PcPlug-U

USB Communication Interface

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LaserPoint srl – Via Burona, 51 – 20090 Vimodrone (Milano) – Italy
Phone +39 02 27 400 236 – Fax +39 02 25 029 161
www.laserpoint.eu

Table of Contents:

1. INSTALL

Connect the ***PcPlug-U*** electronics through the USB port to the host PC.

Follow the prompt to install the USB drivers. They will be automatically installed through Windows update automatic download, or manually installed by using the driver installers available on the provided USB flash drive: inside the USB flash folder

X:\DRIVER\

you can find the driver installers for both 64 and 32 bit PCs:

\dpinst_amd64.exe
\dpinst_x86.exe

2. SET UP THE COMMUNICATION:

The ***PcPlug-U*** employs an FTDI FT232RQ chip that is a USB to serial UART interface.

This means that, for the host PC and for the user, this device will appear like a true COM port.

Example:
The COM number associated to this device can be known using Windows^{TM} "Device Manager" panel.
And any serial terminal software (like Windows^{TM} HyperTerminal) can be used to open and test the communication with this device. See Chapter 8.1 for the example

These are the communication parameters that must be used:

Baud Rate:	For product Series #2 and #3**: 38400 bps** For product Series #1: **9600 kbps** (See chapter 4 for part number lists)
Parity:	**no**
Data Bits:	**8**
Stop Bits:	**1**

When writing your Code, include the FTD2XX.DLL Dynamic Library for Windows in order to write your application. This library provides useful functions to recognize and set up the communication with the ***PcPlug-U*** device.

Please see the FTD2XX.DLL complete manual on FTDI website, or refer to the extract we included in Annex 1 at the end of this paper.

3. COMMANDS AND ANSWERS FORMATTING:

When the ***PcPlug-U*** receives a valid input command, it confirms to the host device that the command has been received and return an answer. The Commands and Answers are ASCII formatted.

3.1 Command format

The format of a valid command is: *COMMANDNAME:
where:

""*	Start of command
"COMMANDNAME"	The command instruction is a sequence of ASCII characters. It must be in capitals. Each command is described in the following pages.
":"	End of command

3.2 Answer format

When the ***PcPlug-U*** receives a valid Input Command it replies sending a message through the USB interface.

The format of an answer is: #ANSWER;
where:

"#"	Start of answer
"ANSWER"	there are three kind of answer: • **String**: ASCII character sequence • **Int**: integer number, numerical sequence (in ASCII code) • **Float**: floating point number, numerical sequence plus decimal point (in ASCII code)
";"	End of answer

Please note that maximum response time from ***PcPlug-U*** is ~50msec. It's therefore recommended to set a delay of 50ms between write and read function.

3.3 Error Message

When the ***PcPlug-U*** receives an invalid command or a command affected by communication errors the answer is "??;"
where:

"??"	USB communication error
";"	End of answer

Common reasons of error message are:

Input command not started with * character
Input command not in capitals
Input command does not correspond with the command list

4. Product Series and associated Command Tables.

This manual includes different communication tables for different product series. Each product series has its specific commands and setting.
Please use the following table to find the correct commands and settings tables for your device.

Series #1 – **OEM Series:**	**Series #2 –** **Thermopile Series:**	**Series #3 –** **BLINK Series:**
CSA-2-D12-BBF-U CSA-2-D12-HPB-U CSA-5-D12-BBF-U CSA-20-D20-BBF-U CSA-20-D20-HPB-U CSW-50-D20-BBF-U CSW-50-D20-HPB-U CSW-50-D25-BBF-U CSW-50-D25-HPB-U CSW-200-D20-HPB-U CSW-200-D30-HPB-U Fit-50-H-U Fit-200-H-U Fit-500-H-U Fit-3000-H-U Fit-6000-H-U Fit-IPL-R-H-U	A-02-D12-BBF-U A-2-D12-BBF-U A-2-D12-HPB-U A-5-D12-BBF-U A-10-D12-HPB-U A-10-D20-BBF-U A-10-D20-HPB-U A-30-D25-HPB-U A-40-D25-BBF-U A-40-D25-HPB-U A-40-D40-HPB-U A-40/200-D25-HPB-U A-40/200-D40-HPB-U A-40/200-D60-HPB-U A-200-D25-HPB-U A-200-D25-SHC-U A-200-D40-HPB-U A-200-D40-SHC-U A-200-D60-HPB-U A-200-D60-SHC-U A-300-D60-HPB-U A-600-D40-HPB-U A-600-D60-SHC-U A-1200-D60-SHC-U W-200-D40-HPB-U W-200-D40-SHC-U W-500-D70-SHC-U W-600-D30-HPB-U W-600-D30-SHC-U W-1500-D40-HPB-U W-1500-D40-SHC-U W-3000-D55-HPB-U W-3000-D55-SHC-U W-6000-D55-SHC-U 10-BB-D25-U 10-UVA-D25-U 10-UVC-D25-U 20-BB-D40-U 20-UVA-D40-U 20-UVC-D40-U A-30-D12-SHC-L-U 10-BB-D12-L-U A-10-D12-DIF-U A-30-D18-DIF-U A-40-D33-DIF-U	BL-W-50W-16-K-U BL-A-30W-16-K-U
For these devices refer to: **Chapter 5.**	For these devices refer to: **Chapter 6.**	For these devices refer to: **Chapter 7.**

5. Commands and Answer Tables for Product Series #1

This product series includes these products:

Series #1 – OEM Series			
CSA-2-D12-BBF-U CSA-2-D12-HPB-U CSA-5-D12-BBF-U CSA-20-D20-BBF-U CSA-20-D20-HPB-U CSW-50-D20-BBF-U CSW-50-D20-HPB-U CSW-50-D25-BBF-U CSW-50-D25-HPB-U CSW-200-D20-HPB-U CSW-200-D30-HPB-U	Fit-50-H-U Fit-200-H-U Fit-500-H-U Fit-3000-H-U Fit-6000-H-U Fit-IPL-R-H-U		

5.1 *Information commands*

These commands are used to get ID information about the ***PcPlug-U*** and the sensor. This info may be useful when asking Laserpoint for support.

