



MRO

MOTORISED ROTATOR



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MRO

Motorised Rotator

Congratulations on your purchase of the motorised rotator from Optogama, UAB.

October 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 rotator 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 rotator is intended for industrial and scientific use only. If there are any other electrical devices connected to or used in conjunction with the rotator, 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.

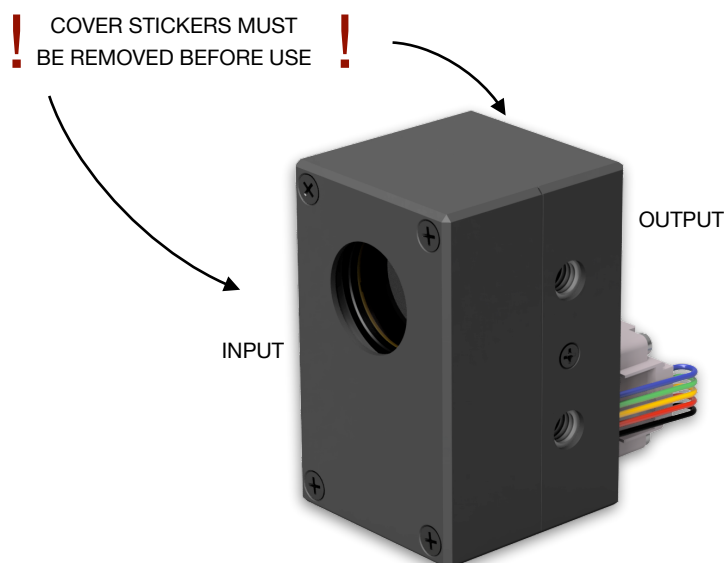
1. Safety requirements

- 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 rotator.
- 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

MRO is a compact motorised rotator which is based on the LPA platform. It comes with external controller (SMC) and a wave-plate. There are two standard options:

- ZO L/2 wave-plate (zero-order half wave-plate). This setup is **used to shift polarisation direction of linearly polarised light.**
- ZO L/4 wave-plate (zero-order quarter wave-plate). This setup is **used to convert linearly polarised light into circularly polarised and vice versa.**

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

- Compact design
- High resolution - 175543 μ steps in 360 deg rotation
- High accuracy - ± 10 μ steps accuracy (± 0.02 deg)
- Clear aperture - 18 mm
- Fast adjustment - less than 0.2 sec (0 to 45 deg)

3. Product description

Rotator (MRO) is a compact motorised device for laser polarisation control.

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

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

3.1. Optical specifications

Clear input aperture	ø18 mm	
Clear output aperture	ø18 mm	
LIDT coating	>10 [J/cm ²] (10 ns @ 1064 nm)	
Close to open time 0 to 45 deg	< 0.2 sec	
Resolution	175,543 μsteps in full rotation 21,943 μsteps in 45deg rotation (0.002 deg, 7.2 arcsec, 0.035 mrad)	
Accuracy	±10 μsteps (±0.02 deg)	
Motor	2 phase stepper motor 200 steps with 256 μstepping	
Available coatings		
A. Standard wavelenghts, nm		
1550	780	355
1064	400	343
1030	532	266
800	515	257

3.2. Mechanical specifications

	MRO - rotator	Controller
Lenght	37.5 mm	125 mm
Width	36 mm	53 mm
Height	58 mm	31 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

3.5. Controller

3.5.1. Interfaces, pinout

1. RS-232 (DB9), USB 2.0 type B, and power plug for DC 12 V (standard plug 5.5x2.1 mm).

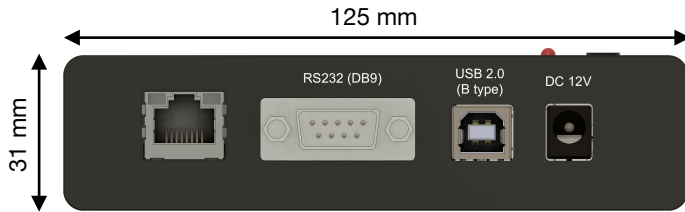


Fig 3. Front view of MRO controller.

RS232 (DB9) Pinout

- 2 - D+ (RS-232: Tx)
- 3 - D- (RS-232: Rx)
- 5 - GND



2. HD-15 connector (for rotator connection to controller).

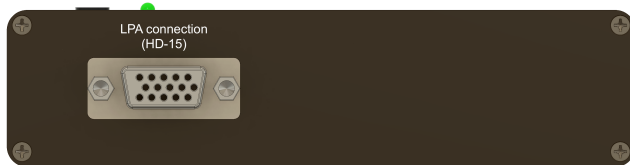


Fig 4. Back view of MRO controller.

3.5.2. LEDs, Buttons functions

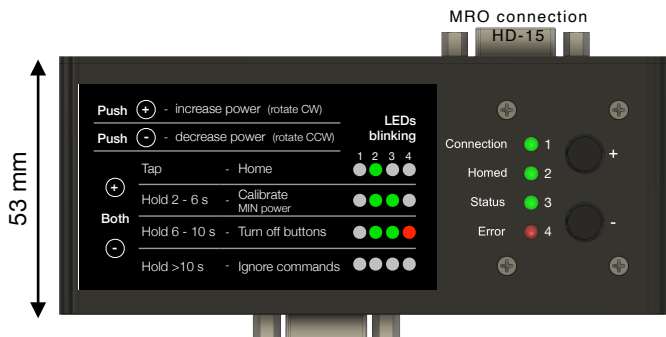


Fig 5. Top view of MRO controller.

LED explanation

Connection	Green - Power ON
Homed	Green - Device is homed and ready to use
Status	Green blinking - Device is in motion
Error	Red - there is an error, please connect PC for further troubleshooting

BUTTONS functions

CW MROation (+)	Push "+" button to rotate clock-wise
CCW MROation (-)	Push "-" button to rotate counter clock-wise
Home (Tap)	Tap both "+" & "-" buttons to home the device

Hold both "+" & "-" buttons from 2 to 6 seconds to define (calibrate) current position as 0 deg or reset it.

Calibrate / Reset (Hold 2 to 6 s)

"Homed" and "Status" LED's will start blinking when it is right time to release buttons to calibrate the device

Hold both "+" & "-" buttons longer than 6 seconds to turn off buttons. You will be able to turn buttons ON again only via MRO software (Settings > Buttons ON) or using command.

Button lock (Hold 6 to 10 s)

"Homed", "Status" and "Error" LED's will start blinking when it is right time to release buttons to lock them.

Hold both "+" & "-" buttons longer than 10 seconds to ignore commands.

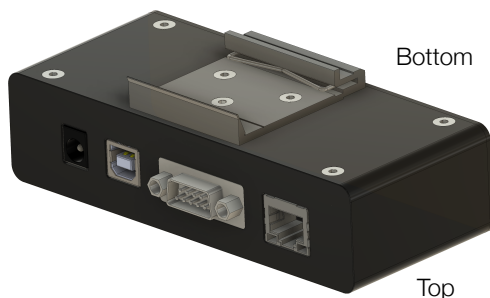
Ignore (Hold more than 10s)

"Homed", "Status" and "Error" LED's will stop blinking when it is right time to release buttons to ignore commands.

3.5.3. Mounting

MRO uses SMC controller which is suitable for standard *DIN35 rail mounting. You simply attach DIN35 Rail adapter with provided screws.

