

L-Band Redundant LNA System

LRL-1100

Introduction

Redundant LNA systems minimize system downtime due to LNA failure by providing a spare LNA and an automatic means of switching to the spare upon failure of a primary LNA. A 1:1 system provides one spare LNA for one primary LNA. The system consists of an outdoor plate assembly which mounts at the antenna hub and an indoor control panel.

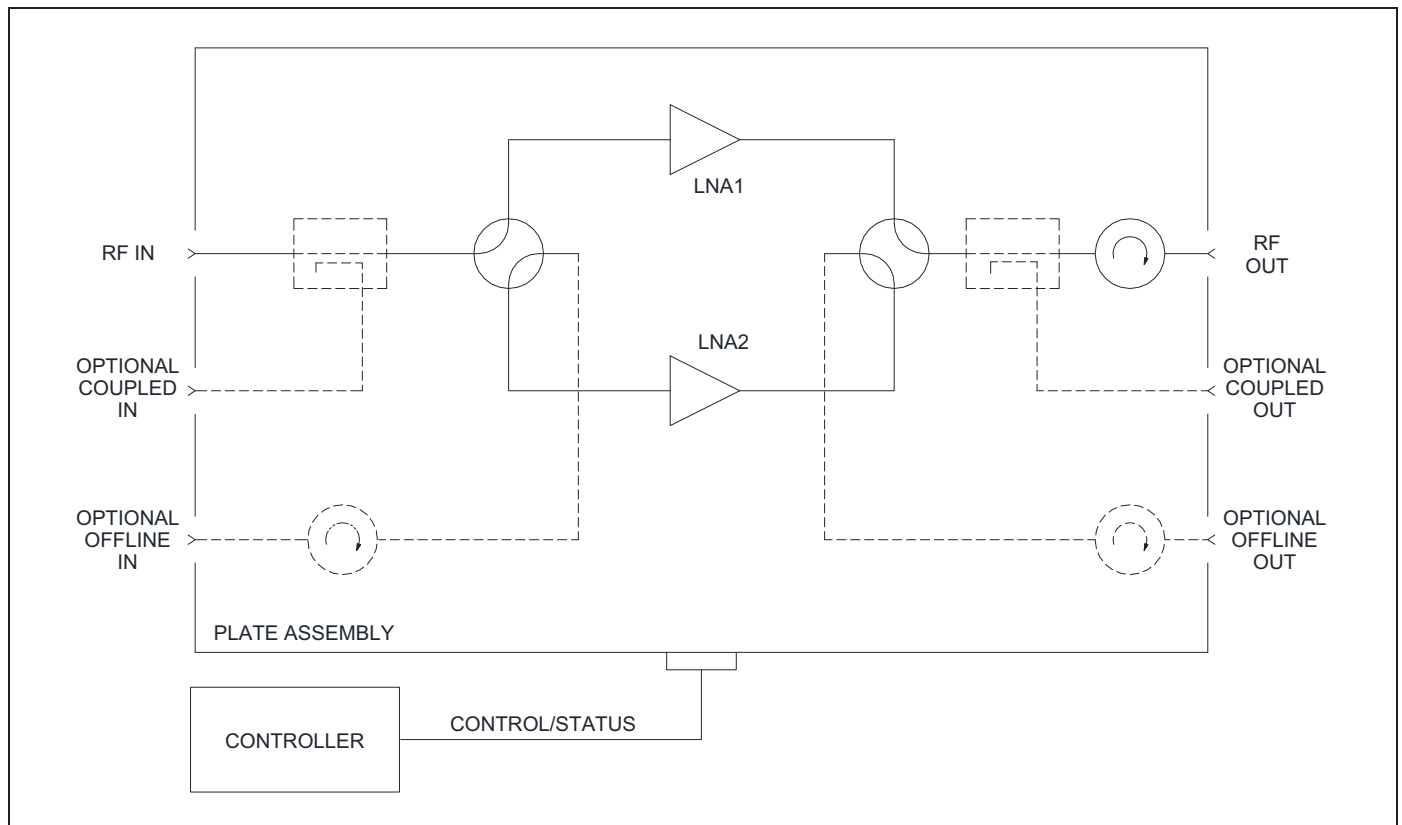
Plate Assembly Features

- High quality dual coaxial switches
- Manual override
- Output coaxial isolator standard
- Input coupler, output coupler, and offline I/O options available