Command	Answer *(example)*	Description
HEADN	"H" + String 8 char	Displays the Sensor Head model name (shortened)
SERNU	"S" + Int 6 digit	Displays the Sensor Head serial number
FHV	"H" + 2 char + "F" + 4 char	Displays the ***PcPlug-U*** Electronics Hardware and Firmware version
KEFUN	"K" + Int 2 digit	This 2 digit code number identifies the sensor type and the available functionalities. For this series of devices, the answer will be one among the highlighted: **00 = OEM Thermopile sensor - Power** **01 = OEM Thermopile sensor - Fit Mode** **02 = OEM Thermopile sensor - Energy** **03 = OEM Thermopile sensor - Power + Energy** **04 = OEM Thermopile sensor - Fit Mode + Energy** ~~05 = Thermopile sensor – Power~~ (see chapter 6) ~~06 = Thermopile sensor – Power + Energy~~ (see chapter 6) ~~07 = Thermopile sensor – Fit mode~~ (see chapter 6) ~~08 = Thermopile sensor – Fit mode + Energy~~ (see chapter 6) ~~09 = Photodiode sensor~~ ~~10 = NA~~ ~~11 = NA~~ ~~12 = Blink Series Sensor - Power~~ (see chapter 7) ~~13 = Blink Series Sensor - Power + Energy~~ (see chapter 7)

5.2 *Measurement setup commands*

These commands are used for the initial set up: operation mode selection (Power, Energy, others) and a reset of zero.

Command	Answer *(example)*	Description
POWER	"ok" or "NA" (if not available)	Set ***PcPlug-U*** in Power Meter mode (if available)
ENERGY	"ok" or "NA" (if not available)	Set ***PcPlug-U*** in Energy operation mode (if available)
ZERO	"ok"	Perform a Zero. This action will take about 3 seconds, and will reset the zero value of the sensor. Please make sure that this action is performed only when the sensor is not hit by laser or any other thermal source.
FAST	"FAST"	This is the default setting. It enables the acceleration algorithm, granting a faster response time.
SLOW	"SLOW"	Disables the acceleration algorithm. The response time may be dramatically lowered, but also noise (from laser source, or from cooling, or from environment) can be mitigated.
FASTSLOW	"FAST" or "SLOW"	Returns the Fast/Slow current setting

5.3 *Gain and Full Scale Commands*

These commands allow selection of electronic amplifier gain (or in other words the selection of a Full Scale Range).

Command	Answer *(example)*	Description
SETX1 0	"ok" "NA" (if not available)	Set the 0th electronic amplifier gain (gain x1) (bigger full scale)
SETX1 1	"ok" "NA" (if not available)	Set the 1st electronic amplifier gain (gain x10) (smaller full scale)
X1D	Int 1 digit, 0 or 1	Displays the currently selected electronic amplifier gain: 0: x1 gain 1: x10 gain

5.4 ***Wavelength setup commands***

Command	**Answer** *(example)*	**Description**
LAMBDA	"LAMBDA" + Int 1 digit *LAMBDA3*	Displays the currently selected wavelength number. From number 1 to 5.
SETLAM + Int 1 digit *SETLAM2*	"ok"	Select the wavelength number. From number 1 to 5.
NOML1	String 3 char *CO2*	Displays wavelength 1 Label
NOML2	String 3 char *YAG*	Displays wavelength 2 Label
NOML3	String 3 char *LDS*	Displays wavelength 3 Label
NOML4	String 3 char *VIS*	Displays wavelength 4 Label
NOML5	String 3 char *EXC*	Displays wavelength 5 Label
CFWL1	Float 2int.3dec *00.000*	Displays the spectral correction coefficient of wavelength 1. If the value is 00.000 it means that this wavelength is not available.
CFWL2	Float 2int.3dec *01.000*	Displays the spectral correction coefficient of wavelength 2. If the value is 00.000 it means that this wavelength is not available.
CFWL3	Float 2int.3dec *00.950*	Displays the spectral correction coefficient of wavelength 3. If the value is 00.000 it means that this wavelength is not available.
CFWL4	Float 2int.3dec *00.990*	Displays the spectral correction coefficient of wavelength 4. If the value is 00.000 it means that this wavelength is not available.
CFWL5	Float 2int.3dec *00.000*	Displays the spectral correction coefficient of wavelength 5. If the value is 00.000 it means that this wavelength is not available.

NOTE: in order to choose the correct wavelength is recommended to use all the NOMLx and CFWLx commands, so you can know which wavelengths are available (if CFWL answer ≠ 0) or not available (if CFWL answer = 0).

5.5 <u>Measurement acquisition commands</u>

Command	Answer *(example)*	Description
OUTPM	Float *4.325*	Displays measured power (W). The answer is formatted according to VISCA command.
VISCA	Int 1 digit	This command is used to know the measured number format and Unit of measure: 0 = unit of measure W (or J) – no decimal number 1 = unit of measure W (or J) – one decimal number 2 = unit of measure W (or J) – two decimal number 3 = unit of measure mW (or mJ) – no decimal number 4 = unit of measure mW (or mJ) – one decimal number 5 = unit of measure mW (or mJ) – two decimal number 6 = unit of measure W (or J) – no decimal number (steps of 5W or 10W depending on sensor and gain)
STATUS	Int 3 digits *114*	Displays status byte. Notice that this 3 digit integer must be converted into binary. bit 0: arm/zeroing done; (1) yes, (0) no bit 1: measure running; (1) yes, (0) no bit 2: Head connected; (1) yes, (0) no bit 3: cool alarm running; (1) yes, (0) no bit 4: wait before start a new measure; (1) yes bit 5: not used; default value (0) bit 6: overflow alarm; (1) yes, (0) no bit 7: thermistor connected; (1) yes, (0) no
TERMI	Int 1 digit	Thermistor availability: (1) yes, (0) no If thermistor is available the temperature
TEMP	Int 3 digit *255*	Displays Head temperature x 10 (°C)

6. Commands and Answer Tables for Product Series #2

This product series includes these products:

Series #2 - Thermopile Series			
A-02-D12-BBF-U	A-40/200-D40-HPB-U	W-200-D40-HPB-U	10-BB-D25-U
A-2-D12-BBF-U	A-40/200-D60-HPB-U	W-200-D40-SHC-U	10-UVA-D25-U
A-2-D12-HPB-U	A-200-D25-HPB-U	W-500-D70-SHC-U	10-UVC-D25-U
A-5-D12-BBF-U	A-200-D25-SHC-U	W-600-D30-HPB-U	20-BB-D40-U
A-10-D12-HPB-U	A-200-D40-HPB-U	W-600-D30-SHC-U	20-UVA-D40-U
A-10-D20-BBF-U	A-200-D40-SHC-U	W-1500-D40-HPB-U	20-UVC-D40-U
A-10-D20-HPB-U	A-200-D60-HPB-U	W-1500-D40-SHC-U	A-30-D12-SHC-L-U
A-30-D25-HPB-U	A-200-D60-SHC-U	W-3000-D55-HPB-U	10-BB-D12-L-U
A-40-D25-BBF-U	A-300-D60-HPB-U	W-3000-D55-SHC-U	A-10-D12-DIF-U
A-40-D25-HPB-U	A-600-D40-HPB-U	W-6000-D55-SHC-U	A-30-D18-DIF-U
A-40-D40-HPB-U	A-600-D60-SHC-U		A-40-D33-DIF-U
A-40/200-D25-HPB-U	A-1200-D60-SHC-U		

6.1 Information commands

These commands are used to get ID information about the ***PcPlug-U*** and the sensor. This info may be useful when asking Laserpoint for support.

