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Low Noise Factory

Manual

LNF-PS3b

Low Noise HEMT Power Supply

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1. Introduction

LNF-PS3b is a compact power supply designed for LNF's Low Noise Amplifiers. The drain voltage is regulated and adjustable within a wide range, and the gate voltage is automatically and continuously adjusted to give a set drain current. Vd and Id are displayed on the LCD monitor screen for easy bias control. Vg can be monitored for trouble shooting through the banana sockets on the front panel using a multimeter. Vd and Id are set by trim potentiometers on the front panel. The LNF-PS3b is redesigned from ground up and features new low noise electronic components for much improved performance compared to previous models. There is also a drain voltage sense function for situations where bias wire resistance is significant. The display can be switched off for ultra-low noise operation. The power supply is powered by LNF's Power Block, LNF-PBA.

The LNF-PS3b is delivered with a 1.5-meter cable to be used between the LNF-PS3b and the LNF-PBA. The part number of this cable is LNF-CAB_PBA_PS3b. Also included is a 2-meter-long cable for the DC-output from the LNF-PS3b. The PS3b end has a M12 connector and the other end of the cable is blunt for the end-user to solder their connector to mate with their system. The part number of this cable is LNF-CAB_PS3b_LNA.

2. Specifications

Input					
Parameter	**Description**	**Minimum**	**Nominal**	**Maximum**	**Unit**
+12V range	+12 V rail input voltage range	12	-	15	VDC
-12V range	-12 V rail input voltage range	12	-	15	VDC

Output					
Parameter	**Description/Conditions**	**Minimum**	**Nominal**	**Maximum**	**Unit**
Vd range		0.00		2.40	VDC
Id range		0.00		65.00	mA
Vg range		-10		+10	V
Vd noise	Drain ripple and noise		3		mV_{PK-PK}
Vg noise	Gate ripple and noise		3		mV_{PK-PK}

Environmental					
Parameter	**Description/Conditions**	**Minimum**	**Nominal**	**Maximum**	**Unit**
Storage Temperature		-40		85	°C
Operating Temperature		5		40	°C
Relative Humidity[1]	Non-Condensing	5		80	%RH

[1] The LNF-PS3b is for indoor use only, pollution degree 2.

Physical	
Weight	354 g
Dimensions	98 (W) x 44 (H) x 99 (D) millimeters

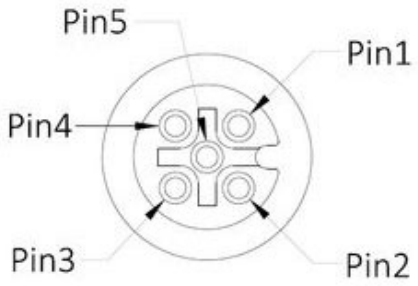
3. Before Starting Use

After unpacking, make a visual inspection that there is no damage to the unit. If any damage is found, please contact the factory prior to taking it into operation.

4. Wiring

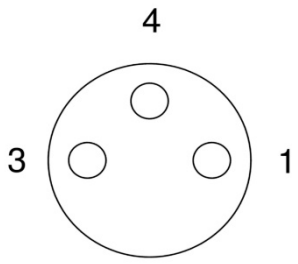
The PS3b comes with a cable to connect it to the Power Block, LNF-PBA. This cable has a M8 female connector in one end and a M8 male in the other end. It is possible to use the PS3b with a standard lab supply capable of delivering +/-12 VDC. The maximum current from +12 V and -12 V is 150 mA and 25 mA respectively. If a third-party supply is used to power the PS3b, then simply replace the female connector on the supplied cable with a suitable one for the third-party power supply.

