FLUKE®

1773/1775/1777

3 Phase Power Quality Analyzer

Calibration Manual

BC
4/2022 (English)

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Introduction

⚠⚠ Warning

To avoid electric shock or personal injury, do not perform the calibration verification tests or calibration procedures described in this manual unless you are qualified to do so. The information provided in this manual is for the use of qualified personnel only.

This Calibration Manual provides all the information necessary to do basic maintenance, perform verification, and make calibration adjustments for the *1773/1775/1777 3 Phase Power Quality Analyzer* (Analyzer or Product). For complete operating instructions, refer to the *Users Manual* at www.fluke.com.

Contact Fluke

Fluke Corporation operates worldwide. For local contact information, go to our website: www.fluke.com

To register your product, or to view, print, or download the latest manual or manual supplement, go to our website.

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Safety Information

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.

A **Warning** identifies hazardous 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.

Specifications

Complete specifications are at www.fluke.com. See the *1773/1775/1777 Product Specifications.*

Maintenance

If the Product is used appropriately it does not require special maintenance or repair. Maintenance work may be executed only by trained and qualified personnel. This work may only be done at a company-related service center within the guarantee period. See www.fluke.com for locations and contact information of Fluke Service Centers worldwide.

⚠⚠ Warning

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

- **Do not operate the Product with the battery door removed or the case open. Hazardous voltage exposure is possible.**
- **Remove the input signals before you clean the Product.**
- **Use only specified replacement parts.**
- **Have an approved technician repair the Product.**

How to Clean

⚠ Caution

To prevent damage, do not use abrasives or solvents on this Product.

If the Product is dirty, wipe it off carefully with a damp cloth (without cleaning agents). Mild soap may be used.

Battery Replacement

⚠⚠ Warning

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

- **Do not short the battery terminals together.**
- **Do not disassemble or crush battery cells and battery packs.**
- **Do not put battery cells and battery packs near heat or fire. Do not put in sunlight.**

⚠ Caution

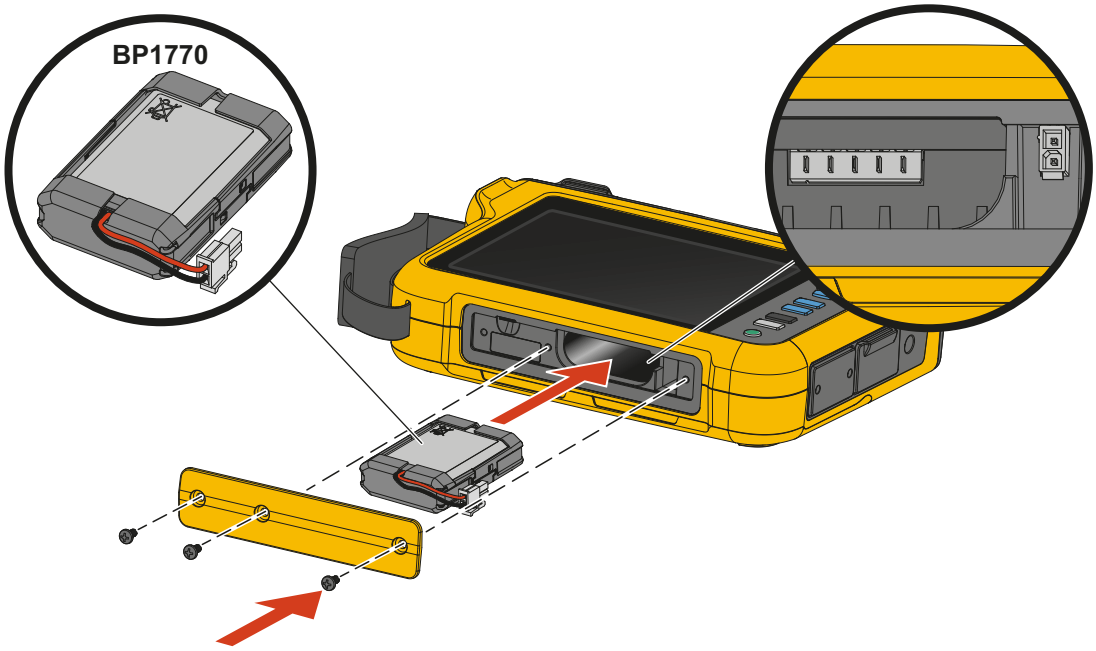
Replace the rechargeable battery after 5 years.

The Product has an internal rechargeable Lithium-ion battery.

To replace the battery:

1. Unfasten the screws and remove the battery door. See Figure 1.

Figure 1. Battery



Product Disposal

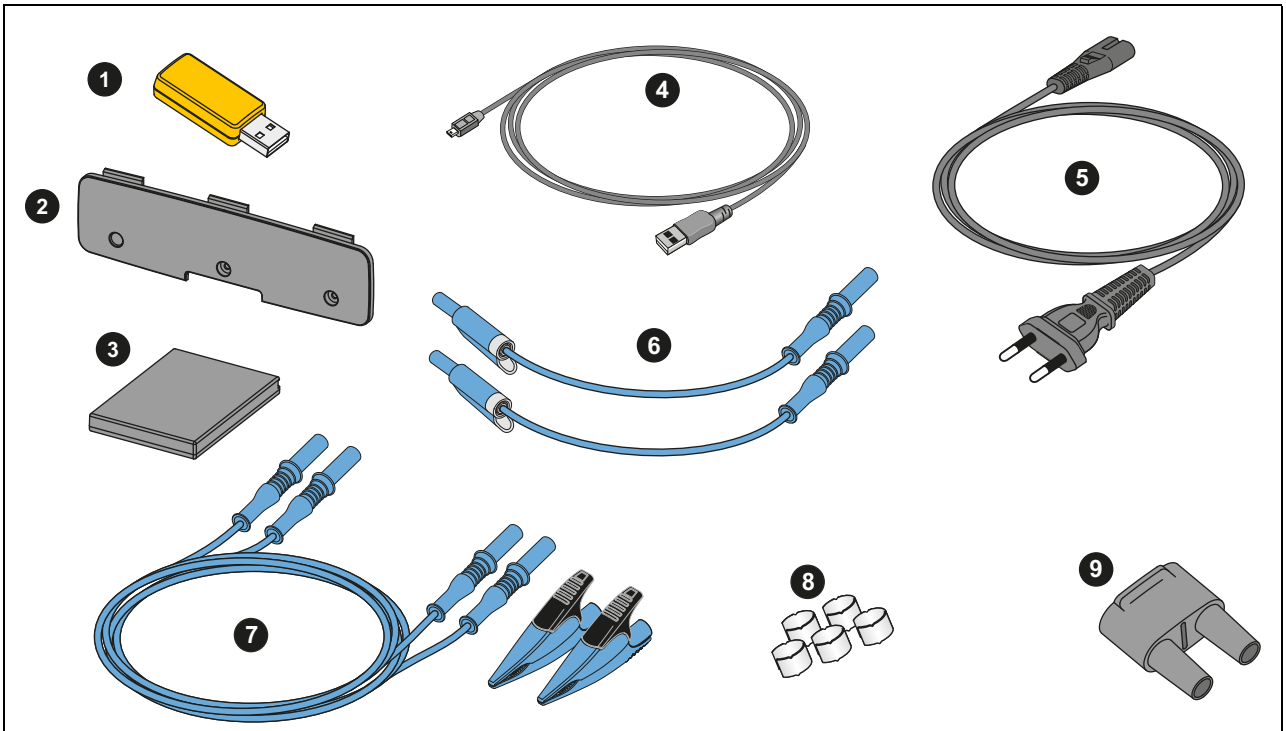
Dispose of the Product in a professional and environmentally sound manner:

- Delete personal data on the Product before disposal.
- Remove batteries that are not integrated into the electrical system before disposal and dispose of batteries separately.
- If this Product has an integral battery, put the entire Product in the electrical waste.

