



SPECTRADYNAMICS, INC.



**LNFR-100 OPT D
LOW NOISE FREQUENCY REFERENCE
with 100 MHz Ext Input**

Operating Manual

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1.0 Introduction

The LNFR-100 OPT D is an ultra-low noise 5 MHz, 10 MHz and 100 MHz source. The instrument can be used as a low noise frequency reference for time frequency and quantum applications. The instrument can also be used as a cleanup oscillator for optically stabilized sources.

The LNFR-100 OPT D contains a 10 MHz and a 100 MHz ultra low noise ovenized oscillators. The internal 100 MHz oscillator is distributed to provide two front panel outputs at 100 MHz. The two outputs at 5 MHz and 10 MHz are obtained by dividing a third buffered 100 MHz signal. The 100 MHz oscillator can be locked to an internal 10 MHz low noise oscillator for standalone operation or it can be locked to an external 100 MHz reference. The selection is implemented with a switch on the front panel. The external lock bandwidth is 200 Hz.

The LNFR-100 OPT D is available in a 1U, 19-inch rackmount enclosure. It can be powered by a 100—240 VAC mains source and, for units with the DC option installed, +12 to +36 VDC source. In the event that one of the two power sources fails, the instrument will continue uninterrupted operation and the corresponding monitor LED, AC or DC, will turn off indicating the failure.

LNFR-100 Options:

Part Number	Reference Frequency (MHz)	Standard Outputs Frequency (MHz)	Optional Outputs Frequency (MHz)
LNFR-100	5	5, 10, 100	20, 40, 80
LNFR-100 OPT 100	5	5, 5, 10, 10, 100, 100	
LNFR-100 OPT D	100	5, 5, 10, 10, 100, 100	

2.0 Safety and Preparation for Use

The LNFR-100 OPT D is designed for indoor applications and is not suitable for outdoor use or in wet conditions. The instrument can be installed in a standard 19-inch instrumentation rack or used on a laboratory bench. It is crucial to guarantee access to turn off or disconnect the power to the instrument in the event of an emergency. Prior to initial use, examine the instrument and power cords for any signs of damage.

2.1 Electrical Safety

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

AC power

This instrument is designed to operate with 100 to 240 VAC, 47 to 63 Hz power source and has a detachable three-wire power cord for connection to grounded AC power sources. The enclosure 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.

DC power

DC operation with +12 to +36 VDC, +2 Amperes is an option. The instrument may be equipped with a RM12BRD-6PH DC connector on the back panel with the following configuration:

- Pin 1 NC
- Pin 2 NC
- Pin 3 NC
- Pin 4 +12 to +36 VDC power return
- Pin 5 +12 to +36 VDC power
- Pin 6 Chassis GND / Earth GND



DC Connector

DC Mating Connector

RM12BRD-6PH

RM12BPE-6S

The power return (pin 4) is NOT connected to the instrument case ground internally, however both ground connections (pin 4) and pin 6) are available at the DC power connector and may be connected together at this point.

Requirements for the external DC power supply

The following specifications must be adhered to in order to guarantee optimal performance.

DC Supply voltage	+12 to +36 VDC, 2.0 Amps
Line regulation	+/- 0.05 % for a 10 % line change
Load regulation	+/- 0.05 % for a 50 % load change
Output ripple	< 5 mV peak-to-peak
Pin configuration	Same as RM12BRD-6PH DC connector on the back panel

2.0 Safety and Preparation for Use

Applying AC voltage to the amplifier's DC power connector may cause injury or death to personnel, cause irreparable damage to the instrument, and voids all warranties.

Fuses

A 2.0 Ampere 250 V 5X20 mm slow-blow fuse is used for 100 to 240 VAC operation.

A 4.0 Ampere 250 V 5X20 mm slow-blow fuse is used for +12 to +36 VDC operation.

Only replace fuses with the same type and specifications.

Ground bolt

A chassis ground bolt is available on the rear panel to connect the chassis of the instrument to the ground bus bar in an instrumentation rack. The ground bolt is connected to the earth ground terminal on the power entry receptacle.

2.2 Instrument Safety

The LNFR-100 OPT D is an ultra-low noise 5 MHz, 10 MHz and 100 MHz source. The instrument can be used as a low noise frequency reference.

Input RF and DC signals

Input signals must be kept below +16 dBm as greater power levels will damage the unit. The recommended power level for input signal is +7 dBm to +14dBm. Input and output levels below +5dBm will trigger a fault condition. The maximum DC tuning port levels are +/-5VDC.