Command	**Answer** *(example)*	**Description**
HEADN	"H" + String 8 char	Displays the Sensor Head model name (shortened)
SERNU	"S" + Int 6 digit	Displays the Sensor Head serial number
FHV	"H" + 2 char + "F" + 4 char	Displays the ***PcPlug-U*** Electronics Hardware and Firmware version
KEFUN	"K" + Int 2 digit	This 2 digit code number identifies the sensor type and the available functionalities. For this series of devices, the answer will be one among the highlighted: ~~00 = OEM Thermopile sensor - Power~~ (see chapter 5) ~~01 = OEM Thermopile sensor - Fit Mode~~ (see chapter 5) ~~02 = OEM Thermopile sensor - Energy~~ (see chapter 5) ~~03 = OEM Thermopile sensor - Power + Energy~~ (see chapter 5) ~~04 = OEM Thermopile sensor - Fit Mode + Energy~~ (see chapter 5) **05 = Thermopile sensor – Power** **06 = Thermopile sensor – Power + Energy** **07 = Thermopile sensor – Fit mode** **08 = Thermopile sensor – Fit mode + Energy** ~~09 = Photodiode sensor~~ ~~10 = NA~~ ~~11 = NA~~ ~~12 = Blink Series Sensor - Power~~ (see chapter 7) ~~13 = Blink Series Sensor - Power + Energy~~ (see chapter 7)

6.2 Measurement setup commands

These commands are used for the initial set up: operation mode selection (Power, Energy, others) and a reset of zero.

Command	Answer *(example)*	Description
POWER	"ok" or "NA" (if not available)	Set ***PcPlug-U*** in Power Meter mode (if available)
ENERGY	"ok" or "NA" (if not available)	Set ***PcPlug-U*** in Energy operation mode (if available)
ZERO	"ok"	Perform a Zero. This action will take about 3 seconds, and will reset the zero value of the sensor. Please make sure that this action is performed only when the sensor is not hit by laser or any other thermal source.
FAST	"FAST"	This is the default setting. It enables the acceleration algorithm, granting a faster response time.
SLOW	"SLOW"	Disables the acceleration algorithm. The response time may be dramatically lowered, but also noise (from laser source, or from cooling, or from environment) can be mitigated.
FASTSLOW	"FAST" or "SLOW"	Returns the Fast/Slow current setting

6.3 *Gain and Full Scale Commands*

These commands allow selection of electronic amplifier gain (or in other words the selection of a Full Scale Range).

Command	Answer *(example)*	Description
SETX1 0	"ok" Or "NA" (if not available)	Set the 0th electronic amplifier gain (biggest full scale)
SETX1 1	"ok"	Set the 1st electronic amplifier gain
SETX1 2	"ok" "NA" (if not available)	Set the 2nd electronic amplifier gain (smallest full scale)
SETX1 3	"ok" "NA" (if not available)	Set the "automatic" selection of the electronic amplifier gain
X1D	Int 1 digit, from 0 to 5	Displays the currently selected electronic gain set up: 0: x1 gain 1: x10 gain 2: x100 gain 3: automatic gain, current x1 gain 4: automatic gain, current x10 gain 5: automatic gain, current x100 gain
FSWX1 0	Number + _ + Unit of measure *10.0000_W*	Command used to know the Power Full Scale of the 0th gain. NOTE: this command and the following "FS*X1*" commands are also useful to get the **formatting** and the **Unit of measure** of the values received when using the acquisition commands (see "Measurement acquisition commands")
FSWX1 1	Number + _ + Unit of measure *5.0000_W*	Command used to know the Power Full Scale of the 1st gain.
FSWX1 2	Number + _ + Unit of measure *1000.00_mW*	Command used to know the Power Full Scale of the 2nd gain.
FSJX1 0	Number + _ + Unit of measure *NA*	Command used to know the Energy Full Scale of the 0th gain.
FSJX1 1	Number + _ + Unit of measure *10.0000_J*	Command used to know the Energy Full Scale of the 1st gain.
FSJX1 2	Number + _ + Unit of measure *1000.00_mJ*	Command used to know the Energy Full Scale of the 2nd gain.

6.4 *Wavelength setup commands*

Command	Answer *(example)*	Description
LAMBDA	LAMBDA + Int 5 digit *LAMBDA01064*	Displays the currently selected wavelength (nm)
SETLAM + Int 5 digit *SETLAM00970*	"LAMBDA" + Int 5 digit *LAMBDA00970*	Command used to set the desired wavelength (nm).
RANGEWL	"RWL_" + Int5digit + "_to_" + Int5digit *RWL_00200_to_01100*	Displays the minimum and maximum value of the wavelength range (nm). Any wavelength among this range can be selected. (see SETLAM command)
SINGLEWL	"SWL_" + Int5digit + "_" + Int5digit + "_" +... *SWL_1550_2940_10600*	Displays a variable list of wavelengths (nm). These are discrete wavelength and only the specific value values are wavelength that can be selected (see SETLAM command).

6.5 Measurement acquisition commands

Command	Answer *(example)*	Description
OUTPM	Float *4.325*	Displays measured power value (or energy). The number format varies depending on many parameters. To know the number format of each scale, please use the "FS*X1 *" commands. This is a "one command – one answer" command: each time this command is sent, one one value is answered. This command is used to request a few samples per seconds (max 5-8 requests). For higher sampling it's recommended to use the OUTPTS command.
STATUS	"Y" + Int 5 digits *Y00003*	Displays the status byte. Notice that this 5 digit integer must be converted into binary. Bit 0: Head connected: (1) yes, (0) no Bit 1: thermistor connected: (1) yes, (0) no Bit 2: not used Bit 3: cool warning (1) Bit 4: battery: connected to AC (1) Bit 5: battery: charge in progress (1) Bit 6: overload warning (1) Bit 7: overflow warning (1) Bit 8: status "ready", for Fit/Energy mode (1) Bit 9: status "triggered", for Fit/Energy mode (1) Bit 10: status "wait", for Fit modes (1) Bit 11: not used Bit 12: overflow ADC gain G=x1 (1) Bit 13: overflow ADC gain G=x10 (1) Bit 14: overflow ADC gain G=x100 (1) Bit 15: not used
TERM	"T" + Int 1 digit	Thermistor availability: (1) yes, (0) no
TEMP	"t" + Int 3 digit *t258*	Displays Head temperature x 10 (°C)
OUTPTS	Integer + "_" + Integer + "_" + Integer *0.0994_00003_258*	This command is used to get a continuous stream of measured values (formatted like OUTPM command) + status byte (formatted like STATUS) + sensor temperature (formatted like TEMP). It is used when power mode is selected and a continuous flow of measurement is required. The output is delivered at 8hz, meaning 125ms interval between two measures.