Replacement Parts

Table 1 is a list of replacement parts and accessories. To order parts and accessories, see *Contact Fluke*.

Table 1. Replacement Parts



Item	Description	QTY	Fluke Part or Model Number
1	WiFi-to-USB Adapter	2	4723989
2	Battery Door	1	4388072
3	Battery Pac, Li-ion 3.7 V 2500 mAh	1	4146702
4	USB Cable	1	1671807
5	Line Cord, country-specific (N. America, Europe, UK, Australia, Japan, India/S. Africa, Brazil)	1	varies
6	Test Leads 0.8 m blue, 1000 V CAT III	1 set	5016873
7	Test Leads 2 m, 2x Alligator Clips, blue, 1000 V CAT III	1 set	5020006
8	Cable Marker	1 set	5046009
9	Mains Adapter MA-C8	1	4945842

Setup

Before you start the verification procedures or make calibration adjustments, refer to this section for the equipment, system, and setup requirements.

Required Equipment

See Table 2 for a list of requirements for the verification tests and calibration adjustment of the Product. If the specific equipment is not available, use equivalent equipment that has the same or better performance.

Table 2. Required Equipment

Item	Model	Comments	Used for:	
			Verification	Adjustment
Calibrator	5522A with 8588A Reference DMM	5730A Calibrator, or equivalent, if 8588A is not available.	●	●
Digital Multimeter (DMM)	8588A or 8846A	Voltage verification/ calibration and AUX Adapter verification	●	●
Cable Assembly	3PHVL-1730	Voltage Test Lead 3-Phase+N	●	●
Test Lead	Pomona 6358	For voltage PE connection	●	●
17xx AUX Input Calibration Cable [1]	NA		●	●
17xx Calibration Cables: Voltage-to-Current Input Cable Assembly[1]	NA		●	●
17xx Verification Box[1]	NA			●
USB Cable	USB A-to-USB C		●	●
Coil	5500A/COIL Optional: 52120A with Coils	for iFlex verification	●	
Coil	NA	5 turns	●	
Banana-to-Pin Adapter	Pomona Electronics 4690	for AUX Adapter verification	●	

[1] The 173x/174x calibration cables and verification box are not available from Fluke. See Equipment Assembly for information on how to make these items. The 17xx calibration equipment is identical with the previous 173x/174x equipment.

Equipment Assembly

The 17xx calibration cables and verification box are not available from Fluke. If you plan to calibrate your Product rather than send it to a Fluke Service Center, use the assembly instructions that follow.

Note

The 17xx calibration cables are identical and the verification box is similar to the previous 173x/174x calibration equipment.

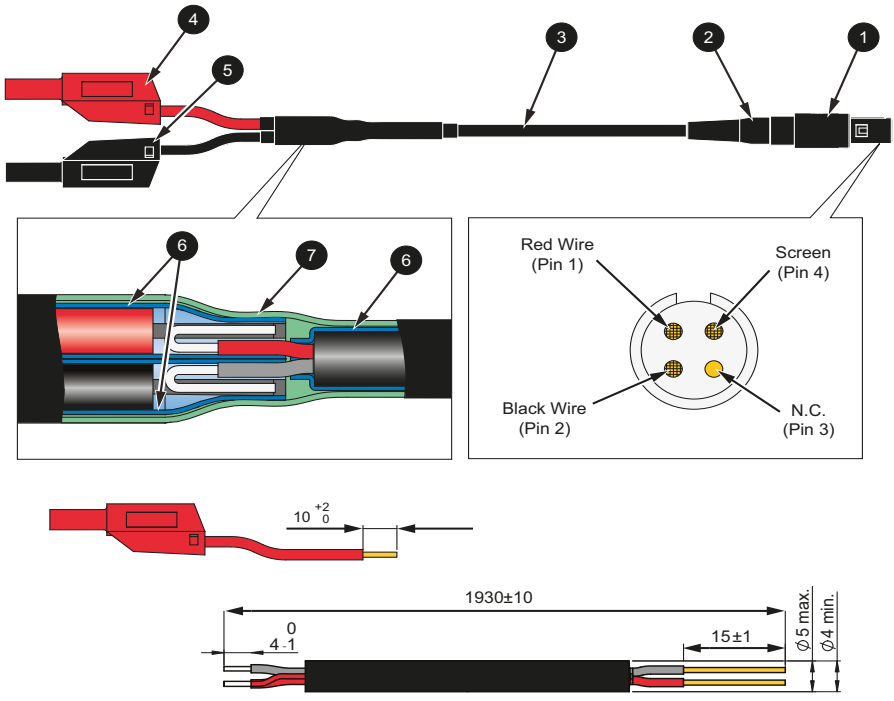
17xx Calibration Cable Assembly

See Table 3 for instructions on how to make the calibration cables.

⚠ Caution

Cable must be marked with "max. 30 V to earth." Remove any voltage-, category-, or current-ratings on safety plugs.

Table 3. 17xx Calibration Cables, Voltage-to-Current-Input



Item	Description	Part Number/Info	QTY
❶	Straight Plug, IP50, 4-Pole	ODU: S21M08-P04MJG0-528S	1
❷	Cable Bend Relief	ODU: 701-023208965-040	1
❸	Signal-Cable, 2x AWG 22-24, shielded	∅4-5 mm (Fluke equiv. # 3803634)	1

Table 3. 17xx Calibration Cables, Voltage-to-Current-Input (cont.)

Item	Description	Part Number/Info	QTY
❹	Test Lead with 4 mm Safety Plug, stackable	red	1
❺	Test Lead with 4 mm Safety Plug, stackable	black	1
❻	Heat Shrink Tubing, 2:1	∅=4.8 mm (3/16”); L=35 mm	3
❼	Heat Shrink Tubing, 3:1, adhesive	∅=12 mm (1/2”); L=60 mm	1

17xx AUX Input Calibration Cable

See Table 4 and Figure 2 for instructions on how to make the calibration cable.

