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FLUKE Biomedical
QA-ES III User Communication Interface

Version 1.1 06/18/2020

INTRODUCTION

This document specifies the communications interface for the QA-ES III Electrosurgery Analyzer.

The QA-ES can be controlled remotely by sending it commands and receiving responses.

The QA-ES has 2 communications ports:

- USB Device Port: Uses FTDI chip. This port can be configured to look like a COM port to the PC or to look like a regular USB Device.
- Wireless Port: Communicates with a Windows computer Bluetooth interface.

- Note: The Wireless Port can be enabled or disabled as part of calibration. It can only legally be enabled for use in countries where Fluke has obtained certification for the radio frequencies used by the Wireless module.

USB DEVICE PORT

USB CABLE CONNECTION

The USB Device Port has a Micro Type B connector. It connects to a PC USB Controller Port that has a Type A rectangular connector.

Connect the QA-ES to your PC with the USB Type A to Micro Type B cable supplied.

OPERATING SYSTEM REQUIREMENT

Fluke supports connecting the QA-ES to a PC running Windows XP, Vista, Windows7, 8, or later version.

WINDOWS SOFTWARE DRIVER

The QA-ES USB Device Port is built from an integrated circuit (IC) device that is commonly used inside adapter cables that convert USB to RS232. When this device is connected to a PC it looks like a COM port to the PC. When Windows enumerates the device it assigns a COM port number to it. It is called a virtual COM port (VCP).

The IC is an FT232R from the FTDI Company. It is compatible with the USB Version 2.0 Full Speed specification.

Versions of Windows XP, Vista, Windows7, and later, include a software driver for FTDI USB Serial Converters, including the FT232R. The USB ID numbers are: VID 0403 and PID 6001.

When you connect the Impulse to your PC for the first time, Windows should recognize and register your QA-ES as a USB Serial Converter and USB Serial Port (COMx).

The QA-ES can be controlled as a virtual COM port or from the FTDI D2XX Direct Interface API. Typically, single users typing commands in a terminal emulation program would use the COM interface. Users writing their own programs might prefer D2XX.

VIRTUAL COM PORT

When using the virtual COM port, USB port resides inside the QA-ES, but the PC acts like it now has an additional COM port and that COM port is connected to an RS232 serially controlled instrument.

D2XX INTERFACE

When using the D2XX exclusively, such as when only using the Ansur program to communicate with QA-ES, you can turn off the virtual COM port in Device Manager.

DEVICE MANAGER

The QA-ES is configured to enable COM port enumeration unless turned off in device manager.

Run Device Manager to check the status of the QA-ES COM port. When viewing by Type, your QA-ES shows up in two places:

- Universal Serial Bus controllers / USB Serial Converter.
- Ports (COM & LPT) / USB Serial Port (COMx).

If you view by Connection, the QA-ES will be under one of the USB Root Hubs as:

- USB Serial Converter / USB Serial Port (COMx).

If Device Manager only lists the USB Serial Converter but not the COM port it could be that the Virtual COM Port driver is not enabled. Open USB Serial Converter Properties and go to Advanced. Check the Load VCP box if it is not already checked and press OK. Then the COM port should show up.

You can change the COM port number assigned by Windows in Device Manager. Open the Properties for the USB Serial Port (COMx), go to Port Settings and press Advanced. Select the desired COM Port Number from the drop down list box and press OK. To get the device list to show the new COM port number perform a Scan for hardware changes.

If Device Manager says that a COM port number is in use, it may be from another USB device that is no longer being used. You can click through the error message and force it to the number you want.

If you unplug your QA-ES, you can still see it in Device Manager by selecting View / Show hidden devices. It will be shown grayed out.

If you do not want a COM port enumerated, open USB Serial Converter Properties and go to Advanced. Uncheck the Load VCP box and press OK. Then you can go to any COM ports already enumerated for QA-ES and delete them.

ADVANCED USERS

Advanced users can get more information about the FT232R from the FTDI web site: www.ftdichip.com. You can get new software drivers, application notes, and USB utilities. You can learn how to view your USB connections and load and/or delete all FTDI drivers from your PC. You can get drivers for other operating systems. You can learn how to use the D2XX direct interface API to include in your own custom interface programs if you don't want to use a COM port.

