上海昊量光电设备有限公司
Aunion Tech Co.,Ltd.

AUNION TECH
昊量光电

Delivering Modulation Solutions

The ModBox-Pulse is an optical modulation unit that generates high performance optical pulses. The equipment incorporates a modulation stage based on a high bandwidth LiNb0$_3$ Mach-Zehnder modulator, coupled with a high performance pulse RF driver and an automatic bias control circuitry. It also integrates an optional laser source and a programmable pulse generator.

The optical pulses delivered by the ModBox-Pulse are characterized by sharp edges, short width down to 100 ps and high extinction ratio compatible with post optical amplification. Moreover, when driven with a user modulation signal, the pulses profile can be tailored to any shape, allowing for pre-distorsion.

The ModBox-Pulse provides R&D and production engineers with state of the art performance and the peace of mind of a turn-key instrument. It can be used as a reference transmitter in laboratories and production for a broad variety of applications : components and material characterization, seeder for high energy lasers, lidars...

FEATURES

- Tunable pulse width down to 100 ps
- Short rise / fall time : 30 ps
- High extinction ratio > 30 dB
- High stability, pulse-to-pulse repeatability

APPLICATIONS

- Reference pulse transmitter
- Test in R&D and production
- Pulse generation / picking / slicing
- High energy laser seeder

OPTIONS

- Internal laser
- Internal pulse generator
- Internal optical receiver
- Shorter rise / fall time
- Custom designs

Performance Highlights

Parameter	Min	Typ	Max	Unit
Optical wavelength range	850, 1053, 1060, 1064, 1080, 1550, 2000			nm
Rise / fall time	-	30	-	ps
Pulse width	80 p	-	1 µ	s
Frequency repetition rate	1	-	10 G	Hz
Optical pulse extinction ratio	30	-	55	dB