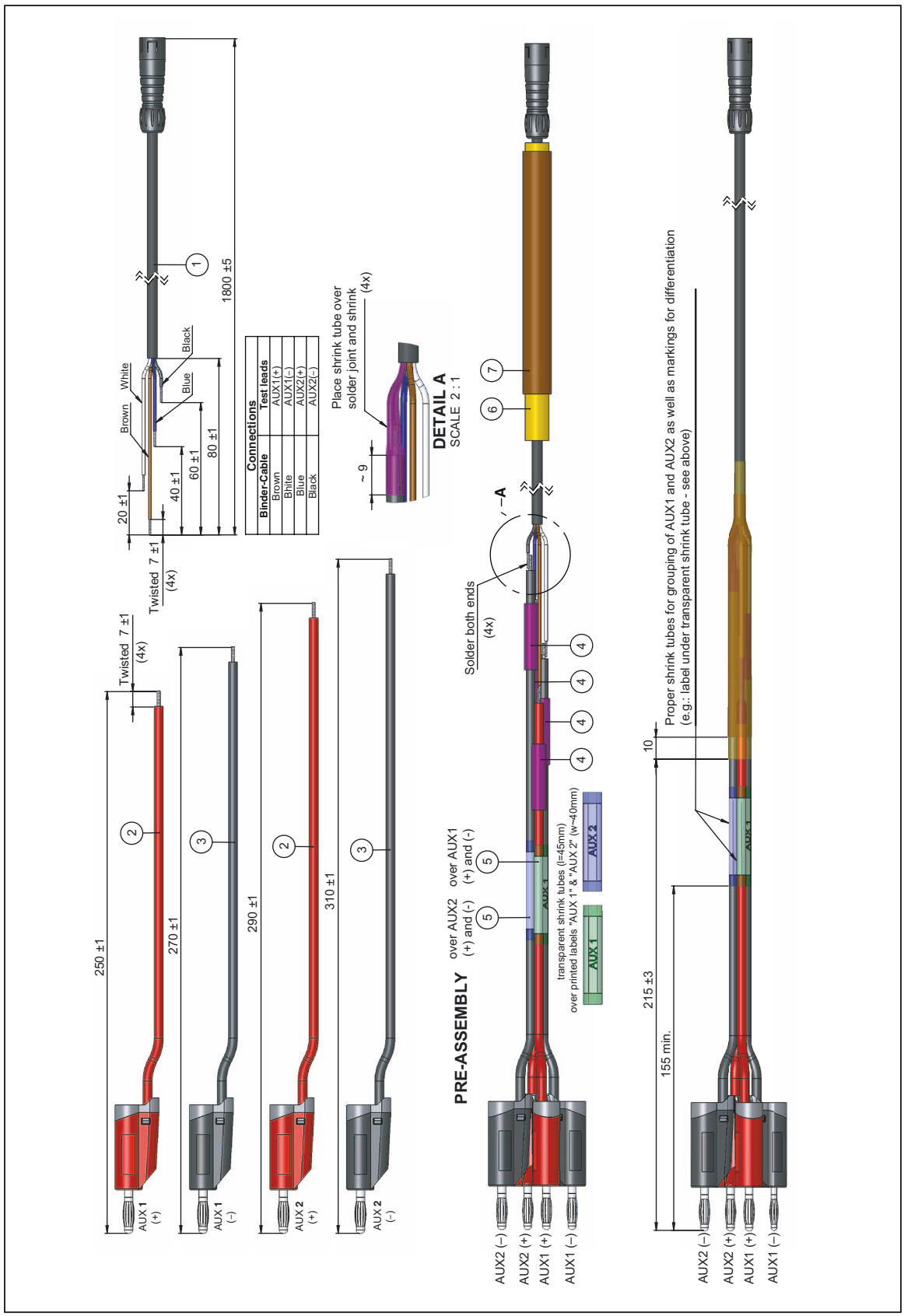
⚠ Caution

Cable must be marked with “max. 30 V to earth.” Remove any voltage-, category-, or current-ratings on safety plugs.

Table 4. 17xx AUX Input Calibration Cable

Item	Description	Part Number/Info	QTY
❶	Binder: Series 620 - Male Cordset, 4-pole, 2 m	Binder: 79 9241 020 04	1
❷	Test Lead 0.75 mm² with 4 mm Banana Plug, stackable	red	2
❸	Test Lead 0.75 mm² with 4 mm Banana Plug, stackable	black	2
❹	Shrink tube Ø 5-6 mm, black, thin wall, 3:1	L = 30 mm	4
❺	Shrink tube Ø 8-10 mm, transparent, thin wall, 2:1	L = 45 mm	2
❻	Shrink tube Ø 10-12 mm, black, thin wall, adhesive, 3:1	L = 30135	1
❼	Shrink tube Ø 12-14 mm, black, thin wall, 3:1	L = 110 mm	1

Figure 2. 17xx AUX Input Calibration Cable

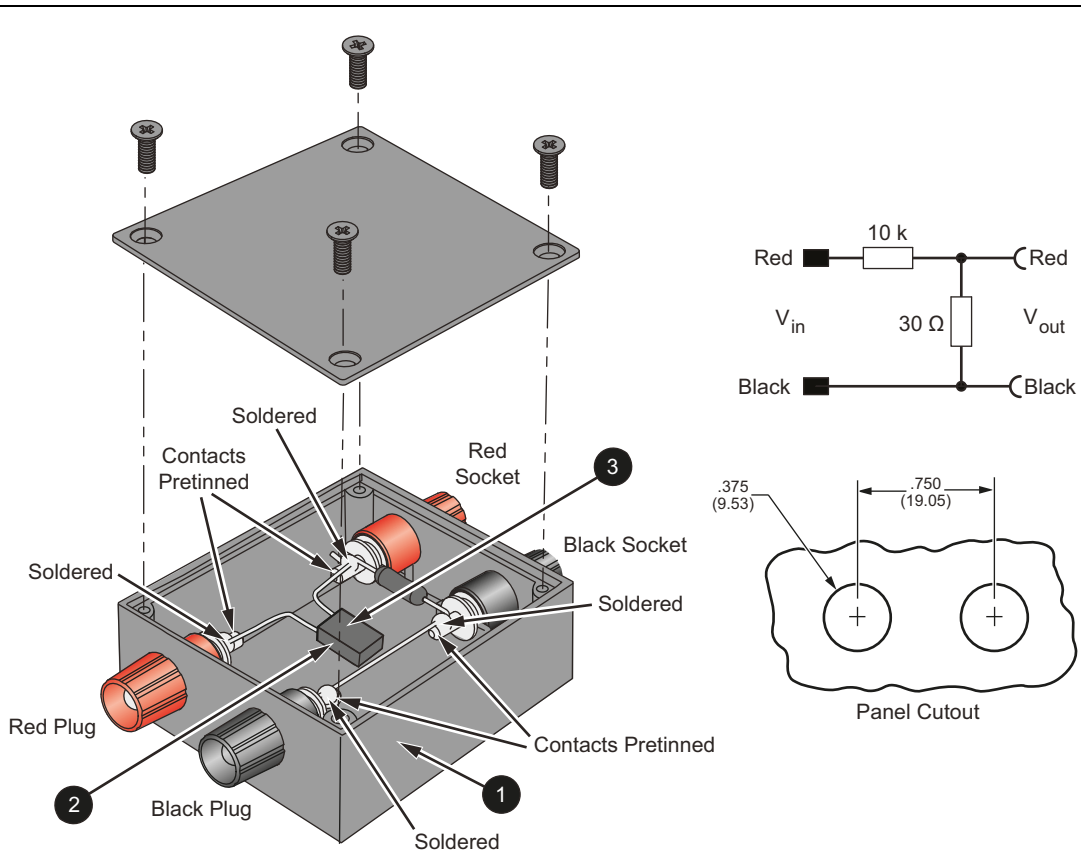


Verification Box Assembly

This Verification Box provides more accurate voltages than a direct connection to the 5520A. The 5520A uses a divider with a 50 Ω output impedance when sourcing <330 mV. Due to variations in the Analyzer input impedance, the actual applied voltage is less than the programmed voltage. Using an external divider where the parallel resistance is ~30 Ω allows calculation of the applied voltage with confidence that the Analyzer input loading will not significantly impact the applied voltage.