7. Commands and Answer Tables for Product Series #3

This series includes these products:

Series #3 – BLINK Series			
BL-W-50W-16-K-U BL-A-30W-16-K-U			

Please notice that the Baud Rated for this product series is 38400 bps (see Chapter 2 for communication setup)

7.1 Information commands

These commands are used to get ID information about the ***PcPlug-U*** and the sensor. This info may be useful when asking Laserpoint for support.

Command	**Answer** *(example)*	**Description**
HEADN	"H" + String 8 char	Displays the Sensor Head model name (shortened)
SERNU	"S" + Int 6 digit	Displays the Sensor Head serial number
FHV	"H" + 2 char + "F" + 4 char	Displays the ***PcPlug-U*** Electronics Hardware and Firmware version
KEFUN	"K" + Int 2 digit	This 2 digit code number identifies the sensor type and the available functionalities. For this series of devices, the answer will be one among the highlighted: ~~00 = OEM Thermopile sensor - Power~~ (see chapter 5) ~~01 = OEM Thermopile sensor - Fit Mode~~ (see chapter 5) ~~02 = OEM Thermopile sensor - Energy~~ (see chapter 5) ~~03 = OEM Thermopile sensor - Power + Energy~~ (see chapter 5) ~~04 = OEM Thermopile sensor - Fit Mode + Energy~~ (see chapter 5) ~~05 = Thermopile sensor – Power~~ (see chapter 6) ~~06 = Thermopile sensor – Power + Energy~~ (see chapter 6) ~~07 = Thermopile sensor – Fit mode~~ (see chapter 6) ~~08 = Thermopile sensor – Fit mode + Energy~~ (see chapter 6) ~~09 = Photodiode sensor~~ ~~10 = NA~~ ~~11 = NA~~ **12 = Blink Sensor - Power** **13 = Blink Sensor - Power + Energy**

7.2 Measurement setup commands

These commands are used for the initial set up: operation mode selection (Power, Energy, others) and a reset of zero.

Command	Answer *(example)*	Description
POWER	"ok" or "NA" (if not available)	Set ***PcPlug-U*** in Power Meter mode (if available)
ENERGY	"ok" or "NA" (if not available)	Set ***PcPlug-U*** in Energy operation mode (if available)
ZERO	"Zok"	Perform a Zero. This action will take about 3 seconds, and will reset the zero value of the sensor. Please make sure that this action is performed only when the sensor is not hit by laser or any other thermal source.
FAST	"FAST"	**This is the default setting.** It enables the acceleration algorithm, granting a faster response time.
SLOW	"SLOW"	Disables the acceleration algorithm. The response time may be dramatically lowered, but also noise (from laser source, or from cooling, or from environment) can be mitigated.
FASTSLOW	"FAST" or "SLOW"	Returns the Fast/Slow current setting

7.3 KEFUN=0-1-2-3-4 Gain and Full Scale Commands

These commands allow selection of electronic amplifier gain (or in other words the selection of a Full Scale Range).

Command	Answer *(example)*	Description
SETX1 0	"ok" "NA" (if not available)	Set the 0th electronic amplifier gain (biggest full scale)
SETX1 1	"ok" or "NA" (if not available)	Set the 1st electronic amplifier gain
SETX1 2	"ok" "NA" (if not available)	Set the 2nd electronic amplifier gain (smallest full scale)
SETX1 3	"ok" "NA" (if not available)	Set the "automatic" selection of the electronic amplifier gain
X1D	Int 1 digit, from 0 to 5	Displays the currently selected electronic gain set up: 0: x1 gain 1: x10 gain 2: x100 gain 3: automatic gain, current x1 gain 4: automatic gain, current x10 gain 5: automatic gain, current x100 gain
FSWX1 0	Number + _ + Unit of measure *10.0000_W*	Command used to know the Power Full Scale of the 0th gain. NOTE: this command and the following "FS*X1*" commands are also useful to get the **formatting** and the **Unit of measure** of the values received when using the acquisition commands (see "Measurement acquisition commands")
FSWX1 1	Number + _ + Unit of measure *5.0000_W*	Command used to know the Power Full Scale of the 1st gain.
FSWX1 2	Number + _ + Unit of measure *1000.00_mW*	Command used to know the Power Full Scale of the 2nd gain.
FSJX1 0	Number + _ + Unit of measure	Command used to know the Energy Full Scale of the 0th gain.

	NA	
FSJX1 1	Number + _ + Unit of measure *10.0000_J*	Command used to know the Energy Full Scale of the 1st gain.
FSJX1 2	Number + _ + Unit of measure *1000.00_mJ*	Command used to know the Energy Full Scale of the 2nd gain.

7.4 Wavelength setup commands

Command	Answer *(example)*	Description
LAMBDA	LAMBDA + Int 5 digit *LAMBDA01064*	Displays the currently selected wavelength (nm)
SETLAM + Int 5 digit *SETLAM00970*	“LAMBDA” + Int 5 digit *LAMBDA00970*	Command used to set the desired wavelength (nm).
RANGEWL	“RWL_” + Int5digit + “_to_” + Int5digit *RWL_00200_to_01100*	Displays the minimum and maximum value of the available wavelength range (nm). Any wavelength among this range can be selected. (see SETLAM command)
SINGLEWL	“SWL_” + Int5digit + “_” + Int5digit + “_” +... *SWL_1550_2940_10600*	Displays a variable list of available wavelengths (nm). These are discrete wavelength and only the specific value values are wavelength that can be selected (see SETLAM command).

7.5 Measurement acquisition commands

Command	Answer *(example)*	Description
OUTPM	Float *4.325*	Displays measured power value (or energy). The number format varies depending on many parameters. To know the number format of each scale, please use the “FS*X1 *” commands. This is a “one command – one answer” command: each time this command is sent, one one value is answered. This command is used to request a few samples per seconds (max 5-8 requests). For higher sampling it’s recommended to use the OUTPTS command.
OUTPTS	16 x [Integer + “_”] + “s” + 5 digit Integer + “t” + 3 digit Integer + “c” + 2 digit Integer *3.056_3.054_3.052_3.049_ 3.047_3.045_3.043_3.041_ 3.038_3.036_3.034_3.032_ 3.030_3.028_3.026_3.025 s00003t251c49*	This command is used to activate a continuous stream of measured values. It is used when power mode is selected and a continuous flow of measurement with high sampling rate is required. The answer is delivered 12 times per second in form a of a string. Each string contains: 16 measured values (formatted like OUTPM command) + Status bytes (formatted like STATUS command) + Sensor temperature (formatted like TEMP) + 2 digit counter (increasing from 00 to 99) NOTE: The total number of values outputted per second is = 12 strings x 16 values = 192 samples NOTE2: the counter that can be used to check if strings are complete and/or if there is some string that is missing due to communication errors.

