C (91 °F to 662 °F)     | ± 0.02 °C                                                                                 |
| 9144                              | 50 °C to 660 °C (122 °F to 1220 °F)   | ± 0.03 °C at 50 °C<br>± 0.05 °C at 420 °C<br>± 0.05 °C at 660 °C                          |
| <b>Portable calibration baths</b> |                                       |                                                                                           |
| 6109A                             | 35 °C to 250 °C (95 °F to 482 °F)     | ± 0.015 °C                                                                                |
| 7109A                             | -25 °C to 140 °C (-13 °F to 284 °F)   | ± 0.01 °C                                                                                 |
| <b>Micro-Baths</b>                |                                       |                                                                                           |
| 6102                              | 35 °C to 200 °C (95 °F to 392 °F)     | ± 0.02 °C                                                                                 |
| 7103                              | -30 °C to 125 °C (-22 °F to 257 °F)   | ± 0.03 °C                                                                                 |
| <b>Handheld dry-wells</b>         |                                       |                                                                                           |
| 9100S                             | 35 °C to 375 °C (95 °F to 707 °F)     | ± 0.1 °C at 100 °C<br>± 0.3 °C at 375 °C                                                  |
| 9102S                             | -10 °C to 122 °C (14 °F to 252 °F)    | ± 0.05 °C                                                                                 |
| <b>Field dry-wells</b>            |                                       |                                                                                           |
| 9009                              | -15 °C to 350 °C (5 °F to 662 °F)     | ± 0.05 °C                                                                                 |
| 9103                              | -25 °C to 140 °C (-13 °F to 284 °F)   | ± 0.02 °C at -25 °C<br>± 0.04 °C at 140 °C                                                |
| 9140                              | 35 °C to 350 °C (95 °F to 662 °F)     | ± 0.03 °C at 50 °C<br>± 0.05 °C at 350 °C                                                 |
| <b>Infrared calibrators</b>       |                                       |                                                                                           |
| 4180                              | -15 °C to 120 °C (5 °F to 248 °F)     | ± 0.1 °C at -15 °C<br>± 0.05 °C at 0 °C<br>± 0.1 °C at 120 °C                             |
| 4181                              | 35 °C to 500 °C (95 °F to 932 °F)     | ± 0.05 °C at 35 °C<br>± 0.2 °C at 200 °C<br>± 0.4 °C at 500 °C                            |
| 9132                              | 50 °C to 500 °C (122 °F to 932 °F)    | ± 0.5 °C at 100 °C<br>± 0.8 °C at 500 °C                                                  |
| 9133                              | -30 °C to 150 °C (-22 °F to 302 °F)   | ± 0.4 °C                                                                                  |
| <b>Metrology Wells</b>            |                                       |                                                                                           |
| 9170                              | -45 °C to 140 °C (-49 °F to 284 °F)   | ± 0.005 °C                                                                                |
| 9171                              | -30 °C to 155 °C (-22 °F to 311 °F)   | ± 0.005 °C                                                                                |
| 9172                              | 35 °C to 425 °C (95 °F to 797 °F)     | ± 0.00 °C : 35 to 100 °C<br>± 0.008 °C : 100 °C to 225 °C<br>± 0.2 °C : 225 °C to 425 °C  |
| 9173                              | 50 °C to 700 °C (122 °F to 1292 °F)   | ± 0.1 °C : 50 °C to 100 °C<br>± 0.25 °C : 100 °C to 425 °C<br>± 0.4 °C : 425 °C to 700 °C |
| <b>Zero point dry-well</b>        |                                       |                                                                                           |
| 9101                              | 0 °C (32 °F)                          | ± 0.005 °C                                                                                |
| <b>Thermocouple furnaces</b>      |                                       |                                                                                           |
| 9150                              | 150 °C to 1200 °C (302 °F to 2192 °F) | ± 0.5 °C                                                                                  |
| 9118A                             | 300 °C to 1200 °C (572 °F to 2192 °F) | Uniformity ± 0.5 °C<br>Stability ± 0.2 °C                                                 |

## Standard platinum resistance thermometers (SPRTs)



### 5681, 5683, 5684, and 5685 Quartz-Sheath SPRTs

The performance you expect from world-class SPRTs.

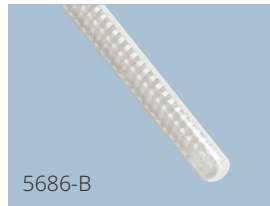
- Drift rates as low as 0.0005 K
- Proprietary gas mixtures ensures high stability
- Most experienced SPRT design team in the business



### 5698-25 Working Standard SPRT

High performance-to-price ratio.

- Conforms to ITS-90 SPRT Guidelines
- Drift rate typically 0.003 °C
- Calibration options by fixed point



### 5686-B Metal-Sheath Capsule SPRT

Designed for metrology work requiring small SPRTs.

- Temperatures from -260 °C (13 K) to 232 °C
- Stability typically 0.001 °C over 100 °C range
- Miniature capsule package eliminates stem conduction



### 5699 High-Temperature Metal-Sheath SPRT

Affordable working standard SPRT.

- Range to aluminum point (660 °C)
- Inconel™ sheaths guard against contamination of sensor
- Drift rates less than 8 mK/year

## ITS-90 fixed-point cells



### 5901 Triple Point of Water Cells

Must-have, primary temperature standards.

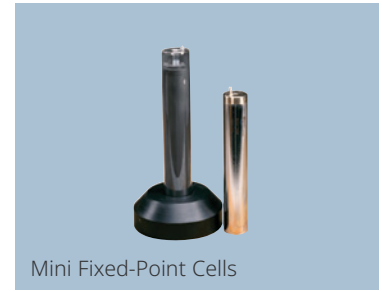
- Easy-to-use, inexpensive standard with uncertainty better than  $\pm 0.0001$  °C
- Four sizes and two shells (glass and quartz) to choose from
- Isotopic composition of Vienna Standard Mean Ocean Water



### ITS-90 Fixed-Point Cells

Best cell uncertainties commercially available.

- Every ITS-90 fixed point available from mercury to copper
- Plateaus last days (gallium for weeks and TPW for months)
- Manufactured and tested by Fluke Calibration's primary standards scientists



### Mini Fixed-Point Cells

Least expensive, easiest-to-use fixed-point standards.

- Lower uncertainties than comparison calibrations
- All ITS-90 fixed points from TPW to copper
- Reduced equipment and annual recalibration costs

## Cell maintenance apparatus



9114, 9115A, 9116A

### 9114, 9115A, 9116A Freeze-Point Furnaces

Designed for maximum-length plateaus.

- Designed to extend plateaus
- High-stability OEM controllers, RS-232 included
- External cooling coils

### 9210 Mini Triple Point of Water Maintenance Apparatus

Simple supercool-and-shake realization and maintenance of the 5901B Mini TPW Cell.

- Easy preprogrammed realization
- Inexpensive fixed-point solution
- Training complete in less than an hour

### 9230 Gallium Cell Maintenance Apparatus

Realize and maintain the melting point of the 5943 Gallium Cell.

- One week plateau duration
- No hassle automatic realizations
- Used daily in our Primary Lab

### 9260 Mini Fixed-Point Cell Furnace

Inexpensive, easy-to-use fixed-point maintenance apparatus.

- Realize and maintain In, Sn, Zn and Al fixed-point cells
- Good introduction to fixed-point calibration
- User friendly and inexpensive

### 9117 Annealing Furnace

Keeps SPRTs and PRTs performing at their highest levels.

- Relieves mechanical strain
- Guards against contamination
- Anneals both SPRTs and HTSPRTs



7508/7511/7512



7196B

### 7508/7511/7512 Refrigerated Temperature Calibration Baths

Unmatched refrigerated temperature stability and precision for a variety of applications.

- Proprietary hybrid analog/digital controllers power the 7508/7511/7512 refrigerated calibration bath
- High temperature stability of  $\pm 0.0007^\circ\text{C}$
- Exceptional low-temperature performance down to  $-10^\circ\text{C}$ :
- Temperature stability:  $\pm 0.0015^\circ\text{C}$
- Temperature uniformity:  $\pm 0.003^\circ\text{C}$
- Set-Point Resolution of  $0.001^\circ\text{C}$
- Multiple bath sizes available to calibrate a wide range of instruments

### 7196B LN<sub>2</sub> Comparison Calibrator

Lowest-cost calibration to  $-196^\circ\text{C}$ .

