



Acousto-Optic Amplifier

Including: Basic Modulator Alignment

Instruction Manual

AF0-xxxT-1-y Series

(Formerly model 500F)

'xxx' indicates the nominal centre frequency

xxx	:	minimum 3dB bandwidth
30	:	20-40MHz
50	:	40-60MHz
80	:	50-90MHz
85	:	60-110MHz
100	:	65-135MHz
150	:	100-200MHz
200	:	125-275MHz
245	:	175-325MHz

and where appended,

'y' indicates power and options (combinations possible)

2	:	2 Watt output
4	:	4 Watt output
H	:	Mounted to heatsink
W	:	Mounted to water cooled plate



1. GENERAL

The AF0- series Power Amplifiers are Class A broadband RF amplifiers specifically designed for use with Isomet acousto-optic modulators and deflectors. The driver accepts a low level signal from a suitable frequency source such as the Isomet iMS2 and iMS4 synthesizers.

Figure 2 is a block diagram of the amplifier.

The maximum driver output power level is set by the Power Adjust potentiometer.

2. OPERATING INSTRUCTIONS

The Amplifier accepts an input signal up to 3dBm (2mW, 900mVpp/50ohm) and has a gain of >30dB. The RF output is adjustable with the screwdriver power adjust on the unit. The factory set level will be noted on the amplifier test data.

SERIOUS DAMAGE TO THE AMPLIFIER MAY RESULT IF THE TEMPERATURE EXCEEDS 70°C. SERIOUS DAMAGE TO THE AMPLIFIER MAY ALSO RESULT IF THE RF OUTPUT CONNECTOR IS OPERATED OPEN-CIRCUITED OR SHORT-CIRCUITED.

The amplifiers require stable DC power for operation. The required voltage is **+24Vdc** at a current drain of approximately 600mA. The external power source should be regulated to $\pm 2\%$ and the power supply ripple voltage should be less than 100mV for best results.

3. INSTALLATION AND ADJUSTMENT

3.1 Using M3 screws, install the Amplifier on a heat sink through the 3.2mm ID holes identified in figure 1. Use heat conducting compound between the Amplifier and mounting face and the heat sink.

.2 DC power applied is applied via a Phoenix 3.81mm pitch connector. A mating connector with screw terminals is provided. If this is not pre-wired, ensure the +Vdc and 0V inputs are wired to the correct terminals. These are indicated on the case lid.

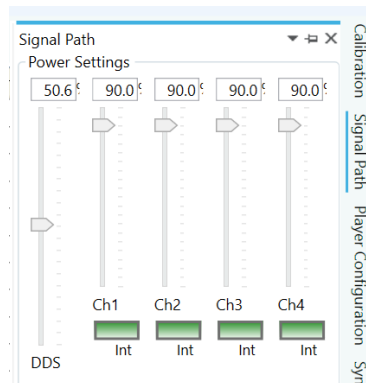
DO NOT EXCEED +28Vdc or apply reverse polarity.

3.3 Connect the RF output SMA jack to an acousto-optic modulator (or 50 Ω RF load, if it is desired to measure the RF output power).



3.4 Connect a 50ohm RF signal source to the RF input SMB jack.

To start, set input level at approximately 0.25mW (320mVpp).



As a guide, for iMS4, V-pp, 50ohms, 110MHz

		Ch1, 2, 3, 4 Channel Level / Ext'l modulation Level										
		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
DDS Level	0%											
	10%	0.006	0.014	0.032	0.07	0.11	0.16	0.21	0.25	0.27	0.28	0.28
	20%	0.008	0.016	0.036	0.08	0.12	0.17	0.22	0.26	0.28	0.29	0.29
	30%	0.008	0.016	0.04	0.082	0.13	0.18	0.23	0.27	0.29	0.31	0.31
	40%	0.008	0.02	0.05	0.09	0.14	0.19	0.24	0.28	0.31	0.33	0.33
	50%	0.01	0.03	0.06	0.1	0.15	0.21	0.26	0.3	0.33	0.35	0.35
	60%	0.01	0.04	0.07	0.12	0.17	0.23	0.28	0.32	0.35	0.38	0.38
	70%	0.02	0.05	0.09	0.14	0.19	0.25	0.3	0.35	0.39	0.42	0.42
	80%	0.04	0.08	0.13	0.18	0.23	0.29	0.34	0.39	0.44	0.47	0.47
	90%	0.07	0.13	0.19	0.25	0.3	0.36	0.41	0.47	0.53	0.57	0.57
100%	0.09	0.17	0.24	0.32	0.39	0.46	0.54	0.6	0.66	0.73	0.73	

3.5 Adjustment of the RF output power is best done with Amplifier connected to the acousto-optic modulator.

The optimum RF power level required for the modulator to produce maximum first order intensity will depend on the laser wavelength. Applying RF power in excess of this optimum level will cause a decrease in first order intensity (a false indication of insufficient RF power) and make accurate Bragg alignment difficult. It is therefore recommended that initial alignment be performed at a low RF power level.

