COMPACT MOTORISED BEAM EXPANDERS

1x - 3x | 1x - 8x

MEX13
MEX18
MEX18-ACH
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MEX
Motorised beam expander

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

March 2018

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No part of this manual may be reproduced, transmitted in any form without the permission of Optogama.

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-authorised 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 beam expander 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 beam expander is intended for industrial and scientific use only. If there are any other electrical devices connected to or used in conjunction with the beam expander, 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.
- This manual should be read carefully before first intended use.
- All rules and regulations concerning safe operation of lasers must be known and applied while installing and operating motorised beam expander.
- Even when with 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.
- 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!** Make sure laser beam is not converging after passing through the beam expander - it may damage other optical elements along the optical axis.

**CAUTION!** Device is meant to be used with collimated beam. Users take full responsibility when using the expander with highly converging beam.
2. Operation principle

MEX13(18) series motorised beam expander consists of two motorised adjustable lenses. Expansion adjustment is achieved by changing the position of the second lens which is followed continuously by the first one. While changing the magnification level this technology prevents the system from focusing laser beam and damaging optical elements that are situated along the optical axis.

**NOTE:** No homing required.

**CAUTION!** Before increasing laser power make sure laser beam is not converging after passing through the beam expander. It may damage optical elements situated along the optical axis.

**NOTE:** Required laser beam divergence is achieved by adjusting divergence value (DOF coefficient) in the software (or terminal).

3. Features and advantages

- Highest beam pointing stability (< 0.1 mrad on request)
- Fused silica optical elements
- Integrated controller
- No homing required. Closed loop design
- Diffraction limited performance for all magnifications

4. Optical design

To achieve best performance and highest pointing stability during operation (<0.5 mrad, <0.2 mrad for PS model) MEX optical design is based on sliding-lenses closed loop design. Neither of the lenses is rotating while changing both zoom and divergence levels.

Optical design of MEX13 and MEX18 series (see Fig 1. below):
Converging > Diverging > Converging

**NOTE:** Continuous change of expansion and divergence.

**NOTE:** No ghost reflections.

**NOTE:** Diffraction limited optical design.

![Fig 1. Schematic explanation of optical design for MEX13 and MEX18 series motorised beam expander.](image-url)

![Fig 2. Schematic explanation of optical design for MEX18-ACH series motorised beam expander.](image-url)
5. Product description

MEX series motorised laser beam expanders are used to increase or decrease laser beam diameter and adjust its divergence.

Standard or custom made beam expanders and reducers have a unique closed loop sliding-lens design, ensuring highest pointing stability and minimal dimensions.

5.1. Optical specifications

<table>
<thead>
<tr>
<th>Magnification ranges</th>
<th>MEX13 - 1.0x - 3.0x</th>
<th>MEX18 - 1.0x - 8.0x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear input aperture</td>
<td>11 mm</td>
<td></td>
</tr>
<tr>
<td>Clear output aperture</td>
<td>MEX13 - 23 mm</td>
<td>MEX18 - 38 mm</td>
</tr>
<tr>
<td></td>
<td>MEX18-ACH - 23 mm</td>
<td></td>
</tr>
<tr>
<td>Optical elements</td>
<td>3</td>
<td>4 (MEX18-ACH)</td>
</tr>
<tr>
<td>LIDT coating</td>
<td>10 [J/cm²] (10 ns @ 1064 nm)</td>
<td></td>
</tr>
<tr>
<td>Pointing stability</td>
<td>&lt;0.5 mrad</td>
<td>(&lt;0.2 mrad for PS version)</td>
</tr>
<tr>
<td>adjustment time</td>
<td>MIN to MAX - in 1 sec</td>
<td></td>
</tr>
<tr>
<td>Available coatings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Standard wavelengths, nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st harm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1064</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1020 - 1040</td>
<td></td>
<td></td>
</tr>
<tr>
<td>760-840</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd harm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>532</td>
<td></td>
<td></td>
</tr>
<tr>
<td>510 - 520</td>
<td></td>
<td></td>
</tr>
<tr>
<td>390 - 410</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd harm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>355</td>
<td></td>
<td></td>
</tr>
<tr>
<td>343</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Dual wavelengths, nm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1064 + 532</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1030 + 515</td>
<td></td>
<td></td>
</tr>
<tr>
<td>800 + 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Custom wavelengths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Custom coating available</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.2. Mechanical specifications

