FLUKE Biomedical

QA-ES III

Electrosurgery Analyzer

Getting Started Manual

PN 4473063
December 2015, Rev. 1

Warranty and Product Support

Fluke Biomedical warrants this instrument against defects in materials and workmanship for one year from the date of original purchase OR two years if at the end of your first year you send the instrument to a Fluke Biomedical service center for calibration. You will be charged our customary fee for such calibration. During the warranty period, we will repair or at our option replace, at no charge, a product that proves to be defective, provided you return the product, shipping prepaid, to Fluke Biomedical. This warranty covers the original purchaser only and is not transferable. The warranty does not apply if the product has been damaged by accident or misuse or has been serviced or modified by anyone other than an authorized Fluke Biomedical service facility. NO OTHER WARRANTIES, SUCH AS FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSED OR IMPLIED. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, ARISING FROM ANY CAUSE OR THEORY.

This warranty covers only serialized products and their accessory items that bear a distinct serial number tag. Recalibration of instruments is not covered under the warranty.

This warranty gives you specific legal rights and you may also have other rights that vary in different jurisdictions. Since some jurisdictions do not allow the exclusion or limitation of an implied warranty or of incidental or consequential damages, this limitation of liability may not apply to you. If any provision of this warranty is held invalid or unenforceable by a court or other decision-maker of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

7/07

Notices

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Unpacking and Inspection

Follow standard receiving practices upon receipt of the instrument. Check the shipping carton for damage. If damage is found, stop unpacking the instrument. Notify the carrier and ask for an agent to be present while the instrument is unpacked. There are no special unpacking instructions, but be careful not to damage the instrument when unpacking it. Inspect the instrument for physical damage such as bent or broken parts, dents, or scratches.

Technical Support

For application support or answers to technical questions, either email techservices@flukebiomedical.com or call 1-800- 850-4608 or 1-440-248-9300. In Europe, email techsupport.emea@flukebiomedical.com or call +31-40-2965314.

Claims

Our routine method of shipment is via common carrier, FOB origin. Upon delivery, if physical damage is found, retain all packing materials in their original condition and contact the carrier immediately to file a claim. If the instrument is delivered in good physical condition but does not operate within specifications, or if there are any other problems not caused by shipping damage, please contact Fluke Biomedical or your local sales representative.

Returns and Repairs

Return Procedure

All items being returned (including all warranty-claim shipments) must be sent freight-prepaid to our factory location. When you return an instrument to Fluke Biomedical, we recommend using United Parcel Service, Federal Express, or Air Parcel Post. We also recommend that you insure your shipment for its actual replacement cost. Fluke Biomedical will not be responsible for lost shipments or instruments that are received in damaged condition due to improper packaging or handling.

Use the original carton and packaging material for shipment. If they are not available, we recommend the following guide for repackaging:

- Use a double–walled carton of sufficient strength for the weight being shipped.
- Use heavy paper or cardboard to protect all instrument surfaces. Use nonabrasive material around all projecting parts.
- Use at least four inches of tightly packed, industry-approved, shock-absorbent material around the instrument.

Returns for partial refund/credit:

Every product returned for refund/credit must be accompanied by a Return Material Authorization (RMA) number, obtained from our Order Entry Group at 1-440-498-2560.

Repair and calibration:

To find the nearest service center, go to www.flukebiomedical.com/service or

In the U.S.A. and Asia:

Cleveland Calibration Lab
Tel: 1-800-850-4608 x2564
Email: globalcal@flukebiomedical.com

In Europe, Middle East, and Africa:

Eindhoven Calibration Lab
Tel: +31-40-2675300
Email: ServiceDesk@fluke.com

To ensure the accuracy of the Product is maintained at a high level, Fluke Biomedical recommends the product be calibrated at least once every 12 months. Calibration must be done by qualified personnel. Contact your local Fluke Biomedical representative for calibration.

Certification

This instrument was thoroughly tested and inspected. It was found to meet Fluke Biomedical's manufacturing specifications when it was shipped from the factory. Calibration measurements are traceable to the National Institute of Standards and Technology (NIST). Devices for which there are no NIST calibration standards are measured against in-house performance standards using accepted test procedures.

