9170 / 9171 / 9172 / 9173
Block calibrator

Accurate enough for laboratory use, rugged and mobile enough to be transported wherever it is needed

- The most powerful industrial temperature sources in the world (accuracy, temperature stability and homogeneity)
- Immersion depth up to 203 mm
- Optional ITS-90 reference input to read PRTs up to ±0.006 °C
- Temperature range from -45 °C to 700°C

Sometimes a product is released which sets completely new standards. This happened when we put our mobile temperature block calibrators on the market. They combine the accuracy of a temperature bath with the functionality of a block calibrator. Since they can also be used for reference temperature measurements, they deserve being called metrological block calibrators.

The block calibrators from Fluke are equipped with groundbreaking new and patent-pending electronics. They allow you laboratory quality calibrations in almost every environment. The new analog and digital control techniques offer a stability of ±0.005 °C.

The dual zone control allows you to achieve an axial (or vertical) temperature homogeneity of ±0.02 °C over a 60 mm zone. (Actually 60 mm!) In general, only liquid baths can offer you such a performance.

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Put in short terms, one industrial temperature source has six important criteria (i.e. as determined by a metrological committee within the EU with the document EA-10/13): Difference between the display of the calibration thermometer and the temperature in the measurement zone, temporal stability, axial temperature homogeneity, temperature differences between the drill holes, temperature effects due to different load and hysteresis. As seventh criteria we have added the input of a reference thermometer. This has led to the creation of a completely new product category: metrological block calibrators.

(The metrological block calibrators are the only products with published specifications on the market which comply with the performance category listed in EA-10/13. Our specifications aren't just expectations or guidelines. They apply to every metrological block calibrator in our product range).

Indication Accuracy

The calibration of block calibrators is being carried out by inserting a calibrated PRT into the drill hole of the tube and by correcting the calibrator's internal measurement sensor based on the measurement values of the PRT. This is of limited value because the unique characteristics of the reference PRT which are being "calibrated into" the calibrator often differ from the thermometers tested by the calibrator. This becomes more complicated because of the significant thermic gradients in the block and the insufficient immersion of the sensors in the block due to being too short.

When using the metrological block calibrators, all this is different. Temperature gradients, temperature effects due to load and hysteresis have been minimized to make the calibration of the indicator more significant. For the calibration of metrological block calibrators we just use authorized PRTs with traceable calibration. Our own electronics continuously has a repeatability which is 10 times higher than our specifications which cover a range of ±0.1 °C at the most often used temperatures up to ±0.25 °C at 661 °C.

Application information is available. It should help you to a better understanding of the uncertainties mentioned above. Click here (click with the right mouse button and choose the option "Save as…" to download the application information "Understanding the uncertainties associated with the use of Metrology Wells" in the Adobe Acrobat (.pdf) format.

Metrological block calibrators with integrated electronics are available in order to read external PRTs with ITS-90 characteristics. (See margin bar, Built in Reference Thermometry)

Stability

The temperature sources of Fluke Calibration have already been known for a long time to be one of the most stable temperature sources in the world. Metrological block calibrators have even more improvements. Both low temperature units (model 9170 and 9171) are stable to ±0.005 °C over their entire range. Even the 700 °C unit (model 9173) achieves a stability of ±0.03 °C.

A better stability can only be achieved by liquid baths and fixed point ovens or cells which are usually being used as primary standards. Commonly available controllers which are being used by most of the manufacturers of block calibrators can't offer you this performance.

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Axial temperature homogeneity

According to document EA-10/13, block calibrators should cover a zone of max. temperature homogeneity which has a length of 40 mm und is generally located on the bottom of the drill hole of the tube.

The metrological block calibrators combine out proprietary electronics with dual zone control and a bigger depth of the tube and the drill hole than it is common for block calibrators in order to allow a 60 mm long homogeneous zone. Vertical gradients in these zones reach from ±0.02 °C at 0 °C to ±0.4 °C at 700 °C.

And even more importantly: The specifications of metrological block calibrators for all units have been published and we guarantee their compliance.

Radial temperature homogeneity

The term radial temperature homogeneity refers to the temperature difference between two drill holes. When using inadequately prepared temperature source of measurement sensor with a large diameter, these differences can be significant. The specifications of our metrological block calibrators are defined as the largest temperature difference between the vertical homogeneous zones of two drill holes of which each has a diameter of 6.4 mm or smaller. The block calibrators with cooling (model 9170 and 9171) offer radial temperature homogeneity of ±0.01 °C. The models with heating (9172 and 9173) achieve ±0.01 °C to ±0.04 °C (at 700 °C).

Temperature effects due to load

The temperature effects due to load are defined as the change in temperature which is measured by a reference sensor which is being put in the lower area of a drill hole after all the other drill holes have already been prepared with thermometers.

