



**APPLIED INSTRUMENTS, INC.**

RF TEST AND MEASUREMENT

# NS-3 RF Noise Source Operation Manual



**Version 2.04**

June 3, 2016

## SPECIFICATIONS

Frequency .....	5 MHz to 2.15 GHz.
Maximum output level .....	at least -90 dBm/Hz (+50 dBmV) total power +13 dBmV @ 280 kHz bandwidth +26 dBmV @ 5.2 MHz bandwidth -17 dBm @ 20 MHz bandwidth
Output flatness .....	±1.5 dB 5 MHz to 1 GHz
(at max output level)	±2.0 dB 1 GHz to 2 GHz ±3.0 dB 5 MHz to 2.15 GHz
Impedance .....	75 Ohm (standard), 50 Ohm (optional)
Displayed level .....	relative
Repeatability .....	±0.5 dB
Level adjustment .....	30 dB, in steps of 0.1, 1.0 or 10 dB
Input power .....	120/240 VAC
Output connector .....	Front panel Type BNC or F female (standard) Rear panel Type SMA, N, BNC, or F female (optional)
Size, Weight .....	7.3"W x 3.7"H x 9.25"D, 4.5 lbs. (18.5cm) x (9.4cm) x (23.5cm), 2.04 kg

Recommended duration between conformance inspections: two years

*Specifications subject to change without notice*

## **1. Introduction**

The Applied Instruments Model NS-3 RF Noise Source generates a high quality RF noise signal for laboratory and field use.

### **Features**

- 5 MHz to 2.15 GHz frequency range
- 30 dB of adjustment range in 0.1 dB steps
- Adjustable step size in addition to direct numeric entry
- On/off pulsed modulation modes in three speeds
- Settable reference point
- Remote control via RS232 and/or USB port

### **Standard Accessories**

- AC Line cord
- 30" patch cable
- USB cable

### **Options**

- Rack-mount kit
- 75 Ohm or 50 Ohm output impedance
- Rear panel RF output connector (Type SMA, N, BNC, or F)
- BNC 75 to 50 ohm matching pad (75 ohm male BNC to 50 ohm female BNC)
- External RF amplifier
- External band-pass filters, inquire for frequencies

## 2. Safety and Service

### 2.1. Symbols Used

The following symbols are used in this manual and/or marked on the instrument.



Hazardous areas on the instrument are marked with this symbol. Consult this manual to learn the nature of the hazard and proper actions for safe operation.



Indicates an earth ground terminal



Indicates possibility of electric shock



Indicates a protective conductor terminal

### 2.2. Safety Instructions

- Read and follow all instructions in this manual.
- Risk of electrical shock exists if the unit is opened when AC is connected.
- Cleaning: Unplug and turn unit off before cleaning. Clean with a dry cloth only.
- Use only the cord supplied with the unit or an equivalent cord rated for at least 1.4 Amps and containing a protective earth ground conductor.
- Servicing should be done by qualified service technicians only.
- Use of the instrument in a manner not consistent with the instructions in this manual may impair the safety features and lead to damage or injury.

### 2.3. AC Operation



When operating the instrument from AC power, adhere to these rules:

1. Warning: The appliance coupler (AC cord) is used as the disconnect device. Do not position the instrument so that it is difficult to operate the appliance coupler.
2. Use only the cord supplied with the unit or an equivalent cord rated for at least 1.4 Amp and containing a protective earth ground conductor.
3. Warning: The AC plug shall be connected to a mains socket outlet with a protective earthing connection.

### 2.4. Operating Conditions

This instrument is intended for use under the following environmental conditions. Use outside of these conditions may result in safety hazards, incorrect operation, or damage.

1. Indoor use
2. Altitude  $\leq$  2000 meters
3. Ambient temperature 10 °C to 50 °C
4. Relative humidity  $<80\%$  up to 31 °C,  $<50\%$  at 40 °C
5. AC voltage  $\pm 10\%$  of nominal (some temporary over-voltage tolerated)
6. Transient voltage spikes  $<2500$  Vp
7. Pollution degree 2 or less, non-conductive pollution

## 2.5. Water Ingress and Mounting

Do not set up or use unit where liquids or other conductive materials are used. Ensure that no liquids are spilled into the unit.

If water or other conductive material enters the enclosure, immediately turn off the unit and unplug it. Contact a qualified technician or return the unit to Applied Instruments for repair.

## 3. Servicing Instructions

With normal use, the only servicing of the unit that should be expected is recalibration. A calibration period of two years is recommended.