*(DIN35 rail mount is optional)



3.6. 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".

MRO 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.

3.7. What's in the box?

Standard kit includes:

1. Motorised rotator (MRO)
2. Controller (SMC)
3. Software (LPA)
4. Power supply DC 12V (GST60A12-P1J)
5. USB cable (1.5 m)

NOTE: Other accessories must be purchased separately.

4. Software

4.1. Minimum Hardware requirements (recommended)

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

4.2. System requirements

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

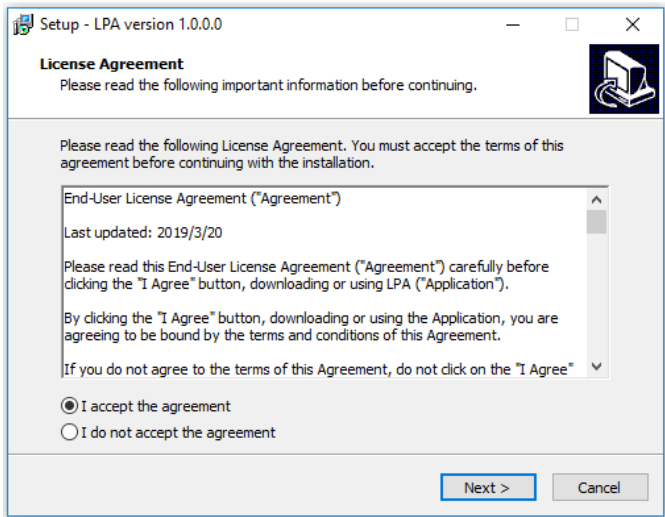
To run MRO application Microsoft .NET 4.5.2 Framework or later must be installed. The installer detects Microsoft .NET Framework and installs it. Administrator privileges are required for installation. Contact your network administrator if you do not have administrator rights on the computer.

4.3. Supported client operating systems

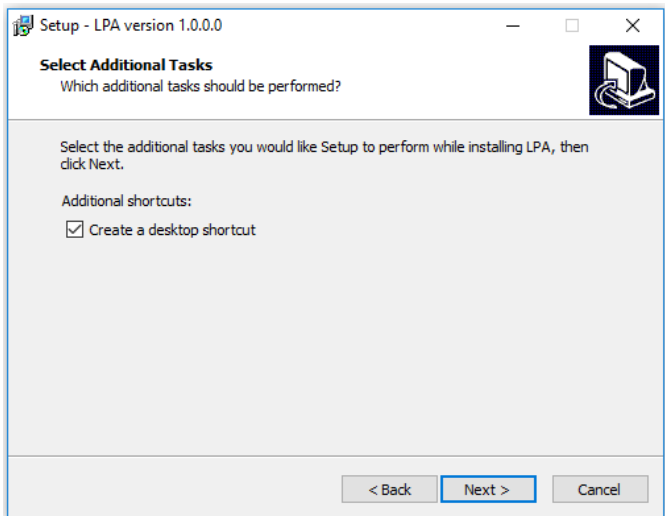
- Windows Vista SP2
- Windows 7 SP1
- Windows 8
- Windows 8.1 (.NET included with OS)
- Windows 10 (.NET 4.6 included with OS)
- Windows Server 2008 SP2/R2
- Windows Server 2012 (.NET included with OS)

4.4. Installing the software

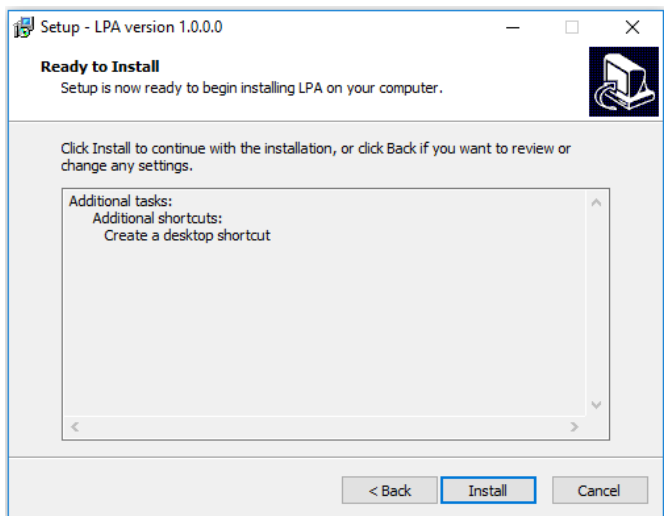
1. Check and download the latest LPA software from the flash drive which was sent with the device itself, website (www.optogama.com, www.4lasers.com) or contact us directly at sales@optogama.com.
2. Run the downloaded software installation file. Installation window will appear, click "Next" to continue:



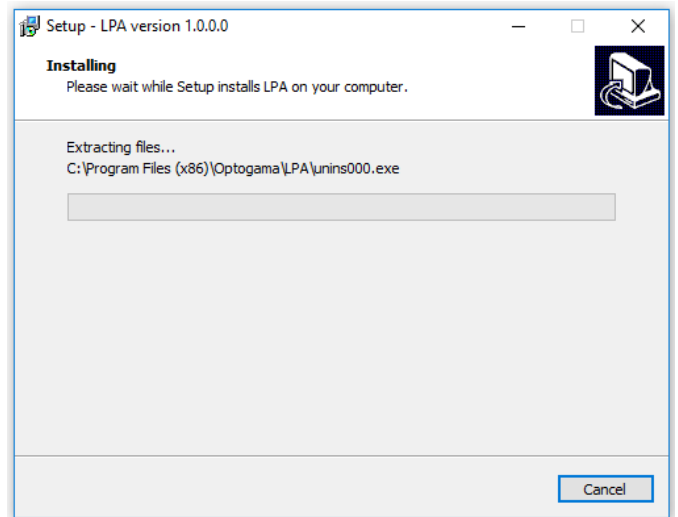
3. Select “Create a desktop shortcut” if it is necessary and click “Next”:



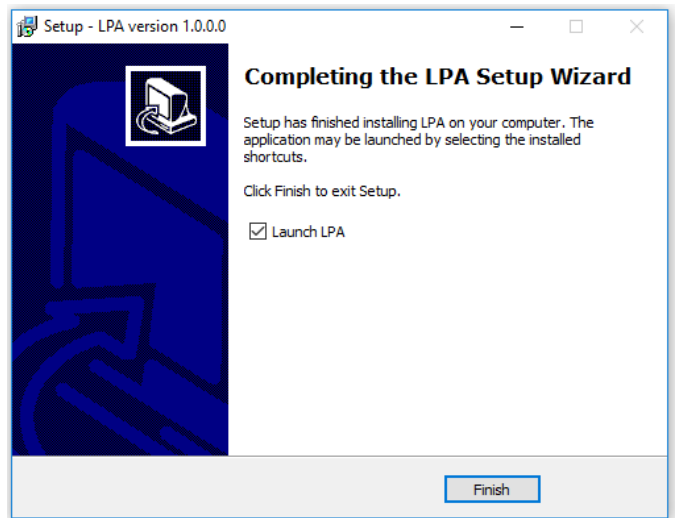
Review setup information and proceed the installation. To continue click “Install”:



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.

