



FTC FLAT-TOP CONVERTER

FTC series



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FTC

Integrated Flat-Top beam converter

Congratulations on your purchase of the motorised laser power attenuator from Optogama, UAB.

March 2022

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Claims will not be accepted and warranty repair will not be carried out in case of improper use, incorrect service and maintenance not according to product instructions. Warranty claim shall not be accepted if there are any signs of:

- Non-authorized alteration
- Disassembling of the device
- Mechanical or any external damage
- If warranty term has expired
- Serial number of the product is missing

Symbols

CAUTION!

Sections marked with this symbol indicate dangerous situations that can result in damage to the device, components connected to it or operator.

NOTE:

Sections marked with this symbol indicate important information on laser power attenuator or about this manual.

Due to constant development of our products we reserve the right to make changes in the production line without further notice. Up-to-date information is available at our website www.optogama.com. If there are any further questions, please contact us.

Optogama is not liable for damage or injury resulting directly or indirectly from use of this product for anything other than its intended purpose.

The motorised laser power attenuator is intended for industrial and scientific use only. If there are any other electrical devices connected to or used in conjunction with the laser power attenuator, all legal regulations and technical standards that are applied to those devices must be observed as well.

For any technical assistance and consultation please contact your local dealer or directly sales@optogama.com.

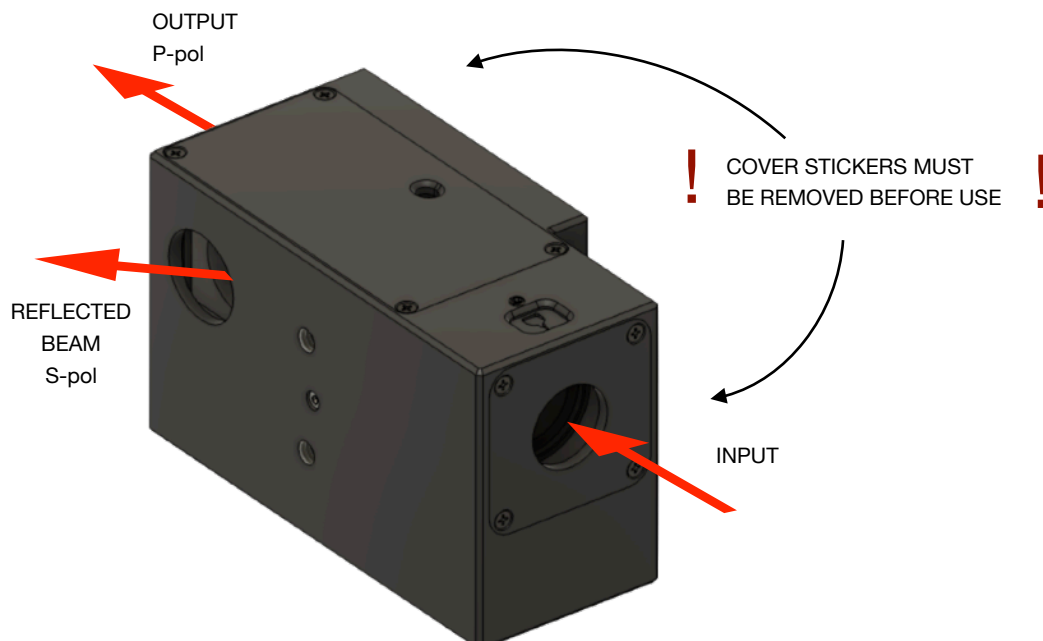
1. Safety requirements

- All safety instructions must be followed.
- All rules and regulations concerning the safe operation of lasers must be known and applied while installing and operating motorised laser power attenuator.
- Even when wearing safety glasses avoid eye contact with direct or scattered laser light while assembling, installing and operating the device.
- The device should never be exposed to dirt, dust or moisture.
- Before any operation make sure the device is installed correctly and well adjusted and all cover stickers are removed.
- Protective measures should be considered if necessary.
- Electrical safety requirements must be complied while operating this device.

CAUTION! High laser output power may damage or destroy optical elements.

CAUTION! The device is meant to be used with a collimated beam. Users take full responsibility when using the device with a highly converging beam.

CAUTION! Before increasing laser power make sure the device is aligned and there is no beam cut. It may damage optical elements.



2. Operation principle

FTC consists of quarter-order waveplate, polarising element and Brewster type thin film polariser. Linear polarised laser beam is converted to circular polarised by Quarter-order waveplate. Brewster type thin polariser passes P-polarised and reflects the S-polarised laser beam. Switching between Flat-top and Gaussian beam mode is achieved by motorised rotating of the polarising element, which is located in the incident of the laser beam.

NOTE: Before use calibration is required

NOTE: Homing is required.

CAUTION! Before increasing laser power make sure the device is aligned and there is no beam cut. It may damage optical elements.

2.1. Features and advantages

- Quick change between Gaussian and Flat-top beam
- The beam profile remains Flat-Top shape along optical axis up to 1m*
- Integrated controller
- Designed according your laser specs.
- Clear aperture up to 15 mm
- Quick switching time - 0.2 sec
- High damage threshold up to 10J/cm² (10 ns @ 1064 nm)
- Conversion efficiency up to 70% (while on Flat-Top mode)

2.2. Optical design

FTC optical elements are coated for high LIDT (10 (J/cm²) (10 ns @ 1064 nm) and can be applied for high power lasers. Manual rotation of quarter wave-plate should be done once and remain in the same position for both - Gaussian and Flat top beam modes. Switching is achieved by motorised rotation of polarising element.

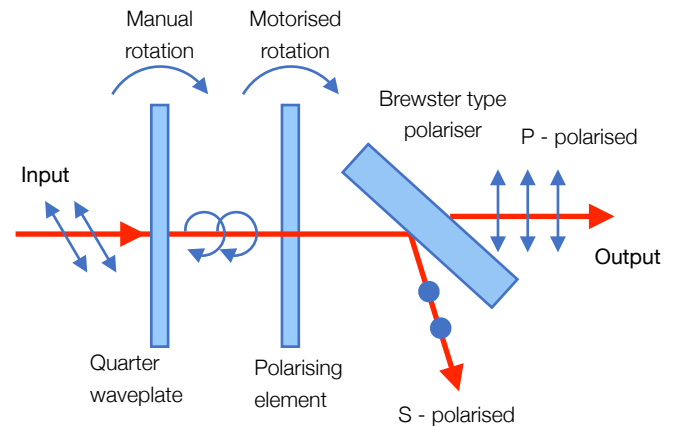


Fig 1. Schematic explanation of optical design of Flat-top converter (FTC)

2.3. Contrast improvement. Angle adjustment

Incident light's angle α should be adjusted to improve device contrast (± 2 deg maximum). Use HEX 1,5 key.

- Clock-wise to decrease angle
- Counter clock-wise to increase angle

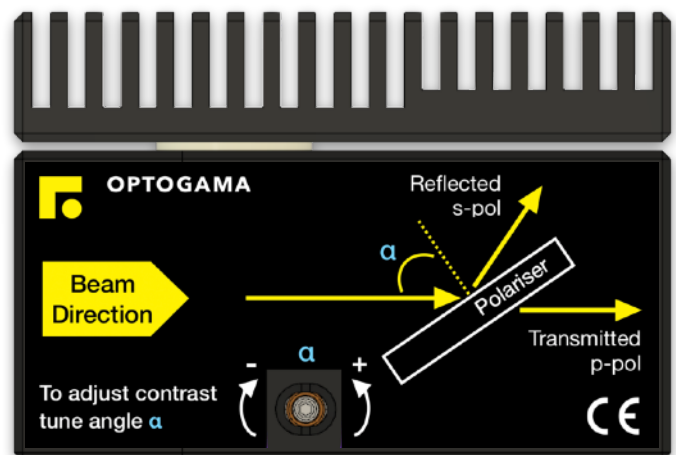


Fig 2. Schematic explanation of optical design of (FTC)

3. Product description

Flat top converter unit is all in one motorised solution for a Gaussian beam transformation to a Flat-Top (Top Hat) beam. The beam profile remains Flat-Top shape along optical axis up to 1 meter.

The device consist of quartz wave-plate, space-variant wave-plate and a high contrast polariser.

The FTC is produced in the UV, visible and NIR spectral ranges, from 250 nm to 2000 nm.

All optical components of the FTC are made for high LIDT and provide stable and reliable performance even using them with high power lasers in industrial applications.

A secondary laser beam from Flat top converter unit can be rejected to an external beam dump. The beam dump is used for avoiding any thermal effects or stress in the housing of the FTC device.

