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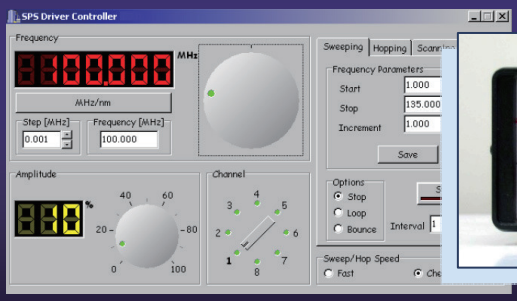
ROBUST . RELIABLE . ACCURATE

Free Space
Acousto-Optic Tunable Filter



KEY FEATURES

- All Rugged, Solid State
- No Moving Parts – Immune to vibrations
- Use with Multiple Laser Lines Simultaneously
- Wide Spectral Wavelength Range
- Fast Switching Speed
- Low Sensitivity to Input Angle
- High Optical Throughput
- Auto Calibration between Each Measurement
- Custom Configurations Available
- **Ideal for Real-Time NIR**

APPLICATIONS

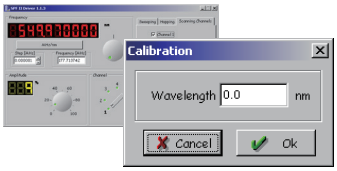
- Scientific:
  - Spectrophotometry Monochromation
  - Florescence Analysis, Transmission
  - Laser Displays
- Industrial:
  - Process Control
- Biomedical:
  - Confocal Microscopy
  - Polarimetric Hyperspectral Imagery
    (the AOTF is inserted in the imagery system)
- Other OEM Applications

Free Space Acousto-Optic Tunable Filters

The Brimrose Acousto-Optic Tunable Filter (AOTF) is a solid state acousto-optic device with no moving parts. It functions as a tunable transmissive filter. It is able to precisely and rapidly adjust the wavelength, and intensity of the diffracted/filtered light by varying the RF power.

Brimrose offers both standard and custom AOTFs. AOTFs are used widely in numerous optical systems and applications, especially in industrial or process control near-infrared (NIR) spectroscopy applications.

SPS/SPF PC Controlled AOTF Drivers



The SPS and SPF AOTF Controllers are high performance, RF frequency generators. They provide fast frequency sweep (up to 16,000 λ/sec) using a direct digital synthesizer incorporated into a self-contained case with AC power supply. Standard units are provided in laboratory enclosures with one, four or up to eight RF output channels.

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Acousto-Optic Tunable Filters (AOTF) Specification

Model #	Spectral Range (nm)	Drive Freq. (MHz)	Optical Aperture (mm)	Spectral Resolution (nm)		Acceptance Angle (deg.)		DE (%)
QZAF-.20-.40	200-400	90-250	2.0 x 10.0	1.2-7.0		4.4-7.2		20-30
TEAF_-.36-.52_	360-520	100-190	5.0 x 5.0 Available Standard Optical Apertures Includes: 3.0 x 3.0 5.0 x 5.0 7.0 x 7.0 10.0 X 10.0 Other Optical Apertures Are Available Upon Request.	S	H	S	H	70
				0.8-4.0	0.5-2.2	4.18-4.36	2.85-3.4	
TEAF_-.40-.65_	400-650	220-110		1.0-5.1	0.5-2.5	4.8-6.2	3.4-4.4	70-90
TEAF_-.45-.70_	450-700	180-100		1.7-6.2	0.8-3.2	5.2-6.5	3.6-5.0	70-90
TEAF_-.55-1.0_	550-1000	155-70		1.5-8.3	0.9-5.0	4.3-5.9	3.2-4.5	70-90
TEAF_-.40-1.0-2CH*	400-1000	220-70		1.2-8.3	0.7-5.0	3.8-5.9	2.8-4.6	50-60
TEAF_-.80-1.6_	800-1600	130-60		S	H	EH	S	H	70-90
				4-10	3-8	2-6	5.39-5.71	4.96-7.2	
TEAF_-1.2-2.0_	1200-2000	90-50		6-16	6-12	4-9	6.78-8.56	5.3-7.5	25-35
TEAF_-1.5-3.0_	1500-3000	68-34		9-37	8-29	6-22	7.4-9.26	6.6-7.95	30
TEAF_-2.4-4.5_	2400-4500	40-20		25-83	18-65	14-48	8.43-11.38	7.3-9.72	40
TEAF_-0.8-1.6-UH	800-1600	190-90		S	H	S	H	60
				2-6	2.0-4.5	9.9-15.2	8.65-13.3	
TEAF_-1.2-1.7-UH	1200-1700	120-80		5-7	3.0-5.0	11.9-14.68	9.47-12.88	50
TEAF_-1.5-2.4-UH	1500-2400	90-55		6-14	4.5-11.0	13.4-16.95	11.9-15.2	40
TEAF_-2.4-3.2-UH	2400-3200	55-40		14-25	11.0-17.0	16.95-19.8	15.2-17.29	35
TEAF_-3.2-4.5-UH	3200-4500	45-30		24-48	17.5-37.0	19.8-23.44	17.29-20.9	30