4.5. Using the software

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



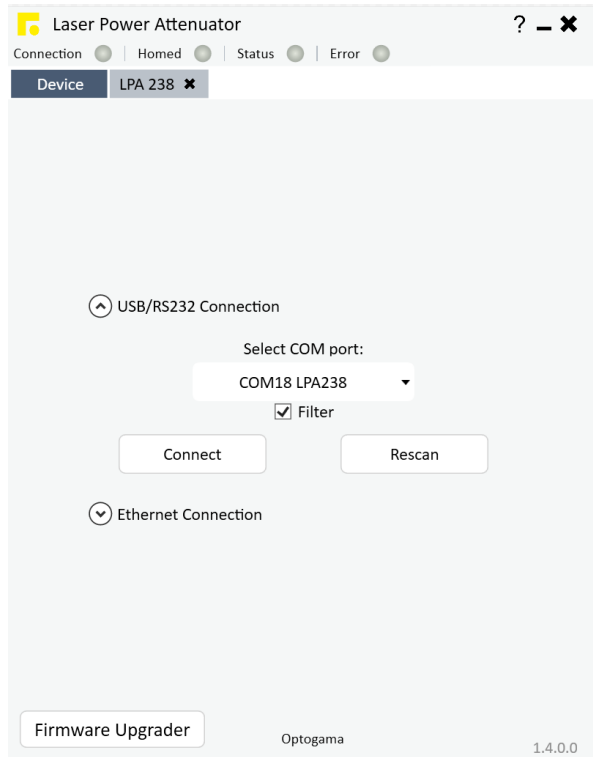
Launch LPA program using LPA icon on the desktop.

4.5.1. Connection

10. Device selector window will appear. Select COM port (to which the rotator 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.

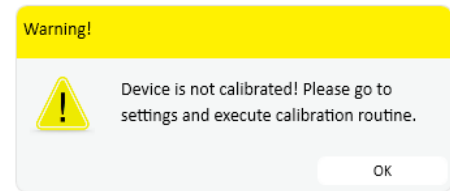
NOTE: When connecting via RS232 cable “Filter” must be deselected, otherwise device will not be visible.

NOTE: Rotator will be seen as MROxxx (for ex. *MRO001*)

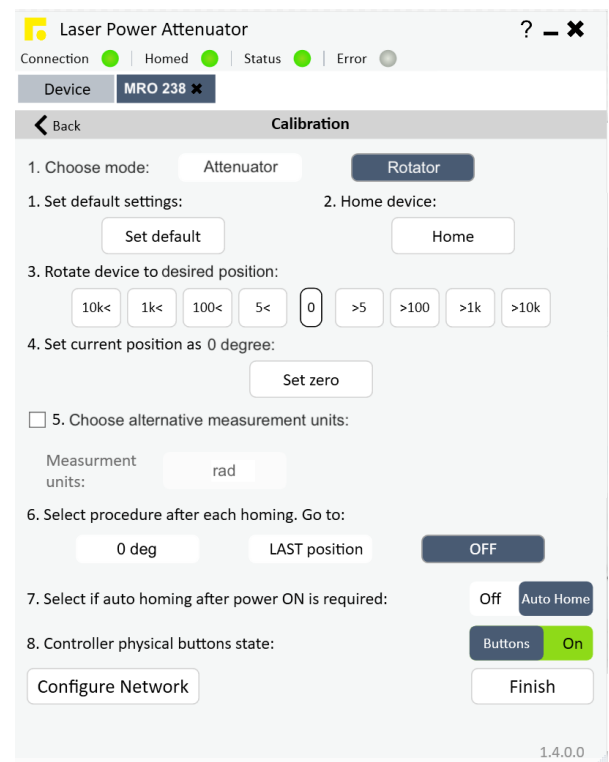


4.5.2. Settings, calibration

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



12. For MRO 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. Choose device’s mode (rotator by default)

NOTE: Polariser is necessary for attenuator mode.

2. Set default settings

3. Home device

4. Find required position by rotating the waveplate (it will be defined as 0 degree)

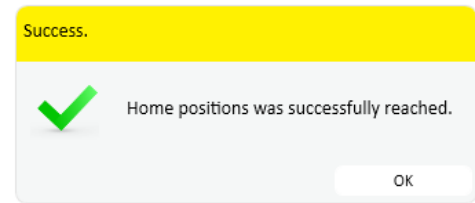
5. Set current position as 0 deg.

6. Choose alternative measurement units if necessary (radians are by default)

7. Select procedure after each homing:

1. 0 deg - each time after homing the device, the attenuator instantly will go to defined position (0 degree).
 2. Last position - each time after homing the device, the attenuator will go to last position before .
 3. OFF - each time after homing the device, the attenuator will remain in home position.
8. Select if automatic homing is required after turning the device ON.

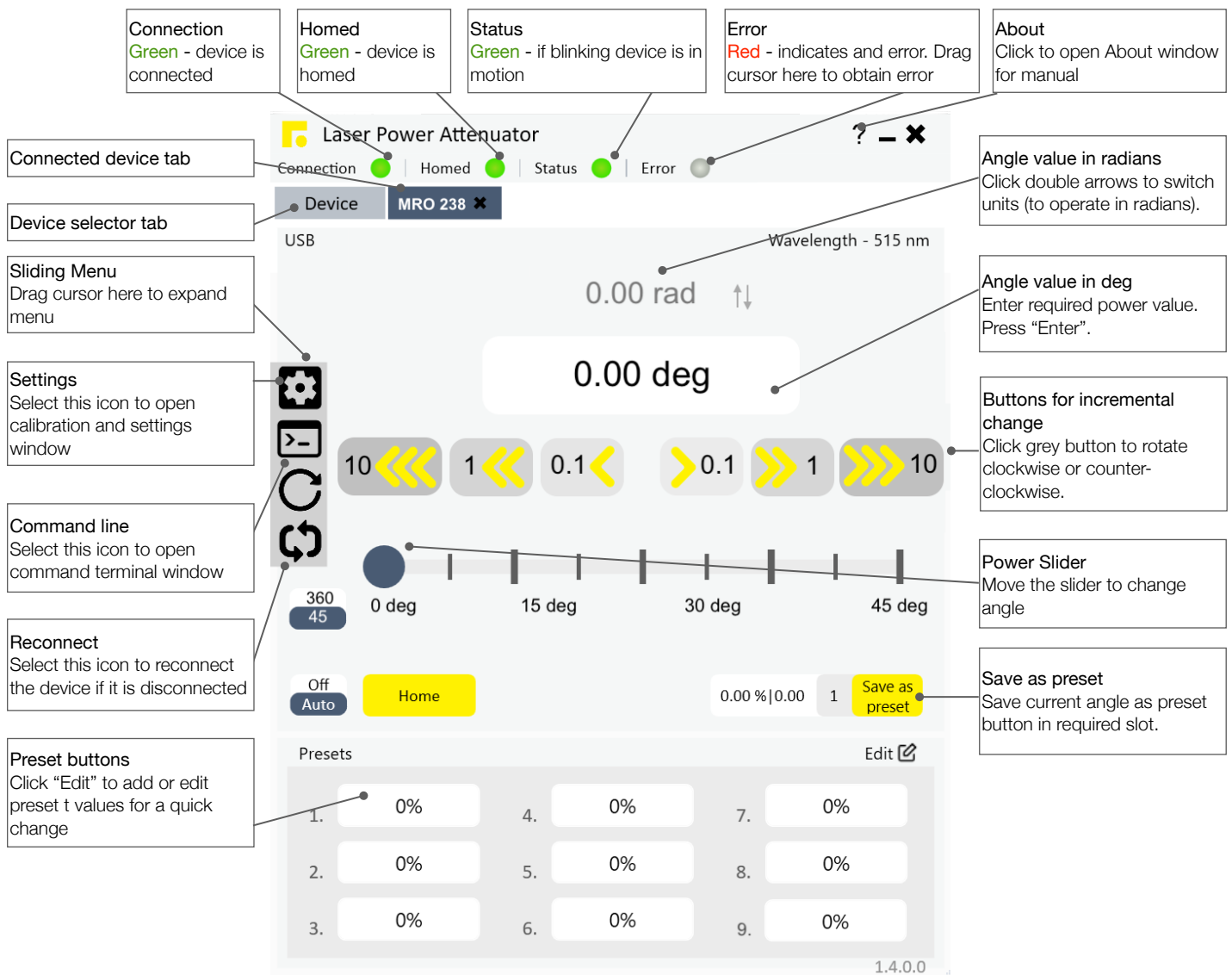
9. Choose if physical buttons are required, if no, you can lock them by choosing "Buttons OFF".
10. After finishing the calibration routine you will be greeted into MAIN window