WARNING

Unauthorized user modifications or application beyond the published specifications may result in electrical shock hazards or improper operation. Fluke Biomedical will not be responsible for any injuries sustained due to unauthorized equipment modifications.

Restrictions and Liabilities

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Manufacturing Location

The QA-ES III Electrosurgery Analyzer is manufactured at Fluke Biomedical, 6920 Seaway Blvd., Everett, WA, U.S.A.

Table of Contents

Introduction

The QA-ES III (or the Product) measures the performance of high frequency Electrosurgery Units (ESU) and saves test records that you can transmit to a computer (PC). You can control the Product remotely from the Fluke Ansur software program.

The Product makes these measurements and tests:

- Generator output:
  - Power, RMS
  - Current, RMS
  - Voltage, peak-to-peak
  - Crest Factor
- Vessel Sealing Loop Current
- HF Leakage Current in various configurations
- Contact Quality Monitor (CQM) test
- Power Distribution test automatically makes a series of Generator Output measurements at various loads

Intended Use

The Product is a precision instrument for use in performing tests on high-frequency electrosurgical units in accordance with national and international standards. It is for use by trained service technicians. Tests include automatic power distribution measurement, crest factor measurement, RF leakage measurement, and CQM (contact quality monitor) test. The Product will be used in hospitals, clinical engineering departments, independent service organizations, and at ESU OEMs. The Product will not be used in patient rooms while a patient is present.

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.

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. Risk of electric shock.
CE	Conforms to European Union directives.
	Conforms to relevant North American Safety Standards.
	Conforms to relevant Australian EMC standards.
	This product complies with the WEEE Directive 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.

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, follow these guidelines:

- **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.**
- **Limit operation to the specified measurement category, voltage, or amperage ratings.**
- **Use the correct terminals, function, and range for measurements.**
- **Carefully read all instructions.**
- **Do not touch voltages >30 V ac rms, 42 V ac peak, or 60 V dc.**
- **Do not use the Product around explosive gas, vapor, or in damp or wet environments.**
- **Do not use the Product if it operates incorrectly.**
- **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 test leads if they are damaged. Examine the test leads for damaged insulation, exposed metal, or if the wear indicator shows. Check test lead continuity.**
- **Use this Product indoors only.**
- **Use only the mains power cord and connector approved for the voltage and plug configuration in your country and rated for the Product.**
- **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.**
- **Replace the mains power cord if the insulation is damaged or if the insulation shows signs of wear.**

- **Use only current probes, test leads, and adapters supplied with the Product.**
- **Connect the common test lead before the live test lead and remove the live test lead before the common test lead.**
- **Only use probes, test leads, and accessories that have the same measurement category, voltage, and amperage ratings as the Product.**
- **Remove all probes, test leads, and accessories that are not necessary for the measurement.**
- **Do not connect measurement inputs directly to mains.**
- **Do not use test leads if they are damaged. Examine the test leads for damaged insulation and measure a known voltage.**
- **Disable the Product if it is damaged.**
- **Do not use the Product if it is damaged.**
- **Do not touch exposed metal on banana plugs, they can have voltages that could cause death.**
- **Remove circuit power before you connect the Product in the circuit when you measure current. Connect the Product in series with the circuit.**
- **Connect an approved three-conductor mains power cord to a grounded power outlet.**
- **Do not put the Product where access to the mains power cord is blocked.**
- **Make sure that the Product is grounded before use.**
- **Do not put metal objects into connectors.**
- **Make sure that the space around the Product meets minimum requirements.**
- **Do not use the Analyzer in CAT II, III, or IV environments.**
- **Retractable end of test leads are for use on ESU only.**
- **No probes or accessories supplied with the Analyzer are intended for handheld use. Setup and stand clear when activating the ESU with the footswitch.**

Terminology

The Product uses the following terminology as described in IEC 60601-2-2:

- HF – high frequency surgical signals also called RF (radio frequency).
- Neutral Electrode also called Dispersive Electrode.
- Contact Quality Monitor (CQM) also called Return Electrode Monitor (REM trademarked by Covidien) or Return Electrode Current Monitor (RECM).