Absolute maximum ratings

Input RF Power	+16 dBm Maximum
Reverse RF Power	+20 dBm Maximum
Voltage at the RF Input and Outputs	+50 V Maximum
Voltage at DC Tuning Port	+/- 5 V Maximum

2.3 General Specifications and Environmental Conditions

AC Input Voltage Range	100 to 240 VAC, 42 W, 47 to 63 Hz
DC Input Voltage Range	12 to 36 VDC, 2.0 A
Indoor use only	
Operating Temperature	0 to +50 °C
Overvoltage category	OVC II
Pollution degree	PD 2
Rackmount chassis	1U H, 19" W, 14" D
Relative humidity	5% to 95% Non-condensing
Storage temperature	-10 to +75 °C
Weight	11 lb

3.0 Front Panel Description



AC POWER LED

The AC POWER LED turns on when AC power is applied to the instrument.

DC POWER LED

The DC POWER LED turns on when DC power is applied to the instrument.

OSC LED

This LED lights up when the internal 100 MHz oscillator is operating normally.

LOCK LED

The LED turns on when the internal 100 MHz oscillator is locked to a reference. The reference can either be the internal 10 MHz oscillator or an externally provided 100 MHz signal.

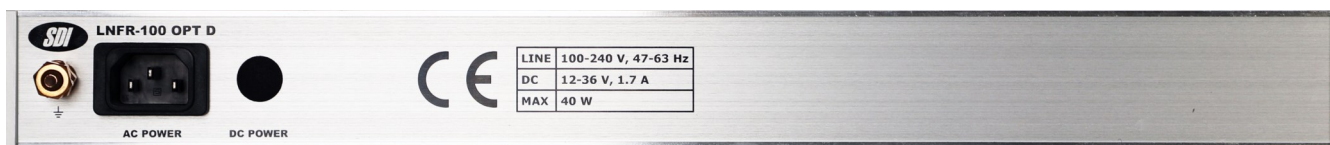
REF LED

The REF LED turns on when the instrument is connected to a reference signal that has a level greater than +5 dBm and less than +15 dBm.

REF SELECT SWITCH

The reference select switch is used to select the desired reference for the instrument. The reference can be the internal 10 MHz oscillator or an externally provided 100 MHz signal with a level greater than +5 dBm.

4.0 Back Panel Description



Ground Bolt

The ground bolt may be used to tie the chassis of the instrument to the ground bus bar of an instrument rack.

AC Power

The LNFR-100 OPT D is designed to operate on 100 to 240 VAC.

DC Power

This instrument may also operate on DC power from +12 to +36 VDC. If the LNFR-100 OPT D is set up to operate with both AC and DC power sources at the same time, the DC power is used as backup power in case of AC power outages.

5.0 Installation

The LNFR-100 OPT D may be installed in a conventional 19-inch instrument rack or may be operated on a laboratory bench. A standard North American, European, or Chinese IEC power cord and a DC power connector are provided with the instrument.

If power redundancy is desired, a DC power cable is needed and can be prepared using the provided DC connector RM12BPE-6S and the pin configuration described on page 2.

5.1 Connecting power

Locate the AC power entry module on the back of the instrument, connect the power cord, and plug it into an appropriate AC power outlet. For redundant operation a DC power cable can also be connected to the instrument and plugged into a +12 to +36 VDC power supply.

5.2 Connecting external 100 MHz reference signal

Connect an SMA cable with the 100 MHz reference signal to the input labeled EXT REF. The 100 MHz signal should have a level greater than +5 dBm and a frequency of 100 MHz +/- 100 Hz. Toggle the Lock selection to the EXT position. The lock should be automatic and the LOCK LED indicator should turn on.

5.3 Connecting RF output signals

Using the correct SMA cable for the application is crucial for signal integrity. The outputs provided by the LNFR-100 OPT D are AC coupled with matched 50-ohm impedance. The instrument provides 2 outputs at 5 MHz, 10 MHz and 100 MHz with nominal levels of +12 dBm +/- 2dB.

6.0 Operation

6.1 Startup

Once the instrument has been installed it is ready for operation. Connect power to the instrument. The AC POWER and/or DC POWER LEDs on the front panel will turn on to indicate the instrument is being powered by AC and/or DC power.

6.2 Instrument Operation

If the instrument is used with an external 100 MHz reference, set the REF select switch to the EXT position and connect a signal with a nominal frequency of 100 MHz and +10 dBm level +/- 5 dB to the SMA connector labelled 100 MHz. The REF LED should turn on.

If the instrument is used without an external reference set the REF select switch to the INT position. The internal 100 MHz oscillator will automatically lock to the internal 10 MHz reference oscillator.

8.0 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

Email: support@spectradynamics.com, Website: www.spectradynamics.com/support/

AC POWER LED if off

Disconnect the power cords. Use a Torx T8 screwdriver to remove the six screws securing the top lid to the instrument and set the lid aside. Check the main AC power fuse and power cord. If the fuse is blown, replace it with same type and rating. Replace the lid before powering on the instrument. Contact SDI if the fuse blows again or if the event that caused the fuse to blow is unknown.

DC POWER LED is off

Disconnect the power cords. Use a Torx T8 screwdriver to remove the six screws securing the top lid to the instrument and set the lid aside. Check the main DC power fuse and power cord. If the fuse is blown, replace it with same type and rating. Replace the lid before powering on the instrument. Contact SDI if the fuse blows again or if the event that caused the fuse to blow is unknown.