100 ps Optical Pulse

DeliveringModulationSolutions
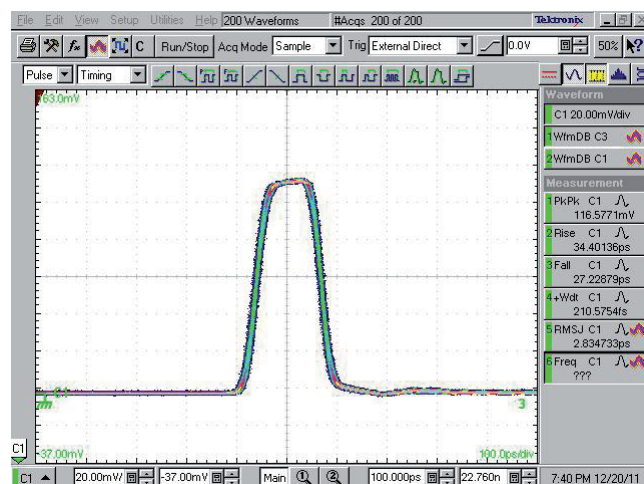
ModBox

Functional Block Diagram
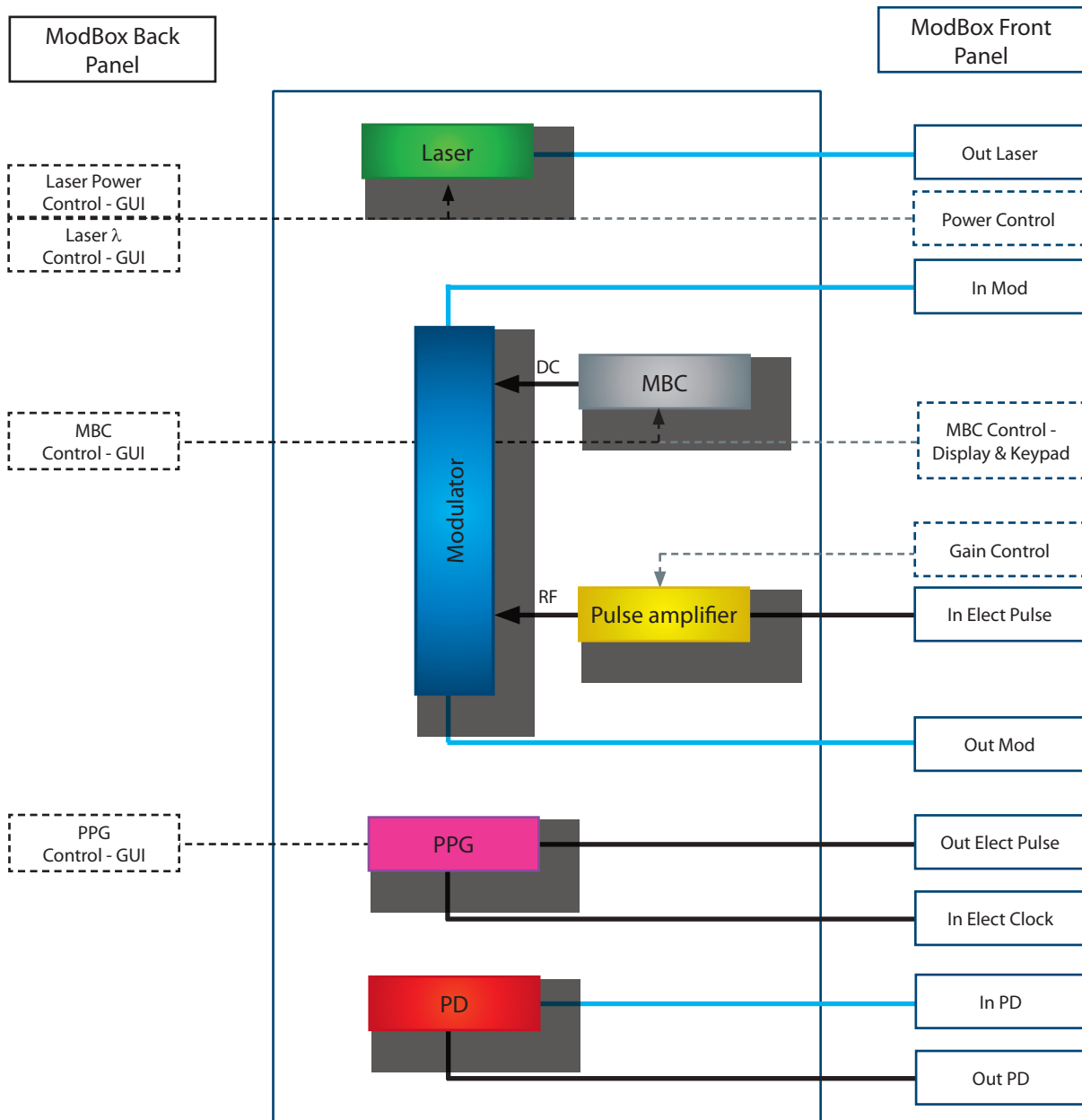
The ModBox-1060nm-ProgPulse integrates :

- a high speed, high power handling and high extinction ratio LiNb0$_3$ Mach-Zehnder modulator (MZM),
- a high speed RF pulse amplifier with gain level tuning for optical pulse extinction ratio adjustment,
- a modulator bias control circuit to lock the MZM in extinction mode and ensure a highly stable output optical signal,
- an optional programmable electrical pulse generator (PPG) for short to long pulse generation,
- an optional laser source (DFB, ECL, ITLA) with its high precision driver to control the output power and wavelength,
- an optional high bandwidth photodetector (PD).

Input Electrical Specifications - Driver input - user supplied, not a ModBox specification when ordered without optional PPG

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Type	-	Single ended - AC coupled	Pulse			-
Operating input voltage	V_{IN}	Single ended - AC coupled	-	500	-	mV_{pp}
Impedance matching	Z_{IN}	-	-	50	-	Ω
Input signal amplitude	V_{IN}	Single ended	-	0.5	-	V_{pp}
Pulse with	PW	-	80 p	-	1 μ	s
Frequency repetition rate	FRR	-	1	-	10 G	Hz
Rise & fall time	t_R / t_F	20 % - 80 %	-	30	-	ps

Input Optical Specifications - Modulator input - user supplied, not a ModBox specification when ordered without optional laser

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Laser type	-	CW	DFB			-
Optical wavelength range *	λ	Other wavelength on request	850, 1053, 1060, 1064, 1080, 1550, 2000			nm
Polarization	—	-	Linear and controlled			-
Spectral width	Δλ	FWHM	-	1	-	MHz
SMSR	-	-	30	-	-	dB
Input optical power	OP_{IN-CW}	Continuous	-	-	100	mW
	OP_{IN-P}	Peak power	-	-	5	W

* Performance is optimized for one wavelength.