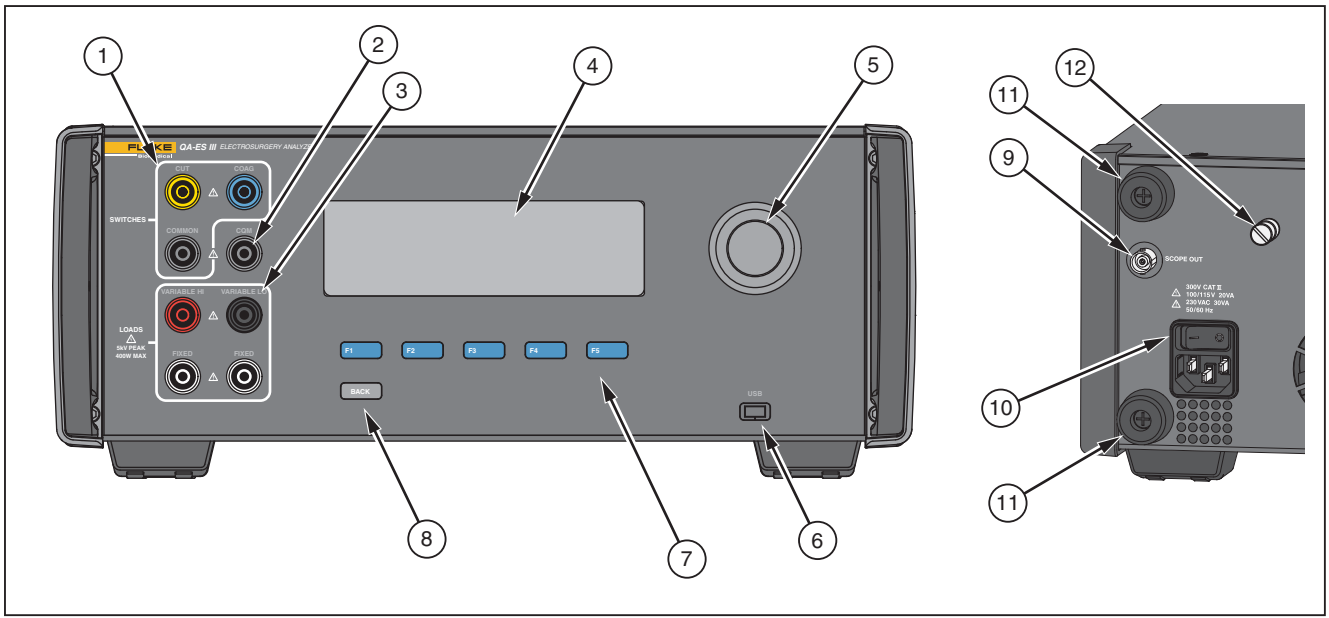
Unpack the Product

Carefully unpack all items from the box and check that you have the following items:

- QA-ES III Electrosurgery Analyzer
- Users Manual on CD
- Getting Started Manual
- Alligator clips, black and red
- Dispersive safety lead
- CQM safety lead
- Jumper safety lead (Shorting Leads)
- 40 inch stackable/retractable safety leads, black, red (2), blue, yellow, and green
- 20 inch stackable/retractable safety leads, black and red
- Multi-stacking 4 mm banana plug patch cord, black
- RECM Alarm Disabling Lead
- Bipolar Activation Lead
- USB cable
- Ansur Software CD ROM

Product Familiarization

Figure 1 and Table 2 describe the controls and connections on the product.



hwg001.eps

Figure 1. Product Controls and Connections

Table 2. Controls and Connections

Item	Description
①	Footswitch connections: CUT, COAG, COMMON
②	CQM connection for the Contact Quality Monitor test
③	Load connections: VARIABLE HI, VARIABLE LO, FIXED
④	LCD
⑤	Rotary selector knob
⑥	USB Device port
⑦	Function keys (**F1** through **F5**)
⑧	**BACK** key
⑨	Scope out
⑩	Mains power connection and On/Off switch
⑪	Bumpers to protect back panel
⑫	Ground lug

Turn On the Product

Before you turn on the Product, check for damage or wear. Check for adequate ventilation. The Product requires a clear area of 10 cm (4 in) at the rear panel and all vent openings.

