FLUKE®
Calibration

1586A

SUPER-DAQ Precision Temperature Scanner

Calibration Manual

July 2014

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Introduction

The Fluke Calibration 1586A SUPER-DAQ Precision Temperature Scanner (the Product or Instrument) is a 45 analog channel bench-top measurement instrument that measures and records temperature, resistance, dc volts, and dc current. See the *Specifications* section for information on the types and ranges of the measurement inputs the Product can accept.

Contact Fluke Calibration

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

- Technical Support USA: 1-877-355-3225
- Calibration/Repair USA: 1-877-355-3225
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31-40-2675-200
- Japan: +81-3-6714-3114
- Singapore: +65-6799-5566
- China: +86-400-810-3435
- Brazil: +55-11-3759-7600
- Anywhere in the world: +1-425-446-6110

To see product information and download the latest manual supplements, visit Fluke Calibration's website at www.flukecal.com.

To register your product, visit http://flukecal.com/register-product.

Safety Information

A **Warning** identifies conditions and procedures that are dangerous to the user. A **Caution** identifies conditions and procedures that can cause damage to the Product or the equipment under test.

See Table 1 for a list of symbols used in this manual and on the Product.

Table 1. Symbols

Symbol	Description	Symbol	Description
⚠	Risk of Danger. Important information. See Manual.	⎓	DC (Direct Current)
⚠	Hazardous voltage. Risk of electric shock.	≂	AC or DC (Alternating or Direct Current)
⏚	Earth ground.	⎍	Digital signal
♲	Recycle	⏻	Power ON / OFF
	Conforms to relevant South Korean EMC Standards.	CE	Conforms to European Union directives.
CAT II [1]	Measurement Category II is applicable to test and measuring circuits connected directly to utilization points (socket outlets and similar points) of the low-voltage MAINS installation.		
CAT III [1]	Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage MAINS installation.		
CAT IV [1]	Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation.		
	This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.		

[1] This equipment is not intended for measurements in CAT II, CAT III, or CAT IV environments. These definitions are included because the test leads supplied with the product include these ratings.

⚠⚠Warning

To prevent possible electrical shock, fire, or personal injury:

- **Read all safety information before you use the Product.**
- **Carefully read all instructions.**
- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**
- **Examine the case before you use the Product. Look for cracks or missing plastic. Carefully look at the insulation around the terminals.**
- **Do not use the Product if it operates incorrectly.**
- **Do not use the Product if it is damaged.**
- **Disable the Product if it is damaged.**
- **Use only the mains power cord and connector approved for the voltage and plug configuration in your country and rated for the Product.**
- **Replace the mains power cord if the insulation is damaged or if the insulation shows signs of wear.**
- **Make sure the ground conductor in the mains power cord is connected to a protective earth ground. Disruption of the protective earth could put voltage on the chassis that could cause death.**
- **Do not put the Product where access to the mains power cord is blocked.**
- **Use only correct measurement category (CAT), voltage, and amperage rated probes, test leads, and adapters for the measurement.**
- **Use only cables with correct voltage ratings.**
- **Do not use test leads if they are damaged. Examine the test leads for damaged insulation and measure a known voltage.**
- **Do not exceed the Measurement Category (CAT) rating of the lowest rated individual component of a Product, probe, or accessory.**
- **Keep fingers behind the finger guards on the probes.**
- **Do not apply more than the rated voltage, between the terminals or between each terminal and earth ground.**

- **Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.**
- **Limit operation to the specified measurement category, voltage, or amperage ratings.**
- **Measure a known voltage first to make sure that the Product operates correctly.**
- **Consider all accessible channels to be hazardous live and an electric shock hazard if any channel is connected to a hazardous voltage source.**
- **Do not remove, touch, or change the internal wiring of hazardous inputs until the input source is turned off.**
- **Remove inputs from hazardous voltage sources before an input module is opened.**
- **Use the correct terminals, function, and range for measurements.**
- **Use this Product indoors only.**
- **Do not use the Product around explosive gas, vapor, or in damp or wet environments.**

General Specifications

Mains Voltage
- 100 V Setting ..... 90 V to 110 V
- 120 V Setting ..... 108 V to 132 V
- 220 V Setting ..... 198 V to 242 V
- 240 V Setting ..... 216 V to 264 V

Frequency ..... 47 Hz to 440 Hz

Power Consumption ..... 36 VA peak (24 W average)

Environment Temperature
- Operating ..... 0 °C to 50 °C
- Full accuracy ..... 18 °C to 28 °C
- Storage ..... −20 °C to 70 °C
- Warm-up ..... 1 hour to full accuracy specifications

Relative Humidity (non-condensing)
- Operating ..... 0 °C to 30 °C <80 %
30 °C to 50 °C <50 %
- Storage ..... −20 °C to 70 °C <95 %

Altitude
- Operating ..... 2,000 m
- Storage ..... 12,000 m

Vibration and Shock ..... Complies with MIL-PRF-28800F Class 3

Channel Capacity
- Total analog channels 45
- Voltage/resistance channels 41
- Current channels 5
- Digital I/O ..... 8 bits
- Totalizer 1
- Alarm outputs 6
- Trigger input 1

Safety
- Mains Input ..... IEC 61010-1, Overvoltage Category II, Pollution Degree 2
- Measurement Input ..... 50 Vdc max, all functions and ranges.

Electromagnetic Environment ..... IEC 61326-1: Basic (Controlled EM for full specification)

Radio Frequency Emissions ..... IEC CISPR 11: Group 1, Class A. (Group 1 has intentionally generated and/or uses conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself. Class A equipment is suitable for use in non-domestic locations and/or directly connected to a low-voltage power supply network.)

Electromagnetic Compatibility ..... Applies to use in Korea only. Class A Equipment (Industrial Broadcasting & Communication Equipment) [1]

[1] This product meets requirements for industrial (Class A) electromagnetic wave equipment and the seller or user should take notice of it. This equipment is intended for use in business environments and is not to be used in homes.

Math Channels
- Number of channels 20
- Operations ..... sum, difference, multiply, divide, polynomial, power, square root, reciprocal, exponential, logarithm, absolute value, average, maximum, minimum

Triggers ..... interval, external (trigger input), alarm, remote (bus), manual, automated test

Memory
- Scan data RAM ..... 75,000 readings with timestamp
- Data/Setup flash memory ..... 20 MB

USB Host Port
- Connector type ..... Type A
- Function ..... Memory
- File system FAT32
- Memory capacity ..... 32 GB

USB Device Port
- Connector type ..... Type B
- Class ..... Instrument
- Function ..... Control and data transfer
- Command protocol ..... SCPI

LAN
- Function ..... Control and data transfer
- Network protocols ..... Ethernet 10/100, TCP/IP
- Command protocol ..... SCPI

RS-232
- Connector ..... D-sub 9 pin (DE-9)
- Baud rates 1200, 2400, 4800, 9600, 19200, 38400
- Function ..... Temperature source control output

Dimensions
- Height ..... 150 mm
- Width ..... 245 mm
- Depth ..... 385 mm
- Weight ..... 6 kg (typical configuration)
- Shipping Weight ..... 9.5 kg (typical configuration)

Conformity ..... CE, CSA, IEC 61010 3rd ed.

Measurement Specifications

Accuracy specifications generally apply with medium and slow sample rates (unless otherwise noted), after a warm-up time of 1 hour, and within an environment temperature range of 18 °C to 28 °C, and may depend on the channel. The confidence level for accuracy specifications is 95 % within 1 year of calibration.

Scan rate
- Fast ..... 10 channels per second max (0.1 seconds per channel)
- Medium ..... 1 channel per second (1 second per channel)
- Slow ..... 4 seconds per channel

Display Resolution ..... 4 ½ to 6 ½ digits, depending on function and Sample Rate (see Measurement Characteristics tables below to find the display resolution of temperature readings)

PRT/RTD

Temperature Range ..... −200 °C to 1200 °C (depending on the sensor)

Resistance Range ..... 0 Ω to 4 kΩ

Offset Compensation
- 0 Ω to 400 Ω, 4-wire ..... automatic current reversal
- 400 Ω to 4000 Ω or 3-wire ..... none

Source Current Reversal Interval (0 Ω to 400 Ω range)
- Fast sample rate ..... 2 ms
- Medium sample rate ..... 250 ms
- Slow sample rate ..... 250 ms

Maximum Lead Resistance (4-wire Ω) ..... 2.5 % of range per lead for 400 Ω and 4 kΩ ranges.

PRT/RTD Resistance Accuracy

Accuracy is given as % of measurement or ohms, whichever is greater. Basic accuracy is for 4-wire PRT/RTD. When using 3-wire PRT/RTD add 0.013 Ω to the accuracy specification for internal resistance mismatch and voltage offset if using Channel 1, or add 0.05 Ω if using channels x01 through x20. If the environment temperature is outside the specified range, multiply the temperature coefficient numbers by the temperature deviation and add to the accuracy specification.

Range	Sample Rate	DAQ-STAQ Module and Channel 1	High-Capacity Module	T.C./ °C Outside 18 °C to 28 °C
0 Ω to 400 Ω	Slow	0.002 % or 0.0008 Ω	0.003 % or 0.003 Ω	0.0001 % or 0.0008 Ω
	Medium	0.002 % or 0.002 Ω	0.003 % or 0.003 Ω	0.0001 % or 0.0008 Ω
	Fast	0.002 % or 0.005 Ω	0.003 % or 0.006 Ω	0.0001 % or 0.0008 Ω
400 Ω to 4 kΩ	Slow	0.004 % or 0.06 Ω	0.006 % or 0.06 Ω	0.0001 % or 0.008 Ω
	Medium	0.004 % or 0.1 Ω	0.006 % or 0.1 Ω	0.0001 % or 0.008 Ω
	Fast	0.004 % or 0.18 Ω	0.006 % or 0.18 Ω	0.0001 % or 0.008 Ω
Note: For conducted disturbances on mains input >1 V from 10 MHz to 40 MHz, add 0.25 Ω. For disturbances >3 V, accuracy is unspecified.				

PRT/RTD Temperature Accuracy

Accuracy is for 4-wire 100 Ω nominal PRT/RTD. When using 3-wire PRT/RTD add 0.039 °C to the accuracy specification for internal resistance mismatch and voltage offset if using Channel 1, or add 0.15 °C if using channels x01 through x20. If the environment temperature is outside the specified range, multiply the temperature coefficient number by the temperature deviation and add to the accuracy specification. Linear interpolation may be used between points in the table. Specifications do not include sensor accuracy. The practical range of temperature measurement depends on the sensor and characterization.

Sample Rate	Temperature	DAQ-STAQ Module and Channel 1	High-Capacity Module	T.C./ °C Outside 18 °C to 28 °C
Slow	−200 °C 0 °C 300 °C 600 °C	0.002 °C 0.005 °C 0.012 °C 0.02 °C	0.008 °C 0.008 °C 0.018 °C 0.03 °C	0.002 °C 0.003 °C 0.006 °C 0.01 °C
Medium	−200 °C 0 °C 300 °C 600 °C	0.005 °C 0.005 °C 0.012 °C 0.02 °C	0.008 °C 0.008 °C 0.018 °C 0.03 °C	0.002 °C 0.003 °C 0.006 °C 0.01 °C
Fast	−200 °C 0 °C 300 °C 600 °C	0.013 °C 0.013 °C 0.014 °C 0.02 °C	0.015 °C 0.015 °C 0.018 °C 0.03 °C	0.002 °C 0.003 °C 0.006 °C 0.01 °C
Note: For conducted disturbances on mains input >1 V from 10 MHz to 40 MHz, add 0.6 Celsius. For disturbances >3 V, accuracy is unspecified.				