* Available in low or standard resolution.

Brimrose uses a crystal of Tellurium Dioxide (TeO_2) AOTF that operates in the NIR region in a so-called non-collinear configuration - the acoustic and optical waves propagate at quite different angles through the crystal.

Material: TE – Tellerium Dioxide (350-5000 nm) QZ – Quartz (SiO_2)
Options: S – Standard Resolution H – High Resolution
EX – Extra high Resolution UH – Ultra high Resolution

For more information, please check the Brimrose website or contact us at office@brimrose.com.

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SPS/SPF Model AO Controller Specification

The SP Model AO Controllers are high performance RF frequency synthesizers incorporated into a self-contained case with AC power supply. A modular cable with a DB9 connector interface allows frequency control via the Personal Computer USB port (Serial RS232 optional). Using simple commands with any terminal (modem) program (such as ProComm) allows the user to set any frequency from the computer keyboard. In addition, included with the unit is a frequency control program that can be used with any IBM PC computer.

Driver Model #	VFI-XX-YY-SPS-A-C3	VFI-XX-YY-SPF-A-C3
Frequency Range	Matching the AOTF requirements.	
Frequency Step Size	4 Hz	10 Hz
Frequency Stability	0.010% absolute (100 PPM); +15°C to +75°C	0.015%; +15°C to +75°C
Frequency Switching Speed	15 ms typ. (from f_{min} to f_{max})	8 ns
Minimum Duration of Each Step	N/A	32 ns for sweeping mode 1 ms for hopping mode (for <300 hops) 15 ms for hopping mode (>300 hops)
Power Output	Optimized for maximum performance of the AOTF device.	
Power Control	N/A	12 bit attenuator with 25 dB range (min.)
Modulation	None (TTL or Analog Optional)	
Enclosure	The unit will be packaged in a 190 mm (7.5 inch) wide by 100 mm (4 inch) high by 220 mm (8.75 inch) deep instrument case. The rear panel heat sink increases the depth to 270 mm (10.5 inches) maximum. The size is exclusive of connectors. A detachable AC line cord and RF cable are provided.	
Environmental	Nominal Laboratory Conditions: The maximum temperature is +35° C. The unit is not sealed against moisture or condensing humidity.	
Output Impedance	50 ohms	
Output Connectors	SMA jack on front panel	

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Free Space
Acousto-Optic Modulators

KEY FEATURES

- Compact Integrated Design
- Wide Spectral Wavelength Range
- Low RF Power Consumption
- Fast Switching Speed
- High Bandwidth
- High Diffraction Efficiency
- Good Temperature Stability
- Custom Configurations – "Our Specialty"

APPLICATIONS

- TTL/Digital Amplitude Modulation
- Analog Amplitude Modulation
- Photo Processing
- Laser Displays
- Micro Machining
- Pulse Picking
- OEM Designs

Free Space Acousto-Optic Modulators

The Brimrose free space Acousto-Optic Modulator (AOM) with RF driver is used to vary and control laser beam intensity. It is electronically programmable using a microprocessor connected to the Brimrose RF driver unit. The RF driver features all the necessary components to drive the modulator with analog or digital input control.

Our free space AO products are housed in environmentally stable packages. They offer superior resistance to humidity and temperature, and are suitable for laboratory as well as various OEM applications and instrumentations.

Brimrose offers a large variety of **RF drivers** compatible with our AO Modulators. A typical AO RF driver consists of an RF oscillator, amplitude modulation scheme and RF amplifier. Changing the RF power level will vary the intensity of the transmitted light.

