

## Introduction:

The TimeMachines GPS Low Noise Amplifier (LNA) product was created to both extend the length of cable that can be used between a time server and the outdoor antenna, as well as allow for a greater number of signal splits to occur downstream of the outdoor antenna. The LNA was designed specifically for GPS signal amplification in timing environments by TimeMachines. These basic indoor amplifiers are made with a simple PCB design and 3D printed enclosure to maintain the TimeMachines commitment to price and performance.



## LNA Part Numbers:

Part Number	Description
760-610-000	LNA with SMA connectors, primarily for splitter install to multiple time servers
760-611-000	760-610-000, including Type-N adapters for inline cable install, extended cable lengths

Electrical Specifications		Mechanical Specifications	
Frequency	1575.42MHz	Size (WxDxH)	2.2 x 2.45 x 0.85 inches
Impedance	50 Ohm	Enclosure Material	PLA
Amplifier Gain	40 dB	Connectors	SMA Male/Female
Noise Figure	2.2 dB	PCB	RoHs, Lead Free
3 <sup>rd</sup> Order Intercept	9 dB	Waterproof	Not Waterproof
1dB Compression	-41.5 dB		
Input VSWR	1.6 : 1	Temp Range	-40 to +80 C
Output VSWR	2.0 : 1	Power	From Center Conductor
DC Voltage MAX	9V (-PWR Model)	Voltage Range	3.3V-9V
DC Current MAX	25mA @ 5V		

The 760-610-000 does not have a connector for external power injection. Power is sourced from the center conductor of the connected cable. When using a TimeMachines un-powered splitter, one of the output ports will pass DC power from the time server to the antenna to power the antennas internal amplifier. The other ports will block the DC power that the time server puts on the center conductor of the SMA connector. There is no need to disable the power output on the TimeMachines products. Some time servers will generate an error message if their antenna output current is zero. Generally this feature can be disabled if it is causing an issue although current models of splitters should alleviate this issue. There are two typical configurations for the TimeMachines LNA.

## Power Requirements:

The important thing to note about the power requirement is that currently shipping TimeMachines time servers (TM1000A, TM2000B, TM2500C) can supply power to run **ONE** LNA plus the antenna. If more than a single LNA is put into series in the line, then a power source separate from the time server itself is required. TimeMachines 2 and 4 port splitters with power injection can be used for this (SKUs: 760-602-PWR and 760-604-PWR). Even if the splitting function isn't required, the ability to inject 9V onto the center conductor of the

antenna cable will enable multiple LNA devices to be placed into the cable running to the antenna. The LNA is also capable of passing power through to the next device which could be another LNA, or the antenna itself.

## **Installation:**

The next pages cover the common installation methods. It is critical that the input/output orientation be followed. Power status can be confirmed by looking through the hole on the side of the unit for the LED.