PRT/RTD Measurement Characteristics

Range	Temperature Display Resolution		Source Current
	Slow / Medium Sample Rate	Fast Sample Rate	
0 Ω to 400 Ω	0.001 °C	0.01 °C	±1 mA
400 Ω to 4 kΩ	0.001 °C	0.01 °C	0.1 mA

Thermistor

Temperature Range ..... −200 °C to 400 °C (depending on the sensor)

Resistance Range ..... 0 Ω to 1 MΩ

Thermistor Resistance Accuracy

Accuracy is given as ± (% of measurement + Ω). The basic accuracy specification is for 4-wire thermistor, slow sample rate. When using medium or fast sample rate, add the number given in the table to the accuracy specification. If the environment temperature is outside the specified range, multiply the temperature coefficient numbers by the temperature deviation and add to the accuracy specification. For 2-wire thermistor add 0.02 Ω internal resistance if using Channel 1 or 1.5 Ω if using channels x01 through x20, and add external lead wire resistance.

Range	Slow Sample Rate	Medium Sample Rate Rate	Fast Sample Rate	T.C./ °C Outside 18 °C to 28 °C
0 Ω to 2.2 kΩ	0.004 % + 0.2 Ω	add 0.3 Ω	add 1 Ω	0.0005 % + 0.05 Ω
2.1 kΩ to 98 kΩ	0.004 % + 0.5 Ω	add 0.5 Ω	add 1.3 Ω	0.0005 % + 0.1 Ω
95 kΩ to 1 MΩ	0.015 % + 5 Ω	add 5 Ω	add 13 Ω	0.001 % + 2 Ω

Note:
For conducted disturbances on mains input >1 V from 10 MHz to 40 MHz, add 8 Ω. For disturbances >3 V, accuracy is unspecified.

Thermistor Temperature Accuracy

Accuracy specifications are for 4-wire thermistor. When using 2-wire thermistor, add the number given in the table to the specification for internal resistance. If the environment temperature is outside the specified range, increase the accuracy specification by 25 % for every 1 °C outside the specified environment temperature range. Specifications do not include sensor accuracy. The practical range of temperature measurement depends on the sensor.

Temperature	Accuracy 2.2 kΩ Thermistor			
	Slow Sample Rate	Medium Sample Rate	Fast Sample Rate	2-wire
−40 °C	0.001 °C	0.001 °C	0.01 °C	add 0.001 °C
0 °C	0.003 °C	0.004 °C	0.01 °C	add 0.004 °C
25 °C	0.006 °C	0.011 °C	0.02 °C	add 0.016 °C
50 °C	0.008 °C	0.018 °C	0.04 °C	add 0.05 °C
100 °C	0.047 °C	0.114 °C	0.28 °C	add 0.34 °C
150 °C	0.23 °C	0.56 °C	1.34 °C	add 1.7 °C

Note:
For conducted disturbances on mains input >1 V from 10 MHz to 40 MHz, add 0.02 Celsius. For disturbances >3 V, accuracy is unspecified.

Temperature	Accuracy 5 kΩ Thermistor			
	Slow Sample Rate	Medium Sample Rate	Fast Sample Rate	2-wire
−40 °C	0.003 °C	0.004 °C	0.01 °C	add 0.001 °C
0 °C	0.002 °C	0.002 °C	0.01 °C	add 0.002 °C
25 °C	0.004 °C	0.006 °C	0.01 °C	add 0.007 °C
50 °C	0.005 °C	0.009 °C	0.02 °C	add 0.022 °C
100 °C	0.022 °C	0.052 °C	0.13 °C	add 0.16 °C
150 °C	0.096 °C	0.24 °C	0.57 °C	add 0.7 °C

Note:
For conducted disturbances on mains input >1 V from 10 MHz to 40 MHz, add 0.02 Celsius. For disturbances >3 V, accuracy is unspecified.

Temperature	Accuracy 10 kΩ Thermistor			
	Slow Sample Rate	Medium Sample Rate	Fast Sample Rate	2-wire
−40 °C	0.003 °C	0.004 °C	0.01 °C	add 0.001 °C
0 °C	0.002 °C	0.002 °C	0.01 °C	add 0.002 °C
25 °C	0.003 °C	0.004 °C	0.01 °C	add 0.004 °C
50 °C	0.005 °C	0.009 °C	0.02 °C	add 0.011 °C
100 °C	0.011 °C	0.024 °C	0.06 °C	add 0.067 °C
150 °C	0.04 °C	0.098 °C	0.24 °C	add 0.29 °C
Note: For conducted disturbances on mains input >1 V from 10 MHz to 40 MHz, add 0.02 Celsius. For disturbances >3 V, accuracy is unspecified.				

Thermistor Measurement Characteristics

Range	Temperature Display Resolution		Source Current
	Slow / Medium Sample Rate	Fast Sample Rate	
0 Ω to 2.2 kΩ	0.0001 °C	0.001 °C	10 µA
2.1 kΩ to 98 kΩ	0.0001 °C	0.001 °C	10 µA
95 kΩ to 1 MΩ	0.0001 °C	0.001 °C	1 µA

Thermocouple

Temperature Range ..... −270 °C to 2315 °C (depending on the sensor)

Voltage Range ..... −15 mV to 100 mV

Thermocouple Voltage Accuracy

Accuracy is given as ± (|% of measurement| + µV). Basic accuracy specification is for medium or slow sample rate. When using a fast sample rate add the number given in the table to the accuracy specification. If the environment temperature is outside the specified range, multiply the temperature coefficient numbers by the temperature deviation and add to the accuracy specification.

Range	Accuracy Channel 1	Ch. x01 – x20	Fast Sample Rate	T.C./ °C Outside 18 °C to 28 °C
−15 mV to 100 mV	0.004 % + 4 µV	add 2 µV	add 1 µV	0.0005 % + 0.0005 mV

Thermocouple Reference Junction Accuracy

Module	CJC Accuracy	T.C./ °C Outside 18 °C to 28 °C
DAQ-STAQ Module	0.25 °C	0.02 °C
High-Capacity Module	0.6 °C	0.05 °C

Thermocouple Temperature Accuracy

Accuracy specifications apply using medium or slow sample rate. When using fast sample rate, increase the accuracy specification by 25 %. If the environment temperature is outside the specified range, increase the accuracy specification by 12 % for every 1 °C outside the specified environment temperature range. Accuracy with fixed/external CJC does not include the accuracy of the reference junction temperature. Linear interpolation may be used between points in the table. Specifications do not include sensor accuracy. The practical range of temperature measurement depends on the sensor.

Type (Range)	Temperature	Accuracy			
		Fixed / External CJC		Internal CJC	
		Channel 1	Ch. x01 – x20	DAQ-STAQ Module	High-Capacity Module
K −270 °C to 1372 °C	−200 °C 0 °C 1000 °C	0.28 °C 0.10 °C 0.14 °C	0.41 °C 0.15 °C 0.20 °C	0.76 °C 0.29 °C 0.32 °C	1.60 °C 0.62 °C 0.64 °C
T −270 °C to 400 °C	−200 °C 0 °C 200 °C 400 °C	0.27 °C 0.10 °C 0.08 °C 0.08 °C	0.40 °C 0.15 °C 0.12 °C 0.11 °C	0.76 °C 0.30 °C 0.23 °C 0.20 °C	1.60 °C 0.65 °C 0.47 °C 0.41 °C
R −50 °C to 1768 °C	0 °C 300 °C 1200 °C 1600 °C	0.76 °C 0.42 °C 0.33 °C 0.34 °C	1.13 °C 0.63 °C 0.47 °C 0.49 °C	1.16 °C 0.64 °C 0.48 °C 0.50 °C	1.28 °C 0.71 °C 0.52 °C 0.54 °C
S −50 °C to 1768 °C	0 °C 300 °C 1200 °C 1600 °C	0.74 °C 0.45 °C 0.37 °C 0.39 °C	1.11 °C 0.67 °C 0.54 °C 0.56 °C	1.14 °C 0.68 °C 0.55 °C 0.57 °C	1.26 °C 0.76 °C 0.60 °C 0.63 °C
J −210 °C to 1200 °C	−200 °C 0 °C 1000 °C	0.20 °C 0.08 °C 0.11 °C	0.29 °C 0.12 °C 0.14 °C	0.65 °C 0.28 °C 0.25 °C	1.41 °C 0.61 °C 0.53 °C
N −270 °C to 1300 °C	−200 °C 0 °C 500 °C 1000 °C	0.42 °C 0.15 °C 0.12 °C 0.14 °C	0.62 °C 0.23 °C 0.17 °C 0.19 °C	0.90 °C 0.34 °C 0.24 °C 0.26 °C	1.69 °C 0.64 °C 0.44 °C 0.45 °C
E −270 °C to 1000 °C	−200 °C 0 °C 300 °C 700 °C	0.17 °C 0.07 °C 0.06 °C 0.08 °C	0.25 °C 0.10 °C 0.09 °C 0.10 °C	0.64 °C 0.27 °C 0.21 °C 0.21 °C	1.42 °C 0.61 °C 0.46 °C 0.45 °C
B 100 °C to 1820 °C	300 °C 600 °C 1200 °C 1600 °C	1.32 °C 0.68 °C 0.41 °C 0.38 °C	1.97 °C 1.02 °C 0.60 °C 0.55 °C	1.97 °C 1.02 °C 0.60 °C 0.55 °C	1.97 °C 1.02 °C 0.60 °C 0.55 °C
C 0 °C to 2315 °C	600 °C 1200 °C 2000 °C	0.23 °C 0.28 °C 0.44 °C	0.33 °C 0.40 °C 0.60 °C	0.37 °C 0.45 °C 0.66 °C	0.54 °C 0.63 °C 0.91 °C
D 0 °C to 2315 °C	600 °C 1200 °C 2000 °C	0.22 °C 0.26 °C 0.39 °C	0.32 °C 0.36 °C 0.53 °C	0.34 °C 0.39 °C 0.56 °C	0.44 °C 0.49 °C 0.69 °C
G 0 °C to 2315 °C	600 °C 1200 °C 2000 °C	0.24 °C 0.22 °C 0.33 °C	0.36 °C 0.32 °C 0.46 °C	0.36 °C 0.32 °C 0.46 °C	0.36 °C 0.33 °C 0.46 °C
L −200 °C to 900 °C	−200 °C 0 °C 800 °C	0.13 °C 0.08 °C 0.09 °C	0.19 °C 0.12 °C 0.12 °C	0.45 °C 0.28 °C 0.23 °C	0.99 °C 0.62 °C 0.48 °C
M −50 °C to 1410 °C	0 °C 500 °C 1000 °C	0.11 °C 0.10 °C 0.10 °C	0.16 °C 0.15 °C 0.14 °C	0.30 °C 0.25 °C 0.21 °C	0.64 °C 0.51 °C 0.41 °C
U −200 °C to 600 °C	−200 °C 0 °C 400 °C	0.25 °C 0.10 °C 0.08 °C	0.37 °C 0.15 °C 0.11 °C	0.71 °C 0.30 °C 0.20 °C	1.48 °C 0.63 °C 0.40 °C
W 0 °C to 2315 °C	600 °C 1200 °C 2000 °C	0.24 °C 0.22 °C 0.33 °C	0.36 °C 0.32 °C 0.46 °C	0.36 °C 0.32 °C 0.46 °C	0.36 °C 0.33 °C 0.46 °C

Thermocouple Measurement Characteristics

Range	Temperature Display Resolution	
	Slow / Medium Sample Rate	Fast Sample Rate
−270 °C to 2315 °C	0.01 °C	0.1 °C

DC Voltage

Maximum Input..... 50 V on any range

Common Mode Rejection..... 140 dB at 50 Hz or 60 Hz (1 kΩ unbalance in LOW lead) ±50 V peak maximum

Normal Mode Rejection..... 55 dB for power line frequency ±0.1 %, ±120 % of range peak maximum

A/D Linearity..... 2 ppm of measurement + 1 ppm of range

Input Bias Current..... 30 pA at 25 °C

DC Voltage Accuracy

Accuracy is given as ± (% measurement + % of range). Basic accuracy specification is for Channel 1, medium or slow sample rate. For channels x01 through x20 or when using Fast sample rate, add the numbers given in the table to the accuracy specification. If the environment temperature is outside the specified range, multiply the temperature coefficient numbers by the temperature deviation and add to the accuracy specification.

