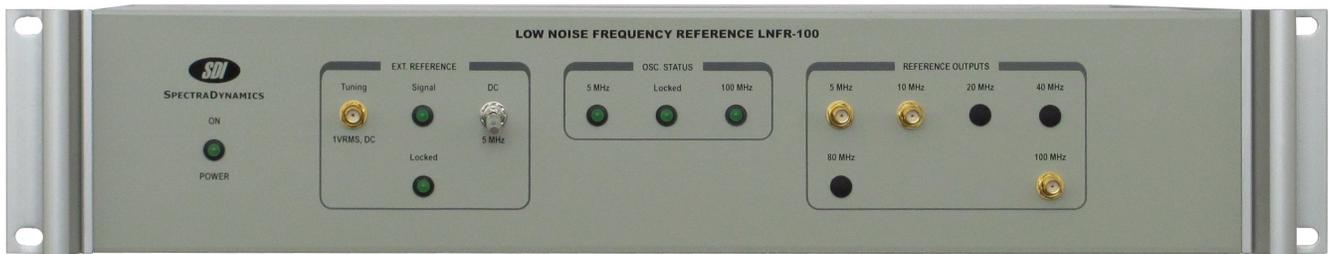




SPECTRADYNAMICS, INC



**LNFR-100
LOW NOISE FREQUENCY REFERENCE
OPERATING MANUAL**

SPECTRADYNAMICS, INC • 1849 Cherry St. Unit 2. • Louisville, CO 80027
Phone: (303) 665-1852 • Fax: (303) 604-6088
www.spectradynamics.com

Contents

1.0	Introduction	1
2.0	Safety and preparation for use	2
2.1	Electrical	2
2.2	Instrument	3
3.0	Front panel description	4
4.0	Back panel description	5
5.0	Installation	6
6.0	Operation	7
7.0	Troubleshooting	8
8.0	Specifications	10
9.0	Warranty and service	11

1.0 Introduction

The LNFR-100 is an ultra-low noise 5 MHz, 10 MHz and 100 MHz source. It contains a high stability 5 MHz oscillator and a 100 MHz ultra-low noise ovenized oscillator. The output at 10 MHz, is obtained by doubling the signal from the 5 MHz oscillator. The 100 MHz oscillator is phase locked to the 5 MHz oscillator to provide a lower phase noise signal inside the bandwidth of the PLL. All outputs to the front panel are buffered with low noise isolation amplifiers. The LNFR-100 can be phase locked via an electrical tuning port or by providing an external 5 MHz reference.

The instrument can be used as a low noise frequency reference for amplitude and phase noise measurement systems. Other applications include high stability frequency synthesizers, reference frequency generation and frequency synthesis chains.

Other LNFR Options:

Product Name	Standard Outputs Frequency (MHz)	Optional Outputs Frequency (MHz)
LNFR-100 Optional outputs must be specified on the order.	5, 10, 100	20, 40, 80
LNFR-100 HS High Stability Option Optional outputs must be specified on the order.	5, 10, 100	20, 40, 80
LNFR-400 Optional outputs must be specified on the order.	5, 10, 100	20, 40, 80, 200, 400
LNFR-100E Four buffered outputs of 10MHz	10	
LNFR-100E8 Eight buffered outputs of 10 MHz	10	
LNFR-400 HS High Stability Option Optional outputs must be specified on the order.	5, 10, 100	20, 40, 80, 200, 400

2.0 Safety and Preparation for Use

The LNFR-100 was designed for indoor use only and is not intended for operation outdoors or in a wet environment. The instrument may be mounted in a standard 19-inch instrumentation rack or may be used on a laboratory bench.

Inspect the instrument and power cords for damage before first use.

2.1 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.

Line Voltage

This instrument is designed to operate on either 100 to 120 VAC or 220-240VAC, 47 to 63 Hz AC power source. The voltage is selected by removing the fuse holder located on the power entry module on the rear panel of the instrument, flipping it over and reinstalling it. The selected voltage is displayed on the power entry module.

