WAVESOURCE PHOTONICS

81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

WaveSource Photonics

Acousto-Optic Modulator Model AOM-20 & Driver AOD-21

User Manual

4/8/2020

`

81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

TABLE OF CONTENTS

81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

1 DESCRIPTION

WaveSource Photonics fiber-terminated acousto-optic modulator is designed for use in pulsed fiber laser system, as a pulse picker for short pulse, high repetition rate mode-locked fiber lasers. It can also be used for intensity modulation, fixed or variable frequency shifting, high-speed fiber optic switch, or fiber laser Q-switching. This fiber pigtailed device is meant to be used for a single wavelength within operation range of 1030-1090 nm.

User can select input and output fiber types, fiber jacket, and fiber connectors in order to meet their specific requirements. Mode-filed adaptor (MFA) can be built inside the AOM to accommodate different input and output fibers, for example, input fiber is PM980 fiber, and output fiber is single- or double-clad large mode area (LMA) fibers, or PM-LMAs. Bandpass filter (BPF) can also be integrated inside the AOM to back the damaging back-reflected, broadband amplified spontaneous emission (ASE) to protect the delicate front end devices, such as the seed lasers. These integrated functionalities can reduce the splicing loss, reduce the effort of fiber routing and component arrangement, and specially, provide user the freedom for laser cavity length to achieve desire pulse repetition frequency (PRF).

AOM-20 is distinguished from the similar products made by the best-in-class competitors in regards to insertion loss (IL), on/off extinction ratio (ER), polarization extinction ratio, return loss, and maximum optical power, in additional to the above-mentioned built-in, integrated functionalities. Table 1 shows the key optical parameter comparison of our AOM-20 to that of the best-in-class competitors.

Key Optical Parameters	WaveSource AOM-20	G&H Fiber Q	AA MT200-IR20-F10	Brimrose TEM-200-50-10
IL [dB	1.8	4.0	3.0	3.0
On/Off Extinction Ratio	>50	45	45	50
Polarization Extinction Ratio [dB]	23	18	18	16
Return Loss [dB]	50	40	40	40
Maximum Optical Power [W]	3, 10, 20	1	1	1
Mode-Field Adaptor Option	yes	no	no	no
ASE Blocking Option	yes	no	no	no

81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

2 SPECIFICATION

2.1 Optical, Electrical & Environmental Characteristics

T_{OP} =25C, beginning of life unless otherwise specified

Parameter	Unit	Nominal	Min	Max
Operating wavelength	nm	1045	1020	1070
Insertion loss	dB	1.7		2.2
Rise-time/Fall-time (10% - 90%)	ns	15		20
Extinction ratio (on/off)	dB	50	45	
Return loss (RF on/RF off)	dB	50	45	
Optical polarization		Linear, along PM fiber slow axis		
Polarization extinction ratio	dB	23	20	
RF frequency	MHz	80		
Input impedance	Ω	50		
VSWR		2 : 1		
RF power	W	7.5		10
Fiber type		Fujikura SM98-PS-U25, 1.5m, bare fiber (or per request)		
Dimension (LxWxH)	inch (mm)	2.44x1.77x1.22 (62x45x31)		

2.2 Absolute Maximum Rating:

Stress beyond those ratings may cause damage to the device. These values are stress ratings only. Operations of the device at these or beyond these ratings are not implied. Exposure to these ratings for extended time may affect device reliability

Parameter	Unit	Min	Max
Storage temperature	C	-20	65
Operating case temperature	C	-20	65
Humidity	%		90
Average optical input power*	W		3, 10, 20
Peak power handling (< 10 picosec laser pulse)	W		3000
RF input power (continuous)	W		15
Fiber bend radius	mm	30	
Fiber pull force	N	5	
ESD (human body model)	V		500

* Standard 3W version is supplied. High power 10W & 20W versions per request.

81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

3 AOM CONTROL

The functionalities of the AOM can be controlled and modified by an RF driver. An RF driver generates an RF signal that is used to generate the acoustic wave within the crystal of an AOM. The frequency and intensity of the acoustic wave will determine how much an optical beam is modulated, deflected, or tuned.

WSP's RF driver AOD-21 produces an output with both very stable frequency and intensity; both can be controlled and modulated by several modulation methods—allowing the user to choose the optimized modulation method to meet application need.

