

1551A Ex/1552A Ex

Stik Thermometer

Calibration Manual

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Introduction

The Stik Thermometer (the Product or the Probe) is a precision digital thermometer that can be used as an alternative to mercury liquid-in-glass (LIG) thermometers. It can also be used as a reference standard for other types of digital or analog thermometers. Because of its intrinsically safe certification, it can be used in many of the same hazardous locations as analog thermometers. For complete usage instructions, see the *1551A Ex/1552A Ex Users Manual*.

How to Contact Fluke

To contact Fluke, call one of the following telephone numbers:

- Technical Support USA: 1-800-44-FLUKE (1-800-443-5853)
- Calibration/Repair USA: 1-888-99-FLUKE (1-888-993-5853)
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31 402-675-200
- Japan: +81-3-6714-3114
- Singapore: +65-6799-5566
- China: +86-400-921-0835
- Brazil: +55-11-3530-8901
- Anywhere in the world: +1-425-446-5500

Or, visit Fluke's website at www.fluke.com.

To register your product, visit <http://register.fluke.com>.

To see, print, or download the latest manual supplement, visit <http://us.fluke.com/usen/support/manuals>.

Safety Information

A **Warning** identifies conditions and actions that pose hazard(s) to the user. A **Caution** identifies conditions and procedures that could cause Product damage, equipment under test damage, or permanent loss of data.

General Safety Information is in the printed Safety Information document that ships with the Product and at www.Fluke.com. More specific safety information is listed where applicable.

If the Product overheats or is exposed to sudden physical shock, examine it for damage that can cause a safety risk. If possible, compare the displayed temperature to a known reference before Product use. If not sure, send the Product to Fluke Corporation. Refer to “How to Contact Fluke”.

Substitution of components will impair suitability for hazardous locations.

Ex Safety Information

This manual contains data and safety regulations that must be followed for safe, reliable use of the Product in hazardous areas under the detailed conditions. If you do not follow these instructions, personal injury or Product damage can occur. Violation of applicable legislation can also occur. Read the full manual before you use the Product. To make sure of safe Product operation, fully follow all instructions and warnings in the manual. If you are not sure (due to translation and/or printing errors), refer to the English manual.

An “Ex-hazardous area,” as used in this manual, refers to an area made hazardous by the possible presence of flammable or explosive vapors. These areas are also referred to as “hazardous locations.”



Ex ib IIB T4 Gb ($-10\text{ }^{\circ}\text{C} \leq T_a \leq +50\text{ }^{\circ}\text{C}$)
ITS19ATEX204844X
IECEX ETL 19.0023X



Manufactured by Fluke Corporation,
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Specifications

(Ambient: 23 °C ±5 °C)

Measurement Range

1551A Ex	–50 °C to 160 °C (–58 °F to 320 °F)
1552A Ex	–80 °C to 300 °C (–112 °F to 572 °F)

Accuracy (1 year) ±0.05 °C (0.09 °F)

Resolution Selectable (0.1, 0.01, 0.001) factory default is 0.01

Sample Rate User selectable 0.5/sec, 1/sec or 2/sec factory default is 1/sec

Readout Temperature Coefficient Add ±10 ppm/°C of full scale temperature from –10 °C to 18 °C and 28 °C to 50 °C

Probe Temperature Coefficient 0.00385 Ω/Ω/°C nominal

Nominal Probe Resistance at 0 °C 100 Ω

Probe Hysteresis ±0.01 °C

Probe Response Time Approximately 20 seconds

Operating Temperature Range of Readout –10 °C to 50 °C (14 °F to 122 °F)

Humidity Range 0 to 95 % RH Non-condensing

Storage Temperature Range –20 °C to 60 °C (–4 °F to 140 °F)

Safety IEC 60079-0, IEC 60079-11: Ex ib IIB T4 Gb;
IEC 61010-1: Pollution Degree 2

Electromagnetic Compatibility

International	IEC 61326-1: Portable Equipment; IEC 61326-2-2; CISPR 11: Group 1, Class B <i>Group 1: Equipment has intentionally generated and/or uses conductively-coupled radio frequency energy that is necessary for the internal function of the equipment itself.</i> <i>Class B: Equipment is suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.</i>
USA (FCC).....	47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.

Power 3 AAA alkaline batteries
(Must use only approved batteries. See Table 10)

Battery Life Approximately 300 hours without back light

Battery Save (auto-off) Range Selectable from 1 to 30 minutes or can be disabled

Size (readout only) 125 mm x 62 mm x 35 mm (5 in x 2.5 in x 1.4 in).

Probe Size..... 1551A-9: 4.8 mm x 229 mm (3/16 in. x 9 in.)
1551A-12: 6.35 mm x 305 mm (1/4 in. x 12 in.)
1551A-20: 6.35 mm x 508 mm (1/4 in. x 20 in.)
1552A: 6.35 mm x 305 mm (1/4 in. x 12 in.)