Range	Accuracy Channel 1	Ch. x01 – x20	Fast Sample Rate	T.C./ °C Outside 18 °C to 28 °C
±100 mV	0.0037 % + 0.0035 %	add 2 µV	add 0.0008 % of range	0.0005 % + 0.0005 %
±1 V	0.0025 % + 0.0007 %	add 2 µV	add 0.0008 % of range	0.0005 % + 0.0001 %
±10 V	0.0024 % + 0.0005 %	–	add 0.0008 % of range	0.0005 % + 0.0001 %
±50 V	0.0038 % + 0.0012 %	–	add 0.0008 % of range	0.0005 % + 0.0001 %

Notes:

- For conducted disturbances on mains input >1 V from 10 MHz to 20 MHz, add 0.02 % of range. For disturbances >3 V, accuracy is unspecified.
- For radiated disturbances > 1V/m from 450 MHz to 550 MHz, add 0.02 % of range. For disturbances > 3V/m, accuracy is unspecified.

DC Voltage Input Characteristics

Range	Resolution		Input Impedance
	Slow / Medium	Fast	
±100 mV	0.1 µV	1 µV	10 GΩ [1]
±1 V	1 µV	10 µV	10 GΩ [1]
±10 V	10 µV	100 µV	10 GΩ [1]
±50 V	100 µV	1 mV	10 MΩ ±1 %

[1] - Input beyond ±12 V is clamped. The clamp current is up to 3 mA.

DC Current

Input Protection ..... 0.15 A resettable PTC

DC Current Accuracy

Accuracy is given as ± (% measurement + % of range). Basic accuracy specification is for medium or slow sample rate. When using a fast sample rate, add the number given in the table to the accuracy specification. If the environment temperature is outside the specified range, multiply the temperature coefficient numbers by the temperature deviation and add to the accuracy specification.

Range	Accuracy	Fast Sample Rate	T.C./ °C Outside 18 °C to 28 °C
±100 µA	0.015 % + 0.0035 %	add 0.0008 % of range	0.002 % + 0.001 %
±1 mA	0.015 % + 0.0011 %	add 0.0008 % of range	0.002 % + 0.001 %
±10 mA	0.015 % + 0.0035 %	add 0.0008 % of range	0.002 % + 0.001 %
±100 mA	0.015 % + 0.0035 %	add 0.0008 % of range	0.002 % + 0.001 %

DC Current Input Characteristics

Range	Resolution		Burden Voltage
	Slow / Medium	Fast	
±100 µA	0.1 nA	1 nA	<1 mV
±1 mA	1 nA	10 nA	<1 mV
±10 mA	10 nA	100 nA	<1 mV
±100 mA	100 nA	1 µA	<1 mV

Resistance

Max. Lead Resistance (4-wire ohms) ..... 10 Ω per lead for 100 Ω and 1 kΩ ranges. 1 kΩ per lead on all other ranges.

Resistance Accuracy

Accuracy is given as ± (% measurement + % of range). Basic accuracy specification is for 4-wire resistance, medium or slow sample rate. For 2-wire resistance add 0.02 Ω internal resistance if using Channel 1, or 1.5 Ω if using channels x01 through x20, and add external lead wire resistance. When using Fast sample rate, add the numbers given in the table to the accuracy specification. If the environment temperature is outside the specified range, multiply the Temperature Coefficient numbers by the temperature deviation and add to the accuracy specification.

Range	Accuracy	Fast Sample Rate	T.C./ °C Outside 18 °C to 28 °C
100 Ω	0.004 % + 0.0035 %	add 0.001 % of range	0.0001 % + 0.0005 %
1 kΩ	0.003 % + 0.001 %	add 0.001 % of range	0.0001 % + 0.0001 %
10 kΩ	0.004 % + 0.001 %	add 0.001 % of range	0.0001 % + 0.0001 %
100 kΩ	0.004 % + 0.001 %	add 0.001 % of range	0.0001 % + 0.0001 %
1 MΩ	0.006 % + 0.001 %	add 0.002 % of reading plus 0.0008 % of range	0.0005 % + 0.0002 %
10 MΩ	0.015 % + 0.001 %	add 0.002 % of reading plus 0.0008 % of range	0.001 % + 0.0004 %
100 MΩ	0.8 % + 0.01 %	add 0.01 % of range	0.05 % + 0.002 %
Note: For conducted disturbances on mains input >1 V from 10 MHz to 40 MHz, add 0.6 % of range. For disturbances >3 V, accuracy is unspecified.			

Resistance Input Characteristics

Range	Resolution		Source Current (open-circuit voltage)
	Slow / Medium	Fast	
100 Ω	0.1 mΩ	1 mΩ	1 mA (4 V)
1 kΩ	1 mΩ	10 mΩ	1 mA (4 V)
10 kΩ	10 mΩ	100 mΩ	100 µA (6 V)
100 kΩ	100 mΩ	1 Ω	100 µA (12 V)
1 MΩ	1 Ω	10 Ω	10 µA (12 V)
10 MΩ	10 Ω	100 Ω	1 µA (12 V)
100 MΩ	100 Ω	1 kΩ	0.1 µA (12 V)

Digital I/O

Absolute Voltage Range ..... -4 V to 30 V
Input Minimum Logic High ..... 2.0 V
Input Maximum Logic Low ..... 0.7 V
Output Type ..... open drain active low
Output Logic Low (<1 mA) ..... 0 V to 0.7 V
Maximum Sink Current ..... 50 mA
Output Resistance ..... 47 Ω

Totalizer

Absolute Voltage Range ..... -4 V to 30 V
Minimum Logic High ..... 2.0 V
Maximum Logic Low ..... 0.7 V
Minimum Pulse Width ..... 50 µs
Maximum Frequency ..... 10 kHz
Debounce Time..... 1.7 ms
Maximum Count..... 1048575 (20 bits)

Trigger

Absolute Voltage Range ..... -4 V to 30 V
Minimum Logic High ..... 2.0 V
Maximum Logic Low ..... 0.7 V
Minimum Pulse Width ..... 50 µs
Maximum Latency..... 100 ms

Alarm Output

Absolute Voltage Range ..... -4 V to 30 V
Output Type ..... open drain active low
Output Logic Low (<1 mA) ..... 0 V to 0.7 V
Maximum Sink Current ..... 50 mA
Output Resistance ..... 47 Ω

1586-2588 DAQ-STAQ Input Module Specifications

Maximum Input ..... 50 V
Offset Voltage ..... <2 µV
3-Wire Internal Resistance Mismatch ..... <50 mΩ
Basic CJC Accuracy ..... 0.25 °C

1586-2586 High-Capacity Input Module Specifications

Maximum Input ..... 50 V
Offset Voltage ..... <2 µV
3-Wire Internal Resistance Mismatch ..... <50 mΩ
Basic CJC Accuracy ..... 0.6 °C

General Maintenance

The subsequent sections describe how to maintain the Product.

Clean the Product

To clean the Product, wipe the instrument with a cloth that is lightly dampened with water or mild detergent. Do not use aromatic hydrocarbons, chlorinated solvents, or methanol based fluids.

⚠Caution

To prevent possible damage to the Product, do not use solvents or abrasive cleansers.

⚠Caution

For safe operation and maintenance of the Product:

- **Have an approved technician repair the Product.**
- **Do not allow water to get inside the Product.**

If the Product Does Not Turn On

To help solve problems encountered when turning on the Product:

1. Make sure that the power switch is in the “On” position.
2. Make sure that the mains power cord is firmly plugged into the power module on the rear of the Product.
3. Make sure the power source that the Product is plugged into is energized.
4. Make sure that the line power fuse is good. See *Replace the Line Power Fuse*.

If these steps do not solve the problem, then contact Fluke Calibration. See *Contact Fluke Calibration*.

Replace the Line Power Fuse

The Product has a fuse that protects from overcurrent. Each voltage selection requires a specific fuse. See Table 2 for the correct fuse for each of the four line-voltage selections. This fuse is located on the rear panel.

⚠⚠Warning

To prevent possible electrical shock, fire, or personal injury, use only specified replacement parts.

Table 2. Fuses

Voltage Selector	Fuse	Fluke Part Number
100 V	⚠ 0.25 A, 250 V (slow blow)	166306
120 V	⚠ 0.25 A, 250 V (slow blow)	166306
220 V	⚠ 0.160 A, 250 V (slow blow)	4394437
240 V	⚠ 0.160 A, 250 V (slow blow)	4394437

To replace the fuses, see Figure 1:

1. Remove any High-Capacity Modules or test leads from the Product where hazardous voltage may be present.
2. Disconnect the mains-power cord from the power-entry module.
3. Insert a small, flat screwdriver blade into the narrow recess to the left of the fuse holder and pry to the right until the holder pops out. The Product is shipped with a replacement fuse of the same rating as the fuse installed in the fuse block.
4. Replace the fuse with the replacements as listed in Table 2.
5. Slide the fuse holder back into the Product until it locks into place.