The RF driver typically consists of an RF oscillator, a modulation circuit, and a power amplifier which generates an RF signal to drive an AOM. The transducer within the acousto-optic modulator uses the piezoelectric effect to precisely convert the RF signal to an acousto-optic wave in an interactive optical material at a fixed or variable frequency.

The AOD-21 has a digital modulation input for fast and easy control its RF output during ad intensity. The RF output duration is determined by the input digital modulation pulse width.

The AOD-21 may be modulated from DC to 1.2MHz. The AOD-21 can produce up to 15 watts output into a 50 ohm load.

An acousto-optic device and its RF driver should be selected together to optimize speed, efficiency, and stability. Additional application-specific features may include pulse shaping, first pulse suppression, synchronization, or multi-channel operation.

The AOD-21 has a maximum output RF power 15W. A typical plot of the IL value of the AOM_20 as a function of the AOD-21 output RF power is shown below. Typically, the highest coupling efficiency reaches between 10-12W RF powers. The output power of AOD-21 can be adjusted by a trim port from outside of its case with a small flat screw driver. The output power can be monitor through a RF power, such as meter in serial connection as shown. The AOD-21 default output power is 10W.

81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

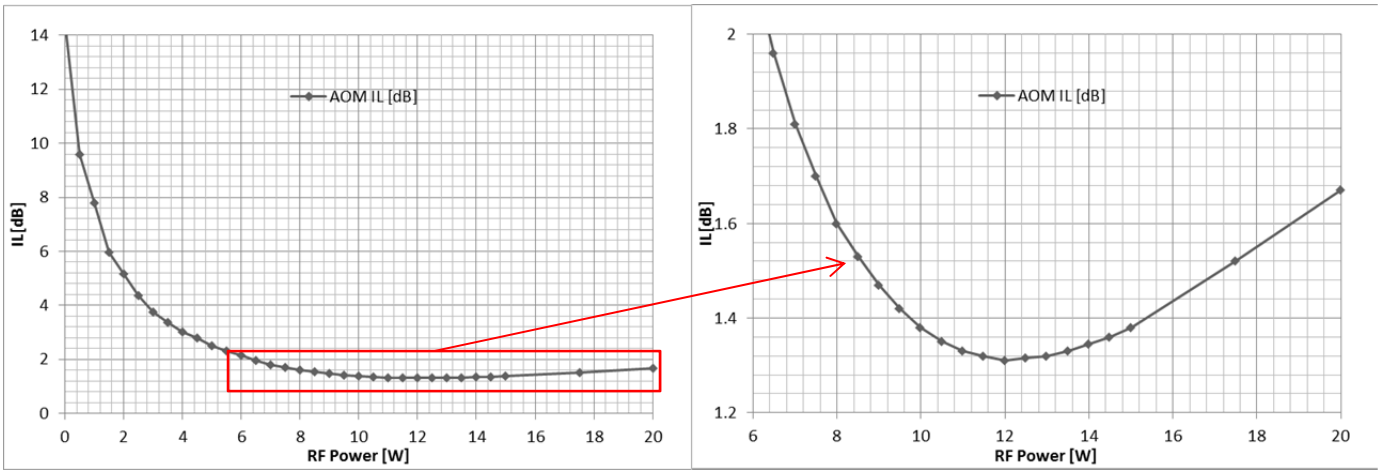


Figure 1. AOM-20 insertion loss as a function of AOD-21 output RF power.

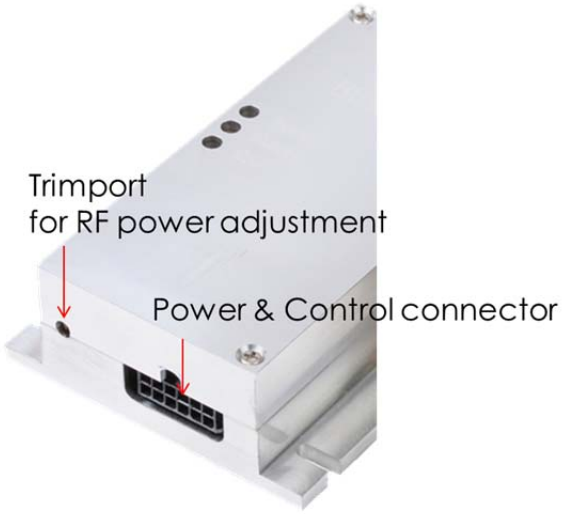


Figure 2. Locations of AOD-21 input power & control connector (Molex 0430451221), and trim-port for output RF power setting.