Weight 200 g (6.9 oz)

Calibration

Warning

To prevent fire, explosion, or personal injury, the RS-232 interface must not be used in hazardous areas.

This procedure is to be considered a general guideline. Each laboratory should develop their own specific procedure based on their equipment and requirements. The procedure should be accompanied by an uncertainty analysis also based on the laboratory's equipment and environment.

Calibration should only be performed by qualified personnel. The technician should be familiar with the *1551A Ex/1552A Ex Users Manual*.

The calibration must be performed in the following ambient conditions:

Temperature: 23 °C ±2 °C

Relative humidity: 70 % maximum

Overview

The calibration consists of inserting the Product probe into a temperature bath having a known temperature and observing the difference between the temperature measured by the Product and the known temperature of the bath. The temperature of the bath is determined using an accurate reference thermometer. An equilibration block helps to ensure that the temperatures of the reference thermometer and 1551A Ex/1552A Ex Thermometer are uniform and stable.

If necessary, the calibration parameters in the Product can be adjusted to improve its accuracy. Adjustments are made by sending the appropriate command to the Product through an RS-232 cable connected to a computer. For completeness of documentation, the calibration parameters should be recorded before and after adjustment.

In summary, the main calibration steps are as follows:

- Record as-found calibration parameter values
- Evaluate as-found measurement errors
- Adjust the calibration parameters
- Evaluate as-left measurement errors
- Record as-left calibration parameters values

Recommended Equipment

The equipment listed in Table 1 will satisfy the calibration requirements:

Table 1. Recommended Equipment

Equipment	Recommended Model
Temperature Baths	Fluke 6331 40 °C to 300 °C Hot Bath Fluke 7381 -80 °C to 110 °C Cold Bath Fluke 7196 Equilibration Block
Reference Thermometer	Fluke 5699-S Extended Range Metal-Sheath SPRT
Reference Thermometer Readout	1594A Super-Thermometer readout
Computer	Computer with an RS-232 com port RS-232 serial cable Terminal software to communicate with the 1551A Ex/1552A Ex Thermometer

Initial Setup

Check the batteries in the Product and replace them if necessary. The battery level indication is found in the Setup menu.

Several settings in the Setup menu relate to measurement and should be set as follows:

- Sample Rate: 1 per second
- Damping: OFF
- Display Resolution: 0.001
- Auto Power Off: OFF

The unit of measurement in the 1551A Ex/1552A Ex Thermometer may be set to °C or °F, but must match the unit of the reference thermometer.

The baud rate in the computer software must match the baud rate of the 1551A Ex/1552A Ex Thermometer, which is usually 9600 but may be set to 2400.

Record as-found Calibration Parameters

Before any adjustments are made, the present values of the Product calibration parameters should be recorded. Connect the serial cable between the computer and the Product. The commands used to read the values of the calibration parameters are given in Table 2. Commands must be terminated with a carriage return character. Table 2 may also be used to record the values of the calibration parameters.

Table 2. As-found Calibration Parameters

Parameter	Command	Value (fill in)
TEMP1	CAL:USER:TEMP1?	
ADJ1	CAL:USER:ADJ1?	
TEMP2	CAL:USER:TEMP2?	
ADJ2	CAL:USER:ADJ2?	
TEMP3	CAL:USER:TEMP3?	
ADJ3	CAL:USER:ADJ3?	
DATE	CAL:DEV:DATE?	

Evaluate as-found Measurement Errors

The Product should be tested to evaluate its accuracy before any adjustments are made. It is recommended that it be tested near the five temperatures listed in Table 3, depending on the model.

Table 3. Test Temperatures

Point	1551A Ex	1552A Ex
1	-50 °C	-80 °C
2	-25 °C	-25 °C
3	0 °C	0 °C
4	100 °C	100 °C
5	157 °C	300 °C

At each of the test temperatures, readings are recorded of the temperature of the reference thermometer and the indication of the Product. Before recording the readings, make sure the temperatures of the bath, reference thermometer, and 1551A Ex/1552A Ex Thermometer are settled and stable.

At each calibration point the measurement error may be calculated by subtracting the reference thermometer temperature from the 1551A Ex/1552A Ex temperature. The temperatures and measurement errors may be recorded in Table 4.

Table 4. As-found Measurement Errors

Point	Reference (fill in)	1551A Ex/1552A Ex (fill in)	Error (fill in)
1			
2			
3			
4			
5			

If the measurement errors are well within the specified accuracy, it may not be necessary to adjust the calibration parameters. If the error is larger than desired (say 50 % of the specified accuracy), then adjustments to the Product calibration parameters are necessary. Proceed to the next section.