Connect the power cord to Mains power and push the power switch. The start-up sequence begins.

During the start-up sequence, a screen shows the firmware version for reference. You can use the start-up sequence to update the firmware.

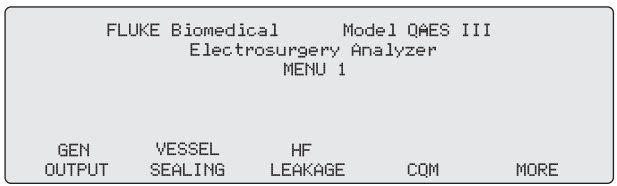
After the start-up sequence, the Product starts the application. When the Top Menu screen shows, the Product is ready for use.

Top Menus

The Top Menus 1 and 2 have sub-menus to make measurements, set up the instrument, and maintain memory. Use the controls and softkeys to make selections from the menus. Table 3 describes the Top Menu controls.

For complete operating instructions, refer to the Users Manual on the accompanying CD. Manuals are also available at www.flukebiomedical.com.

Table 3. Top Menu Controls



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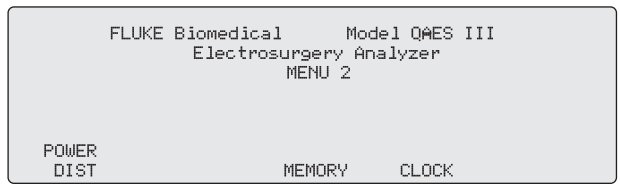

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Softkey	Goes to
F1	Generator Output measurement menu
F2	Vessel Sealing measurement menu
F3	HF Leakage measurement menu
F4	CQM (Contact Quality Monitor) test menu
F5	Top Menu 2 for more functions

Softkey	Goes to
F1	Power Distribution measurement menu
F2	--
F3	Memory menu
F4	Clock menu
F5	--

Note

*Use the **BACK** key to return to Top Menu 1.*

Measurement Connections

Connect the ESU to the Product to make measurements. See the Users Manual for more information.

Footswitch Connections

Some ESUs use a footswitch to turn on the ESU generator. The Product has connections that simulate a footswitch. Use the footswitch feature to automatically turn on the ESU generator at an appropriate time.

Note

As an alternative to a footswitch, some ESUs use a hand switch. For this manual, hand switches and footswitches are both called footswitches.

It is not practical to make a single measurement or a Power Distribution test without the footswitch feature. Without the feature, you must manually turn on the ESU (or use an actual footswitch or hand switch) at the correct time after the delay starts.

The Product has connections for both CUT (yellow) jack and COAG (blue) jack footswitches and a COMMON (gray) connection jack.

The footswitch feature is available during all measurements and CQM tests. In continuous measurement mode, the Product activates the footswitch relays to turn on the ESU. The ESU remains on and the footswitch is engaged until you stop the measurement.

If you are not using the footswitch feature, ignore the footswitch connections.

Neutral Connections

ESUs with CQM alarms have two neutral connections. You must connect the neutral connections together for Generator Output, Vessel Sealing, and HF Leakage measurements.

The Shorting Leads supplied with the Product have a resistance that is sufficiently low to prevent an alarm on the ESU. Some ESUs require the Shorting Lead to have a minimum resistance, as well as, a maximum resistance. A simple jumper may not work. Use the Shorting Leads for all measurements except the CQM test.

Setup Communications

The Product has a USB Device Port for communication to a computer (PC). Some Products also have wireless functionality. You can use the communications ports to:

- Send saved test records to a PC.
- Send commands and receive responses to control the Product remotely.