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Free Space Acousto-Optic Modulator Specifications

Model #	Spectral Range (nm)	Rise Time (ns)	Active Aperture (mm)	Modulation Bandwidth (MHz)	Diffraction Efficiency* (%)
TEM-85-2	380-1600	280	2.0	2	80
TEM-85-10	380-1600	55	1.0	10	80
TEM-110-25	380-1600	22	0.5	25	80
TEM-200-50	380-1600	10	0.3	50	70
TEM-400-100	380-1600	5.5	0.075	100	50
TEM-800-200	380-1600	3	0.05	200	35
AMM-27-2	1000-2500	300	1	1.8	>80
AMM-80-4	1000-2500	160	1	4	>80
AMM-100-8	1000-2500	68	0.3	8	>80
FQM-80-2	200-1300	195	1.6	2.8	70
FQM-80-20	200-1300	30	1	18	70
FQM-200-40	200-1300	14	0.3	40	70
GEM-40-4	2000-11,000	125	1.5	5	70
GPM-200-50	600-1600	11	0.3	50	>75
GPM-400-100	600-1600	5.1	0.1	108	>65
GPM-800-200	600-1600	2.6	0.05	217	>40
GPM-1600-400	600-1600	1.4	0.025	400	>25
IPM-200-26	1000-1600	21	0.3	26	60
IPM-400-100	1000-1600	5	0.075	100	50

* Diffraction efficiency may vary depending on the wavelength of operation.

The Free Space AOM models shown above represent some examples of our fabrication capabilities. In addition, other wavelengths, frequencies or configurations are available.

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Fixed Frequency Driver Specifications

Driver Model #	FFA-XX-B1-FY	FFA-XX-B2-FY
Frequency (MHz)	XX MHz (compatible with the AO Device)	
Frequency Control	Quartz crystal referenced phase locked loop	
Frequency Accuracy (%)	0.015	
Harmonic Content (dBc)	≤ - 20	
Frequency Stability	0.0015% minimum after 15 minute warm-up	
Output Power	Power is optimized for peak efficiency with the supplied AO device.	
Output Protection	Power amplifiers used will tolerate an infinite V.S.W.R. without damage. Rated power is available only when a proper RF load is connected.	
Rise/Fall Time	To match AO Modulator requirements	
Modulation Type	Analog amplitude modulation	TTL compatible
Modulation Rate	To match AO Modulator requirements	
Modulation Input	50 Ω; 0-1 V	330 Ω; 0-5 V
Operating Power	90-240 VAC, 50-60 Hz, 55 Watts max.	
Enclosure	The unit will be packaged in a 190 mm (7.5 inch) wide by 100 mm (4 inch) high by 220 mm (8.75 inch) deep instrument case. The rear panel heat sink increases the depth to 240 mm (9.75 inches) maximum. The size is exclusive of connectors. A detachable AC line cord and RF cable are provided.	
Environmental	Nominal Laboratory Conditions: The maximum temperature is +35° C. The unit is not sealed against moisture or condensing humidity.	

OEM packaging is also available.

In addition to the standard product shown, customer configurations are available for specialized applications.

For questions, please contact Brimrose at office@brimrose.com.

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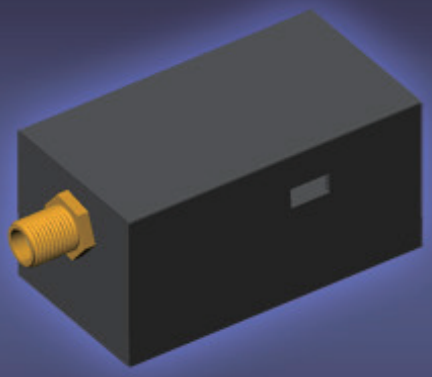
Free Space
Acousto-Optic Frequency Shifters



KEY FEATURES

- Compact Integrated Design
- Wide Spectral Wavelength Range
- Low Drive Power
- Fast Switching Speed
- High Diffraction Efficiency
- Good Temperature Stability
- Custom Configurations Available

APPLICATIONS

- Industrial:
  - Vibrometry
  - Process Control
  - Pulse Picking or Power Control
  - Atom Cooling
- Scientific:
  - Optical Heterodyning
  - Interferometric System
  - Laser Doppler Velocimetry
- OEM Designs

Free Space Acousto-Optic Frequency Shifters

The Brimrose Free Space Acousto-Optic Frequency Shifter (AOFS) with RF driver is used to modify the frequency of the optical beam. Due to a Doppler shift, the frequency of the diffracted first order optical beam in the AO modulator or AO frequency shifter is shifted in frequency (wavelength) by the acoustic carrier frequency (wavelength).