Fluke recommends using a verification box that has a divider with 30 Ω across the Analyzer input and 10 kΩ in series with high side of the input. See Table 5 for instructions on how to make the verification box.

Table 5. 17xx Verification Box



Item	Description	Part Number/Info	Fluke Part Number	QTY
❶	Plastic Box: 2.69 in L x 1.82 in W	Pomona: 3850-0	1924576	1
❷	Binding Post, Black	Pomona: 4243-0	1633063	2
❸	Resistor, Metal Foil 10 kΩ, ±0.1 %, 0.6 W, ±4.5 PPM	Red Plug/Red Socket	2114858	1
❹	Resistor, 30 Ω, 1 W, 1 % 20 PPM	Red Socket/Black Socket + Bridge Black Plug/Socket	1757740	1

System Requirements

The system requirements for this verification procedure are:

- Windows 10 or Windows 11 32/64-bit (earlier Windows versions below 10 are not tested)
- Monitor, 1280 x 1024 (@4:3) or 1440 x 900 (@16:10), wide-screen (16:10) at higher resolution recommended
- USB 2.0 port
- RS232 port or USB-to-RS232 converter to control the calibrator (optional)
- Microsoft Excel 2010 32/64-bit software or higher (versions below 2010 are not tested)
- Fluke Energy Analyze software V3.8 or higher

USB Communication

The verification and adjustment require remote commands to query measurement data and write commands to set configurations that are not available on the instrument UI. To communicate between the PC and the instrument, either a USB 2.0 type A to USB-C or USB-C to USB-C cable can be used. The device driver is included with the Windows operating system.

How to Use the 17xx Calibration Tool

The application, Fluke17xx-CalibrationTool_Vx.x is available at www.fluke.com and communicates with the instrument using remote commands through the USB ports. The application also supports the control of the Fluke Calibrators for automated procedures.

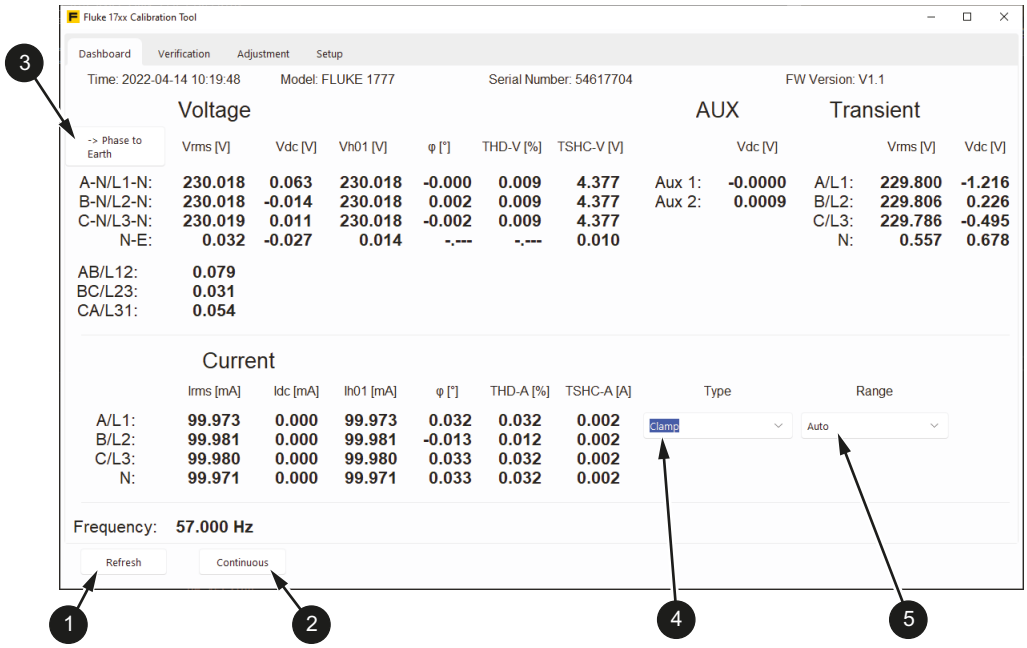
The application (Calibration Tool) contains sheets for various tasks:

- **Dashboard** – Live measurements and set current input range/mode
- **Verification –** Procedures to perform the verification
- **Adjustment –** Procedures to perform the adjustment
- **Setup** – Configuration of, for example, the COM ports and resistor values of the voltage divider

Dashboard

The Dashboard sheet provides all measurement readings at a glance that are required for manual calibration. See Table 6.

