FLUKE®

1730

Energy Analyzer

Calibration Manual

July 2014

LIMITED WARRANTY AND LIMITATION OF LIABILITY

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is two years and begins on the date of shipment. Parts, product repairs, and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries, or to any product which, in Fluke's opinion, has been misused, altered, neglected, contaminated, or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

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Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center to obtain return authorization information, then send the product to that service center, with a description of the difficulty, postage and insurance prepaid (FOB Destination). Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that failure was caused by neglect, misuse, contamination, alteration, accident, or abnormal condition of operation or handling, including overvoltage failures caused by use outside the product's specified rating, or normal wear and tear of mechanical components, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

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To register your product online, visit register.fluke.com.

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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.

The *1730 Energy Analyzer Calibration Manual* provides all the information necessary to perform basic maintenance and make calibration adjustments.

For complete operating instructions, refer to the *1730 Energy Analyzer Users Manual* on the USB drive provided with your product or at www.fluke.com.

How to Contact Fluke

To contact Fluke, use one of these telephone numbers:

- USA: 1-800-760-4523
- Canada: 1-800-36-FLUKE (1-800-363-5853)
- Europe: +31 402-675-200
- Japan: +81-3-6714-3114
- Singapore: +65-6799-5566
- Anywhere in the world: +1-425-446-5500

Go to www.fluke.com to register your product, download manuals, and find more information.

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

Safety Information

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.

⚠⚠ Warning

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

- **Read all safety information before you use the Product.**
- **Use the Product only as specified, or the protection supplied by the Product can be compromised.**
- **Comply with local and national safety codes. Use personal protective equipment (approved rubber gloves, face protection, and flame-resistant clothes) to prevent shock and arc blast injury where hazardous live conductors are exposed.**
- **Examine the case before you use the Product. Look for cracks or missing plastic. Carefully look at the insulation around the terminals.**
- **Replace the mains power cord if the insulation is damaged or if the insulation shows signs of wear.**
- **Use Product-approved measurement category (CAT), voltage, and amperage rated accessories (probes, test leads, and adapters) for all measurements.**
- **Do not use test leads if they are damaged. Examine the test leads for damaged insulation and measure a known voltage.**
- **Do not use the Product if it is damaged.**
- **The battery door must be closed and locked before you operate the Product.**
- **Do not work alone.**
- **Use this Product indoors only.**
- **Do not use the Product around explosive gas, vapor, or in damp or wet environments.**
- **Use only the external mains power supply included with the Product.**
- **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 use a current measurement as an indication that a circuit is safe to touch. A voltage measurement is necessary to know if a circuit is hazardous.**

- **Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.**
- **Do not apply more than the rated voltage, between the terminals or between each terminal and earth ground.**
- **Measure a known voltage first to make sure that the Product operates correctly.**
- **De-energize the circuit or wear personal protective equipment in compliance with local requirements before you apply or remove the flexible current probe.**
- **Remove all probes, test leads, and accessories before the battery door is opened.**

Table 1 is a list of symbols used on the Product or in this manual.

Table 1. Symbols

Symbol	Description
	Risk of Danger. Important information. See manual.
	Hazardous voltage
	Conforms to relevant South Korean EMC standards
	Battery
	Conforms to relevant Australian EMC standards
	Conforms to relevant North American Safety Standards
CE	Conforms to European Union directives
	Double Insulation
CAT II	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	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	Measurement Category IV is applicable to test and measuring circuits connected at the source of the building's low-voltage MAINS installation.
 Li-ion	This product contains a Lithium-ion battery. Do not mix with the solid waste stream. Spent batteries should be disposed of by a qualified recycler or hazardous materials handler per local regulations. Contact your authorized Fluke Service Center for recycling information.
	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.

Specifications

General Specifications

Color LCD Display ..... 4.3-inch active matrix TFT, 480 pixels x 272 pixels, resistive touch panel.

Power/Charging/LED Indicator

Warranty

1730 and Power Supply ..... 2 years (battery not included)
Accessories ..... 1 year

Calibration Cycle ..... 2 years

Dimensions

1730 ..... 19.8 cm x 16.7 cm x 5.5 cm (7.8 in x 6.6 in x 2.2 in)
Power Supply ..... 13.0 cm x 13.0 cm x 4.5 cm (5.1 in x 5.1 in x 1.8 in)
1730 with power supply attached ..... 19.8 cm x 16.7 cm x 9 cm (7.8 in x 6.6 in x 3.5 in)

Weight

1730 ..... 1.1 kg (2.5 lb)

Power Supply ..... 400 g (0.9 lb)

External Protection ..... Holster, Kensington lock

Environmental Specifications

Operating Temperature ..... –10 °C to 50 °C (14 °F to 122 °F)

Storage Temperature ..... –20 °C to 60 °C (–4 °F to 140 °F), with battery: –20 °C to 50 °C (–4 °F to 122 °F)

Operating Humidity ..... <10 °C (<50 °F) non condensing
10 °C to 30 °C (50 °F to 86 °F) ≤95 %
30 °C to 40 °C (86 °F to 104 °F) ≤75 %
40 °C to 50 °C (104 °F to 122 °F) ≤45 %

Operating Altitude ..... 2,000 m (up to 4,000 m derate to 1000 V CAT II/600 V CAT III/300 V CAT IV)

Storage Altitude ..... 12,000 m

IP Rating ..... IEC 60529:IP50, in connected condition with protection caps in place.

Vibration ..... MIL 28800E, Type 3, Class III, Style B

Safety ..... IEC 61010-1: Overvoltage CAT IV, Measurement 1000 V CAT III / 600 V CAT IV, Pollution Degree 2

Electromagnetic Environment ..... IEC 61326-1: Industrial

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 not to be used in homes.

Radio Frequency Emissions ..... IEC CISPR 11: Group 1, Class A.

Group 1 has intentionally generated and/or use 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.