Control Panel Features

- Standard 19" rack panel, 3½" high
- Dual, redundant power supplies
- Worldwide universal AC input capability
- Manual or automatic operation
- Monitors LNA bias currents to detect faults
- Automatically switches to standby LNA when fault occurs
- RS-232/-422/-485 and parallel I/O M&C interfaces
- Audible alarm

System Block Diagram



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System Specifications*

Parameter	Notes	Min.	Nom./Typ.†	Max.	Units
Frequency Range	Band "A"	1.525		1.561	GHz
	Band "B"	1.510		1.577	GHz
Noise Temperature, System	At +23 °C, standard With input coupler Versus temperature			$T_{LNA} + 10$	K
			See Table 1	$T_{LNA} + 25$	K
Gain	Standard LNA	50	53		dB
	LNA with Option 1	60	63		dB
Gain Match	Between LNAs			1	dB
Gain Flatness	Full band Per 10 MHz			±0.5	dB
				±0.25	dB
Gain Stability	Per day, constant temp Versus temperature		-0.04	±0.2	dB dB/°C
VSWR	Input, standard		1.25	1.30	:1
	Input, with coupler		1.30	1.40	:1
	Output		1.20	1.25	:1
Power Output	At 1 dB compression ($P_{1\text{ dB}}$)	+9	+12		dBm
Third Order Intercept	Output, OIP_3	+19	+22		dBm
AM/PM Conversion	At -5 dBm out			0.05	°/dB
Group Delay per 36 MHz	Linear			0.05	ns/MHz
	Parabolic			0.005	ns/MHz ²
	Ripple			1.0	ns p-p
Maximum Input Power	Without damage			+10	dBm
	Desens. threshold 1.625–1.661 GHz			-50 ^A	dBm
Connectors	RF Input, standard RF Input, with coupler RF Output Offline In/Out (Optional) Coupler In/Out (Optional)		SMA Female Type N Female Type N Female Type N Female Type N Female		
Temperature Range	Switch Plate Assy	-40		+60	°C

* System specifications depend on choice of LNA and various options. Specifications shown are for a typical system using LL-1500 series LNAs.

† When there is only one value on a line, the Nom./Typ. column is a nominal value; otherwise it is a typical value. Typical values are intended to illustrate typical performance, but are not guaranteed.

^A -60 dBm for LNAs with Option 1 (60 dB gain).

Part Number/Ordering Information (Copy and FAX this page to General Dynamics.)

LRL-1100

1100 = 1:1 System

Standard system includes:

LNAs	Controller	Plate Assy	O&M Manual	Test Data
2	1	1	✓	✓

Specify LNA Model number: _____ (See LL-1500 Series data sheet.)

Order interface cable separately.

Options Available:

Cable length _____ ft or _____ m
(Up to 500 ft [150 m] in 50 ft [15 m] increments)

Input Coupler:

30 dB (standard), _____ dB (custom)

Output Coupler:

20 dB (standard), _____ dB (custom)

Offline LNA Input/Output Ports:

No isolators, or with isolators

Remote Control Panel (RCP)

Cable for Remote Panel:

_____ ft or _____ m (Up to 4000 ft [1200 m] in 50 ft [15 m] increments)

Additional O&M Manuals, Qty.: _____

Table 1 — Noise Temperature vs. Ambient Temperature

Noise temperature vs. ambient temperature can be found from the equation,

$$NT_2/NT_1 = (T_2/T_1)^n$$

where:

NT_2 = Noise Temperature at T_2

NT_1 = Noise Temperature at T_1

T_2 = Temperature 2 in K

T_1 = Temperature 1 in K

n = 1.5 for the LNAs or = 1.0 for passive losses

For the case where $T_1 = 296$ K (+23 °C), the ratio NT_2/NT_1 is shown in the table below for both LNAs ($n = 1.5$) and for passive losses ($n = 1.0$):