81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

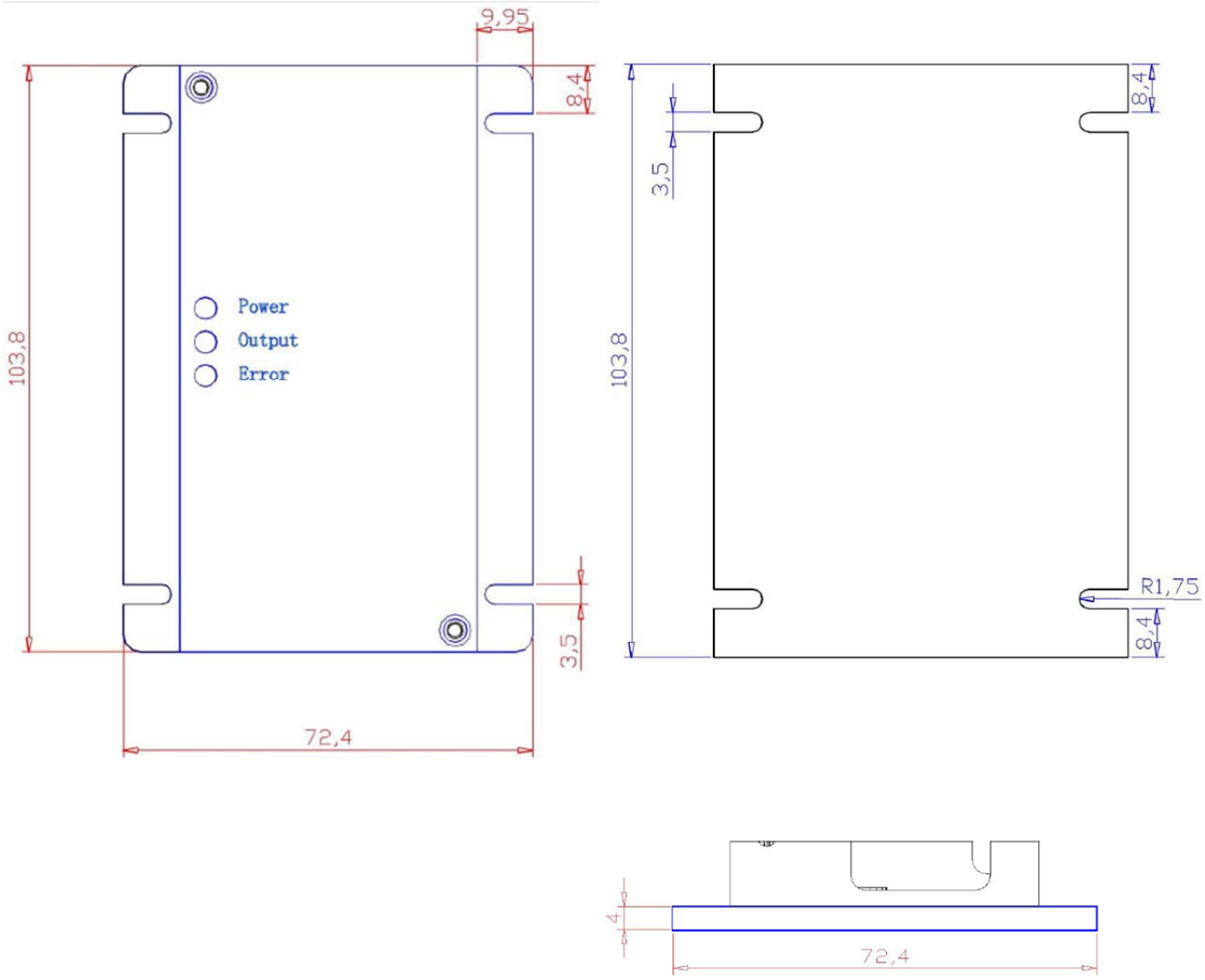
4 AOM DRIVER SPECIFICATION

4.1 AOM-20 Specifications

Parameter	Unit	Specification
Output Frequency	MHz	80
Output power	W	10
Maximun Output Power	W	15
Analog in (pin1) for Output Power Control	V	0 - 5, analog, input impedance 1.5kW
Modulation Input (pin3)	Hz	TTL, *Low* = min RF output, *High* = max RF output
Modulation Repetition Rate	Hz	DC to 1.2 x10^6
Synchout Level (pin11)	V	3.3 ± 5%
Output Impedance	Ω	50
Supply Voltage (pin2)	V	12.0 ± 5%
Supply Current	A	< 2.0
Spurious Level	dB	< -50
Harmonic Distortion	dB	< 20
Extnction ratio	dB	> 50
RF Rise Time (10% - 90%)	ns	<15
RF Fall Time (90% - 10%)	ns	< 20
Standby Mode (< 0.2W dissipation, pin4)	*TTL High* or no connection = normal operation *TTL Low* = standaby mode	
LED Status Function	*Red* = drive on, *Green* = stand-by, *Yellow* = fault condition	
Contact Cooling	Must be attahced to a 20W dissipation heatsink/breadboard	
