SPECTRADYNAMICS, INC.

LOW NOISE FREQUENCY SYNTHESIZER
LNFS-100 OPT 3
OPERATING MANUAL

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

Table of Contents

Description

The LNFS-100 with option 3 is a versatile low noise synthesizer with an output frequency range of 100 kHz to 120 MHz. The synthesizer has a low-noise internal time base that can be phase-locked to an external 10 MHz signal for long-term stability. The synthesizer can be used as a frequency source for instrumentation, microwave synthesis, phase noise characterization, radar and telecommunication clock systems.

The synthesizer has 48-bit frequency resolution, 14-bit phase resolution and 12-bit amplitude control. Three sine wave outputs are provided on the front panel. All instrument functions and settings are displayed and controlled via the front panel LCD touch screen. Remote control of the instrument is possible through RS-232 communications.

The LNFS-100 has AM, FM and PM modulation capabilities. The LNFS-100 comes in a stand-alone 2U rack mount enclosure.

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

Safety and Preparation for Use

CAUTION!
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 can be setup to operate on 110-120 or 220-240 VAC and a line frequency of 50 to 60 Hz. **The setup voltage for this LNFS-100 is specified on page 6.** For conversion to a different line voltage please contact SDI.

Fuse
A 2.0 Ampere 250V slow-blow fuse is used for 100-120 VAC operation.
A 1.0 Ampere 250V slow-blow fuse is used for 220-240 VAC operation.
Only replace fuses with the same type and specifications.

Line Cord
The LNFS-100 has a detachable, three wire power cord for connection to a grounded 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.

Service
Do not attempt to service or adjust the instrument unless another person, capable of providing first aid or resuscitation, is present.

Operation
To operate the unit, locate the AC power entry connector on the rear panel and connect the power cable. When power is applied to the unit, a green LED located on the front panel, labeled “ON”, should light up.

Important!!!
The LNFS-100 is a frequency synthesizer and may be locked to an external reference for higher stability. The external reference provided should be at 10 MHz +/- 0.1 Hz with a level of +10 to +15 dBm. On startup the external reference tuning is disabled by default. To use the external reference, the external PLL must be activated using the PLL Screen.

The Front Panel

ON The LED is on when power is applied to unit and the unit is operating properly.

DATA The LED is on when data is being sent or received via the RS-232 port.

STATUS The LED is on when an error has occurred. View the instrument status via the PLL Screen. The LED will turn off once the error condition is corrected or no longer present and the PLL status has been checked. If the LNFS-100 is under RS-232 control use the *SRE to determine the error condition and the *CLS command to clear the status register and turn off the STATUS LED.

RS-232 DB-9 connector for serial communications. This is a dumb terminal RS-232 port. A null modem adapter is not required.

DISPLAY The LCD display and touch screen is used to control the LNFS-100 in local control mode.

REFERENCE INPUTS

Ext Ref SMA input for the external 10 MHz reference. This input port has an impedance of 50 ohms. The external reference provided should be at 10 MHz +/- 0.1 Hz with a level of +10 to +15 dBm.

Signal LED The 10 MHz signal LED will turn on when a 10 MHz reference is present.

PLL LED The PLL lock LED will turn on when the LNFS-100 is phase locked to an external reference.

Trig In Not Used

Aux 1, 2, 3 SMA input for an external modulation input. This input port has an impedance of 1 kΩ. The modulation signal should conform to TTL specifications and must not exceed +5.5 VDC. The voltage at this input must never be negative or the synthesizer will be damaged and warranty voided.

OUTPUTS

Out 1 SMA output number one providing the sine-wave output signal of synthesizer number one. This output signal has a maximum level of +15 dBm.

Out 2, Out 3 Additional SMA outputs for the second and third synthesizer modules.

The Back Panel

AC POWER ENTRY MODULE
The LNFS-100 is configured to operate on:

- ❑ 100-120 VAC
- ❑ 220-240 VAC

RS-232 Port

RS-232 Communication Port

The LNFS-100 functions are accessed through the RS-232 port located on the front panel. A standard serial cable with a DB-9 connector can be used to interface to the LNFS-100. The user can input commands using a simple dumb terminal program on a remote computer or more sophisticated control can be used with software such as Labview.

On the front panel above the RS-232 connector there are three LEDs. The power LED labeled ON should be lit when power is applied. The second LED labeled DATA will light up only when data is being received or sent on the RS-232 port. This LED can be used to verify that the unit is communicating. The third LED is labeled status and is a hardware representation of the internal status flag. The status LED is on whenever an error has occurred. The user must query the unit to determine the source of error and then clear the error flag. When the error flag is cleared the LED will turn off.

Port Settings

On power-up the RS-232 port settings are:
Baud rate 9600 8 Bits 1 Stop Bit No Parity.

Hardware handshaking is not used. The DB-9 connector pin-out is described below.