		To stop the data stream use the command *COMMAND:
COMMAND	“COMMAND”	This command is used to stop any data stream mode that is active.
STATUS	“Y” + Int 5 digits *Y00003*	Displays the status byte. Notice that this 5 digit integer must be converted into binary. Bit 0: Head connected: (1) yes, (0) no Bit 1: thermistor connected: (1) yes, (0) no Bit 2: not used Bit 3: cool warning (1) Bit 4: battery: connected to AC (1) Bit 5: battery: charge in progress (1) Bit 6: overload warning (1) Bit 7: overflow warning (1) Bit 8: status “ready”, for Fit/Energy mode (1) Bit 9: status “triggered”, for Fit/Energy mode (1) Bit 10: status “wait”, for Fit modes (1) Bit 11: not used Bit 12: overflow ADC gain G=x1 (1) Bit 13: overflow ADC gain G=x10 (1) Bit 14: overflow ADC gain G=x100 (1) Bit 15: not used
TERM	“T” + Int 1 digit	Thermistor availability: (1) yes, (0) no
TEMP	“t” + Int 3 digit *t258*	Displays Head temperature x 10 (°C)

8. Examples and Notes

8.1 EXAMPLE 1 – quick communication test

The simplest way to test the communication, between the PC and a ***PcPlug-U***, is using a simple serial terminal software (like Hyperterminal, Putty, CoolTerm, and many others).

Once the ***PcPlug-U*** has been connected to the PC and the drivers have been installed:

- set the correct COM port in the serial terminal software (use the device manager to get the COM number)
- use these settings:

Baud Rate:	38400 bps
Parity:	no
Data Bits:	8
Stop Bits:	1

Start the connection and send a simple command:

*SERNU: to get a 6 digit serial number as an answer
or *OUTPM: to get a measured value as an answer.

8.2 EXAMPLE 2 – opening the communication using FTDXX functions

Here below is reported an example of the main steps necessary to start the communication with a ***PcPlug-U*** device by using the FTDXXX functions. The programming language for this example is VB.NET.

```
‘ Get the number of the connected FTDI devices:
FT_Status = FT_GetNumberOfDevices(NumDevicesConnected, vbNullChar, FT_LIST_NUMBER_ONLY)
```

Browse all the connected FTDI devices to find Laserpoint ***PcPlug-U*** device

```
‘ 1 Get the device description
FT_Status = FT_GetDeviceString(i, Description, FT_LIST_BY_INDEX Or FT_OPEN_BY_DESCRIPTION)

‘ 2 Shrink the description returned as 64 chars string to the correct number of chars.
‘ Ex: " PcPlug_V3                  " --> " PcPlug_V3"
Description = Microsoft.VisualBasic.Left(Description, InStr(1, Description, vbNullChar) - 1)
```

NOTE: Description of Laserpoint ***PcPlug-U*** devices is “*PcPlug_V3*”

Get the serial number of Laserpoint device using the description

```
‘ Get serial number of device using index
FT_Status = FT_GetDeviceString(i, Serial, FT_LIST_BY_INDEX Or FT_OPEN_BY_SERIAL_NUMBER)

‘ Shrink the description from 64 chars to the correct number of chars
‘ Ex: "123456              " --> "123456"
Serial = Microsoft.VisualBasic.Left(Serial, InStr(1, Serial, vbNullChar) - 1)
```

```
‘ Open communication with device identified by its serial number. Function will return a communication Handle which will
‘ be used for all the following communications
FT_Status = FT_OpenBySerialNumber(Serial, FT_OPEN_BY_SERIAL_NUMBER, COM_Handle)
```

```
‘ Setting communication parameters
FT_Status = FT_SetBaudRate(COM_Handle, 38400)
FT_Status = FT_SetDataCharacteristics(COM_Handle, FT_DATA_BITS_8, FT_STOP_BITS_1, FT_PARITY_NONE)
FT_Status = FT_SetFlowControl(COM_Handle, FT_FLOW_NONE, 0, 0)
FT_Status = FT_SetTimeouts(COM_Handle, 500, 100)
FT_Status = FT_Purge(COM_Handle, FT_PURGE_RX Or FT_PURGE_TX)
```

```
' Read and write to serial port
FT_Status = FT_Write_String(COM_Handle, "*COMMAND:", 9, byteswritten)

' Set a delay of 50ms between write and read function to wait for device to reply
System.Threading.Thread.Sleep(50)

' Read the response from the device
FT_Status = FT_GetQueueStatus(COM_Handle, RXBytes)
ReadString = Space(RXBytes)
FT_Status = FT_Read_String(COM_Handle, ReadString, RXBytes, bytesread)
```

8.3 EXAMPLE 3 – command sequence to perform an energy measure

Here below is reported an example of ***PcPlug-U*** command sequence to perform an ENERGY measure using a sensor from series #1 (sensors with **KEFUN code 0-1-2-3-4**)

*Please note that the answers to the command "*STATUS:" are just an example and may be different depending on the sensor employed.*

Command	**Answer**	**Comment**
ENERGY	Ok	*Activating energy measurement mode*
SETX1 0	Ok	*Activating the "standard" full scale range*
NOML2	"YAG"	*Checking the "name" of the wavelength saved in the 2nd position of memory.*
CFWL2	0.982	*Checking the coefficient of this wavelength* *(It's important to check that is not = 0. The "0" value means that this wavelength is not activated)*
You may repeat last two commands, for each number from 1 to 5, in order to know which wavelength are available.		
SETLAM2	ok	*Selecting the 2nd wavelength*
STATUS	132 (=1000010**0**)	*As expected, the first time the device is started the answer is a "no" (=0) on bit number 0.* *That's because the instrument **has not been zeroed/armed yet***
ZERO	ok	*Zeroing the **PcPlug-U***
NOTE: it's important that the sensor is in steady state while performing the zero, and no laser or thermal radiation must hit the sensor during this 3-4 seconds operation.		
STATUS	133 (=1000010**1**)	*Now the bit number 0 is =1 (=yes, the instrument has been zeroed).* *The **PcPlug-U** is armed and ready to measure.*
Turn the laser ON and shoot. *NOTE: Laser pulse maximum duration is 100-300 ms depending on sensor type.*		
STATUS	134 (=100001**1**0)	*Bit number 1 is =1.* *Meaning that the measure is running.* *(this status will lasts 4-5 seconds usually)*
STATUS	148 (=100**1**0100)	*Bit number 5 is = 1. Meaning "Wait before start new measure".* *(this status may last from 4 to 40 seconds, depending on sensor type).* *You may use the command ***HOFTE:** to know approximately the duration of this status (seconds).*
ATTENTION: *No LASER pulses must hit the sensor during this span of time (while bit 5 = 1 = meaning "wait before start the new measure").*		
OUTPM	1.65	*Getting the energy measured (Joules)* *NOTE: this value is available from the moment the "measure running" stops, and it will be available until a new measure starts or a new zero is performed*