COM PORT SETTINGS

Settings for the COM port should be made by the program that opens and uses the COM port such as a terminal emulation program (HyperTerminal, Tera Term or other). The settings in Device Manager are usually irrelevant because they are overridden by the controlling program.

Set the COM port to:

- 115,200 baud, No parity, 8 data bits, 1 stop bit.
- Hardware handshaking must be turned on. QA-ES uses hardware handshaking but does not use XON/XOFF software handshaking.

WIRELESS PORT

The Wireless Port can communicate with a Windows computer Bluetooth interface. Many laptop and other computers have the Bluetooth interface built in. For computers that lack the interface, an adapter can be added to install it.

ADDING BLUETOOTH INTERFACE TO a COMPUTER

There are several Bluetooth adapters commercially available that plug into a computer USB port. When the adapter is plugged in, Windows recognizes it and activates the interface.

Some adapters come with additional software, but it is not necessary to use it and it is likely to result in unnecessary confusion.

BLUETOOTH SETTINGS

Open Bluetooth Settings:

- There could already be a Bluetooth icon in the notification area. If so, right click-it and select Open Settings.
- If no icon, there could be a selection in the Start Menu.
- If you have installed an adapter, open Devices and Printers from the Control Panel and find it there, then right-click it and select Bluetooth Settings.

It is OK to keep the default Bluetooth Settings:

- Must be checked: Allow Bluetooth devices to connect to this computer.
- Recommend checked: Alert me when a new Bluetooth device wants to connect.
- Recommend checked: Show the Bluetooth icon in the notification area.
- Recommend unchecked: Allow Bluetooth devices to find this computer. The computer will instead find the QA-ES. The computer will use an Outgoing COM port for the interface.

INSTALLING BLUETOOTH DEVICE

Right-click Bluetooth Devices icon and select Add a Device, or select Show Bluetooth Devices and from there select Add a Device.

The QA-ES III should show in the window with its serial number in the name to distinguish it from others that might be in the area. It shows as a Bluetooth headset (including the picture icon) even though it is a QA-ES III. The picture icon is a headset, and the name might come up originally as “Bluetooth headset”, but it should change eventually to QA-ES III.

Select the QA-ES III and press Next. The message says to compare the displayed code with one on the device. There is actually no code on the device. Ignore this code and leave Yes checked and press Next.
If you check the Driver Software Installation, it should install 2 Standard Serial over Bluetooth link COM ports, but fails to install Bluetooth Peripheral Device. That is OK, ignore it and close that window. The Add a device window should show the device successfully added to the computer. Close the window.

Right-click the Bluetooth icon and select Show Bluetooth Devices. It should show the QA-ES III with the serial number in the name. Don’t worry about the missing driver for Bluetooth Peripheral Device. Right-click the QA-ES and select Properties and look at Hardware. It should show a COM port for Standard Serial over Bluetooth link. Use this COM port for the interface. It is an Outgoing port.

If you go back to Bluetooth Settings and look at COM ports, it shows that the QA-ES has 2 COM ports: Outgoing (initiated by the computer) and Incoming (initiated by the device). We will always use the Outgoing port.

COM PORT SETTINGS

Settings for the COM port should be made by the program that opens and uses the COM port such as Ansur or a terminal emulation program (HyperTerminal, Tera Term or other). The settings in Device Manager are usually irrelevant because they are overridden by the controlling program.

Set the COM port to:

- 115,200 baud, No parity, 8 data bits, 1 stop bit.

- Hardware handshaking must be turned on. QA-ES uses hardware handshaking but does not use XON/XOFF software handshaking.

USING THE PORT
The Bluetooth Port is not active on the computer unless the QA-ES is turned on. If the QA-ES is turned off, the computer loses the port and must close it. Then, when the QA-ES is turned on again, the computer must reopen the port to use it.

Once the Bluetooth Device is installed and assigned to the COM port, that port should be available whenever the QA-ES is turned on.