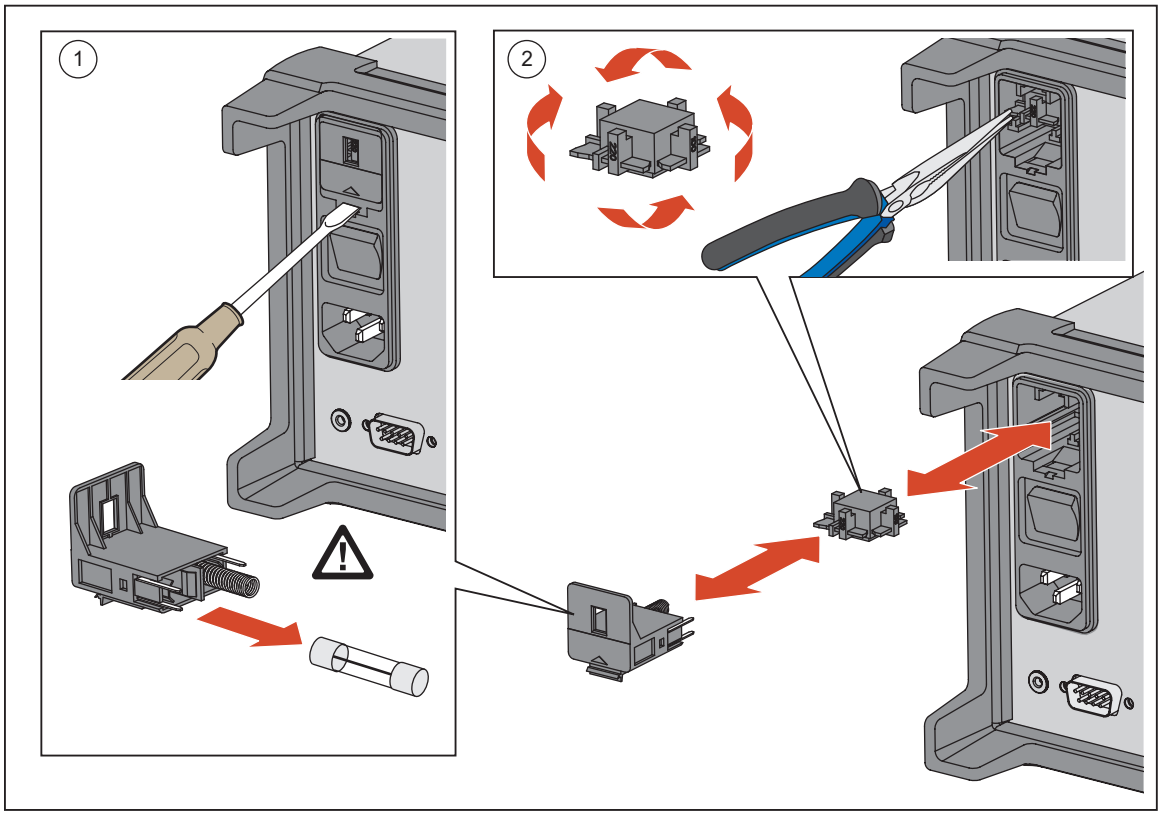

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Figure 1. Fuse Replacement

Battery Replacement

The battery in the Product is used for Product memory.

To replace the battery, see Figure 2:

1. Disassemble the Product as described in the *Disassembly* section.
2. Remove the battery and replace with one rated appropriately for the selected voltage.
3. Reassemble the Product.

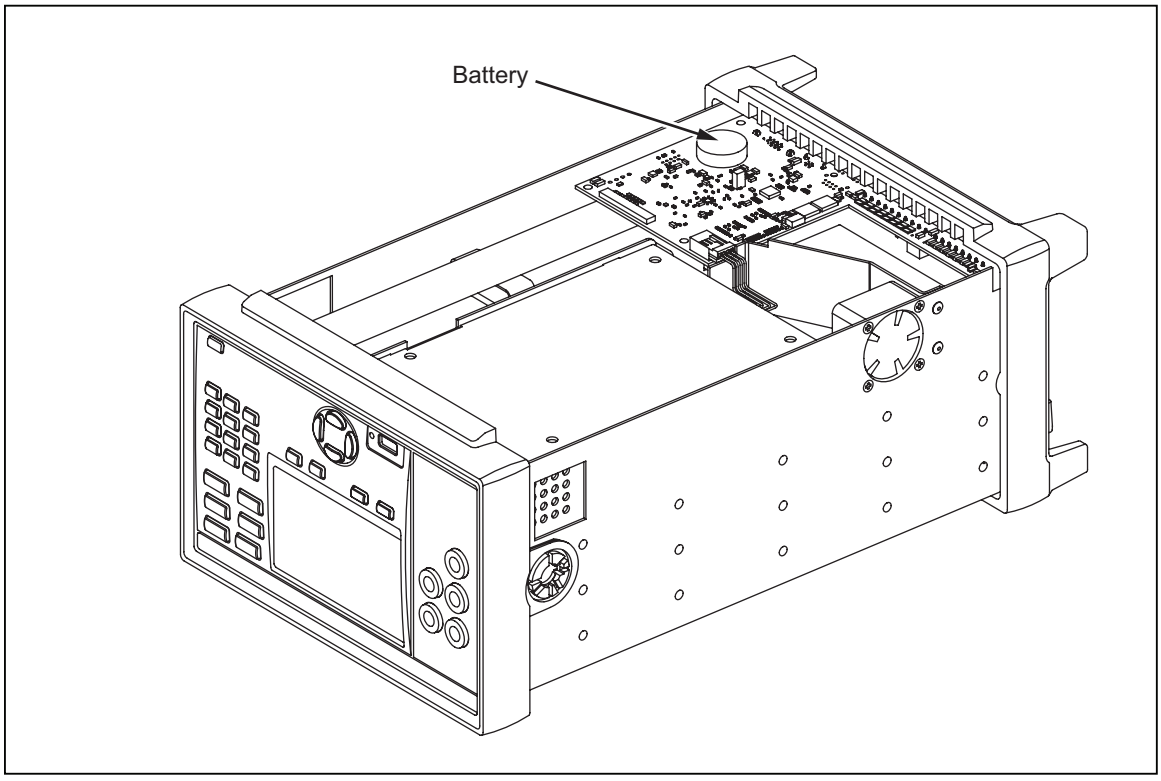

Figure 2. Battery Location

Memory and Factory Reset

The Product has two memory reset functions:

- Clear all Files
- Factory Reset

See Table 3 for a comparison of these functions.

Note

All memory reset functions require the Admin password.

Table 3. Memory Clear Functions

Task	Clear All Files	Factory Reset
Deletes test setup files, DMM data files, and scan data files from the internal memory.[1]	•	
Clears the configuration of the channel setup, test setup, and instrument setup[2]		•

[1] Does not remove data from the USB drive.

[2] Does not reset the MAC address, the serial number, calibration, clock time, or the Admin or User passwords.

To clear all files:

1. Push MEMORY.
2. Push F1 twice.
3. Enter the Admin password.
4. Push F4.
5. Push F3 to confirm.

To reset the Product to factory settings:

1. Push INSTRUMENT SETUP.
2. Push F2.
3. Enter the Admin password, then push F4.

Required Equipment

Table 4 lists the equipment required for performance tests and calibration of the Product.

Table 4. Required Test Equipment

Function	Instrument Type	Model	Comments
Volts DC	Standard	Fluke 5720A	
	8½ digit meter	Fluke 8508A	Used to characterized the 5522A
	4-wire short	Fluke 884X-SHORT, low thermal 4-wire short or equivalent	Fluke PN 2653346
	Alternate standard[1]	Fluke 5522A	Must be characterized with 8508A
Ohms	Standard	Fluke 5720A	
	4-wire short	Fluke 884X-SHORT, low thermal 4-wire short or equivalent	Fluke PN 2653346
	Alternate standard	The standard resistors which have equivalent spec with Fluke 5720A.	
PRT	Standard	Fluke 5522A (for 1 kΩ value) Standard resistors of 25 Ω, 100 Ω, 200 Ω and 400 Ω	Resistance accuracy specification (k = 2) should be equal to or better than: 6 ppm (for 25 Ω) 4 ppm (for 100 Ω, 200 Ω and 400 Ω)
	4-wire short	Fluke 884X-SHORT, low thermal 4-wire short or equivalent	Fluke PN 2653346
	Alternate standard	The standard resistors which have equivalent specification	
Thermistor	Standard	Fluke 5522A	Must be characterized with 8508A
	8½ digit meter	Fluke 8508A	Used to characterized the 5522A
	4-wire short	Fluke 884X-SHORT, low thermal 4-wire short or equivalent	Fluke PN 2653346
	Alternate standard[1]	Fluke 5720A	

Table 4. Required Test Equipment (cont.)

Function	Instrument Type	Model	Comments
Current DC	Standard	Fluke 5522A	Must be characterized with 8508A
	8½ digit meter	Fluke 8508A	Used to characterized the 5522A
	Alternate standard[1]	Fluke 5720A	
1586-2586 Input Module CJC	Metrology Drywell	Fluke 9171 with insert block	
	Reference thermistor probe	Fluke 5610-9	Accuracy 0.013 °C or better at 25 °C
	Reference thermometer	Fluke 1586A	Only for CJC verification
	E-type thermocouples	Omega TT-E-24-SLE	Must be calibrated. Accuracy 0.026 °C or better at 25 °C.
1586-2588 DAQ-STAQ CJC	Metrology Drywell	Fluke 9171 with insert block	
	Reference thermistor probe	Fluke 5610-9	Accuracy 0.013 °C or better at 25 °C.
	Reference thermometer	Fluke 1586A	Only for CJC verification
	E-type thermocouples	Omega TT-E-24-SLE with NMP-E-M TC adaptor	Must be calibrated. Accuracy 0.026 °C or better at 25 °C.
Cables	To reduce the possibility of inducing errors with ac signals picked up by the test leads, use short, shielded twisted-pair PTFE-insulated test cables between the test equipment and the Meter. Fluke makes a 2 foot (PN 738716) and 4 foot (PN 738724) PTFE insulated test cable for this purpose		

[1] Other alternate standards beside those listed can be used as long as they provide sufficient traceable [Test uncertainty Ratios (TURs)] at each calibration and verification point.

Test Considerations

For optimum performance, all test procedures should comply with these recommendations:

- Assure the calibration ambient temperature (T_{cal}) is stable and between 18 °C and 28 °C. Ideally, the calibration should be done at 23 °C ±2 °C.
- Assure ambient relative humidity is <80 %.
- Allow a 60-minute warm-up period.
- Use shielded twisted-pair PTFE-insulated cables to reduce settling and noise errors.
- Keep all input cables as short as possible.
- Ensure that the calibration standards and test procedures used do not introduce additional errors.

Note

Ideally, the standards used to verify and adjust the Product should be four times more accurate than each full-scale error specification of the Product.

- User the Fluke low-thermal 4-Wire short for all voltages and Ohm shorts. See Table 4 for Fluke part number.

Performance Tests

This section provides performance tests to verify that the Product operates within published specifications as well as a complete calibration adjustment procedure. The performance test and, if necessary, the calibration procedure can be done both periodically and after service or repair.

The performance tests can be used as an acceptance test upon receipt of the Product. Use the 90-day specifications when an acceptance test is done after the Product is calibrated.

These performance tests are provided to ensure that the Product is in proper operating condition. If the Product fails any of the performance tests, calibration adjustment and/or repair is needed. The performance test works best if done in the sequence shown in Table 5.

Each of the measurements listed in the following tests assumes the Product is being tested after a one-hour warmup in an environment with an ambient temperature of 18 °C to 28 °C and a relative humidity of <80 %.

Note

All instrument settings for verification use power up conditions except as noted by the verification step.

Front Panel Test

To test the keypad and LEDs on the front panel:

1. Turn on the Product.
2. Push **Instrument Setup**.
3. Push and hold [5] for 3 seconds to enter keypad diagnostic.
4. Push every key, the key name should be shown correctly on the screen.
5. Push [SCAN MONITOR], [MEASURE DMM], [CHANNEL SETUP], [RECORD] and [⏻] again, to check the LED.
6. Push [F5] to exit the keypad diagnostic program.

DC Volts Verification

Connect the Product to the test equipment as shown in Figure 3 and apply the voltages listed in Table 5.

Note

For the 0 V tests, use the 4-wire short to short the Hi/Lo and Sense inputs.

