High Power Laser Shutter

User Manual

Altechna

Contents

1. Introduction

This user manual is designed to help to install and operate High Power Laser Shutter. Before installing and operating the product please read installation and operation instructions carefully. Safety instructions must be read carefully. If there are any questions about contents of this manual please contact info@altechna.com. *Altechna* reserves the right to update contents of this manual without any notification.

1.1 Short description

High Power Laser Shutter is designed for fast single interruption or multiple exposure of high power laser beam. It can be utilized as safely device for fast laser beam shutting as well as a device for modulating laser beam exposure time or pulse trains. It can be controlled either manually, or via computer by sending TTL signal from external signal generator via BNC connection or commands via serial port.

1.2 General safety requirements

High Power Laser Shutter is designed to operate in conjunction with laser systems. All applicable rules and regulations for safe operation of lasers must be known and applied while installing and operating the shutter. The user is solely responsible for laser safety while using High Power Laser Shutter as a standalone device or integrated into system. The user must consider protective measures.

While assembling or operating the shutter, do not stare at the direct or scattered laser light even with safety goggles. All parts of the body must be kept away from the laser radiation. While adjusting laser beam through the shutter, laser power must be kept as low as possible. Hazardous laser radiation can increase while optical components or instruments are used in combination with the shutter. Appropriate eye protection must be worn at all times. Electrical safety requirements must be complied while assembling and operating the shutter.

1.3 Symbols

Warning!

Sections marked with this symbol explain dangerous situations that can result as personal injury or death. Always read the associated information carefully, before performing indicated procedure.

Attention!

Paragraphs preceded by this symbol explain hazards that could damage the instrument and connected equipment or may cause loss of data.

Note

This manual also contains "NOTES" and "HINTS" written in this form.

1.4 Regulation

Attention!

The following statement applies to the products covered in this manual, unless otherwise specified herein. The

statement for other products will appear in the accompanying documentation.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can create radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference with radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment causes harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

Altechna is not responsible for any radio or television interference caused by modifications of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by *Altechna*. The correction of interference caused by unauthorized modification, substitution or attachment will be treated as responsibility of the user.

Attention!

Cellular phones or other radio transmitters are not recommended to be used within the range of three meters of this unit since the electromagnetic field intensity may then exceed the maximum allowed disturbance values according to IEC 61326-1.

1.5 Operating and storage conditions

For proper High Power Laser Shutter functioning please use the assigned controller (found in the same package). Using unassigned controllers might be harmful to the device.

Environmental conditions that must be hold while storing, servicing and operating are:

- Storage temperature should be between -25 °C and +60 °C.

- Operating temperature is 25 °C ± 10 °C.

- High Power Laser Shutter must be protected from humidity, dust and corrosive vapors to avoid damaging optical components and electronics.

- Avoid strong static electricity and electromagnetic fields.

2. Package contents

High Power Laser Shutter package includes:

- Laser shutter head

- Controller

- RS232 cable (to connect the shutter to the controller)

- Ø10 mm optics adapters

- Ø2 mm beam alignment adapters

- Power Cable

- User manual and serial command list in USB drive

3. Operation principle

Operation of the shutter is based on the fast galvanomagnetic scanner. Scanner is incorporated in nondispersive optical system to achieve speed of blanking better than parts of milliseconds. This design ensures both- high speed and high damage threshold of the shutter.

Construction of the shutter is based only on reflecting non-focusing optics and is presented in Fig.1.
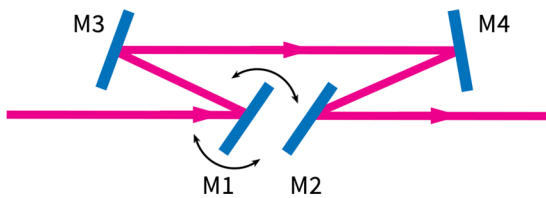

Figure 1. Beam diagram of collinear shutter. M1-rotating galvo mirror, M2-M4-adjustable 100% metal mirror.

System includes: galvo driver and mount, power supply, galvo mirror, standard cable

(Master-Slave) for connecting controller with PC, cable for connecting galvo driver. As an option dpss green or red diode laser should be applied for system alignment (not included).

