DISCLAIMER FOR COMMUNICATION INTERFACES

FLUKE Biomedical
ESA620 User Communication Interface

Version 1.0   05/06/2020

SERIAL COMMUNICATION

These are common specifications for all serial ports:
Baud rate: 115,200 baud.
Format: 8 data bits, no parity, 1 stop bit.

Modes

1. Power up:
    1.1. The instrument performs a number of self-diagnostic tests during this temporary start-up mode.
    1.2. The display shows a 'splash' screen during this period.
2. Local:
    2.1. This is the default mode entered after power-up.
    2.2. The user controls the instrument by pressing buttons and viewing the display.

2.3. The Computer Interface is active at any of the user menus. But the UI can only execute a few commands: those that put the instrument into remote mode or request instrument status. All other commands are illegal.
3. Remote:
   3.1. The display indicates that the instrument is under remote control.
   3.2. The UI receives commands from the USB interface to control the instrument.
   3.3. The instrument can be put back to local mode by a command or by pressing a key.
   3.4. The UI will directly execute some commands that it can without contacting the Meter.
   3.5. Other commands not executable by the UI will be forwarded to the Meter exactly as received. Then, the UI will get the response from the Meter and pass it back to the computer as received.
4. C Remote:
   4.1. Same as Remote Mode, except that responses from the unit are enclosed in 'packets'. Commands from the PC to the unit must also follow this format.
   4.2. This protocol also applies to sub-modes within remote control.
   4.3. When returning to Local Mode, the communication protocol is restored to normal operation.
   4.4. The packet format is defined below:

STX	Byte Count	Data	ETX	Checksum	NULL
1 byte	4 bytes	N bytes	1 byte	2 bytes	1 byte

STX	=	'0x02' character.
Byte Count	=	Number of bytes in the Data field only (N bytes).
Data	=	Command to or response from the unit.
ETX	=	'0x03' character.
Checksum	=	Sum of the bytes in the Byte Count and Data fields only

(4 + N bytes).

NULL	=	'0x00' character

Note: Special characters that do not need to be followed by CRLF, such as ESC and BACKSPACE characters, must be sent outside of packets.

5. Error:
   5.1. The instrument enters the error mode when it detects an internal fault.
   5.2. The display shows an error screen where the user is prompted to take a given action to correct the error.

LOCAL Mode Commands:

ITEM	COMMAND	PARAMETERS	DESCRIPTION
1	**CREMOTE=**	P	Puts the ESA in Computer Remote Control Mode.
2	**IDENT**		Returns Analyzer Model, UI Firmware Version, and Meter Processor Firmware Version. (IE: "ESA 620, UI-1.00")
3	**REMOTE**		Puts the ESA in Remote Control Mode.
4	**RSTUI**		Resets the ESA.

REMOTE Mode Commands:

ITEM	COMMAND	PARAMETERS	DESCRIPTION
1	**ACCV**		Select Accessible Voltage Test.
2	**ACCL**		Select Accessible Leakage test
3	**ALTEARTH**	**C**	Close the Meter- to EO GND only during Alternate Equipment Leakage function.
		O	Open the Meter- to EO GND only during Alternate Equipment Leakage function.
4	**AP=**	**[Parts +] / [Parts -] / [Remaining Parts]**	Selects parts to connect to meter +, parts to connect to meter -, and what to connect remaining parts to. Parameters are: 1) Parts = RL, RA, LA, LL, V1-V6, or ALL. 2) Remaining Parts = OPEN or GND. IE: a typical command example would be: "AP=RL,LL/RA,V3/GND" This would connect RL,LL to meter (+), RA,V3 to meter (-), and all other leads to GND.
5	**AP2=**	**[Parts +] / [Parts -] / [Remaining Parts]**	Selects parts to connect to meter +, parts to connect to meter -, and what parts to connect to GND (remaining parts are set to OPEN) 1) Parts = RL, RA, LA, LL, V1-V6, or ALL. 2) Remaining Parts = RL, RA, LA, LL, V1-V6. IE: a typical command example would be: "AP2=RL,LL/RA,V3/LA,V2" This would connect RL,LL to meter (+), RA,V3 to meter (-), LA,V2 to GND, and all other leads OPEN. **Note:** This command applies only to ECG PCA revision 2. See PCA_TYPE? command.
6	**APINS**		Select Applied Parts Insulation Test.
7	**AUX**		Select Patient Auxiliary Leakage Test.
8	**DIFF**		Select Differential Current Test.
9	**DIRL**		Select Direct Leakage Test.

