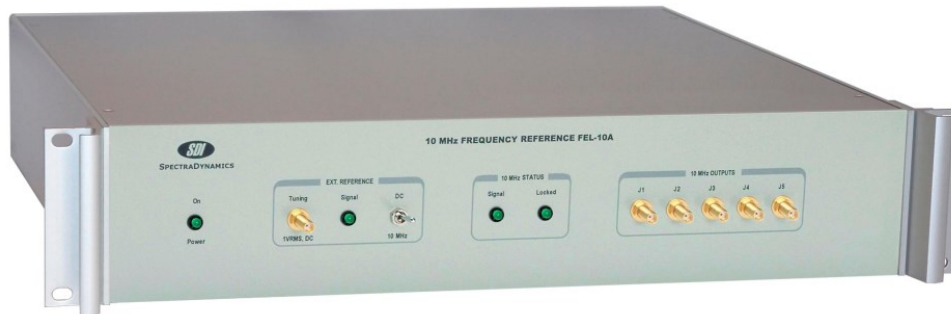




SPECTRADYNAMICS, INC



**HIGH PERFORMANCE
DISTRIBUTED FREQUENCY REFERENCE
FEL-10A
OPERATING MANUAL**

SPECTRADYNAMICS, INC • 1849 Cherry St. Unit 2. • Louisville, CO 80027
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Description

The FEL-10A is a high performance 10 MHz distributed frequency reference. It contains a 10 MHz SC cut ovenized oscillator and a high performance distribution amplifier module (HPDA-5i). The 10 MHz signal is distributed by the HPDA-5i to provide five outputs of 10 MHz. The channel-to-channel and reverse isolation is typically greater than 120 dB. The phase noise of the distribution module is exceptionally low, typically -130 dBc/Hz @ Fourier frequency of 10 Hz and -165 dBc/Hz @ Fourier frequency greater than 10 kHz. The FEL-10A outputs are matched to 50 ohms to obtain better than 30 dB return loss. All outputs are AC coupled and the grounds are DC isolated to reduce the effect of ground loops.

The FEL-10A internal 10 MHz oscillator can be phase-locked to an external 10 MHz reference source or it may be tuned with an externally provided DC voltage.

Electrical Safety and Preparation for Use

Voltages capable of causing injury or death are present in this instrument. Use extreme caution whenever the instrument cover is removed.

This instrument was designed for indoor use only.

Line Voltage

This instrument may be setup to operate on 100-120 or 220-240 VAC and a line frequency of 50 to 60 Hz. **The setup voltage for this FEL-10A is specified on page 5.**

Fuse

A 2.0 Ampere 250V slow-blow fuse is used for 100-120 VAC operation.

A 2.0 Ampere 250V slow-blow fuse is used for 220-240 VAC operation.

Only replace fuses with the same type and specifications.

AC Power

The instrument has a detachable three wire power cord for connection to a grounded AC power source. The enclosure of the unit is directly connected to the outlet ground to protect against electrical shock. Always use an outlet with a protective ground and do not disable this safety mechanism. Make sure you have access to the rear panel power switch or provide an externally accessible AC disconnect means for your FEL-10A.



Instrument Safety and Preparation for Use

Internal Oscillator

The internal 10 MHz SC cut ovenized oscillator requires a 1 hour warm-up period for the output frequency to stabilize.

RF Output Signals

The FEL-10A RF outputs are DC isolated from the chassis ground to prevent ground loops. Make sure to observe proper grounding procedures and do not connect the FEL-10A to equipment that is not connected to safety ground.

External Reference

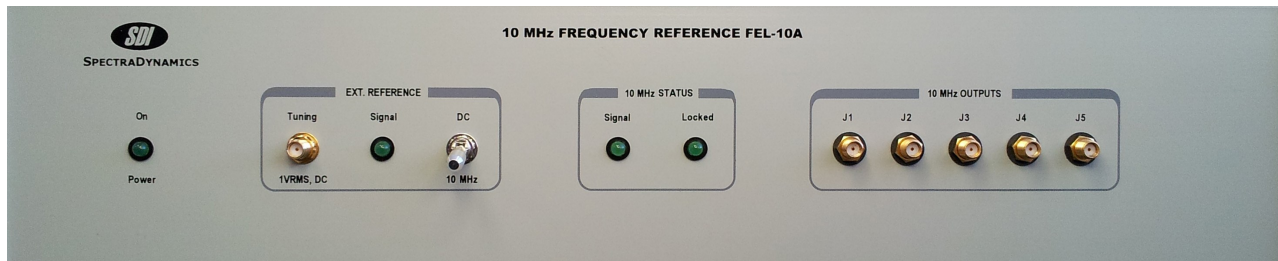
To phase lock the internal 10 MHz oscillator to an external signal you must provide a RF signal of 10 MHz with a minimum power level of +5 dBm and a maximum of +15 dBm. In DC tuning mode a +/- 5 VDC signal may be used to adjust the frequency of the FEL-10A.

An output ground potential greater than 50 V will damage the amplifier and could cause injury or death to personnel.