<table>
<thead>
<tr>
<th></th>
<th>MEX13</th>
<th>MEX18</th>
<th>MEX18-ACH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lenght</td>
<td>140 mm</td>
<td>237 mm</td>
<td>226 mm</td>
</tr>
<tr>
<td>Width</td>
<td>45 mm</td>
<td>45 mm</td>
<td>45 mm</td>
</tr>
<tr>
<td>Height</td>
<td>45 mm</td>
<td>45 mm</td>
<td>45 mm</td>
</tr>
</tbody>
</table>

5.3. Electronic specifications

Interface options:

- Terminal: Using commands described in p. 8 “Commands”
- Software: Using BDS software
- Input voltage: 12 V
- Transmission speed: up to 115,200 bits/s (RS-232) full speed USB 2.0

5.4. Conditions

Operating temperature: 10 °C to 40 °C
Storage temperature: -15 °C to 50 °C
5.5. Interfaces

There are two types of connections available:
1. USB 2.0 and power plug for 12 V.
2. RS-232 and power plug for 12 V.

5.6. Identification

Nameplate on beam expander:

- Product, Expansion: MEX 1X-3X
- Wavelength: 515+1030 nm
- Serial number: SN: 1B10318039

5.7. Wiring

PC connection | Power supply
--- | ---
1 - D+ (RS-232: Tx) | 1 - GND
2 - D- (RS-232: Rx) | 2 - GND
3 - VUSB (RS-232: NC) | 3 - 12V
4 - GND

Fig 4. MEX connectors

5.8. 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".

MEX 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.

5.9. What’s in the box?

Standard version includes:
1. Motorised beam expander
2. Software
3. Power supply
4. USB or RS-232 (D-Sub 9) cable

NOTE: Other accessories must be purchased separately
6. Software

6.1. 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 application you must have administrator rights on your computer.

To run BDS application Microsoft .NET 4.5.2 Framework or later must be installed. 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 BDS software from our website [www.optogama.com](http://www.optogama.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”:
4. Review setup information and proceed the installation. To continue click “Install”:

5. Setup will finish the installation:

6. Press “Finish” to end the installation:

7. Connect the device and the PC via USB or RS232 cable.

**NOTE:** Lenses may move themselves when power is plugged in.

8. Plug in MEX power supply and AC adaptor to wall outlet.

9. The device will be detected and configured.

10. 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 BDS program using BDS icon on the desktop.

11. Device selector window will appear. Select COM port (to which the beam expander 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.

12. Once you are connected to your device you will be greeted by main program window for motorised beam expander. Window is the same for all devices but only specific options for control will be available. (Detailed explanation in p. 11 “Main window (expander mode) / (full beam control mode)”.)
13. Select “Settings” in a sliding menu located on the left. Settings menu will appear. Select laser wavelength from drop down menu, then press “Set”.

14. Change Magnification offset to calibrate magnification values (MOF)

6.6. Main window

- **Connected device tab**
- **Device selector tab**
- **Sliding Menu**
  - Drag cursor to expand menu
- **Settings**
  - Select this icon to open settings window in which laser parameters and Beam control mode could be changed
- **Command line**
  - Select this icon to open command terminal window
- **Reconnect**
  - Select this icon to reconnect the device if it is being disconnected
- **Demo mode**
  - Select this icon to start demo mode which automatically changes magnification level by 0.25x step
- **Preset buttons**
  - Click “Edit icon” to add preset required magnification and divergence offset values for a quick change