If supplied as a set with a Synthesizer or VCO frequency source, the RF Power Adjust will be factory set and should not require readjustment. Section 3.6 is included for reference.

- 3.6 (See note above) The PWR ADJ pot is a multi-turn type. Minimum power is when fully anti-clockwise (CCW). Use an insulated alignment tool or screwdriver, rotate the PWR ADJ potentiometer CCW at least 5 turns, then CW approximately 2 turns for ~ half maximum power.
- 3.7 Apply DC power to the driver as appropriate for the model.
(Refer Amplifier Test Data Sheet)
- 3.8 Apply a ~ 0.25mW (320mVp-p) frequency signal to the RF IN input (e.g. from VCO or IMS)
- 3.9 Observe the diffracted first-order output from the acousto-optic modulator and the undeflected zeroth order beam. Adjust the Bragg angle (rotate the modulator) to maximise first order beam intensity.
- Note: depending on RF power level, the diffraction efficiency may not exceed 20-30% at this point in the alignment procedure.
- 3.10 After the Bragg angle has been optimised, slowly increase the RF power until maximum first order intensity is obtained. However, if the intensity reduces then the initial RF power level could be too high and should be reduced immediately.

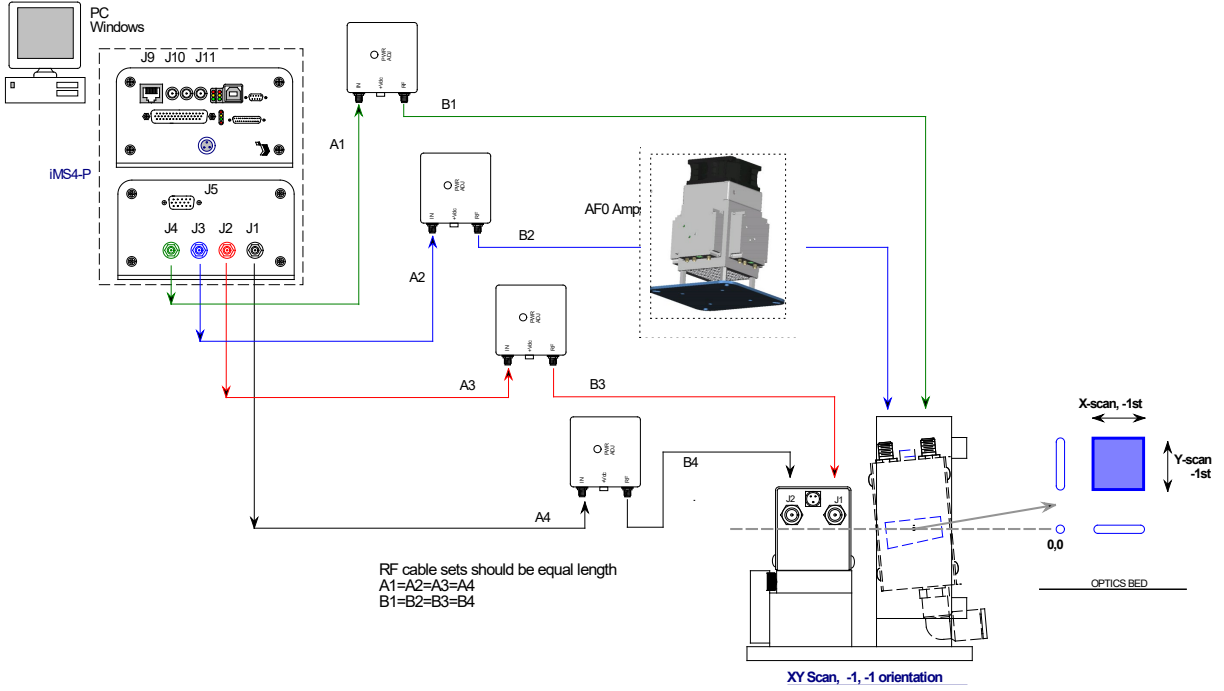
RF power may be increased at the input source and/or using the Pwr Adjust Pot on the amplifier. To avoid saturation do not exceed 1mW (0dBm) input level.