Absolute Maximum Ratings

RF power on tuning port	+20dBm Maximum
DC Voltage on tuning port	+/- 5 VDC Maximum
Reverse RF Power on outputs	+20dBm Maximum
DC Voltage on outputs	50 VDC Maximum
Storage Temperature	-10 to +75 °C
Operation Environment	0 to +50 °C

Front Panel



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Back Panel



AC POWER

The FEL-10A is configured to operate on:

- 100-120 VAC
- 220-240 VAC

Operation

To operate the unit, locate the power entry module on the rear of the enclosure and connect the power cord. Plug it into an appropriate power outlet and turn the unit on. The LED on the front panel labeled “Power” will turn on. The FEL-10A contains a 10 MHz SC cut, ovenized oscillator and the required warm-up time for frequency stabilization of the oscillator is one hour.

The FEL-10A has two modes of operation, DC tuning mode and External Reference mode. Once the FEL-10A has warmed up, select the mode of operation by toggling the switch on the front panel.

DC Selection

When the DC tuning mode is selected, the internal oscillator is free running and its frequency can be controlled by applying a DC voltage in the range of -5 to +5 VDC to the SMA input connector labeled tuning port. In DC mode, the tuning port sensitivity of the oscillator is 0.5 Hz/V, the modulation bandwidth is approximately 300 Hz and the input impedance is greater than 1 k Ω . Only the 10 MHz status signal LED on the front panel should be illuminated when DC mode is selected.

10 MHz Selection

When the 10 MHz External Reference mode is selected, the internal oscillator is automatically phase locked to an externally provided 10 MHz reference signal that is applied to the SMA input connector labeled tuning port. The 10 MHz signal should be in the range of +5 to +15 dBm. In this mode of operation, the tuning port impedance is 50 Ω . Once the reference signal is connected, the LED in the External Reference section labeled Signal should be illuminated. The LED labeled Locked will turn on once the FEL-10A is locked to the external reference. The PLL bandwidth has been set to 2 Hz at the factory. For different PLL bandwidth requirements please contact SDI.

If the FEL-10A is unable to lock to the external reference signal, the LED labeled Locked will be off or blinking. If this is the case, proceed to check the external reference signal amplitude and frequency. The frequency must be 10 MHz +/-1 Hz. If the external reference signal level and frequency are correct, please follow the mechanical tuning procedure on page 7 to adjust the FEL-10A internal oscillator frequency. The user may proceed to connect the distributed outputs of the FEL-10A after the instrument has warmed up and the operation mode has been selected.

Mechanical Tuning

Mechanical frequency tuning is available to adjust the frequency of the oscillators. **Only fully qualified service personnel should perform this procedure.** Frequency adjustments should be made with the unit having been powered on for at least 1 hour. **Caution must be used to avoid shorting or accidentally touching a line voltage point.**

The top cover of the FEL-10A must be removed to perform mechanical tuning.

Before you begin the mechanical tuning adjustment disconnect any incoming signal to the tuning port.

Select the DC mode of operation with the external reference switch.

Connect one of the 10 MHz outputs on the front panel to a frequency counter and make sure that the counter has an accurate frequency reference.

Inside the unit, locate the 10 MHz oscillator, look for a screw on the right side panel of the oscillator and remove it using a flat blade screwdriver to gain access to the tuning pot inside the oscillator.

Insert a small flat blade screwdriver and adjust the frequency of the 10 MHz oscillator to the desired frequency by turning the pot.

Once the frequency is adjusted, return the cover screw to the oscillator's tuning port. Replace the cover of the FEL-10A.

Make sure you wait one hour after tuning the oscillator to use the FEL-10A.

Specifications

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Level	50 ohm load	10	12	15	dBm
Output Impedance	Return Loss @ 10 MHz		-30	-25	dB
Distortion	50 ohm load		-43	-38	dBc
Isolation	output to output	110	120		dB
Temperature Stability	0 - 50 °C		+/- 2x10 ⁻⁸		
Mechanical Tuning			+/- 1x10 ⁻⁶		
Electrical Tuning	+/-5VDC		+/- 2x10 ⁻⁷		
Aging			5x10 ⁻¹⁰ /day		
Stability	Allan Variance t=1s		1E-11		
Phase Noise	10 Hz		-130	-127	dBc/Hz
	100 Hz		-155	-153	
	1 kHz		-165	-163	
	10 kHz		-165	-163	



Warranty and Service

WARRANTY

The FEL-10A is warranted to be free of defects under normal operating conditions, as specified, for one year from date of original shipment from SpectraDynamics, Inc (SDI). SDI's obligation and liability under this warranty is expressly limited to repairing or replacing, at SDI's option, any product not meeting the said specifications. This warranty shall be in effect for one (1) year from the date a FEL-10A is sold by SDI. SDI makes no other warranty, express or implied, and makes no warranty of the fitness for any particular purpose. SDI's obligation under this warranty shall not include any transportation charges or costs of installation or any liability for direct, indirect, or consequential damages or delay. Any improper use, operation beyond capacity, substitution of parts not approved by SDI, or any alteration or repair by others in such manner as in SDI's reasonable judgement affects the product materially and adversely shall void this warranty. No employee or representative of SDI is authorized to change this warranty in any way or grant any other warranty.

SERVICE

Do not attempt to service or adjust the instrument unless another person, capable of providing first aid or resuscitation, is present. *Please remember that any alteration or repair may void the warranty.* Contact SDI with any questions or to request an RMA if a repair is needed.

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