NOTE: After homing the device message box will appear

4.5.3. Main window

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



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

About
Click to open About window for manual

Connected device tab
Device selector tab

Sliding Menu
Drag cursor here to expand menu

Settings
Select this icon to open calibration and settings window

Command line
Select this icon to open command terminal window

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

Preset buttons
Click "Edit" to add or edit preset t values for a quick change

Angle value in radians
Click double arrows to switch units (to operate in radians).

Angle value in deg
Enter required power value. Press "Enter".

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

Power Slider
Move the slider to change angle

Save as preset
Save current angle as preset button in required slot.

Presets

1.	2.	3.	4.	5.	6.	7.	8.	9.
0%	0%	0%	0%	0%	0%	0%	0%	0%

1.4.0.0

4.6. Ethernet connection

MRO software has implemented TCP/IP communication. It is practically plug-and-play usage in the software once network settings of the MRO device are correctly configured for TCP/IP communication. The interface and usage of the software stay the same as for USB or RS-232, only communication pMROocol is changed.

NOTE: MRO network settings must be configured using USB or RS-232 connection before use. This can be done using commands from Command description (p. 16) or using software.

4.6.1. About TCP/IP pMROocol

The device can communicate via RJ45 connector using “Transmission Control PMROocol/Internet PMROocol” (TCP/IP) network pMROocol. The TCP/IP pMROocol is designed such that each computer or device in a network has the unique IP address and each IP address can open and communicate over up to 65535 different “ports” for sending and receiving data to or from any other network device. The IP address uniquely identifies the computer or device on the network and a “Port Number” identifies a specific connection between one computer or device and another (between two IP addresses). A TCP/IP Port can be thought of as a private two-way communications line where the port number is used to identify a unique connection between two devices. The TCP/IP pMROocol creates a “virtual IP port” and the network hardware and software are responsible for routing data in and out of each virtual IP port.

4.6.2. Client and Server Connection

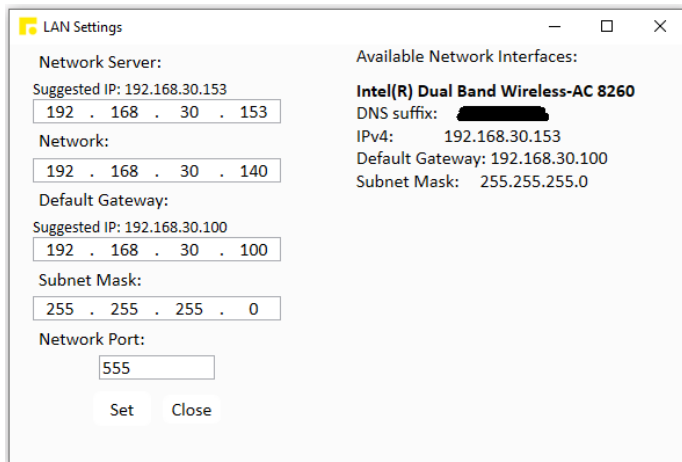
TCP/IP connection works in a manner like a telephone call where someone has to initiate the connection by dialling the phone. At the other end of the connection, someone has to be listening for calls and then pick up the line when a call comes in. **The Client in a TCP/IP connection is the MRO controller** that “dials the phone” and the **“Server” is the computer or another device** that is “listening” for calls to come in. The Client needs to know the IP address of whatever Server it wants to connect to and it also needs to know the port number that it wants to send and receive data through after a connection has been established. The server only has to listen for connections and either accept them or reject when they are initiated by a client.

Once a connection through a TCP/IP port has been established between a TCP/IP Client and a TCP/IP Server, data can be sent in either direction. The MRO controller will never send any data through TCP/IP port unless asked by the TCP/IP Server sending commands (see in command description Pg. 16). The connection between a Client and a Server remains open until either the client or the server terminates the connection.

The above description is basic and describes a general concept of how TCP/IP communication works. For deeper understanding at least networking basics must be known.

4.6.3. Ethernet configuration using MRO software

1. Connect MRO to PC via USB or RS232.
2. Open MRO software. After connecting the MRO go to **“Settings” > “Configure Network”**. The LAN Settings window will pop-up:



On the left side of the Network Settings window, current network settings for MRO will be displayed.

On the right side of the window network interfaces which are available will be listed, usually, there's only one available interface. Furthermore, IP addresses will be suggested for MRO network settings from the available interface.

3. Configure Ethernet settings for MRO:

- 3.1. Input Network (TCP) Server (your PC) IP address. (It is filled automatically if only one network interface is available)
- 3.2. Input Network client (MRO) IP address. Choose any, but It has to be unique IP address in your local network.
- 3.3. Input Router/Default Gateway address. (It is filled automatically if only one network interface is available)
- 3.4. Input Subnet Mask address. (It is filled automatically if only one network interface is available)
- 3.5. Input Network Port. By default it is 555, but you can choose any up to 65535.

NOTE: Default “Network port”: 555.

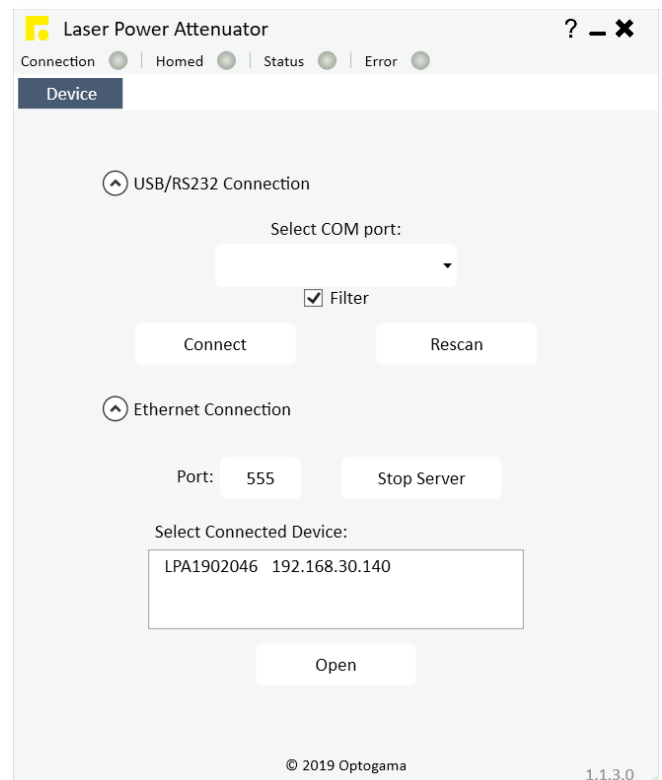
Configuration is complete.