STATUS	132 (=1000010**0**)	*The waiting time is finished,* *The **PcPlug-U** is not yet armed.*
STATUS	133 (=1000010**1**)	*The **PcPlug** is ready to run a new measure*

8.4 EXAMPLE 4 – command sequence to perform a power measure

This is an example of ***PcPlug-U*** command sequence to perform a POWER measure using a sensor **of KEFUN family 5-6-7-8-9** or **12-13.**

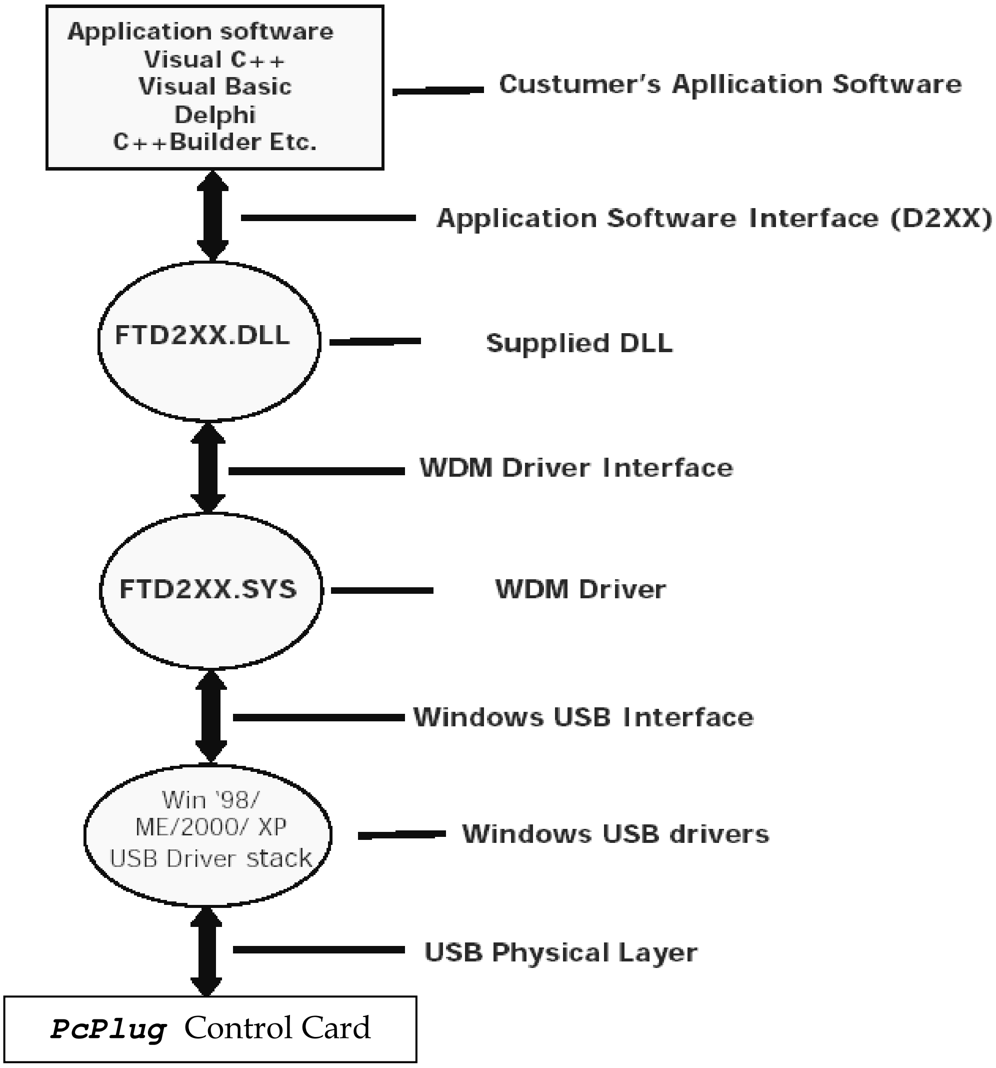
*Please note that the answers to the command "*STATUS:" are just an example and may be different depending on the model of employed sensor.*

Command	**Answer**	**Comment**
RANGEWL	RWL_00200_to_01100	*Get info about available wavelengths.* *This answer means that any wavelength in the **range** 200nm – 1100 nm can be selected.*
SINGLEWL	SWL_1550_2940	*This answer means that 1550nm and 2940nm are available as discrete values (e.g. 1600nm is not selectable).*
SETLAM01070	LAMBDA01070	*The wavelength of 1070nm has been selected.*
FSWX1 0	20.0000_W	*Command used to know the maximum Power and the unit of measure of the 0th electronic gain (this Full Scale).*
FSWX1 1	5.0000_W	*Command used to know the maximum Power and the unit of measure of the 1st electronic gain (this Full Scale).*
SETX1 1	ok	*Select the 5W Full Scale*
STATUS	Y00003 = 0000000000000011	*This status shows that.* Bit 0: Head connected: (1) yes Bit 1: thermistor connected: (1) yes *no alarms or warnings are activated.*
OUTPM	0.0027	*The measured value is 0.0027 Watts.* *It has to be evaluated an instrument Zeroing.* *Note that the number of digits outnumbers the precision and noise of the instrument: it's therefore recommended to round up the number to match the display needs.*
ZERO	Zok	*Perform a zero reset*
OUTPM	0.0006	*The measured value is now 0.0006 Watts.* *Note that the number of digits outnumbers the precision and the noise of the instrument.* *Therefore:* *- after zeroing, the answer will not be 0.0000* *- it's recommended to round up this value according to the displaying needs*
After the laser has been turned ON		
OUTPM	2.4986	*The measured value is now 2.499 Watts. (rounded)*

9. ANNEX 1 – FTD2XX.DLL DYNAMIC LIBRARY

The FTD2XX.DLL Dynamic Library for Windows allows you to write your application.
The architecture of the FTD2XX.DLL drivers consists of a Windows WDM driver that communicates with the device via the Windows USB Stack and a DLL which interfaces the Application Software (written in VC++, C++ Builder, Delphi, VB etc.) to the WDM driver.
The FTD2XX.DLL interface provides a simple, easy to use, set of functions to access ***PcPlug-U*** control card.