3.1. Optical specifications

Clear input aperture	Up to $\varnothing 15$ mm (depends on configuration)		
Clear output aperture	Up to $\varnothing 15$ mm (depends on configuration)		
Conversion efficiency and Transmission	Up to 70 % (Flat-Top beam mode) No less than 97 % (Gaussian beam mode)		
LIDT coating	>10 [J/cm ²] (10 ns @ 1064 nm)		
Switching time	0.2 sec		
Aboslute pos. encoder	Yes, with 3.7 arcsec resolution		
Flat-Top beam	The beam profile remains Flat-Top shape along optical axis up to: - 0.5 meter - 1 meter (when using beam expander)		
Available coatings			
A. Standard wavelenghts, nm			
	1 st harm	2 nd harm	3 rd harm
	1064	532	355
	1020 - 1040	510 - 520	343
	760-840	390 - 410	-
B. Custom wavelenghts			
Custom coating available			

3.2. Mechanical specifications

	FTC	FTC with beam dump (BD-6)
Lenght	105 mm	105 mm
Width	53 mm	70 mm
Height	62.5 mm	62.5 mm

3.3. Electronic specifications

Interface options:

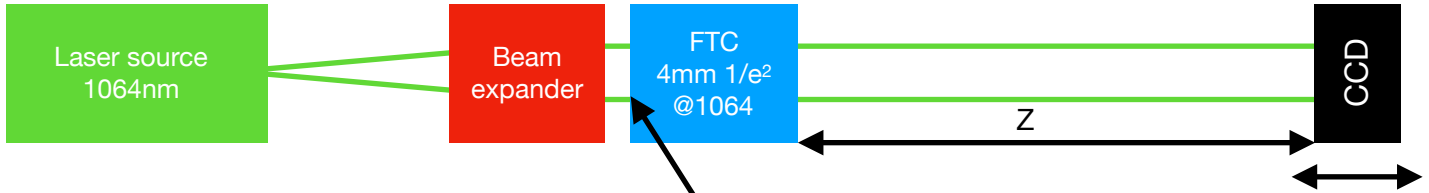
Terminal	Using commands described in p. 12 "Commands"
Software	Using LPA software
Input voltage	DC 12 V
Transmission speed	up to 115,200 bits/s (RS-232) full speed USB 2.0

3.4. Conditions

Operating temperature	10 °C to 40 °C
Storage temperature	-15 °C to 50 °C

4. Measurements

4.1. Setup parameters



Laser parameters:

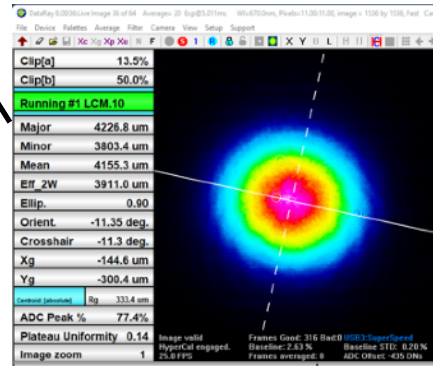
Wavelength 1064nm

Beam diameter X 4.2mm, Y 3.8mm 1/e²

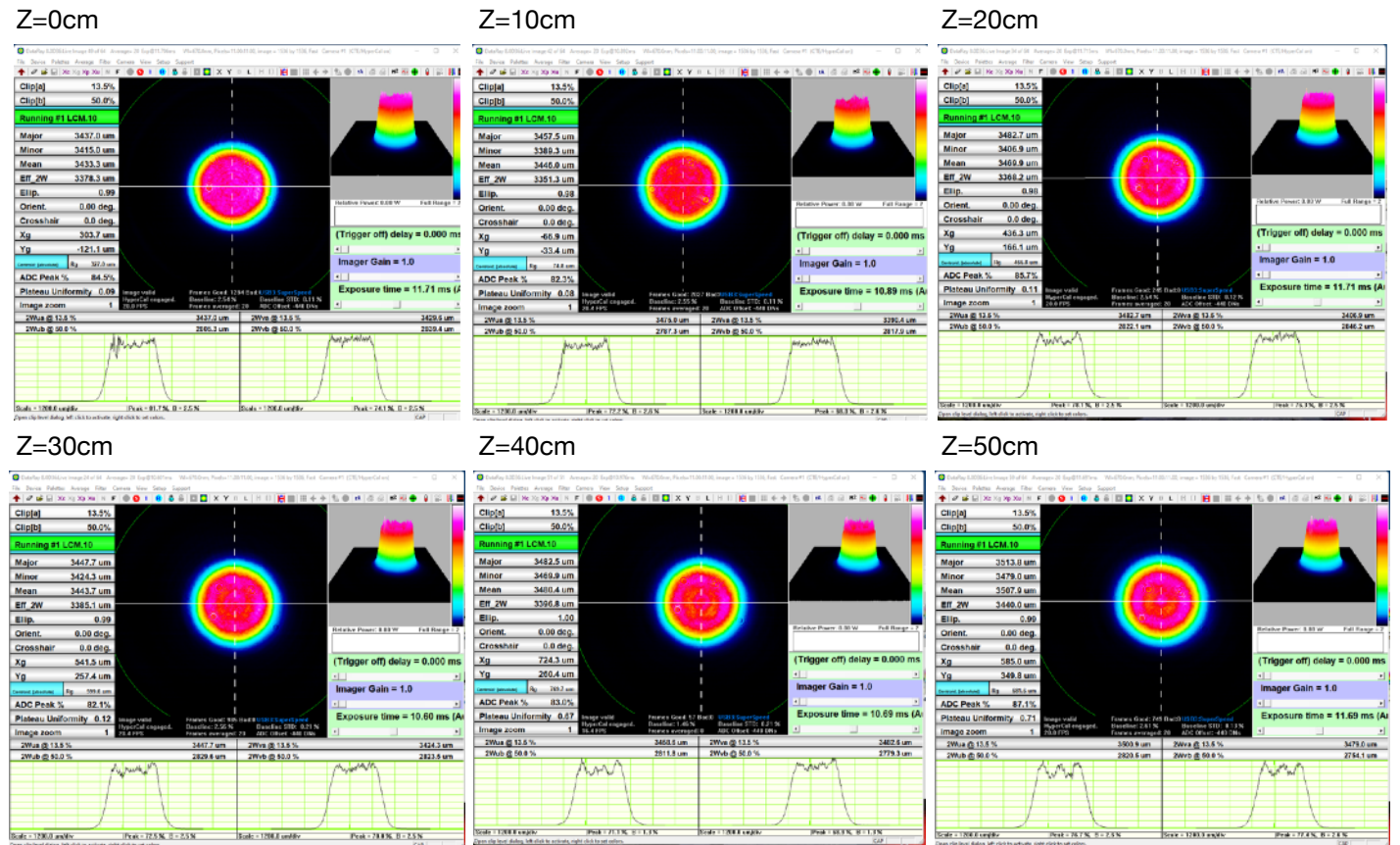
Flat top converter parameters:

Wavelength 1064nm

Beam diameter 4mm 1/e²



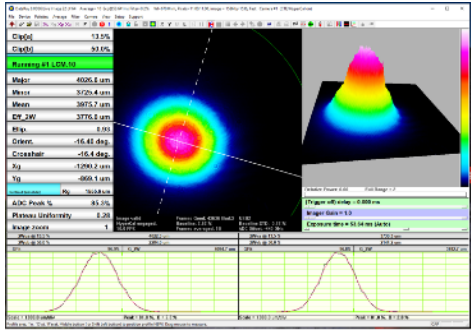
4.2. Flat top mode (no expander after FTC)



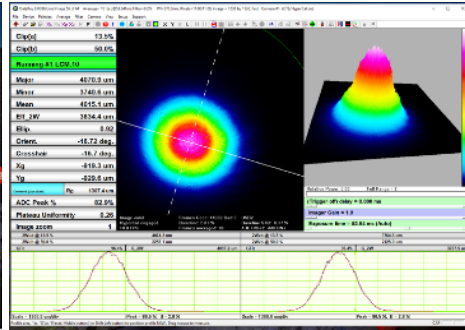
Z - distance between Flat Top Converter and CMOS camera