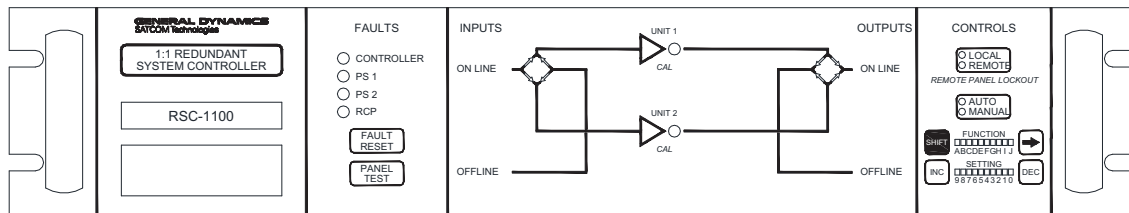
Ambient Temperature T_2 (°C)	$n = 1.5$ NT_2/NT_1	$n = 1.0$ NT_2/NT_1
0	0.89	0.92
+23	1.00	1.00
+40	1.19	1.06
+50	1.14	1.09
+60	1.19	1.13

Example: For a 1:1 system with input coupler option and 50 K LNAs, $T_{LNA} = 50$ K at +23 °C and passive losses = 25 K at +23 °C; thus, $T_{SYS} = 75$ K at +23 °C. What is T_{SYS} at +50 °C?

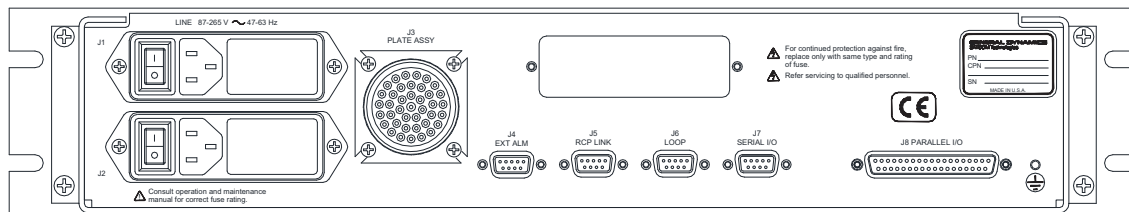
From the table, NT_2/NT_1 at 50 °C = 1.14 for the LNAs and 1.09 for the passive losses:

$$NT_2 = 1.14 \times (50 \text{ K}) + 1.09 \times (25 \text{ K}) = 57 \text{ K} + 27.3 \text{ K} = 84.3 \text{ K at } +50 \text{ °C.}$$

Controller Front Panel:



Controller Rear Panel:



Specifications

Controller

LNA Status Monitor Method	Control panel monitors LNA bias current. Alarm is generated if current goes outside of allowed tolerance window.
Window Width	±5% to ±25% of nominal; software selectable in 5% steps
Switchover Time	100 ms
Serial I/O: Interface Connector	RS-232/RS-422/RS-485 2- or 4-wire 9-Pin D, female
Parallel I/O: Status outputs Control inputs Connector	Form 'C' dry contacts; 100 Vdc, 0.5 A, 3 W max (resistive load) Contact closures to ground; withstand 15 V, sink 20 mA 37-pin D, male
Controller Dimensions	19" (483 mm) W x 3.47" (88.1 mm) H x 17.5" (445 mm) D; 25 lb (11.4 kg)
Chassis Slides	Standard
Cable Length to Plate Assy	Order cable separately. 100 ft (30 m) to 500 ft (150 m) lengths in 50 ft (15 m) increments are standard; other lengths are available by special order.
AC Input	87-265 Vac, 47-63 Hz, 100 W. Dual AC inputs and dual redundant power supplies.
Operating Temperature Range	0 to +50 °C