Electrical Specifications

Power Supply

Voltage Range ..... nominal 100 V to 500 V (85 V min to 550 V max) using safety plug input

Mains Power ..... nominal 100 V to 240 V (85 V min to 265 V max) using IEC 60320 C7 input (figure 8 power cord)

Power consumption ..... Maximum 50 VA (max. 15 VA when powered using IEC 60320 input)

Standby Power ..... <0.3 W only when powered using IEC 60320 input

Efficiency ..... ≥68.2 % (in accordance with energy efficiency regulations)

Mains Frequency ..... 50/60 Hz ±15 %

Battery Power ..... Li-ion 3.7 V, 9.25 Wh, customer-replaceable

On-Battery Runtime ..... up to 4 hr (up to 5.5 hr in energy saving mode)
Charging Time ..... <6 hr

Data Acquisition

Resolution ..... 16-bit synchronous sampling
Sampling Frequency ..... 5120 Hz
Input Signal Frequency ..... 50/60 Hz (42.5 to 69 Hz)
Wiring Configurations ..... 1-Φ, 1-Φ IT, Split phase, 3-Φ wye, 3-Φ wye IT, 3-Φ wye balanced, 3-Φ delta, 3-Φ Aron/Blondel (2-element delta), 3-Φ delta open leg, 3-Φ high leg delta, 3-Φ delta balanced. Currents only (load studies)
Interfaces
USB-A ..... File transfer via USB Flash Drive, Firmware updates, max. supply current: 120 mA
USB-mini ..... Data download device to PC
Extension port ..... Accessories
Total Harmonic Distortion (THD) ..... THD for voltage and current is calculated on 25 harmonics
Averaging Time ..... User selectable: 1 sec, 5 sec, 10 sec, 1 min, 5 min, 10 min, 15 min, 30 min
Averaging time min/max values
Voltage ..... Full cycle RMS (20 ms at 50 Hz, 16.7 ms at 60 Hz) according to IEC61000-4-30 Class A
Current ..... Half cycle RMS (10 ms at 50 Hz, 8.3 ms at 60 Hz)
Aux, Power ..... 200 ms
Demand Interval ..... User selectable: 5 min, 10 min, 15 min, 20 min, 30 min
Data Storage ..... Internal flash memory (not user replaceable)
Memory Size ..... Typical 20 logging sessions of 10 weeks with 10-minute intervals[1]

Logging Period

Averaging Period	Recommended for 20 sessions	Logging Period for 1 session
1 sec	3 hr	2.5 days
5 sec	15 hr	12 days
10 sec	28 hr	24 days
30 sec	3.5 days	10 weeks
1 min	7 days	20 weeks
5 min	5 weeks	2 years
10 min	10 weeks	>2 years
15 min	3.5 months	>2 years
30 min	7 months	>2 years

[1] The number of possible logging sessions and logging period depends on user requirements.

Voltage Inputs

Number of Inputs ..... 4 (3 phases and neutral)
Maximum Input Voltage ..... 1000 V_{rms} (1700 V_{pk}) phase to neutral
Input Impedance ..... 10 MΩ each phase to neutral
Bandwidth (–3 dB) ..... 42.5 Hz - 2.3 kHz
Scaling ..... 1:1, variable

Current Inputs

Number of Inputs ..... 3, mode selected automatically for attached sensor
Current Sensor Output Voltage
Clamp ..... 500 mV_{rms} / 50 mV_{rms}; CF 2.8
Rogowski Coil ..... 150 mV_{rms} / 15 mV_{rms} at 50 Hz, 180 mV_{rms} / 18 mV_{rms} at 60 Hz; CF 4; all at nominal probe range
Range ..... 1 A to 150 A / 10 A to 1500 A with iFlex1500-12
3 A to 300 A / 30 A to 3000 A with iFlex3000-24
6 A to 600 A / 60 A to 6000 A with iFlex6000-36
40 mA to 4 A / 0.4 A to 40 A with 40 A clamp i40s-EL
Bandwidth ..... 42.5 Hz – 2.3 kHz
Scaling ..... 1:1, variable

Auxiliary Inputs

Number of Inputs 2
Input Range ..... 0 to ±10 V dc, 1 reading/s
Scale factor ..... Format: kx + d (Gain and offset) user configurable
Displayed units ..... User configurable (up to 8 characters, for example °C, psi, or m/s)

Accuracy at Reference Conditions

Parameter			Range	Max. Resolution	Intrinsic Accuracy at Reference Conditions (% of Reading + % of Range)
Voltage			1000 V	0.1 V	±(0.2 % + 0.01%)
Current	Direct Input	Rogowski Mode	15 mV	0.01 mV	±(0.3 % + 0.02 %)
			150 mV	0.1 mV	±(0.3 % + 0.02 %)
		Clamp Mode	50 mV	0.01 mV	±(0.2 % + 0.02 %)
			500 mV	0.1 mV	±(0.2 % + 0.02 %)
	1500A Flex		150 A	0.1 A	±(1 % + 0.02 %)
			1500 A	1 A	±(1 % + 0.02 %)
	3000 A Flexi		300 A	1 A	±(1 % + 0.03 %)
			3000 A	10 A	±(1 % + 0.03 %)
	6000 A Flexi		600 A	1 A	±(1.5 % + 0.03 %)
			6000 A	10 A	±(1.5 % + 0.03 %)
	40 A		4 A	1 mA	±(0.7 % + 0.02 %)
			40 A	10 mA	±(0.7 % + 0.02 %)
Frequency			42.5 Hz to 69 Hz	0.01 Hz	±0.1 %
Aux Input			±10 Vdc	0.1 mV	±(0.2 % + 0.02 %)
Voltage Min/Max			1000 V	0.1 V	±(1 % + 0.1 %)
Current Min/Max			defined by accessory	defined by accessory	±(5 % + 0.2 %)
THD on Voltage			1000 %	0.1 %	±(2.5 % + 0.05 %)
THD on Current			1000 %	0.1 %	±(2.5 % + 0.05 %)

Power/Energy					
Parameter	**Direct Input[1]**	**iFlex1500-12**	**iFlex3000-24**	**iFlex6000-36**	**i40S-EL**
	Clamp: 50 mV/500 mV Rogowski: 15 mV/150 mV	150 A/1500 A	300 A/3000 A	600/6000 A	4 A/40 A
Power Range W, VA, var	Clamp: 50 W/500 W Rogowski: 15 W/150 W	150 kW/1.5 MW	300 kW/3 MW	600 kW/6 MW	4 kW/40 kW
Max. Resolution W, VA, var	0.1 W	0.1 kW/1 kW	1 kW/10 kW	1 kW/10 kW	1 W/10 W
Max. Resolution PF, DPF	0.01				
Phase (Voltage to Current) [1]	±0.2 °	±0.28 °			±1 °
[1] Only for calibration laboratories					