4.3. Gaussian beam mode

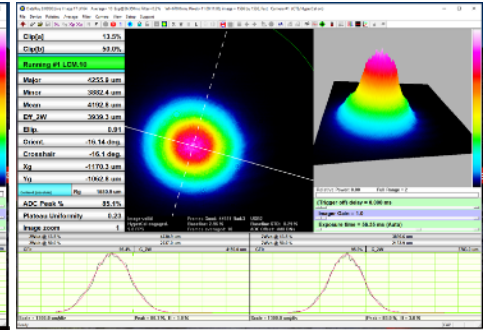
Z=0cm



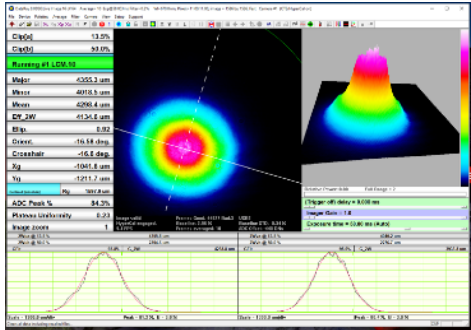
Z=10cm



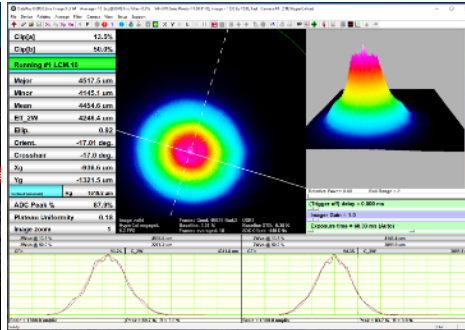
Z=20cm



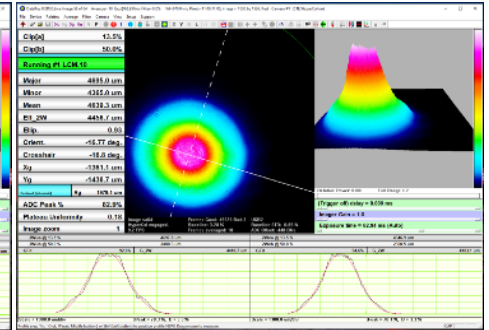
Z=30cm



Z=40cm

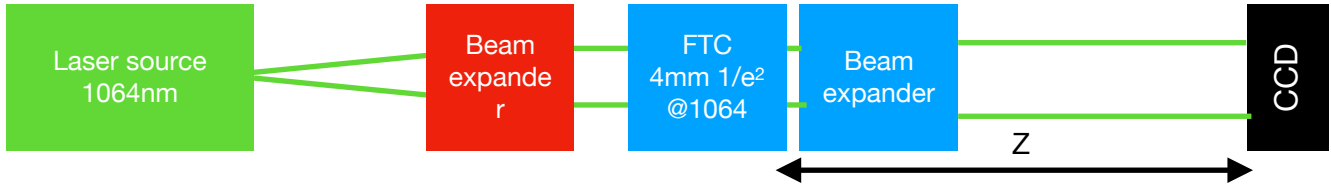


Z=50cm

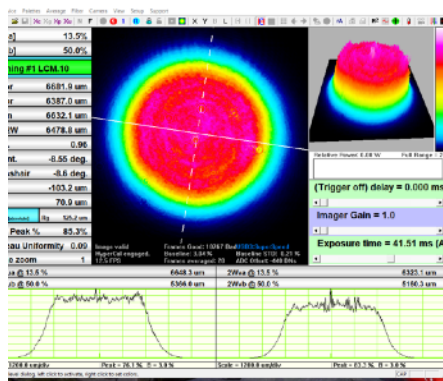


Z - distance between Flat Top Converter and CMOS camera

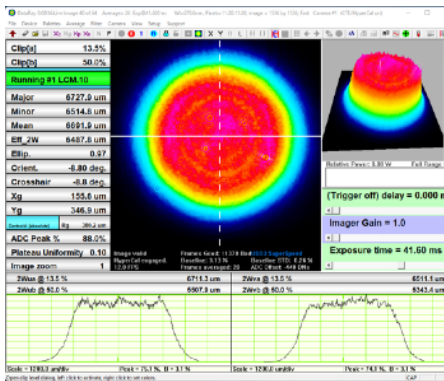
4.4. FTC with beam expander (2X)



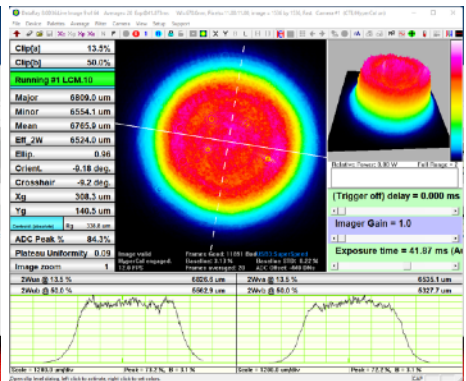
Z=10cm



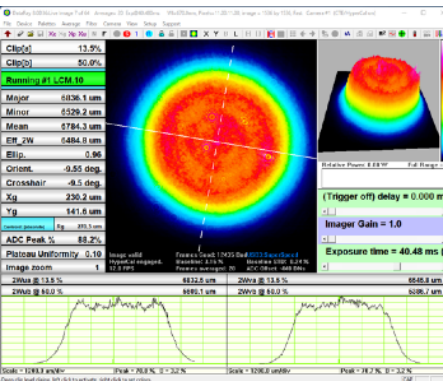
Z=20cm



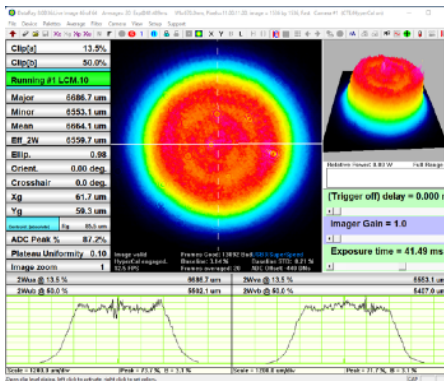
Z=30cm



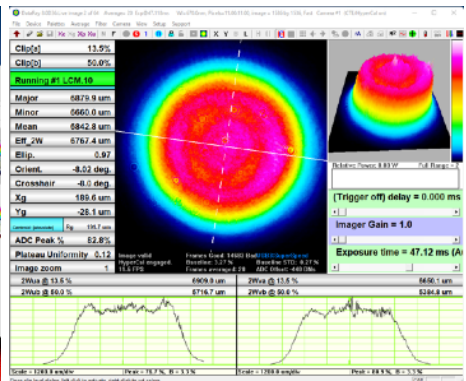
Z=40cm



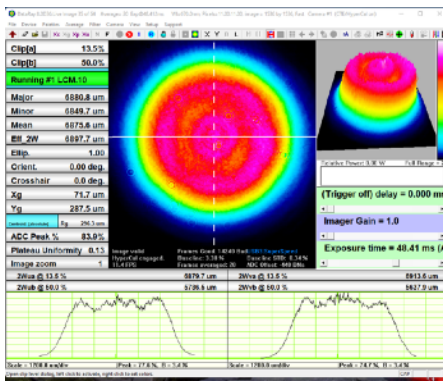
Z=50cm



Z=75cm



Z=100cm

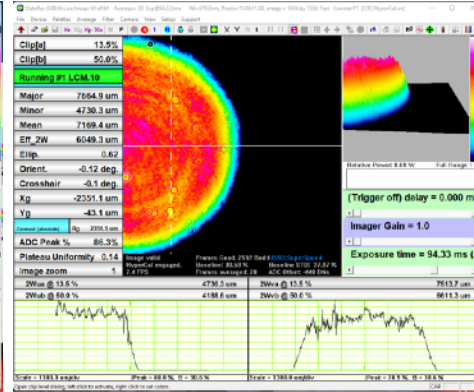
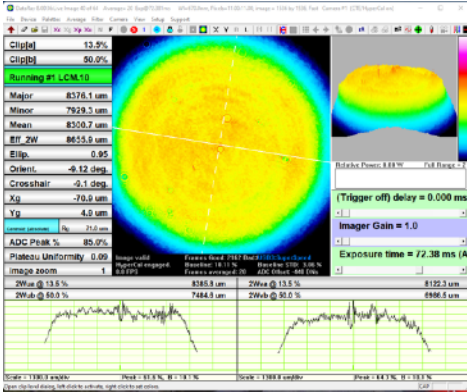


Z - distance between Flat Top Converter and CMOS camera

4.5. FTC with beam expander (3X)

Z=10cm

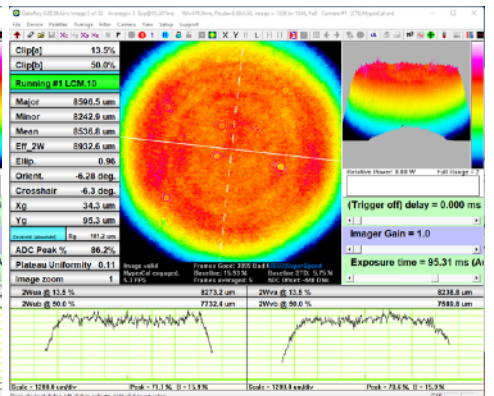
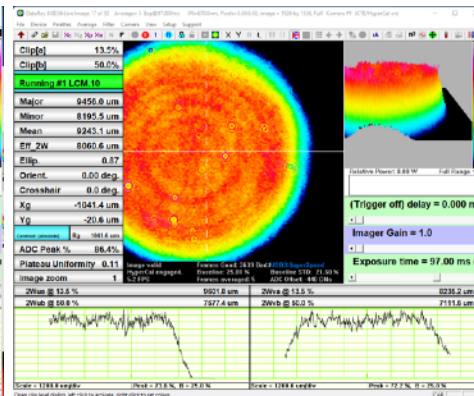
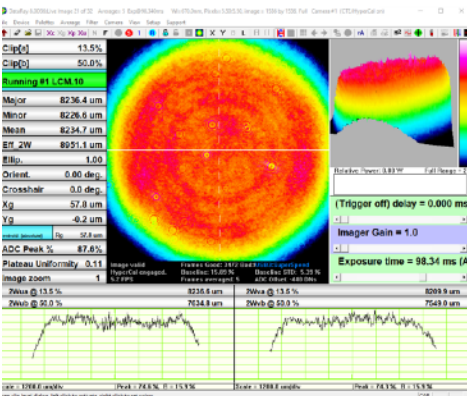
Z=10cm (edge)



Z=30cm

Z=30cm (edge)

