

## Delivering Modulation Solutions

### ModBox



#### FEATURES

- Optical waveform flexibility
- Low jitter
- Low rise & fall times
- Very high extinction ratio (35 dB, 55 dB)
- Proven solution

#### APPLICATIONS

- Inertial confinement fusion
- Interaction of intense light with matter
- Laser plasma interaction
- Laser implosion
- Interaction of ion beam with HP laser

#### OPTIONS

- Complete Front-End System
- Extinction ratio value
- Choise of electrical pulse generator

#### RELATED EQUIPMENTS

- ModBox Spectrum Broadening
- CW high power laser
- Pulsed optical amplifiers

The Photline Modbox-Pulse-Shaper is an Optical Modulation Unit to generate short shaped pulses with high extinction ratio at 1030 nm, 1053 nm or 1064 nm. It allows dynamic extinction ratio from 35 dB to above 55 dB with user adjustable pulse duration, repetition rate and temporal pulse shape. One benefit of the Photline Modbox-Pulse-Shaper is to pre-compensate the pulse distortion that occurs in the amplifiers chains that operate in (a highly) saturated regime .

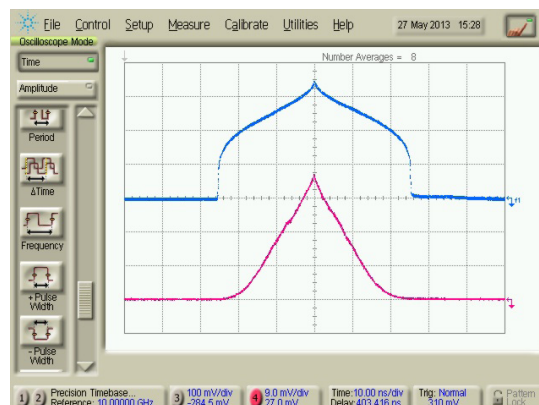
When combined with properly selected high power CW laser, pulsed optical amplifier, and Pulse Broadening ModBox, the Photline Modbox-Pulse-Shaper makes up a complete Front End System that can deliver custom pulses with energy of several uJ.

Photline has accumulated a strong experience in such systems and successfully installed them in many Intense Laser Facilities all over the world.

#### Performance Highlights

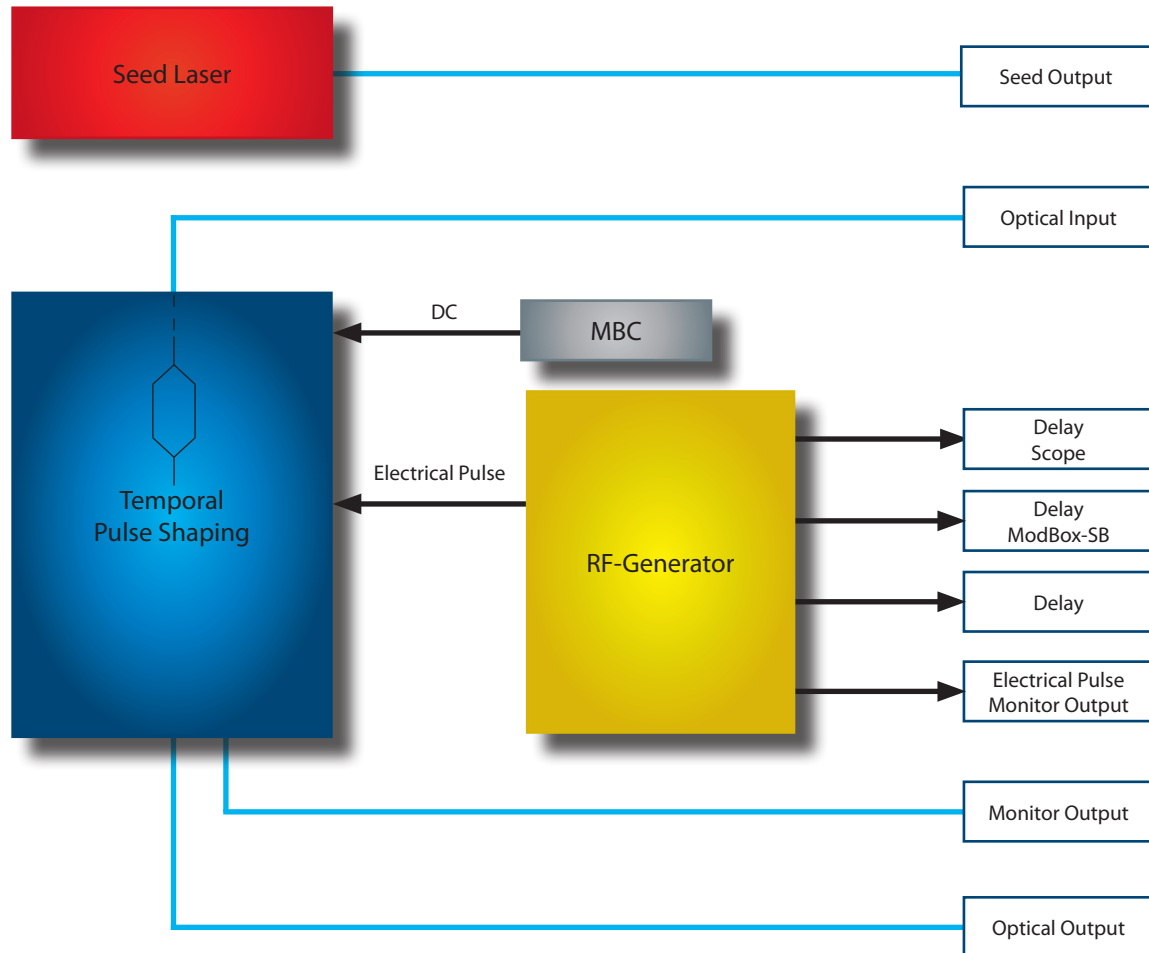
| Parameter            | Min                        | Typ | Max |
|----------------------|----------------------------|-----|-----|
| Operating wavelength | 1030 nm, 1053 nm, 1064 nm  |     |     |
| Pulse contrast       | 35 dB, or > 55 dB          |     |     |
| Pulse waveform       | Arbitrary, user adjustable |     |     |
| Pulse width          | > 125 ps                   |     |     |
| Rise / Fall times    | < 50 ps                    |     |     |
| Jitter               | < 10 ps                    |     |     |