- Simple to use
- Uncertainty less than 2 mK



9210



9230



9260



9117

## Thermometer readouts



1586A



DAQ-STAQ Multiplexer



1595A



1529



1504



1524



1551A Ex and 1552A Ex



1620A

### 1586A Super-DAQ Precision Temperature Scanner and DAQ-STAQ Multiplexer

Best-in-class temperature measurement accuracy and up to 40 isolated input channels for measuring RTDs, thermocouples, thermistors, dc voltage, dc current, and resistance.

- PRTs:  $\pm 0.005$  °C;  
Thermocouples:  $\pm 0.29$  °C;  
Thermistors:  $\pm 0.002$  °C
- Scan speed of up to 10 channels per second
- Real-time color trending—chart up to four channels simultaneously
- Control Fluke Calibration temperature sources such as dry-wells or Micro-Baths for automated calibration routines

### 1595A Super-Thermometers

Thermometry bridge accuracy combined with time-saving features.

- Calibrate SPRTs, PRTs, RTDs and thermistors (0  $\Omega$  to 500 k $\Omega$ )
- Accuracy as good as 0.06 ppm (0.000015 °C)
- Ratio Self-Calibration verifies and calibrates resistance ratio accuracy

### 1529 Chub-E4 Standards Thermometer

Lab-quality accuracy on four channels for PRTs, thermistors and thermocouples.

- Four channels for PRTs, thermistors, and thermocouples
- Displays eight user-selected data fields from any channel
- Logs up to 8,000 readings with date and time stamps

### 1502A/1504 Thermometer Readouts

Best performance thermometers in their price range.

- Single-channel reference thermometers
- Two models to choose from—reading PRTs or thermistors
- Best price/performance package

### 1524 Reference Thermometers

Measure, graph and record three sensor types with one tool.

- High accuracy: PRTs:  $\pm 0.011$  °C;  
Thermocouples:  $\pm 0.24$  °C;  
Thermistors:  $\pm 0.002$  °C
- A simple user interface to see trends quickly
- Smart connectors to load probe information automatically

### 1551A Ex and 1552A Ex Stik Thermometer

The best substitute for precision mercury-filled glass thermometers.

- Accuracy of  $\pm 0.05$  °C ( $\pm 0.09$  °F) over full range
- Intrinsically safe (ATEX and IECEx compliant)
- Two models to choose from (-50 °C to 160 °C or -80 °C to 300 °C)

### 1620A Digital Thermometer-Hygrometer

The most accurate temperature and humidity graphical data logger on the market.

- Superior accuracy
- Network enabled
- Powerful logging and analysis tools

## Secondary standard PRTs

### 5608/5609 Secondary PRTs

Very stable thermometer from -200 °C to 670 °C.

- 5608: -200 °C to 500 °C (80 mm minimum immersion)
- 5609: -200 °C to 670 °C (100 mm minimum immersion)
- Calibration not included, NVLAP-accredited calibration optional, lab code 200348-0

### 5615 Secondary PRT

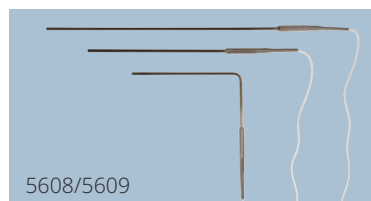
Reference-grade platinum sensing element.

- -200 °C to 420 °C
- $\pm 0.012$  °C accuracy at 0 °C
- Drift of  $\pm 0.007$  °C after 100 hours at max temperature

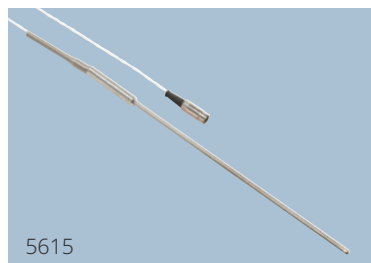
### 5626/5628 Secondary SPRT, PRT, Temperature Sensors

High-temperature secondary standards.

- -200 °C to 661 °C
- Meets all ITS-90 requirements for resistance ratios
- Rtp drift < 20 mK after 500 hours at 661 °C



5608/5609



5615



5626/5628

## Thermistor standards

### 5640 Series Thermistor Standards Probes

High accuracy temperature probes with excellent stability.

- Accuracy to  $\pm 0.001$  °C
- Affordable system accuracy to  $\pm 0.004$  °C or better
- NIST-traceable calibration included from manufacturer

## High temperature PRT

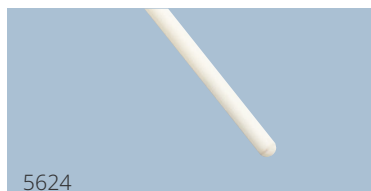
### 5624 Platinum Resistance Thermometer

Precision PRT accuracy at thermocouple temperatures.

- Temperature range of 0 °C to 1000 °C
- Accuracy of  $\pm 0.05$  °C to 962 °C (includes short-term stability and calibration uncertainty)
- Long-term drift of 0.01 °C at 0 °C after 100 hours at 1000 °C



5640



5624



5649/5650



5627A

## Thermocouple standards

### 5649/5650 Type R and Type S Thermocouple Standards

Eight models to fit any type R or S thermocouple applications.

- 0 °C to 1450 °C
- Two sizes available, each with or without reference junction
- Optional fixed-point calibration, uncalibrated accuracy is the greater of  $\pm 0.6$  °C or  $\pm 0.1$  % of reading

## Precision industrial PRTs

### 5627A Precision Industrial PRTs

Durable PRTs with temperature range to 420 °C and accuracy to 0.025 °C.

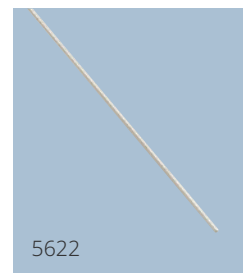
- Vibration and shock resistant
- NVLAP-accredited calibration included, lab code 200706-0

## Fast response PRTs

### 5622 Fast Response PRTs

Designed for temperature measurements requiring fast response or short immersion over a wide range.

- Time constants as fast as 0.4 seconds
- Available as DIN/IEC Class A PRTs or with NVLAP-accredited calibration, lab code 200348-0
- Small probe diameters ranging from 0.5 mm to 3.2 mm



5622

## Small diameter industrial PRTs

### 5618B Small Diameter Industrial RTD

Secondary level performance with full ITS-90 calibration.

- Small diameter sheath, 3.2 mm (0.125 in)
- Excellent stability
- Includes ITS-90 coefficients



## Full immersion PRTs

### 5606 Full Immersion PRT

PRTs for laboratory freezers, autoclaves, and furnaces.

- Transition junction designed to withstand full temperature range of probe
- 5606: -200 °C to 160 °C
- Calibration accuracy of  $\pm 0.05$  °C



## Secondary thermistor probes

### 5610/5611/5611T/5665 Secondary Reference Thermistor Probes

Lab-grade thermistors probes for accurate work across a narrow temperature range.

- Short-term accuracy to  $\pm 0.01$  °C; one-year drift  $< \pm 0.01$  °C
- Accredited NVLAP calibration optional
- Flexible Teflon and silicone coated fast-response models



## Compact calibration baths

### 7340/7380 Compact Temperature Calibration Baths

Compact baths with the stability and uniformity required for thermometer calibration.

- Stability and uniformity each better than  $\pm 0.008$  °C
- Metrology-level performance in lab-friendly sizes
- Convenient use on benchtops or on matching carts



### 6331/7341/7381 Deep-Well Compact Baths

Ample immersion depth and great stability, in a high value compact bath.

- 457 mm (18 in) of depth with just 15.9 liters (4.2 gal) of fluid
- Perfect for liquid-in-glass thermometers with optional LIG kit
- Fast, quiet, compact (yet deep), and economical



## Standard calibration baths



### 6020 High Temperature Calibration Oil Bath

Stable, uniform heat sources for calibrations up to 300 °C.

- Stability as good as 0.001 °C
- Large-capacity tanks for higher productivity
- Built-in cooling coils for external cooling sources



### 6050H Extremely High Temperature Calibration Salt Bath

Designed for high-temperature calibration—up to 550 °C.

- Eliminates messy sand baths
- Electronically adjustable temperature cutouts
- Stability of  $\pm 0.008$  °C at 550 °C



### 7080 Really Cold Temperature Calibration Baths

Cool to -40 °C, -60 °C, or -80 °C without external coolants.