Intrinsic Uncertainty ±(% of measurement value + % of power range)						
Parameter	**Influence Quantity**	**Direct Input [1]**	**iFlex1500-12**	**iFlex3000-24**	**iFlex6000-36**	**i40S-EL**
		Clamp: 50 mV/500 mV Rogowski: 15 mV/150 mV	**150 A/1500 A**	**300 A/3000 A**	**600/6000 A**	**4 A/40 A**
Active Power P Active Energy E_a	PF ≥ 0.99	0.5 % + 0.005 %	1.2 % + 0.005 %	1.2 % + 0.0075 %	1.7 % + 0.0075 %	1.2 % + 0.005 %
	0.1≤ PF < 0.99	$\left(0.5+\frac{\sqrt{1-PF^2}}{3\times PF}\right)\%$ + 0.005 %	$\left(1.2+\frac{\sqrt{1-PF^2}}{2\times PF}\right)\%$ + 0.00 5 %	$\left(1.2+\frac{\sqrt{1-PF^2}}{2\times PF}\right)\%$ + 0.0075 %	$\left(1.7+\frac{\sqrt{1-PF^2}}{2\times PF}\right)\%$ + 0.0075 %	$\left(1.2+1.7\times\frac{\sqrt{1-PF^2}}{PF}\right)\%$ + 0.005 %
Apparent Power S Apparent Energy E_{ap}	0≤ PF ≤ 1	0.5 % + 0.005 %	1.2 % + 0.005 %	1.2 % + 0.0075 %	1.7 % + 0.0075 %	1.2 % + 0.005 %
Reactive Power Q Reactive Energy E_r	0≤ PF ≤ 1	2.5 % of measured apparent power/energy				
Power Factor PF Displacement Power Factor DPF/cosφ	-	Reading ± 0.025				
Additional uncertainty (% of power high-range)	V_{P-N} > 250 V	0.015 %	0.015 %	0.0225 %	0.0225 %	0.015 %

[1] Only for calibration laboratories

Reference Conditions:

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

Input conditions: CosΦ/PF=1, Sinusoidal signal f=50/60 Hz, power supply 120 V/230 V ±10 %.

Current and power specifications: Input voltage 1ph: 120 V/230 V or 3ph wye/delta: 230 V/400 V

Input current > 10 % of current range

Primary conductor of clamps or Rogowski coil in center position

Temperature Coefficient: Add 0.1 x specified accuracy for each degree C above 28 °C or below 18 °C

Example:

Measurement at 120 V/16 A using an iFlex1500-12 in low range. Power Factor is 0.8

Active power uncertainty σ_P:

$\sigma_P = \pm\left(\left(1.2\ \% + \frac{\sqrt{1-0.8^2}}{2\times 0.8}\right) + 0.005\ \% \times P_{Range}\right) = \pm(1.575\ \% + 0.005\ \% \times 1000\ V \times 150\ A) = \pm(1.575\ \% + 7.5\ W)$

The uncertainty in W is $\pm(1.575\ \% \times 120\ V \times 16\ A \times 0.8 + 7.5\ W) = \pm 31.7$ W

Apparent power uncertainty σ_S:

$\sigma_S = \pm\left(1.2\ \% + 0.005\ \% \times S_{Range}\right) = \pm(1.2\ \% + 0.005\ \% \times 1000\ V \times 150\ A) = \pm(1.2\ \% + 7.5\ VA)$

The uncertainty in VA is $\pm(1.2\ \% \times 120\ V \times 16\ A + 7.5\ VA) = \pm 30.54$ VA

Reactive/non-active power uncertainty σ_Q:

$\sigma_Q = \pm(2.5\ \% \times S) = \pm(2.5\ \% \times 120\ V \times 16\ A) = \pm 48\ var$

In case of a measured voltage that is >250 V, the additional error is calculated with:

$Adder = 0.015\ \% \times S_{High\ Range} = 0.015\ \% \times 1000\ V \times 1500\ A = 225$ W / VA / var

Maintenance

If the Logger 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 covers 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 avoid damage, do not use abrasives or solvents on this instrument.

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

Battery Replacement

The Logger has an internal rechargeable Lithium-ion battery.

To replace the battery:

1. Remove the Power Supply.
2. Unscrew the four screws and remove the battery door.
3. Replace the battery.
4. Fasten the battery door.

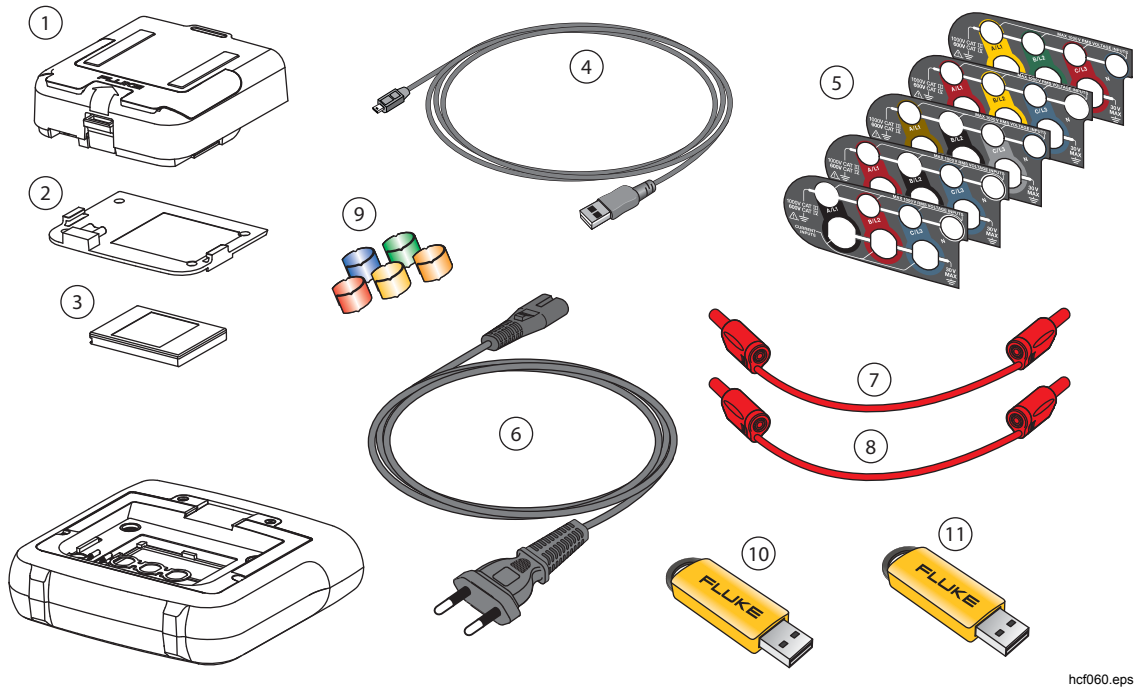
⚠ Caution

To prevent damage to the Product, use only original Fluke batteries.

Replacement Parts

Replacement parts and accessories are listed in Table 2. To order parts and accessories, see *How to Contact Fluke*.