Table 6. Dashboard

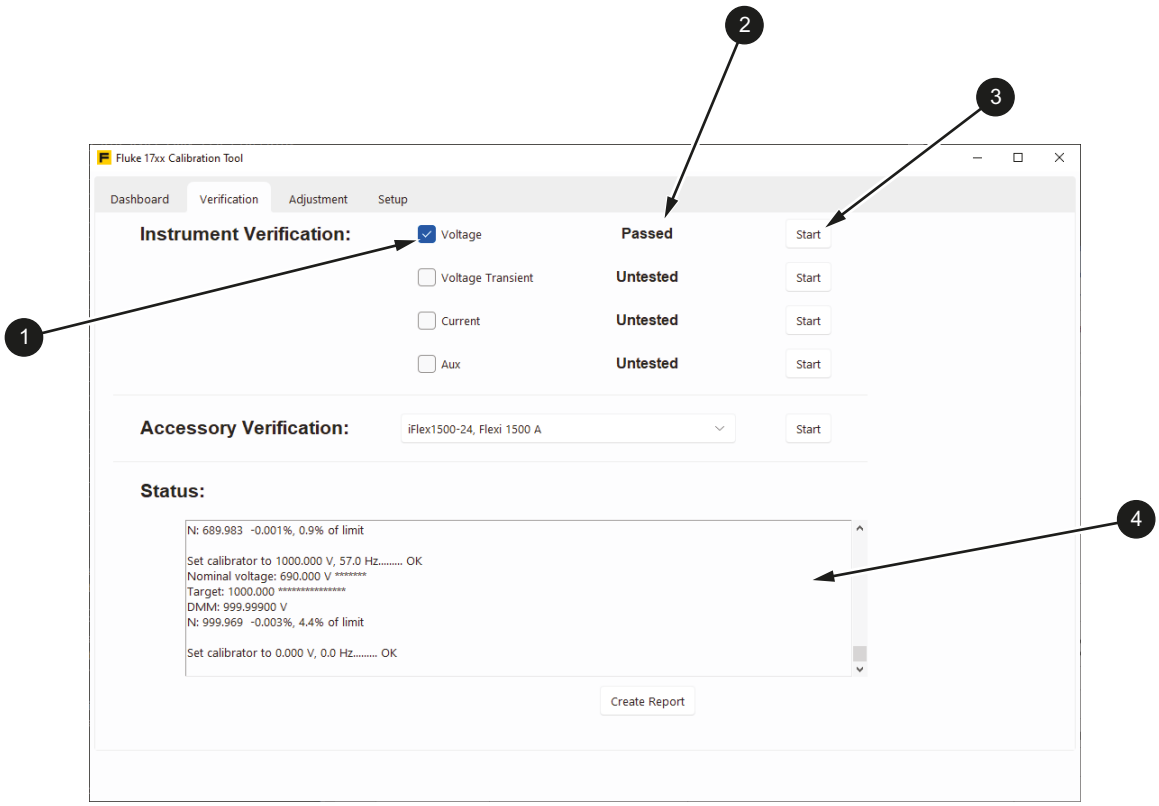


Item	Description
❶	**Refresh:** One-time live data update.
❷	**Continuous:** Start live data read-out. The readings are refreshed every few seconds. Use the same button to stop live updates. During the live updates other tabs are not accessible.
❸	**Phase to Earth:** Switch voltage measurement between Phase-to-Neutral and Phase-to-Earth.
❹	**Type:** Select the type of the current accessory. The options are *Auto, Clamp, iFlex,* and *DC-Clamp*. The default is *Auto.*
❺	**Range**: Select the range of the current channels. The options are *Auto*, *High*, and *Low*. The default is *Auto*.

Verification

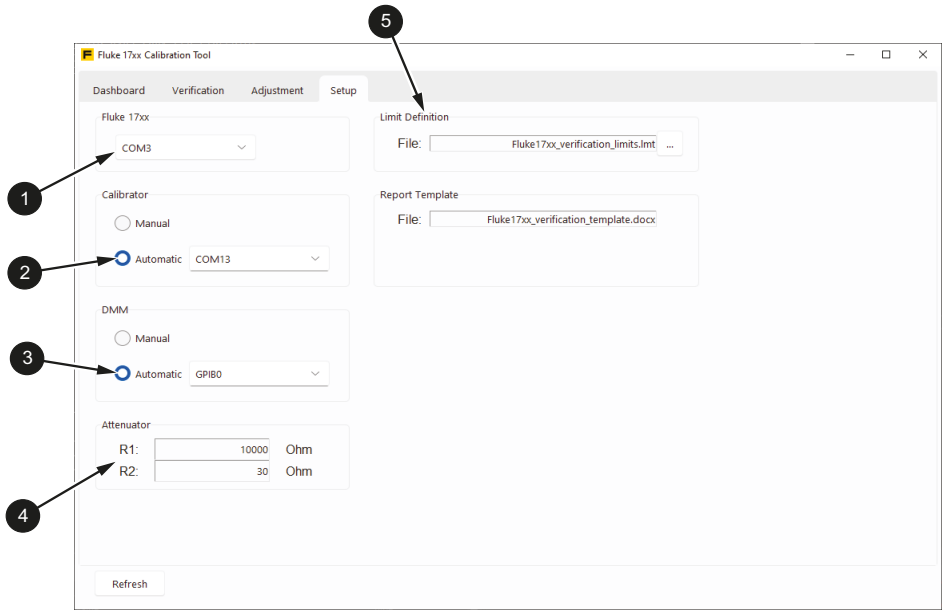
The Verification and Adjustment sheets are the built-in procedures. See Table 7.

Table 7. Calibration



Item	Description
1	**Verification items**: For a complete instrument verification all of these items must be verified in successive tests: Voltage, Voltage Transient, Current, and AUX. A specific order is not required. Completed items are shown with a check mark.
2	**Result:** Status of the verification items. After performing the verification, the result of each item shall be PASS. FAIL indicates a deviation outside the tolerance limits.
3	**Start:** Start of the verification for the selected item.
4	**Status:** Log of the verification process. This information is also stored in a log file.

Table 8. Setup



Item	Description
❶	**17xx COM Port:** The 17xx_CalibrationTool automatically searches for the COM port of the connected device and the found port is displayed here.
❷	**Calibrator Control Setup:** When the calibrator is connected to the PC using a RS232 cable select *Automatic* to control the calibrator. Use the drop-down list box to configure the COM port. Otherwise select **Manual**.
❸	**Multimeter Control Setup:** When the DMM is connected to the PC with a GPIB interface, select *Automatic* to control the DMM and read the measurement values. Use the drop-down list box to configure the GPIB port. Otherwise, select *Manual*.
❹	**Voltage Divider Setup:** Configure the resistor values, R1 and R2, of the voltage divider for current verification. Store the Excel workbook to keep the applied values for future use.
❺	**File:** This is the file with the verification parameters. Usually there is no need to change this definition.

Supported Calibrators:
- Fluke 5522A with reference DMM 8588A. 5730A for voltage verification/calibration only.

Calibrator settings:
- Baud rate: 9600
- Data bits: 8 Stop bit: 1
- Parity: None
- Stall: XON/XOFF
- EOL: CR/LF

DMM settings:
- Remote interface: GPIB or USB (on 8558A)

8558A only:
- Emulation: 8508A

Basic Instrument Setup for all Verifications

The Fluke17xx-CalibrationTool_Vx.x has built-in procedures to verify and adjust the Analyzer. The Verification of uses an external divider. This divider, (see *Verification Box Assembly*) provides more accurate voltages than a direct connection to the 5520A. The 5520A uses a divider with a 50 Ω output impedance when sourcing <330 mV. Due to variations in the Analyzer input impedance, the actual applied voltage is less than the programmed voltage. Using an external divider where the parallel resistance is ~30 Ω allows calculation of the applied voltage with confidence that the Analyzer input loading will not significantly impact the applied voltage.

The Calibration Tool calculates the voltage that should be applied based on the values entered in the setup screen:

1. Apply power to the Analyzer using the power supply and line cord.
2. Turn on the Analyzer.
3. Connect the Analyzer USB to the PC.

Accuracy Verification Procedure

The procedure verifies the Analyzer accuracy at ambient temperature 23 °C ±5 °C (intrinsic error). Allow at least one hour for the Analyzer to warm up.

A complete accuracy verification of the 177x consists of:

- Voltage Measurement
- Voltage Transient Measurement (1775 and 1777 only)
- Current Measurement
- AUX Measurement
- Optional iFlex, Current Clamp, and 17xx Auxiliary Input Adapter Verification

Voltage Measurement

To measure voltage:

1. Select the setup. See *Basic Instrument Setup for all Verifications*.
2. Make sure the instrument is on battery power with ≥50 % charge.
3. Connect the 3PHVL-1730 "N" lead and the single test lead **Earth** to the calibrator NORMAL LO.
4. Use the 55x2A or 5730A calibrator to:
   a. Connect the calibrator NORMAL V output to the 3PHVL-1730 L1+L2+L3 leads.
   b. Connect the calibrator NORMAL V output to the V input of the reference DMM.
   c. Sequentially set the calibrator to the voltages in Table 9 and check that the Analyzer reading is between the limits.

Note

Use the DMM readings as reference with the 55x2A calibrator.

5. Do this for all ranges in Table 9:

   a. Set the calibrator to supply a 57.0 Hz sine wave for all voltages.

   b. Wait until each reading has stabilized.

   The Calibration Tool is the first choice for readings because the resolution is higher than the instrument UI. If this is not available, select **PQ Meter** from **Home** menu to see the voltage readings.