9.1 D2XX Driver Architecture



9.2 Useful links for FTDI drivers and libraries:

For a complete list and description of FTDXXX functions, please download the "FTD2XX Programmer's Guide" at this link:
http://www.ftdichip.com/Support/Documents/ProgramGuides.htm

To download the right libraries for your Operative System / architecture please check this section of FTDI website:
http://www.ftdichip.com/Drivers/D2XX.htm

For software examples with different programming languages please check this section:
http://www.ftdichip.com/Support/SoftwareExamples/CodeExamples.htm

9.3 DLL Functions

Here below we report only an extract of the "FTD2XX Programmer's Guide" (for the full document see the link above), that collects the most important functions that may be used to identify and communicate with the ***PcPlug-U***:

FT_ListDevices

Description Gets information concerning the devices currently connected. This function can return such information as the number of devices connected, and device strings such as serial number and product description.

Syntax FT_STATUS **FT_ListDevices** (PVOID *pvArg1*, PVOID *pvArg2,* DWORD *dwFlags*)

Parameters
pvArg1 meaning depend on the *dwFlags* value (see note below)
pvArg2 meaning depend on the *dwFlags* value (see note below)
dwFlags Determines format of returned information (see note below)

Return Value FT_OK if successful, otherwise the return value is an FT error code

Note Remarks This function can be used in a number of ways to return different types of information.
In its simplest form, it can be used to return the number of devices currently connected. If **FT_LIST_NUMBER_ONLY** bit is set in **dwFlags**, the parameter **pvArg1** is interpreted as a pointer to a **DWORD** location to store the number of devices currently connected.
It can be used to return device string information. If **FT_OPEN_BY_SERIAL_NUMBER** bit is set in **dwFlags**, the serial number string will be returned from this function. If **FT_OPEN_BY_DESCRIPTION** bit is set in **dwFlags**, the product description string will be returned from this function. If neither of these bits is set, the serial number string will be returned by default. It can be used to return device string information for a single device. If **FT_LIST_BY_INDEX** bit is set in **dwFlags**, the parameter **pvArg1** is interpreted as the index of the device, and the parameter **pvArg2** is interpreted as a pointer to a buffer to contain the appropriate string. Indexes are zerobased, and the error code **FT_DEVICE_NOT_FOUND** is returned for an invalid index.
It can be used to return device string information for all connected devices. If **FT_LIST_ALL** bit is set in **dwFlags**, the parameter **pvArg1** is interpreted as a pointer to an array of pointers to buffers to contain the appropriate strings, and the parameter **pvArg2** is interpreted as a pointer to a **DWORD** location to store the number of devices currently connected. Note that, for **pvArg1**, the last entry in the array of pointers to buffers should be a **NULL** pointer so the array will contain one more location than the number of devices connected.

FT_Open

Description Opens the device and return a handle which will be used for subsequent accesses.

Syntax FT_STATUS **FT_Open** (int *iDevice*, FT_HANDLE **ftHandle*)

Parameters
iDevice indicates the number of the device to be opened. Must be 0 if only one device is attached. For multiple devices 1, 2 etc.
ftHandle Pointer to a variable of type FT_HANDLE where the handle will be stored. This handle must be used to access the device.

Return Value FT_OK if successful, otherwise the return value is an FT error code

Note Although this function can be used to open multiple devices by setting iDevice to 0, 1, 2 etc. there is no ability to open a specific device. To open named devices, use the function **FT_OpenEx.** With the **FT_OpenEx** function (not described in this user manual) it is possible to open a device also trough its *serial number* or trough its description. For further information, please contact **LASERPOINT.srl.**

FT_Close

Description Closes the communication with a open device.

Syntax FT_STATUS **FT_Close** (FT_HANDLE *ftHandle*)

Parametres
ftHandle pointer to the communication *handle* of the device to close.

Return Value FT_OK if successful, otherwise the return value is an FT error code

FT_Read

Description Reads a string from the device.

Syntax FT_STATUS **FT_Read** (FT_HANDLE *ftHandle*, LPVOID *lpBuffer*, DWORD *dwBytesToRead*, LPDWORD *lpdwBytesReturned*)

Parameters
ftHandle pointer to the communication *handle* of the device to read.
lpBuffer pointer to the buffer that receives the data from the device.
DwBytesToRead Number of bytes to be read from the device.
lpdwBytesReturned Pointer to a variable of type DWORD which receives the number of bytes read from the device.

Return Value FT_OK if successful, FT_IO_ERROR otherwise.

Note FT_Read always returns the number of bytes read in **lpdwBytesReturned**. This function does not return until **dwBytesToRead** have been read into the buffer. The number of bytes in the receive queue can be determined by calling **FT_GetStatus** or **FT_GetQueueStatus**, and passed to **FT_Read** as **dwBytesToRead** so that the function reads the device and returns immediately. When a read timeout value has been specified in a previous call to **FT_SetTimeouts**, **FT_Read** returns when the timer expires or **dwBytesToRead** have been read, whichever occurs first. If the timeout occurred, **FT_Read** reads available data into the buffer and returns **FT_OK**. An application should use the function return value and **lpdwBytesReturned** when processing the buffer. If the return value is **FT_OK**, and l**pdwBytesReturned** is equal to **dwBytesToRead** then **FT_Read** has completed normally. If the return value is **FT_OK**, and **lpdwBytesReturned** is less then **dwBytesToRead** then a timeout has occurred, and the read has been partially completed. Note that if a timeout occurred and no data was read, the return value is still **FT_OK**. A return value of **FT_IO_ERROR** suggests an error in the parameters of the function, or a fatal error like USB disconnect has occurred.

FT_Write

Description Writes a string to the device.

Syntax FT_STATUS **FT_Write** (FT_HANDLE *ftHandle*, LPVOID *lpBuffer*, DWORD *dwBytesToWrite*, LPDWORD *lpdwBytesWritten*)

Parameters
ftHandle pointer to the communication *handle* of the device to write.
lpBuffer pointer to the buffer which contains the bytes to be written in the device.
DwBytesToWrite number of bytes to write to the device.
lpdwBytesWritten pointer to a variable of type DWORD which receives the number of bytes written to the device

Return Value FT_OK if successful, otherwise the return value is an FT error code.

FT_ResetDevice

Description Sends a Reset command to the device.

Syntax FT_STATUS **FT_ResetDevice** (FT_HANDLE *ftHandle*)

Parameters
ftHandle pointer to the communication *handle* of the device to reset .

Return Value FT_OK if successful, otherwise the return value is an FT error code.

FT_SetBaudRate

Description Sets the *baudrate* for the device.

Syntax FT_STATUS **FT_SetBaudRate** (FT_HANDLE *ftHandle*, DWORD *dwBaudRate*)

Parameters
FtHandle pointer to the communication *handle* of the device to set out.
dwBaudRate value of the *baudrate* to set out.