Use Ansur or a terminal emulation program (for example HyperTerminal or Tera Term) to set the COM port options. COM port settings are:

- 115,200 baud
- No parity
- 8 data bits
- 1 stop bit
- Hardware handshaking is on. (The Product uses hardware handshaking but does not use XON/XOFF software handshaking.)

Operating system requirements:

- Windows Vista
- Windows 7
- Windows 8 or later

USB Device Port

The USB port on the Product (a Micro Type B connector) connects to a USB controller port on the PC (Type A rectangular connector). Use the supplied USB Type A-to-Micro-B cable to connect the Product to a PC.

The PC sees the USB Port while the cable is connected to the Product (even if the Product is turned off). If the cable is disconnected, the PC must close the port and reopen the connection.

Windows Software Driver

The USB port uses an integrated circuit (IC) to convert USB to RS232. Adapter cables frequently use this IC (FT232R from the company FTDI). When the Product connects to a PC for the first time, the PC registers the Product as a virtual COM port (VCP). The virtual COM port looks like a serial (RS232) device.

The IC is compatible with the USB Version 2.0 Full Speed specification. The USB ID numbers are: VID 0403 and PID 6001.

Device Manager

The Device Manager is a PC program that changes COM port settings. Access the Device Manager according to your operating system, usually one of these methods:

- From the **Control Panel**, select **Device Manager**.
- Select **Hardware and Sound** and then select **Device Manager** (under **Devices and Printers**).

Table 4 describes the functions of the Device Manager.

Note

While the Device Manager on the PC can set COM port options, the controlling program overwrites the Device Manager settings.

Table 4. COM Port Controls

Function	Steps
Enable the driver	1. Right-click **USB Serial Converter** and select **Properties | Advanced**. 2. Select **Load VCP** and click **OK**. 3. Click **OK**. The COM port shows in the Device Driver.

Table 4. COM Port Controls (cont.)

Function	Steps
Verify COM port settings	1. Right-click the **COM port**. 2. Select **Port Settings** and check the settings.
Change the COM port number assigned by Windows:	1. Right-click the **USB Serial Port** (COMx) and select **Properties | Port Settings | Advanced**. 2. Select the number from the **COM Port Number** menu and click **OK**. 3. Scan for hardware changes. The device list shows the new COM port number. If the COM port number is in use, the number could be assigned to an unused device. Click through the error message to use the number.

Wireless Port

For Products with wireless functionality, the wireless port communicates with a PC that has an 802.15 (Bluetooth) wireless interface. For PCs without the interface, use a commercially available USB adapter. The PC starts the interface when you connect the adapter. (Additional software is not necessary.)

The PC sees the wireless port while the Product is on. When the Product is turned off, the PC closes the port. When the wireless device is assigned to a COM port, the COM port reopens when the Product is turned on again.

Note

The wireless port on the Product is a Classic Bluetooth port not a Low Energy Bluetooth port.

To install a wireless device:

1. Right-click the Bluetooth Devices icon and select **Add a Device**, or select **Show Bluetooth Devices | Add a Device**.

   The Product shows in the window. The serial number of the Product is part of the name.

   Note

   It is okay if the icon is a headset, or if the name is Bluetooth headset. *These are defaults and the name will change to the Product.*

2. Select the Product and click **Next**.

   The system prompts you to compare the codes. Ignore the message and continue with the next step.

3. Make sure **Yes** is selected and click **Next**.

4. Select **Driver Software Installation**.

   The system installs two standard serial-over-Bluetooth-link COM ports. The Bluetooth Peripheral Device will fail. Ignore the message and close the window. The Add a device window shows the device successfully added to the computer.

5. Close the Add a device window.

6. Right-click the Bluetooth icon and select **Show Bluetooth Devices**.

   The Product name (including serial number) shows. Ignore the message about the missing driver for the Bluetooth Peripheral Device.

7. Right-click the Product and select **Properties**.

   The Hardware section shows a COM port for a Standard Serial-over-Bluetooth link. Use this Outgoing COM port for the interface.

   The Bluetooth Settings COM ports show that the Product has 2 COM ports: Outgoing (initiated by the PC) and Incoming (initiated by the Product). The system uses the Outgoing port only.