COMMAND PROTOCOL

COMMANDS
Commands are made up of alphanumeric characters. The first character must be alphabetic. Alphabetic characters may be sent in upper or lower case.

Special characters are:

Name	Abbreviation	Hex Value
Carriage Return	**CR**	**0D**
Line Feed	**LF**	**0A**
Space	**SP**	**20**
Backspace	**BS**	**08**
Escape	**ESC**	**1B**

- Commands must be terminated by **CR** or **LF** or both.
- **SP** characters are ignored.
- **BS** erases the last character from the command.
- **ESC** erases all characters from the command.
- Some commands require one or more parameters to be sent with them. Where a command needs parameters, the command is followed by an equal sign and the parameters. Multiple parameters are separated by commas.
- In the command specification, parameters are given names in *lower case italics* which are place holders for the actual parameter to be sent with the command.
- Integer parameters can be any number of digits within the specified limits.
- Double floating point parameters can be in any standard recognizable format.
- Signed numeric parameters must include polarity sign: **+** or **–**.
- Boolean parameters are **TRUE** or **FALSE** or can be shortened to **T** or **F**.

COMMAND RESPONSES
After receiving a command, the QA-ES will not store or respond to additional received characters until it has executed the command and responded to it.

The QA-ES always responds to a command after it has executed it, by returning a response, terminated by **CR** and **LF**.

The standard command response is "*****", unless other data is to be returned. "*****" indicates that the command was understood and executed.

Incorrect commands return the following error coded messages.

Error Coded Message	Description
!	Command empty, no characters
!01 Unknown command	Command not recognized
!02 Illegal command	Command not legal for current mode or condition
!03 Illegal parameter	Parameter not legal for command
!04 Buffer overflow	Command too long for buffer

CONTROL STATES AND MODES

LOCAL CONTROL MODE

The QA-ES powers up initially under Local control by user keys.

REMOTE CONTROL MODE(S)

In Remote control, the QA-ES accepts commands and executes them. The user interface is disabled.

Some commands set the QA-ES into special modes which are sub-modes from the **RMAIN** Remote mode. Some commands are only legal in certain modes. The modes are listed in the table:

Mode Mnemonic	Type	Description
LOCAL	Local	Local control.
RMAIN	Main	Main Remote control mode

The **LOCAL** command brings the QA-ES back to local control. Also, a key press is available to return to Local control.

COMMAND SPECIFICATIONS

Unless specified otherwise:

- Commands return *****.
- Commands are only legal in RMAIN remote mode.

GENERAL

IDENT	Get the instrument identification and firmware version.
Legal modes:	All modes
Returns:	Model number and firmware version number, including the build: **QA-ESIII,VER:1.00.06**

SN	Get instrument serial number.
Legal modes:	All modes
Returns:	The serial number, usually 7 digits.

LOCAL	Go to Local control mode.
Legal modes:	All modes
Returns:	**LOCAL.**

REMOTE	Go to Remote control **RMAIN** mode.
Legal modes:	All modes
Returns:	**RMAIN.**

QMODE	Query the mode.
Legal modes:	All modes
Returns:	The Remote mode mnemonic per table above.

EXIT	Exit the current mode and go to the **RMAIN** Remote mode.
Legal modes:	All remote modes.
Returns:	**RMAIN.**

MEASUREMENT

DELAY=*delay*	Set the measurement delay: the time from when the foot switch connects to when the measurement is made.
delay	Delay time in tenths of seconds: 2 to 250 Upper limit =25 seconds

LOAD=*resistance*	Select the load resistance. But does not connect load to user jacks.
Legal condition:	Only legal when load is disconnected from user jacks.
resistance	Load resistance in ohms: 0, 10, 20, 25 to 2500 by 25's, or 2500 to 3200 by 100's. For **GENOUT**, zero ohms not legal. For **VSEAL** all loads are legal. For **HFLEAK** this setting not used as load of 200 ohms is always used.

CONN=*connect*	Connect or disconnect load to user jacks.
connect	Boolean: **TRUE** connects, **FALSE** disconnects.
Returns:	**OK** if command performed, **HOT** if can't connect because it is too hot.