Fuse

A 2.0 Ampere 250V 5X10mm slow-blow fuse is used for 100 to 120 VAC and for 220 to 240 VAC operation. Only replace fuse 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. The instrument power switch is located on the rear panel of the instrument. Make sure you have access to the rear panel or provide an external accessible AC disconnect means for the LNFR-100.

2.0 Safety and Preparation for Use

2.2 Instrument safety and preparation for use

The LNFR-100 requires a one-hour warm up period for the output frequency to stabilize. *Make sure you plug the instrument into an appropriate outlet and let it warm up before using it or making any adjustments.*

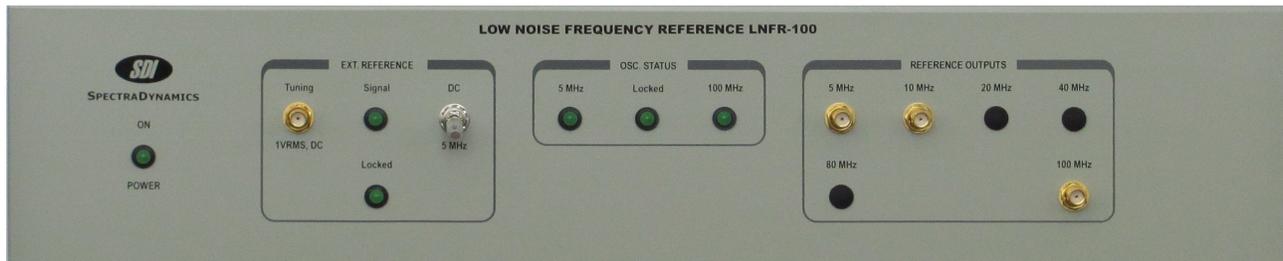
If an external reference signal is used please make sure that the level is in the range of +7 dBm and +15 dBm. If a DC level will be used for tuning the LNFR-100 make sure that the DC signal level does not exceed the limits for the device of +/- 5 VDC.

The external reference PLL bandwidth has been set to 2 Hz at the factory. For different PLL bandwidth requirements please contact SpectraDynamics.

Absolute Maximum Ratings

RF power on tuning port	+20 dBm Maximum
DC Voltage on tuning port	+/-5.5 VDC Maximum
RF Power on outputs	+20 dBm Maximum
DC Voltage on outputs	50 VDC Maximum
Storage Temperature	-10 to +75 °C
Operation Environment	0 to +50 °C
Humidity	5% to 95% Non-condensing

3.0 Front Panel



ON POWER LED

The LED labeled POWER turns on when AC power is applied to unit.

External Reference Input

The SMA input connector labeled tuning accepts an external 5 MHz (+7 to +15 dBm) reference signal or a +/- 5 VDC tuning voltage.

Signal LED

The Signal LED will turn on when a 5 MHz (+7 to +15 dBm) external signal gets applied to the Tuning SMA connector.

Locked LED

The LED labeled Locked will turn on once the internal 5 MHz oscillator is locked to the external signal.

DC / 5 MHz Switch

The switch is used to select the type of signal applied to the LNFR-100. In the DC position the tuning signal should have a DC level in the range of +/- 5V. In the 5 MHz position, the tuning signal should have a frequency of 5MHz +/- 1Hz and a level in the range of +7 to +15 dBm.

OSC. STATUS LEDs

5 MHz LED - Turns on as an indication that the 5 MHz internal oscillator is operating properly.

Locked LED - When LED is ON the internal oscillators are locked.

100 MHz LED - Turns on to indicate that the 100 MHz internal oscillator is operating properly.

REFERENCE OUTPUTS

Standard outputs are provided at 5 MHz, 10 MHz and 100 MHz. Optional outputs at 20 MHz, 40 MHz and 80 MHz are available and may be added upon customer request.

4.0 Back Panel



AC Power

The LNFR-100 power switch, fuse holder and voltage selector are all contained on the power entry module located on the rear panel.

5.0 Installation

Connecting power

This instrument has been setup to operate on 100 to 120 VAC. The unit can be converted to operate on a line voltage of 220 to 240 VAC. To change the line voltage of operation, use a flat-blade screwdriver to carefully remove the plastic cover of the power entry connector. The cover should swing down towards the IEC power socket. Remove the red fuse holder and rotate to select the desired line voltage. The appropriate fuse must be replaced to ensure safe operation. Insert the fuse holder and replace the plastic cover. The selected line voltage setting will be displayed on the power entry module.