- Self-contained refrigeration—no LN2 or chiller required
- Temperatures as low as -80 °C in real metrology baths
- Stability of  $\pm 0.0025$  °C at -80 °C

## Special application baths



### 7009/7108 Resistor Baths

Three size options for any quantity of resistors.

- Stability to  $\pm 0.0007$  °C
- Independent high- and low-temperature cutout circuit

## Metrology wells

### 9170/9171/9172/9173 Metrology Well Calibrators

Accurate enough for lab use yet rugged and portable.

- Best-performing industrial heat sources (accuracy, stability, uniformity) in the world
- $-45^{\circ}\text{C}$  to  $700^{\circ}\text{C}$
- Immersion depth to 203 mm (8 in)
- Optional ITS-90 reference input reads PRTs to  $\pm 0.006^{\circ}\text{C}$

## Field metrology wells

### 9190A Ultra-Cool Field Metrology Well

Ultra-cool dry-block calibrator with best-in-class stability.

- Wide temperature range from  $-95^{\circ}\text{C}$  to  $140^{\circ}\text{C}$
- Best-in-class stability:  $\pm 0.015^{\circ}\text{C}$  full range
- Accuracy using built-in reference thermometer readout:  $\pm 0.05^{\circ}\text{C}$  full range
- Display accuracy:  $\pm 0.2^{\circ}\text{C}$  full range

### 9142/9143/9144 Field Metrology Wells

Small dry wells for big field applications.

- Lightweight, portable, and fast
- Cool to  $-25^{\circ}\text{C}$  in 15 minutes and heat to  $660^{\circ}\text{C}$  in 15 minutes
- Built-in two-channel readout for PRT, RTD, thermocouple, 4-20 mA current



9103

## Field dry-well calibrators

### 9103/9140 Field Dry-Well Calibrators

Great performance in portable instruments.

- Lightweight and very portable
- Accuracy to  $\pm 0.25^{\circ}\text{C}$
- RS-232 and Interface-it software included



6102/7103

## Micro-Baths

### 6102/7103 Micro-Bath Thermometer Calibrators

Portable and extremely stable.

- Small portable calibration baths
- Calibrates sensors of different size or shape
- Accuracy  $\pm 0.25^{\circ}\text{C}$



6109A/7109A

## Portable calibration baths

### 6109A/7109A Portable Calibration Baths

Four times more calibration throughput and twice the accuracy of Micro-Baths and dry-block calibrators.

- Calibrate up to four tri-clamp sanitary sensors at the same time
- Wide temperature ranges cover most process applications  
– 6109A:  $35^{\circ}\text{C}$  to  $250^{\circ}\text{C}$   
– 7109A:  $-25^{\circ}\text{C}$  to  $140^{\circ}\text{C}$
- Excellent display accuracy of  $\pm 0.1^{\circ}\text{C}$  provides 4:1 test uncertainty ratio for critical applications
- Stainless steel casing withstands harsh sterilizing chemicals and is rust proof
- NVLAP-accredited calibration included standard



9170/9171/9172/9173



9190A



9142/9143/9144

## Handheld calibrators

### 9100S/9102S Handheld Dry-Well

Small, light, and portable dry-wells.

- Ranges from  $-10^{\circ}\text{C}$  to  $375^{\circ}\text{C}$
- Accuracy to  $\pm 0.25^{\circ}\text{C}$ , stability of  $\pm 0.05^{\circ}\text{C}$  at  $0^{\circ}\text{C}$

### 9009 Industrial Dual-Block Thermometer Calibrator

Double your productivity or cut your calibration time in half.

- Temperatures from  $-15^{\circ}\text{C}$  to  $350^{\circ}\text{C}$  in one unit
- Two wells in each block for simultaneous comparison calibrations
- Rugged, lightweight, water-resistant enclosure



9100S/9102S



9009



4180/81

## Infrared calibrators

### 4180/81 Precision Infrared Calibrators

Accredited performance for point-and-shoot calibrations.

- Calibrated radiometrically for meaningful, consistent results
- Accredited calibration included
- Accurate, reliable performance from  $-15^{\circ}\text{C}$  to  $500^{\circ}\text{C}$
- Supported in MET/CAL software

### 9132 and 9133 Portable Infrared Calibrators

Precision when you need it for infrared temperature calibration.

- Certify IR pyrometers from  $-30^{\circ}\text{C}$  to  $500^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$  to  $932^{\circ}\text{F}$ )
- Large 57 mm (2.25 in) black-body target
- RTD reference well for contact temperature measurement



9132 and 9133



9101



9150

## Zero-point dry-well

### 9101 Zero-Point Dry-Well, $0^{\circ}\text{C}$

Ice-point reference without the ice.

- $\pm 0.005^{\circ}\text{C}$  stability in a portable ice-point reference
- Easy re-calibration for long-term reliability
- Ready light frees user's time and attention

## Thermocouple furnaces

### 9150 Thermocouple Furnace

Convenient, portable thermocouple furnace.

- $150^{\circ}\text{C}$  to  $1200^{\circ}\text{C}$
- Stability of  $\pm 0.5^{\circ}\text{C}$  over full range
- NIST-traceable calibration included
- RS-232 port standard

### 9118A Thermocouple Calibration Furnace

High performance furnace for thermocouple calibrations to  $1200^{\circ}\text{C}$ . The Fluke Calibration 9118A Thermocouple Calibration Furnace is a horizontal, open-ended tube furnace with a temperature range of  $300^{\circ}\text{C}$  to  $1200^{\circ}\text{C}$ .

- Wide temperature range
- Calibrates many thermocouple types
- Best-in-class temperature stability and uniformity
- Automated setpoint control



9118A



# Humidity calibration

Humidity affects many properties of air and the materials that are exposed to it. Monitoring and measuring humidity is important wherever there is a need to prevent condensation, corrosion, mold, warping or spoilage of products. For example, it's important to measure humidity in industries that manufacture and distribute foods, pharmaceuticals, chemicals, fuels, wood, textiles, and paper.

The sensors that measure humidity need to be calibrated regularly to ensure they continue to operate within their specifications. Humidity sensor calibration is typically done using an instrument called a humidity generator.

Most humidity generators are based on one of two designs. A mixed-flow generator controls humidity by using the split-stream method. In this method, dry gas is drawn into the generator and divided into two parts. One part is partially or completely saturated with water vapor; the other part is mixed in until the targeted humidity output is reached. The humidity

depends on the wet air's humidity and the mixing ratio. A high-volume fan in the test chamber keeps the temperature and humidity uniform.

A two-pressure generator has two chambers. The first, called the saturator, contains air saturated with water vapor at a high pressure. The air passes from the saturator to the second chamber, called the test chamber. The test chamber is at a lower pressure. As the air passing into the test chamber reduces in pressure, its relative humidity also drops.

A mixed-flow generator is faster than a typical two-pressure generator, and is also more portable, which makes this type of calibrator a good solution for work in the lab or on-site in the field.

## Product highlights



5128A RHapid-Cal Humidity Generator

### **Fast, portable humidity probe and logger calibration with accredited 1% RH system accuracy**

- Best-in-class system accuracy for dependable humidity probe calibration
- Rapid humidity and temperature stabilization time for high calibration throughput
- Supports on-site, multi-point calibration of humidity probes
- Versatile design accommodates a large workload
- Compact size and lightweight for easy transport
- ISO 17025 accredited system calibration included standard
- Easy to maintain
- Supported in MET/CAL software



# Pressure calibration

Pressure calibration is the comparison of the output of a device used to measure pressure with that of another pressure measurement device, or pressure measurement standard. This usually involves plumbing the device under test (DUT) to the standard device and generating a common pressure in the measurement circuit. The outputs of the devices are compared at one or more pressures, typically from the lowest to highest readings of the DUT's full scale range, or the range over which it is normally used.

The comparison process can be performed in a chain from the highest level of fundamental pressure realization down to everyday pressure measurement devices, such as analog gauges, transducers and transmitters, to ensure that pressure measurements are accurate and comply with accepted or mandated standards.