#### Electrical & Optical Pulse Diagrams



Electrical pulse from AWG (blue curve) with corresponding Optical output (pink curve)

Functional Block Diagram



The ModBox Pulse Shaper integrates :

- a temporal pulse shaping block based on a modulators set to ensure a very high optical pulse extinction ratio (35 dB, or 55 dB) and flexible pulse shaping,
- an automatic Modulator Bias Control circuitry (MBC) to guarantee high extinction ratio stability over long periods of time,
- an RF-Generator with an arbitrary waveform capability

The ModBox offers several electrical outputs :

- "Delay scope" : for scope synchronization,
- "Delay ModBox-SB" : for pulse synchronization with the ModBox-Spectrum-Broadening,
- "Monitor output" : an optical monitoring output.

## Optical Input Specifications

| Parameter            | Symbol           | Condition | Min                                | Typ | Max | Unit |
|----------------------|------------------|-----------|------------------------------------|-----|-----|------|
| Operating wavelength | $\lambda$        | -         | 1030 nm, 1053 nm, 1060 nm, 1064 nm |     |     |      |
| Line-width           | $\Delta\lambda$  | -         | -                                  | 1   | 3   | MHz  |
| Optical input power  | OP <sub>in</sub> | -         | -                                  | -   | 5   | W    |