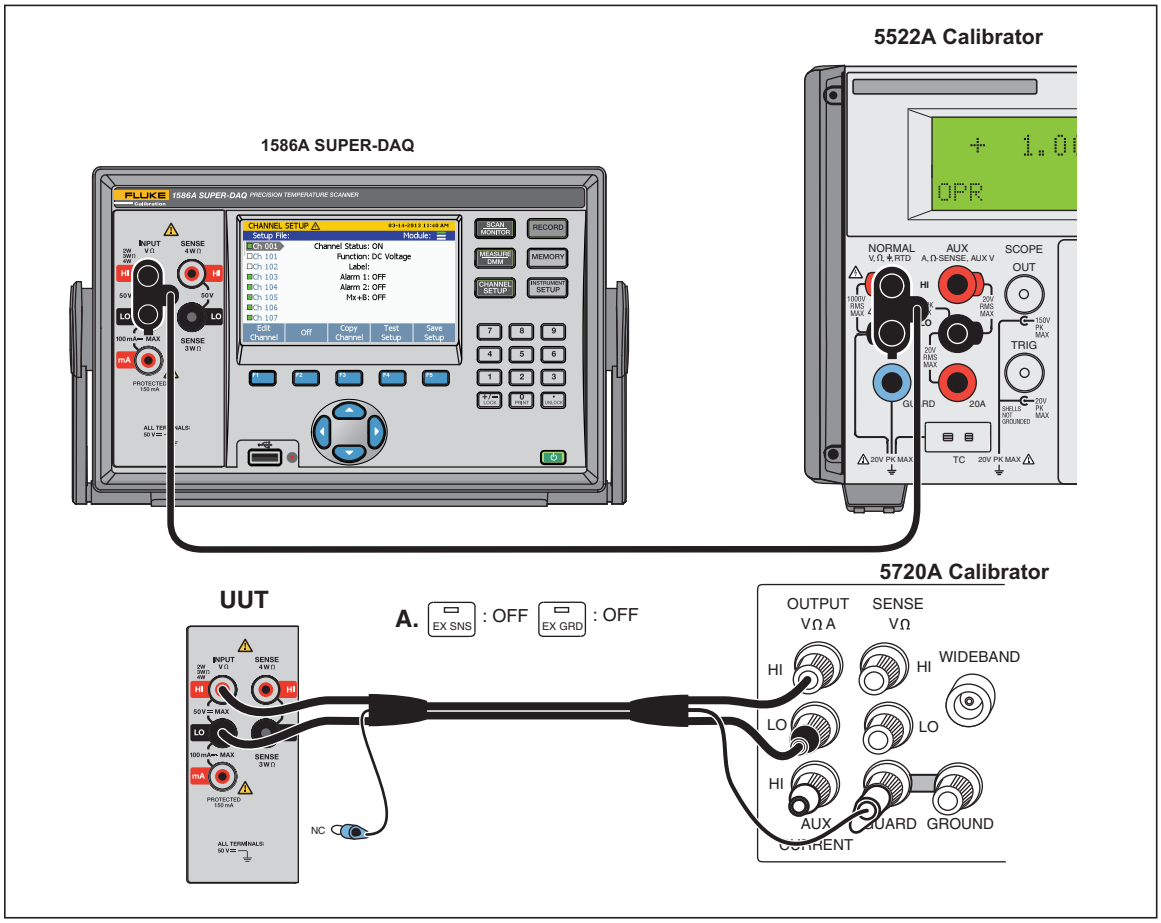

Figure 3. DC Voltage Test Connections

Table 5. DC Volts Verification Steps

Nominal Input(V)	Range	1-Year Test Limits	
		High	Low
0	0.1	3.5 μV	-3.5 μV
0.04[1]	0.1	40.005 mV	39.995 mV
0.1[1]	0.1	100.0072 mV	99.9928 mV
-0.04[1]	0.1	-39.995 mV	-40.005 mV
-0.1[1]	0.1	-99.9928 mV	-100.0072 mV
0	1	7.0 μV	-7.0 μV
1[1]	1	1.000032 V	0.999968 V
-1[1]	1	-0.999968 V	-1.000032 V
0	10	50.0 μV	-50.0 μV
10[1]	10	10.00029 V	9.99971 V
-10[1]	10	-9.99971 V	-10.00029 V
0	50	600.0 μV	-600.0 μV
50[1]	50	50.0025 V	49.9975 V
-50[1]	50	-49.9975 V	-50.0025 V
[1] 5522A must be used with 8508A to obtain suitable test uncertainty ratio.			

4-Wire Ohms Verification

Connect the Product to the test equipment as shown in Figure 4 and apply the resistance listed in Table 6.

Note

For the 0 Ω tests, use the 4-wire short to short the Hi/Lo and Sense inputs.

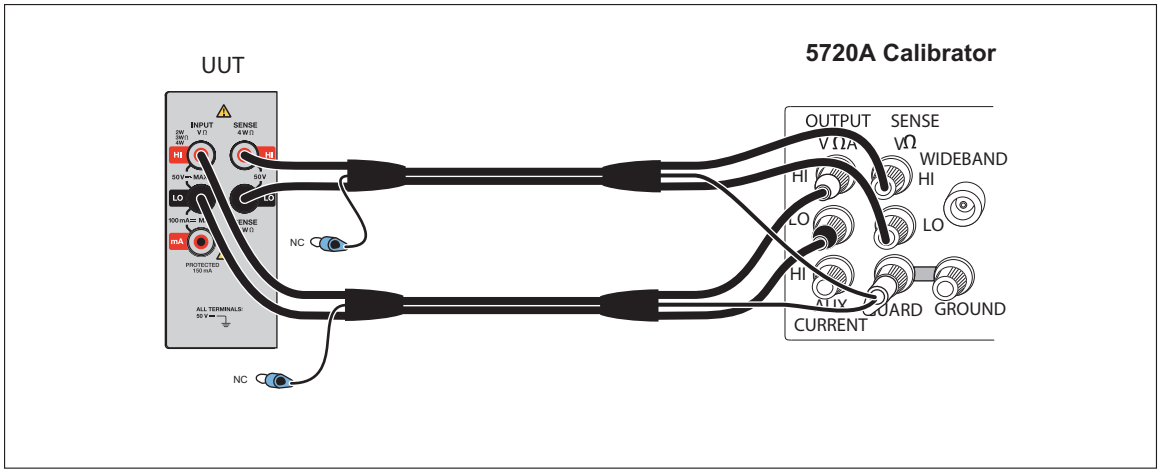

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Figure 4. 4-Wire Ohms Test Equipment Setup

Table 6. 4-Wire Ohms Verification Steps

Nominal Input	Range	1-Year Test Limits	
		High	Low
0 Ω	100	0.0035 Ω	-0.0035 Ω
100 Ω	100	100.0075 Ω	99.9925 Ω
0 Ω	1 K	0.00001 kΩ	-0.00001 kΩ
1 k Ω	1 K	1.000031 kΩ	0.999969 kΩ
0 Ω	10 K	0.0001 kΩ	-0.0001 kΩ
10 kΩ	10 K	10.00041 kΩ	9.99959 kΩ
0 Ω	100 k	0.001 kΩ	-0.001 kΩ
100 kΩ	100 k	100.0041 kΩ	99.9959 kΩ
0 Ω	1 M	0.00001 MΩ	-0.00001 MΩ
1 MΩ	1 M	1.000041 MΩ	0.999959 MΩ
0 Ω	10 M	0.0001 MΩ	-0.0001 MΩ
10 MΩ	10 M	10.0016 MΩ	9.9984 MΩ
0 Ω[1]	100 M	0.01 MΩ	-0.01 MΩ
100 M Ω[1]	100 M	100.81 MΩ	99.19 MΩ
[1] 2-Wire			

PRT Verification

Connect the Product as in Figure 5 for the 1 kΩ value listed in Table 7. For all other values in the table, use standard resistors. Configure Ch001 as a 4-wire PRT function with resistance display.

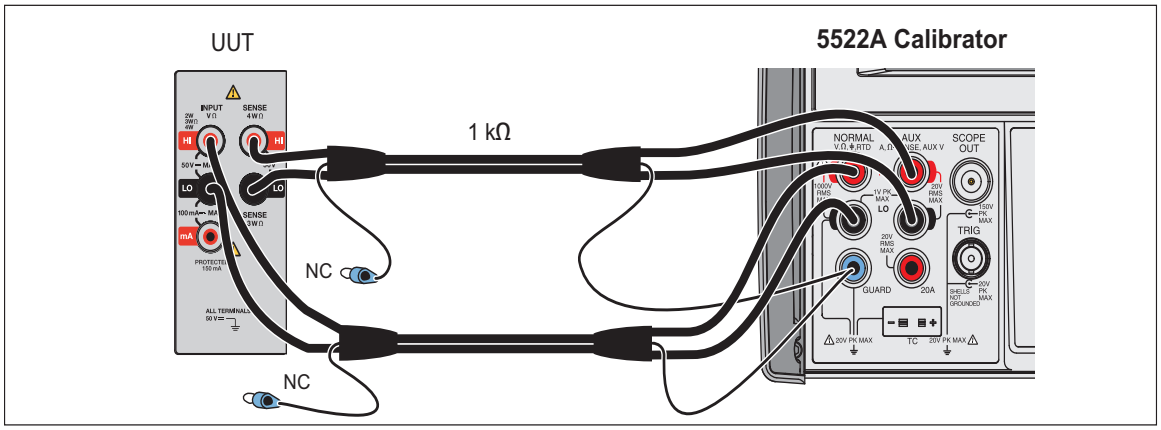

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Figure 5. PRT Test Equipment Setup

Table 7. PRT Verification Steps

Nominal Input	Range	1-Year Test Limits	
		High	Low
0 Ω	100	0.0008 Ω	-0.0008 Ω
25 Ω	100	25.0008 Ω	24.9992 Ω
100 Ω	100	100.002 Ω	99.998 Ω
1 kΩ	1k	1.00006 kΩ	0.99994 kΩ

Thermistor Verification Steps

Connect the Product to the test equipment as shown in Figure 6 and apply the resistance listed in Table 8. Configure Ch001 as a 4-wire thermistor function with resistance display.

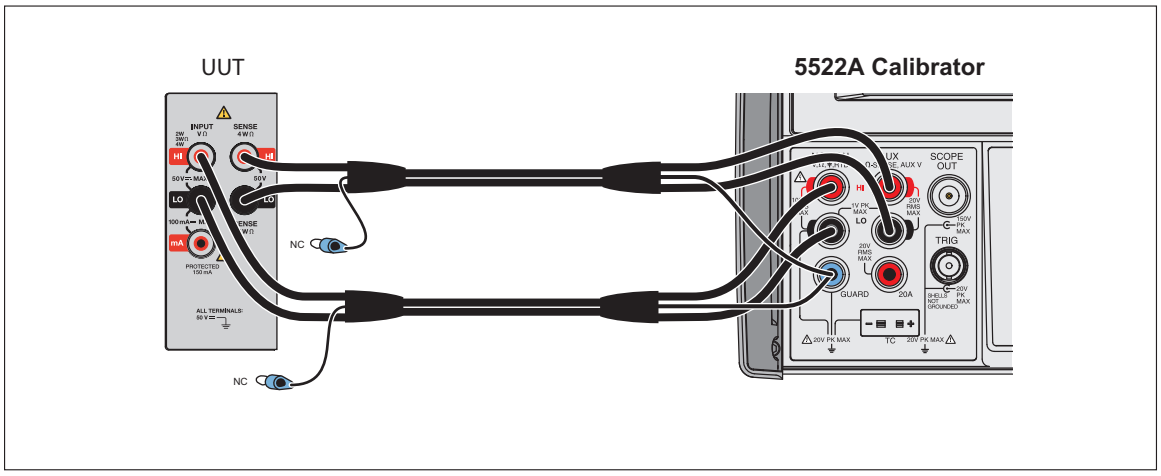

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Figure 6. Thermistor Test Equipment Setup

Table 8. Thermistor Verification Steps

Nominal Input	Range	1-Year Test Limits	
		High	Low
0 Ω	2.2 k	0.2 Ω	-0.2 Ω
2 kΩ	2.2 k	2000.28 Ω	1999.72 Ω
90 kΩ	98 k	90004.1 Ω	89995.9 Ω
900 kΩ	1 M	900140 Ω	899860 Ω

DC Current Verification

Connect the Product to the test equipment as shown in Figure 7 and apply the values listed in Table 9.