The test fluid inside a pressure calibration system may be liquid or gas depending on the application. In general, gas (usually compressed nitrogen or air) is used for cleanliness and precision at lower pressures, and liquids (usually oil or water) are often used for safety, leak integrity, and ease of pressure generation at higher pressures above 7 MPa to 40 MPa (1,000 psi to 6,000 psi). There is a great deal of overlap in the actual ranges for which liquid or gas may be used practically, as reflected in the range of Fluke Calibration instruments that are specialized for each type of test fluid.

## Product highlights



8270A/8370A Modular Pressure Controllers/Calibrators

### Widest workload coverage in an automated high-pressure controller

The 8270A and 8370A are automated pneumatic pressure controllers that calibrate a wide workload of pressure sensors, covering twice the pressure ranges at twice the speed of other high-pressure controllers. Two models let you balance price and performance:

- The 8270A measures and controls pressures from vacuum to 44 MPa (6400 psi). It can be configured with ranges as low as 100 kPa (15 psi).
- The 8370A measures and controls pressures from atmosphere to 107 MPa (15,500 psi). It can be configured with ranges as low as 700 kPa (100 psi).

Fluke Calibration's unique control technology enables you to use these calibrators at low or high pressures, all in the same instrument. Control precision is 0.002 % of active range.



6270A Modular Pressure Controller/Calibrator

### Calibrate a wide range of pressure gauges and sensors with a single instrument

- Modular configuration makes this a versatile and expandable solution
- Easy to operate and maintain
- Wide measurement range—vacuum to 3000 psi (20 MPa)
- Three levels of accuracy—0.02 % FS, 0.01 % reading from 50 % to 100 % span, or 0.01 % reading from 30 % to 100 % span—let you balance performance and budget
- High speed, stable pressure control
- Localized graphical user interface in choice of ten languages
- Can be fully automated with COMPASS® for Pressure software
- Optional contamination prevention system keeps valves clean and free from debris

## Selection guide

### Pneumatic deadweight testers

| Model | Full Scale Pressure                 | Hand Pump | Fine Inc. Weights | Standard Accuracy | Optional Accuracy | Positive Pressure | Vacuum Pressure |
|-------|-------------------------------------|-----------|-------------------|-------------------|-------------------|-------------------|-----------------|
| P3011 | 100 kPa<br>(30 mmHg)                | ○         |                   | 0.015 %           | 0.008 %           |                   | ✓               |
| P3012 | 100 kPa<br>(400 inH <sub>2</sub> O) | ✓         |                   | 0.015 %           | 0.008 %           | ✓                 |                 |
| P3013 | 200 kPa<br>(800 inH <sub>2</sub> O) | ✓         |                   | 0.015 %           | 0.008 %           | ✓                 |                 |
| P3014 | 1 MPa<br>(150 psi)                  | ✓         | ○                 | 0.015 %           | 0.008 %           | ✓                 |                 |
| P3015 | 3.5 MPa<br>(500 psi)                | ○         | ○                 | 0.015 %           | 0.008 %           | ✓                 |                 |
| P3022 | 100 kPa<br>(400 inH <sub>2</sub> O) | ○         | ○                 | 0.015 %           | 0.008 %           | ✓                 | ✓               |
| P3023 | 200 kPa<br>(800 inH <sub>2</sub> O) | ○         | ○                 | 0.015 %           | 0.008 %           | ✓                 | ✓               |
| P3025 | 3.5 MPa<br>(500 psi)                | ○         | ○                 | 0.015 %           | 0.008 %           | ✓                 | ✓               |
| P3031 | 7 MPa<br>(1 000 psi)                |           |                   | 0.015 %           | 0.008 %           | ✓                 |                 |
| P3032 | 14 MPa<br>(2 000 psi)               |           |                   | 0.015 %           | 0.008 %           | ✓                 |                 |

✓ = Standard    ○ = Optional

## Selection guide

### Hydraulic deadweight testers

| Model        | Full Scale Pressure                     | Media | Priming Pump | Fine Inc. Weights | Standard Accuracy | Optional Accuracy | Single Piston | Dual Piston |
|--------------|-----------------------------------------|-------|--------------|-------------------|-------------------|-------------------|---------------|-------------|
| <b>P3111</b> | 3.5 MPa<br>(500 psi)                    | Oil   | ✓            | ○                 | 0.015 %           | 0.008 %           | ✓             |             |
| <b>P3112</b> | 14 MPa<br>(2 000 psi)                   | Oil   | ✓            |                   | 0.015 %           | 0.008 %           | ✓             |             |
| <b>P3113</b> | 35 MPa<br>(5 000 psi)                   | Oil   | ✓            | ○                 | 0.015 %           | 0.008 %           | ✓             |             |
| <b>P3114</b> | 70 MPa<br>(10 000 psi)                  | Oil   | ✓            | ○                 | 0.015 %           | 0.008 %           | ✓             |             |
| <b>P3115</b> | 110 MPa<br>(16 000 psi)                 | Oil   | ✓            | ○                 | 0.015 %           | 0.008 %           | ✓             |             |
| <b>P3116</b> | 140 MPa<br>(20 000 psi)                 | Oil   | ✓            | ○                 | 0.015 %           | 0.008 %           | ✓             |             |
| <b>P3117</b> | 30 000 psi,<br>2 000 bar, or<br>200 MPa | Oil   | ✓            | ○                 | 0.02%             | 0.015%            | ✓             |             |
| <b>P3118</b> | 40 000 psi,<br>2 600 bar, or<br>260 MPa | Oil   | ✓            | ○                 | 0.02%             | 0.015%            | ✓             |             |
| <b>P3119</b> | 000 psi,<br>4 000 bar, or<br>400 MPa    | Oil   | ✓            | ○                 | 0.02%             | 0.015%            | ✓             |             |
| <b>P3123</b> | 35 MPa<br>(5 000 psi)                   | Oil   | ✓            | ○                 | 0.015 %           | 0.008 %           |               | ✓           |
| <b>P3124</b> | 70 MPa<br>(10 000 psi)                  | Oil   | ✓            | ○                 | 0.015 %           | 0.008 %           |               | ✓           |
| <b>P3125</b> | 110 MPa<br>(16 000 psi)                 | Oil   | ✓            | ○                 | 0.015 %           | 0.008 %           |               | ✓           |
| <b>P3211</b> | 3.5 MPa<br>(500 psi)                    | Water | ✓            | ○                 | 0.015 %           | 0.008 %           | ✓             |             |
| <b>P3213</b> | 35 MPa<br>(5 000 psi)                   | Water | ✓            | ○                 | 0.015 %           | 0.008 %           | ✓             |             |
| <b>P3214</b> | 70 MPa<br>(10 000 psi)                  | Water | ✓            | ○                 | 0.015 %           | 0.008 %           | ✓             |             |
| <b>P3223</b> | 35 MPa<br>(5 000 psi)                   | Water | ✓            | ○                 | 0.015 %           | 0.008 %           |               | ✓           |
| <b>P3224</b> | 70 MPa<br>(10 000 psi)                  | Water | ✓            | ○                 | 0.015 %           | 0.008 %           |               | ✓           |

✓ = Standard    ○ = Optional

## Gas pressure controllers/calibrators



6270A

### 6270A Modular Pressure Controller/Calibrator

Calibrate a wide range of pressure gauges and sensors with a single instrument.

- Modular configuration makes this a versatile and expandable solution
- Wide measurement range—vacuum to 3000 psi (20 MPa)
- Three levels of accuracy—0.02 % FS, 0.01 % reading from 50 % to 100 % for most ranges, or 0.01 % reading from 30 % to 100 % of span—let you balance performance and budget
- Can be fully automated with COMPASS™ for Pressure software
- Optional contamination prevention system keeps valves clean and free from debris



7250LP

### 7250LP Low Pressure Controller/Calibrator

Specialized measurement and control for very low draft pressure range.

- Precision: 0.005 % of reading
- Control stability: 0.004 % of each range
- Resolution to 0.0001 in H<sub>2</sub>O
- Select from three range combinations: 10 in H<sub>2</sub>O and 30 in H<sub>2</sub>O or 20 in H<sub>2</sub>O and 60 in H<sub>2</sub>O or 35 in H<sub>2</sub>O and 100 in H<sub>2</sub>O



7250/7250i/7250xi

### 7250/7250i Gas Pressure Controllers/Calibrators

Combining advanced precision, stability, speed and affordability.