## Electrical Output Specifications

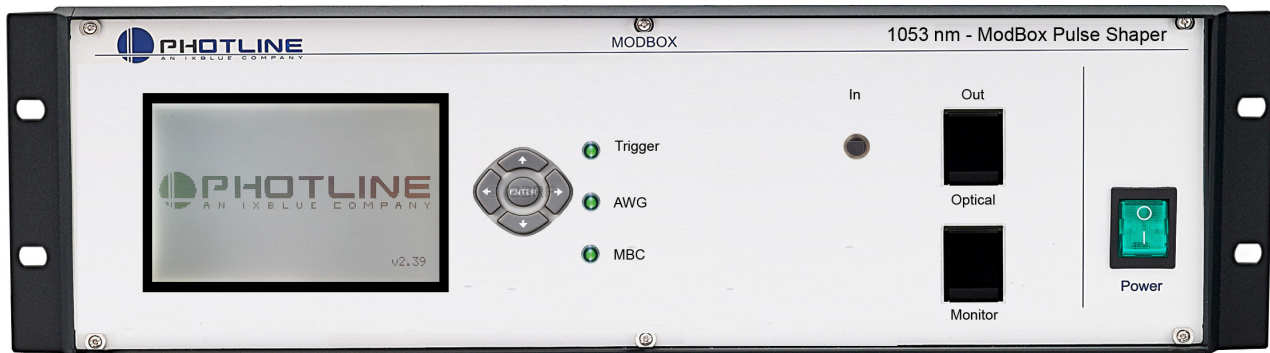
| Parameter                                     | Symbol           | Condition                              | Min | Typ | Max | Unit |
|---|------------------|--|-----|-----|-----|------|
| Delay scope / Delay ModBox-SB / Delay outputs |                  |  |     |     |     |      |
| Delay range                                   | -                | -                                      | 0   | -   | 10  | s    |
| Delay resolution                              | R                | -                                      | -   | 1   | -   | ps   |
| Delay RMS jitter                              | J <sub>RMS</sub> | Internal trigger w/o additional delay  | -   | 10  | 15  | ps   |
|   |                  | External trigger w/o additional delay  | -   | -   | 25  | ps   |
| Delay accuracy                                | -                | -                                      | -   | -   | 150 | ps   |
| Trigger delay                                 | -                | (Insertion delay)                      | -   | -   | 100 | ns   |
| External trigger rate input                   | -                | +1 V on 50 $\Omega$ with positive slop | 0   | -   | 1   | MHz  |
| Output pulse amplitude                        | -                | In step of 10 mV, on 50 $\Omega$       | 2.5 | -   | 10  | V    |

## Optical Output Specifications

| Parameter                     | Symbol                         | Condition                           | Min                        | Typ | Max   | Unit      |
|-------------------------------|--------------------------------|-------------------------------------|----------------------------|-----|-------|-----------|
| Output pulse shapes           | -                              | -                                   | Arbitrary, user adjustable |     |       | -         |
| Sample rate                   | -                              | -                                   | 8                          | -   | -     | Gsample/s |
| Number of samples             | -                              | Per pulse                           | -                          | 800 | -     | -         |
| Pulse width                   | PW                             | Remotly adjustable                  | 100 p                      | -   | 10 n  | s         |
| Frequency repetition rate     | FRR                            | Adjustable by the trigger frequency | 1                          | -   | 100 k | Hz        |
| Rise time / Fall time         | t <sub>r</sub> /t <sub>f</sub> | 20 % - 80 %                         | -                          | 35  | 50    | ps        |
| Pulse extinction ratio        | SER                            | ModBox-PS-WL-AWG-35dB               | 33                         | 35  | -     | dB        |
|                               |                                | ModBox-PS-WL-AWG-55dB               | 53                         | 55  | -     | dB        |
| Extinction ratio stability    | $\Delta$ SER                   | Over 12 hours                       | -                          | -   | 1     | %rms      |
| Pulse energy stability        | $\Delta$ E                     | Based on rectangular pulse shape    | -                          | -   | 1     | %rms      |
| Polarisation extinction ratio | PER                            | -                                   | 15                         | 20  | -     | dB        |
| RMS jitter                    | J <sub>RMS</sub>               | -                                   | -                          | -   | 10    | ps        |
| Optical return loss           | ORL                            | -                                   | 40                         | -   | -     | dB        |
| Insertion loss                | IL                             | ModBox-PS-WL-AWG-35dB               | -                          | 8   | 10    | dB        |
|                               |                                | ModBox-PS-WL-AWG-55dB               | -                          | 13  | 15    | dB        |

## Panels

| Parameter     | Condition       | Min | Typ | Max | Unit   |
|---------------|-----------------|-----|-----|-----|--|
| Front panel   |                 |     |     |     |  |
| Interface     | AWG, Delay, MBC |     |     |     | LCD interface with keypad                          |
| Optical ports | Main & Monitor  |     |     |     | FC/APC, SC/APC, bare fibers                        |
| Optical fiber | -               |     |     |     | Polarization maintaining fiber, Corning PM 98-U25A |



| Parameter                    | Condition                                       | Min | Typ | Max | Unit |
|------------------------------|---|-----|-----|-----|------|
| Rear Panel                   |   |     |     |     |      |
| Delay output connectors      | -   |     |     |     | SMA  |
| Trigger input connector      | -   |     |     |     | BNC  |
| AWG monitor output connector | -   |     |     |     | SMA  |
| Remote control connector     | Rf Generator (AWG & Delay)<br>Seed laser<br>MBC |     |     |     | USB  |