Output Optical Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Insertion loss	IL	At maximum modulator transmission	-	4	6	dB
DC extinction ratio	ER_{DC}	-	30	-	55	dB
Pulse width	PW	-	80 p	-	1 μ	s
Frequency repetition rate	FRR	-	1	-	10 G	Hz
Rise & fall time	t_R / t_F	20 % - 80 %	-	30	-	ps
Return loss	ORL	-	-40	-45	-	dB
Chirp	α	-	-0.1	0	0.1	-
Additive RMS jitter	G	-	-	-	1	ps

Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

Parameter	Symbol	Min	Max	Unit
Optical input power	OP_{IN-CW}	CW optical input signal	100	mW
	OP_{IN-P}	Pulse optical input signal	5	W
Pulse input voltage	EV_{in}	-	1	V_{pp}

Optional Laser Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Wavelength	λ	Other wavelength on request	850, 1053, 1060, 1064, 1080, 1550, 2000			nm
Laser type	-	-	DFB, DBR			-
Optical output power	OP_{IN-CW}	CW	10	-	100	mW
Spectrum linewidth	$\Delta\lambda$	FWHM	-	1	-	MHz
Optical return loss	ORL	-	30	35	-	dB
Side mode suppression ratio	SMSR	-	30	-	-	dB
Optical output power adjustment	P_{CW}	Front & back panels with GUI	20	-	100	mW
Wavelength laser tuning range	-	Back panel with GUI	-	0.8	1	nm

Exampe of Optional Programmable Electrical Pulse Generator Specifications : PPG-100

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Generator type	-	Discrete	Programmable PW & FRR			-
Pulse shape	-	-	Square			-
Pulse width	PW	-	100	-	3 400	ps
Rise & fall time	t_R / t_F	-	-	35	-	ps
Pulse width tuning step	ΔPW	Discrete	-	100	-	ps
Freq repetition rate tuning step	ΔFRR	N = integer	-	$156*2^N$	-	MHz
Internal clock frequency	Clk_{IN}	Fixed	622	625	707	MHz
Clock output power	$P_{Clk-Out}$	-	-	0	-	dBm
Output pulse amplitude	P_{Out-SE}	Single ended swing	300	400	500	mV_{pp}
	P_{Out-D}	Differential swing	600	800	1000	
Electrical coupling	—	-	AC			-

Optional Photodetector Specifications

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Photodetector type	-	-	APD			-
Operating wavelength range	λ	-	850, 1053, 1060, 1064, 1080, 1550, 2000			nm
Operating optical input range	P_{opt}	-	-20	-	13	dBm
Rise & fall time	t_R / t_F	-	-	35	-	ps
Optical return loss	ORL	-	25	-	-	dB
Photodiode DC responsivity	R	Optimum polarisation	-	0.5	-	A/W