- Pressure ranges from 0 to 5 and 0 to 3000 psi (0 to 35 kPa and 0 to 21 MPa)
- Model 7250i provides precision of  $\pm(0.005\%$  of reading) from 40 % FS to 100 % FS
- Model 7250 provides 0.003 % of full scale precision
- Stability: 0.0075 % of reading per year
- Time to setpoint: 20 seconds or less typical with zero overshoot into a 15 in<sup>3</sup> (245 cc) volume in 10% full scale increments for ranges to 2,500 psi (17.25 MPa) 60 seconds for 3,000 psia (21 MPa) range



7252/7252i



PPC4

### 7250xi High Performance Gas Pressure Controllers/Calibrators

Unmatched precision and speed.

- Pressure ranges from 0 to 140 kPa and to 17 MPa (0 to 20 psi and to 2500 psi, 0 to 1.4 bar and to 170 bar)
- Advanced precision of 0.005% of reading precision from 20% to 100% Full scale
- Stability: 0.0075 % of reading per year
- Time to setpoint: 20 seconds or less typical with zero overshoot into a 15 in<sup>3</sup> (245 cc) volume in 10% full scale increments for ranges to 2,500 psi (17.25 MPa) 60 seconds for 3,000 psia (21 MPa) range

### 7252/7252i Dual Output Gas Pressure Controllers

A unique and flexible approach to performing automated calibrations over a wide pressure range.

- Two independent pressure measurement and control modules
- Two performance models available, 7252i and 7252
- Fast control: 20 seconds or less typical with zero overshoot into a 15 in<sup>3</sup> (245 cc) volume in 10% full scale increments
- Choose from any pressure range combination from as low as 10 inH<sub>2</sub>O (25 mbar) up to 2500 psi (172 bar) gauge / 3000 psi (210 bar) absolute.

### PPC4 Gas Pressure Controller/Calibrator

Wide rangeability and flexibility in a single controller. Ranges and accuracy classes can be selected to best suit the application.

- Up to two internal Quartz Reference Pressure Transducers (Q-RPTs) from absolute (vacuum) to 14 MPa (2000 psi)
- Full-scale standard class Q-RPTs provide 0.015 % full scale of selected range measurement uncertainty
- Standard class Q-RPTs provide 0.01% reading measurement uncertainty
- Premium class Q-RPTs provide 0.008 % reading measurement uncertainty
- 4 ppm control precision as low as 1 kPa (0.15 psi) with large turndown
- Can use RPM4 reference pressure monitors as integrated remote pressure references for additional Q-RPT ranges

## High pressure controllers/calibrators

### 8270A/8370A Modular Pressure Controllers/Calibrators

Widest pressure calibration workload coverage with twice the speed of other high-pressure controllers.

- 8270A covers a wide range of vacuum to 44 MPa (6300 psi). It can be configured with ranges as low as 100 kPa (15 psi).
- 8370A covers a wide range of atmosphere to 107 MPa (15000 psi). It can be configured with ranges as low as 700 kPa (100 psi).
- Three levels of accuracy, 0.02 % FS, 0.01 % reading from 50 % to 100 % for most ranges or 0.01 % reading from 30 % to 100 % of span
- Can be fully automated with COMPASS for Pressure software
- Optional contamination prevention system keeps valves clean and free from debris

### PPCH Hydraulic Pressure Controller/Calibrator

Wide rangeability and flexibility with precise high pressure hydraulic control.

- Ranges to 200 MPa (30 k psi)
- One or two internal Q-RPTs with large range turndown
- High precision control over wide range
- Can use RPM4 reference pressure monitors as integrated remote pressure references for additional Q-RPT ranges



8270A/8370A



PPCH

## Reference pressure indicators

### RPM4 Reference Pressure Monitor

Premium measurement performance in a compact and rugged instrument.

- One or two independent quartz reference pressure transducer modules (Q-RPTs) with individual self-defense systems (SDS™) to prevent over-pressure
- Infinite Ranging and AutoRange™
- Differential measurement mode (channel 1- channel 2)
- Can be used as integrated external reference pressure transducer for PPC pressure controller/calibrators

### 7050 Series Digital Pressure Indicators

Unmatched precision with long term stability.

- Pressure ranges from 0 to 10 in H<sub>2</sub>O and 0 to 1,500 psi (0 to 25 mbar and 0 to 100 bar)
- Model 7050i provides precision of 0.005 % of reading
- Model 7050 provides 0.003 % of full scale precision
- Active matrix color screen with enhanced navigation menus
- Model 7050LP is dual range, select from 10/30 inH<sub>2</sub>O or 20/60 inH<sub>2</sub>O or 35/100 inH<sub>2</sub>O range combinations with precision of 0.005% of reading from 10% to 100% Full Scale (FS)



RPM4



7050/7050i

## Piston gauges

### PG7601 Absolute Gas Piston Gauge

Gas piston gauge with vacuum reference for defining absolute pressures.

- Gas pressure from 5 kPa to 7 MPa (0.7 psi to 1,000 psi) gauge or absolute pressure
- Onboard measurement of test conditions, and real-time calculation and display of test pressure
- Compatible with PPC4 and 6270A pressure controller

### PG7202 High Pressure Gas Piston Gauge

Gas piston gauge with oil-lubricated piston-cylinder for operation in high pressure gas or oil.

- Gas pressures from 100 kPa to 110 MPa (15 to 16,000 psig), oil pressures from 100 kPa to 200 MPa (15 to 30,000 psig)
- Gas operated, liquid lubricated for robust operation and low piston sink rates
- Onboard measurement of test conditions, and real-time calculation and display of test pressure
- Compatible with 8370A pressure controller and AMH-100 Automated Mass Handler

### PG7302 Piston Gauge

Oil piston gauge for measurement of high gauge pressures.

- Oil pressures from 100 kPa to 500 MPa (15 psi to 75,000 psig)
- Onboard measurement of test conditions, and real-time calculation and display of test pressure
- Compatible with PPCH pressure controller and AMH-100 Automated Mass Handler

### PG7000-AMH Automated Mass Handler

Automated Mass Handler for PG7000 Piston Gauges.

- Add to PG7000 Series piston gauge to fully automate pressure testing in gauge or absolute mode
- Designed and tested to provide years of reliable, maintenance free operation
- Reduce wear and possible mass value changes caused by manual mass handling



PG7601



PG7202



PG7302



PG7000-AMH

## National Metrology Institute piston gauges

### PG9607 Gas Piston Gauge

Fully automated primary pressure reference for absolute and gauge pressures to 500 kPa.

- Gauge and absolute pressures from 11 kPa to 500 kPa with a single piston-cylinder
- Large diameter 50 mm piston-cylinder with improved geometry allows direct traceability to dimensional measurements with very low uncertainties

### PG9602 Gas Piston Gauge

Fully automated primary pressure reference for absolute and gauge pressures to 11 MPa.

- Gauge and absolute pressures from 10 kPa to 11 MPa
- Up to 100 kg mass load under vacuum bell jar for large turndown and overlap of piston-cylinder ranges



PG9607/ PG9602

## Manual pressure generation and control



3990

### 3990 Gas Pressure Control Pack

Precise, manual absolute and gauge pressure control for gas piston gauges and indicators.

- Models from vacuum to 7 MPa and 20 MPa (1,000 psi and 3,000 psi)
- Self-contained for intuitive, easy use



MPG2

### MPG2 Hydraulic Pressure Generator/Controller

Precise, manual control for hydraulic piston gauges and indicators.

- Models to 100 MPa and 200 MPa (15 k psi and 30 k psi)
- Self-contained for intuitive and easy generation and precise control to full pressure



700HPPK

### 700HPPK Pneumatic Test Pump Kit

Generate 21 MPa (3,000 psi) easily in the field, without liquid contamination or the hazard of a pressurized gas cylinder.

- Generate and adjust pneumatic pressures up to 21 MPa (3,000 psi)
- Rugged, portable and stable enough to go anywhere—on any surface
- Reaches pressure in 20 seconds to full scale into a 30 cm<sup>3</sup> volume
- Detachable pressure adjustment system for adjusting pressure, connecting reference and test devices on bench and in the field, and isolating and venting pressure

## Industrial deadweight testers



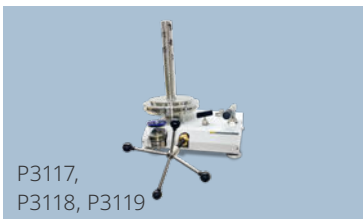
P3000



P3100



P3200



P3117,  
P3118, P3119



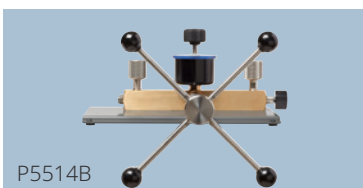
P5510



P5513



P5515



P5514B

### P3000 Pneumatic Deadweight Tester

High performance gas deadweight testers, with unique suspended piston design for vacuum calibration.