**Device name**
- Indicates available expansion range and selected wavelength

**Magnification Slider**
- Move the slider to change into required magnification level

**Connection**
- Green - device is connected
- Red - device is disconnected

**Moving**
- Green - lenses are in motion
- Stabilised - Green - lenses are stabilised

**Error**
- Red - indicates position error, click on it to reset.

**Magnification value**
- Enter required magnification value, Press “Enter”.

**Divergence slider**
- Move the slider to change divergence value

**Divergence offset slider**
- Double-click “Less” and “More” to decrease or increase divergence offset range.

**Expansion divergence offset range**
- Double-click “Less” and “More” to decrease or increase divergence offset range.

**Save as preset**
- Save current magnification and divergence values as preset button in required slot.

**Mag | Div**
- Current values

**Buttons for incremental change**
- Click yellow button for incremental change. Double-click on the number to change the increment size.
6.7. Magnification calibration. MOF coefficient

Command is used to adjust all magnification values:

- input \(>0\) (positive values) to increase Magnification offset
  For. Ex. \textit{MEX}>\textit{MOF!}+0.7

- input \(<0\) (negative values) to decrease Magnification offset
  For. Ex. \textit{MEX}>\textit{MOF!} -0.6

- to reset Magnification offset input 0.
  For. Ex. \textit{MEX}>\textit{MOF!}0

\textbf{NOTE:} MOF coefficient will be applied for all magnification values.

For. Ex. 1X magnification value (MAG_1) is chosen, but according to your laser beam parameters 1.09X actual magnification value is reached, so to calibrate magnification to required value \textit{MEX}>\textit{MOF!}-0.4 or other negative value could be sent while observing the output.

6.8. Divergence adjustment. DOF coefficient

Once you have right magnification value you can adjust beam divergence. To do that, you have to change DOF coefficient (Divergence offset) with \textit{MEX}>\textit{DOF!}\_value command:

- input \(>0\) to increase beam divergence (positive values)
  For. Ex. \textit{MEX}>\textit{DOF!}+0.7

- input \(<0\) to decrease beam divergence (negative values)
  For. Ex. \textit{MEX}>\textit{DOF!} -0.6

- to reset Divergence offset input 0.
  For. Ex. \textit{MEX}>\textit{DOF!}0

\textbf{NOTE:} DOF coefficient will be applied for all magnification values. If different Divergence offset must be set it has to be adjusted each time.

For. Ex. You can observe that laser beam beam is diverging too much and it must be collimated. To do that \textit{MEX}>\textit{DOF!}-0.5 or other negative value must be sent while observing the output.
6.9. Updating the firmware

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

   ![Firmware Upgrader](image)

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

   ![Update Confirmation](image)

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

   ![Warning Message](image)

4. During update, if device is not corrupted, there’ll be created a backup of settings stored in your device.

   ![Backup Creation](image)

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

   ![Update Success](image)

**NOTE:** After update turn off the “Firmware Upgrader”, **reset device by removing USB and Power cables.** Reconnect the cables and connect to device using software.
6. You may get a warning sign saying that you must set default coefficients in case there are some error with device settings:

![Warning!]

Some coefficients for current wavelength don't match. Please set default coefficients.

OK

7. In order to rewrite default coefficients go to **Settings** -> **choose wavelength** -> Press “Set” -> Press “Default coeff.”

**NOTE:** In order to rewrite coefficients for all wavelengths you must repeat this action for all available wavelengths.

8. Finally, choose desired wavelength, check if **“Motor state”** and **“Calculations”** are marked then press **“Set”**. Coefficients for the wavelength will be automatically changed by device. Now you’re ready to go.
9. Commands

9.1. Interface

The MEX 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, MEX communicates on the **configured Baud rate (by default 57600)** (see Command descriptions), using **8 data bits, no parity and 1 stop bit**.

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 MEX are conducted by sending **literal ASCII string commands terminated with the newline character \n**. For example, the beam expansion coefficient can be set to 2.5 by issuing a “**MEX>MAG!_2.5\n**” command to which the device will respond with “**MEX>MAG_2.5\n**”.