4.6.4. Ethernet connection using MRO software

1. Connect MRO controller via Ethernet cable (RJ45 plug).
2. Open MRO software.
3. Open “Ethernet Connection” and select your Network (TCP) Server IP from the drop-down menu (usually it is only one available address)
4. Input communication port (555 by default) and press “Start Server”.

NOTE: Port must be the same for both Network (TCP) server and Network client (MRO).

5. **If everything is configured correctly your MRO device should appear in the connected devices list.** You will see MRO serial number and IP from which it connected (if local network, IP should be the same as configured). Select device you want to use and press “Open”.



For further usage refer to section **“4.5 Using the Software”**.

After the TCP server is started it constantly waits only for MRO devices.

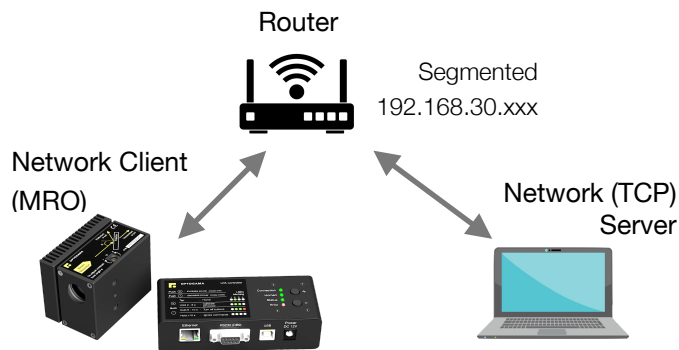
NOTE: If any other device or computer tries to connect to the TCP Server, connection is refused.

4.6.5. Ethernet configuration using commands

In this manual two cases of network settings configurations will be reviewed:

- First case is when MRO and device communicate on the same network.
- Second case when MRO and other device communicate from different networks over internet. The latter is like the first case but has more steps included.

1. MRO and other device **communication on the same network:**



IP: 192.168.30.140

Connecting to 192.168.30.153:555

IP: 192.168.30.153

Listening on port 555

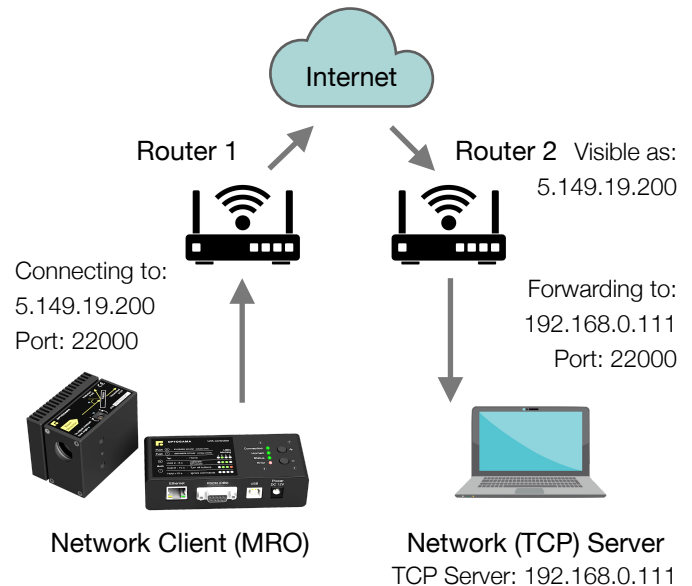
As shown in the picture device that wants to communicate with MRO has to be TCP Server, while MRO is TCP Client by default. Both Server and MRO are connected to the router. The server may be connected via Ethernet cable or Wi-Fi. According to this setup MRO network settings have to be set as follows:

- “MRO>NIP!_192.168.30.140” – Client (MRO) IP address in the local network.
- “MRO>NSIP!_192.168.30.153” – Server IP address in the local network.
- “MRO>GWIP!_192.168.30.100” – Router/Default Gateway IP address.
- “MRO>NMSK!_255.255.255.0” – Local network subnet mask.
- “MRO>NPRT!_555” – Port over which both devices communicate.

With these settings, MRO device which has Network client IP address 192.168.30.140, will try to connect to Network Server (PC) with IP address 192.168.30.153 over Port 555.

The connection will be made through Router whose IP address is 192.168.30.100 and both devices are connected to it. If everything is configured correctly TCP Server during “listening” of Port 555 should get a request of connection from MRO device.

2. MRO and other device **communication from different networks** over internet:



MRO is a Client and another device is a Server. In this case ,both devices are on different networks and the only way they can reach each other is through the internet. To do this MRO settings have to be as following:

- “MRO>NIP!_192.168.0.3” – Client (MRO) IP address in the local network.
- “MRO>NSIP!_5.149.19.200” – Server’s Public IP Address.
- “MRO>GWIP!_192.168.0.1” – Default Gateway/Router1 IP address.
- “MRO>NMSK!_255.255.255.0” – Local network subnet mask.
- “MRO>NPRT!_22000” – Port over which both devices communicate.

In this case, MRO will try to connect to a server with port 22000 over the internet which has the Public IP Address 5.149.19.200. Router 2 should accept connection from MRO and Port Forward to a device in the Local Network with IP address 192.168.0.111.

NOTE: Port Forwarding must be configured on Router 2. This procedure varies on different devices and instructions should be available on Router 2 user manual.

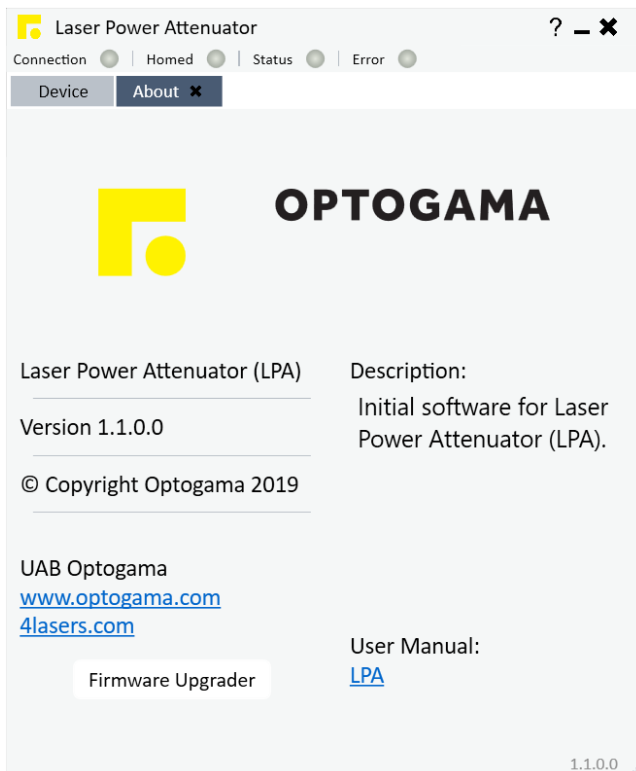
4.7. Updating the firmware

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

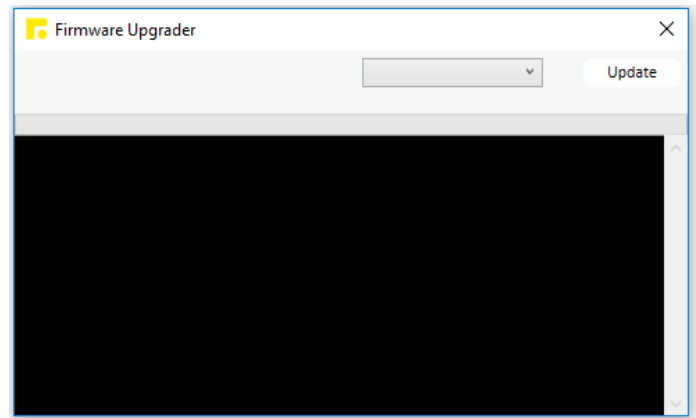
NOTE: Compatible software had been delivered with device. If lost contact us (sales@optogama.com)