- 0.015 % of reading accuracy standard (0.008 % optional)
- 3 to 500 psi (0.2 to 35 bar) pressure
- Optional low range 0.03 to 1 bar vacuum (1 to 30 inHg)
- Integrated vacuum and pressure pump available to 2 MPa (300 psi)

### P3100 Hydraulic Deadweight Tester

Highly accurate oil deadweight tester, with quick and easy-to-use single and dual piston deadweight models.

- Pressure ranges to 140 MPa (20 k psi, 1400 bar)
- 0.015 % of reading accuracy standard (0.008 % optional)
- Built-in pressure generation and adjustment
- Single or dual piston formats

### P3200 Hydraulic Deadweight Tester

Hydraulic deadweight tester specially designed to use water as a test medium.

- Pressure ranges to 70 MPa (10 k psi, 700 bar)
- 0.015 % of reading accuracy standard (0.008 % optional)
- Built-in pressure generation and adjustment is standard
- Single or dual piston formats
- Water media

### P3117, P3118 and P3119 Hydraulic Deadweight Tester

FPO copy High performance and simplicity for very high pressure hydraulic calibration.

- Pressure ranges to 400 MPa (60 k psi, 4,000 bar)
- 0.02 % of reading accuracy standard (0.015 % optional)
- Includes hand pump and intensifier for generating and adjusting high pressures

## Pressure comparators

### P5510 Pneumatic Pressure Comparator\*

Precise, cost effective solution for checking pressure measuring instruments to 300 psi (20 bar).

- Dual pressure/vacuum capability
- Pressure to 21 MPa (300 psi, 20 bar)
- Vacuum from 0 to 80 kPa (0 to 24 inHg, 800 mbar)
- Built-in pressure and vacuum generation

### P5513 Pneumatic Pressure Comparator\*

Precise, cost effective solution for checking pressure measuring instruments to 3,000 psi (210 bar).

- Pressure range 0 to 21 MPa (3 k psi, 210 bar)
- High pressure pneumatic operation
- Screw press for fine pressure adjustments
- High quality needle valves for fine control

### P5514B and P5515 Series Hydraulic Pressure Comparators\*

Quick and easy solutions for checking pressure measuring instruments to 10,000 psi (700 bar).

- Compatible with a wide range of fluids
- P5514B Test Pump generates pressures to 70 MPa (10 k psi, 700 bar)
- P5515 Test Pump generates pressures to 140 MPa (20 k psi, 1,400 bar)
- P5515 has a built-in hand pump for system priming and large volume applications

\* Can be used with the 2700G Reference Pressure Gauge to provide a complete calibration solution

## Pressure calibrators



E-DWT-H

### E-DWT-H Electronic Deadweight Tester

A digital alternative to the traditional deadweight tester.

- Set and measure pressure precisely without limitation of mass loading resolution
- Pressure measurement is insensitive to local gravity and orientation
- One year uncertainty of  $\pm 0.02\%$  of reading
- Run onboard test routines and store calibration data for review and export to a PC



2700G

### 2700G Series Reference Pressure Gauges

Best-in-class measurement performance in a rugged, easy-to-use, economical package.

- Precision pressure measurement from 100 kPa (15 psi) to 70 MPa (10,000 psi)
- Accuracy to 0.02 % of full scale
- Easy-to-use, rugged construction for reliable performance
- Combine with the 700PTPK or 700HTPK pump kits for a complete portable pressure testing solution for up to 4 MPa (600 psi) with the PTP-1 pneumatic pump and up to 70 MPa (10,000 psi) with the HTP-2 hydraulic pump
- Combine with the P5510, P5513, P5514B, or P5515 Pressure Comparators for a complete bench top pressure calibration solution
- USB communications cable and universal power supply included standard

## Air data calibration



7750i

### 7750i Air Data Calibrator

Air data test set with unequalled precision and long term stability and superior pressure control technology.

- High accuracy, RVSM compliant
- Accuracy to  $\pm 2$  feet, 0.02 knots
- True differential sensor for airspeed (Qc)



# Gas flow calibration

## What is gas flow calibration?

Gas flow calibration refers to the calibration of a flow sensing device such as a flow meter or flow controller by comparing its measurement against a flow measurement reference. Typically, the device, or device under test (DUT), is pneumatically connected in series with the flow reference so they measure the same gas flow; then the indications of the two devices are compared.

## molbloc™/molbox™ system components

Fluke Calibration's molbloc/molbox gas flow calibration system consists of molbloc flow elements that connect to a flow terminal, molbox1+, so the terminal can use pressure and temperature measurements from around the flow element, combined with gas properties and prior molbloc calibration data, to determine and display the gas flow rate.

## Mass flow vs. volume flow

A frequent topic of discussion and confusion surrounding gas flow measurement is that of mass flow versus volume flow. Flow meters and flow units used for flow measurements are used to measure and express either the amount of volume of gas or the amount of mass (number of moles or molecules) passing through the device. When performing a gas flow calibration, it is nearly always beneficial to use a mass flow reference measurement, because the mass flow rate stays constant throughout a flow system in steady state. Since gas is compressible, the volume flow rate varies at different locations in a flow system due to changes in density caused by changing temperature and pressure. Fluke Calibration molblobs are mass flow standards, which allow reliable comparisons to other flow devices. The molbox terminal is also able to calculate and express the flow rate in terms of volume flow at another point in the system to allow testing of volume-based devices.

## Gas flow standards



molbox2

### molbox2 Flow Terminal

0.125 % of reading—lowest uncertainty for gas flow calibration.

- Allows coverage of flow range from less than 1 sccm to over 5000 slm with a single user interface and transportable system
- Real-time flow measurements makes adjusting analog flow devices fast and easy
- Perform fully-automated flow calibrations using molbox terminal with COMPASS for Flow software
- Get accredited and traceable uncertainty specification of +/- 0.5% of reading for 9 select gases and get traceable uncertainty specifications for 18 additional gases for molbloc-L, without calibrations in actual gases - based upon gas properties in NIST REFPROP10 and the default N2 gas calibration
- Three times faster flow response speed compared to previous molbox versions



molbloc-L

### molbloc-L Laminar Flow Element

Laminar flow elements for flow from 1 sccm to 100 slm.

- Traceable to primary gravimetric mass flow measurements
- Multiple gases supported
- Integrated filter to protect against contamination
- Integral gas temperature conditioning and measurement
- No moving parts that cause pressure/flow fluctuations or threaten reliability



molbloc-S

### molbloc-S Sonic Nozzle Flow Element

Sonic nozzle based molblocs for gas flow up to 5,000 slm.

- Covers ranges up to 5,000 slm in N2 and air
- Multiple gases supported
- Proven critical flow venturi (sonic) nozzle operating principle traceable to primary gravimetric flow measurements

### molstic Mounting Systems

- Used to conveniently mount and protect molbloc elements, connect devices under test and provide flow and pressure.
- molstic-L used for molbloc-L mass flow elements
- Quick connector input
- 2-micron (0.5 micron for low flow) filter to protect the downstream components
- Adjustable regulator protects the molbox transducers

### molstic-S used for molbloc-S mass flow elements

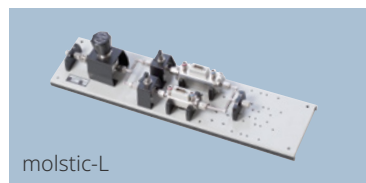
- Available in 1/2 inch or a 1/4-inch system plumbing size
- Integrated flow shut-off/metering valves

### Gas Flow Automation Accessories

#### MFC-CB™ Control Box

Stand-alone unit for setting/reading analog mass flow controllers (MFCs) and mass flow meters (MFMs).

- Set and read 0 to 5 V or 4 to 20 mA on two (2) channels
- Complete front panel local control and remote operation via RS-232 and IEEE-488 interfaces



molstic-L



molstic-S



MFC-CB™



# Calibration software

Calibration software automates all or part of a calibration process via computer control. Calibration software also allows users to manage their calibration and asset data.