The RF drive level for peak diffraction efficiency is described as the saturation power, 'Psat'. For a given AO design, Psat level is a function of the wavelength² and is provided on the AO Test Data sheet. In some cases Psat will exceed the safe CW rating of the AO device .

For applications using a well focussed input beam into the AOM, the correctly adjusted Bragg angle condition is indicated when the zero order shows a characteristic dark line through the middle of the beam at or near the Psat drive level.

4. APPLICATIONS

4.1 X-Y AOD deflector and iMS4 synthesizer.
Four AF0 amps mounted on AFM-FC heatsink module (optional accessory)





5. MAINTENANCE

5.1 Cleaning

It is of utmost importance that the optical apertures of the deflector optical head be kept clean and free of contamination. When the device is not in use, the apertures may be protected by a covering of masking tape. When in use, frequently clean the apertures with a pressurized jet of filtered, dry air.

It will probably be necessary in time to wipe the coated window surfaces of atmospherically deposited films. Although the coatings are hard and durable, care must be taken to avoid gouging of the surface and residue of the cleaning solution. It is suggested that the coatings be wiped with a soft ball of brushed (short fibres removed) cotton, slightly moistened with clean alcohol. Before the alcohol has had time to dry on the surface, wipe again with dry cotton in a smooth, continuous stroke. Examine the surface for residue and, if necessary, repeat the cleaning.

5.2 Troubleshooting

No troubleshooting procedures are proposed other than a check of alignment and operating procedure. If difficulties arise, take note of the symptoms and contact the manufacturer.

5.3 Repairs

In the event of deflector malfunction, discontinue operation and immediately contact the manufacturer or his representative. Due to the high sensitive of tuning procedures and the possible damage which may result, no user repairs are allowed. Evidence that an attempt has been made to open the optical head will void the manufacturer's warranty.