Pinout of M12 DC OUT Connector				
Pin #	**Function**	**Wire Color Cable V1**	**Wire Color Cable V2**	**Wire Color Cable V3**
1	Vd	Blue	Brown	Black
2	Vd_sense+	Blue/White	White	Brown
3	Vd_sense-	Orange	Blue	Red
4	Vg	Orange/White	Black	Orange
5	GND	Green	Yellow/Green	Yellow
Shield	Earth	Foil	Foil	Foil



Female connector seen from connector side

Pinout of M8 DC IN Connector		
Pin #	**Function**	**Wire Color of Included Cable**
1	+12 V	TBD
3	-12 V	TBD
4	GND	TBD
Shield	Earth	Foil



Female connector seen from connector side

The PS3b comes with a cable for the DC OUT connection to the LNA. It has a 5 pin M12 connector in one end while the other end is blunt for the end-user to attach a suitable connector for their system. If the LNA to be powered by the PS3b is for room temperature operation, solder the 9-pin nano-D connector pigtail connector to the open end of this cable. For cryogenic LNAs, a connector compatible with your cryo cooler should be used. It is recommended to not connect the shield in the LNA end. In the general case, the Vd sense function is not needed, but if the cryo cooler is equipped with high resistance wires, the sense function could come in handy. It is recommended to keep the actual Vds at the LNA terminals to +/-0.05 V of the nominal Vds. We can consider the example when nominal Ids and Vds are 12 mA and 0.5 V respectively and the drain and ground wire resistance in the fridge are 10 ohm each. We set Vds = 0.5 V and Ids=12 mA on the PS3b. The actual Vds at the LNA terminals will be:

$$V_{dsLNA} = V_{ds\_supply} - R_{drain} \times I_{ds} - R_{gnd} \times I_{ds}$$
$$V_{dsLNA} = 0.5 - 10 \times 0.012 - 10 \times 0.012$$
$$V_{dsLNA} = 0.26\,V$$

Where:

V_{dsLNA}= the actual V_{ds} at the LNA terminals
V_{ds_supply}= V_{ds} supplied by the PS3b
R_{drain}= Drain wire resistance
R_{gnd}= Ground wire resistance

In this example using the Vd sense function would ensure a properly biased LNA which performs maximally. Note that if the power supply is not run in floating configuration (See section 6 in the manual for LNF-PBA), the ground return current is likely to take a different path back to the power supply than through the 10 ohm ground wire. The LNA's DC-ground is connected to its chassis and the chassis likely connected to the ground of the fridge. In this case, the voltage drop is likely to be about half of what it is in the example above.

$$R_{max} = \frac{0.05}{I_{ds}}$$

The equation above can be used as a guideline of the maximum wire resistance Rmax (sum of drain and ground resistance) allowed without having to pay special attention to compensating for the voltage drop. In the example above, the maximum resistance is 4 ohm. In floating mode, this means 2 ohm in each of the drain and ground wires.