If you've heard about the benefits of automated calibration and asset management but are puzzled about how everything fits together, call on Fluke Calibration for solutions.

Other types of calibration software from Fluke Calibration include data-logging software, software that generates calibration constants and references, and various add-on and plug-in software programs.

## Why use calibration software?

Using software to automate all or part of the calibration process offers several important advantages.

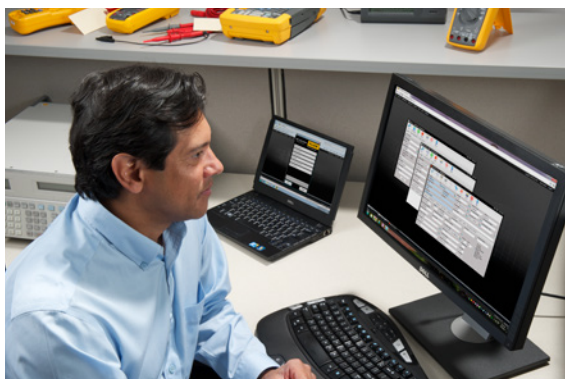
**Consistency**—Software automation ensures that calibrations can be performed exactly the same way by multiple operators in multiple locations. This improves the quality of results, reduces errors and standardizes methods.

**Efficiency**—Automating the calibration process allows technicians to set up tests and then go on to perform other tasks, making more efficient use of their time. Calibrations are typically completed much more quickly, saving time and money. If the software is capable of calibrating multiple devices under test simultaneously, automation increases throughput as well.

**Documentation and reports**—Calibration automation software typically includes features for documenting calibration procedures, storing calibration data, and producing reports, allowing users to eliminate paper records or spreadsheets.

Because Fluke Calibration software does such a good job of keeping accurate records of all parts of the calibration process, it also supports compliance with a wide variety of quality standards.

## Product highlights



### **MET/TEAM™ Test Equipment Asset Management Software**

MET/TEAM software is a powerful, flexible, and scalable calibration management software solution for managing your calibration assets. Designed by metrologists for metrology, it is ideal for calibration professionals who need to manage workflow through the calibration laboratory.

- Browser-based software enables access that is convenient, yet secure
- Fully featured for tracking and managing assets
- Fully integrated with the Runtime function of industry leading MET/CAL software
- Replaces MET/TRACK as the recommended data-base engine for MET/CAL software
- Popular Microsoft SQL server database for reliable, affordable, non-proprietary data storage
- Workflow management
- Highly customizable fields and labels
- Shortcuts (quick links) for easy navigation
- Promotes quality processes to support accreditation
- Customizable reports with Crystal Reports Professional
- Automated email alerts and recall escalation
- Mobile module for on-site calibration
- Customer web portal to allow read-only access for remote customers
- Commerce module for quoting, billing, and contract pricing
- Designed for metrology by metrologists
- Backed by Fluke Calibration, expert in calibration instrumentation and software
- Collect and store manual calibration data



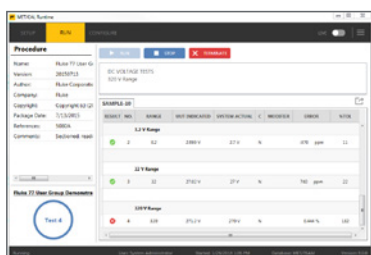
### **MET/CAL™ Calibration Management Software**

MET/CAL software automates the calibration process to help you manage your workload more efficiently and consistently. The MET/CAL suite of applications includes MET/CAL software, the industry leader for automated calibration; plus MET/TEAM software for asset management.

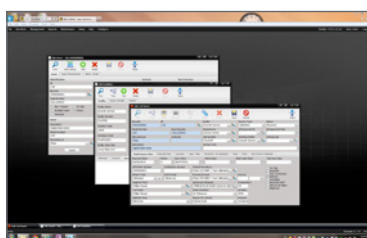
An updated Runtime interface offers better visibility into the calibration process. An updated Procedure Editor interface lets users view test results in a graphical user interface.

MET/CAL software provides you with the tools you need to:

- Perform automated calibration on all kinds of test and measurement tools and equipment, including DC/LF, RF and microwave instruments
- Create, edit, test, and document calibration procedures, quickly and easily
- Configure and report a wider range of measurement uncertainty parameters and include verification data to provide an audit trail and support further analysis
- Track asset information including calibration and maintenance history and status, traceability, users, customers, and location
- Analyze and report asset information; produce customized printed certificates and reports.
- Make data available to other corporate systems
- Import asset and calibration data into MET/CAL software
- Help meet the requirements of quality standards like ISO 9000, ISO/IEC 17025, NRC 10 CFR, ANSI Z540.3, and others



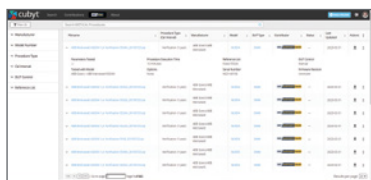
MET/CAL



MET/TEAM



MET/SUPPORT



Warranted Procedures for MET/CAL

## Electrical/RF calibration software

### MET/CAL™ Calibration Software

The complete solution for automating calibration processes plus managing and reporting measurement assets.

- Perform fast, repeatable, and powerful calibration
- Full storage of calibration data
- Rich reporting capabilities
- Configure and report a wider range of measurement uncertainty parameters

### Warranted Procedures for MET/CAL

Fully tested, ready-to-go procedures designed to satisfy your needs.

- Optional calibration procedures for MET/CAL Calibration Software
- Warranted by Fluke Calibration to produce valid calibrations on the intended device under test (DUT) for the specified model and revision level
- These procedures automate the calibration process under MET/CAL control

## Calibration asset management software

### MET/TEAM™ Test Equipment Asset Management Software

Manage more workload with less work with MET/TEAM software.

- Browser-based calibration asset management software
- Fully integrated with MET/CAL Software
- Microsoft SQL Server database
- Highly customizable
- Email automation
- On-site calibration
- Work flow management
- Pricing/billing/invoicing
- Customer web portal
- Installation and training services

### MET/CONNECT™ Calibration Integration Software

MET/CONNECT™ is the hub of a fast-growing community of main-line calibration software providers. These companies have partnered with Fluke Calibration to support MET/CAL automation. Whatever calibration management system you use, MET/CONNECT unlocks calibration and workflow automation in your lab.

MET/CONNECT partners:

- Indysoft
- AssetSmart
- Qualer
- MET/TEAM™

## Software support programs

### MET/SUPPORT™ Gold

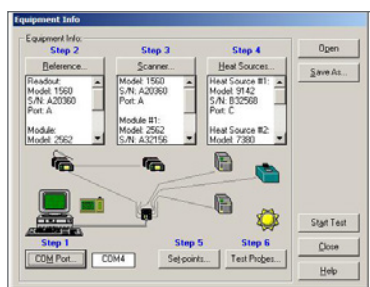
Annual support programs for MET/CAL and MET/TEAM software. These premier support services help you maximize your software investment.

- Premium support and services to help you maximize productivity with MET/CAL and MET/TEAM software
- Access to warranted procedure library
- Prioritized technical support
- Software updates and upgrades
- Priority web content
- Discounts on a variety of services

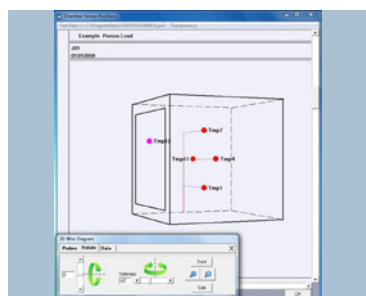
### Software Training and Services

A range of services to help you maximize your investment in calibration software.

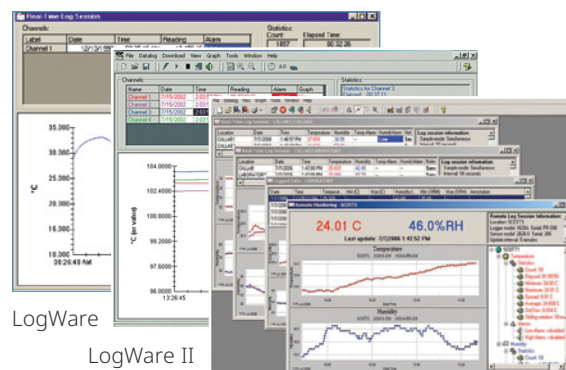
- MET/TEAM software installation and startup
- MET/TEAM data migration and import
- Classroom or onsite training classes:
  - MET/CAL procedure writing
  - Advanced procedure writing
  - MET/TEAM Asset Management
  - Crystal Reports Writing
- Custom MET/CAL procedures
- Custom software services



9938 MET/TEMP II Temperature Calibration Software v5



TQSoft and TQAero Thermal Validation Software



LogWare

LogWare II

LogWare III

## Temperature calibration software

### 9938 MET/TEMP II Temperature Calibration Software v5

New version of the proven solution for automated temperature calibration.