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 MRO software:



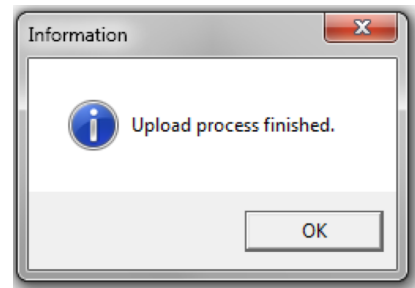
2. In the opened window press **"Update"** button. You will be asked if you really want to update device:



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 **“MRO>PWR!_10\n”** command to which the device will respond with **“MRO>PWR_10\n”**.

4.2. Description

Command	Response	Comments	Example usage	
			User command	Device response
Motion Power - PWR, Angle - ANG, Target - TGT, Stop - STP				
MRO>PWR?	MRO>PWR_X.XXX	When used in attenuator mode. Command used to get the current power value in percentages.	MRO>PWR?	MRO>PWR!_45.125
MRO>PWR!_X.XXX	MRO>PWR!_X.XXX	When used in attenuator mode. Command used to set a new power value in percentages.	MRO>PWR!_10	MRO>PWR_10.000
			MRO>PWR!_45.1	MRO>PWR_45.100
			MRO>PWR!_0.07	MRO>PWR_0.070
MRO>ANG?	MRO>ANG_X.XXX	Command used to get the current angle value in degrees.	MRO>ANG?	MRO>ANG_22.143
MRO>ANG!_X.XXX	MRO>ANG_X.XXX	Command used to set the angle value in degrees.	MRO>ANG!_22.5	MRO>ANG_22.500
MRO>TGT!_X.XXX	MRO>TGT_X.XXX	Command used to set the target in micro-steps.	MRO>TGT!_44521	MRO>TGT_44521
MRO>TGT?	MRO>TGT_X.XXX	Command used to get the current position in micro-steps.	MRO>TGT?	MRO>TGT_44521
MRO>STP!	MRO>STP	Command used to stop motor instantly. Device could be used normally, homing is not require.	MRO>STP!	MRO>STP
Homing, Calibration & Auto-go Homing - HOME, Auto-homing - AHOME, Calibration - DEF, Auto-go - AUTOGO				
MRO>HOME!	MRO>HOME	Command used to home the device (motor goes to home position - TGT_0).	MRO>HOME!	MRO>HOME
MRO>AHOME!	MRO>AHOME_1	Command used to turn ON auto homing after power ON.		
MRO>NOAHOME!	MRO>AHOME_0	Command used to turn OFF auto homing after power ON.		
MRO>AHOME?	MRO>AHOME_0	Command used to get auto homing state. If 1 - Auto homing is enabled, 0 - disabled.		

Command	Response	Comments	Example usage	
			User command	Device response
MRO>DEF!	MRO>DEF_offset	Command used to define current position as 0 deg. Used for calibration.	MRO>DEF!	MRO>DEF_-25432
MRO>DEF?	MRO>DEF_offset	Command used to get an offset value from home to 0 deg position. Used for calibration.	MRO>DEF?	MRO>DEF_-25432
MRO>AUTOGO!_X	MRO>AHOME_X	Command used to set procedure after each homing: 0 - device remains in home position (TGT_0); 1 - device goes to 0 deg position (calibrated position as 0 deg); 2 - device goes to LAST position it was before homing.		
MRO>AUTOGO?	MRO>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 0 deg position (calibrated position as 0 deg); 2 - device goes to LAST position it was before homing.		
Settings Baud rate - BAUD, Buttons lock - KEYLOCK, Default settings - LDF				
MRO>BAUD?	MRO>BAUD_baud rate	Command used to get baud rate.	MRO>BAUD?	MRO>BAUD_115200
MRO>BAUD!_baud rate	MRO>BAUD_baud rate	Command used to set baud rate. Available speeds: 115200, 57600, 38400, 19200, 9600, 4800. Other values are ignored.	MRO>BAUD!_57600	MRO>BAUD_57600
MRO>KEYLOCK!	MRO>KEYLOCK_X	Command used to ENABLE / DISABLE controller physical buttons: 1 - disabled, 0 - enabled.		
MRO>KEYLOCK?	MRO>KEYLOCK_X	Command used to get controller physical buttons state: 1 - disabled, 0 - enabled.		
MRO>LDF!	MRO>LDF	Command used to load default settings. Device after this command must be: 1. Homed; 2. Recalibrated.		
Ethernet settings				
MRO>NIP!_x.x.x.x	MRO>NIP_x.x.x.x	Command used to set Client (MRO) IP address in local network.	MRO>NIP!_192.168.30.140	MRO>NIP_192.168.30.140
MRO>NIP?	MRO>NIP_x.x.x.x	Command used to get Client (MRO) IP address in local network.	MRO>NIP?	MRO>NIP_192.168.30.140
MRO>NSIP!_x.x.x.x	MRO>NSIP_x.x.x.x	Command used to set Server (PC) IP address in local or public network.	MRO>NSIP!_192.168.30.153	MRO>NSIP_192.168.30.153
MRO>NSIP?	MRO>NSIP_x.x.x.x	Command used to get Server (PC) IP address in local or public network.	MRO>NSIP?	MRO>NSIP_192.168.30.153
MRO>GWIP!_x.x.x.x	MRO>GWIP_x.x.x.x	Command used to set Default Gateway IP address.	MRO>GWIP!_192.168.30.100	MRO>GWIP_192.168.30.100
MRO>GWIP?	MRO>GWIP_x.x.x.x	Command used to get Default Gateway IP address.	MRO>GWIP?	MRO>GWIP_192.168.30.100
MRO>NMSK!_x.x.x.x	MRO>NMSK_x.x.x.x	Command used to set Local network subnet mask.	MRO>NMSK!_255.255.255.0	MRO>NMSK_255.255.255.0
MRO>NMSK?	MRO>NMSK_x.x.x.x	Command used to get Local network subnet mask.	MRO>NMSK?	MRO>NMSK_255.255.255.0
MRO>NPRT!_x	MRO>NPRT_x	Command used to set Port over which both devices communicate (555 by default)	MRO>NPRT!_555	MRO>NPRT_555