Note

When use 5720A/5522A as source, connect Hi (source) to Lo (Product) and Lo (source) to mA (Product). For the 0 A tests, open Lo inputs.

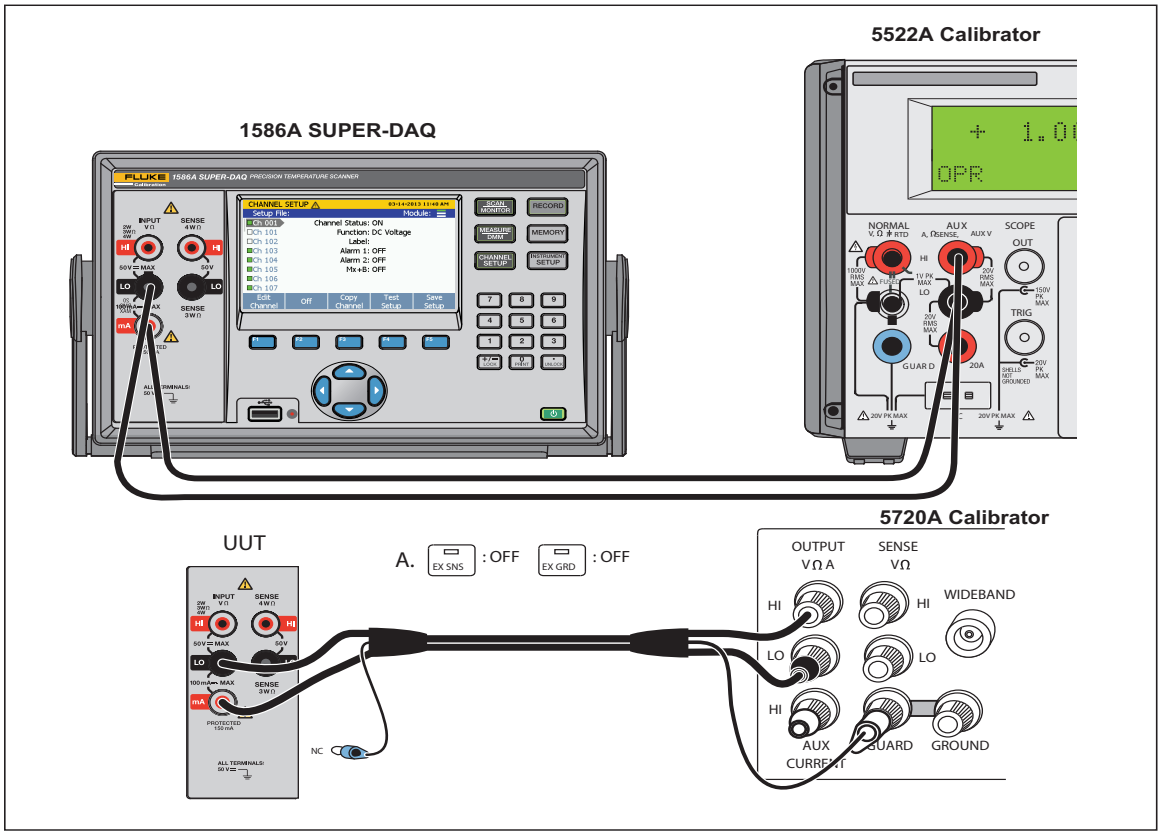

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Figure 7. mA DC Current Equipment Setup

Table 9. DC Current Verification Steps

Nominal Input (mA)	Range	1-Year Test Limits	
		High	Low
0	0.1	3.5 nA	-3.5 nA
0.1[1]	0.1	100.0185 µA	99.9815 µA
-0.1[1]	0.1	-99.9815 µA	-100.0185 µA
0	1	11.0 nA	-11.0 nA
1[1]	1	1.000161 mA	0.999839 mA
-1[1]	1	-0.999839 mA	-1.000161 mA
0	10	0.35 µA	-0.35 µA
10[1]	10	10.00185 mA	9.99815 mA
-10[1]	10	-9.99815 mA	-10.00185 mA
0	100	3.5 µA	-3.5 µA
100[1]	100	100.0185 mA	99.9815 mA
-100[1]	100	-99.9815 mA	-100.0185 mA
[1] 5720A or 5522A must be used with 8508A to obtain suitable test uncertainty ratio.			

1586-2586 CJC Module Accuracy Verification

1. Connect the calibrated E-type thermocouples to channel 10 on the Product (UUT).
2. Insert the thermocouples into a drywell calibrator which is set and stabilized at 25 °C.
3. Configure the channels of the Product for an E-thermocouple.
4. Insert the reference thermistor probe into the drywell to measure the actual temperature.
5. Use the reference thermometer with the reference thermistor probe and the thermocouples with the Product to measure the drywell temperature until all readings are stable.
6. Compare the thermocouple readings and reference thermometer reading.
7. The difference should be <0.6 °C.

1586-2588 Module CJC Accuracy Verification

1. Connect 10 calibrated E-type thermocouples with TC adapors to channels 1 through 10 on the Module TC input connectors.
2. Insert all thermocouples into a drywell calibrator which is set and stabilized at 25 °C.
3. Configure the channels of the Product for E-type thermocouples.
4. Insert the reference thermistor probe into the drywell to measure the actual temperature.
5. Use the reference thermometer with reference thermistor probe and the thermocouples with the Product (UUT) to measure the drywell temperature until all readings are stable.
6. Compare the 10 thermocouple readings and the reference thermometer reading. The maximal difference should be <0.25 °C.

Calibration Adjustment

Calibration adjustment should be done at the desired time interval, or whenever a verification test indicates that a Product function is out of tolerance. Product accuracy stays within specifications only if the adjustment procedure is done at regular intervals. A one-year interval is adequate for most applications. Product accuracy specifications are not valid beyond the one-year interval.

Adjustments are accessed through both the remote interface and front panel with a series of adjustment steps. The remote program directs the test equipment to apply a series of shorts, opens, voltages, currents, and resistances to the Product. At each step, the Product internally makes the necessary adjustment to bring the Product into specification. No internal mechanical adjustments are necessary.

With an automated, computer-controlled procedure, the calibration and verification procedures can be done in under an hour. A MetCal program is available at www.fluke.com to adjust the Product.

Adjustments are password protected to prevent accidental or unauthorized adjustments. The admin password must be entered through the front panel or remote interface.

Unlock the Product

To unlock the Product for adjustments from the front panel:

1. Push **Instrument Setup**.
2. Push **Calibrate**.
3. Use the numeric keypad to enter the 4-digit admin password. The Product is shipped from the factory with the password set to **1586**.
4. Push **OK** to enter the password and continue the adjustments procedure.

Unlock the Product with a Remote Interface

To unlock the Product with a remote interface, send the command:

```
CAL:SEC:STAT OFF,"1586"
```

To relock the Product, send the command:

```
CAL:SEC:STAT ON
```

Reset the Admin Password

If the admin password is lost or forgotten, the password can be reset to 1586 with these steps:

Note

Before doing these steps, try to use the factory default password: ***1586****.*

1. Do the general disassembly steps in the "Disassembly" section.
2. Connect a jumper across J8, as shown in Figure 8.
3. Reconnect the mains power cable between the Product and a power outlet.
4. Turn the on the Product.
5. When the Product is started, the password will automatically be reset to **1586**.
6. Turn the Product off and disconnect the mains power cable.
7. Remove the jumper connected in step 2.
8. Reassemble the Product by doing the reverse procedure in "Disassembly".

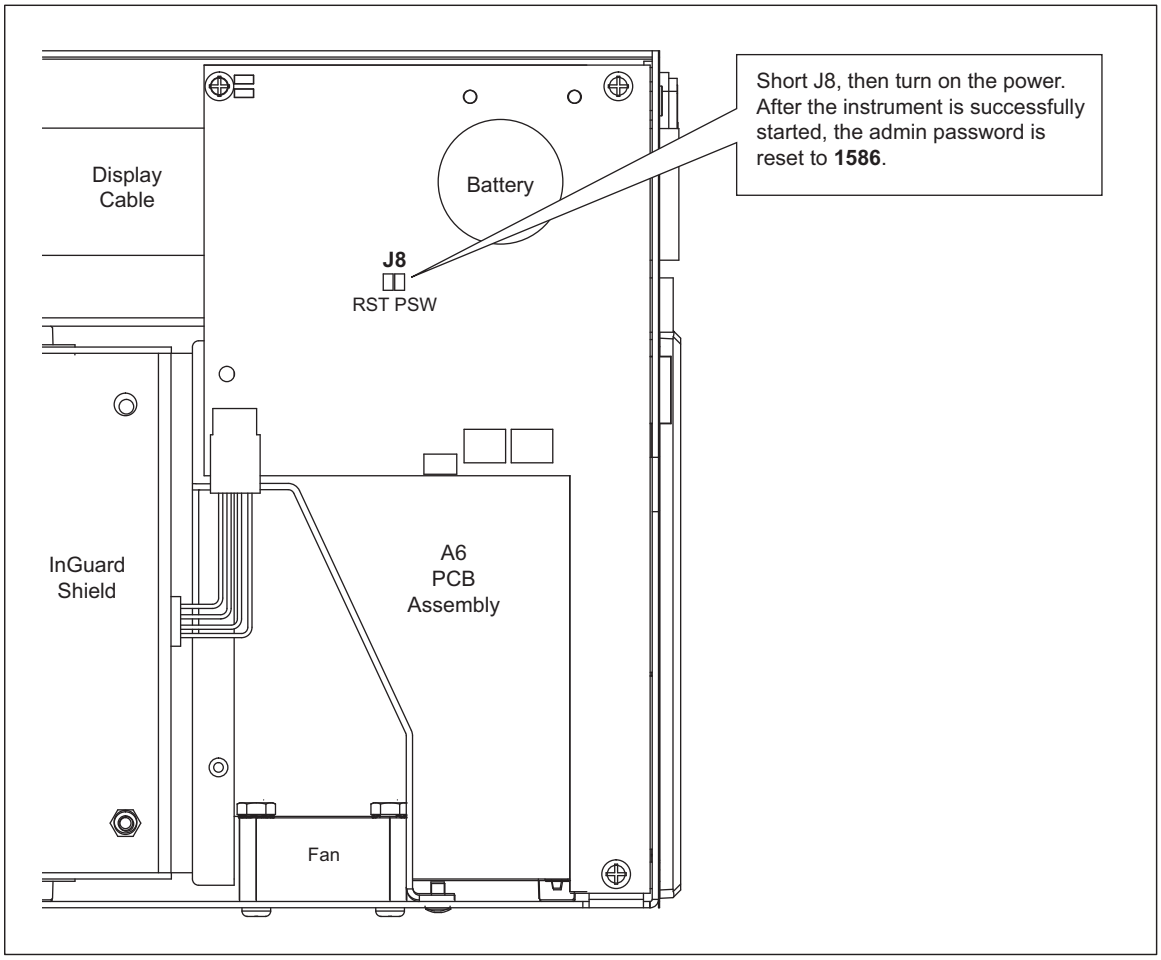

Figure 8. Password Reset Jumper

Disassembly

⚠⚠Warning

To prevent possible electrical shock or personal injury, disconnect the mains power cord before you remove the Product covers.