- Compatible with Windows 7 and 8 operating systems
- Adds support for 9190A Field Metrology Well and 9118A Thermocouple Furnace
- Calibrate PRTs, SPRTs, thermistors, thermocouples, and even liquid-in-glass (LIGs), bi-metallic thermometers, and connected sensors that can't be attached to a readout
- Supports multiple temperature sources and reference probes in the same test for faster calibration and extended test range

### TQSoft and TQAero Thermal Validation Software

For FDA 21 CFR Part 11 and AMS 2750 Compliant Data Collection.

- Support for Fluke 2638A and 1586A, for enhanced data collection and reporting in regulated industries
- Easy menu system and toolbar
- Test equipment preparation and sensor calibration
- Data security, audit trail, and compliance reports

### LogWare

Turn a Fluke Calibration single-channel handheld or 1502A/1504 readout into a real-time data logger.

- Collects real-time data
- Calculates statistics and displays customizable graphs
- Allows user-selected start times, stop times and sample intervals

### LogWare II

Turn any Fluke Calibration multi-channel thermometer readout into a real-time data logger.

- Collects real-time data using Fluke Calibration multi-channel readouts
- Calculates statistics and displays customizable graphs
- Allows user-selected start times, stop times and sample intervals

### LogWare III

Remotely monitor and log a virtually unlimited number of concurrent log sessions into a central data repository.

- Up to two temperature and two humidity inputs for each DewK
- Customize your graph trace color, alarms, and statistics as you go

## Pressure/Flow calibration software

### COMPASS™ for Pressure

Universal platform for automating pressure calibration.

- Integrated piston gauge support
- Runs complete automated calibration sequences
- Supports multiple units under test
- Automates virtually any pressure standard or device under test

### COMPASS for Flow

Macro-enabled mass flow calibration software package.

- Fully customizable
- Supports non Fluke Calibration flow references
- Performs complex real time flow computations, and allows you to alter test scenarios based on data collected



COMPASS for Pressure

COMPASS for Flow

# Fluke Built, Fluke Protected.

Priority manufacturer's accredited calibration, repair and extended warranty — Reduce ownership costs and turnaround time for your Fluke Calibration instrument.

## Why Premium Care?

Your calibration equipment is a precision instrument. Keep it that way with the support from the people who know it best: the Original Equipment Manufacturer (OEM).



### Reduce downtime

- Expedited repairs and express inbound/outbound shipping (EU\* & UK) with Premium Care – Gold
- Priority turnaround time on all calibrations and repairs
- We don't cut corners! We check every calibration point, with up to 30% more test points than third-party providers, to ensure your instrument performs at its best.



### Stay audit-ready

- Annual ISO/IEC 17025 accredited calibration included with Premium Care – Gold
- Regular performance checks help ensure the instrument continues to meet published specifications and regulatory requirements
- Free firmware and hardware updates included



### Control costs, save more

- Up to 50% savings over the life of the instrument compared to on-demand servicing
- Fixed pricing with multi-year plans = protection against any price increases
- Additional savings on training, repairs and upgrade services
- Reduce recalibration frequency by up to 30%, lowering your total cost of ownership over time



### Get expert, OEM-certified service

- We designed it, we know how to optimize it
- Access to original parts and firmware updates
- Services performed by Fluke Calibration's world-class metrologists and technicians



## What's in it for you?

- Think ROI – Save time, money and stress long-term
- Easy budget planning with fixed costs
- Reduced risk of failure, drift from environmental factors or component wear
- Trusted warranty coverage for up to 5 years

## Think you don't need it? Think again:

*"The price is too high."*

Premium Care can save up to 50% in total service costs over time.

*"These instruments are built to last."*

Yes, but accidents, electrical component failure, or drift happen. Premium Care keeps you covered.

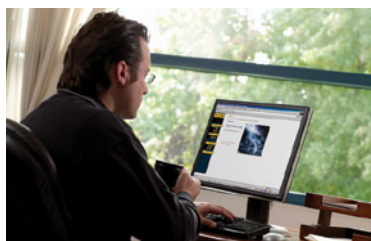
*"A third-party lab handles my service"*

Third-party labs offer ISO/IEC 17025 accredited calibration – but only Fluke Calibration can ensure your instrument is returned to full OEM specification compliance and accuracy, with access to the latest product updates and firmware.

# PremiumCare

Uptime Protection by

**FLUKE**®



### Register your Fluke Calibration product online

Visit [my.fluke.com/en-us/register-product/](https://my.fluke.com/en-us/register-product/) to register your product today.

### Authorized Fluke Calibration Service Centers

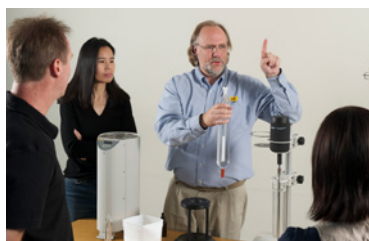
Fluke Calibration offers calibration and repair services and support through our flagship metrology laboratories and service partners worldwide. To find the best solution for your calibration product you can visit <https://www.fluke.com/en/support/service-center-locations>, call +31-402-675300, or email us at [servicedesk@fluke.com](mailto:servicedesk@fluke.com).

## Training

Calibration and metrology training from Fluke Calibration can help you and your staff become more knowledgeable in a wide variety of disciplines. Instructors are experts who work in electrical, temperature, pressure and flow calibration, and who really want to help you learn the foundation and techniques of metrology that you can put to immediate use in your workplace. Fluke Calibration offers introductory, intermediate, and advanced level courses in a variety of formats to meet your needs.

### Instructor-led classroom courses

Our instructor-led courses cover a variety of metrology topics and range from two to five days in length. Held in various locations around the world, training from Fluke Calibration is a great way to maximize your investment in your calibration product.



### Instructor-led web-based training

Our instructor-led web-based trainings offer the same great access to Fluke Calibration software experts, with the added benefit of not having to travel. Instructor-led web-based trainings are designed to fit into your schedule, without disrupting your workflow. Courses are set up in anywhere from one to five parts, two hours each, held on consecutive days.

### Self-paced online training

Our self-paced calibration and metrology training courses were developed by technical experts in the metrology community using proven instructional design components. At the start of each module, a brief tutorial describes how the course is laid out. The learning objectives are clearly stated. Topics are selected from easy-to-navigate menus and sub-menus. Embedded questions are presented frequently to increase retention. Engaging graphics, photos, formulas and tables support text material. A final post-test provides proof of competency. Tests are shuffled after each use. Most importantly, a certificate of completion satisfies documentation requirements.

### Self-paced training tools

In addition to self-paced online training, Fluke Calibration offers additional self-paced training tools for dc/low frequency metrology. Fluke Calibration offers the only comprehensive text book on dc/low frequency metrology, *Calibration: Philosophy in Practice, Second Edition*. It covers real world concepts and applications, and is designed and written for the working technician.



### On-site training

Fluke Calibration instructor-led courses may also be taught at your facility. If you have a large number of students, or if the material you wish to discuss is considered confidential, you may find On-Site Training an attractive alternative. Contact your local Fluke Calibration representative to discuss specific requirements and arrangements, or email [training@flukecal.com](mailto:training@flukecal.com) for a Fluke Calibration representative to contact you.

For up-to-date course schedules, pricing and training resources, contact your local Fluke Calibration representative.

### Installation and training supplemental services

Fluke Calibration offers expert consulting to help you configure and use your calibration products as productively and cost-effectively as possible. We can help:

- Minimize downtime
- Make sure your equipment runs efficiently
- Confirm that systems are operating properly
- Train you and your staff at your site with your newly acquired Fluke equipment.



**Fluke.** Keeping your world up and running.™

[Fluke.com](https://www.fluke.com)

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