Table 2. Replacement Parts



Ref.	Description	Qty.	Fluke Part or Model Number
①	Power Supply	1	4212737
②	Battery Door	1	4388072
③	Battery Pack, Li ion 3.7 2500 mAh	1	4146702
④	USB Cable	1	1671807
⑤	Input Decal, country specific (US, Canada, Europe/UK, UK/old, China)	1	varies
⑥	Line Cord, country specific (N. American, Europe, UK, Australia, Japan, India/S. Africa, Brazil)	1	varies
⑦	Set of Test Leads 0.10 m Red/Black, 1000 V Cat III	1	4344653
⑧	Set of Test Leads 2 m Red/Black, 1000 V Cat III	1	4344675
⑨	Color-coded Wire Clips	1 set	4394925
⑩	USB Flash Drive	1	4298561
⑪	Users Manual on USB Flash Drive	1	NA

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 3 for a list of requirements for the verification tests and calibration adjustment of the 1730.

Table 3. Required Equipment

Equipment	Model	Notes	Used on:	
			Verification Tests	Calibration Adjustment
Calibrator	5522A	5520A is also supported	X	X
Coil	5500A/COIL		X	X
Cable Assembly	3PHVL-1730	Voltage Test Lead 3-Phase+N	X	X
1730 AUX Input Cable	PN 4395217	Qty. 2 required	X	X
Male BNC to Dual Female BNC Adapter	PM9093		X	X
BNC Female to Double Banana Plug	Pomona 1269		X	X
1730 Calibration Cables – Voltage-to-Current Input Cable Assembly[1]	NA	Qty. 3 required	X	X
1730 Verification Box[1]	NA		optional	X
USB cable	type A-to-mini A		X	X

[1] The 1730 calibration cables and verification box are not available from Fluke. See *Equipment Assembly* for information on how to make these items.

Equipment Assembly

The 1730 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.

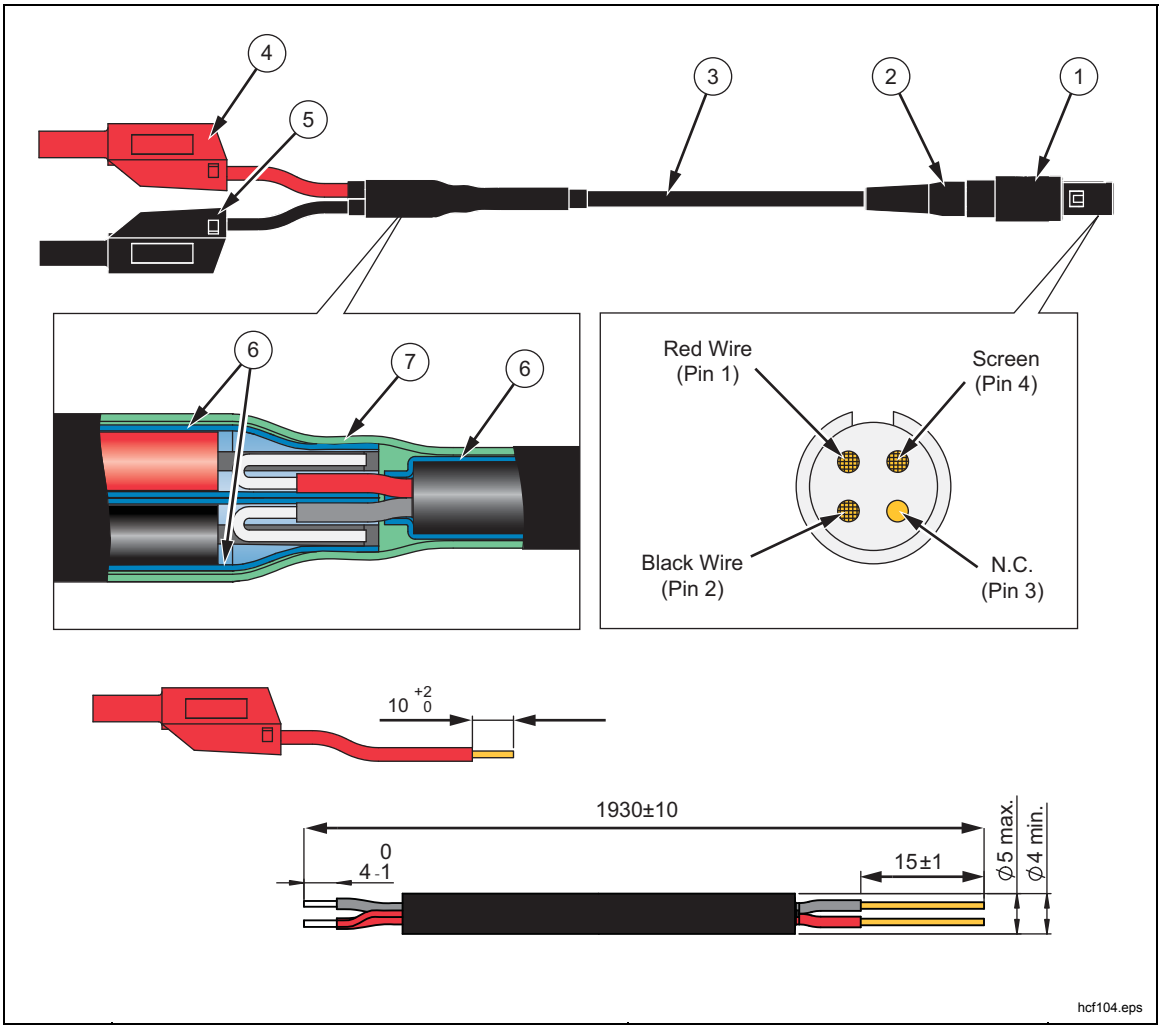
1730 Calibration Cable Assembly

See Table 4 for instructions on how to make the calibration cables.