Table 9. Voltage Verification

Declared Input Voltage U_{din} [1]	Range	Calibrator Voltage 57 Hz sine wave	Minimum Reading -0.1 % of U_{din}	Maximum Reading +0.1 % of U_{din}
			for 10 % to 150 % of supported U_{din}: ± (0.1 % of U_{din}), otherwise 0.1 % of range	
120 V	1000 V	12 V	11.88 V	12.12 V
	1000 V	120 V	119.88 V	120.12 V
	1000 V	180 V	179.88 V	180.12 V
230 V	1000 V	23 V	22.77 V	23.23 V
	1000 V	230 V	229.77 V	230.23 V
	1000 V	345 V	344.77 V	345.23 V
480 V	1000 V	48 V	47.52 V	48.48 V
	1000 V	480 V	479.52 V	480.48 V
	1000 V	720 V	719.52 V	720.48 V
690 V	1000 V	1000 V[2]	999.31 V	1000.69 V

[1] In the power quality standard IEC 61000-4-30, the declared input voltage U_{din} determines the accuracy requirements of voltages from 10 % to 150 % of U_{din}. For measurements in low voltage mains supplies, U_{din} is identical to the nominal supply voltage, for example 120 V or 230 V.

[2] The test voltage is limited by the maximum output voltage of the calibrator. According to IEC 61000-4-30 the 150 % test voltage is 1035 V.

6. When you are done, set the calibrator to Standby.

Voltage Transient Measurement

This verification is required on the 1775 and 1777 models only.

To measure transient voltage:

1. Select the setup. See *Basic Instrument Setup for all Verifications*.
2. Make sure the Analyzer is on battery power with ≥50 % charge.
3. Connect the single test lead **Earth** to the calibrator NORMAL LO.
4. Use the 552xA or 57x0A calibrator to:

   a. Connect the calibrator NORMAL V output to the 3PHVL-1730 L1+L2+L3+N leads.

   b. Connect the calibrator NORMAL V output to the V input of the reference DMM.

c. Sequentially set the calibrator to the voltages and frequencies in Table 10 and check that the Analyzer reading is between the limits.

Note

Use the DMM readings as reference with the 552xA calibrator.

5. Do this for all ranges in Table 10:
   a. Set the calibrator to supply a sine wave for all voltages.
   b. Wait until each reading has stabilized.

   The spreadsheet is the first choice for readings. Readings will have more resolution from the spreadsheet.

Use the Calibration Tool for the RMS readings. Note that the instrument UI does not provide the voltage transient RMS values.

If the Calibration Tool is not available, you can do manual readings:

1. Start a Logging session
2. Apply the voltages from Table 10.

   Be sure to wait at least 30 seconds between the test steps.
3. Download the measurement to *Energy Analyze Plus* software.
4. Go to **PQ+ Study** > **Events**.
5. Select the transient events and use the cursors on the transient waveform recordings to identify the peak-to-peak voltage of the sine wave.
6. Calculate the RMS value by dividing the peak-to-peak reading by 2.8284.

Table 10. Transient Voltage Calibration

Calibration Output		Range	Minimum Reading	Maximum Reading
Voltage	**Frequency**			
1000 V	200 Hz	±8 kV	930 V	1070 V
600 V	10 kHz	±8 kV	550 V	650 V
200 V	100 kHz	±8 kV	170 V	230 V

7. When you are done, set the calibrator to Standby.

Current Measurement

Fluke recommends using a divider with 30 Ω across the Analyzer input and 10 kΩ in series with high side of the input:

- Fluke PN 2114858 (10 kΩ)
- Fluke PN 1757740 (30 Ω) – see Table 5 for the recommended assembly of this divider. Best practice is to measure the resistor values at time of use.

⚠ Caution

Be careful when you set the calibrator output voltages. High voltages applied to the current input will damage the Product.

To measure current:

1. Connect the Voltage-to-Current Input Cable Assembly to the Analyzer current probe input. See Table 3.
2. Connect the 3PHVL-1730 "N" lead and the single test lead **Earth** to the calibrator AUX LO.
3. Connect the calibrator AUX HI output to the 3PHVL-1730 L1+L2+L3 leads.
4. Stack the 17xx Calibration Cable Assembly together: red to red and black to black.
5. Plug the attenuator into the calibrator Normal HI and LO.
6. Connect the stacked Calibration Cable Assembly to the attenuator. Connect the black leads to NORMAL LO.

Note

For accurate results, it is important to connect the 17xx Calibration Cable Assemblies to all four current inputs on the device.

7. For all ranges in Table 11, set the calibrator to the voltages indicated in the given order. Check that the values are between the limits.

Table 11. iFlex Current Probe Input Verification

Range	Calibrator output[1] (57 Hz sine wave, 5 V out AUX)	Nominal Reading	Reading Limits
Direct Flexi Low	1.000 mV	1.000 mV	0.994 to 1.006
	10.000 mV	10.000 mV	9.967 to 10.033
	15.000 mV	15.000 mV	14.952 to 15.048
Direct Flexi High	10.00 mV	10.00 mV	9.94 to 10.06
	100.00 mV	100.00 mV	99.67 to 100.33
	150.00 mV	150.00 mV	149.52 to 150.48
Direct Clamp Low	5.00 mV	5.00 mV	4.98 to 5.02
	10.00 mV	10.00 mV	9.97 to 10.03
	50.00 mV	50.00 mV	49.89 to 50.11
Direct Clamp High	50.0 mV	50.0 mV	49.8 to 50.2
	100.0 mV	100.0 mV	99.7 to 100.3
	500.0 mV	500.0 mV	498.9 to 501.1

[1] Calibrator Output Impedance and Analyzer loading will effect actual voltage being applied. Fluke recommends that you use a divider and the Calibrator Tool described above.

8. When finished, set the calibrator to Standby.

AUX Input Check

To check the AUX input:

1. Connect 173x/174x AUX input calibration cable to the Analyzer AUX inputs.
2. Stack the two red banana plugs together and connect them to the calibrator Normal HI.
3. Stack the two black banana plugs together and connect them to the calibrator Normal LO.
4. For each voltage in Table 12, set the calibrator and check that the values are between the limits.

Table 12. AUX Input Verification

Calibrator Out DC Volts	Lower Limit Vdc	Upper Limit Vdc
-10.0000	-10.025	-9.975
-5.0000	-5.015	-4.985
-1.0000	-1.007	-0.993
-0.5000	-0.506	-0.494
-0.1000	-0.1052	-0.0948
-0.0100	-0.01502	-0.00498
0.00	-0.005	0.005
0.0100	0.00498	0.01502
0.1000	0.0948	0.1052
0.5000	0.494	0.506
1.0000	0.993	1.007
5.0000	4.985	5.015
10.0000	9.975	10.025

5. Set the calibrator to Standby.

Optional Verification for iFlex or Clamp (Combined Analyzer and Probe Specifications)

This feature of the Calibration Tool checks the Analyzer combined with current probes. These tests use the 552x and the 5500 Coil, or the 52120A Coil as an option. The Test Uncertainty Ratios (TUR) is typically <2:1. This system can only source 1000 A, consequently, this test will not be made at full-scale of the iFlex probes.