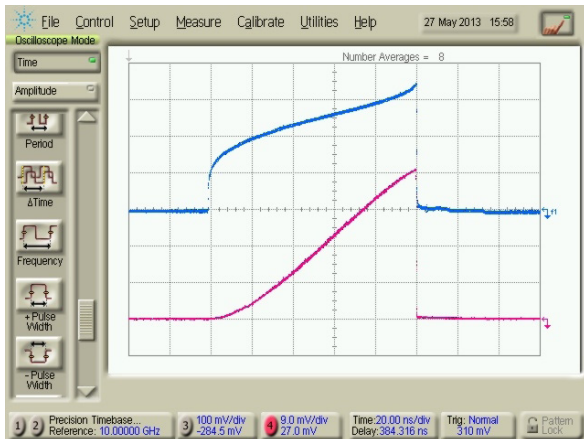
## Dimensions - Compliance

| Parameter         | Unit   |
|-------------------|--|
| Size              | 19 inches 3U or 4U                                     |
| Weight            | 5 kg   |
| Power supply      | 100 - 120 V / 220 - 240 V automatic switch, 50 - 60 Hz |
| <b>Compliance</b> |  |
| Safety            | EN 60625-1   |
| Marking           | CE   |

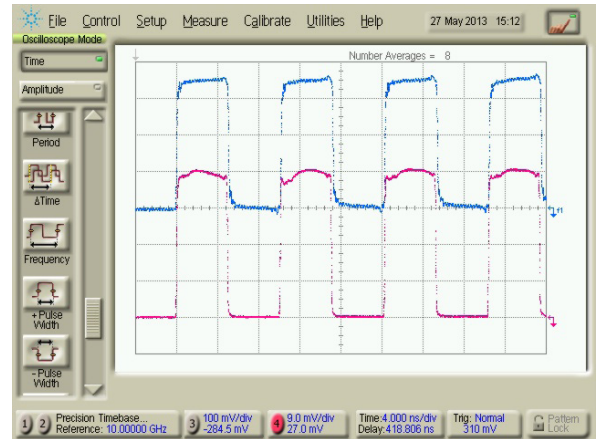
### ModBox Electrical and Optical Outputs

The following equipment was used to obtain below results :

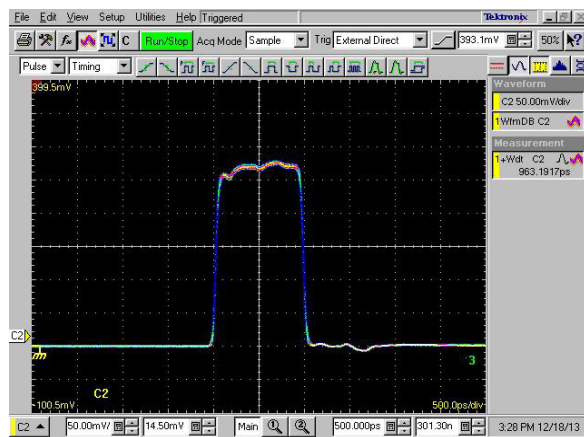
- ModBox-Pulse-Shaper with built-in AWG
- Oscilloscope Agilent 86100B
- Tektronix CSA 8000 oscilloscope



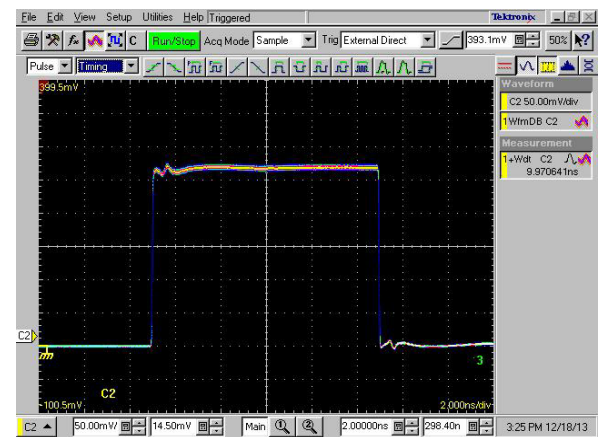
Electrical pulse from AWG (blue curve) with corresponding Optical output (pink curve)



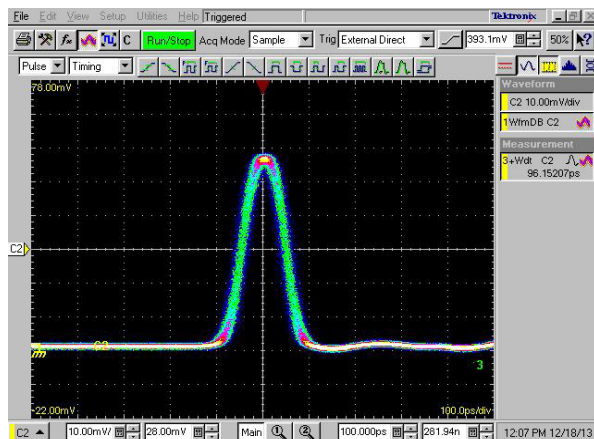
Electrical pulse from AWG (blue curve) with corresponding Optical output (pink curve)