Only disassemble the Product to reset the password or replace the battery. See Figure 9.

A 2# Phillips screwdriver and small crescent wrench are required for disassembly.

1. Remove all High-Capacity Modules and test leads from the Product.
2. Turn off the mains power at the rear of the Product and remove the mains power cord. The front panel power key only puts the Product into a power-save mode and does not remove mains power.
3. Remove the bail by pulling from a corner and stretching the boot off the Product.
4. Remove the bail by rotating the handle upright to a 90 ° angle from the top of the Product and pull the bail out from the sides.
5. Remove the top cover by removing the two screws on the sides of the chassis, and slide the cover towards the back of the Product.

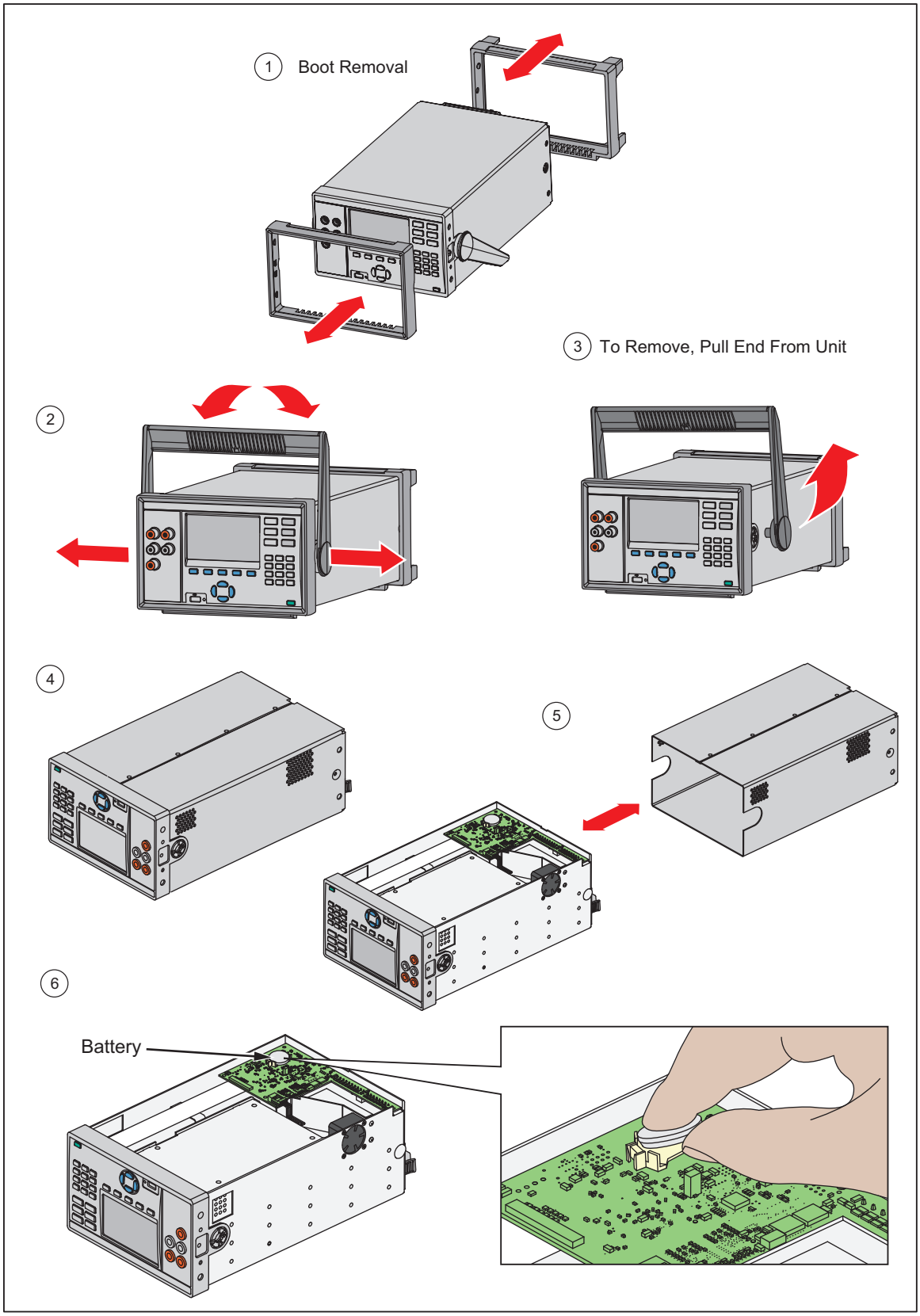

Figure 9. Disassembly

Change the Calibration Date Remotely

The calibration date is automatically updated when the "`CALibrate:STORe`" command is sent.

Equipment for "Mainframe" Calibration

The required equipment for calibration is listed in Table 4.

"Mainframe" Adjustment Process

Table 10 lists the steps to adjust the "mainframe". The table shows:

- Step numbers
- Description of the adjustment
- Measurement adjustment type (open, zero, or gain adjustment)
- Product value or range that is to be adjusted
- Amplitude of the adjustment signal
- The frequency of the adjustment signal (if necessary)

Table 10. Adjustment Steps

Step	Value Range	Input Signal	Description	Entry Point
MAIN				
A2D		open	ADC self-calibration	Y
DCV				
DC100MV	0.1		Start calibration of dc 100 mV range	Y
DC_P100MV_1		100.0 mV		N
DC_0V_1		0.0V		N
DC_N100MV_1		-100.0 mV		N
DC1V	1.0		Start calibration of dc 1 V range	Y
DC_P1V_2		1.0 V		N
DC_0V_2		0.0 V		N
DC_N1V_2		-1.0 V		N
DC10V	10.0		Start calibration of dc 10 V range	Y
DC_P10V_3		10.0 V		N
DC_0V_3		0.0 V		N
DC_N10V_3		-10.0 V		N
DC50V	50.0		Start calibration of dc 50 V range	Y
DC_P50V_4		50.0 V		N
DC_0V_4		0.0 V		N
DC_N50V_4		-50.0 V		N

Table10. Adjustment Steps (cont.)

Step	Value Range	Input Signal	Description	Entry Point
OHM				
R100	100.0		Start calibration of FRES 100 Ω range	Y
R_100_1		100.0 Ω		N
R_19_1		19.0 Ω		N
R_0_1		0.0 Ω		N
R1K	1.0E+3		Start calibration of FRES 1 kΩ range	Y
R_1K_2		1.0 kΩ		N
R_190_2		190.0 Ω		N
R_0_2		0.0 Ω		N
R10K	10.0E+3		Start calibration of FRES 10 kΩ range	Y
R_10K_3		10.0 kΩ		N
R_1_9K_3		1.9 kΩ		N
R_0_3		0.0 Ω		N
R100K	100.0E+3		Start calibration of FRES 100 kΩ range	Y
R_100K_4		100.0 kΩ		N
R_19K_4		19.0 kΩ		N
R_0_4		0.0 Ω		N
R1M	1.0E+6		Start calibration of FRES 1 MΩ range	Y
R_1M_5		1.0 MΩ		N
R_190K_5		190.0 MΩ		N
R_100K_5		100.0 kΩ		N
R_0_5		0.0 Ω		N
R10M	10.0E+6		Start calibration of RES 10 MΩ range	Y
R_10M_6		10.0 MΩ		N
R_1_9M_6		1.9 MΩ		N
R_1_0M_6		1.0 MΩ		N
R_0_6		0.0 Ω		N

Table 10. Adjustment Steps (cont.)

Step	Value Range	Input Signal	Description	Entry Point
R100M	100.0E+6		Start calibration of RES 100 MΩ range	Y
R_100M_7		100.0 MΩ		N
R_19M_7		19.0 MΩ		N
R_0_7		0.0 Ω		N
PRT				
P400FR	400.0		Start calibration of PRT 400 Ω range	Y
P_400_FR		400.0 Ω		N
P_200_FR		200.0 Ω		N
P_0_FR		0.0 Ω		N
THERM				
T2K	2.2E+3		Start calibration of FTH 2 kΩ range	Y
T_1_9K_1		1.9 kΩ		N
T_1_0K_1		1.0 kΩ		N
T_190_1		190.0 Ω		N
T_0_1		0.0 Ω		N
T90K	90.0E+3		Start calibration of FTH 90 kΩ range	Y
T_100K_2		100.0 kΩ		N
T_19K_2		19.0 kΩ		N
T_10K_2		10.0 kΩ		N
T_0_2		0.0 Ω		N
T1M	90.0E+3		Start calibration of FTH 1 MΩ range	Y
T_1M_3		1.0 MΩ		N
T_190K_3		190.0 kΩ		N
T_100K_3		100.0 kΩ		N
T_0_3		0.0 Ω		N

Table 10. Adjustment Steps (cont.)

Step	Value Range	Input Signal	Description	Entry Point
DCI				
DC100UA	100.0E-6		Start calibration of dc 100 μA range	Y
DC_P100UA_1		100.0 μA		N
DC_0A_1		Open		N
DC_N100UA_1		-100.0 μA		N
DC1MA	1.0E-3		Start calibration of dc 1 mA range	Y
DC_P1_0MA_2		1.0 mA		N
DC_0A_2		Open		N
DC_N1_0MA_2		-1.0 mA		N
DC10MA	10.0E-3		Start calibration of dc 10 mA range	Y
DC_P10MA_3		10.0 mA		N
DC_0A_3		Open		N
DC_N10MA_3		-10.0 mA		N
DC100MA	100.0E-3		Start calibration of dc 100 mA range	Y
DC_P100MA_4		100.0 mA		N
DC_0A_4		Open		N
DC_N100MA_4		-100.0 mA		N

Remote Commands for Calibration

Table 11 alphabetically lists the command set for calibration.

Table 11. List of Commands

Remote Command	Meaning
CALibrate:ABORt	Instruct Product to abort calibration procedure after present step.
CALibrate:BACKup	Backup to previous entry point in calibration procedure.
CALibrate:CONSt?	Retrieve the value in use of the given calibration constant.
CALibrate:DATE?	Return a CAL date associated with stored calibration constants.
CALibrate:INFO?	Return message or instructions associated with running step.
CALibrate:MOD:DATE <slot>,<year>,<month>,<day>	Set CAL date of module in specified slot.
CALibrate:NEXT [<reference>]	Continue a calibration procedure if it is waiting.
CALibrate:REF?	Return nominal value expected for reference entry.
CALibrate:SECure:STATe <boolean>,<admin_password>	Instruct unit to enable calibration.
CALibrate:SECTion	Skip to next section of calibration procedure.
CALibrate:SKIP	Skip to next entry point in calibration procedure.
CALibrate:STARt <procedure>[,<step>]	Start a calibration procedure.
CALibrate:STATe?	Return state of calibration.
CALibrate:STEP?	Return name of step currently running.
CALibrate:STORe	Store new calibration constants.
CALibrate:MODule:DATE <slot>,<year>,<month>,<day>	Set module CAL date.

Remote Programming Examples

This section gives examples of command sequences for several likely scenarios.

Start a Full Calibration

Table 12 shows an example for how to run a full calibration.