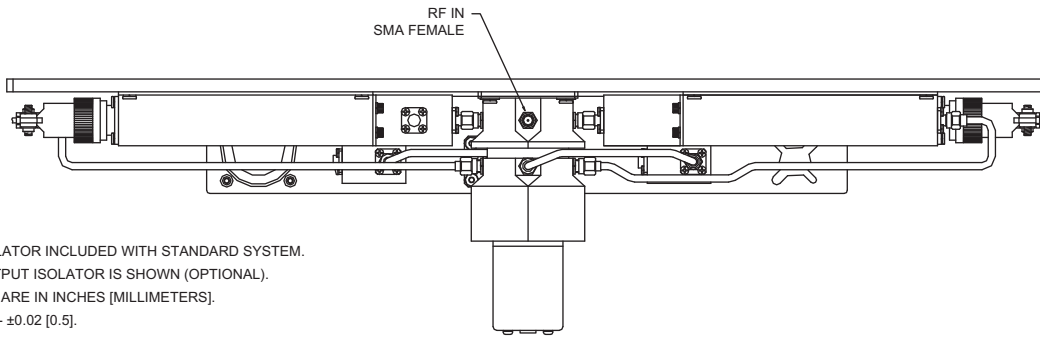
Front Panel Controls and Indicators

LNA Status Alarms	LED Indicators glow green when OK, red when an LNA fault is detected.
PS1, PS2 Indicators	Glow red to show fault with dual redundant power supplies.
Panel Test Pushbutton	Lights all indicators & test audible alarm.
Unit Pushbuttons and Indicators	Pushbuttons are used to manually switch the LNAs. Arrow indicators show which LNAs are switched on-line. Unit indicators light red to show faulted LNAs. In 1:1 systems, LNA1 is normally the primary LNA and LNA2 is on standby.
Auto/Manual Switch and Indicators	In Auto mode, an LNA failure initiates automatic switchover to the standby LNA. In manual mode, the on-line LNA can be selected from the front panel.
Remote/Local Switch and Indicators	Selects either local control, or remote control from serial I/O, parallel I/O, or remote panel.

Rear Panel I/O Interface

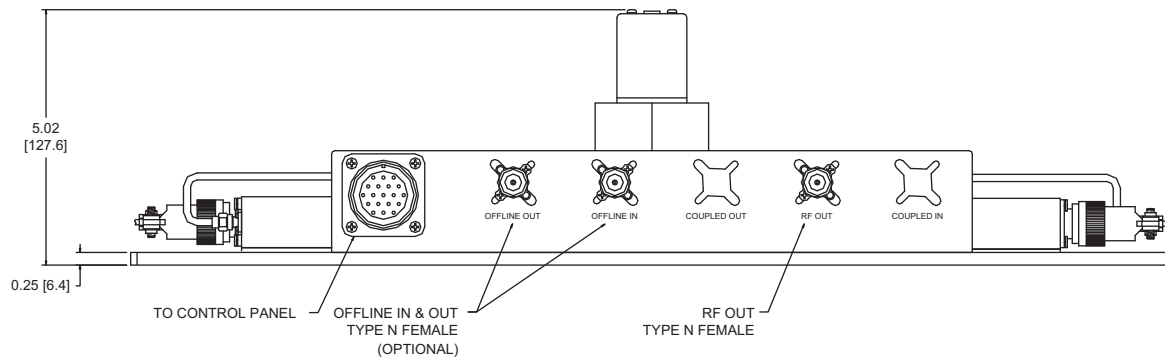
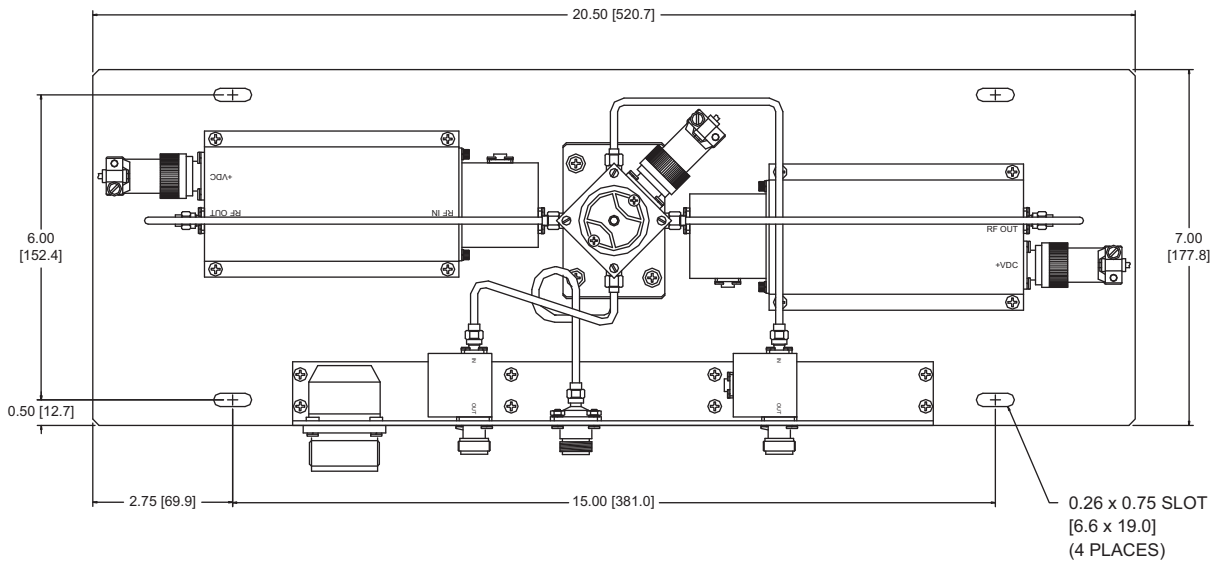
LINE 1 - J1, LINE 2 - J2	Dual power entry modules contain the AC line input connector, fuses, and power switch. System can be powered from separate AC lines if desired. Either or both power supplies are capable of operating the system.
TO PLATE ASSEMBLY - J3	Cable to antenna plate assembly carries LNA power and switch drive signals. Order cable separately. Standard lengths are from 100' (30 m) to 500' (150 m) in 50' (15 m) increments; other lengths are special order.
Parallel I/O - J8	<p>Parallel I/O connection for customer control or monitoring. Capable of controlling all features of the system except remote/local switch.</p> <p>Form 'C' relay contact outputs:</p> <ul style="list-style-type: none"> • LNA1 status • PS1 status • Auto/Manual mode • LNA2 status • PS2 status • Local/Remote mode • Switch position <p>Control inputs—contact closure to ground:</p> <ul style="list-style-type: none"> • LNA1 select • LNA2 select • Auto/Manual select
Serial I/O and Loop - J6 & J7	RS-232/RS-422/RS-485 connectors for user M&C System. Commands provide monitoring, controlling, and configuration.
RCP Link - J5	For optional Remote Control panel, which duplicates all front panel functions.
External Alarm - J4	External Alarm inputs. Substitute for or combine with internal LNA current monitor alarms. Allows an external signal to indicate LNA failure. Unused inputs can be used as status inputs to M&C system.