See above (axial gradients) for the reasons which also lead to a reduction of the the temperature effects due to load. We use longer tubes with deeper drill holes than in other block calibrators. We also use proprietary dual zone control. Temperature effects due to load only add up to ±0,005 °C in models equipped with cooling function.

Hysteresis

Temperature hysteresis occurs more often with internal measurement sensors than with high quality reference PRTs. Hysteresis is being detected by comparing the difference between two external measurements of the same set point temperature which is being measured from two different directions (warmer or colder). It is usually the largest at the midpoint of a temperature source's temperature range. Hysteresis because control sensors are usually built to resist and therefore don't have the same expansion as SPRTs or even most of the PRTs. The hysteresis effects of metrological block calibrators reach from 0.025 °C to 0.07 °C.

Immersion depth

The immersion depth is important. It doesn't just contribute to the decrease of the axial gradients and the effects to load but also to the definition of the immersion characteristics of each one of the thermometers tested with the temperature source. These characteristics are position and size of the sensor in the measurement probe, width and warming mass of the measurement probe and the lines to connect to the sensor. Model 9171, 9172 and 9173 have drill holes with a depth of 203 mm. Model 9170 has a depth of 160 mm in order to support temperatures from -45 °C.

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Other functions

A large LCD display, a numeric keypad and display menus make using the block calibrators simple and intuitive. The display offers an overview of the block temperature, the temperature of the internal reference thermometers, the switch-off temperature as well as the stability criteria and the ramp speed. The user interface is available in the following languages: English, French and Chinese. Each one of the four models is equipped with a serial RS-232 interface. The software “Interface-it” is included in the delivery of the calibrator model 9930. All models support the MET/TEMP II software model 9938 for fully automated calibrations of RTDs, thermo elements and thermistors.

Also if you don’t have a PC at your disposal, you can use the different programmable calibration procedures of the block calibrator with up to eight temperature set points including ramp duration and hold time between each one of the values. The function allowing a fully automated switch test defines switching points and dead zone for thermo switches. The dedicated °C/ °F key allows you to change the temperature units easily.

For every unit you can order one of six tubes with drill holes for measurement probes with diameters in metrical and other units. (See the introduction on the right hand side. Download the entire data sheet in order to see all the details). Metrological block calibrators are small and light enough to be transported to wherever you need them.

9170
Model 9170 allows you to achieve the lowest possible temperature with this series of calibrators (-45 °C) under normal environment conditions. The device is stable up to ±0.005 °C over its entire temperature range (to 140 °C) and has an immersion depth of 160 mm. With its max. temperature homogeneity of ±0,02 °C and its radial temperature homogeneity of ±0.01 °C, this model offers remarkable uncertainties and is therefore ideally suited for several pharmaceutical and other applications.

9171
In case you require a larger depth, model 9171 offers which an immersion depth of 203 mm over the entire temperature range from -30 °C to 155 °C with a continuous stability of ±.005 °C. Just like the model 9170, this block calibrator also has remarkably high axial and radial temperature homogeneity. The display of the model 9171 has an accuracy of ±0.1 °C over its entire range.

9172
Model 9172 allows temperatures from 35 °C to 425 °C with a calibrated display with an accuracy of ±0.2 °C at 425 °C. Apart from its unique accuracy, the device is stable over a range of ±0.005 °C to ±0.01 °C depending on the temperature. The device’s immersion depth of 203 mm helps reducing thermal conduction errors on the sensor base at high temperatures significantly.

9173
The model 9173 devices offer an outstanding performance over their entire application range of 50 °C to 700 °C. The device has a display accuracy of ±0.25 °C at 700 °C and an immersion depth of 203 mm. Thanks to its outstanding stability and temperature homogeneity, this models help reducing the uncertainty when calibrating thermometers at high temperatures. Of course, temperature block calibrators are still being used. Fluke Calibration manufactures some of the transportable and fast block calibrators with the best performance in the world and will also continue doing so in the future. There are no better products to carry out time-saving tests and calibrations of industrial temperature probes and sensors.