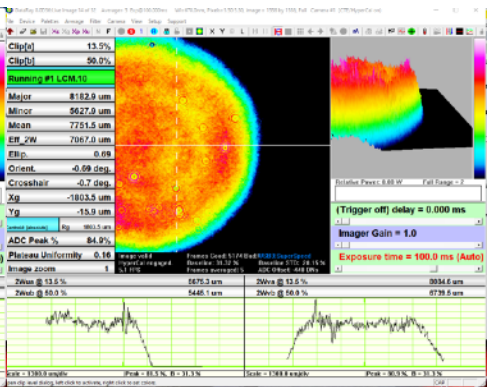
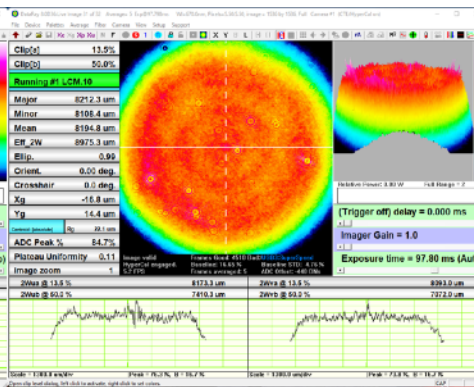
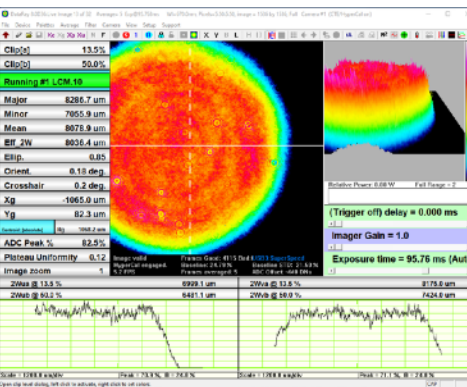
Z=50cm



Z=50cm (edge)

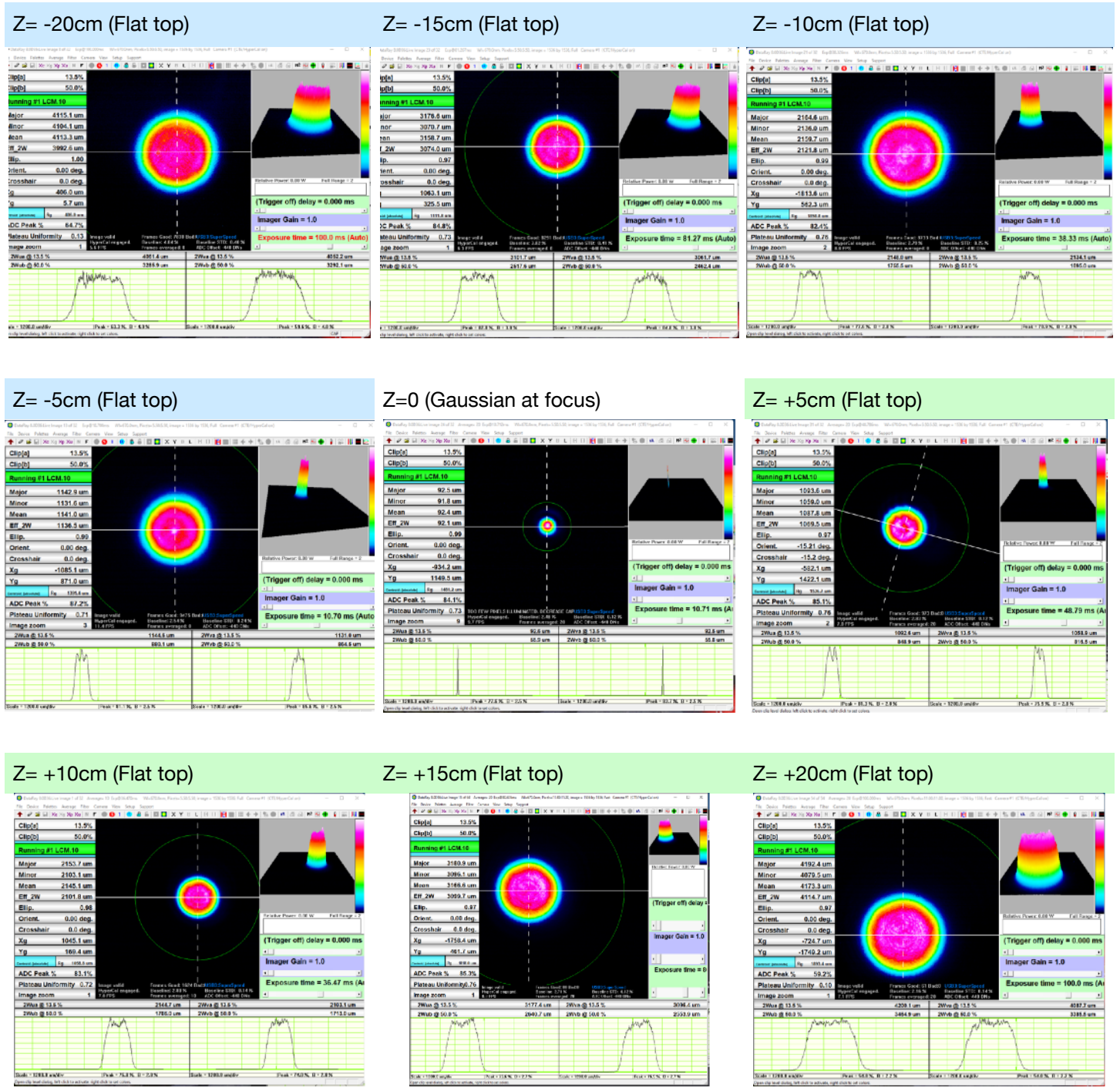
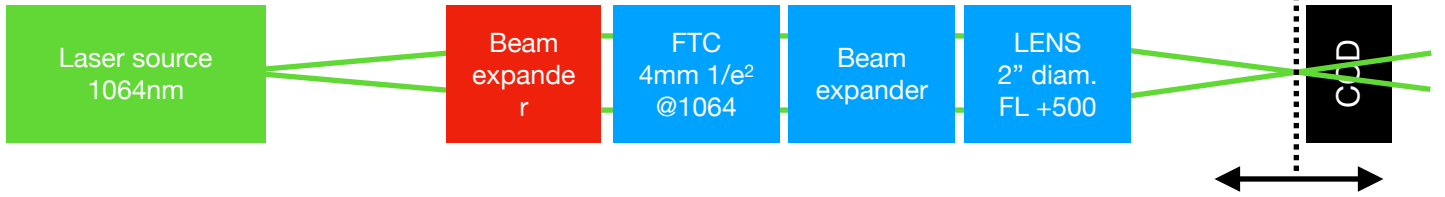
Z=100cm

Z=100cm (edge)



Z - distance between Flat Top Converter and CMOS camera

4.6. Focusing Flat Top beam (with 3X expander)



5. Controller

5.1. Interfaces, pinout

- There are two contacts:
 - 691323100005 for communication;
 - 691323100002 for Power supply - DC 12 V
- Connector wire gauge parameters:

Wire Gauge MAX. - 16 AWG

Wire Gauge MIN. - 24 AWG

Type	Contact	Connector
Communication	691323100005	691364100005
Power supply	691323100002	691364100002

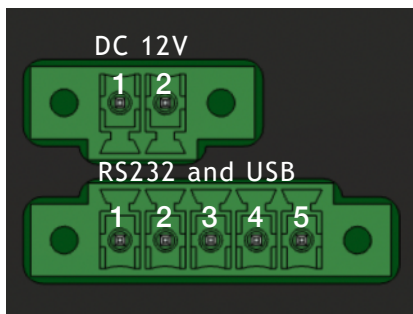
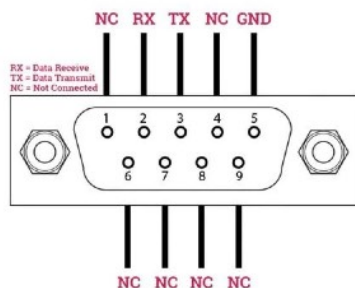


Fig 3. Side view of FTC.

PINOUT

DC 12 V	RS232	USB
1. +12 V DC	1. RS232 TX	3. GND
2. GND	2. RS232 RX	4. USB D+
	3. GND	5. USB D-

NOTE: RS-232 cable has standard DB9 female connector at one end:



5.2. Voltage levels

The RS-232 standard defines the voltage levels that correspond to logical one and logical zero levels for the data transmission and the control signal lines. Valid signals are either in the range of +3 to +15 volts or the range -3 to -15 volts with respect to the "Common Ground" (GND) pin; consequently, the range between -3 to +3 volts is not a valid RS-232 level. For data transmission lines (TxD, RxD), logic one is defined as a negative voltage, the signal condition is called "mark". Logic zero is positive and the signal condition is termed "space".

FTC operates on signal levels of ± 5 V and can accept signal levels of up to ± 15 V. Because the voltage levels are higher than logic levels typically used by integrated circuits, special intervening driver circuits are required to translate logic levels. These also protect the device's internal circuitry from short circuits or transients that may appear on the RS-232 interface and provide sufficient current to comply with the slew rate requirements for data transmission.

5.3. What's in the box?

Standard kit includes:

- Flat top converter
- Software
- Power supply DC 12V (GST60A12-P1J)
- USB cable (1.5 m)

NOTE: Other accessories must be purchased separately.

5.4. Available accessories

Beam dump (<6W):

- 1064, 1030 (with AR/AR coated window)
- 532, 515 for all standard wavelengths
- 343, 355
- 247, 266

RS232 cable:

- 1.8 m
- 5 m
- 10 m
- 15 m

6. Software

6.1. Minimum Hardware requirements (recommended)

Processor	1 Ghz
RAM	512 Mb
Disk space	
32-bit	4,5 Gb
64-bit	4,5 Gb

6.2. System requirements

To install the application you must have administrator rights on your computer.