Pin	Function
1	NC
2	Data out
3	Data in
4	NC
5	GND
6	NC
7	NC
8	NC
9	NC

Mechanical Tuning

Mechanical frequency tuning is available to adjust the frequency of the internal LNFS-100 oscillator. **Only fully qualified service personnel should perform this procedure.** Frequency adjustments should be made with the unit having been powered on for at least 2 hours. **Caution must be taken to avoid shorting or accidentally touching a line voltage point.**

1. To adjust the frequency of the oscillator, remove the top cover of the LNFS-100. The oscillator module is located at the right side of the. The tuning access for the 10 MHz oscillator is on the top side of the oscillator enclosure. A hermetic cover screw must be removed with a screwdriver to gain access to the tuning screw. A small flat blade tuning tool is needed to make the adjustment.

2. Connect the external 10 MHz reference to the input labeled Ext Ref. Make sure that the reference signal level is between +10 dBm and +15 dBm. Program the LNFS-100 to lock to the external frequency reference.

3. Enter the PLL screen to view the RF power levels and control voltages. The internal oscillator power level should be 12 $\pm$ 2 dBm. The reference signal power level should be between 10 dBm and 15 dBm. If the LNFS-100 is phase locked to the external reference the LOCK voltage will be greater than 0.2 V. Adjust the mechanical tuning screw of the 10 MHz oscillator to achieve a lock condition. Continue adjusting the mechanical tuning screw until the PLL voltage displayed is at 0 volts. At this point the internal lock indicator LED should be on, the LOCK voltage should be greater than 0.2 V and the PLL voltage should be at 0.0 $\pm$ 0.2 V.

4. Replace all hermetic covers when done adjusting the frequency of the oscillators. Replace the top cover of the LNFS-100.

Note: The LNFS-100 should be turned on for 2 hours prior to any mechanical frequency adjustment.

Specifications

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Phase Resolution		-	0.022	-	degrees
Phase offset range		-	+/- 360	-	degrees
Amplitude Resolution		-	0.01	-	Vrms
Frequency Resolution		-	1 E-6	-	Hz
Frequency Tuning Range		-	100E3 – 120 E6	-	Hz
Mech. Tuning Range		-	+/-1 E-6	-	-
Int. Oscillator Aging	After 30 days of operation	-	5 E-6	-	Per day
Max Sine Output Level	50 Ohm Load, Accuracy +/-2dB	+14	+15	+16	dBm
Output Isolation	Channel to channel Reverse	- -	80 80	- -	dB
Phase Noise $\mathcal{L}$(f) 5 MHz Output, +15dBm	10 Hz 100 Hz 1 kHz >10 kHz	- - - -	-135 -147 -154 -160	-133 -145 -152 -155	dBc/Hz
Phase Noise $\mathcal{L}$(f) 10 MHz Output, +15dBm	10 Hz 100 Hz 1 kHz >10 kHz	- - - -	-130 -142 -150 -155	-127 -140 -147 -153	dBc/Hz
Allan Deviation $\sigma_y(\tau)$ Locked to ext reference	f = 5E6 1 s 10 s 100 s	 - - -	 2.1 E-13 3.2 E-14 2.0 E-14	 - - -	
Allan Deviation $\sigma_y(\tau)$ Locked to ext reference	f = 10E6 1 s 10 s 100 s	 - - -	 3.0 E-13 4.0 E-14 6.0 E-15	 - - -	
Spurious	+13 dBm Output Level	-100	-50	-45	dBc
Harmonics	+13 dBm Output Level	-60	-45	-32	dBc

External Reference	10.0 MHz ± 2.0 E-8	+10 dBm to +15 dBm
DC Tuning Voltage	+/- 5VDC	
External Trigger	400ns min. pulse width	TTL Compatible Levels
AC Power	110–120/ 220–240VAC	see page 6.

Rack-mount Enclosure
Size: 3.5” X 19” X 17”
Weight: 29 lbs

Main Screen

Main Screen The main screen displays the current frequency and phase and amplitude of the LNFS-100. The soft keys at the bottom of the screen display the five main functions that are available.

DISPLAYS

Frequency The frequency is displayed in units of Hertz (Hz).

Phase The phase is displayed in units of degrees (deg).

Amplitude The amplitude is displayed in units of dBm, Vrms or Vpp.

MENU

FREQ Change frequency command. The FREQ key will bring up the Frequency Screen.

PHASE Change phase command. The PHASE key will bring up the Phase Screen.

AMPL Change amplitude command. The AMPL key will bring up the Amplitude Screen.

SET Change instrument settings. The SET key will bring up the Settings Screen.

SYNTH (1, 2, 3) Selects synthesizer module one, two or three.

Number Entry Screen

Number Screen The number entry screen is used to make numeric entries.

DISPLAYS

The current setting will be displayed across the top of the screen. The new entry is displayed in a number entry box.