1:1 Plate Assembly Outline Drawing, Standard Configuration



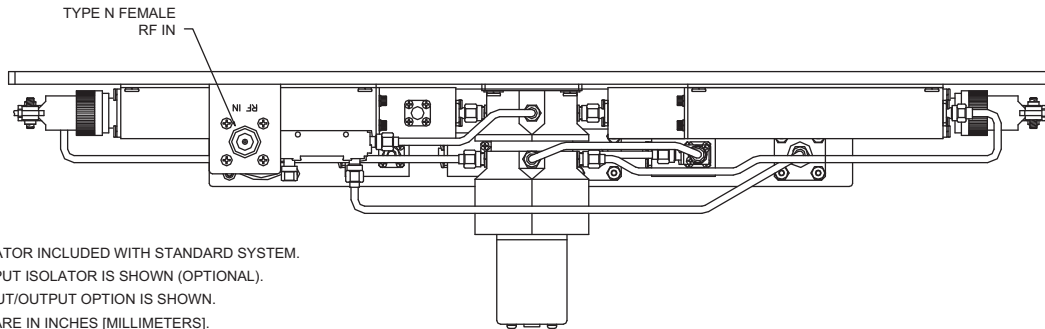
NOTES:

1. OUTPUT ISOLATOR INCLUDED WITH STANDARD SYSTEM.
2. OFFLINE OUTPUT ISOLATOR IS SHOWN (OPTIONAL).
3. DIMENSIONS ARE IN INCHES [MILLIMETERS].
4. TOLERANCE - ± 0.02 [0.5].