To connect the customer current probes to the Analyzer:

1. Connect the 3PHVL-1730 "N" lead and the single test lead to the calibrator NORMAL LO.
2. Connect the calibrator NORMAL V output to the 3PHVL-1730 L1+L2+L3 leads.
3. Connect the calibrator AUX jacks:
   - For the 5500 Coil verification (see Table 13) connect the 5500 coil to the calibrator and the black jack to AUX LO. For a i40S-EL clamp, connect a 5-turn coil to the calibrator. Connect the red jack to either the AUX jack when <3 A is requested or the 20 A jack when >3 A is requested.
   - For the 52120A Coil verification (see Table 14) connect calibrator AUX HI and LO to the 52120A INPUT HI and LO.
4. Connect the current probes under test:
   - For the 5500 Coil verification through the 5500 Coil with arrows pointing up for the correct phase match.
   - Pass the iFlex, or clamp under test through a single loop, or 3 KA coil, or 6 KA coil, with arrows pointing up for the correct phase match as indicated in the table.

   The range can be set in the Dashboard tab of the Calibration Tool.

   Optionally, the range can be set manually in the measurement settings, for example, in PQ Meter on the user interface of the device.
5. Set the calibrator to source 100 V @ 57 Hz and the appropriate currents for the current probe under test.
   - For the 5500 Coil verification (see Table 13) when the 20 A jack column is “No” use the AUX HI connections. When “Yes,” use a 20 A connection. The calibrator switches to the Standby mode when the jack requirement changes.
   - For the 52120A Coil verification (see Table 14) source the voltages listed in the table on the AUX jack, maintaining the 100 V @ 57 Hz out the Normal jacks.

Table 13. Clamp Current Probe Input Verification with 5500A/COIL

Type/Range	20 A Jack	55x2A Current	Applied Signal	Upper Limit	Lower Limit
i40S-EL, Clamp 40A HIGH	No	0.08 A	0.4 A	0.4108	0.3892
i40S-EL, Clamp 40A HIGH	No	0.8 A	4 A	4.036	3.964
i40S-EL, Clamp 40A HIGH	Yes	8 A	40 A	40.288	39.712
i40S-EL, Clamp 40A LOW	No	0.008 A	0.04 A	0.04108	0.03892
i40S-EL, Clamp 40A LOW	No	0.08 A	0.4 A	0.4036	0.3964
i40S-EL, Clamp 40A LOW	No	0.8 A	4 A	4.0288	3.9712
i17xx-FLEX1.5KIP, Flexi 1500A HIGH	Yes	20 A	1000 A	1010.3	989.7
i17xx-FLEX1.5KIP, Flexi 1500A HIGH	Yes	10 A	500 A	505.3	494.7
i17xx-FLEX1.5KIP, Flexi 1500A HIGH	No	2 A	100 A	101.3	98.7
i17xx-FLEX1.5KIP, Flexi 1500A LOW	No	2 A	100 A	101.03	98.97
i17xx-FLEX1.5KIP, Flexi 1500A LOW	No	0.2 A	10 A	10.13	9.87
i17xx-FLEX1.5KIP, Flexi 1500A LOW	No	0.02 A	1 A	1.04	0.96
i17xx-FLEX3KIP, Flexi 3000A HIGH	Yes	20 A	1000 A	1010.9	989.1
i17xx-FLEX3KIP, Flexi 3000A HIGH	Yes	10 A	500 A	505.9	494.1
i17xx-FLEX3KIP, Flexi 3000A HIGH	No	2 A	100 A	101.9	98.1
i17xx-FLEX3KIP, Flexi 3000A LOW	No	2 A	100 A	101.09	98.91
i17xx-FLEX3KIP, Flexi 3000A LOW	No	0.2 A	10 A	10.19	9.81
i17xx-FLEX3KIP, Flexi 3000A LOW	No	0.02 A	1 A	1.10	0.90
i17xx-FLEX6KIP, Flexi 6000A HIGH	Yes	20 A	1000 A	1016.8	983.2
i17xx-FLEX6KIP, Flexi 6000A HIGH	Yes	10 A	500 A	509.3	490.7
i17xx-FLEX6KIP, Flexi 6000A HIGH	No	2 A	100 A	103.3	96.7
i17xx-FLEX6KIP, Flexi 6000A LOW	No	2 A	100 A	101.68	98.32
i17xx-FLEX6KIP, Flexi 6000A LOW	No	0.2 A	10 A	10.33	9.67
i17xx-FLEX6KIP, Flexi 6000A LOW	No	0.02 A	1 A	1.195	0.805

Table 14. Clamp Current Probe Input Verification with 52120A Coil

Type/Range	52120A Range	55x2A Voltage	Applied Signal	Upper Limit	Lower Limit
i40S-EL, Clamp 40A HIGH	2 A	0.4 V	0.4 A	0.4108	0.3892
i40S-EL, Clamp 40A HIGH	20 A	0.4 V	4 A	4.036	3.964
i40S-EL, Clamp 40A HIGH	120 A	0.4 V	40 A	40.288	39.712
i40S-EL, Clamp 40A LOW	2 A	0.04 V	0.04 A	0.04108	0.03892
i40S-EL, Clamp 40A LOW	2 A	0.4 V	0.4 A	0.4036	0.3964
i40S-EL, Clamp 40A LOW	20 A	0.4 V	4 A	4.0288	3.9712
i17xx-FLEX1.5KIP, Flexi 1500A HIGH	120 A + 3 KA COIL[1]	0.6 V	1500 A	1515.3	1484.7
i17xx-FLEX1.5KIP, Flexi 1500A HIGH	120 A + 3 KA COIL[1]	0.32 V	800 A	808.3	791.7
i17xx-FLEX1.5KIP, Flexi 1500A HIGH	120 A	1 V	100 A	101.3	98.7
i17xx-FLEX1.5KIP, Flexi 1500A LOW	120 A	1.1 V	110 A	111.04	108.6
i17xx-FLEX1.5KIP, Flexi 1500A LOW	120 A	0.6 V	60 A	60.9	59.1
i17xx-FLEX1.5KIP, Flexi 1500A LOW	2 A	1 V	1 A	1.04	0.96
i17xx-FLEX3KIP, Flexi 3000A HIGH	120 A + 3 KA COIL[1]	1 V	2500 A	2525.9	2474.1
i17xx-FLEX3KIP, Flexi 3000A HIGH	120 A + 3 KA COIL[1]	0.48 V	1200 A	1212.9	1187.1
i17xx-FLEX3KIP, Flexi 3000A HIGH	120 A	1 V	110 A	101.6	98.4
i17xx-FLEX3KIP, Flexi 3000A LOW	120 A + 3 KA COIL[1]	0.1 V	250 A	253.4	246.6
i17xx-FLEX3KIP, Flexi 3000A LOW	120 A	1.1 V	110 A	112.0	108.0
i17xx-FLEX3KIP, Flexi 3000A LOW	2 A	1 V	1 A	1.07	0.93
i17xx-FLEX6KIP, Flexi 6000A HIGH	120 A + 6 KA COIL[1]	1.1 V	5500 A	5584.3	5415.7
i17xx-FLEX6KIP, Flexi 6000A HIGH	120 A + 6 KA COIL[1]	0.5 V	2500 A	2539.3	2460.7
i17xx-FLEX6KIP, Flexi 6000A HIGH	120 A	1 V	100 A	103.3	96.7
i17xx-FLEX6KIP, Flexi 6000A LOW	120 A + 6 KA COIL[1]	0.11 V	550 A	560.1	540.0
i17xx-FLEX6KIP, Flexi 6000A LOW	120 A	1.1 V	110 A	113.5	106.6
i17xx-FLEX6KIP, Flexi 6000A LOW	2 A	1 V	1 A	1.20	0.80

[1] Steps that use coils are for performance check only due to the low TUR (Test Uncertainty Ratio).