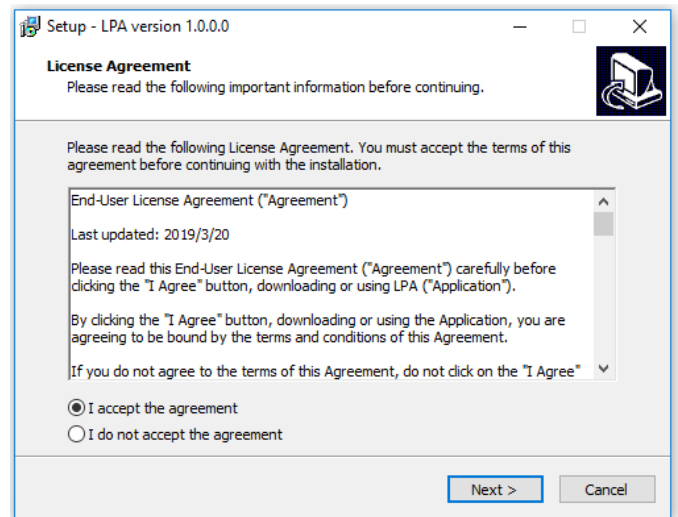
To run LPA application Microsoft .NET 4.5.2 Framework or later must be installed. The installer detects Microsoft .NET Framework and installs it. Administrator privileges are required for installation. Contact your network administrator if you do not have administrator rights on the computer.

6.3. Supported client operating systems

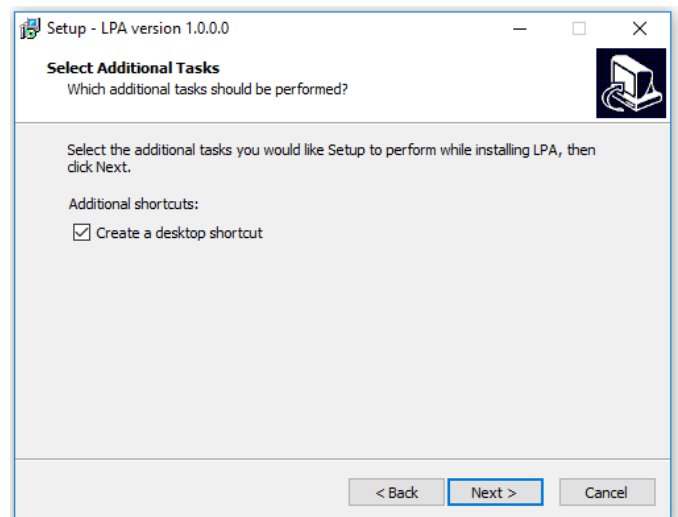
- Windows Vista SP2
- Windows 7 SP1
- Windows 8
- Windows 8.1 (.NET included with OS)
- Windows 10 (.NET 4.6 included with OS)
- Windows Server 2008 SP2/R2
- Windows Server 2012 (.NET included with OS)

6.4. Installing the software

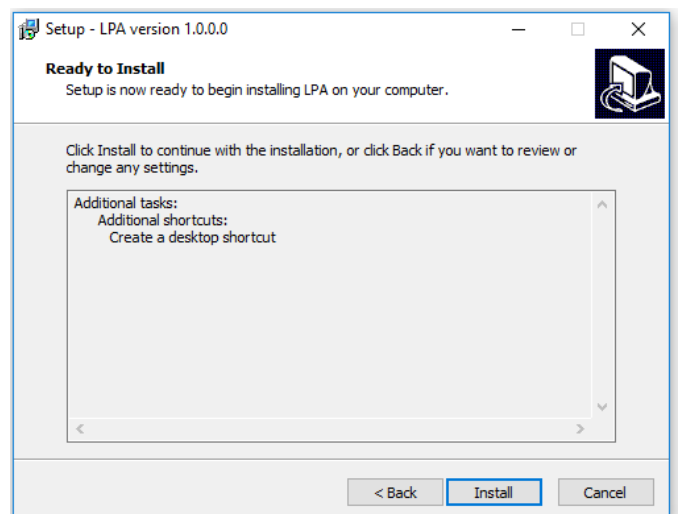
1. Check and download the latest LPA software from our website (www.optogama.com, www.4lasers.com) or contact us directly at sales@optogama.com.
2. Run the downloaded software installation file. Installation window will appear, click “Next” to continue:



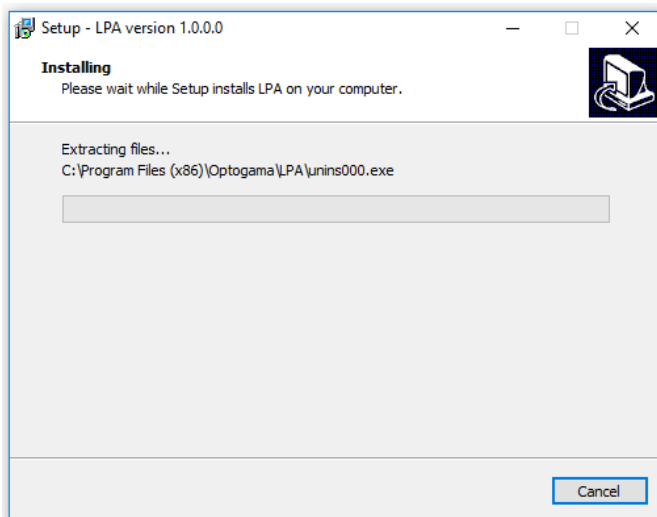
3. Select “Create a desktop shortcut” if it is necessary and click “Next”:



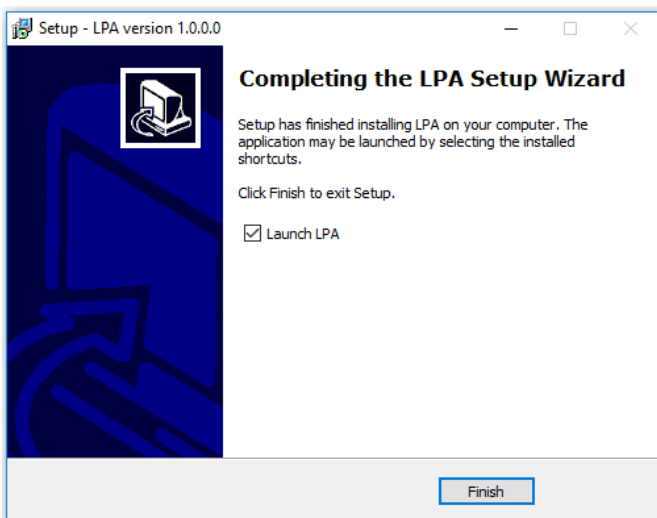
- Review setup information and proceed the installation. To continue click “Install”:



4. Setup will finish the installation:



5. Press “Finish” to end the installation:



Connect the device and controller via HD-15 cable.

6. Connect the PC and controller via USB or RS232 cable.
7. Plug in power supply to controller and AC adaptor to wall outlet.
8. The device will be detected and configured.
9. The device installation is complete.

6.5. Using the software

CAUTION! Do not switch the laser ON if the device is not adjusted properly, it may damage or destroy optical elements.

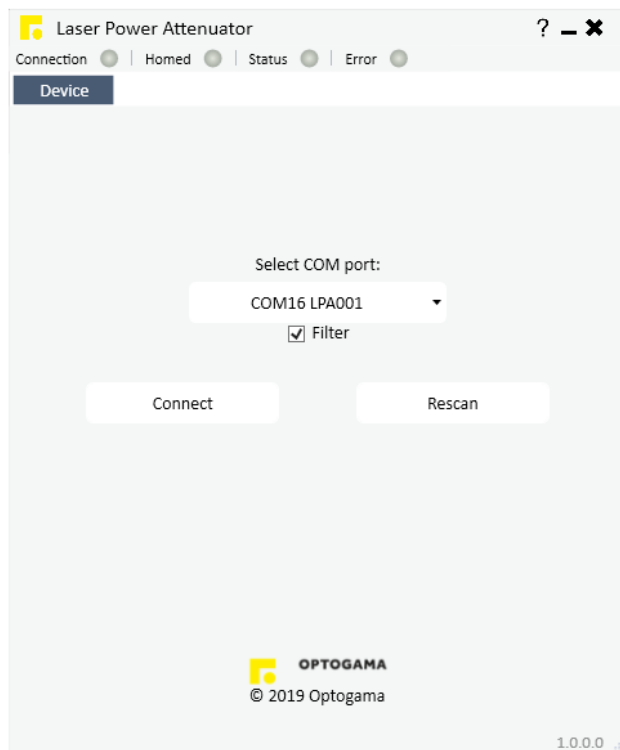
Launch LPA program using LPA icon on the desktop.



6.5.1. Connection

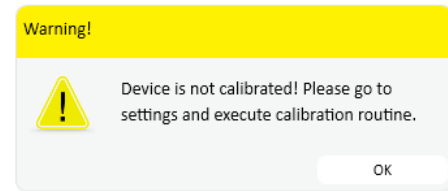
10. Device selector window will appear. Select COM port (to which the laser power attenuator is connected) from the drop down menu. Press **“Connect”** to connect the device or **“Rescan”** if your device is not visible. Select **“Filter”** when device is connected via USB cable. All other COM ports will be hidden except our device.

NOTE: When connecting via RS232 cable “Filter” must be deselected, otherwise device will not be visible.