SPECIAL KEYS

Hz	Enter number in Hertz.
kHz	Enter number in kiloHertz.
MHz	Enter number in MegaHertz.
deg	Enter number in degrees.
dBm	Enter number in dBm.
Vrms	Enter number in Volts RMS.
Vpp	Enter number in Volts peak-to-peak.
BK	Backspace.
ENTER	Enter new number and exit number menu.
ESC	Exit number menu discarding changes.
0-9	Numbers zero through nine.
.	Decimal point.
-	Negative sign.

Frequency Screen

Frequency Screen The frequency screen displays the frequency of the selected synthesizer module in the LNFS-100. Use the Main Screen to change the selected synthesizer module.

DISPLAYS

Frequency The frequency is displayed in units of Hertz.

MENU

SET Enter new frequency. The SET key will bring up the Number Screen. The maximum frequency is 120 MHz. The frequency resolution is 1 uHz.

STEP Enter a frequency step size. The STEP key will bring up the Number Screen. The maximum step size is 120 MHz. Frequency step resolution is 1 uHz.

UP Increase the frequency by the frequency step size.

DOWN Decrease the frequency by the frequency step size.

EXIT Exit to previous screen.

Phase Screen

Phase Screen The phase screen displays the phase of the selected synthesizer module in the LNFS-100. Use the Main Screen to change the selected synthesizer module.

DISPLAYS

Phase The phase is displayed in units of degrees.

MENU

SET Enter the new phase. The SET key will bring up the Number Screen. The phase entered cannot exceed +/- 360 degrees. The phase change is instantaneous. The phase resolution is 0.022 degrees.

STEP Enter a phase step size. The STEP key will bring up the Number Screen. The phase step size cannot exceed 360 degrees. The phase step resolution is 0.022 degrees.

UP Increase the phase by the phase step size.

DOWN Decrease the phase by the phase step size.

EXIT Exit to previous screen.

Amplitude Screen

Amplitude Screen The amplitude screen displays the amplitude of the selected synthesizer module in the LNFS-100. Use the Main Screen to change the selected synthesizer module.

DISPLAYS

Amplitude The amplitude is displayed in units of dBm, Vrms or Vpp.

MENU

SET Enter the new amplitude. The SET key will bring up the Number Screen. The amplitude entered cannot exceed +15 dBm, 1.26 Vrms, or 3.56 Vpp. The amplitude units are selected when entering the desired value.

STEP Enter an amplitude step size. The STEP key will bring up the Number Screen. The amplitude step size cannot exceed 30 dB, 1.26 Vrms or 3.56 Vpp. The amplitude resolution is 0.01 dBm, 0.01 Vrms and 0.1 Vpp.

UP Increase the amplitude by the amplitude step size.

DOWN Decrease the amplitude by the amplitude step size.

EXIT Exit to previous screen.

Settings Screen

Settings Screen The settings screen is used to access, view and edit instrument options.

MENU

MOD Setup Modulation options.

FM Setup Frequency Modulation.

PM Setup Phase Modulation.

AM Setup Amplitude Modulation.

INST Instrument setup and information. The INST key will bring up the Instrument Screen.

EXIT Exit to previous screen.

Frequency Modulation Screen

FM Screen The frequency modulation screen is used to select frequency modulation options.

MENU

FSWP Select Frequency Sweep.

FSK Select Frequency Shift Keying.

EXIT Exit to previous menu.

Phase Modulation Screen

PM Screen The phase modulation screen is used to access, view and edit phase shift keying modulation options. When PM is enabled a *** character** will appear before the phase display in the Main Screen.

DISPLAYS

Phase 1 First output phase setting in degrees.

Phase 2 Second output phase setting in degrees.

MENU

PHAS1 Enter or edit phase 1 setting.

PHAS2 Enter or edit phase 2 setting.

ON/OFF Toggle phase modulation on or off.

UP/DOWN Toggle between phase 1 and phase 2.

EXIT Exit to previous menu.

Uses Hardware Trigger Input.
Phase shift between phase 1 and phase 2 of the synthesizer occurs on each rising edge of a TTL level signal on the external trigger input. **To turn off the modulation toggle the ON/OFF button.**

Amplitude Modulation Screen

AM Screen The amplitude modulation screen is used to access, view and edit amplitude shift keying modulation options. When AM is enabled a *** character** will appear before the phase display in the Main Screen.

DISPLAYS

RTIM The ramp time, the time in microseconds that it takes for the output amplitude to go from off to on.

MENU

RTIM Enter or edit ramp time setting.

ON/OFF Toggle modulation on or off.

UP/DOWN Toggle between amplitude off to amplitude on.

EXIT Exit to previous menu.

Uses Hardware Trigger Input.
The amplitude change from off state to on state of the synthesizer occurs on each rising edge of a TTL level signal on the external trigger input. **To turn off the modulation toggle the ON/OFF button.**

Frequency Sweep Screen

FSWP Screen The frequency sweep screen is used to access, view and edit frequency sweep options. When FSWP is enabled a *** character** will appear before the frequency display in the main screen.

DISPLAYS

F1 Start Frequency in Hz. Valid frequency range is 0 Hz to 120 MHz.