4. Specifications

Characteristic	Rating
Beam diameter	10 mm
Pulse energy, μJ	≤0.3μJ
Laser beam polarization	any
Max laser power, W	≤20
Switching frequency range, Hz	0-200
Switching time (closed-opend), ms	≥0.2 / 1
Typical switching time (opened-opened), ms	≥0.5 /2
Control via RS232 port, TTL signal	Yes
Control from external (0-5V) generator	Yes
Control from internal (0-5V) generator	Yes
Manual control	Yes
Manual switching	Yes
Shutter position indication	Yes
Sinchro output	Yes
Shutter dimensions, mm	185 x 40 x 60
Controller dimensions, mm	252 x 145 x 74
Electrical power consumption, W	≤30

4.1 Shutting characteristics

Main parameters of the shutter are opening/closing time and residual scattered light. Typical shutter operation results in the range of 10-250Hz are presented in Fig 3a and Fig 3b. The noise is attributed to the fact that the photodiode used for testing did not have either optical or electronic filters for suppressing background noise. The testing was performed using a 700 nm red laser.
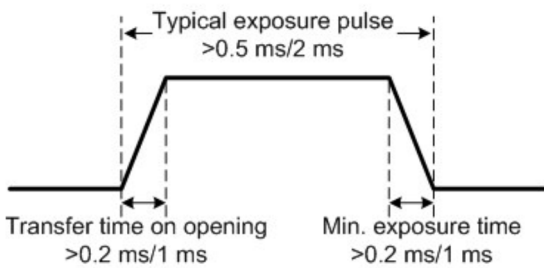

Figure 2. Main temporal parameters of the shutter.

Figure 3a. Typical CW Ø1.5mm laser beam modulation oscilograms at 1Hz and 10Hz rates.
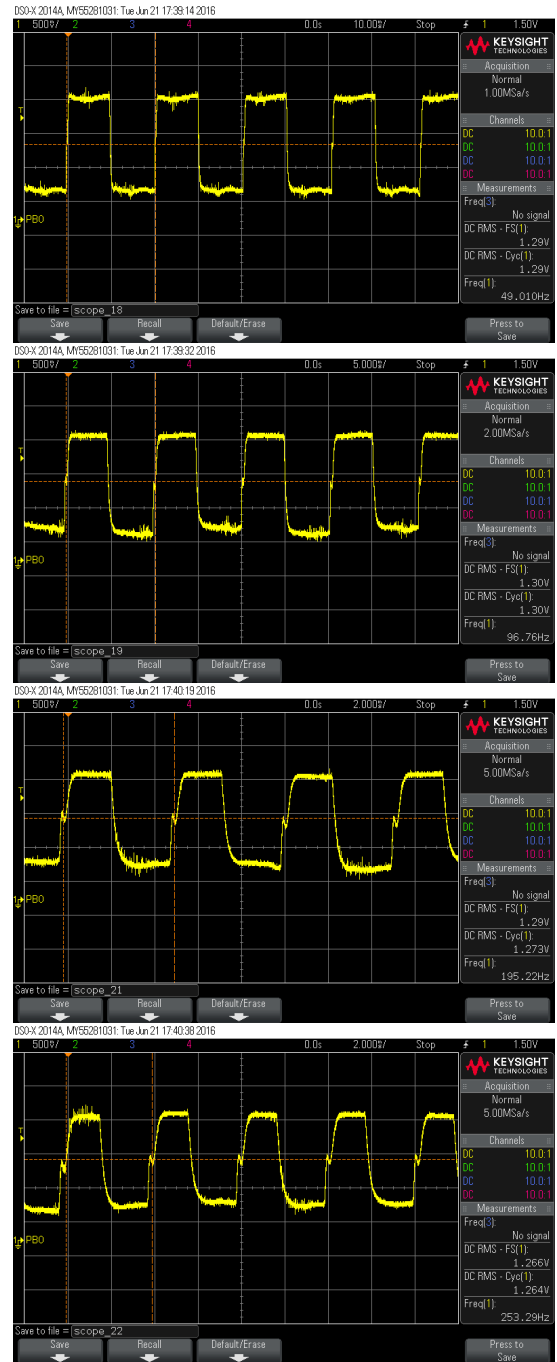

Figure 3b. Typical CW Ø1.5mm laser beam modulation oscilograms at 50Hz, 100Hz, 200Hz and 250Hz rates.

5. Operation manual

5.1 Alignment

To align the shutter with the laser beam, the following actions should be performed:

1. Align guiding beam with the high power operating beam (if operating before shutter beam is invisible) and turn off the high power beam, or set it to harmless power level if it will be used to guide beam.

2. The beam must enter the shutter through the center of the entrance hole (use housing-engraved arrow for reference). Make sure the beam that is entering the shutter is at right angle with respect to the housing. It is recommend to place a mirror with <1 arcmin parallelism to the front surface of the housing and make sure the angle of incidence is 0°.