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Technical data	9170	9171	9172	9173
Range (@ 23 °C environment temperature)	–45 °C to 140 °C	–30 °C to 155 °C	35 °C to 425 °C	50 °C to 700 °C†
Display accuracy	±0.1 °C over entire range		±0.1 °C: 35 °C to 100 °C ±0.15 °C: 100 °C to 225 °C ±0.2 °C: 225 °C to 425 °C	± 0.2 °C: 50 °C to 425 °C ± 0.25 °C: 425 °C to 660 °C
Stability	±0.005 °C over entire range		±0.005 °C: 35 °C to 100 °C ±0.008 °C: 100 °C to 225 °C ±0.01 °C: 225 °C to 425 °C	±0.005 °C: 50 °C to 100 °C ±0.01 °C: 100 °C to 425 °C ±0.03 °C: 425 °C to 700 °C
Axial temperature homogeneity (60 mm)	±0.1 °C @ -45 °C ±0.04 °C @ -35 °C ±0.02 °C @ 0 °C ±0.07 °C @ 140 °C	±0.025 °C @ -30 °C ±0.02 °C @ 0 °C ± 0.07 °C @ 155 °C	±0.05 °C: 35 °C to 100 °C ±0.1 °C: 100 °C to 225 °C ±0.2 °C: 225 °C to 425 °C	±0.1 °C: 50 °C to 100 °C ±0.25 °C: 100 °C to 425 °C ±0.4 °C: 425 °C to 700 °C
Radial temperature homogeneity	±0.01 °C over entire range		±0.01 °C: 35 °C to 100 °C ±0.02 °C: 100 °C to 225 °C ±0.025 °C: 225 °C to 425 °C	±0.01 °C: 50 °C to 100 °C ±0.025 °C: 100 °C to 425 °C ±0.04 °C: 425 °C to 700 °C
Effects due to load (with a 6.35 mm reference measurement sensor and three 6.35 mm measurement probes)	±0.02 °C @ -45 °C ±0.005 °C @ -35 °C ±0.01 °C @ 140 °C	±0.005 °C @ -30 °C ±0.005 °C @ 0 °C ±0.01 °C @ 155 °C	±0.01 °C over entire range	±0.02 °C @ 425 °C ±0.04 °C @ 700 °C
Hysteresis	0.025 °C		0.04 °C	0.07 °C
Chamber depth	160 mm	203 mm		
Resolution	0.001 °C			
Display	LCD, °C or °F, user-defined			
Numerical keypad	Ten keys with decimal point and plus/ minus key, functional keys, menu key and °C/ °F key			
Cooling time	44 min: 23 °C to -45 °C 19 min: 23 °C to -30 °C 19 min: 140 °C to 23 °C	30 min: 23 °C to -30 °C 25 min: 155 °C to 23 °C	220 min: 425 °C to 35 °C 100 min: 425 °C to 100 °C	235 min: 700 °C to 50 °C 153 min: 700 °C to 100 °C
Heating time	32 min: 23 °C to 140 °C 45 min: -45 °C to 140 °C	44 min: 23 °C to 155 °C 56 min: -30 °C to 155 °C	27 min: 35 °C to 425 °C	46 min: 50 °C to 700 °C
Dimensions (H x W x D)	66 x 203 x 323 mm 1.8 kg			

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Weight	14.2 kg	15 kg	13.2 kg	15 kg
Power supply	115 V AC (±10 %) or 230 V AC (±10 %), 50/60 Hz, 550 W		115 V AC (±10 %), or 230 V AC (±10 %), 50/60 Hz, 1025 W	
NIST traceable calibration	Data @ -45 °C, 0 °C, 50 °C, 100 °C and 140 °C	Data @ -30 °C, 0 °C, 50 °C, 100 °C and 155 °C	Data @ 100 °C, 150 °C, 250 °C, 350 °C and 425 °C	Data @ 100 °C, 200 °C, 350 °C, 500 °C and 660 °C
Calibrated @ 660 °C; use of reference thermometers recommended at higher temperatures				

Technical data	**Internal reference input**	
Temperature range	-200 °C to 962 °C	
Resistance range	0 Ω to 400 Ω, automatic selection of range	
Characteristics	ITS-90 sub ranges 4, 6, 7, 8, 9, 10 and 11 Callendar-Van cones (CVD): R0, a, b, d	
Resistance accuracy	0 Ω to 20 Ω: 0,0005 W 20 Ω to 400 Ω: 25 ppm	
Temperature accuracy (Uncertainty of the measurement sensor isn't included)	**10 Ω PRTs:** ±0.013 °C @ 0 °C ±0.014 °C @155 °C ±0.019 °C @ 425 °C ±0.028 °C @ 700 °C	**25 Ω- and 100 Ω PRTs:** ±0.005 °C @ -100 °C ±0.007 °C @ 0 °C ±0.011 °C @ 155 °C ±0.013 °C @ 225 °C ±0.019 °C @ 425 °C ±0.027 °C @ 661 °C
Resistance resolution	0 Ω to 20 Ω: 0.0001 Ω 20 Ω to 400 Ω: 0.001 Ω	
Measuring time	1 second	
Measurement probe connection	4-wire with connector shield, 5-pole DIN connector	
Calibration	NVLAP accreditation (only for the integrated reference input), NIST traceable calibration	

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