10	**DMAP**		Select Direct Applied part Leakage test (uses MAP voltage)
11	**EARTH=**	**C**	Close the Ground Line to the Equipment Outlet.
		O	Open the Ground Line to the Equipment Outlet.
12	**EARTHL**		Select Earth Leakage Test.
13	**ECG**		Enters ECG Simulation Mode and connects all parts to ECG.
14	**ENCL**		Select Enclosure Leakage Test.
15	**EQCURR**		Select Equipment Current Test.
16	**ERES =**	**LOW**	Select Earth Resistance 200ma current.
		HIGH	Select Earth Resistance 25 Amp current.
17	**FN**		Returns current function number: 0: No function selected 1: Mains voltage 2: Equipment current 3: Earth resistance 4: Mains to earth insulation 5: Applied parts to earth insulation 6: Earth leakage 7: Enclosure leakage 8: Patient leakage 9: Patient auxiliary leakage 10: Direct equipment leakage 11: Direct applied parts leakage 12: MAP leakage 13: Alternative applied parts leakage 14: Alternative equipment leakage 15: Differential leakage 16: Accessible leakage 17: Point to point leakage 18: Accessible voltage 19: Point to point voltage 20: Point to point resistance 21: Mains to neutral insulation 22: Applied parts to neutral insulation 23: Mains to applied parts insulation 24: Lead isolation leakage
18	**GFI=**	**5MA**	Selects Ground Fault Interrupt trip level.
		10MA	
		25MA	
19	**GFIR**		Resets Ground Fault Interrupt ATTENTION.
20	**IDENT**		Returns Analyzer Model, UI Firmware Version, and Meter Processor Firmware Version. (IE: "ESA, UI-1.00, MTR-2.01")
21	**IDLE**		Turns off all relays, clears faults, ends current test.
22	**INS=**	**LOW**	Select 250V Insulation Voltage
		HIGH	Select 500V Insulation Voltage (default)
23	**INSB**		Select Insulation test – Mains to Non-Earthed Conductive Part (Red Jack)
24	**INSD**		Select Insulation test – Applied Parts to Non-Earthed Conductive Part (Red Jack)
25	**INSE**		Select Insulation test – Mains to Applied Parts
26	**LEAD_ISO**		Select AAMI Lead Isolation Test