⚠ Caution

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

Table 4. 1730 Calibration Cables, Voltage-to-Current-Input



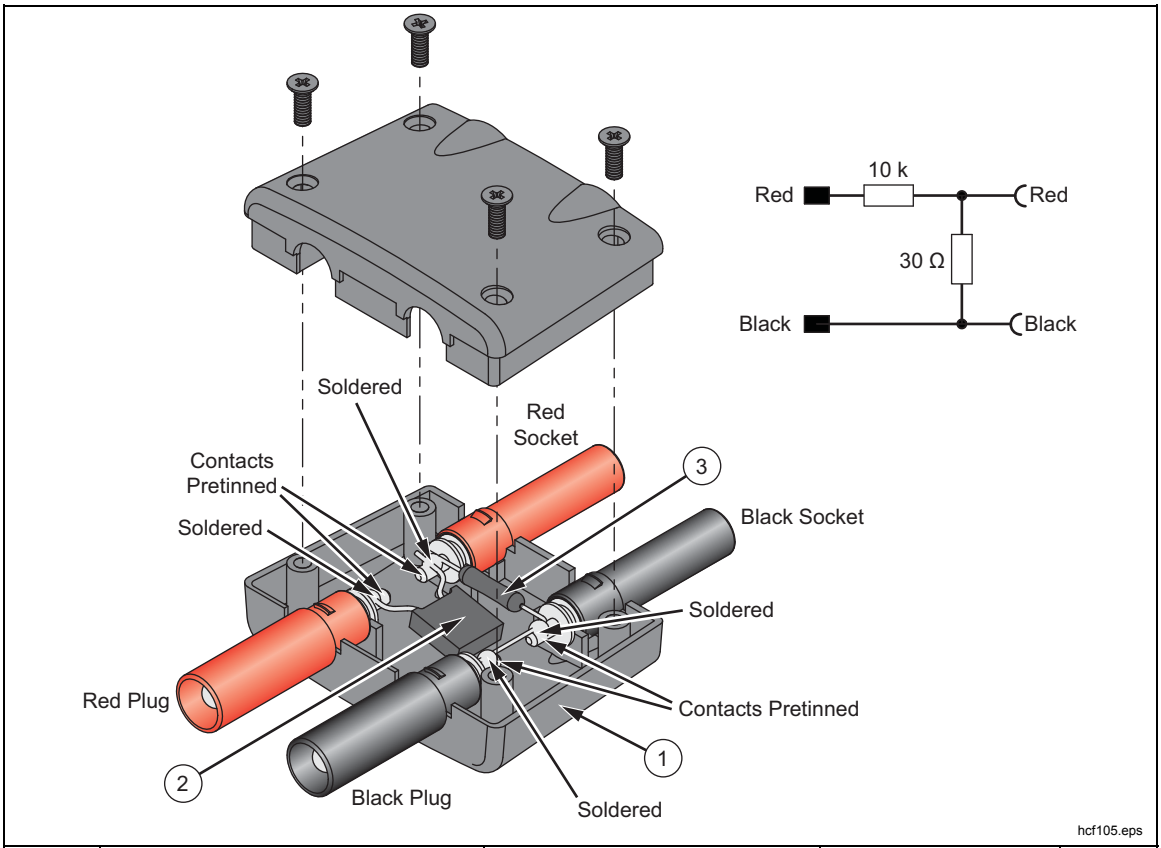
Item	Description	Part Number/Info	QTY
①	Straight Plug, IP50, 4-Pole	ODU: S21M08-P04MJG0-528S	1
②	Cable Bend Relief	ODU: 701-023208965-040	1
③	Signal-Cable, 2x AWG 22-24, shielded	∅4-5 mm (Fluke equiv. # 3803634)	1
④	Test Lead with 4 mm Safety Plug, stackable	red	1
⑤	Test Lead with 4 mm Safety Plug, stackable	black	1
⑥	Heat Shrink Tubing, 2:1	∅=4.8 mm (3/16"); L=35 mm	3
⑦	Heat Shrink Tubing, 3:1, adhesive	∅=12 mm (1/2"); L=60 mm	1

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 1730 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 1730 input loading will not significantly impact the applied voltage.

Fluke recommends using a verification box that has a divider with 30 Ω across the 1730 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. 1730 Verification Box



Item	Description	Part Number/Info	Fluke Part Number	QTY
①	Multi-Contact Box: MA 524	Type: XKH-4/19/A Order-No.: 66.9045-33	NA	1
②	Resistor, Metal Foil 10 kΩ, ±0.1 %, 0.6 W, ±4.5 PPM	Red Plug/Red Socket	2114858	1
③	Resistor, 30 Ω, 1W, 1% 20 PPM	Red Socket/Black Socket + Bridge Black Plug/Socket	1757740	1

System Requirements

The system requirements for this verification procedure are:

- WinXP 32-bit, Windows 7 32/64-bit, Windows 8 32/64-bit
- 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 to control the calibrator (optional)
- Microsoft Excel 2010 32-bit software or higher (versions below 2010 not tested)
- Fluke Energy Analyze software

USB Communication

Some of the range changes in the verification require remote commands to set the range. To communicate between the PC and the 1730, the 1730 driver must be installed. This driver is installed when the Fluke Energy Analyze (FEA) software is installed.

Use these steps to identify the COM port:

1. Make sure the instrument is powered and connected with the PC.
2. Press: <Windows key>**-R**.
3. Type: **devmgmt.msc** <ENTER>.
4. Go to **Ports (COM & LPT)** and double-click to open the sub-tree.
5. Find **Fluke 1730 Energy Logger**. The port number is shown in parenthesis after this text, for example, COM6.

A detailed description of the spreadsheet is found in the *How to Use the Spreadsheet* section.

How to Use the Spreadsheet

The Excel workbook, *Fluke1730-ExcelTool_Vx.xx.xlsm*, (ExcelTool-*available at* www.fluke.com), communicates with the Fluke 1730 using remote commands through the USB ports. The Excel file supports both the 5520A and 5522A Calibrators.

Note

The Excel file uses macros. Make sure execution of macros is enabled on your PC.

Make sure that Fluke Energy Analyze is closed when using the Excel program. After closing Energy Analyze, disconnect and reconnect the USB cable or turn off and turn on the instrument to reset the communication protocol in the instrument.

In order to communicate, you must know which COM port the Fluke 1730 uses.

To find the COM port:

1. Make sure the instrument is powered and connected with the PC.
2. On the PC keyboard, press <Windows key> and type **-R**.
3. Type **devmgmt.msc** and press **<ENTER>**.
4. Go to Ports (COM & LPT) and double-click to open the sub-tree.
5. Find **Fluke 1730 Energy Logger**. The port number is shown in parenthesis after this phrase, for example, COM6.