6. When you are done, set the calibrator to Standby.

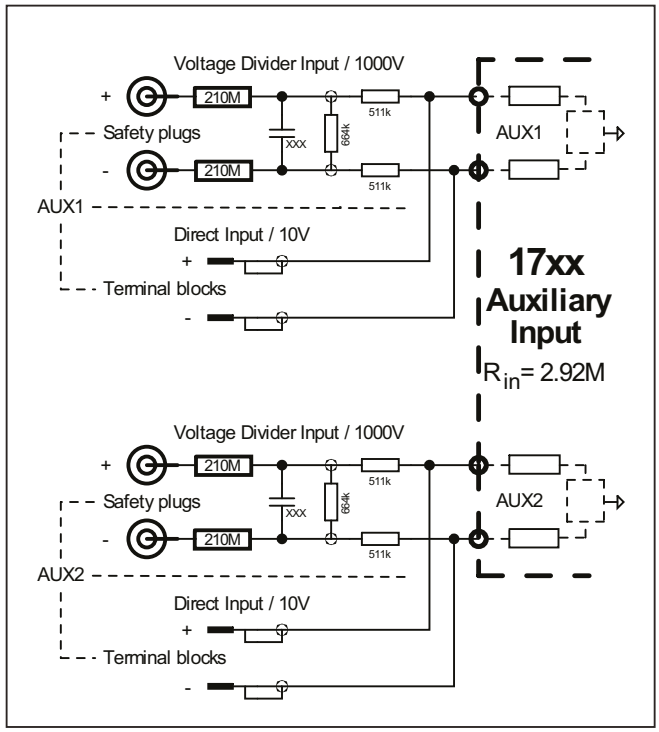
17xx Auxiliary Input Adapter Verification

The Auxiliary Input Adapter has a 1000:1 divider that can be verified with a calibrator and an 8588A. To connect to the pins, use a banana-to-pin adapter. Pomona Electronics 4690 is recommended. See Table 15 and Table 16.

Table 15. 17xx AUX Adapter Pin-out

Pin	Signal
1	AUX 1 +
2	AUX 1 -
3	AUX 2 +
4	AUX 2 -

Table 16. 17xx AUX Voltage Divider Input



Input	Range	Intrinsic Accuracy AUX Adapter + Instrument (% of Reading + % of Range)
Direct Input	±10 V	see instrument specification
Voltage divider input	±1000 V	±(0.5 % + 0.002 V)

Note: Environmental Reference Conditions: 23 °C ±5 °C, instrument operating for at least 30 minutes, no external electrical/magnetic field, RH <65 %.

To verify:

1. Connect the 4-pin connectors AUX 1 + (pin 1) to the 8846A INPUT HI.
2. Connect the 4-pin connectors AUX 1 – (pin 2) to the 8846A INPUT LO.
3. Connect the 17xx AUX Adapter box AUX 1 + and AUX 2 + to the calibrator Normal HI 4.
4. Connect the 17xx AUX Adapter box AUX 1 – and AUX 2 – to the calibrator Normal LO.
5. Set the 8588A to DC V.
6. Apply the voltages in Table 17.
7. Verify that the AUX 1 readings are between the limits.
8. After the values are checked for AUX 1, move the 4-pin connectors leads to AUX 2; Pin 3 to the 8588A INPUT HI; pin 4 connected to the 8588A INPUT LO.
9. Apply the voltages in Table 17. Verify that the AUX 2 readings are between the limits.

Table 17. AUX Input Verification

Calibrator Out DC Volts Vdc	Lower Limit Vdc	Upper Limit Vdc
300.000	2.9848	3.0152
600.000	5.9698	6.0302
990.000	9.8503	9.9497

10. When finished, set the calibrator to Standby.

Calibration Adjust Procedure

This procedure adjusts the Analyzer accuracy at ambient temperature 23 °C ±5 °C (intrinsic error). The required equipment and cables for calibrating the Product are listed in Table 2. See *USB Communication* for instructions on how to set up the PC.

⚠⚠ Warning

To prevent electrical shock, personal injury, or fire:

- **Do not perform the calibration procedures or calibration verification tests described in this manual unless you are qualified to do so.**
- **Repairs or service should be performed only by qualified personnel.**

The Calibration Tool contains an automated adjust. When used, it:

- provides connection instructions
- can control the calibrator to apply the required voltage
- will query the measurement readings of the DMM
- will calculate and store the new calibration factors

In the **Setup** tab, make sure the 177x has a COM port assigned and set the calibrator and DMM control (the Voltage divider is not used for the adjustment procedure).

To do the adjustment:

1. Select the **Adjustment** tab of the 17xx_CalibrationTool. Choose Voltage, Voltage Transient, AUX, or Current calibration for adjustment.
2. Click **Start**.
3. Follow the instructions provided in the automated procedure.

With completion of each measurement parameter adjust, the calibration factors are calculated and stored in the Analyzer.

DC-Offset Calibration

With the instrument firmware V1.1 a feature has been added to automatically adjust the temperature offset drift of the voltage measurement channels. Perform the DC-offset calibration when the V_{RMS} readings show a value of 0.5V or more at any time during the warm-up time.

Note

The DC offset calibration is not mandatory for IEC 61000-4-30 Class A compliance. For AC signals, the DC offset has negligible effect on the VRMS readings. If the AC voltage has an RMS value of 100 V with a DC offset of even 1 V, the error of the VRMS measurement is only 0.005 %. At 10 % of the applied AC voltage, the error is 0.05 V. This is lower than the required maximum deviation of 0.1 V for IEC 61000-4-30 Class A compliance.

To prepare the DC-offset calibration:

- Confirm that the firmware V1.1 or newer is installed.
- Make sure the Analyzer is powered from mains and the BP1770 battery is installed.
- For best results, connect the voltage inputs L1, L2, L3 and N with the voltage input Earth.
- Use the tilt stand to operate the Analyzer in the upright position
- Make sure that the analyzer is not exposed to air flow.

To perform the DC-offset calibration:

1. From the Home Menu navigate to the *Instrument Settings*  .
2. Select **Tools**.
3. Select **DC-Offset Calibration**.

   The message window shows information about the calibration:
   - has calibration been performed
   - internal temperature

Note

Instruments with a serial number above 5600001 are already calibrated in the factory.

4. Start the DC-offset calibration after a few minutes of warm-up time when the internal temperature is about 5 °C above ambient temperature.

   The DC offset calibration measures the DC offset every time the temperature rises by 1 °C. Calibration stops automatically when the temperature has increased by 15 °C from the start value. The calibration may take between one and two hours.

5. Verify the result when the instrument cools down to ambient temperature.

   The VRMS readings should be below 0.2 V. If this is not the case, repeat the procedure and start the DC offset calibration at 35 °C. Then isolate the Analyzer with insulation, for example, bubble wrap, to allow an internal temperature of 50 °C.

   Note

   The internal temperature can reach 70 °C without damage to the Analyzer.