Return Value FT_OK if successful, otherwise the return value is an FT error code.

Note: ***PcPlug-U*** *Baud Rate value is 38400.*

FT_SetDataCharacteristics

Description Sets the data characteristics for the device**.**

Syntax FT_STATUS **FT_SetDataCharacteristics** (FT_HANDLE *ftHandle*, UCHAR *uWordLength*, UCHAR *uStopBits*, UCHAR *uParity*)

Parameters
ftHandle pointer to the communication *handle* of the device to set out .
uWordLength number of *bits* per word. It must set as *FT_BITS_8* (in the case of 8 bit schosen) or as *FT_BITS_7* (in the case of 7 bits chosen).
uStopBits number of stop *bits*. It must set as *FT_STOP_BITS_1* (when one stop bit is requested) or as *FT_STOP_BITS_2* (when two stop bits are requested).
uParity number of parity *bits*. It must set as *FT_PARITY_NONE* (no parity bit) or as *FT_PARITY_ODD* (parity bit is odd) or as *FT_PARITY_EVEN* (parity bit is even) or as *FT_PARITY_MARK* (always high parity bit) or as *FT_PARITY_SPACE* (always low parity bit).

Return Value FT_OK if successful, otherwise the return value is an FT error code.

Note: for ***PcPlug-U*** the DataCharacteristics must be set as FT_DATA_BITS_8, FT_STOP_BITS_1, FT_PARITY_NONE

FT_SetFlowControl

Description Sets the flow control the chip serial communication of chip USB/RS232.

Syntax FT_STATUS **FT_SetDataCharacteristics** (FT_HANDLE *ftHandle*, USHORT *usFlowControl*, UCHAR *uXon*, UCHAR *uXoff*)

Parameters
FtHandle pointer to the communication *handle* of the device to set out.
usFlowControl set the kind of flow control. It must be set as *FT_FLOW_NONE* (no flow control) or as *FT_FLOW_RTS_CTS* (*hardware* RTS/CTS flow control) or as *FT_FLOW_DTR_DSR* (*hardware* DTR/DSR flow control) or as *FT_FLOW_XON_XOFF* (*software* XON/XOFF flow control)
uXon shows the character uses as Xon signal. It must be set only when the flow control is *software* XON/XOFF kind (otherwise, it must be set as zero).
uXoff shows the character uses as Xoff signal. It must be set only when the flow control is *software* XON/XOFF kind (otherwise, it must be set as zero).

Return Value FT_OK if successful, otherwise the return value is an FT error code.

*Note: for **PcPlug-U** the FlowControl must be set as FT_FLOW_NONE*

FT_SetDTR

Description Sets the Data Terminal Ready (DTR) control signal. (Data Terminal Ready).

Syntax FT_STATUS **FT_SetDTR** (FT_HANDLE *ftHandle*)

Parameters
ftHandle pointer to the communication *handle* of the DTR device to set out.

Return Value FT_OK if successful, otherwise the return value is an FT error code.

FT_ClrDTR

Description This function clears the Data Terminal Ready (DTR) control signal (*Data Terminal Ready*).

Syntax FT_STATUS **FT_ClrDTR** (FT_HANDLE *ftHandle*)

Parameters
ftHandle pointer to the communication *handle* of the DTR device to set out.

Return Value FT_OK if successful, otherwise the return value is an FT error code.

FT_SetRTS

Description Sets the Request To Send (RTS) control signal. (Request To Send).

Syntax FT_STATUS **FT_SetDTR** (FT_HANDLE *ftHandle*)

Parameters
ftHandle pointer to the communication *handle* of the RTS device to set out.

Return Value FT_OK if successful, otherwise the return value is an FT error code.

FT_ClrRTS

Description Clears the Request To Send (RTS) control signal (*Request To Send*).

Syntax FT_STATUS **FT_SetDTR** (FT_HANDLE *ftHandle*)

Parameters
FtHandle pointer to the communication *handle* of the RTS device to set out.

Return Value FT_OK if successful, otherwise the return value is an FT error code.

FT_SetTimeouts

Description Sets the read and write timeouts for the device.

Syntax FT_STATUS **FT_SetBaudRate** (FT_HANDLE *ftHandle*, DWORD *dwReadTimeout*, DWORD *dwWriteTimeout*)

Parameters
FtHandle pointer to the communication *handle* of the device to set out .
dwReadTimeout value of the Read timeout, in milliseconds, to set out.
dwWriteTimeout value of the Write timeout, in milliseconds, to set out.

Return Value FT_OK if successful, otherwise the return value is an FT error code.

FT_GetQueueStatus

Description Shows the number of characters in the receive queue.

Syntax FT_STATUS **FT_GetQueueStatus** (FT_HANDLE *ftHandle*, LPDWORD *lpdwAmountInRxQueue*)

Parameters
FtHandle pointer to the communication *handle* of the device to set out .
lpdwAmountInRxQueue Pointer to a variable of type DWORD which receives the number of characters in the receive queue.

Return Value FT_OK if successful, otherwise the return value is an FT error code.

FT_GetStatus

Description Shows the device status including number of characters in the receive queue, number of characters in the transmit queue, and the current event status.

Syntax FT_STATUS **FT_GetStatus** (FT_HANDLE *ftHandle*, LPDWORD *lpdwAmountInRxQueue* , LPDWORD *lpdwAmountInTxQueue*, LPDWORD *lpdwEventstatus*)

Parameters
ftHandle pointer to the communication *handle* of the device to set
out .
lpdwAmountInRxQueu Pointer to a variable of type DWORD which receives the number of characters in the receive queue.
LpdwAmountInTxQueue Pointer to a variable of type DWORD which receives the number of characters in the transmit queue.
lpdwEventstatus Pointer to a variable of type DWORD which receives the current state of the event status.

Return Value *FT_OK if successful, otherwise the return value is an FT error code.*

FTD2XX - Error codes

FT_OK = 0
FT_INVALID_HANDLE = 1
FT_DEVICE_NOT_FOUND = 2
FT_DEVICE_NOT_OPENED = 3
FT_IO_ERROR = 4
FT_INSUFFICIENT_RESOURCES = 5
FT_INVALID_PARAMETER = 6
FT_INVALID_BAUD_RATE = 7
FT_DEVICE_NOT_OPENED_FOR_ERASE = 8
FT_DEVICE_NOT_OPENED_FOR_WRITE = 9
FT_FAILED_TO_WRITE_DEVICE = 10
FT_EEPROM_READ_FAILED = 11
FT_EEPROM_WRITE_FAILED = 12
FT_EEPROM_ERASE_FAILED = 13
FT_EEPROM_NOT_PRESENT = 14
FT_EEPROM_NOT_PROGRAMMED = 15
FT_INVALID_ARGS = 16