Wireless Settings—For Products with wireless functionality, Table 5 shows the settings. You do not need to change the default settings. Choose a method to open Bluetooth settings:

- Right-click the Bluetooth icon and select **Open Settings**.
- Right-click **Bluetooth** from the Start menu.
- If you installed an adapter, select **Control Panel | Devices and Printers**, then right-click the adapter and select **Bluetooth Settings**.

Table 5. Bluetooth Settings

Option	Recommended Setting
Allow Bluetooth devices to connect to this computer.	Selected (Required)
Alert me when a new Bluetooth device wants to connect.	Selected
Show the Bluetooth icon in the notification area.	Selected
Allow Bluetooth devices to find this computer.	Not selected (The PC uses the Outgoing COM port to find the Product.)

Product Maintenance

⚠⚠ Warning

To prevent possible electrical shock, fire, or personal injury, follow these guidelines:

- **Do not use an extension cord or adapter plug.**
- **Do not operate the Product with covers removed or the case open. Hazardous voltage exposure is possible.**
- **Disconnect the mains power cord and input cables before you remove the Product covers.**
- **Remove the input signals before you clean the Product.**
- **Use only specified replacement parts.**
- **Have an approved technician repair the Product.**

After troubleshooting or maintenance, restart the Product and ensure that it starts without errors.

For radio frequency certification, see www.flukebiomedical.com

Cleaning

⚠Caution

For safe operation and maintenance of the Product:

- **Do not spray cleaning solution or water directly on the Product.**
- **Do not pour or drip liquid onto the Product.**

The Product needs little maintenance or special care. To clean, wipe with a damp cloth.

Troubleshooting

Table 6 shows possible problems and solutions.

Table 6. Troubleshooting

Symptom	Resolution
The Product does not show the Top Menu.	Ensure the Product is connected to power.
The Product fails during the initial self-test.	Contact Fluke Biomedical Technical support.
Time stamp on saved records is not accurate.	Set the clock and then turn on the Product and keep it on for a minimum of 1 hour.

Replaceable Parts

Table 7 lists the replaceable parts for the Product.

Table 7. Replaceable Parts

Item	Fluke Biomedical Part Number
AC285 Large Alligator Clips, Black, Red	1610159
ESU-Dispersive Safety Lead	4635167
ESU-CQM Safety Lead	4635171
ESU-Jumper Safety Lead	2772209
Micro USB cable (2 m)	4114833
40 Inch Safety Leads, Black, Red (Stackable/Retractable)	2772159
40 Inch Blue Safety Lead (Stackable/Retractable)	4635180
40 Inch Yellow Safety Lead (Stackable/Retractable)	4635198
40 Inch Green Safety Lead (Stackable/Retractable)	4635209

Table 7. Replaceable Parts (cont.)

Item	Fluke Biomedical Part Number
20 Inch Black Safety Lead (Stackable/Retractable)	4635211
20 Inch Red Safety Lead (Stackable/Retractable)	4635227
40 Inch Black Safety Lead (Stackable)	4635230
Multi-stacking 4 mm banana plug patch cord	4605232
RECM Alarm Disabling Lead	4635253
Bipolar Activation Lead	4635266

Accessories

Table 8 is a list of optional accessories.

Table 8. List of Optional Accessories

Item	Fluke Biomedical Part Number
International Dispersive Lead (1/4 in Phono Plug)	4635248
Test Probe Set, 0.080 Brass Tip	1909216
Ansur QA-ES MK III Plug-In License	4704312

General Specifications

Physical

Housing.....Metal case

Size (HxWxL).....14.5 cm x 35 cm x 47 cm (5.75 in x 13.75 in x 18.5 in)

Weight.....7.5 kg (16.5 lbs)

Power

Power Requirements .....100 V ac, 115 V ac, 230 V ac, 50 Hz / 60 Hz, universal input
100 V/115 V: 20 VA
230 V: 30 VA

User Interface

LCD.....Monochrome 240 pixels x 64 pixels, 8 lines x 40 characters, white LED backlight

Keys.....6 (1 fixed, 5 soft-defined) and Rotary selector knob

Environmental Specifications

Temperature

Operating.....10 °C to 40 °C (50 °F to 104 °F)

Storage .....-20 °C to 60 °C (-4 °F to 140 °F)

Humidity.....10 % to 90 % non-condensing

Altitude.....2000 m maximum

IP Rating IEC60529:IP20

Electromagnetic Compatibility (EMC)

IEC 61326-1: Basic

Emissions
Classification ..... IEC CISPR11: Group 1, Class A.