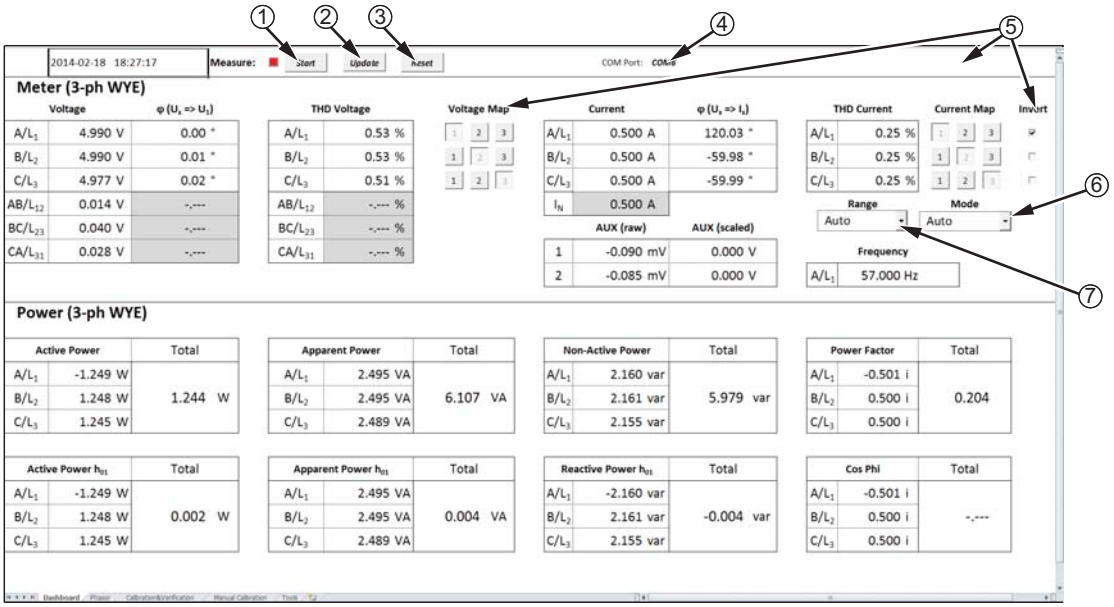
The workbook contains sheets for various tasks:

- **Dashboard** – Live measurement parameters, set current input range/mode, COM port configuration
- **Phasor** – Displays a phasor diagram
- **Calibration & Verification** – Procedures to perform the calibration and verification

Dashboard

The Dashboard sheet provides all parameters at a glance that are available with the Meter and Power buttons on the instrument plus the phase angles and calculated Neutral current I_N. You can configure phase mapping, invert current inputs, and set the hardware range/mode of the current inputs, as well as configure the used COM port in the dashboard. These settings are used also in all other sheets. See Table 6.

Table 6. Dashboard in Excel Worksheet



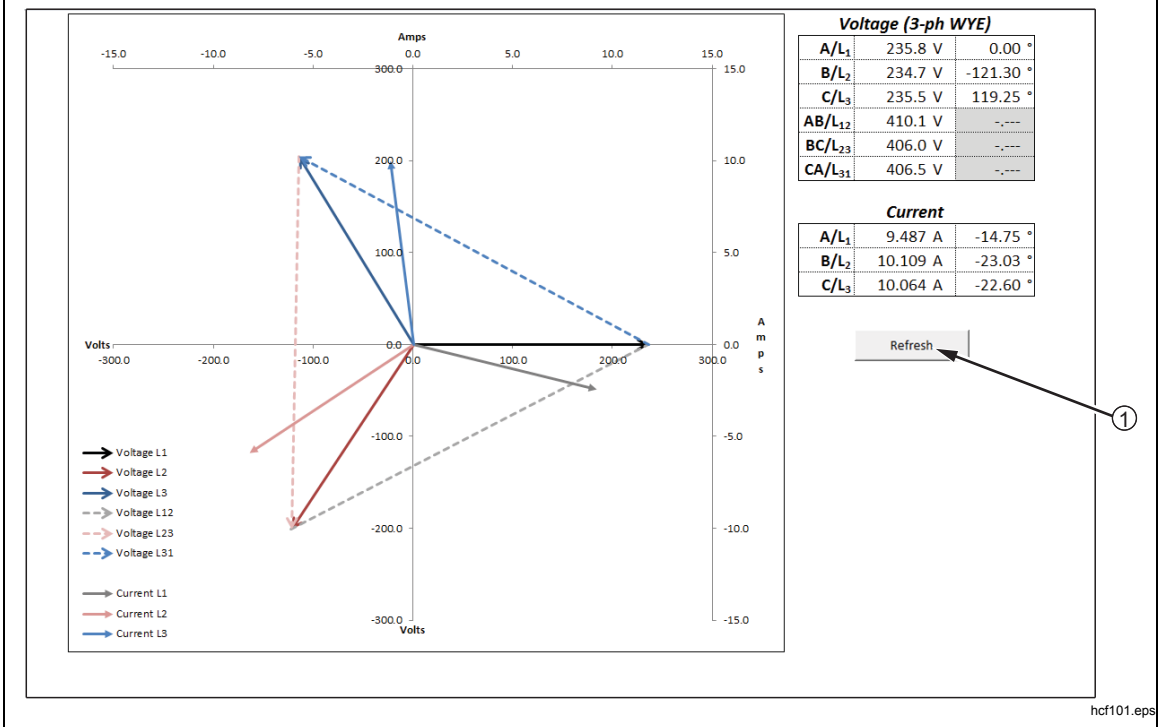
hcf100.eps

Item	Description
①	Start live data read-out. The readings are refreshed every 1 s. Use the same button to stop live updates. During the live updates only the Dashboard and Phasor sheets are accessible.
②	One time live data update.
③	Resets phase mapping and inverted current inputs to default.
④	Selected COM port. Click on the text to get a list of available COM ports. See page 14 for instructions on how to identify the port used by Fluke 1730.
⑤	Phase mapping and inverting current inputs.
⑥	Configure the current input for Rogowski coils (Flexi coils) or Clamps. When set to AUTO, the attached accessory determines the configuration.
⑦	Configure Range as AUTO, High, or Low. Different from the Measurement configuration dialog on the instrument, the settings High and Low can be configured without a connected sensor.

Phasor

The Phasor sheet provides live data read-out as a phasor diagram. See Table 7.