27	LOAD=	1010	Selects the load for the Meter Input.
		601	
		AAMI	
		NONE	
28	LOCAL		Puts the ESA in Local Control Mode.
29	MAINS=	L1-L2	Measure AC, Hot to Neutral.
		L1-GND	Measure AC, Hot to GND.
		L2-GND	Measure AC, Neutral to GND.
30	MAP=	LOW	Switches to MAP Level of 100%.
		HIGH	Switches to MAP Level of 110%.
	(MAP with no params selects MAP function)	NORM	Switches to Normal Polarity MAP voltage.
		REV	Switches to Reverse Polarity MAP voltage.
		1MA	Sets maximum MAP current limit to 1 ma
		3.5MA	Sets maximum MAP current limit to 3.5 ma
		7.5MA	Sets maximum MAP current limit to 7.5 ma
31	MDUAL=	OFF	Selects dual reading mode (AC and DC)
		ON	
32	MINS		Select mains Insulation Test.
33	MODE=	AC	Selects "Volts AC" measurement Mode.
		DC	Selects "Volts DC" measurement Mode.
		ACDC	Selects "Volts AC + DC" measurement Mode.
34	MREAD		Returns Meter Readings continuously (within every 400ms) until an Escape character is received.
35	NEUT=	C	Close the Neutral Line to the Equipment Outlet.
		O	Open the Neutral Line to the Equipment Outlet.
36	NOMINAL=	ON	Causes all leakages except Differential to be multiplied by the ratio of Nominal Mains/Actual Mains when ON.
		OFF	
37	PAT		Select Patient Leakage Test.
38	PCA_TYPE?		Returns Power, Meter and ECG board types In format of P/M/E where P, M and E are the revision numbers for the respective Power, Main, and ECG PCA boards.
39	POL=	OFF	Set AC power to the Equipment Outlet either Normal, Reversed, or Off.
		N	
		R	
40	PPL		Select Point to Point Leakage Test.
41	PPR		Select low current Point to Point Resistance Test (200ma only).
42	PPV		Select Point to Point Voltage Test.
43	READ		Returns a single Meter Reading.
44	RESEND		Resends the last response to the PC
45	RPTIME=	(0-5)	Sets EO polarity switch time (0-5 sec)
46	RWIRE=	2	Select Two Wire Measurement.
		4	Select Four Wire Measurement.
47	SAF		Select Substitute Appliance Fault Leakage Test
48	SN		Returns ESA Serial Number (IE: 1234567)
49	SPAT		Select Substitute Patient Leakage Test
50	STAT		Returns UI Hex Status Word (see table below)
51	STAT1		Returns Hex status word 1 (see table below)
52	STAT2		Returns Hex status word 2 (see table below)
53	STAT3		Returns Hex status word 3 (see table below)

54	**STD=**	**1010**	Selects the standard to be used during tests. It automatically sets the load, GFI trip level, and MAP voltage and current values.
		353	
		601	
		AAMI	
		ASNZ	
		NONE	
55	**ZERO**		Zero the Resistance Meter.

ECG Simulation Mode Commands:

ITEM	COMMAND	PARAMETERS	DESCRIPTION
1	**CPL30**		Runs ECG complex wave @ 30 Hz.
2	**CPL60**		Runs ECG complex wave @ 60 Hz.
3	**CPL120**		Runs ECG complex wave @ 120 Hz.
4	**CPL180**		Runs ECG complex wave @ 180 Hz.
5	**CPL240**		Runs ECG complex wave @ 240 Hz.
6	**EXIT**		Exits ECG Simulation Mode & disconnects all Applied Parts.
7	**IDENT**		Returns Analyzer Model, UI Firmware Version, and Meter Processor Firmware Version. (IE: "ESA, UI-1.00, MTR-2.01")
8	**PLS30**		Runs ECG 63ms pulse @ 30 Hz.
9	**PLS60**		Runs ECG 63ms pulse @ 60 Hz.
10	**RESEND**		Resends the last response to the PC.
11	**SN**		Returns ESA Serial Number (IE: 1234567).
12	**SN10**		Runs ECG sine wave @ 10 Hz.
13	**SN40**		Runs ECG sine wave @ 40 Hz.
14	**SN50**		Runs ECG sine wave @ 50 Hz.
15	**SN60**		Runs ECG sine wave @ 60 Hz.
16	**SN100**		Runs ECG sine wave @ 100 Hz.
17	**SQ125**		Runs ECG square wave @ 0.125Hz.
18	**SQ2**		Runs ECG square wave @ 2.0Hz.
19	**STAT**		Returns device hex status word (see table below)
20	**STAT1**		Returns device hex status word 1 (see table below)
21	**STAT2**		Returns device hex status word 2 (see table below)
22	**STAT3**		Returns device hex status word 3 (see table below)
23	**TR2**		Runs ECG triangle wave @ 2 Hz.
24	**VFIB**		Runs ECG Ventricular Fibrillation