Group 1 have 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

USA (FCC) ..... Intentional Radiators

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. (15.19)

Changes or modifications not expressly approved by Fluke could void the user's authority to operate the equipment. (15.21)

Safety

IEC 61010-1:Overvoltage category II, pollution degree 2

IEC 61010-2-030: Measurement 5,000 V

Wireless Module Listing

FCC (United States) compliant
(Class A)..... FCC ID: X3ZBTMOD3

IC (Industry Canada)
compliant..... IC: 8828A-MOD3

CE (European) certified..... CE0051

Technical Specifications

Specifications apply for a period of one year from date of the most recent calibration.

Measures	Cut and coag waveforms Monopolar and bipolar outputs
Power and current measurements	true RMS
Bandwidth	30 Hz to 5 MHz at -3 dB including loads
Delay Time for single measurements	0.2 seconds to 4.0 seconds from Foot Switch activation to start of measurement

Duty Cycle

Variable Load	10 seconds on, 30 seconds off, at 100 W, all loads
Fixed 200 Ω Load	10 seconds on, 30 seconds off, at 400 W

Generator Output Measurements

Load Resistance

Variable	0 Ω, 10 Ω, 20 Ω, 25 Ω to 2500 Ω (by 25 Ω), 2500 Ω to 5200 Ω (by 100 Ω)
Accuracy	±2.5 %

Power

Ranges.....0.0 W to 99.9 W
100 W to 500 W

Accuracy .....< 10 W: ±5 % + 1 W
≥10 W: ±5 %

Maximum

At 25% duty cycle (10 seconds on, 30 seconds off).....10 Ω: 300 W,
20 Ω to 2900 Ω: 400 W,
3000 Ω to 5200 Ω: 200 W

At 10% duty cycle (5 seconds on, 45 seconds off).....10 Ω: 300 W,
20 Ω to 2400 Ω: 500 W,
2425 Ω to 2900 Ω: 400 W,
3000 Ω to 5200 Ω: 200 W

Current

RMS .....0 mA to 5,500 mA

Accuracy.....±(2.5 % of reading + 1 mA)

Voltage

Peak .....10 kV Peak to Peak

Accuracy.....±(10 % of reading + 50 V)

Crest Factor.....1.4 to 16.0

Defined as the ratio of Peak voltage to RMS voltage (Vpk / Vrms), using the larger of the 2 peaks (positive or negative)

Vessel Sealing Measurement

Loop Current, RMS.....0 mA to 5500 mA

Accuracy .....±(2.5 % of reading + 1 mA)

HF Leakage Current

Fixed Load .....200 Ω

Load Accuracy .....±2.5 %

Power rating.....400 W

Additional Fixed Load .....200 Ω

Current, RMS.....0 mA to 5500 mA

Accuracy ..... ±(2.5 % of reading + 1 mA)

CQM Test (Contact Quality Monitor)

Resistances .....0 Ω to 475 Ω (by 1 Ω)

Accuracy .....0 Ω to 10 Ω ±0.5 Ω,
11 Ω and above ±5 %

Power rating .....0.5 W

Auto Time interval.....1 second to 5 seconds

Oscilloscope Output

1 V per ampere of input current, typical.

Footswitch Simulations

Cut and Coag

Communications

USB Device Port.....Micro B connector
Full speed

Wireless Port .....802.15, Speed:115,200 baud

Memory

Test Records 5,000

Non-volatile .....retained through power cycling

Calibration

Traceable to the International System of Units (SI) through the appropriate National Metrology Institutes such as NIST or through intrinsic standards.