Table 7. Phasor in Excel Worksheet

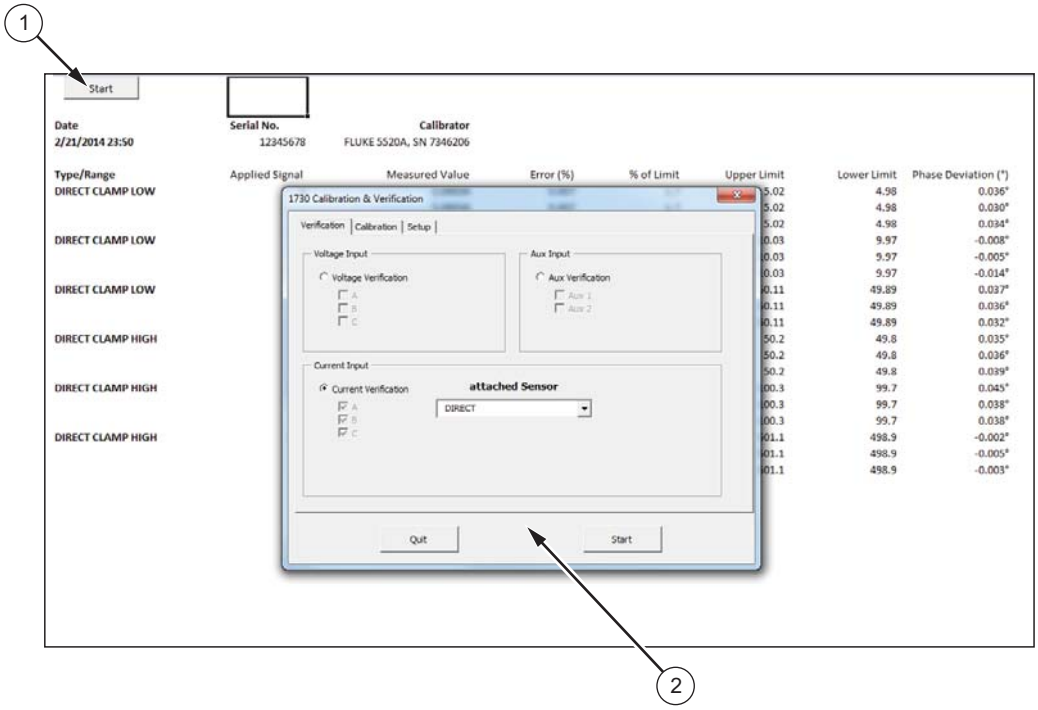


Item	Description
①	Start live data read-out. The readings are refreshed every 1 s. Use the same button to stop live updates. During the live updates only the Dashboard and Phasor sheets are accessible.

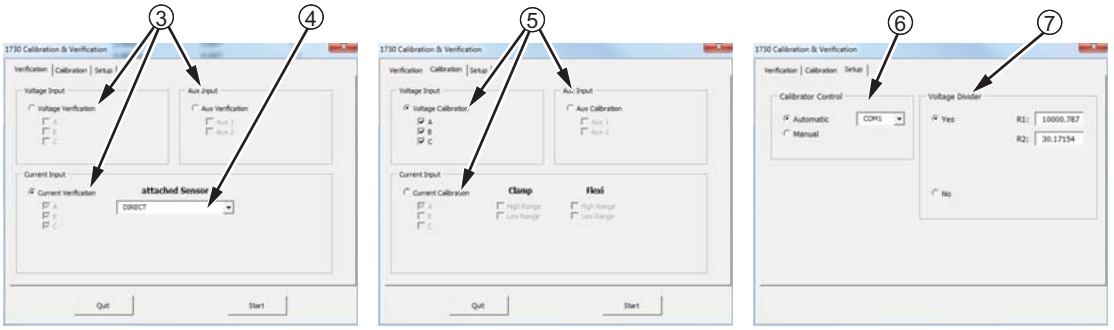
Calibration and Verification

The Calibration and Verification sheet are the built-in procedures. See Table 8.

Table 8. Calibration and Verification in Excel Worksheet



hcf102.eps



Verification Calibration Setup

hcf103.eps

Item	Description
①	Start button – When the selection window ② has been closed with Quit, click the Start button again to open.
②	Selection window – Click on Verification, Calibration, and Setup to select the action. Close the window with Quit. Open again with Start ①.
③	Verification items – Select Voltage Input, AUX Input or Current Input to verify. For a Fluke 1730 verification, all three items must be verified sequentially. Make sure the sensor selector (4) is set to DIRECT for the Fluke 1730 verification. A specific order is not required.

Table 8. Calibration & Verification in Excel Worksheet (cont.)

Item	Description
④	Sensor selector – select items from the list for a verification of the accessory. Use DIRECT for the Fluke 1730 verification.
⑤	Calibration items – Select Voltage, AUX Input or Current input for calibration. For a Fluke 1730 calibration all three items need to be calibrated sequentially. A specific order is not required.
⑥	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*.
⑦	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.
Supported Calibrators: Fluke 5520A and 5522A Calibrator settings: Baud rate: 9600 Data bits: 8 Stop bit: 1 Parity: None Stall: XON/XOFF EOL: CR/LF	

Basic Instrument Setup for all Verifications

The *Fluke1730-ExcelTool_Vxxx* (ExcelTool) has built-in procedures to verify and adjust the 1730. The Verification 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 1730 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 1730 input loading will not significantly impact the applied voltage.

The ExcelTool calculates the voltage that should be applied based on the values entered in the setup screen.

1. Apply power to the 1730 using the power supply and line cord.
2. Turn on the 1730.
3. Connect the 1730 USB to the PC and start a communication program. See *USB Communication*.
4. Select Instrument Setup as **no voltage transformers used**.

Accuracy Verification Procedure

The procedure verifies the Energy Logger accuracy at ambient temperature 23 °C ±2 K (intrinsic error).

A complete accuracy verification of the Fluke 1730 consists of:

- Voltage Measurement
- Current Measurement
- AUX Measurement
- Optional Flexi or Current Verification

Voltage Measurement

1. Select the basic instrument setup required for all verifications, see page 18.
2. Connect the VL1730 "N" lead to the calibrator NORMAL LO.
3. The 1730 must be on battery power with ≥50 % charge.
4. Connect the calibrator NORMAL V output to the VL1730 L1+L2+L3 leads.
5. Sequentially set the calibrator to the voltages indicated in Table 9 and check that the Energy Logger reading is between the limits.
6. Do this for all ranges indicated in Table 9:
   - set the calibrator to supply a 57.0 Hz sine wave for all voltages
   - wait until each reading has stabilized

   The spreadsheet is the first choice for readings. Readings will have more resolution from the spreadsheet.
7. Push METER to select the Energy Logger voltage display.

Table 9. Voltage Verification

Nominal Voltage (Range)	Calibrator voltage (57 Hz sine wave)	Minimum Reading ± (1% + 0.1%)	Maximum Reading
1000	10	9.9	10.1
1000	100	99.7	100.3
1000	500	498.9	501.1
1000	1000	998	1002

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

Current Measurement

Fluke recommends using a divider with 30 Ω across the 1730 input and 10 kΩ in series with high side of the input:

- Fluke PN 2114858 (10 k)
- 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.