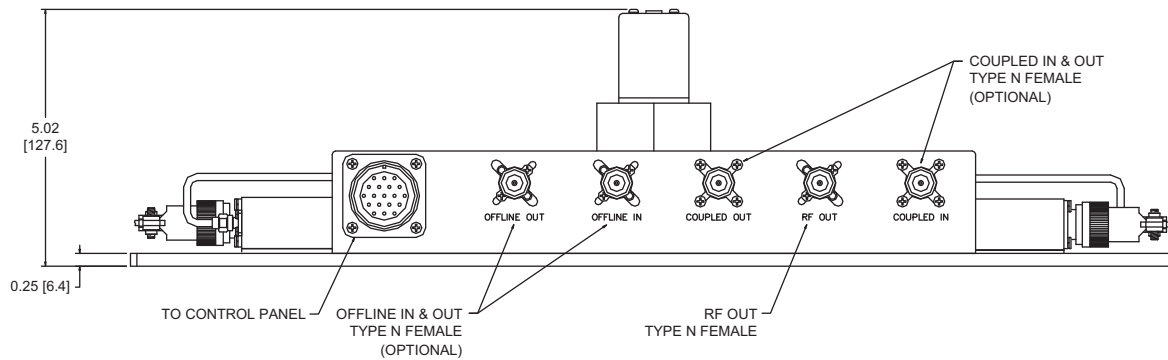
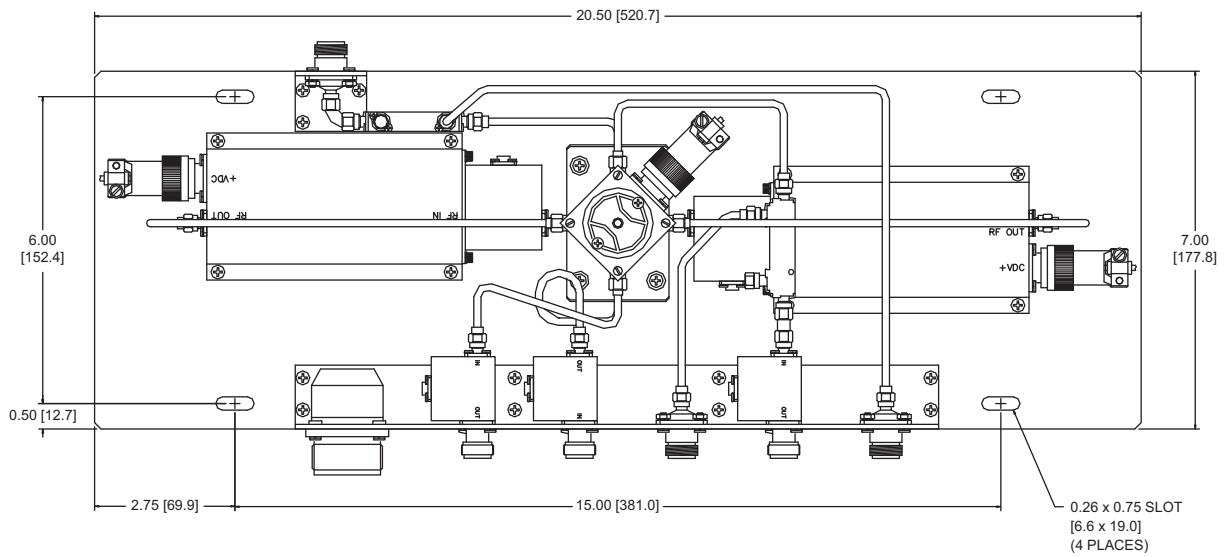
Outline 13963-1

1:1 Plate Assembly Outline Drawing, with Options



NOTES:

1. OUTPUT ISOLATOR INCLUDED WITH STANDARD SYSTEM.
2. OFFLINE OUTPUT ISOLATOR IS SHOWN (OPTIONAL).
3. COUPLED INPUT/OUTPUT OPTION IS SHOWN.
4. DIMENSIONS ARE IN INCHES [MILLIMETERS].
5. TOLERANCE - ± 0.02 [0.5].



Outline 13963-2



Other Products

- Low Noise Amplifiers and LNA Systems
- Solid-State Power Amplifiers and SSPA Systems
- General Purpose Converters
- Satellite Communications Equipment
- Custom Subsystems

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