Table 12. Full Calibration Example

Command	Action
`CAL:SEC:STAT OFF,"1586"`	Disable the security for calibration.
`CAL:STAR MAIN`	Start MAIN calibration procedure, and show instruction of MAIN calibration procedure.
`CAL:NEXT`	Continue to show instruction of VDC calibration.
`CAL:NEXT`	Continue to perform VDC calibration. After it is completed, show instruction to connect the calibrator to the instrument for DCV calibration.
`CAL:NEXT`	Show instruction to ask for +100 mV signal input, and the reference value.
`CAL:NEXT 0.1`	Continue to perform measurements for this point, after it is completed, show instruction to ask for 0 V signal input and the reference value.
`CAL:NEXT 0`	Continue to perform measurements for this point, after it is completed, show instruction to ask for -100 mV signal input and the reference value.
`CAL:NEXT -0.1`	Continue to perform measurements for this point, after it is completed, calculate the calibration constants for dc 100 mV range, then show instructions to ask for +1 V input signal and the reference value (the first calibration point of next dc 1 V range).
…	…
`CAL:STOR`	Store the calibration constants.
`CAL:ABOR`	Abort the calibration procedure.

Calibrate 1 V DC Range only

Table 13 shows an example to run a calibration for 1 V dc.

Table 13. 1 V DC Calibration Example

Command	Action
`CAL:SEC:STAT OFF,"1586"`	Disable the security for calibration.
`CAL:STAR MAIN,DC1V`	Start MAIN calibration procedure, and jump to 1 V dc range directly, it will show ask for 1 V signal input, and the reference value.
`CAL:NEXT 1`	Continue to perform measurements for this point, after it is completed, show instruction to ask for 0 V signal input and the reference value.
`CAL:NEXT 0`	Continue to perform measurements for this point, after it is completed, show instruction to ask for -1 V signal input and the reference value.
`CAL:NEXT -1`	Continue to perform measurements for this point, after it is completed, calculate the calibration constants for DC 1V range, then show instruction to ask for 10 V signal input and the reference value (the first calibration point of next 10 V dc range.
`CAL:STOR`	Store the calibration constants.
`CAL:ABOR`	Abort the calibration procedure.

Write Calibration Date to a Module

Table 14 shows an example to write the calibration date into a module after the CJC accuracy is validated.

Table 14. Write Calibration Date to a Module Example

Command	Action
`CAL:SEC:STAT OFF,"1586"`	Disable the security for calibration.
`CAL:MOD:DATE 1,2014,11,1`	Write "2014/11/1" as new calibration date into module in slot 1.

Command References

CALibrate:ABORt

Description: Instruct unit to abort calibration procedure after present step.

Example: `CAL:ABOR`

Related Commands:

`CALibrate:STATe?`

CALibrate:BACKup

Description: Backup to previous entry point in calibration procedure.

Example: `CAL:BACK`

Related Commands:

`CALibrate:SKIP`

`CALibrate:SECTion`

CALibrate:CONSt? "<cco_name>"

Description: Retrieves the value in use of the given calibration constant.

Example: `CAL:CONS? "DC100MV_A1"`

Response: -1.401686110719e-04

Related Commands:

`CALibrate:SECure:STATe`

`CALibrate:STORe`

CALibrate:DATE?

Description: Return a CAL date associated with stored calibration constants.

Example: `CAL:DATE?`

Response: 2013,11,1

Related Commands:

`CALibrate:MODule:DATE?`

CALibrate:INFOrmation?

Description: Return message or instructions associated with running step

Example: `CAL:INFO?`

Response: “Connect calibrator to Volt terminals”

Related Commands:

`CALibrate:STATe?`

`CALibrate:STEP?`

CALibrate:MODule:DATE <slot>,<year>,<month>,<day>

CALibrate:MODule:DATE? <slot>

Description: Set and query module calibration date.

Example: `CAL:MOD:DATE 1,2013,11,1`

`CAL:MOD:DATE? 1`

Response: 2013,11,1

Related Commands:

`CALibrate:SECure:STATe`

CALibrate:NEXT [<reference>]

Description: Continue a calibration procedure if it is waiting. An optional parameter reference value (used if it's waiting for a reference), If the reference value has no unit, the unit is assumed to be that returned by the `CAL_REF?` command.

Example: `CAL_NEXT`

`CAL_NEXT 2.999987`

`CAL_NEXT 100 mV`

Related Commands:

`CALibrate:REFerence?`

`CALibrate:BACKup`

`CALibrate:SKIP`

CALibrate:REFerence?

Description: Return nominal value expected for reference entry

Example: `CAL:REF?`

Response: 3.000000e+00

Related Commands:

`CALibrate:NEXT`

`CALibrate:STATe?`

`CALibrate:INFOrmation?`

`CALibrate:STEP?`

CALibrate:SECure:STATe <boolean>, <admin_password>

Description: Instruct Product to enable calibration

Example: `CAL:SEC:STATE OFF,"1586"`

Related Commands:

`CALibrate:SECure:STATe?`

CALibrate:SECure:STATe?

Description: Query calibration enable state

Example: `CAL:SEC:STAT?`

Response: 1

Related Commands:

`CALibrate:SECure:STATe`

CALibrate:SECTion

Description: Skip to next section of calibration procedure.

Example: `CAL:SECT`

Related Commands:

`CALibrate:BACKup`

`CALibrate:SKIP`

CALibrate:SKIP

Description: Skip to next entry point in calibration procedure.

Example: `CAL:SKIP`

Related Commands:

`CALibrate:BACKup`

`CALibrate:SECTion`

CALibrate:STARt <procedure>[,<step>]

Description: Start a calibration procedure. As parameter, the name of procedure should be provided (MAIN is the procedure for full instrument calibration), an optional parameter <step> can be provided to start from, if it is omitted, it starts at the beginning. Before any calibration procedure can be started, the calibration secure state should be disabled.

Example: `CAL_START MAIN`

`CAL_START MAIN,DC1V`

Related Commands:

`CALibrate:SECure:STATe`

CALibrate:STATe?

Description: Return state of calibration

Example: `CAL:STAT?`

Response: `RUN` - running a calibration step

`REF` - waiting for a `CAL_NEXT` with reference (measurement) value

`INS` - instruction available, waiting for a `CAL_NEXT`

`NOT` - not in a calibration procedure (or at end of one)

Related Commands:

`CALibrate:STEP?`

`CALibrate:REFerence?`

`CALibrate:INFOrmation?`

CALibrate:STEP?

Description: Return name of step currently running

Example: `CAL:STEP?`

Response: `DC1V`

Related Commands:

`CALibrate:STATe?`

`CALibrate:REFerence?`

`CALibrate:INFOrmation?`

CALibrate:STORe

CALibrate:STORe?

Description: Store new calibration constants or query whether a cal store is needed.

Example: `CAL:STOR`

`CAL:STOR?`

Response: 1 is yes, 0 if no

Related Commands:

`CALibrate:SECure:STATe`

User-Replaceable Parts and Accessories

Table 15 lists the part numbers of each user-replaceable part or accessory for the Product, see Figure 10.

Table 15. User-Replaceable Parts and Accessories

Item	Fluke Part Number	Quantity	Description
①	4281998	1	FLUKE-1586A-2010, 1586A HANDLE
②	4281980	1	FLUKE-1586A-2009, 1586A FRONT PANEL BOOT
③	4281971	1	FLUKE-1586A-2008, 1586A REAR PANEL BOOT
④	4396173	1	FLUKE 1586A-2586 RELAY CARD
⑤	4374710	1	FLUKE-1586A-2586, 1586A, PROTECTIVE SLOT COVER
⑥	4338362	1	FLUKE-1586A, REAR SLOT FRAME
⑦	4357143	6	SCREW,4-40 X 0.375 IN.,FLAT,PHILLIPS,SS,PASSIVATED,LOCK PATCH,ROHS COMPLIANT
⑧	Contact Fluke	1	FLUKE 1586A-2586 HI-CAPACITY MODULE
Not Shown	1588940	1	BATTERY,PRIMARY,LI-MNO2,3V,560MAH,COIN,CR2450,24X5MM,BULK
Not Shown	4348094	1	DIO/ALARM connectors for 1586A
Not Shown	4121552	1	884X-4GB,USB MEMORY, 4GB
Not Shown	4298499	1	CABLE, USB MALE A TO MALE B, 2M
Not Shown	2675487	1	884X-ETH,ETHERNET INTERFACE CABLE, 1m
Not Shown	4396147	1	1586A-ETH,ETHERNET INTERFACE CABLE, 2m
Not Shown	3980562	1	TEST LEAD Set [3]
Not Shown	166306	1	⚠ Fuse 0.25A, 250V (slow blow) [2]
Not Shown	4394437	1	⚠Fuse 0.160A, 250V (slow blow) [2]
Not Shown	4107852	1	Product CD (Contains Manuals and USB drivers)

[1] Quantity of items listed can vary based on kit or model ordered.
[2] Only use exact replacements.
[3] See www.fluke.com for more information about the test leads for your region.

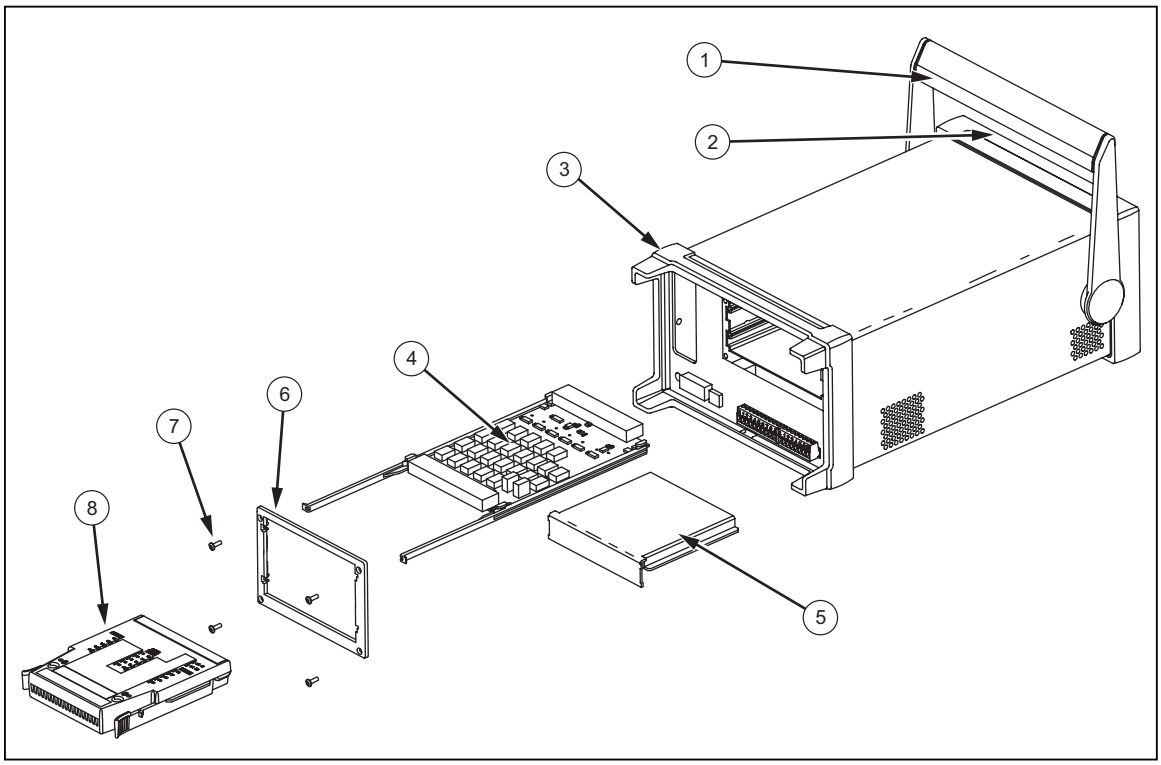

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Figure 10. Replaceable Parts