1. Connect the Voltage-to-Current Input Cable Assembly to the Energy Logger current probe input. See Table 4.

⚠ Caution

Be careful when you set the calibrator output voltages. High voltages applied to the current input will damage the 1730.

2. Connect the VL1730 "N" lead to the calibrator AUX LO.
3. Connect the calibrator AUX HI output to the VL1730 L1+L2+L3 leads.
4. Stack the three calibration cables, PN4293284, together: red to red and blue to blue.
5. Plug the attenuator into the calibrator Normal HI and LO.
6. Connect the stacked calibration cables, PN4293284, to the attenuator. The blue leads connected to NORMAL LO.
7. For all ranges in Table 10, set the calibrator to the voltages indicated in the given order. Check that the values are between the limits.

Table 10. Flexi Current Probe Input Verification

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

[1] Calibrator Output Impedance and 1730 loading will effect actual voltage being applied. Use of divider and Spreadsheet described above recommended

8. When you are finished, set the calibrator to Standby.

AUX Input Check

1. Connect 1730 AUX input cables, PN 4395217, to each of the 1730 AUX inputs.
2. Connect the 1730 AUX input cable BNCs to a BNC-T with a dual banana plug connector.
3. Plug the dual banana into the calibrator Normal HI and LO, Shield to LO.
4. For all the voltages in Table 11, set the calibrator and check that the values are between the limits.

Table 11. AUX Input Verification

Calibrator Out DC Volts	Lower Limit Vdc	Upper Limit Vdc
-10.0000	-9.9790	-10.0210
-5.0000	-4.9890	-5.0110
-1.0000	-0.9970	-1.0030
-0.5000	-0.4980	-0.5020
-0.1000	-0.0988	-0.1012
-0.0100	-0.00898	-0.01102
0.0100	0.01102	0.00898
0.1000	0.1012	0.0988
0.5000	0.5020	0.4980
1.0000	1.0030	0.9970
5.0000	5.0110	4.9890
10.0000	10.0210	9.9790

5. Set the Calibrator to Standby.

Optional Flexi or Clamp Verification (Combined 1730 and Probe Specifications)

This feature of the spreadsheet checks the 1730 combined with current probes. These tests use the 552x and the 5500Coil. 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 Flexi probes.

To connect the customer current probes to the 1730:

1. Connect the VL1730 "N" lead to the calibrator NORMAL LO.
2. Connect the calibrator NORMAL V output to the VL1730 L1+L2+L3 leads.
3. Connect the 5500 coil to the calibrator and the black jack to AUX LO.
4. Connect the red jack to either the AUX jack when <3A is requested or the 20 A jack when >3 A is requested.
5. Connect all the current probes under test through the 5500Coil with arrows pointing up for the correct phase match.
6. The spreadsheet Verification tab has an Attached Sensor drop-down list box to select the probe that is connected.

7. Set the calibrator to source 100 V @ 57 Hz and the appropriate currents from Table 12 for the current probe under test. The 20 A jack column is “No” when the AUX HI connections should be used; “Yes” when 20 A connection is required. The calibrator switches to the Standby mode when the jack requirement changes.

Table 12. Clamp Current Probe Input Verification

Type/Range	20 A Jack	5520A current	Applied Signal	Upper Limit	Lower Limit
i40S-EL, Clamp 40A HIGH	No	0.008 A	0.4A	0.4108	0.3892
i40S-EL, Clamp 40A HIGH	No	0.08 A	4A	4.036	3.964
i40S-EL, Clamp 40A HIGH	No	0.8 A	40A	40.288	39.712
i40S-EL, Clamp 40A LOW	No	0.0008 A	0.04A	0.04108	0.03892
i40S-EL, Clamp 40A LOW	No	0.008 A	0.4A	0.4036	0.3964
i40S-EL, Clamp 40A LOW	No	0.08 A	4A	4.0288	3.9712
iFlex1500-12, Flexi 1500A HIGH	Yes	20 A	1000A	1010.3	989.7
iFlex1500-12, Flexi 1500A HIGH	Yes	10 A	500A	505.3	494.7
iFlex1500-12, Flexi 1500A HIGH	No	2 A	100A	101.3	98.7
iFlex1500-12, Flexi 1500A LOW	No	2 A	100A	101.03	98.97
iFlex1500-12, Flexi 1500A LOW	No	0.2 A	10A	10.13	9.87
iFlex1500-12, Flexi 1500A LOW	No	0.02 A	1A	1.04	0.96
iFlex3000-24, Flexi 3000A HIGH	Yes	20 A	1000A	1010.6	989.4
iFlex3000-24, Flexi 3000A HIGH	Yes	10 A	500A	505.6	494.4
iFlex3000-24, Flexi 3000A HIGH	No	2 A	100A	101.6	98.4
iFlex3000-24, Flexi 3000A LOW	No	2 A	100A	101.06	98.94
iFlex3000-24, Flexi 3000A LOW	No	0.2 A	10A	10.16	9.84
iFlex3000-24, Flexi 3000A LOW	No	0.02 A	1A	1.07	0.93
iFlex6000-36, Flexi 6000A HIGH	Yes	20 A	1000A	1016.8	983.2
iFlex6000-36, Flexi 6000A HIGH	Yes	10 A	500A	509.3	490.7
iFlex6000-36, Flexi 6000A HIGH	No	2 A	100A	103.3	96.7
iFlex6000-36, Flexi 6000A LOW	No	2 A	100A	101.68	98.32
iFlex6000-36, Flexi 6000A LOW	No	0.2 A	10A	10.33	9.67
iFlex6000-36, Flexi 6000A LOW	No	0.02 A	1A	1.195	0.805

8. When you are done, set the Calibrator to Standby.

Calibration Adjust Procedure

This procedure adjusts the 1730 accuracy at ambient temperature 23 °C ±2 K (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 avoid 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 servicing should be performed only by qualified personnel.**

The spreadsheet contains an automated adjust in the *Calibration & Verification* worksheet. When used, it provides connection instructions, can control the calibrator to apply the required voltage, and then will calculate and store the new calibration factors.

When this worksheet is active, the selection box should pop up. If not, click **Start** button on the upper right of the worksheet.

In the Setup tab, only the Calibrator control needs to be set (the Voltage divider is not used in the 1730 Adjust).

Select the Calibration tab of the 1730 Calibration & Verification pop-up. Choose Voltage, AUX, or Current calibration and check the boxes to select items for adjustment.

1. When selection is complete, click **Start**.
2. Follow the instructions provided in the automated procedure.

When the 1730 Calibration & Verification popup box shows again, the calibration factors have been calculated and stored in the 1730.

This concludes the calibration.