If the incident acoustic wave is introduced in the direction of the incident optical wave, the laser frequency shifts towards the higher side. If the incident acoustic wave is introduced in the opposite direction of the incident optical wave, the laser shifts toward the lower frequency side.

Brimrose offers a large variety of **RF drivers** compatible with our AO Frequency Shifters. Typically, those are fixed-frequency or variable-frequency drivers.

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Free Space Acousto-Optic Frequency Shifters Specification

Model #	Spectral Range (nm)	Diffraction Efficiency Up To (%)	Frequency Shift (MHz)	Active Aperture (mm)	Material
AMF-90-2-2.1	1000-2200	15	90	1.0	AM
AMF-55-1.3	1000-2200	80	55	2.0	AM
AMF-100-1.3	1000-2200	80	100	2.0	AM
GEF-40-10	2000-12000	75	40	2.0	Ge
GEF-60-1.5	2000-12000	75	60	1.5	Ge
GEF-80-20	2000-12000	70	80	1.0	Ge
GPF-250-100	590-1000	60	250	0.75	GaP
GPF-650-225	590-1000	50	650	0.18	GaP
GPF-1000-500	590-1000	40	1000	0.076	GaP
GPF-1500-1000	590-1000	10	1500	0.076	GaP
GPF-1700-500	590-1000	30	1700	0.076	GaP
IPF-200-50	1000-1600	40	200	0.75	InP
IPF-400-200	1000-1600	35	400	0.50	InP
IPF-600-200	1000-1600	30	600	0.18	InP
IPF-800-300	1000-1600	20	800	0.076	InP
IPF-1000-350	1000-1600	15	1000	0.076	InP
IPF-1300-400	1000-1600	10	1300	0.076	InP
LNF-2500-1000	400/830	20	2500	0.076	$LiNBO_3$
LNF-3500-1000	400-630	5	3500	0.076	$LiNBO_3$
QZF-80-20	200-4500	75	80	1.0	SiO_2
QZF-150-30	200-4500	75	150	0.75	SiO_2
QZF-210-40	200-4500	75	210	0.5	SiO_2
TEF-200-50	400-1600	60	200	0.75	TEO_2
TEF-270-100	400-1600	60	270	0.75	TEO_2
TEF-540-200	400-1600	40	540	0.18	TEO_2
TEF-600-400	400-1600	40	600	0.18	TEO_2
TEF-1000-300	400-1600	40	1000	0.076	TEO_2
TEF-1700-350	400-1600	15	1700	0.076	TEO_2

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Fixed Frequency Driver Specification

Driver Model #	FFF-XX-B1-FY	FFF-XX-B2-FY
Frequency (MHz)	XX MHz (compatible with the AO device)	
Frequency Control	Quartz crystal referenced phase locked loop	
Frequency Accuracy (%)	0.015	
Harmonic Content (dBc)	≤ - 10	
Frequency Stability	0.0015% minimum after 15 minutes warm-up	
Output Power (Watt)	Power is optimized for peak efficiency with the supplied A-O device.	
Output Protection	Power amplifiers used will tolerate an infinite V.S.W.R. without damage. Rated power is available only when a proper RF load is connected.	
Rise/Fall Time	To match AO Frequency Shifter requirements	
Modulation Type (optional)	Analog amplitude modulation	TTL compatible
Modulation Rate	To match AO Frequency Shifter requirements	
Modulation Input	50 Ω; 0-1 V	330 Ω; 0-5 V
Operating Power	90-240 VAC, 50-60 Hz, 55 Watts max.	
Enclosure	The unit will be packaged in a 190 mm (7.5 inch) wide by 100 mm (4 inch) high by 220 mm (8.75 inch) deep instrument case. The rear panel heat sink increases the depth to a maximum of 270 mm (10.5 inches). The size is exclusive of connectors. A detachable AC line cord and RF cable are provided.	
Environmental	Nominal Laboratory Conditions: The maximum temperature is +35° C. The unit is not sealed against moisture or condensing humidity.	