F2 Stop Frequency in Hz. The stop frequency must be greater than the start frequency and up to 120 MHz.

DF Step size in Hz. The step size must be smaller than the difference in frequency between the start and stop frequency. The smallest step size is 1 uHz.

RATE The frequency step rate in Hz. The frequency step rate must be greater than the 286.1 Hz and less than 150 MHz.

MENU

SET Enter or edit the frequency sweep settings.

ON/OFF Toggle frequency modulation on or off.

UP/DOWN Toggle between sweep up in frequency and sweep down in frequency.

AUTO Turn on automatic sweep up and down function.

EXIT Exit to previous menu.

Uses Hardware Trigger Input.
Frequency sweep starts on the external trigger input. The first rising edge of a TTL level signal on the external trigger input starts a sweep with increasing frequency and subsequent pulses will change direction of the frequency sweep. **To turn off the modulation toggle the ON/OFF button.**

Frequency Shift Keying Screen

FSK Screen The frequency shift keying screen is used to access, view and edit frequency shift keying modulation options. When FSK is enabled a *** character** will appear before the frequency display in the main screen.

DISPLAYS

F1 First output frequency setting in Hz.

F2 Second output frequency setting in Hz.

MENU

F1 Enter or edit frequency 1 setting.

F2 Enter or edit frequency 2 setting.

ON/OFF Toggle frequency modulation on or off.

UP/DOWN Toggle between frequency 1 and frequency 2.

EXIT Exit to previous menu.

Uses Hardware Trigger Input.
Frequency shift between frequency 1 and frequency 2 of the synthesizer occurs on each rising edge of a TTL level signal on the external trigger input. **To turn off the modulation toggle the on/off button.**

Instrument Screen

Instrument Screen The instrument screen is used to view or instrument configuration settings.

MENU

COMM Set serial communications options and RS-232 remote control configuration.

DISP Change the brightness of the LCD display.

UP Increase the value.

DOWN Decrease the value.

EXIT Exit to previous screen.

TIME Set the instrument date and time.

PLL Set external reference or DC tuning options and view phase-lock-loop control voltages and levels. The PLL key brings up the PLL screen.

EXIT Exit to previous screen.

Communications Screen

Communications Screen The communications screen displays the current RS-232 serial port settings. The soft keys at the bottom of the screen are used to set new RS-232 settings, initiate RS-232 control of the instrument or test the serial port connection. The RS-232 port is setup to be controlled by a dumb terminal. A null modem adapter is not needed and should not be used. Hardware handshaking is not used. For additional pin-out information please refer to the RS232 port section on page 7 of this manual.

DISPLAYS

Current baud rate setting.

MENU

REM Enter remote RS-232 control mode.

BAUD Toggle through available baud rates.

9600, 19200, 38400, 57600, 115200, 14400, 28800

LOCAL Return to local control and terminate remote RS-232 control session.
(This button appears only in remote RS-232 control mode).

EXIT Exit to previous screen.

PLL Screen

PLL Screen The PLL screen is used to view the current PLL voltages and RF power levels. Use this function to clear the status register and turn off the status LED. The status LED will turn off only if the error condition has been resolved.

DISPLAYS

OSC The power level of the internal oscillator. This level should be +12dBm ± 1 dB.

REF The power level of the external reference. This level should be between +10 dBm and +15 dBm for proper operation. This value will display only in external reference mode.

LOCK The lock indicator voltage. A voltage greater than 0.2 V indicates that the LNFS-100 is phase locked to the external reference. This value will display only in external reference mode.

PLL The tuning port voltage on the LNFS-100 internal oscillator. This value will display only in external reference mode. For proper operation the tuning port voltage is ± 5.0 V. If the voltage displayed is within 0.5 V of these limits the internal oscillator may need to be mechanically tuned. Please refer to the mechanical tuning section on page 8 of this manual for more information.

TEMP The internal instrument temperature in degrees Celsius.

MENU

EXT Turns on the phase lock loop and enables locking to an external 10 MHz reference. The external reference should have a level of +10 to +15 dBm.

INT Turns off the phase lock loop and enables DC tuning of the internal 10 MHz reference. The external DC voltage should be less than +/- 5 VDC.

EXIT Exit to previous screen.

ASCII Command Set

The LNFS-100 command set is used to control all synthesizer functions. The characters sent to the LNFS-100 must be upper case ASCII characters.