The LNFR-100 ships with a standard North American or European IEC power cord. The instrument may be mounted in a standard 19-inch instrument rack or may be operated on a laboratory bench.

Locate the AC POWER entry module on the rear of the enclosure and connect the power cord and turn on the power.

6.0 Operation

Plug the power cord into an appropriate AC power outlet.

Once AC power is supplied to the instrument and the instrument is turned on, the LED on the front panel labeled AC will turn on.

The LNFR-100 was designed to provide 5 MHz, 10 MHz and 100 MHz outputs. Optional outputs are available at 20 MHz, 40 MHz and 80 MHz. The output levels of the output frequencies are generally +15 +/- 2 dBm. It is important that all unused outputs be terminated with 50 ohms to reduce unwanted emissions. Reverse RF or DC power should not be applied to the output ports.

The LNFR-100 may be used as a free running low noise frequency source or can be locked to an external reference signal. To use the LNFR-100 without locking it to an external reference, or in free running mode, simply turn the switch, located on the front panel, to the DC position. Let the instrument warm up for a period of one hour before using. All three Oscillator Status LEDs should be ON indicating that the internal oscillators are all operating properly and that the 100 MHz oscillator is locked to the internal 5 MHz oscillator. The frequency of the LNFR-100 can be controlled with a DC signal applied to the tuning port input. The sensitivity of the LNFR-100 is approximately 0.3 Hz/Volt at the 5 MHz output and 6 Hz/Volt at the 100 MHz output.

The LNFR-100 may also be locked to an externally provided 5 MHz reference. To lock the unit to the external 5 MHz reference, toggle the front panel switch to the 5 MHz position and supply the 5 MHz signal to the SMA connector labeled tuning. The external reference LED labeled Signal will turn on if the supplied signal has a level greater than +7dBm. The external reference Locked LED will turn on when the LNFR-100 is locked to the external signal. If the Locked LED is blinking, the instrument has not been able to lock to the external reference and the blinking rate will represent the beat note.

7.0 Troubleshooting

Do not attempt to service or adjust the instrument unless another person, capable of providing first aid or resuscitation, is present. If there are problems that cannot be resolved by the troubleshooting steps below please contact technical support.

Technical Support

Tel: +1 (303) 665-1852 , Fax: +1 (303) 604-6088

support@spectradynamics.com, www.spectradynamics.com

AC Power LED does not turn on.

Disconnect the power cord and the fuse holder in the power entry module. Check the main AC power fuse and power cord. If the fuse is blown replace with same type and rating. Please contact SDI if the fuse blows again or if the event that caused the fuse to blow is not known.

OSC STATUS Locked LED is blinking, 5 MHz and 100 MHz signal LEDs are ON

Make sure that the LNFR-100 has been powered on for at least 1 hour. Set the DC / 5 MHz switch to the DC position and remove all cables from the Ext Reference input SMA connector. If the Locked LED is still blinking, the 100 MHz oscillator has aged and must be mechanically tuned so that the frequency is within the locking range of the PLL. Please follow the mechanical tuning procedure on the following page. The instrument may also be returned to the factory for this procedure.

OSC STATUS 5 MHz LED is OFF

The LNFR-100 5 MHz oscillator is not working properly and the instrument must be returned for repair. Please contact SDI for an RMA number and shipping instructions.

OSC STATUS 100 MHz LED is OFF

The LNFR-100 100 MHz oscillator is not working properly and the instrument must be returned for repair. Please contact SDI for an RMA number and shipping instructions.

EXT REFERENCE Signal LED is OFF

Make sure that the 5 MHz signal applied to the EXT REFERENCE input SMA connector has a level greater than +7 dBm. The DC / 5 MHz switch should be in the 5 MHz position. If the Signal LED remains OFF please contact SDI technical support.