Adjustment at the Low Calibration Point

When necessary, the first adjustment is made for the low end of the temperature range of the Product. Set the bath temperature to the Low Adjustment Temperature given in Table 5, depending on the model. Make sure the temperatures of the bath, reference thermometer, and Product are settled and stable before proceeding.

Table 5. Low-Adjustment Temperature

Point	1551A Ex	1552A Ex
Low	-50 °C	-80 °C

Before adjustments to any calibration parameters can be made, access to the protected calibration parameters must be enabled by sending the following command to the Product through the serial interface:

`SYST:PASS:CEN <password>`

The parameter <password> is the current password, originally “1234”.

To make an automatic adjustment at the low calibration point, issue the following command:

`CAL:USER:LOW <temperature>`

The parameter <temperature> is the temperature of the bath as measured by the reference thermometer. Product accepts a temperature value with up to three decimal places of resolution. The temperature value must be in the same unit in which the 1551A Ex/1552A Ex is measuring.

The command will set the value of the CAL:USER:TEMP1 parameter to the given temperature and automatically adjust the CAL:USER:ADJ1 parameter to cause the Product to measure the given temperature accurately. The adjustment made here will not affect the measurements at the other Adjustment temperatures.

Allow the readings of the Product to settle and then verify that the readings match the temperature of the reference thermometer and are well within the specified accuracy of the 1551A Ex/1552A Ex.

Adjustment at the Zero Calibration Point

The next adjustment is made for the middle of the temperature range of the Product. Set the bath temperature to the Zero Adjustment Temperature given in Table 6. Make sure the temperatures of the bath, reference thermometer, and the Product are settled and stable before proceeding.

Table 6. Zero Adjustment Temperature

Point	1551A Ex	1552A Ex
Zero	0 °C	0 °C

To make an automatic adjustment at the Zero calibration point, issue the following command:

`CAL:USER:ZERO <temperature>`

The parameter <temperature> is the temperature of the bath as measured by the reference thermometer. The Product accepts a temperature value with up to three decimal places of resolution. The temperature value must be in the same unit in which the Product is measuring.

The command will set the value of the CAL:USER:TEMP2 parameter to the given temperature and automatically adjust the CAL:USER:ADJ2 parameter to cause the Product to accurately measure the given temperature. This adjustment will not affect the measurements at the other Adjustment temperatures.

Allow the readings of the Product to settle and then verify that the readings match the temperature of the reference thermometer well within the specified accuracy of the 1551A Ex/1552A Ex.

Adjustment at the High Calibration Point

The final adjustment is made for the high end of the temperature range of the Product. Set the bath temperature to the High Adjustment Temperature given in Table 7, depending on the model. Make sure the temperatures of the bath, reference thermometer, and Product are settled and stable before proceeding.

Table 7. High Adjustment Temperature

Point	1551A Ex	1552A Ex
High	157 °C	300 °C

To make an automatic adjustment at the High calibration point, issue the following command:

`CAL:USER:HIGH <temperature>`

The parameter <temperature> is the temperature of the bath as measured by the reference thermometer. The Product accepts a temperature value with up to three decimal places of resolution. The temperature value must be in the same unit in which the Product is measuring.

The command will set the value of the CAL:USER:TEMP3 parameter to the given temperature and automatically adjust the CAL:USER:ADJ3 parameter to cause the Product to measure the given temperature accurately. The adjustment made here will not affect the measurements at the other Adjustment temperatures.

Allow the readings of the Product to settle and then verify that the readings match the temperature of the reference thermometer well within the specified accuracy of the 1551A Ex/1552A Ex.

Set the Calibration Date

The date of calibration should be stored in the Product using the following command:

CAL:DEV:DATE <year>, <month>, <day>

Parameters <year>, <month>, and <day> are numbers representing the year, month, and day of the month respectively.

After all the adjustments have been made and the calibration date has been set, protection of the calibration parameters should be restored using the following command:

SYST:PASS:CDIS

(Protection will always be restored when the Product is switched on.)

Evaluate as-left Measurement Errors

After all adjustments have been made, the Product should be subjected to a final test to ensure that it is measuring accurately over its entire range. The measurements are collected and errors are evaluated in the same way that was explained in “*Evaluating As-found Measurement Errors*.” Table 8 may be used to record the as-left data.

Table 8. As-left Measurement Errors

Point	Reference (fill in)	1551A Ex/1552A Ex (fill in)	Error (fill in)
1			
2			
3			
4			
5			

Record as-left Calibration Parameters

As the last step in the calibration procedure, the final values of the Product calibration parameters should be recorded. The commands required to read the values of the calibration parameters are given in Table 9. Each command must be terminated with a carriage return character. The table may also be used to record the values of the calibration parameters.