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Variable Frequency Driver Specification

Driver Model #	VFF-XX-YY-V-A-F2	
Frequency Range	Corresponding to the AO Device Requirements	
Tuning Voltage	0 - 10 V analog (-2 to +20 VDC no damage)	
Frequency Accuracy	1% nominal after 15 minute warm-up, constant temperature	
Scanning Speed	50 micro sec from min to max frequency with step change in tuning voltage	
Output Power	Power is optimized for peak efficiency with supplied AO device.	
Modulation Type (optional)	Analog amplitude modulation	TTL compatible
Modulation Input	50 Ω; 0-1 V	330 Ω; 0-5 V
Operating Power	90-240 VAC, 50-60 Hz	
Enclosure	The unit will be packaged in a 190 mm (7.5 inch) wide by 100 mm (4 inch) high by 220 mm (8.75 inch) deep instrument case. The rear panel heat sink increases the depth to a maximum of 270 mm (10.5 inches). The size is exclusive of connectors. A detachable AC line cord and RF cable are provided.	
Environmental	Nominal Laboratory Conditions: The maximum temperature is +35° C. The unit is not sealed against moisture or condensing humidity.	

OEM Packaging is also available.

In addition to the standard product shown, customer configurations are available for specialized applications.

For questions, please contact Brimrose at office@brimrose.com.

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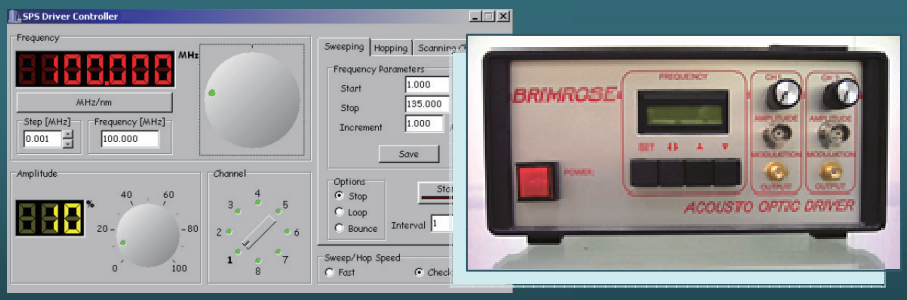
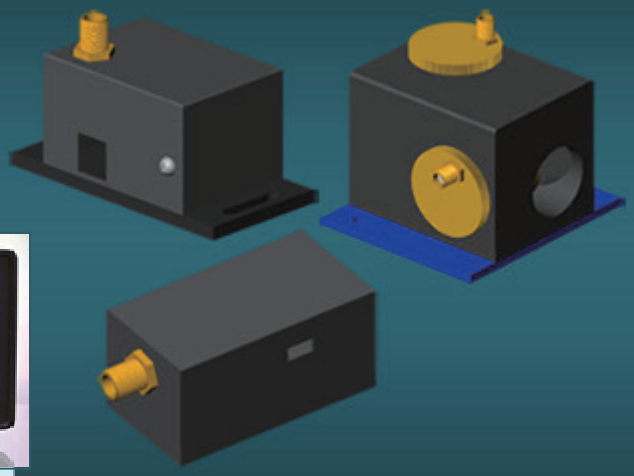
Acousto-Optic Deflectors





KEY FEATURES

- 1-D and 2-D Deflection Systems
- Compact Integrated Design
- Wide Spectral Wavelength Range
- Uniform Scan Intensity
- Low Power Consumption
- Linear Polarization
- Fast Switching Speed
- High Resolution and Bandwidth
- High Throughput
- Custom Configurations Available

REAL-TIME APPLICATIONS

- Photolithography
- Continuous Laser Beam Deflection
- Vector (Random) Scanning
- Signal Processing
- Graphic and Laser Printing
- Optical Inspection and Digital Imaging
- OEM Designs

Acousto-Optic Deflectors

Brimrose Acousto-Optic Deflectors (AODs) combined with RF drivers are specially designed for high-speed scanning applications such as laser recording, optical scanning, signal processing, etc.

The AOD changes the diffraction angle of an input laser beam and its angular position is linearly proportional to the RF frequency, so that the higher the frequency, the larger the diffracted angle.

Brimrose offers a large variety of variable frequency **RF drivers** compatible with our deflectors. The most commonly used are VCO (Voltage Controlled Oscillator) type and computer-controlled direct digital synthesizers. By altering the RF drive frequency to the AOD, the deflection angle is varied.