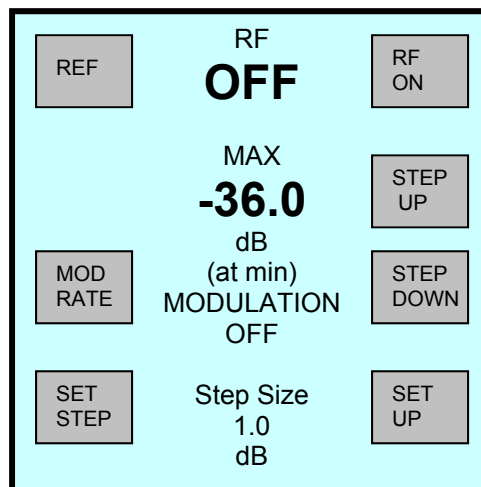
**All service should be performed by a qualified technician only.**



**WARNING:** Risk of shock is present when the cover is removed and AC power is present. Be sure to disconnect from AC before opening the unit.

## 4. Front Panel Operations

After a brief start-up message indicating the firmware version number, the main screen is displayed:



The “soft keys” displayed on the LCD screen are positioned next to their corresponding buttons. The screen is NOT a touch screen, you have to press the button next to the function shown on the screen.

### RF ON/OFF

Press the RF ON soft key to turn the RF output on. The key label will change to “RF OFF” to indicate the action when the button is pressed a second time. The present state is shown in the center of the screen.

### REFERENCE MODE

The RF level is displayed in dB in one of three ways:

- 1) dB down from the maximum output

- 2) dB up from the minimum level
- 3) dB up or down from a set reference level

You select the reference mode by pressing the "REF" soft key. The selected mode appears just above the level number in the middle of the screen. When changing the reference mode, the level itself does not change, but the displayed number will change according to the new mode.

**REFERENCE LEVEL**

When the "REF" reference mode is selected, you can set the reference level by pressing the "SET REF" key. This key is not available or displayed when either the "MIN" or the "MAX" modes are selected.

When you press the "SET REF" key, the displayed level changes to zero (the actual output level does not change). Now you can adjust the level either up or down from this new reference level.

**LEVEL ADJUSTMENT**

There are several ways to change the RF output level:

If you know what numeric value you want, you may use the numeric keypad to enter the number and press the “ENTER” key when finished.

Or, you may use the arrow keys to adjust any digit of the displayed number either up or down. Use the left and right keys to move the cursor between the digits. The level will change as you press the up and down arrow keys. This method allows easy adjustment in 10 dB, 1 dB or 0.1 dB steps.

Finally, you may use the “STEP UP” and “STEP DOWN” soft keys to step up or down at the defined step size.

**STEP SIZE**

The step size is shown at the bottom of the screen and may be set by pressing the “SET STEP” key, entering the step size with numeric keys and pressing “ENTER”.

**MODULATION**

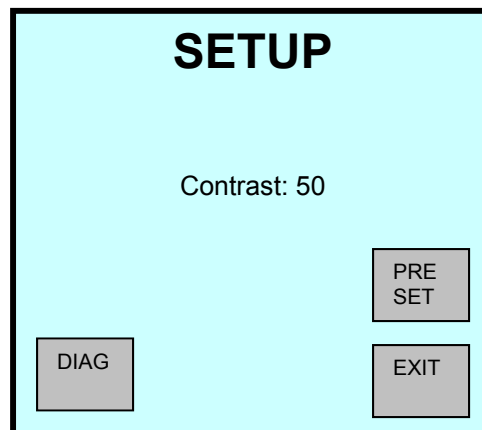
The modulation feature cycles the RF on and off at a 50% duty cycle at three selectable rates:

SLOW – 10 seconds per cycle  
MED – 1 second per cycle  
FAST – 50 cycles per second  
NONE – no cycling

Press the “MOD RATE” soft key to select the desired rate.

**SETUP**

Press the “SET UP” soft key to display the setup screen. This screen lets you enter the desired screen contrast value with the numeric pad or press ENTER and adjust with the arrow buttons. Press ENTER when finished.



The contrast is temperature compensated and should be legible at any operating temperature once it is set.

Press PRESET to return all settings to the factory default settings.  
Press EXIT to return to the main screen.

The “DIAG” soft key allows access to a diagnostic screen intended for service technicians only.

**BACKLIGHT**

The screen backlight has four settings: off, low, medium and high. When turned on with AC power, the backlight is set to high.

The backlight setting may be changed with the +/- key. You must press the key *twice* to change the backlight. The first press is interpreted as either the + or the – and used to change the sign of number being entered. Press it repeatedly until the desired backlight setting is obtained.

## **5. Rear Panel Functions**

The rear panel contains the following items:

- 1) AC power input jack
- 2) RS232 DB-9 connector
- 3) USB connector
- 4) Power option switch
- 5) Rear RF output connector hole

**AC Power Input**

The AC power input jack accepts a standard IEC power cord and may be plugged into 120V or 240V AC power, 50 or 60 Hz. A United States cord is standard; other cords are available on request.

**RS232 Connection**

A standard PC style serial cable with a DB-9 connector may be used to connect a PC to the RS232 port of the NS-3. This enables the remote control functions to be used.

**USB Connector**

The USB port provides the same remote functions as the RS232 port. A standard USB cable is included.