Command	Response	Comments	Example usage	
			User command	Device response
MRO>NPRT?	MRO>NPRT_x	Command used to get Port over which both devices communicate (555 by default)	MRO>NPRT?	MRO>NPRT_555
Information Device state - STATUS, Wavelength - WL, Firmware v. - FW, Serial number - ID				
MRO>STATUS?	MRO>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 calibration is done More info on pg. 19	MRO>STATUS?	MRO>1_0
			MRO>STATUS?	MRO>0_0
			MRO>STATUS?	MRO>1_2
MRO>WL?	MRO>WL_XXX	Command used to get the design wavelength.	MRO>WL?	MRO>WL_355
MRO>FW?	MRO>_Firmware version	Command used to get firmware version.	MRO>FW?	MRO>_1.0.0.1
MRO>ID?	MRO>_MROXXXXXXX	Command used to get serial number.	MRO>ID?	MRO>_MRO1901001
Other Echo, Reset, Motor ON/OFF				
MRO>ECHO!	MRO>ECHO	Command used for troubleshooting. The device echoes sent command before sending the response.	MRO>ECHO! MRO>TGT?	MRO>ECHO MRO>TGT? MRO>TGT_45602
MRO>NOECHO!	MRO>NOECHO	Command used to disable ECHO command.		
MRO>RESET!	MRO>RESET	Command used to reinitialise device.	MRO>RESET!	MRO>RESET
MRO>OFF!	MRO>OFF	Command used to turn motor OFF.	MRO>OFF!	MRO>OFF
MRO>ON!	MRO>ON	Command used to turn motor ON.	MRO>ON!	MRO>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 “MRO>DEF!” command was send and minimum laser power position is known.

5.2. Serial communication example in Python

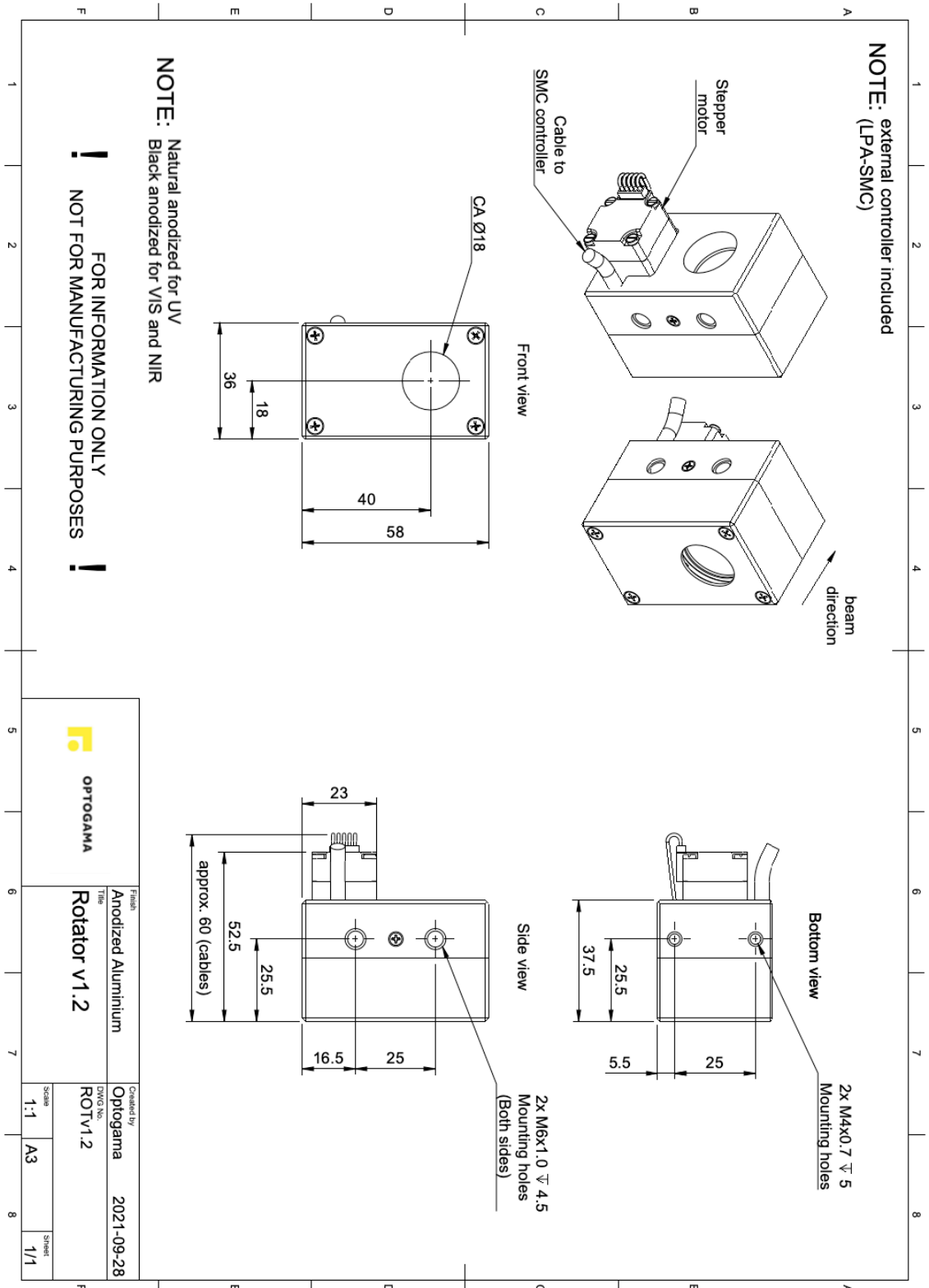
```

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)

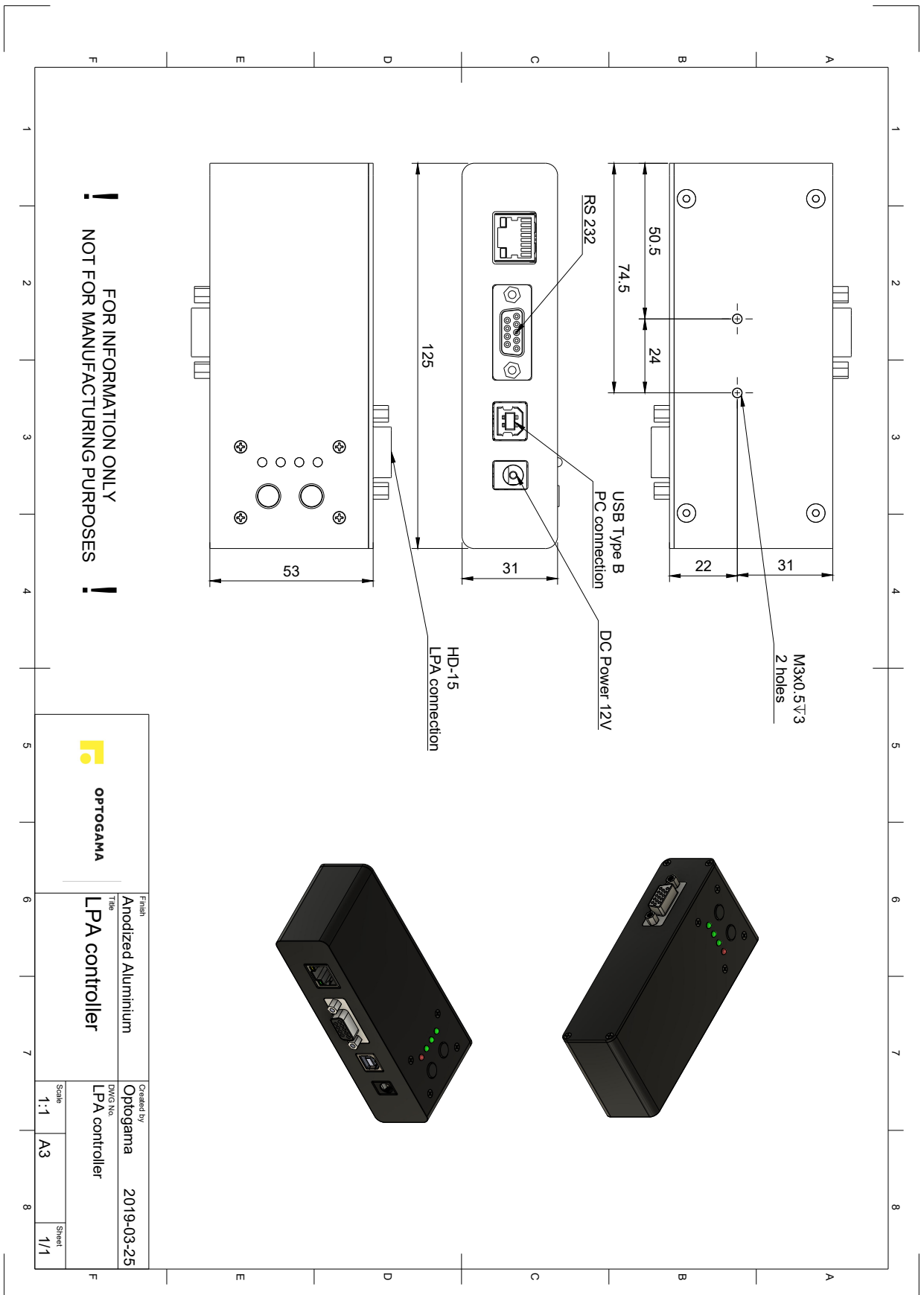
```