OSC monitor LED is off

The OSC led monitors the internal oscillator signal level. The internal oscillator needs a few minutes to warmup after power is applied. It is normal for the OSC led to be off for a few minutes after power on. If this led is off 15 minutes after power on or turns off during normal operation the internal oscillator may not be working properly please contact SDI.

LOCK monitor LED is off

Check to see if the instrument is in internal or external lock mode. If the instrument is locked to the internal reference then allow a few minutes for the internal oscillators to warmup. The lock should be automatic after 15 minutes. If the instrument is in external lock mode check the frequency of the external reference. The external reference should be 100 MHz +/- 10 Hz with a signal level greater than +5 dBm. Contact SDI if the instrument does not lock.

REF monitor LED is off

Check to see if the RF signal provided to the instrument is greater than +5 dBm. If the power level of the input signal is greater than +5 dBm and the monitor LED remains off, contact SDI.

9.0 Specifications

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Output Level	5 MHz	+10	+13	+14	dBm
Output Level	10 MHz	+10	+13	+14	dBm
Output Level	100 MHz	+10	+12	+14	MHz
Electrical Tuning Range	+/- 5 V	+/- 2 E-8	-	-	dB
Impedance	output	-	50	-	Ohms
Harmonics	+12 dBm	-35	-40	-	dBc
Spurious		-	-	-120	dBc
Free running Phase Noise	1 Hz	-	-124	-118	dBc/Hz
Measured at 5 MHz, +13dBm	10 Hz	-	-148	-145	
	100 Hz	-	-159	-157	
	1 kHz	-	-171	-169	
	10 kHz	-	-179	-177	
	100 kHz	-	-182	-177	
Free running Phase Noise	1 Hz	-	-118	-112	dBc/Hz
Measured at 10 MHz, +13dBm	10 Hz	-	-141	-139	
	100 Hz	-	-153	-150	
	1 kHz	-	-167	-165	
	10 kHz	-	-174	-171	
	100 kHz	-	-176	-173	
Free running Phase Noise	1 Hz	-	-97	-92	dBc/Hz
Measured at 100 MHz, +13dBm	10 Hz	-	-123	-120	
	100 Hz	-	-136	-134	
	1 kHz	-	-161	-159	
	10 kHz	-	-172	-170	
	100 kHz	-	-176	-174	
Residual (Locked) Phase Noise	1 Hz	-	-133	-130	dBc/Hz
Measured at 100 MHz, +13dBm	10 Hz	-	-138	-135	
	100 Hz	-	-141	-138	
	1 kHz	-	-161	-158	
	10 kHz	-	-173	-171	
	100 kHz	-	-177	-175	
* Ext Reference PLL BW	+10 dBm	150	200	250	Hz

*Note: small adjustments from 150—250 Hz can be made by adjusting the PLL Tuning screw. CW decreases the PLL tuning BW and CCW increases the PLL tuning bandwidth.

10.0 Cleaning and Decontamination Instructions

Ensure that all required electrical safe work practices are followed before cleaning the instrument.

1. Disconnect power before cleaning to prevent electrical shock or damage.
2. Allow hot surfaces to cool before cleaning.
3. Avoid aerosol sprays, bleaches, or abrasives.
4. Avoid spraying cleaners directly onto equipment.
5. Lint-free, microfiber cloths are recommended to clean the surface without leaving particles behind. Avoid abrasive cloths, towels, or paper towels.
6. Connectors can be cleaned with a lint-free swab or cloth and 99% isopropyl alcohol.
7. Ensure the instrument is clean and completely dry before reconnecting power.



11.0 Warranty and Service

Warranty

The LNFR-100 OPT D 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 OPT D 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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SPECTRADYNAMICS, INC

EU Declaration of Conformity

In accordance with EN ISO/IEC 17050-1:2010

This declaration is issued under the sole responsibility of the manufacturer.

Manufacturers Name: SpectraDynamics Inc
Manufacturers Address: 1849 Cherry St Unit 2
Louisville, CO. USA.
<https://www.spectradynamics.com/>

Product: Low Noise Frequency Reference

Model: LNFR-100 OPTD

The object of the declaration described above is in conformity with the relevant Union harmonization Legislation:

Application of Council Directives:

EMC 2014/30/EU
Low Voltage Directive 2014/35/EU

Standards:

EMC BS EN IEC 61326-1:2021- Basic environment
BS EN IEC 55011:2016+A2:2021 - Emissions
Safety Requirements IEC 61010-1:2010+AMD1:2016 - Safety requirements
for measurement, control and laboratory use
Part 1: General requirements.

We, the undersigned, hereby declare that the equipment specified in this declaration conforms to the above Directives and Standards.

Franklin Ascarrunz, President
March 02, 2025