9.2. Description

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Comments</th>
<th>Example usage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motion</strong></td>
<td>Magnification - MAG, Magnification offset - MOF, Divergence offset - DOF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEX&gt;MAG?</td>
<td>MEX&gt;MAG_X.XXX</td>
<td>Command used to get the current magnification value from the device.</td>
<td>MEX&gt;MAG? MEX&gt;MAG_1.250</td>
</tr>
<tr>
<td>MEX&gt;MAGI_X.XXX</td>
<td>MEX&gt;MAG_X.XXX</td>
<td>Command used to set a new magnification values.</td>
<td>MEX&gt;MAGI_2 MEX&gt;MAG_2.000</td>
</tr>
<tr>
<td>MEX&gt;MAGI_2.5</td>
<td>MEX&gt;MAG_2.500</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEX&gt;MAGI_2.547</td>
<td>MEX&gt;MAG_2.547</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEX&gt;MOF?</td>
<td>MEX&gt;MOF_X.XXX</td>
<td>Command used to get current magnification adjustment coefficient (0 - means the lenses in the device is in their theoretical positions)</td>
<td>MEX&gt;MOF? MEX&gt;MOF_0.3</td>
</tr>
<tr>
<td>MEX&gt;MOFI_X.XXX</td>
<td>MEX&gt;MOF_X.XXX</td>
<td>Command used to adjust magnification values: + to increase magnification - to decrease magnification (For Ex. 1X magnification value (MAG_1) is chosen, but according to your laser beam parameters 1.09X actual magnification value is reached, so to calibrate magnification to required value MEX&gt;MOF_-0.7 command must be sent)</td>
<td>MEX&gt;MOFI_-0.7 MEX&gt;MOF_-0.7</td>
</tr>
<tr>
<td>MEX&gt;DOF?</td>
<td>MEX&gt;DOF_X.XXX</td>
<td>Command used to get current divergence adjustment coefficient (0 - means the lenses in the device is in their theoretical positions)</td>
<td>MEX&gt;DOF? MEX&gt;DOF_1.6</td>
</tr>
<tr>
<td>Command</td>
<td>Response</td>
<td>Comments</td>
<td>Example usage</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
</tbody>
</table>
| MEX>DOF!_X.XXX | MEX>DOF_X.XXX  | Command used to collimate beam or get required divergence value:  
+ to increase beam divergence  
- to decrease beam divergence  
(For Ex. You can observe that laser beam is diverging too much and it must be collimated. To do that MEX>DOF_-0.5 or different values must be sent while observing the output) | MEX>DOF!_-0.5 | MEX>DOF_-0.5 |