6. Technical information

6.1. MRO drawings



6.2. MRO controller drawing

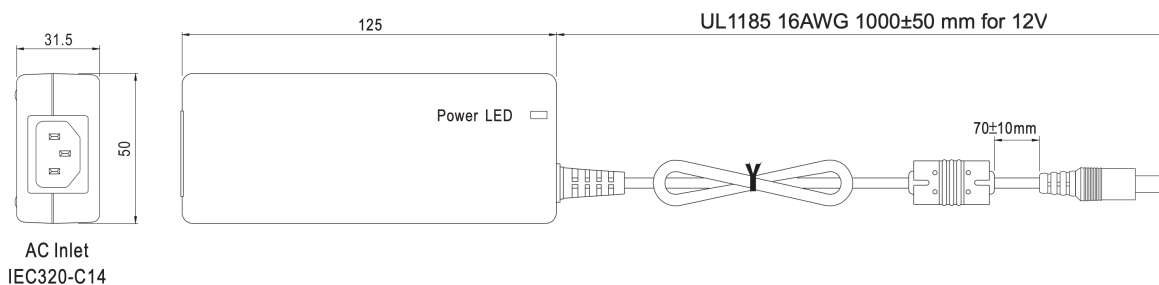


6.3. Power supply

■ Mechanical Specification

Case No. GS60A Unit:mm

GST60A12-P1J



■ DC output plug

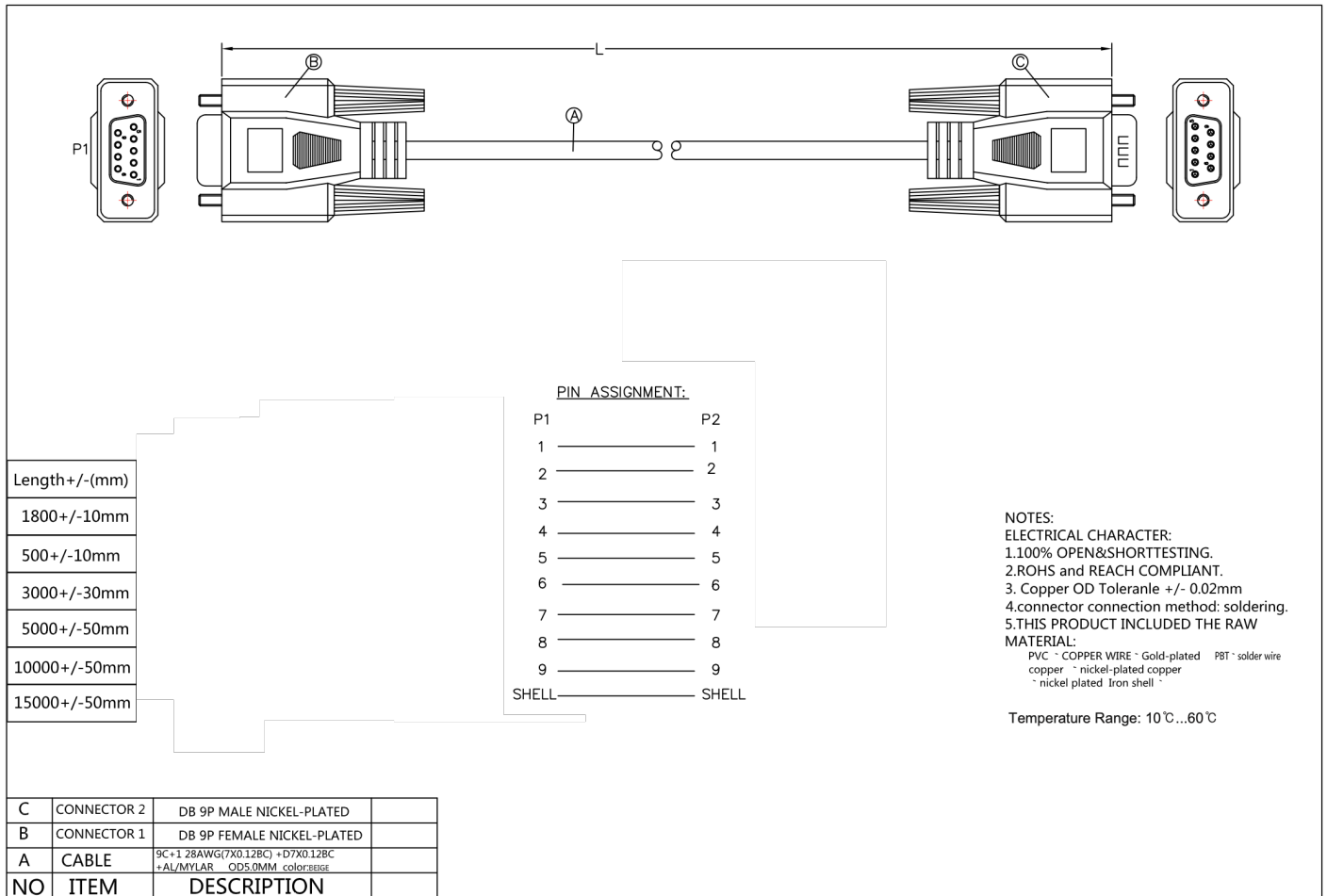
© Standard plug: P1J

P1J		Pin Assignment
		Outside Inside -V not connected to AC FG

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

6.4. RS232 cables



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