Status Word Definitions:

STAT command – Status Word – Bit Definitions

POWER_UP	0x0001	device is in Power Up mode
LOCAL	0x0002	device is in Local mode
REMOTE	0x0004	device is in Remote mode
CREMOTE	0x0008	device is in CRemote mode
(RESERVED)	0x0010	
(RESERVED)	0x0020	
ERROR	0x0040	device is in Error mode
(RESERVED)	0x0080	
OVER_TEMP	0x0100	over temperature condition
(RESERVED)	0X0200	
(RESERVED)	0X0400	
(RESERVED)	0X0800	
(RESERVED)	0X1000	
(RESERVED)	0X2000	
(RESERVED)	0X4000	
(RESERVED)	0X8000	

STAT1 command – Status Word 1 – Bit Definitions

REMOTE	0x0001	device is in Remote mode
(RESERVED)	0x0002	
(RESERVED)	0x0004	
ECG	0x0008	device is in ECG mode
PWRUP	0x0010	device is in Power Up mode
SVOLTS	0x0020	measure from 0 to 300 volts, ac, dc, ac+_dc:
SLEAK	0x0040	measure from 0 to 10,000 ua
SOHMS	0x0080	measure from 0 to 2 ohms @ 200 ma
SOHMS_25A	0x0100	measure from 0 to 2 ohms @ 25 AMPS
SMEG	0x0200	measure from 0 to 100 megohms
SEQUIP	0x0400	measure from 0 to 20 amps AC
SDIFF	0x0800	measure from 0 to 10 ma AC
AC_ONLY	0x1000	measure AC only
DC_ONLY	0x2000	measure DC only
ACDC	0x4000	measure AC + DC
DREAD	0x8000	Dual read flag (ac only/dc only)

STAT2 command – Status Word 2 – Bit Definitions

LDAAMI	0x0001	AAMI load selected
LD1010	0x0002	1010 Load selected
LD601	0x0004	601 Load selected
EO	0x0008	Equipment Outlet ON
MAPHI	0x0010	MAP High selected (110%)
MAPR	0x0020	MAP Reverse selected
MAPON	0x0040	MAP Voltage ON
L2OPEN	0x0080	Neutral Open
EOPEN	0x0100	Earth Open
POLR	0x0200	EO Polarity reversed
GFIL	0x0400	GFI Low selected
GFIH	0x0800	GFI High selected
INS_ON	0x1000	INSULATION VOLTAGE (500V) On
RCURON	0x2000	Resistance Current ON
RW2	0x4000	resistance mode = 2 wire
RW4	0x8000	resistance mode = 4 wire

STAT3 command – Status Word 3 – Bit Definitions

RPT0	0x0001	RPT0-RPT2 = reverse EO Polarity switch time = 0-3.5 sec
RPT1	0x0002	RPT0-RPT2 is a count of 1 sec increments
RPT2	0x0004	
GFIM	0x0008	GFI Medium level (10ma) selected
AVG	0x0010	measuring AVERAGE
RMS	0x0020	measuring RMS
INS_LOW	0x0040	1 - insulation volts = 250V; 0 - insulation volts = 500V
MAP3MA	0x0080	MAP test - current limit = if not 7.5ma, 3.5ma if on, 1ma if off
MAP7MA	0x0100	MAP test - current limit = 7.5ma if on, 3.5ma or 1ma if off
MAINS	0x0200	0 = 115VAC, 1 = 230VAC Mains
(RESERVED)	0x0400	
VOLT_BAD	0x0800	MAINS - voltage L1-l2 out of range
BAD_GND	0x1000	MAINS - AC GND bad
REV_PWR	0x2000	MAINS - L1 & L2 reversed
GFITRIP	0x4000	GFI Interrupt Has occurred
FAULT	0x8000	FAULT Interrupt has occurred