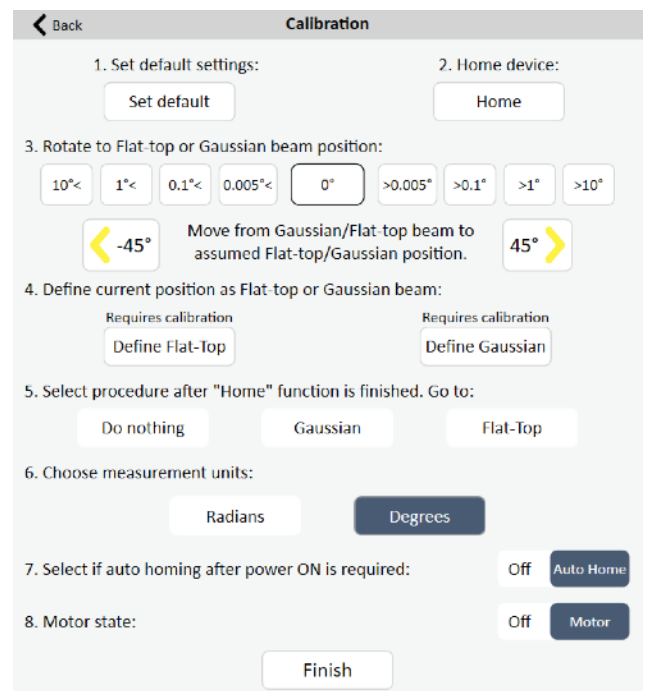


6.5.2. Settings, calibration

11. Using laser power attenuator for the first time the calibration is required. The information window will appear:



12. For FTC calibration, move your mouse to the left side of the window on a gear symbol from the sliding menu and select **“Settings”**. Settings menu will appear:



13. To succeed calibration please follow calibration steps:

1. Set default settings
2. Home device
3. Use buttons to rotate the polarising element until you reach Flat-top beam profile while manually rotating Quarter wave-plate to achieve best beam profile and transmitted energy ratio. Set current position as Flat top position.
NOTE: Quarter wave-plate should be adjusted and remain at the same angle for both Flat top and Gaussian beam mode positions.
4. Rotate polarising element until you reach Gaussian beam profile. Set current position as

Gaussian position. You can use a quick 45deg rotation.

NOTE: Minor angle adjustment may be necessary

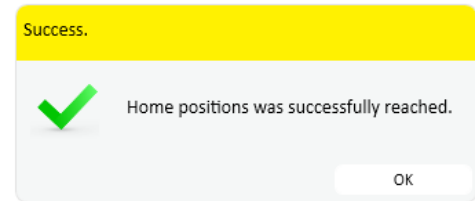
5. Select procedure after each homing:

1. Do nothing - each time after homing the device, the attenuator will remain in home position.
2. Gaussian - each time after homing the device, the attenuator instantly will go to Gaussian beam mode position.
3. Flat top - each time after homing the device, the attenuator will go to Flat top beam mode position.

6. Choose additional measurement units if necessary.

7. Select if automatic homing is required after turning the device ON.

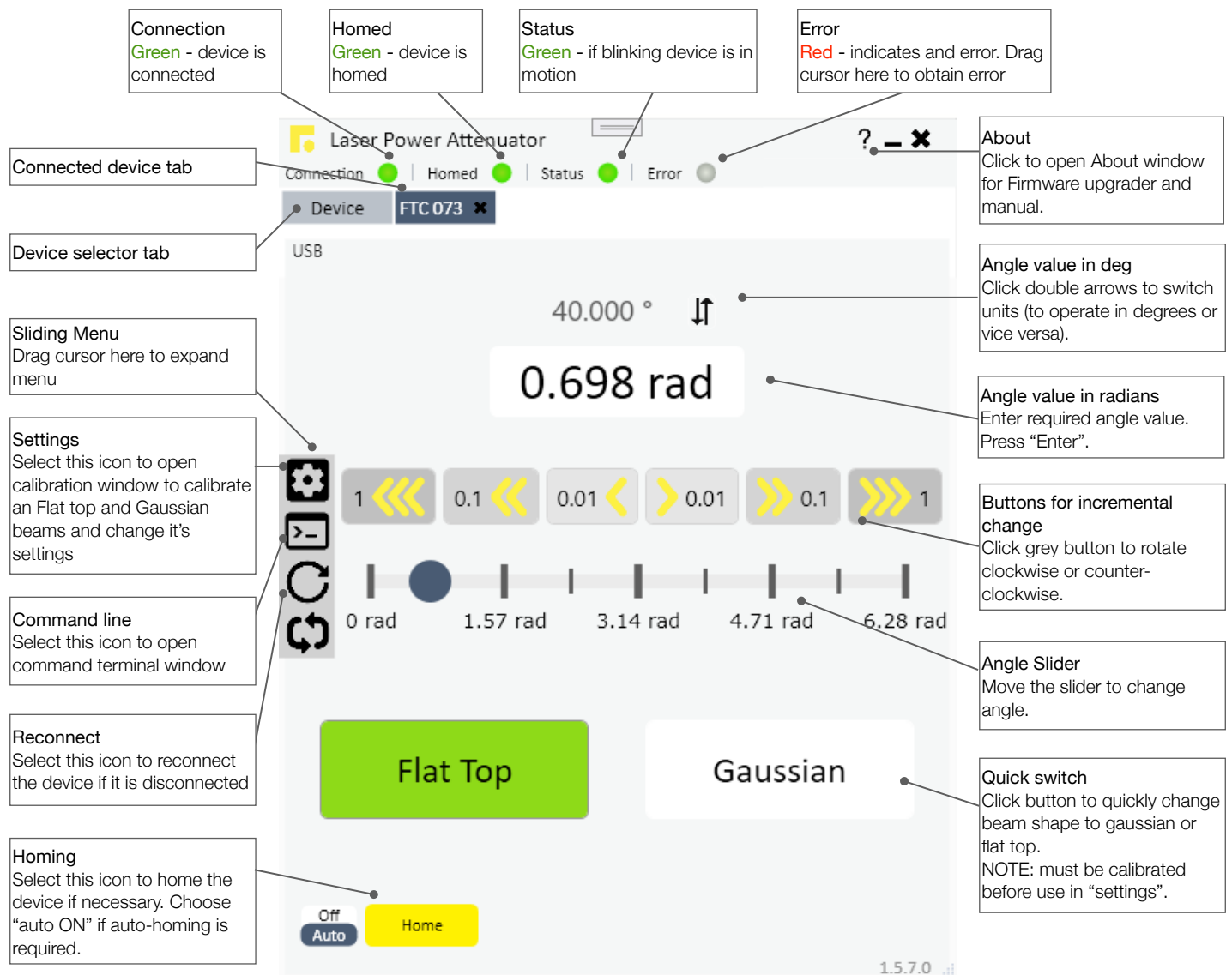
8. After finishing the calibration routine you will be greeted into MAIN window



NOTE: After homing the device message box will appear

6.5.3. Main window

The calibration procedure is done successfully if there is no error, device is connected and homed. The device is ready to use.



The screenshot shows the main window of the Laser Power Attenuator software. The window title is "Laser Power Attenuator" and it shows the device "FTC 073" connected via USB. The current angle is 40.000 degrees, which is equivalent to 0.698 radians. The window includes a status bar with indicators for Connection (Green), Homed (Green), Status (Green), and Error (Grey). There are buttons for "Flat Top" and "Gaussian" beam modes, and a "Home" button. A slider and several buttons are used for angle adjustment. A settings icon is located on the left side of the window.

Connection
Green - device is connected

Homed
Green - device is homed

Status
Green - if blinking device is in motion

Error
Red - indicates and error. Drag cursor here to obtain error

Connected device tab

Device selector tab

Sliding Menu
Drag cursor here to expand menu

Settings
Select this icon to open calibration window to calibrate an Flat top and Gaussian beams and change it's settings

Command line
Select this icon to open command terminal window

Reconnect
Select this icon to reconnect the device if it is disconnected

Homing
Select this icon to home the device if necessary. Choose "auto ON" if auto-homing is required.

About
Click to open About window for Firmware upgrader and manual.

Angle value in deg
Click double arrows to switch units (to operate in degrees or vice versa).

Angle value in radians
Enter required angle value. Press "Enter".

Buttons for incremental change
Click grey button to rotate clockwise or counter-clockwise.

Angle Slider
Move the slider to change angle.

Quick switch
Click button to quickly change beam shape to gaussian or flat top.
NOTE: must be calibrated before use in "settings".

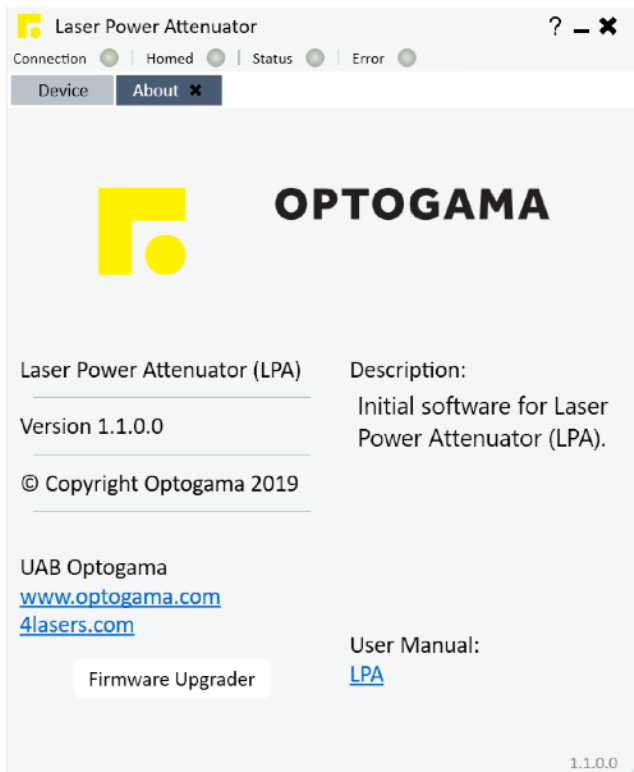
6.6. Updating the firmware

If your device firmware version doesn't match to software's firmware version while connecting to device via FTC software you'll be asked to update your device. If update request pops-up, but you want to keep current firmware and use FTC software, you must use software compatible with that firmware version.