ModBox Pulse
100 ps - µs Optical Pulse Transmitter

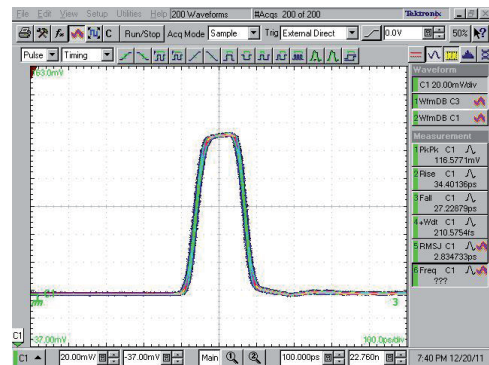## Electrical & Optical Pulse Diagrams

The following equipment was used in obtaining these results :
- Pulse Pattern Generator : Programmable Pulse Generator PPG-100
- Optical Spectrum Analyzer = Agilent 86142B
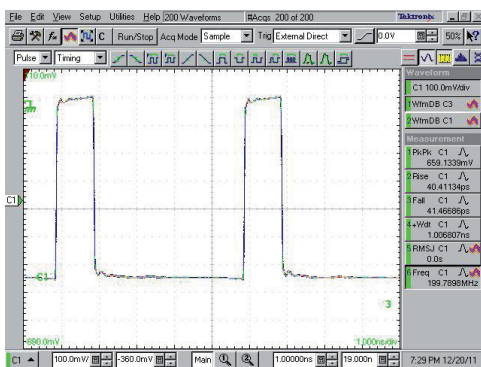
100 ps Input / Output Pulses
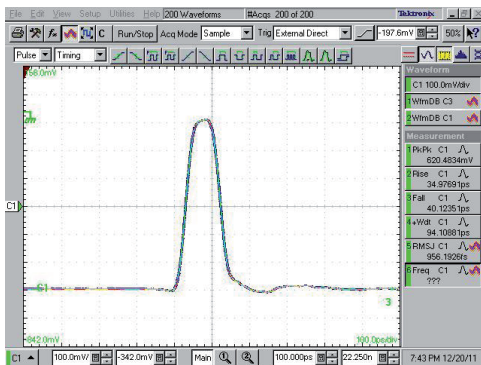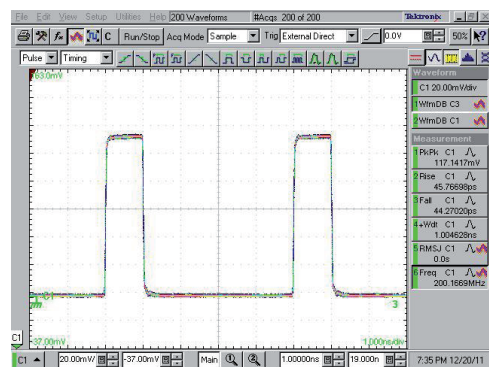

Electrical input signal from PPG-100

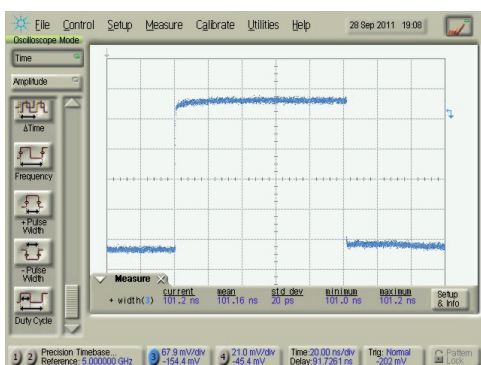Output response

1 ns Input / Output Pulses
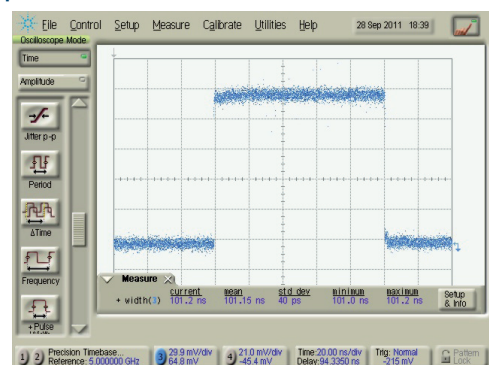

Electrical input signal from PPG-100

Output response

100 ns Input / Output Pulses

Electrical input signal

Output response

Dimensions - Interfaces - Compliance

Dimensions	
Dimensions	19 inches x 3U
Weight	3 kg - 6.6 pounds
Power supply (rear panel)	100 - 120 V / 220 - 240 V automatic switch, 50 - 60 Hz

Interfaces	
Optical connectors	FC/UPC - FC/APC - SC/UPC
RF connector	50 Ω - SMA female
Fiber	Polarization maintaining fiber
Remote type for MBC / Laser / PPG	USB type B with Labview driver

Compliance	
Safety	EN 60625-1
Marking	CE

Ordering Information

ModBox-W-PW-FRR-L-PPG-ORx-XX

W = Wavelength : 850 nm, 1053 nm, 1060 nm, 1064 nm, 1080 nm, 1550 nm, 2000 nm

PW = Pulse Width (range or fix value)

FRR = Frequency Repetition Rate (range or fix value)

L = Laser Option, omit if no Laser - L : with Laser

PPG = Pulse generator Option, omit if no pulse generator - PPG : with Pulse Generator

ORx = Photodetector Option, omit if no photodetector - Rx : with Photodetector

XX = Input / Output connectors, FA : FC/APC - FC : FC/UPC - SC : SC/UPC