Operating Temperature	°C	10 -- 50
Storage Temperature	°C	-20 -- 85
Dimension (LxWxH)	inch (mm)	4.1 x 2.85 x 1.15 (103.8x72.4x29.2)

81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

4.2 AOD-21 Mechanical Dimension

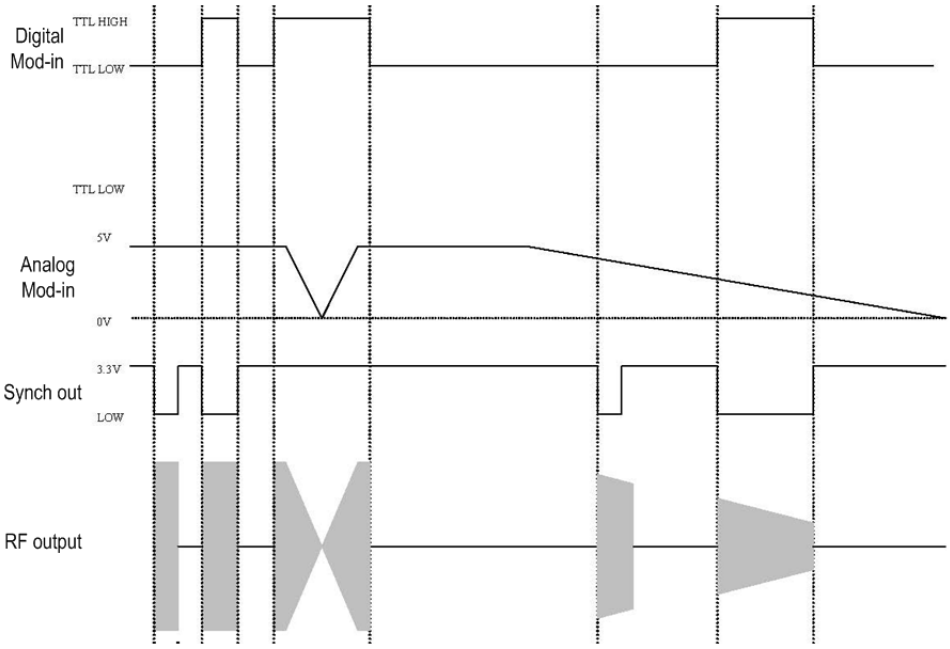


81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

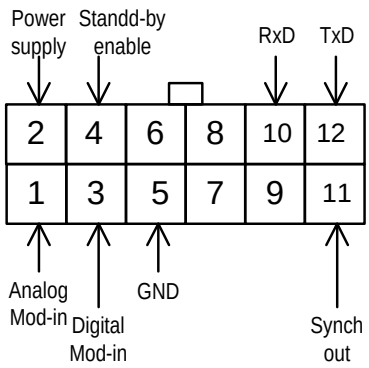
4.3 AOD-21 PIN Designations

PIN No.	Name	Description
1	Analog-Mod-In	analog modulation singal input (0-5V, 0 is lowest, 5V is highest)
2	Supply Power	driver power supply (12VDC)
3	Digital-Mod-In	digital modulation input (TTL, Low= min RF output, High= max RF output)
4	Stand-by Enable	enable device when this pin is not connected or set to TTL high
5	GND	device gound
6	NC	Not connected
7	NC	Not connected
8	NC	Not connected
9	NC	Not connected
10	RxD	serial ort receiving
11	Synch-Out	synchronization output pulse, 3.3V
12	TxD	serial port transmitting