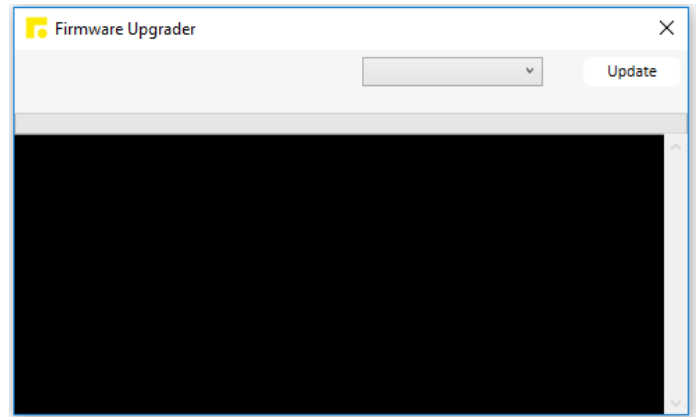
NOTE: Compatible software had been delivered with device.

In order to update your device or rewrite device firmware - **USB cable** must be used (update through RS232 cable is not available).

1. Click button **"Firmware Upgrader"** in the About tab of FTC software:



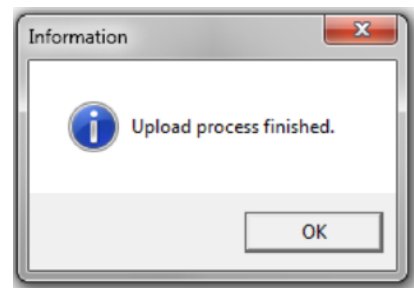
2. In the opened window press **"Update"** button. You will be asked if you really want to update device:



After a warning device **motors will be shut down** and update will start:



3. Update should be done in about a minute. If everything went successfully message box like this should pop-up:



Now you're ready to go.

4. Commands

The device can be controlled using either **USB 2.0** or **RS-232** interface. The device will switch to the required interface upon connection of the appropriate cable.

When using the RS-232 interface, the controller communicates on the **configured baud rate** (see Command descriptions), using **8 data bits, no parity and 1 stop bit**.

4.1. Interface

When the device is connected to the PC through the USB interface, it will appear as a **Virtual Serial COM port**, so all PC side communications are interchangeable between the two interfaces.

All communications with the device are conducted by sending **literal ASCII string commands terminated with the newline character \n**. For example, the power can be set to 10% by issuing a “**FTC>PWR!_10\n**” command to which the device will respond with “**FTC>PWR_10\n**”.

4.2. Description

Command	Response	Comments	Example usage	
			User command	Device response
Motion Power - PWR, Angle - ANG, Target - TGT, Stop - STP				
FTC>ANG?	FTC>ANG_X.XXX	Command used to get the current angle value in degrees.	FTC>ANG?	FTC>ANG_22.143
FTC>ANG!_X.XXX	FTC>ANG_X.XXX	Command used to set the angle value in degrees.	FTC>ANG!_22.5	FTC>ANG_22.500
FTC>FT!_X	FTC>FT_X	FTC>FT!_0 - go to gaussian position FTC>FT!_1 - go to flat-top position	FTC>FT!_0	FTC>FT_0
FTC>FT?	FTC>FT_X	Command used to get current beam mode position: FTC>FT_1 - flat-top FTC>FT_0 - gaussian FTC>FT_0 - not in calibrated position	FTC>FT?	FTC>FT_0
FTC>STP!	FTC>STP	Command used to stop motor instantly. Device could be used normally, homing is not require.	FTC>STP!	FTC>STP
Homing, Calibration & Auto-go Homing - HOME, Auto-homing - AHOME, Calibration - DEF, Auto-go - AUTOGO				
FTC>DEF0!	FTC>DEF0_X.XXX	Command used to save new gaussian beam calibration position	FTC>DEF0!	FTC>DEF0_5.240
FTC>DEF0?	FTC>DEF0_X.XXX	Command used to get gaussian beam calibration position: calibrated - FTC>DEF0_X.XXX not calibrated - FTC>DEF0_null	FTC>DEF0?	FTC>DEF0_5.240 FTC>DEF0_null
FTC>DEF1!	FTC>DEF1_X.XXX	Command used to save new Flat-top beam calibration position	FTC>DEF1!	FTC>DEF1_51.240
FTC>DEF1?	FTC>DEF1_X.XXX	Command used to get Flat-top beam calibration position: calibrated - FTC>DEF0_X.XXX not calibrated - FTC>DEF0_null	FTC>DEF1?	FTC>DEF1_51.240 FTC>DEF1_null
FTC>HOME!	FTC>HOME	Command used to home the device (motor goes to home position - TGT_0).	FTC>HOME!	FTC>HOME
FTC>AHOME!	FTC>AHOME_1	Command used to turn ON auto homing after power ON.		

Command	Response	Comments	Example usage	
			User command	Device response
FTC>NOAHOME!	FTC>AHOME_0	Command used to turn OFF auto homing after power ON.		
FTC>AHOME?	FTC>AHOME_0	Command used to get auto homing state. If 1 - Auto homing is enabled, 0 - disabled.		
FTC>AUTOGO!_X	FTC>AHOME_X	Command used to set procedure after each homing: 0 - device remains in home position (TGT_0); 1 - device goes to GAUSSIAN position; 2 - device goes to FLAT-TOP position.		
FTC>AUTOGO?	FTC>AHOME_X	Command used to get which procedure after each homing is selected: 0 - device remains in home position (TGT_0); 1 - device goes to GAUSSIAN position; 2 - device goes to FLAT-TOP position.		
Settings Baud rate - BAUD, Default settings - LDF				
FTC>BAUD?	FTC>BAUD_baud rate	Command used to get baud rate.	FTC>BAUD?	FTC>BAUD_115200
FTC>BAUD!_baud rate	FTC>BAUD_baud rate	Command used to set baud rate. Available speeds: 115200, 57600, 38400, 19200, 9600, 4800. Other values are ignored.	FTC>BAUD!_57600	FTC>BAUD_57600
FTC>LDF!	FTC>LDF	Command used to load default settings. Device after this command must be: 1. Homed; 2. Recalibrated.		
Information Device state - STATUS, Wavelength - WL, Firmware v. - FW, Serial number - ID				
FTC>STATUS?	FTC>X_Y	Command used to get the current state of the device. X signifies if motor is ON. Y signifies the error byte. X="1" motor is ON (enabled) X="0" motor is OFF (disabled) Y = 16 bits digit with following bits: bit0 -> driver error bit1 -> driver high temperature warning bit2 -> driver over temperature bit3 -> some type of error in the driver load bit4 -> load warning – open load on phase A or B bit5 -> under voltage error bit6 -> external memory error, working/calibration data may be corrupted bit7 -> reset has occurred bit8 -> left limit switch is pressed bit9 -> right limit switch is pressed bit10 -> stall guard flag is active bit11 -> motor is stand still bit12 -> motor target velocity reached bit13 -> target position reached bit14 -> homing procedure was run after the reset bit15 -> device calibrated (bit high) if flat-top and gaussian beam positions defined More info on pg. 19	FTC>STATUS?	FTC>1_0
			FTC>STATUS?	FTC>0_0
			FTC>STATUS?	FTC>1_2

Command	Response	Comments	Example usage	
			User command	Device response
FTC>WL?	FTC>WL_XXX	Command used to get the design wavelength.	FTC>WL?	FTC>WL_355
FTC>FW?	FTC>_Firmware version	Command used to get firmware version.	FTC>FW?	FTC>_1.0.0.1
FTC>ID?	FTC>_FTCXXXXXXX	Command used to get serial number.	FTC>ID?	FTC>_FTC1901001
Other Echo, Reset, Motor ON/OFF				
FTC>ECHO!	FTC>ECHO	Command used for troubleshooting. The device echoes sent command before sending the response.	FTC>ECHO! FTC>TGT?	FTC>ECHO FTC>TGT? FTC>TGT_45602
FTC>NOECHO!	FTC>NOECHO	Command used to disable ECHO command.		
FTC>RESET!	FTC>RESET	Command used to reinitialise device.	FTC>RESET!	FTC>RESET
FTC>OFF!	FTC>OFF	Command used to turn motor OFF.	FTC>OFF!	FTC>OFF
FTC>ON!	FTC>ON	Command used to turn motor ON.	FTC>ON!	FTC>ON

5. Troubleshooting

5.1. STATUS bits explanation

Bit0 – driver error. This bit is high when some error in motor driver happens.

Bit1 – driver high temperature warning. Bit is high when motor driver is in pre-warning temperature range which exceeds 120°C.

Bit2 - driver over temperature. Bit is high when motor driver reaches 150°C. After triggering this temperature the driver remains switched off until the system temperature falls below 120°C. The thermal shutdown is just an emergency measure and temperature rising is prevented by the design.