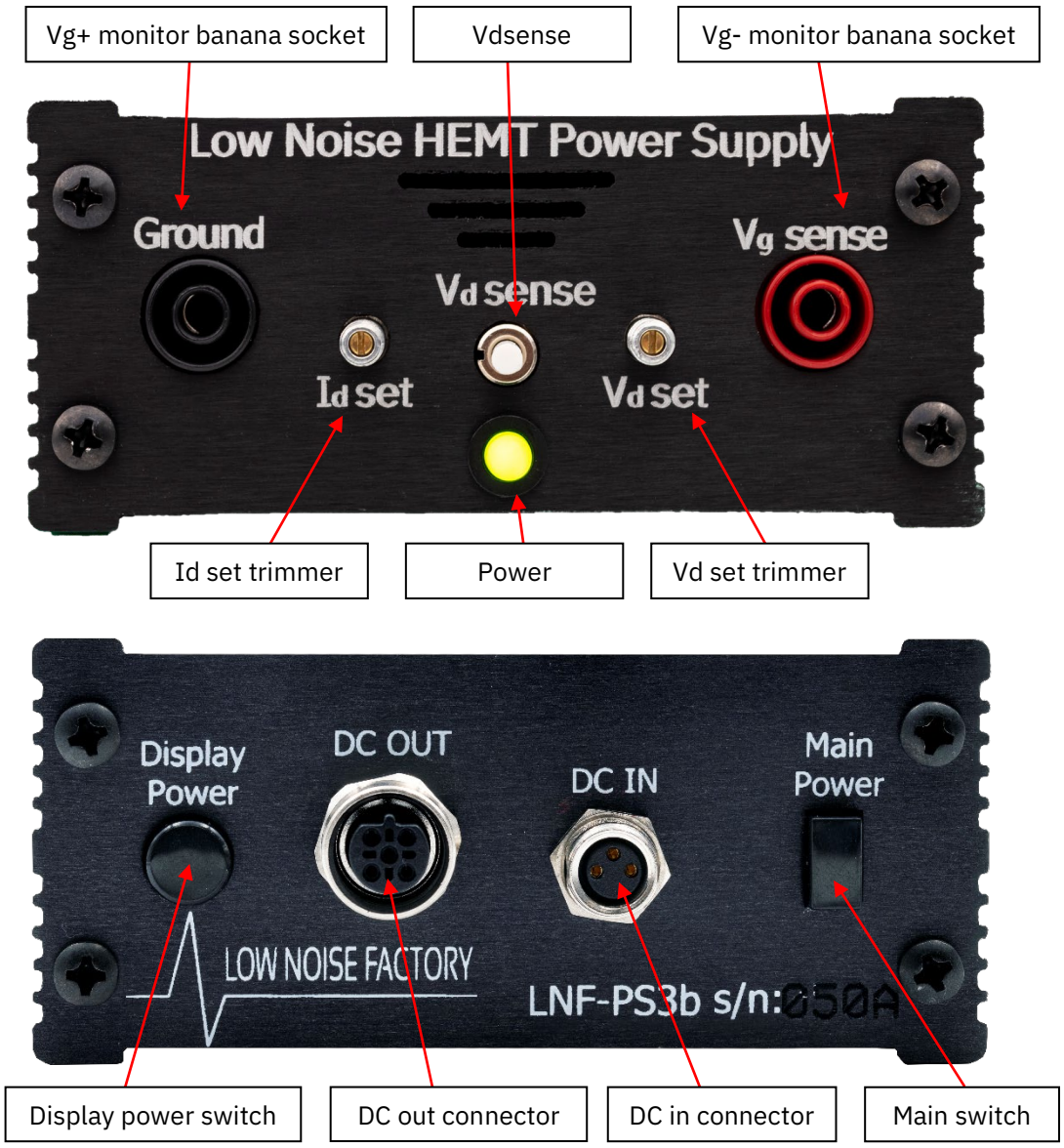
If the Vd sense function is decided to be used, the Vd_sense+ wire should be connected to the drain pin of the LNA close to the nano-D connector. The Vd_sense- wire should be connected to the ground pin of the LNA close to the nano-D connector.

5. Using the Instrument

Once the wiring is done according to section 4, the instrument can be taken into operation.

FIRST TIME POWER UP

1. Connect the LNF-PS3b to the LNF-PBA with the included cable.
2. Ensure the LNF-PBA is in non-floating mode by installing the jumper plug between earth and common.
3. Switch on the LNF-PBA.
4. Switch on the LNF-PS3b.
5. Set Vds to nominal value of the LNA using the trim potentiometer on the front panel of the LNF-PS3b.
6. Switch off LNF-PS3b.
7. Connect the LNF-PS3b to the LNA.
8. Switch on the LNF-PS3b.
9. If floating mode is desired, remove the jumper plug from the LNF-PBA.
10. Adjust Ids to nominal value of the LNA using the trim potentiometer on the front panel.
11. If the Vdsense function is used, press and hold the Vdsense switch on the front panel. The display will now show the actual Vds over the LNA.
12. While holding the Vdsense button pressed, adjust Vds to the nominal value of the LNA.



POWER DOWN

1. Ensure the jumper plug is installed on the LNF-PBA.
2. Switch off the LNF-PS3b using the main power switch.
3. Switch off the LNF-PBA using the mains switch.

SECOND TIME POWER UP

This procedure assumes everything is connected and voltages and currents set to nominal value of the LNA.

1. Ensure the jumper plug is installed on the LNF-PBA.
2. Switch on the LNF-PBA using the mains power switch.
3. Switch on the LNF-PS3b using the main switch.
4. Remove the jumper plug from the LNF-PBA if floating mode is desired.