4.4 AOD-21 PIN Control Diagram



Connector PIN designation

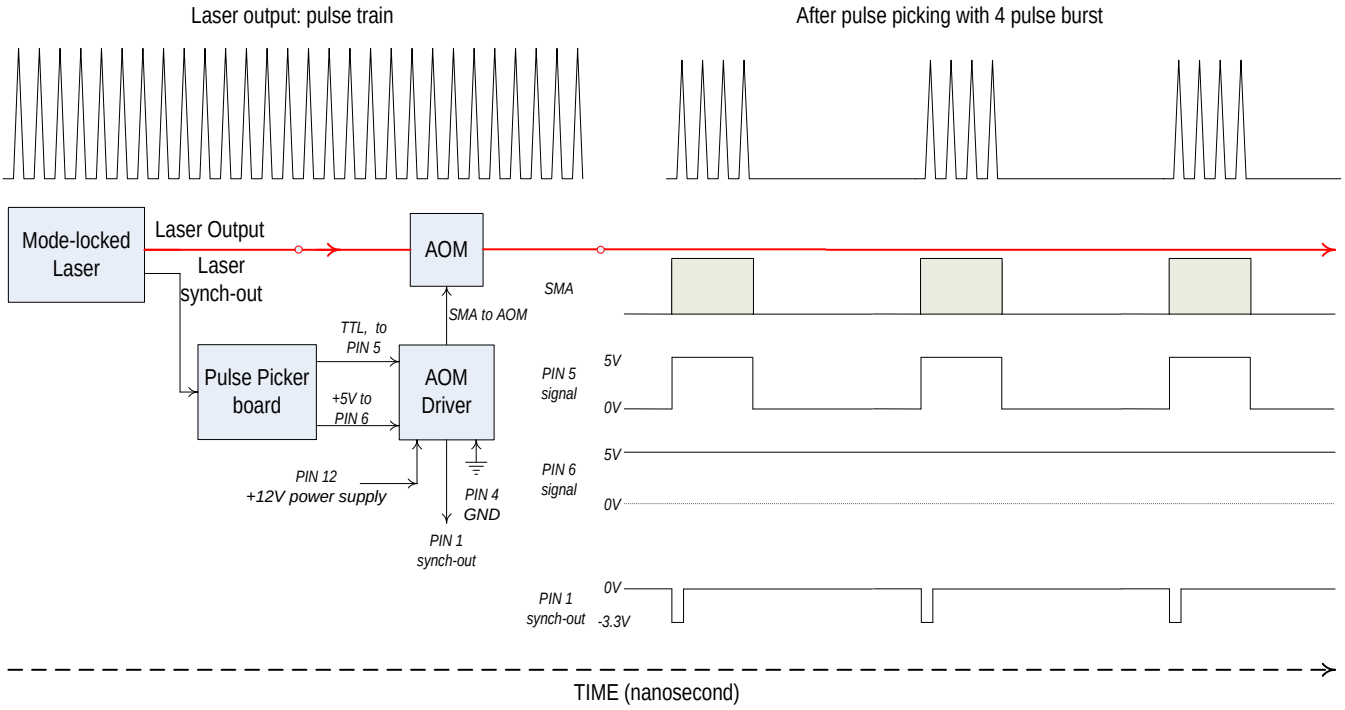


81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

5 APPLICATION EXAMPLES

5.1 High PRF mode-lock fiber laser pulse picking with even pulse intensity

The goal is to pick up a bust of 4 laser pulses at a lower PRF (say 1 KHz) from a 30GHz mode-locked fiber laser. All the pulses in the burst group have the same high possible intensity.



81 Palm Drive
Union City, CA 95687, USA
salesatwsp@gmail.com, 510-972-3324

5.2 Fiber laser pulse picking with arbitrary pulse intensities within a burst group

The goal is to pick up a bust of 4 laser pulses at a lower PRF (say 1 KHz) from a 30GHz mode-locked fiber laser. The 1st pulse in the burst group has highest intensity and the rest pulses have programmed lowers intensities.