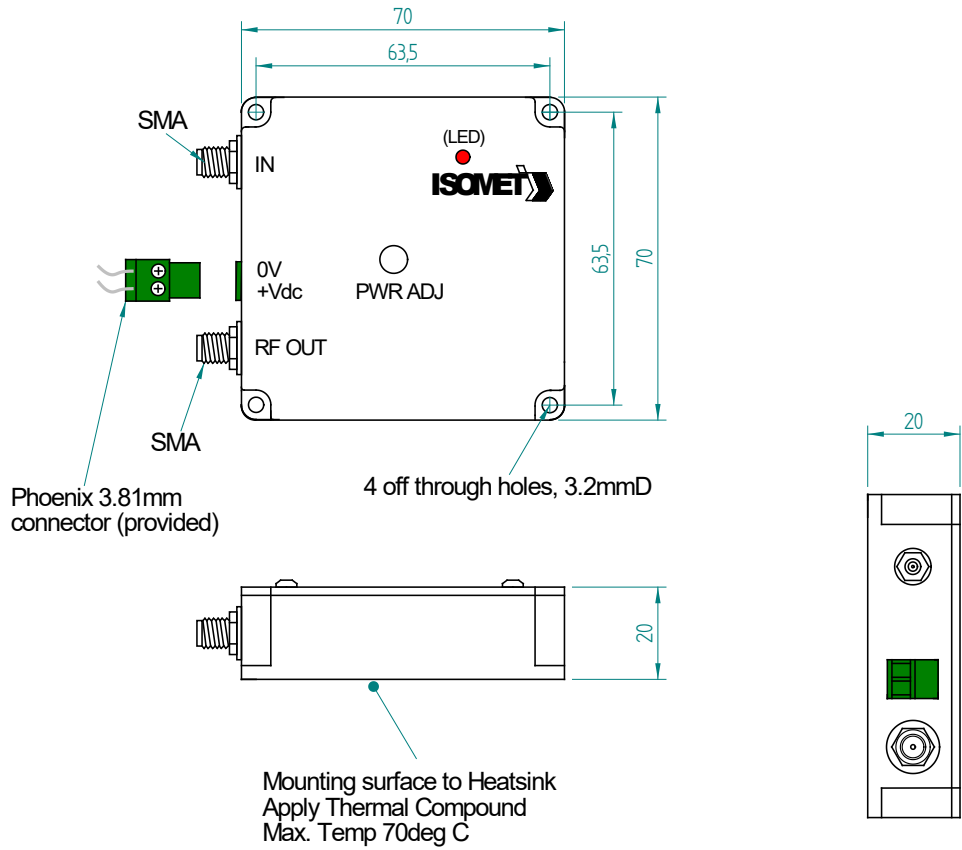


Figure 1: Driver Installation

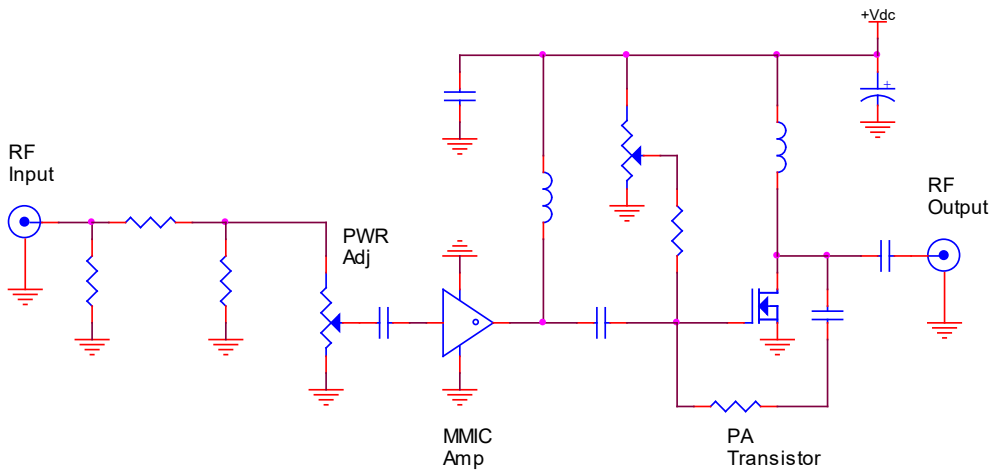
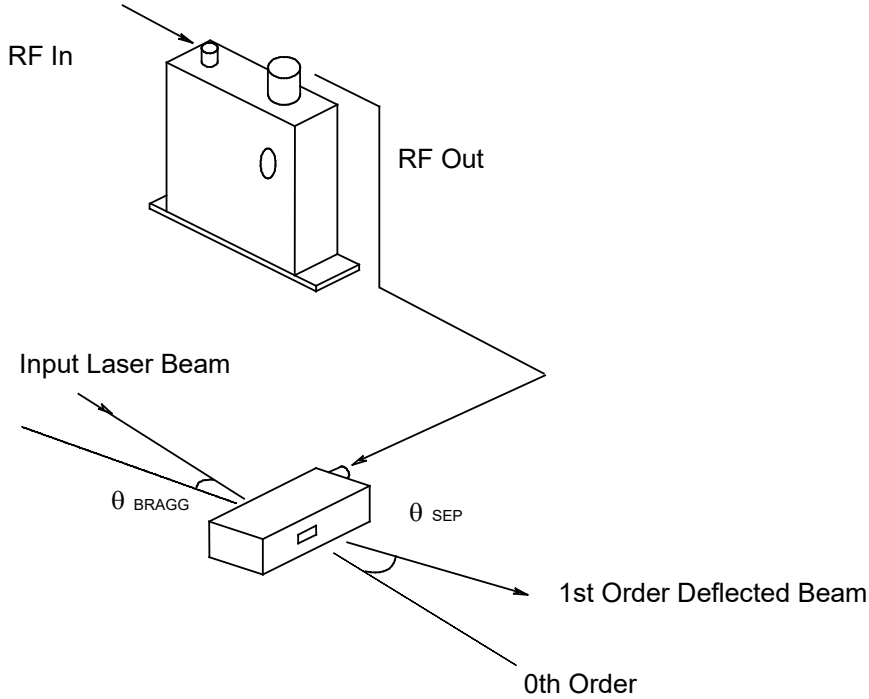


Figure 2: Driver Block Diagram

Schematic for an AO modulator with amplifier



The input Bragg angle, relative to a normal to the optical surface and in the plane of deflection is :

$$\theta_{BRAGG} = \frac{\lambda \cdot fc}{2 \cdot v}$$

The separation angle between the zeroth order and the first order outputs is :

$$\theta_{SEP} = \frac{\lambda \cdot fc}{v}$$

Optical rise time for a Gaussian input beam is approximated by :

$$t_r = \frac{0.65 \cdot d}{v}$$

- where :
- λ = wavelength
 - fc = drive frequency
 - v = acoustic velocity of AO interaction material
 - = 4.21mm/usec (TeO₂)
 - = 3.63mm/usec (PbMoO₄)
 - = 5.70mm/usec (Quartz)
 - = 5.96mm/usec (Fused Si)
 - d = 1/e² beam diameter

Figure 3: AO Basics