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Acousto-Optic Deflector Specifications

Model #	Wavelength Range (nm)	Active Aperture (mm)	Time-Bandwidth Product	3dB Bandwidth (MHz)	Deflection Angle (deg.)	Diffraction Efficiency (%)
TED-130-60	380-1600	1.0 x 4.2	60	60	0.44	70
TED-200-100	380-1600	1.0 x 4.2	100	100	0.8	70
TED-320-200	380-1600	0.5 x 9.0	400	200	1.69	60
TED-400-200	380-1600	0.5 x 5.0	200	200	1.69	50
TED10-100-60-.488	488	3.0 x 7.0	600	60	2.5	>75
TED20-100-60-.488	488	3.0 x 14.0	1200	60	2.5	>70
TED10-100-50-.532	532	3.0 x 7.0	500	50	3.0	>70
TED20-100-50-.532	532	3.0 x 14.0	1000	50	3.0	>70
TED10-75-50-.633	633	3.0 x 7.0	500	50	3.0	>75
TED20-75-50-.633	633	3.0 x 14.0	1000	50	3.0	>70
TED10-60-40-.800	800	3.0 x 7.0	400	40	2.0	>70
TED20-60-40-.800	800	3.0 x 14.0	800	40	2.0	>65
TED10-50-30-1.06	1060	3.0 x 7.0	300	30	2.7	>75
TED20-50-30-1.06	1060	3.0 x 14.0	600	30	2.7	>70
GPD-250-100	633	0.75 x 5.0	70	100	0.57	70
GPD2-250-100	633	0.75 x 13.0	200	100	0.57	40
GPD-350-200	633	0.75 x 5.0	140	200	1.15	40
GPD2-350-200	633	0.75 x 13.0	400	200	1.15	35
GPD-650-300	633	0.18 x 5.0	210	300	2.25	40
GPD-800-400-SC	600-1600	0.18 x 4.2	400	400	4.3	30
GPD2-800-400-SC	600-1600	0.18 x 8.4	800	400	4.3	25
GPD-800-500	600-1600	0.076 x 5.0	350	500	2.9	50
GPD-1500-1000	600-1600	0.075 x 6.3	250	1000	5.7	15-20
LND-2500-1000	630/830	0.075 x 3.4	1000	1000	10 @630nm	10-15
IPD-200-50	1000-2100	0.75 x 6.0	50	50	0.65	40
IPD-400-150	1000-2100	0.75 x 6.0	150	150	1.95	35
IPD-600-200	1000-2100	0.18 x 6.0	200	200	2.6	30
2DS-100-45-532 *	532+/-25	10.0 x 10.0	675 x 675	45	2.3	>40

***** 2-Dimensional AO Deflector is also available in the 400nm to 1600nm optical range.

The models shown above represent some examples of our fabrication capabilities. In addition, other wavelengths (UV-IR), frequencies or configurations are available.

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Variable Frequency Driver Specifications

Driver Model #	VFB-XX-YY-V-A-F2	VFE-XX-YY-V-B1-F2/2Ch
Frequency Range	Corresponding to the AO Device Requirements	Matching the 2-D AOD controlled by application of external tuning voltage
Tuning Voltage	0 - 10 V analog (-2 to +20 VDC no damage)	
Frequency Accuracy	1% nominal after 15 minute warm-up, constant temperature	
Scanning Speed	50 micro sec from min to max frequency with step change in tuning voltage	
Output Power	Power is optimized for peak efficiency with supplied AO device.	
Modulation Type	Analog Amplitude or TTL Compatible (optional)	Analog Amplitude; DC-10 MHz independent for each channel
Modulation Input	50 Ω; 0-1 V or 330 Ω; 0-5 V	50 Ω; 0-1 V
Operating Power	90-240 VAC ±25% 50-60 Hz	
Enclosure	The unit will be packaged in a 190 mm (7.5 inch) wide by 100 mm (4 inch) high by 220 mm (8.75 inch) deep instrument case. The rear panel heat sink increases the depth to 240 mm (9.75 inches) maximum. The size is exclusive of connectors. A detachable AC line cord and RF cable are provided.	
Environmental	Nominal Laboratory Conditions: The maximum temperature is +35° C. The unit is not sealed against moisture or condensing humidity.	

In addition to the standard product shown, customer configurations are available for specialized applications.

If there are any questions please contact Brimrose at office@brimrose.com.

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