**Power Option Switch**

For use in automated test applications, the power option switch enables the instrument to automatically power up whenever AC power is applied. This is useful when installing the NS-3 as part of an equipment rack: the unit will power up when the rack is turned on.

**Rear RF output connector hole**

A rear panel RF output connector is available as an option instead of the front panel connector for the RF output. This is also useful in automated test applications. Connector options include SMA, N, BNC, or F female (specify 75 Ohm or 50 Ohm desired impedance).



## 6. Remote Operations

The NS-3 may be controlled remotely through the RS232 or USB serial ports.

If using the USB port, a standard cable is provided, and a USB virtual com port driver must be installed on your PC. The driver makes the NS-3 appear as another com port on your PC. You may then use any terminal emulation software to communicate with the NS-3.

NOTE: The driver is available from:

[www.appliedin.com/downloads/ns3driver.exe](http://www.appliedin.com/downloads/ns3driver.exe)

If you are using an actual RS232 port, you will need a standard straight-thru 9 pin serial cable (not a null-modem cable). This can be obtained from Applied Instruments or any computer outlet.

Set the serial port on your PC to 9600 baud, 8 data bits, no parity, 1 stop bit, flow control none.

The command set conforms to the SCPI standard and is described below. See <http://www.ivifoundation.org/docs/scpi-99.pdf> for more information on the SCPI standard.

The commands are described below in the standard SCPI notation. Commands are terminated with a carriage return character. Most commands have a query form (trailing question mark) that returns the present value.

### Syntax notes:

1. Commands parts in brackets below are optional.
2. Uppercase denotes required spelling, lower case optional spelling.
3. Either case is accepted.
4. Boolean values may be entered as "OFF", "ON", "0" or "1". "0" is the same as "OFF".

### 6.1. RF On/Off

OUTPut[:STATe] <Boolean>      Turns the RF output on or off.  
OUTPut[:STATe]?                Returns 0 or 1.

Examples:

**output:state on**  
**outp on**  
**output off**

### 6.2. Level Control

[OUTPut:]ATTenuation <value>                Sets the attenuation in dB  
[OUTPut:]ATTenuation?                        Returns the attenuation in dB

The output power level is set to the maximum output minus the attenuation value used here. This corresponds to the MAX reference type on the front panel operations. The MIN and REF types are not supported via remote commands. The step size and stepping functions are also not supported by the remote commands.

Examples:

**Output:attenuation 10.5**  
**attenuation 20**  
**att 5.1**

### 6.3. Modulation

[SOURCE:]PULM[:STATE] <Boolean>	Turns the modulation on or off
[SOURCE:]PULM[:STATE]?	Returns the modulation state (0 or 1).
[SOURCE:]PULM:[INTERNAL:]FREQUENCY <value>	Sets the modulation frequency in Hz.
[SOURCE:]PULM:[INTERNAL:]FREQUENCY?	Return the modulation frequency in Hz.

The NS-3 supports only three pulse frequencies: slow=0.1 Hz, med=1 Hz and fast=50 Hz. The SCPI command uses a numeric value; the NS-3 translates the given frequency into the closest supported frequency.

Examples:

**Source:pulm:state on**  
**Pulm:frequency 50**  
**Pulm:freq?**  
**Pulm off**

### 6.4. Error Reporting

The system error query command is supported for a few types of errors:

SYSTem:ERRor?

Returns one of the following:

0, "No error"  
-100, "Command error"  
-350, "Queue overflow"

### 6.5. SCPI Required Commands

The following commands are implemented as required by the SCPI standard but have no real function in the NS-3.

*CLS	Clear Status Command
*ESE	Standard Event Status Enable Command
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*IDN?	Identification Query
*OPC	Operation Complete Command
*OPC?	Operation Complete Query
*RST	Reset Command
*SRE	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query
*TST?	Self Test Query
*WAI	Wait to continue Command

The NS-3 has no overlapped commands so the \*OPC, \*WAI and \*OPC commands are not needed.

### 6.6. Multiple Commands

SCPI allows multiple commands to be strung together on the same line separated by semi-colons. This feature is not implemented in the NS-3.

## WARRANTY

The Applied Instruments NS-3 is warranted against defects in materials and workmanship for a period of twelve months. Applied Instruments agrees to repair or replace any assembly or component found to be defective under normal use during this period. Our obligation under this warranty is limited solely to repairing the instrument proved to be defective within the scope of the warranty when returned to the factory. Transportation to the factory is to be prepaid by the customer. Authorization by Applied Instruments is required prior to shipment.

Applied Instruments assumes no liability for secondary charges or consequential damages and, in any event, Applied Instruments' liability for breach of warranty under any contract shall not exceed the purchase price of the instrument shipped, and against which a claim is made.

Any application recommendation made by Applied Instruments for the use of its products are based upon tests believed to be reliable, but Applied Instruments makes no warranty of the results to be obtained. This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for Applied Instruments any liability in connection with the sale of our products other than that set forth herein.

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