ASCII Command Set

Command Arguments	Description
id	Synthesizer module address {1, 2, 3}
rt	Amplitude ramp time from on/off or off/on. { 54.5uS – 3495uS }
ampl	Amplitude entered in units indicated by aunit {max +15 dBm}
aunits	Amplitude units {1 – dBm, 2 – Vrms, 3 – Vpp}
askcmd	Amplitude shift command {0 – off, 1 – on/trigger, 2 – signal on, 3 – signal off}
auxcmd	Auxiliary output command {0 – off, 1 – on}
baud	Serial port baud rate. The default is 9600.
mo	Month {1 – 12}
day	Day {1 – 31}
year	Year {1900 – 2100}
f1	Start frequency in Hz {0 – 120 MHz}
f2	Stop frequency in Hz {f1 – 120 MHz}
df	Step frequency in Hz {1uHz –(f1-f2)}
rate	Step rate in Hz {286.1 Hz – 150 MHz}
fskcmd	Frequency shift keying command {0 – off, 1 – on/trigger, 2 – set f1, 3 – set f2}
freq	Frequency in Hz {0 – 120 MHz}
phase	Phase in degrees {+/- 360}
pllcmd	Pll command {0 – DC Tuning, 1 – Lock to Ext 10 MHz}
p1	First phase setting in degrees {+/-360}
p2	Second phase setting in degrees {+/-360}
pskcmd	Phase shift command {0 – off, 1 – on/trigger, 2 – set p1, 3 – set p2}
pw	Pulse width factor {0.0 is 50% duty cycle, range +/- 100.0}
swpcmd	Sweep command {0 m- off, 1 – on/trigger, 2 – autosweep}
hr	Hour {0 – 23}
min	Minute {0 – 59}
sec	Second {0 – 59}

AMASK, AMASK?

AMASK sets the ramp time of the output amplitude from off to on or on to off.

AMASK [id] [rt]<cr>

AMASK has 2 parameters and is executed following the carriage return <cr>

id **synthesizer id, valid values: 1, 2, 3**
rt **ramp time, valid values are in micro-seconds: 54.5 – 3495**

Example: AMASK 1 54.5<cr>

Sets the ramp time on synthesizer module one to 54.5 microseconds. <cr> is a carriage return.

AMASK? Queries the synthesizer ramp time setting.

AMASK? [id]<cr>

AMASK? [id] is executed following the carriage return <cr>

The results of the query are in the following format.

AMASK? [id] [rt]<cr>

Example: AMASK? 1<cr>

Queries the ramp time setting of synthesizer module one. <cr> is a carriage return. The function will return:

AMASK? 1 54.5<cr>

AMPL, AMPL?

AMPL sets the amplitude of the selected synthesizer module.

AMPL [id] [ampl] [aunits]<cr>

AMPL has 3 parameters and is executed following the carriage return <cr>

id	**synthesizer id, valid values: 1, 2, 3**
ampl	**amplitude in desired unit specified by aunits**
aunits	**amplitude units desired**

valid values:

ampl	**aunits**	**units**
-57 to +15	1	dBm
0 to 1.26	2	Vrms
0 to 3.56	3	Vpp

Example: AMPL 1 13.0 1<cr>

Sets the amplitude to 13.0 dBm on synthesizer module one. <cr> is a carriage return.

AMPL? Queries the synthesizer amplitude setting.

AMPL? [id]<cr>

AMPL? is executed following the carriage return <cr>

The results of the query are in the following format.

AMPL? [id] [ampl] [units]<cr>

Example: AMPL? 1<cr>

Queries the amplitude setting of synthesizer module one. <cr> is a carriage return.
The function will return:

AMPL? 1 13.0 dBm<cr>

ASK

ASK enables or disables the amplitude shift keying. When amplitude shift keying is enabled a rising edge on the external trigger will toggle the amplitude on/off. A software trigger will do the same. Use the TRIG command to issue a software trigger.

ASK [id] [askcmd]<cr>

ASK has 2 parameters and is executed following the carriage return <cr>

id **synthesizer id, valid values: 1, 2, 3**
askcmd **amplitude shift command:**

0 – disabled
1 – enabled
2 – set amplitude on
3 – set amplitude off

Example: ASK 1 0<cr>

Disables amplitude shift keying of the first synthesizer module. <cr> is a carriage return.

BAUD, BAUD?

BAUD changes the baud rate of the synthesizer.

BAUD [baud]<cr>

BAUD has 1 parameter and is executed following the carriage return <cr>

baud **baudrate**

valid values are:

110	150	300	600	1200
2400	4800	**9600**	14400	19200
28800	38400	57600	115200	

Example: BAUD 9600<cr>

Sets the baudrate of the synthesizer to 9600. <cr> is a carriage return.

BAUD? Queries the synthesizer baudrate.

BAUD?<cr>

BAUD? is executed following the carriage return <cr>

The results of the query are in the following format.

BAUD? [baud]<cr>

Example: BAUD?<cr>

Queries the baudrate setting of synthesizer module one. <cr> is a carriage return. The function will return:

BAUD? 9600<cr>

DATE, DATE?

DATE changes the date setting of the instrument.

DATE [month/day/year]<cr>

DATE has 3 parameters and is executed following the carriage return <cr>

mo	**month valid values are 1 - 12.**
day	**day valid values are 1 - 31.**
year	**year valid values are 1900 – 2100.**

Example: DATE 02/02/2001<cr>

Sets the date of the instrument to February 2, 2001. <cr> is a carriage return.

DATE? queries the instrument date setting.

DATE?<cr>

DATE? is executed following a carriage return.