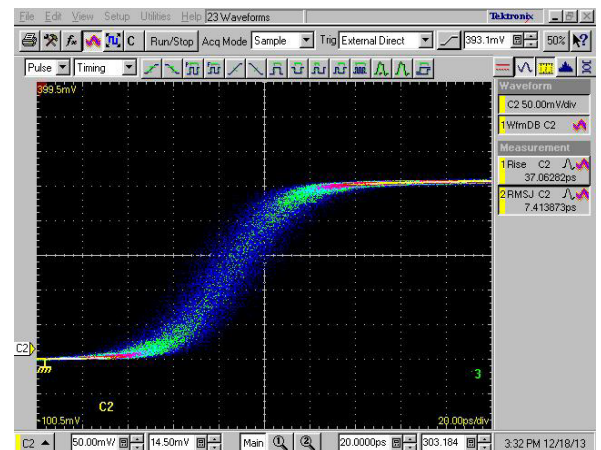
1 ns optical square pulse



10 ns optical square pulse

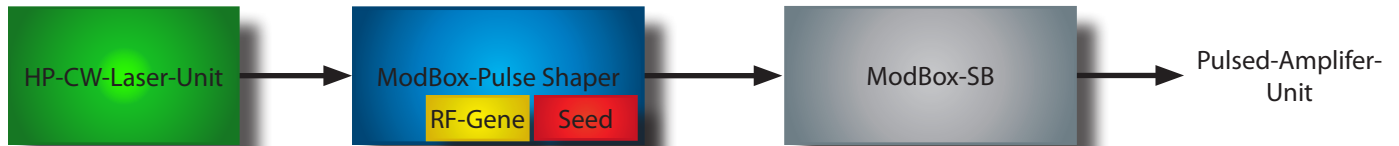


100 ps optical pulse



Jitter and rise time measurements,  
@ 10 ns and 10 kHz repetition rate

## Related equipments



The HP-CW-Laser-Unit is a fiber laser featuring a single narrow line-width seed laser combined with an high output power amplifier. The high power laser delivers up to 5 W at 1053 nm, 1064 nm, and up to 2 W at 1030 nm.



The ModBox-SB is spectral broadening solution to suppress the Stimulated Brillouin Scattering (SBS) caused in optical fibers by high fluxes of highly coherent light. The SBS degrades the signal integrity and prevents the proper transmission through the fiber. Under certain conditions, when amplification occurs for instance, the SBS can lead to the destruction of the fiber and the optical components along or forward the fiber.

The ModBox-SB is electrically triggered with the the ModBox-Pulse-Shaper.

## Ordering information

### ModBox-PS-WL-AWG-ER-AB-CD

WL = Wavelength : 1030nm, 1053 nm, 1064nm

AWG = AWG Option, omit if no electrical AWG

ER = Pulse Extinction Ratio : 35dB, 55dB

AB = Input connector : 00 bare fiber FA FC/APC, SA SC/APC

CD = Output connector : 00 bare fiber FA FC/APC, SA SC/APC

Note : optical connectors are Senko with narrow key or equivalent

#### Ordering Information:



800 Village Walk #316  
Guilford, CT 06437  
Ph: 203-401-8093

Email orders to: [sales@xsoptix.com](mailto:sales@xsoptix.com)  
Fax orders to: 800-878-7282

Example : ModBox-SP-1053nm-AWG-55dB-FA-FA is a Pulse Shapping ModBox operating at 1053 nm which allows 55 dB pulse extinction ratio and equipped with FC-APC connectors.

## About us

Photline is a member of the iXBlue group of companies and a provider of Fiber Optics Modulation Solutions based on the company LiNbO<sub>3</sub> modulators and high-speed electronics modules. Photline Technologies offers high speed and high data rate modulation solutions for the telecommunication industry and the defense, aerospace, instruments and sensors markets. The products offered by the company include : comprehensive range of intensity and phase modulators (800 nm, 1060 nm, 1300 nm, 1550 nm, 2000 nm), RF drivers and modules, transmitters and modulation units.

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