QLOAD	Query the load resistance.
Returns:	The load resistance in ohms, 4 digits, **CONNECTED** or **NOT CONNECTED.**

QHOT	Check if too hot to connect and measure.
Returns:	**OK** if not too hot, **HOT** if too hot.

FTSW=*footswitch*	Set the foot switch selection. But does not connect to user jacks.
footswitch	**CUT** Select Cut foot switch. **COAG** Select Coag foot switch.

GENOUT	Perform a Generator Output measurement: Connects the selected Foot Switch, Waits for the measurement Delay time, Makes the measurement, Disconnects the Foot Switch.
Legal condition:	Only legal when load is connected and it is not zero ohms.
Returns:	Power in watts (3 digits), Current in mA (4 digits), Voltage peak to peak in volts (5 digits), Crest Factor (float formatted 2.1). ex: 245,4312,06867,07.3 Exception if it is too hot, will not perform measurement, returns **HOT**. Exception if the measurement cannot be performed, returns **0**.

VSEAL	Perform a Vessel Sealing measurement:

	Connects the selected Foot Switch, Waits for the measurement Delay time, Makes the measurement, Disconnects the Foot Switch .
Legal condition:	Only legal when load is connected (load can be zero ohms).
Returns:	Current in mA (4 digits) Exception if it is too hot, will not perform measurement, returns **HOT**. Exception if the measurement cannot be performed, returns **0**.

LKPOL=*polarity*	Selects polarity for a HF Leakage measurement.
polarity	**MONO** Monopolar. **BI** Bipolar.

HFLK	Perform a HF Leakage measurement: If Bipolar is selected, connects the 200 ohm bipolar leakage load to earth. Connects the selected Foot Switch, Waits for the measurement Delay time, Makes the measurement, Disconnects the Foot Switch. Disconnects the bipolar leakage load.
Legal condition:	Only legal when 200 ohm load is connected (HF Leakage is always performed through 200 ohms).
Returns:	HF Leakage Current in mA (4 digits) Exception if it is too hot, will not perform measurement, returns **HOT**. Exception if the measurement cannot be performed, returns **0**.
Special note:	If 0 is returned, it is likely that the QA-ES III needs more time to measure the input. Use the "DELAY" command to increase the measurement delay until a valid measurement is returned. If the input from the ESU is modulated or pulsed, 7-8 seconds minimum delay is typically required.

CQM

CONNFTSW=*connect*	Connects the selected foot switch. Note: This command should only be used during CQM testing to connect the Foot Switch that has been selected by the **FTSW** command. Leave the Foot Switch disconnected when through with the CQM test.
connect	Boolean: **TRUE** connects, **FALSE** disconnects.

CQM=*resistance*	Set the CQM resistance.
resistance	Resistance in ohms: 0 to 475.

QCOV	Get the CQM circuit overload status.
Returns:	Boolean: **T** if has been overloaded, else **F.**

RCOV	Reset the CQM circuit overload status to indicate has not been overloaded.

REAL TIME CLOCK

QRTC	Query the real time clock (RTC) for the date and time.
Returns:	The date and time in 24 hour format as: yyyy/mm/dd hh:MM:ss

SETRTC=*year,month, day,hour,minute*	Set the date and time into the real time clock. Uses 24 hour format. Seconds are always cleared to zero.
year	Year : 2014 to 2099
month	Month : 1 to 12
day	Day : 1 to 31
hour	Hour : 0 to 23
minute	Minute: 0 to 59

TEMPERATURE

QTEMP=*sensor*	Get the temperature from one of the sensors on the Load PCA mounted on the large heatsink.
sensor	Sensor number 0 to 1: 0: Front 1: Rear
Returns	Temperature in degrees C, never negative, 3 digits

TEST RECORDS

QRECS	Get the number of test records in user memory.
Returns:	Number of records.

XRECS	Transmit all the test records.
Returns:	All records, one record per line, as described in user manual.

LOAD RESISTORS

CALRESISTORS	Get the stored calibration values of the internal load resistors
Returns:	All 11 stored calibration values for the load resistors.
Special Note:	Available in firmware version v1.04 (not yet released as of 05/06/2020)