3. Toggle the corresponding switches to positions "OPEN", "MAN", "ANALOG", then rotate the "ANGLE" handle counterclockwise.

4. Switch on the controller.

5. Now the beam path should correspond to Fig. 1 . Thus the beam should be fully transmitted through the shutter and should be visible on the screen at the output of the shutter.

6. Toggle corresponding switch from "OPEN" to "CLOSE" and turn the "ANGLE" knob until the

beam has disappeared; i.e. is not visible at the output. Now the shutter is ready for operation.

Figure 4. Shutter controller front and back panels.

5.2 Detailed description of switchers

Below the meaning of the shuter switches and indicators are reviewed.

"ANGLE" – potentiometer that changes the deflection angle of galvo mirror in manual regime. It also sets maximum deflection angle when shutter is controlled with external signal generator.

"OPEN/CLOSE"- switch for regulation of the shutter under first installation in "Manual" regime.

"MAN/EXT"- toggles the mode between manual control and external control.

"COMP/ANALOG"- toggles between signal receiving modes when shutter is operating under external control.

- When on "COMP" TTL signals are generated form internal signal generator which is preset to 10 Hz, shutting frequency can be changed by commands sent from computer via RS232 connection.
- When on "ANALOG" the shutter is either controlled manually with "ANGLE" knob, or externally by using pulse generator, connected to "GEN" connection. TTL Low signal (Ground) corresponds to "Open" position whereas TTL High (+5V) correspond "Close" position.

"GEN"-is used for external triggering by using positive TTL pulses +(2-5)V. In this case switch "Manual/External" should be in position "External".
Switche"Analog/Computer" should be in position "Analog". Amplitude of shutter angle between

Close/Open positions is regulated by "ANGLE" knob on front panel.

"SINC" – output signal for shutter operation in "master" mode.

Note

Inertia should be considered, thus galvo-mirror has certain delay relative to triggering pulse.
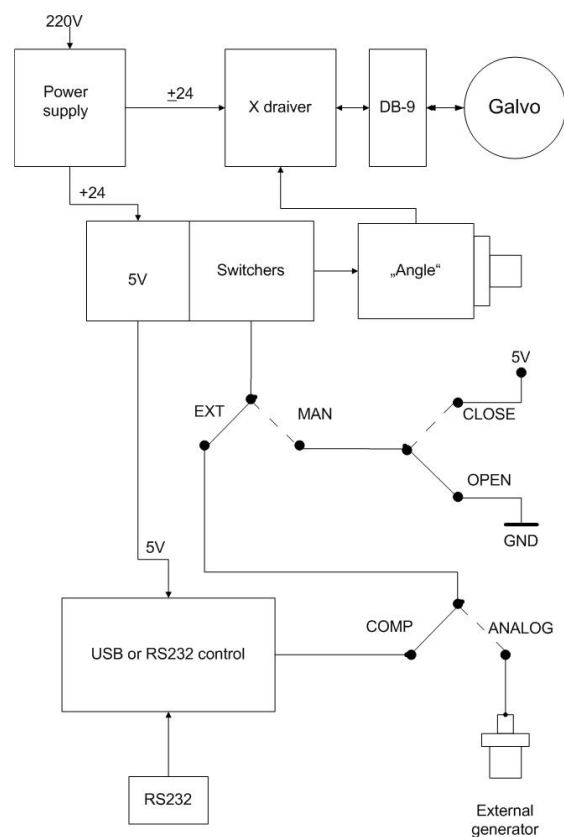

Figure 5. Schematics of switches.

5.3 Control via RS232 port

High Power laser shutter can be controlled via RS232 port by sending serial commands. UART configuration, and commands are listed below.

UART configuration:

- Boud rate:9600
- Data bits:8
- Parity: None
- Step bits:1
- Handshading none

Commands:

- ? – help menu
- a70 – open shutter
- a71 – close shutter
- frX – frequency of opening/closing, where X means frequency (min value 0, max 1000)

Note

RS-232 has its own standard where digital 1 = +3…9V and 0 = -3…-9V. PC and TTL interface has microchips – level converters, which change these analog signals to TTL standard signals. Through COM port commands are sent in ASCII codes. The command list is on file "Shutter comands.cfg" which is supplied with the shutter.

Note

For testing control of the shutter via PC, the RS232 port Terminal software - version 1.9b 20040204 is used, thus it is recommended to use the same software to test the shutter if necessary.

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