**Settings | Baud rate - BAUD, Wavelength - WL, Coefficients - CMAG,**

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Comments</th>
<th>Example usage</th>
</tr>
</thead>
</table>
| MEX>BAUD?     | MEX>BAUD_baud rate | Command used to get baud rate.  
(57600 by default)                                                                                                                                                                                                 | MEX>BAUD?     | MEX>BAUD_115200 |
| MEX>BAUD!_baud rate | MEX>BAUD_baud rate | Command used to set baud rate. Available speeds:  
115200, 57600, 38400, 19200, 9600, 4800  
Other values are ignored.                                                                                                                                                     | MEX>BAUD!_57600 | MEX>BAUD_57600 |
| MEX>CWL?      | MEX>CWL_XXX.XX | Command to get the current working wavelength in nanometers.                                                                                                                                              | MEX>CWL?     | MEX>CWL_532.0  |
| MEX>CWL!_XXX.XX | MEX>CWL_XXX.XX | Command to set the current working wavelength in nanometers. The device will change its current working wavelength only if it matches one of the design wavelengths!  
Design wavelengths can be seen by issuing an MEX>INFO? Command.                                                                                                           | MEX>CWL!_1064 | MEX>CWL_1064.0 |
| MEX>CWL!_999  | MEX>CWL_999   |                                                                                                                                                                                                           | MEX>CWL!_532.1 | MEX>CWL_532.0  |
| MEX>CWL!_532  | MEX>CWL_532   |                                                                                                                                                                                                           | MEX>CWL!_532.0 | MEX>CWL_532.0  |
| MEX>CMAG?     | MEX>CMAG_X.XXXXXX_  
YYYYYZZZZZZ_ U.UUUUUU V.VWWWWW W.WWWWWW  
x.xxxxx_yyyyyy_zzzzz zz_uuuuuu_v.vwwww  
wwwwww | Command used to get the current polynomial coefficients of curves A (uppercase) and B (lowercase). These coefficients are sent in scientific notation with 6 digits of precision starting with the 0th order and ending with the 5th order coefficient. | MEX>CMAG?     | MEX>CMAG_-1.1154e3_8  
0183e1_-2.0505e0_2.362  
0e-2_-1.0279e-4_0.0000_  
-1.1154e3_8.0183e1_-2.0  
505e0_2.3620e-2_-1.0279e-4_0.0000 |
| MEX>CMAG!_X.XXXXXX_  
YYYYYZZZZZZ_ U.UUUUUU V.VWWWWW W.WWWWWW  
x.xxxxx_yyyyyy_zzzzz uuuuuu_v.vwwww  
wwwwww | Command used to set the new polynomial coefficients of curve A (uppercase) and B (lowercase). These coefficients are sent in scientific notation with 6 digits of precision starting with the 0th order and ending with the 5th order coefficient. | MEX>CMAG!_X.XXXXXX_  
YYYYYZZZZZZ_ U.UUUUUU V.VWWWWW W.WWWWWW  
x.xxxxx_yyyyyy_zzzzz uuuuuu_v.vwwww  
wwwwww | MEX>CMAG!_-1.1154e3_8.0183e1_-2.0  
505e0_2.3620e-2_-1.0279e-4_0.0000_  
-1.1154e3_8.0183e1_-2.0  
505e0_2.3620e-2_-1.0279e-4_0.0000 |

**Information | Device state - STATUS, information - INFO, Serial number - ID,**

<table>
<thead>
<tr>
<th>Command</th>
<th>Response</th>
<th>Comments</th>
<th>Example usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEX&gt;STATUS?</td>
<td>ENA_CON_DIRECT_ERR_0</td>
<td>Command used to get the current state of the device. First flag signifies if element actuation is enables or disabled. Second flag signifies if automatic target coordinate calculation is active. Third flag signifies if calculation mode is inverted or direct. The error byte shows if</td>
<td>MEX&gt;STATUS?</td>
</tr>
<tr>
<td>MEX&gt;STATUS?</td>
<td>DIS_CON_INVERT_ERR_3</td>
<td>Command used to get the current state of the device. First flag signifies if element actuation is enables or disabled. Second flag signifies if automatic target coordinate calculation is active. Third flag signifies if calculation mode is inverted or direct. The error byte shows if</td>
<td>MEX&gt;STATUS?</td>
</tr>
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</table>
### Command Table

<table>
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<th>Command</th>
<th>Response</th>
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<th>Example usage</th>
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<tr>
<td>MEX&gt;STATUS?</td>
<td>ENA_CON_DIRECT_ERR_XXX</td>
<td>Bit number meaning if value &quot;high&quot; - 7 - Max position boundary exceeded. 6 - Min position boundary exceeded. 5 - Spacing violation between optical elements. 4 - Calculation error. 3 - Internal device failure. 2 - Reserved. 1 - Stabilizing. 0 - Optical elements in motion.</td>
<td>MEX&gt;STATUS?</td>
</tr>
<tr>
<td>MEX&gt;INFO?</td>
<td>MEX&gt;MMG_X.XXX_Y.YY_Y_MDV_J_JJJ_K_KKK_C_WL_QQQ_Q_WL_ZZ2_Z_UUU_U_VVV_V_WWW_W</td>
<td>Command used to get the current configuration of the device.</td>
<td>MEX&gt;INFO?</td>
</tr>
<tr>
<td>MEX&gt;ID?</td>
<td>MEX&gt;_1BXXXXXXXX</td>
<td>Command used to get serial number.</td>
<td>MEX&gt;ID?</td>
</tr>
<tr>
<td>MEX&gt;MMG?</td>
<td>MEX&gt;MMG_X.XXX_Y.YY</td>
<td>Command used to get the boundaries of available expansion coefficients. The upper boundary is sent first, followed by the lower boundary. These boundaries are specific to the optical assembly and are set at the factory.</td>
<td>MEX&gt;MMG?</td>
</tr>
</tbody>
</table>