Bit3 – dome type of error in the driver load. Motor driver power stages are protected against a short circuit condition. Once a short condition is safely detected the corresponding driver bridge becomes switched off, and flag becomes set.

Bit4 - load warning – open load on phase A or B of stepper motor driver. However, the flag have just informative character and do not cause any action of the driver. This flag works only at low motor velocity operation, which is not the case.

Bit5 – under voltage error. Indicates an under voltage on the motor driver charge pump. The driver is disabled in this case.

Bit6 – external memory error working/calibration data may be corrupted. Flag is set if there was an error reading data from EEPROM.

Bit7 – reset has occurred. Indicates that the motor driver has been reset since the last read access to STATUS All registers have been cleared to reset values.

Bit8/Bit9 – left/right limit switch is pressed. Limit switches are used as reference point in homing procedure.

Bit10 – StallGuard is active. Signal that motor stall is detected. StallGuard provides sensor-less stall detection and mechanical load measurement.

Bit11 – motor is stand still. This flag indicates motor stand still in each operation mode.

Bit12 – motor target velocity reached. Signals, that the target velocity is reached. This flag becomes set while actual and maximum speed match.

Bit13 – target position reached. Signals, that the target position is reached. This flag becomes set while actual and target position match.

Bit14 – Homing procedure was run after the reset. Indicates, that after power on stepper motor was homed and is ready for precise position control.

Bit15 – Device calibration is done. Indicates, that “FTC>DEF!” command was send and minimum laser power position is known.

5.2. Serial communication example in Python

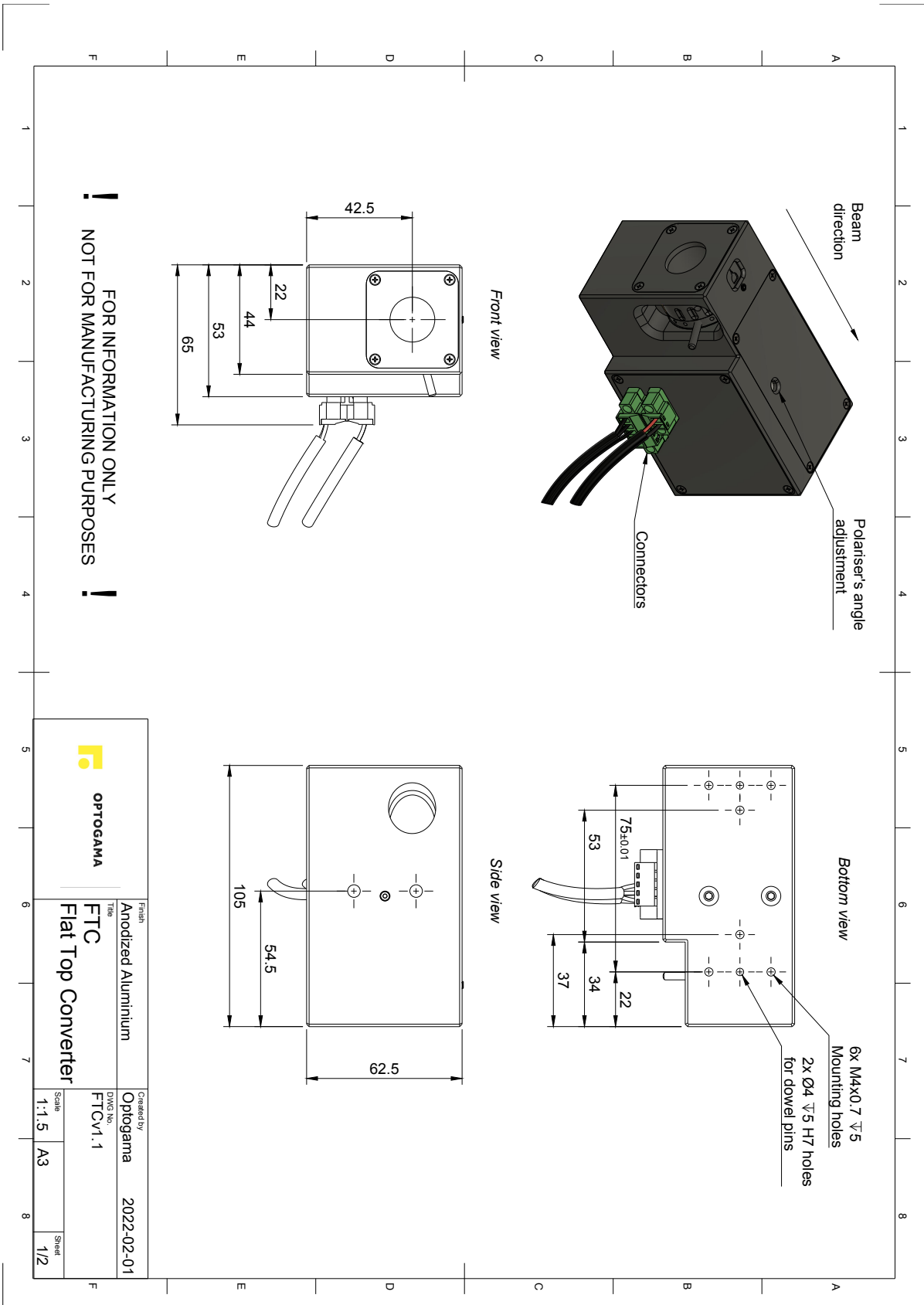
```

1  import serial
2  import glob
3  import sys
4  import time
5
6  def serial_ports():
7      """ Lists serial port names
8
9          :raises EnvironmentError:
10             On unsupported or unknown platforms
11          :returns:
12             A list of the serial ports available on the system
13      """
14      if sys.platform.startswith('win'):
15          ports = ['COM%s' % (i + 1) for i in range(256)]
16      elif sys.platform.startswith('linux') or sys.platform.startswith('cygwin'):
17          # this excludes your current terminal "/dev/tty"
18          ports = glob.glob('/dev/tty[A-Za-z]*')
19      elif sys.platform.startswith('darwin'):
20          ports = glob.glob('/dev/tty.*')
21      else:
22          raise EnvironmentError('Unsupported platform')
23
24      result = []
25      for port in ports:
26          try:
27              s = serial.Serial(port)
28              s.close()
29              result.append(port)
30          except (OSError, serial.SerialException):
31              pass
32      return result
33
34  if __name__ == "__main__":
35      ports = serial_ports()
36      print("Select port number ( starting from 0, 1, 2 etc.):")
37      print(ports)
38      port = ports[int(input())]
39      print(port)
40
41      # configure the serial connections (the parameters differs on the device you are connecting to)
42      ser = serial.Serial(
43          port=port,
44          baudrate=115200,
45          parity=serial.PARITY_ODD,
46          stopbits=serial.STOPBITS_TWO,
47          bytesize=serial.EIGHTBITS,
48          timeout=1 #second
49      )
50      ser.isOpen()
51
52      print('Enter your commands below.\r\nInsert "exit" to leave the application.')
53      cmd=1
54      while 1 :
55          # get keyboard input
56          cmd = input(">> ")
57          # Python 2 users
58          # input = raw_input(">> ")
59          if cmd == 'exit':
60              ser.close()
61              break
62          else:
63              # send the string to the device
64              # (note that I happend a \n line feed to the characters - this is requested by device)
65              cmdBytes = (cmd + '\n').encode()
66              ser.write(cmdBytes)
67              out = ''
68              out = str(ser.readline())
69              if out != '':
70                  print(">>" + out)

```


6. Technical information

6.1. FTC drawings

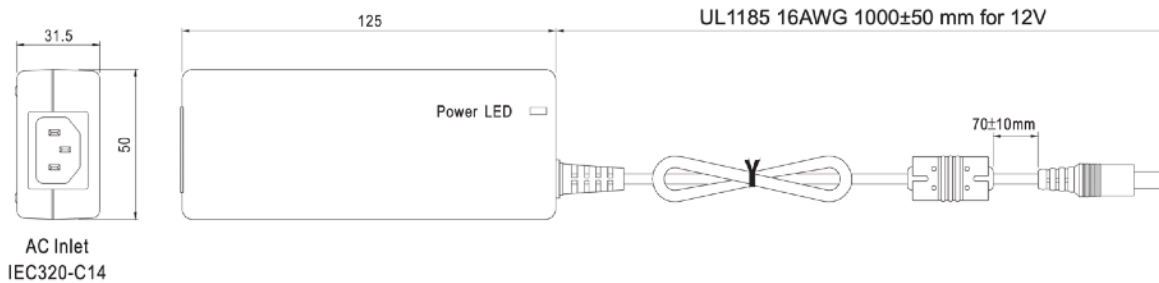


6.2. Power supply

■ Mechanical Specification

Case No. GS60A Unit:mm

GST60A12-P1J



Technical data

Brand	Mean Well
Item number	GST60A12-P1J
Series	GST60A
Description	AC-DC Industrial desktop adaptor; Output 12Vdc at 5A; 3 pole AC inlet IEC320-C14
Application	ITE EN/UL/IEC 60950
Technology	AC/DC
Power Format	Desktop
Output Power (W)	60
Output Voltage (V)	12
Output Current (A)	5
Input Voltage (V)	90 - 264 Universal Input 110/230V
IP Rating	No IP assigned
Width (mm)	50
Height (mm)	31.5
Depth (mm)	125

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