The results of the query are in the following format.

DATE? [mo/day/year]<cr>

Example: DATE?<cr>

Queries the date setting of synthesizer module one. <cr> is a carriage return.
The function will return:

DATE? 02/02/2001<cr>

FMFSK, FMFSK?

FMFSK is used set the frequency shift keying parameters of the selected synthesizer module.

FMFSK [id] [f1] [f2]<cr>

FMFSK has 3 parameters and is executed following the carriage return <cr>

id **synthesizer id, valid values: 1, 2, 3**
f1 **start or first frequency in Hz, valid range is 0 to 120.0 E+6 Hz.**
f2 **stop or second frequency in Hz, valid range is f1 to 120.0 E+6 Hz.**

Example: FMFSK 1 1.0 10000.0<cr>

This command will set the first frequency to be 10 Hz and the second frequency to be 10 kHz. <cr> is a carriage return.

FMFSK? queries the instrument frequency shift keying settings.

FMFSK? [id]<cr>

FMFSK? is executed following a carriage return.

The results of the query are in the following format.

FMFSK? [id] [f1] [f2]<cr>

Example: FMFSK? 1<cr>

Queries the instrument frequency shift keying settings of synthesizer module one. <cr> is a carriage return. The function will return:

FMFSK? 1 1.0 10000.0<cr>

FMSWP, FMSWP?

FMSWP is used set the frequency sweep parameters of the selected synthesizer module.

FMSWP [id] [f1] [f2] [df] [rate]<cr>

FMSWP has 5 parameters and is executed following the carriage return <cr>

id	**synthesizer id, valid values: 1, 2, 3**
f1	**start or first frequency in Hz, valid range is 0 to 120.0 E+6 Hz.**
f2	**stop or second frequency in Hz, valid range is f1 to 120.0 E+6 Hz.**
df	**step frequency in Hz, valid range is 1uHz to (f2-f1).**
rate	**the frequency step rate, valid range is 286.1 Hz to 150.0 E+6 Hz.**

Example: FMSWP 1 1.0 10000.0 1.0 1000.0<cr>

This command will set the start frequency to be 10 Hz and the stop frequency to be 10kHz. The frequency will increment with a step size of 1 Hz at a rate of 1000 steps per second. <cr> is a carriage return.

FMSWP? queries the instrument frequency sweep settings.

FMSWP? [id]<cr>

FMSWP? is executed following a carriage return.

The results of the query are in the following format.

FMSWP? [id] [f1] [f2] [df] [rate]<cr>

Example: FMSWP? 1<cr>

Queries the instrument frequency sweep settings of synthesizer module one. <cr> is a carriage return. The function will return:

FMSWP? 1 1.0Hz 10000.0Hz 1.0Hz 1000.0Hz<cr>

FSK

FSK enables or disables the frequency shift keying. When frequency shift keying is enabled a rising edge on the external trigger will toggle the frequency from f1 to f2 or vice-versa. A software trigger will do the same. Use the TRIG command to issue a software trigger.

FSK [id] [askcmd]<cr>

FSK has 2 parameters and is executed following the carriage return <cr>

id **synthesizer id, valid values: 1, 2, 3**
fskcmd **frequency shift command:**

0 – disabled
1 – enabled
2 – set frequency to f1
3 – set frequency to f2

Example: FSK 1 0<cr>

Disables frequency shift keying of the first synthesizer module. <cr> is a carriage return.

FREQ, FREQ?

FREQ is used to set the frequency of the selected synthesizer module.

FREQ [id] [freq] <cr>

FREQ has 2 parameters and is executed following the carriage return <cr>

id	**synthesizer id, valid values: 1, 2, 3**
freq	**range ± (0 to 120.0 E+6 Hz) resolution is 1.0 E-6Hz.**

Example: FREQ 1 0.001<cr>

The frequency of the first synthesizer will be set to 1 MHz. <cr> is a carriage return.

FREQ? queries the instrument frequency setting.

FREQ? [id]<cr>

FREQ? is executed following a carriage return.

The results of the query are in the following format.

FREQ? [id] [freq]<cr>

Example: FREQ? 1<cr>

Queries the frequency setting of synthesizer module one. <cr> is a carriage return. The function will return:

FREQ? 1 0.001 Hz<cr>>

HELP

HELP is used to display basic help on the ASCII command set.

HELP<cr>

HELP is executed following the carriage return <cr>

Example: HELP<cr>

LOCL

LOCL turns off the RS-232 communications and returns control to the LCD screen and keypad on the instrument.

LOCL<cr>

LOCL is executed following the carriage return <cr>

PHAS, PHAS?

PHAS changes the phase of the selected synthesizer module.

PHAS [id] [phase]<cr>

PHAS has 2 parameters and is executed following the carriage return <cr>

id	**synthesizer id, valid values: 1, 2, 3**
phase	**value is in degrees, the range is 0 to +/- 360, and the resolution is 0.022 deg.**

Example: PHAS 1 36<cr>

Sets the output phase of the first synthesizer module to +36 degrees from the phase = 0 condition. Note that if **phase** = 360 deg and we issue a **PHAS 1 360<cr>** command the output phase will not change because the synthesizer output is already at 360 deg.