Table 9. As-left Calibration Parameters

Parameter	Command	Value (fill in)
TEMP1	CAL:USER:TEMP1?	
ADJ1	CAL:USER:ADJ1?	
TEMP2	CAL:USER:TEMP2?	
ADJ2	CAL:USER:ADJ2?	
TEMP3	CAL:USER:TEMP3?	
ADJ3	CAL:USER:ADJ3?	
DATE	CAL:DEV:DATE?	

Maintenance

Clean the Product

⚠ Caution

To prevent possible damage to the product or to equipment under test, do not use abrasive cleaners. They will damage the case.

To clean the Product, use a cloth with a mild cleaning solution.

Battery Replacement

⚠ Warning

To prevent possible explosion, fire, or personal injury:

- Change the batteries only in areas that are not Ex-hazardous.
- Replace the batteries when the low battery indicator shows to prevent incorrect measurements.

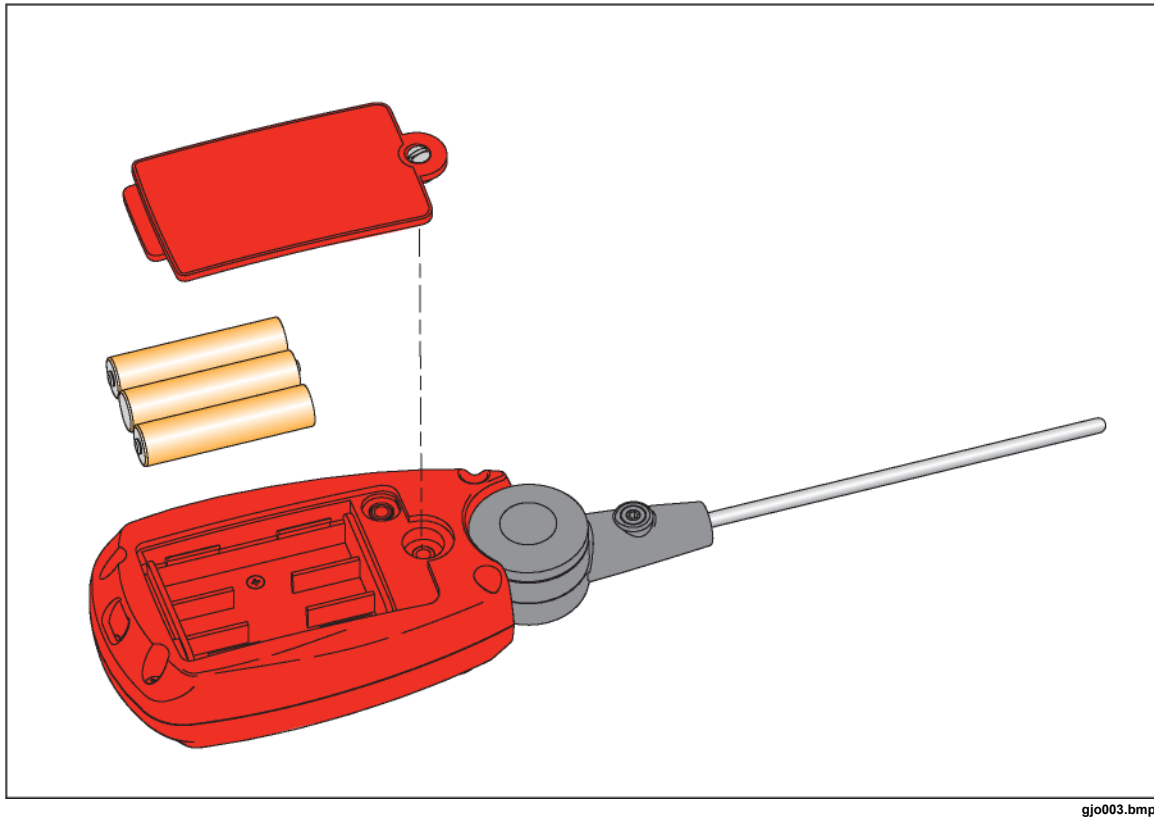
⚠ Caution

To prevent possible damage to the Product or to equipment under test:

- Remove batteries to prevent battery leakage and damage to the Product if it is not used for an extended period.
- Be sure that the battery polarity is correct to prevent battery leakage.

To change the batteries, see Figure 1:

1. Use a flat-blade screwdriver to loosen the integral battery door screw.
2. Remove the battery door to access the three AAA batteries.
3. Replace only with approved AAA batteries listed in this document. See Table 10. Any substitution voids the Product safety rating.
4. Make sure the battery polarity is correct.
5. Replace the battery door and install the screw.



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Figure 1. Battery Replacement

Table 10. Approved Batteries

Battery	Manufacturer	Type
Alkaline AAA (IEC LR03)	Duracell	MN2400
	Energizer	E92VP
	Panasonic	LR03WXA