## **Connections:**

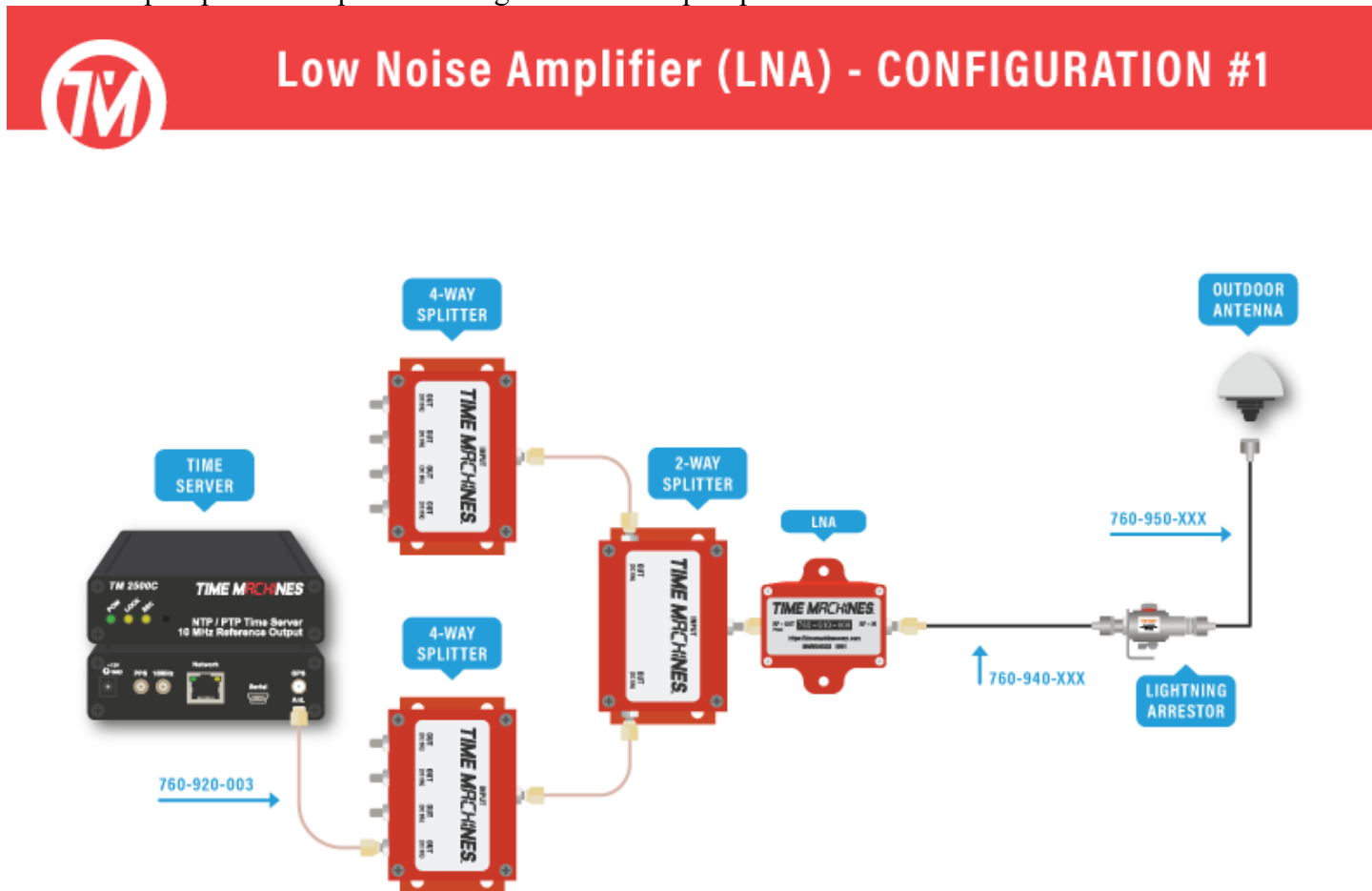
**RF In Port:** should point toward the Antenna. *It is also important that at least 25ft of cable be between the antenna and the LNA. Less than that will over-saturate the input to the LNA causing degraded performance.*

**RF Out Port:** should point toward the time servers

A simple 5/16 inch plastic wrench is included to help with the tightening of the SMA nuts.

## Configuration 1 – Splitter Enhancement:

One common use for the LNA is to allow a single antenna to be split to multiple time servers. TimeMachines makes 2 and 4 port splitters. An ideal 2 port splitter will reduce the signal sent to each of its outputs, roughly in half (3dB loss), while an ideal 4 port splitter will reduce the signal to each port to be about ¼ of the original input signal (6dB loss). Since there are no ideal splitters, the loss per port is a bit worse. Depending on the length of the cable between the antenna and the splitter, the resulting loss of signal can start to cause issues when multiple splits are required. A diagram of a multiple splitter installation is shown below:

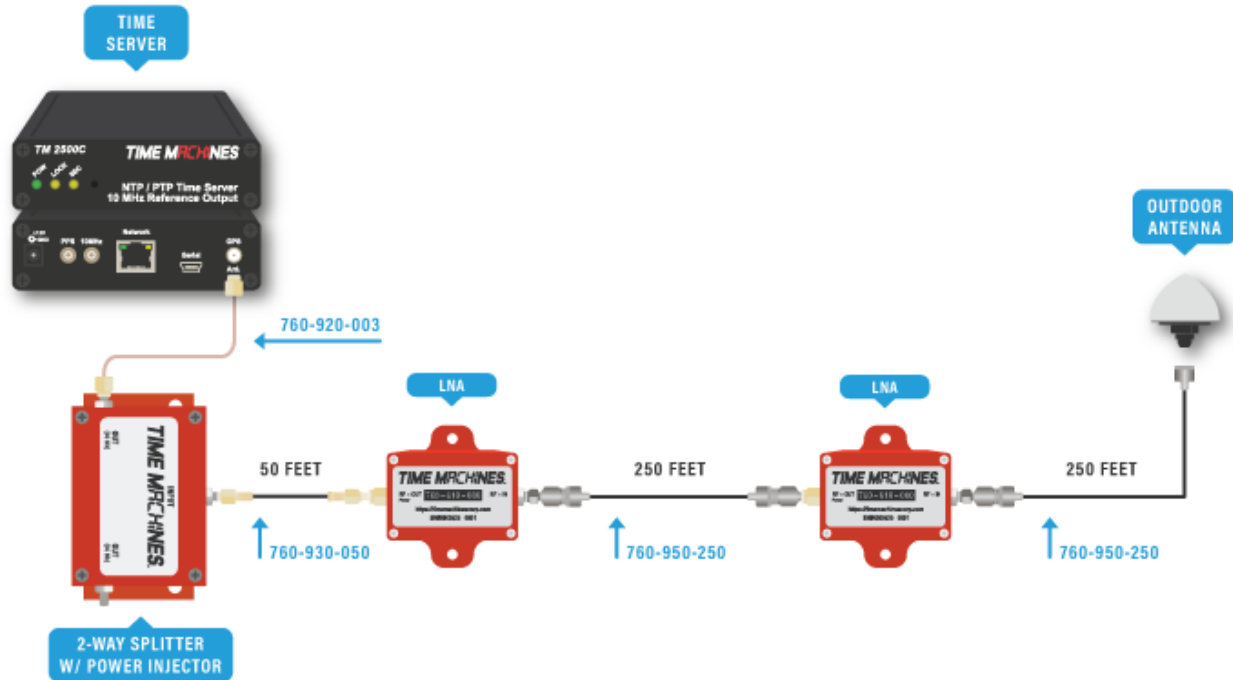


In this configuration, power can come from time server directly and no powered splitter is required. Care must be taken to ensure that a DC path exists between a time server and the LNA/Antenna. Confirming the LED is lit on the inside of the LNA can help verify this. Without power, the LNA and the amplifier on the antenna will not function and no signal will be received. No connector adapters are typically needed in this configuration when used with TimeMachines splitters. The LNA output port can connect directly to the input of the splitter.

## Configuration 2 – Cable Extension:

The second common configuration for the LNA, is to extend cable length beyond the 250ft limit of the RG58/LMR-195 that TimeMachines sells. SKU 760-611-000 is available for this installation configuration and includes the required Type-N connector adapters. An example installation could look like the below diagram:

## Low Noise Amplifier (LNA) - CONFIGURATION #2



An LNA is put inline with the cable. Type-N female adapters are used. A typical spacing is every 250ft of cable. A 760-950-250 cable from the antenna to the first LNA works nicely. Additional runs of the 760-950-250 cable, with an LNA being used to join the cables allow for significant extension of the cable run. The upper limit of this arrangement is not known. As mentioned previously, the moment that a second LNA is introduced to the configuration, a Time Server will not be able to provide sufficient power to the LNAs and a powered splitter will be required such as the 760-602-PWR or 760-604-PWR.