EXT REFERENCE Locked LED OFF or blinking and Signal LED is ON

Check that the frequency of the signal supplied to the external reference input SMA

7.0 Troubleshooting

connector is within the range of 5 MHz +/- 1 Hz. If the frequency of the external reference is accurate and is in the range of 5 MHz +/- 1 Hz and the LNFR-100 Locked LED is blinking then the 5 MHz oscillator has aged and must be mechanically tuned so that the frequency is within the locking range of the PLL. Please follow the mechanical tuning procedure on the following page. The instrument may also be returned to the factory for this procedure.

Mechanical Tuning

Mechanical tuning is available to compensate for the long-term frequency drift of the internal oscillators. Only fully qualified service personnel should perform this procedure.

No signal should be connected to the tuning port when performing mechanical tuning!

5 MHz Tuning:

- Set the switch to the DC position and remove the top cover of the LNFR-100.
- Remove the black cover on the left side of the LNFR-100.
- Connect the 5MHz frequency output to a frequency counter and make sure that the counter has an accurate frequency reference.
- Insert a tuning tool or small screwdriver to the tuning screw and adjust the frequency of the 5 MHz oscillator to the desired frequency.
- Replaced all covers when done adjusting the frequency of the oscillators.

100 MHz Tuning:

- Set the DC/5 MHz switch to the DC position and remove the top cover of the LNFR-100
- Locate the 100 MHz Oscillator and remove the hermetic cover screw to gain access to the tuning screw.
- Insert a tuning tool or small screwdriver into the oscillator's tuning screw to adjust the frequency of the 100 MHz oscillator so that the locked LED blinking rate slows down and the LED remains ON. If the blinking rate increases turn in the opposite direction.
- Unplug the SMA cable attached to the tuning port (SMA connector located on the oscillator's circuit board) and insert an SMA T-connector. Use a voltmeter to measure the tuning voltage from the T connector. Slowly adjust the tuning screw so that the DC voltage on the tuning port is as close as possible to zero volts.
- Remove the T-SMA connector that was inserted and replace the hermetic tuning screw covers. Replace all covers when done adjusting the frequency of the oscillators.
- The two internal oscillators should be locked and the LED labeled Lock on the Oscillator Status should be ON.

8.0 Specifications

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Power Level	5 MHz	+11	+14	-	dBm
Output Power Level	10 MHz	+11	+14	-	dBm
Output Power Level	100 MHz	+11	+14	-	dBm
Electrical Tuning Range	5 MHz, 10 MHz, 100 MHz	+/- 2 E-7		-	-
Tuning Port Voltage			+/- 5		VDC
Temperature Stability	@ 5 MHz, 0 – 60 C	-	+/-5 E-9	+/- 1 E-8	-
Phase Noise measured at 5MHz	1 Hz	-	-120	-118	dBc/Hz
	10 Hz	-	-150	-145	
	100 Hz	-	-169	-164	
	1 kHz	-	-175	-173	
	> 10 kHz	-	-175	-173	
Phase Noise measured at 10MHz	1 Hz	-	-114	-112	dBc/Hz
	10 Hz	-	-144	-141	
	100 Hz	-	-160	-156	
	1 kHz	-	-167	-164	
	>10 kHz	-	-170	-167	
Phase Noise measured at 100MHz	10 Hz	-	-124	-121	dBc/Hz
	100 Hz	-	-134	-132	
	1 kHz	-	-157	-154	
	>10 kHz	-	-177	-172	
Harmonics	5 MHz	-	-40	-30	dBc
Harmonics	10 MHz	-	-40	-30	dBc
Harmonics	100 MHz	-	-40	-30	dBc
Spurious	5 MHz	-	-110	-100	dBc
Spurious	10 MHz	-	-110	-100	dBc
Spurious	100 MHz	-	-110	-100	dBc

Rackmount chassis 2U H, 19" W, 16" D
Storage temperature -10 to +75 °C
Operation environment 0 to +50 °C
Humidity 5% to 95% Non-condensing



9.0 Warranty and Service

The LNFR-100 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 LNFR-100 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.

SpectraDynamics, Inc.
1849 Cherry Street Unit 2.
Louisville, CO 80027
USA

Tel: (303) 665-1852
Fax: (303) 604-6088
support@spectradynamics.com
www.spectradynamics.com