PHAS? queries the instrument phase.

PHAS? [id]<cr>

PHAS? is executed following a carriage return.

The results of the query are in the following format.

PHAS? [id] [phase]<cr>

Example: PHAS? 1<cr>

Queries the phase of the first synthesizer module. <cr> is a carriage return.
The function will return:

PHAS? 1 36 deg<cr>

PLL

PLL is used to select the frequency reference for the synthesizer. The phase locked loop can be enabled to allow locking of the synthesizer to an externally provided 10 MHz reference. DC tuning of the internal 10 MHz reference is selected when the PLL is turned off.

PLL [pllcmd] <cr>

PLL has one parameter and is executed following the carriage return <cr>

pllcmd **0 – pll disabled. DC tuning of internal 10 MHz reference is selected. The tuning voltage is applied to the external reference SMA input. The tuning voltage should not exceed +/-5 VDC. The tuning bandwidth is approximately 300 Hz and the tuning port impedance is 10 kOhm.**

1 – pll enabled. Locking to an externally provided 10 MHz signal is enabled. The 10 MHz signal should be applied to the external reference SMA input. The level of the 10 MHz signal should be between +10 dBm to +15 dBm for optimal operation. Locking to signals as low as +3 dBm is possible, however there may be a degradation in the close in phase noise.

Example: **PLL 1<cr>**

PLL is enabled and the synthesizer will lock to an external 10 MHz reference. <cr> is a carriage return.

PLL?

PLL? queries the critical levels and voltages in the main instrument control loop.

PLL?<cr>

PLL? is executed following the carriage return <cr>

OSC Power level of the internal oscillator. Valid range +11.0 to +13.0 dBm.

REF Power level of external reference signal. Valid range +10 to +16 dBm.

LOCK Voltage of the lock detector. Valid range is 0.2 to 0.35 V.

PLL Tuning port voltage on the oscillator. Valid range is +/- 5 V.

Note that if the tuning port voltage exceeds +/- 5 V the instrument will lose phase-lock to the external reference. This voltage can also be monitored and used to decide when the internal oscillator must be mechanically tuned to adjust for aging.

Example: PLL?<cr>

Queries the critical levels and voltages in the LNFS-100 control loop. <cr> is a carriage return.

The function returns:

PLL? Osc: 12.0dBm Ref: 15.0dBm Lock: 0.3V PLL: -0.2V

Note if the pll is disabled only the internal oscillator level will be returned.

PLL? Osc: 12.0dBm DC Tuning Enabled

PMPSK, PMPSK?

PMPSK is used to set the phase shift keying parameters of the selected synthesizer module.

PMPSK [id] [p1] [p2]<cr>

PMPSK has 3 parameters and is executed following the carriage return <cr>

id **synthesizer id, valid values: 1, 2, 3**
p1 **first phase in degrees, valid range is +/- 360 degrees.**
p2 **second phase, valid range is +/- 360 degrees.**

Example: PMPSK 1 0.0 180.0<cr>

The output of the first synthesizer module will change in phase from 0 degrees to 180 degrees. <cr> is a carriage return.

PMPSK? queries the phase shift keying parameters.

PMPSK? [id]<cr>

PMPSK? executed following a carriage return.

The query returns the phase shift keying parameters.

The results of the query are in the following format.

PMPSK? [id] [p1] [p2]<cr>

Example: PMPSK? 1<cr>

Queries the phase shift keying parameters of the first synthesizer module. <cr> is a carriage return. The function will return:

PMPSK? 1 0.0Deg 180.0Deg<cr>

PSK

PSK enables or disables phase shift keying of the selected synthesizer module. When phase shift keying is enabled a rising edge on the external trigger will toggle the phase from p1 to p2 or vice-versa. A software trigger will do the same. Use the TRIG command to issue a software trigger.

PSK [id] [pskcmd]<cr>

PSK has 2 parameters and is executed following the carriage return <cr>

id **synthesizer id, valid values: 1, 2, 3**
pskcmd **phase shift command:**

0 – disabled
1 – enabled
2 – set phase to p1
3 – set phase to p2

Example: PSK 1 0<cr>

Disables phase shift keying of the first synthesizer module. <cr> is a carriage return.

SWP

SWP enables or disables the frequency sweep function of the selected synthesizer module. When frequency sweeping is enabled, a rising edge on the external trigger of the selected synthesizer module will toggle the frequency sweep from f1 to f2 or vice-versa. A software trigger will do the same. Use the TRIG command to issue a software trigger.

SWP [id] [swpcmd]<cr>

SWP has 2 parameters and is executed following the carriage return <cr>

id **synthesizer id, valid values: 1, 2, 3**
swpcmd **frequency sweep command:**

0 – disabled
1 – enabled
2 – auto sweep

Example: SWP 1 1<cr>

Enables the frequency sweep function on the first synthesizer module. <cr> is a carriage return. The hardware trigger should be provided at the Aux 1 port for synthesizer 1.