### Other | Echo, Reset, Motor ON/OFF

<table>
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<th>Command</th>
<th>Response</th>
<th>Comments</th>
<th>Example usage</th>
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<tbody>
<tr>
<td>MEX&gt;ECHO!</td>
<td>MEX&gt;ECHO</td>
<td>Command used for troubleshooting. The device echoes the command sent to it before sending the response.</td>
<td>MEX&gt;ECHO!</td>
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<tr>
<td>MEX&gt;NOECHO!</td>
<td>MEX&gt;NOECHO</td>
<td>Command used to disable ECHO command.</td>
<td>MEX&gt;NOECHO!</td>
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<tr>
<td>MEX&gt;RESET!</td>
<td>MEX&gt;RESET!</td>
<td>Command used to reset the device</td>
<td>MEX&gt;RESET!</td>
</tr>
<tr>
<td>MEX&gt;ON!</td>
<td>MEX&gt;ON</td>
<td>Command used to enable optical element actuation.</td>
<td>MEX&gt;ON!</td>
</tr>
<tr>
<td>MEX&gt;OFF!</td>
<td>MEX&gt;OFF</td>
<td>Command used to disable optical element actuation</td>
<td>MEX&gt;OFF!</td>
</tr>
<tr>
<td>BOOTMODE</td>
<td>BOOTMODE</td>
<td>Command used to switch the device into firmware update mode.</td>
<td>BOOTMODE</td>
</tr>
</tbody>
</table>
9.3. Serial communication example in Python

```python
import serial
import glob
import sys
import time

def serial_ports():
    """ Lists serial port names

    :raises EnvironmentError:
        On unsupported or unknown platforms
    :returns:
        A list of the serial ports available on the system
    """
    if sys.platform.startswith('win'):
        ports = [f'COM{i}' % (i + 1) for i in range(256)]
    elif sys.platform.startswith('linux') or sys.platform.startswith('cygwin'):
        # this excludes current terminal '/dev/tty'
        ports = glob.glob('/dev/tty[A-Za-z]*')
    elif sys.platform.startswith('darwin'):
        ports = glob.glob('/dev/tty.*')
    else:
        raise EnvironmentError('Unsupported platform')

    result = []
    for port in ports:
        try:
            s = serial.Serial(port)
            s.close()
            result.append(port)
        except (IOError, serial.SerialException):
            pass
    return result

if __name__ == '__main__':
    ports = serial_ports()
    print("Select port number (starting from 0, 1, 2 etc.):")
    print(ports)
    port = ports[int(input())]
    print(port)

    # configure the serial connections (the parameters differs on the device you are connecting to)
    ser = serial.Serial(
        port=port,
        baudrate=57600,
        parity=serial.PARITY_ODD,
        stopbits=serial.STOPBITS_TWO,
        bytesize=serial.EIGHTBITS,
        timeout=1)  # second
    ser.isOpen()

    print("Enter your commands below.\r\nInsert "exit" to leave the application.")
    cmd=1
    while 1:
        # get keyboard input
        cmd = input("\r")
        # Python 2 users
        # input = raw_input("\r")
        if cmd == 'exit':
            ser.close()
            break
        else:
            # send the string to the device
            # (note that I happen to a \n line feed to the characters - this is requested by device)
            cmdBytes = (cmd + '\n').encode()
            ser.write(cmdBytes)
            out = ''
            out = str(ser.readline())
            if out != '':
                print("\r"""+ out)
```

10. Technical drawings

Motorised beam expander
MEX13v2.1

FOR INFORMATION ONLY
NOT FOR MANUFACTURING PURPOSES

Output CA Ø23
Input CA Ø11.5

M4x0.7 mounting holes

1:1.5 optical ratio