TEMP?

TEMP? Queries the system temperature.

TEMP?<cr>

TEMP? is executed following a carriage return,

Example: TEMP?<cr>

Returns

TEMP? 40.1C<cr>

TIME, TIME?

TIME changes the time of day of the instrument.

TIME [hr:min:sec] <cr>

TIME has 3 parameters and is executed following the carriage return <cr>

hr **Hour valid range 0 – 23**

min **Minutes valid range 0 – 59**

sec **Seconds valid range 0 – 59**

Example: TIME 12:01:00<cr>

Sets the time of day to 12 hours, 1 minute and 0 seconds. <cr> is a carriage return.

TIME? Queries the system time of day.

TIME?<cr>

TIME? is executed following a carriage return,

Example: TIME?<cr>

Returns

TIME? 12:01:31<cr>

TRIG

TRIG issues a software trigger on the selected synthesizer module.

TRIG [id]<cr>

TRIG has 1 parameter and is executed following the carriage return <cr>

id **synthesizer id, valid values: 1, 2, 3**

Example: **TRIG 1<cr>**

Issues a software trigger on synthesizer module one. This is the equivalent of a rising edge arriving on the Aux 1 input connector. <cr> is a carriage return.

*RST

***RST** resets the synthesizer to default power on settings.

***RST<cr>**

*RST is executed following the carriage return <cr>

Example: *RST<cr>

Resets the synthesizer. <cr> is a carriage return.

*SRE, *CLS

***SRE** queries the synthesizers for the value of the status register.

***SRE<cr>**

*SRE is executed following a carriage return.

The results of the query are in the following format.

SRE [status]<cr>

status is an 8-bit value that contains the sum of the error conditions. status is 0 when there are no errors.

External reference error	0x01
Internal oscillator error	0x02
PLL Lock error	0x04
Tuning voltage error	0x08
Invalid parameter	0x10
Invalid command	0x20
Reserved 1	0x40
Reserved 2	0x80

Example: ***SRE<cr>** query status
SRE 10 the return value indicates that an invalid parameter was sent to the synthesizer.

***CLS** clears the status register and turns off the status LED.

***CLS<cr>**

*CLS is executed following a carriage return.

Troubleshooting

The LNFS-100 needs up to 30 minutes to warm up after power is applied to the unit. After this warm up period the power on LED and the OSC signal LED should be on. On power on the instrument phase locked loop is turned off and the synthesizer has DC tuning enabled. To lock to an external 10 MHz reference. Connect a 10 MHz signal with a level of +10dBm to +15 dBm to the external reference input SMA on the front panel. Once the external reference is applied the external reference signal LED will turn on. Proceed to enter the PLL screen from the keypad and enable the PLL function by pressing the EXT key in the PLL Screen. The LNFS-100 will automatically lock to the external reference. Once the PLL is locked the PLL lock LED will turn on. The status LED will remain on if an error condition occurs and will stay on until the PLL Screen is invoked and the PLL status is reviewed. NOTE that the PLL can also be enabled in remote control mode.

Problems

Unit does not turn on.

Check power cord, fuses and make sure on/off switch is in on position.

Unit does not respond to keypad

Make sure unit is in local control mode and not in RS-232 mode.

External reference signal LED is off

Check that the external 10 MHz signal is present and that the level is between +10 and +15 dBm.

PLL Lock LED is off or blinking

Check that the external 10 MHz signal is present. Check that the frequency of the external reference is 10.0 MHz +/- 0.1 Hz and that the level is between +10 and +15 dBm. Check that the PLL is enabled.

Check that the LNFS-100 output is present.

Check PLL status using the PLL Screen function.

- OSC level should read +12 dBm +/- 2.0 dB
- REF level should be between +10 dBm and +15 dBm.
- LOCK voltage should be greater than 0.2 V
- PLL voltage should be between +4.5 V and –4.5V
- The unit temperature should not exceed +50C.

If the unit remains unlocked the oscillator may require mechanical tuning. Refer to the Mechanical Tuning section on page 8.

Troubleshooting

OSC signal LED is not on
Send unit to SpectraDynamics, Inc. for repair.

STATUS LED is on
Activate the PLL Screen and check the PLL status and make sure that the external reference is adequate. If the RS-232 control mode is being used use the *SRE command to read the status register and the *CLS command to clear the status register.

RS-232 communications failed
Check that the correct RS-232 cable is being used.
Do not use a null modem adapter.
Check baud rate of the LNFS-100 and set the controller to the same baud rate.
Use the TEST function to test the serial connection.
The DATA LED should flash when data is being received by the LNFS-100.
Make sure that the LNFS-100 is in remote control mode and not in local control mode.

If any error condition persists please contact technical support.

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

Warranty

Warranty

The LNFS-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 an LNFS-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 judgment 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.