

# Installation Instructions for Arbiter Systems GPS Antenna Preamplifier Order Number AS0044700

## Introduction

The AS0044700 GPS Antenna Preamplifier adds a minimum of 21 dB of gain at the GPS L1 frequency (1.575 GHz), when used with Arbiter Systems GPS-Controlled Clocks. This allows longer cable runs between the antenna and the clock, by compensating for the additional cable loss incurred in such installations. The preamplifier receives dc operating power, via the antenna cable, from a supply built into the clock, and also passes dc power on to the antenna.



**Figure 1**  
**AS0044700 GPS Antenna Preamplifier**

## Precautions

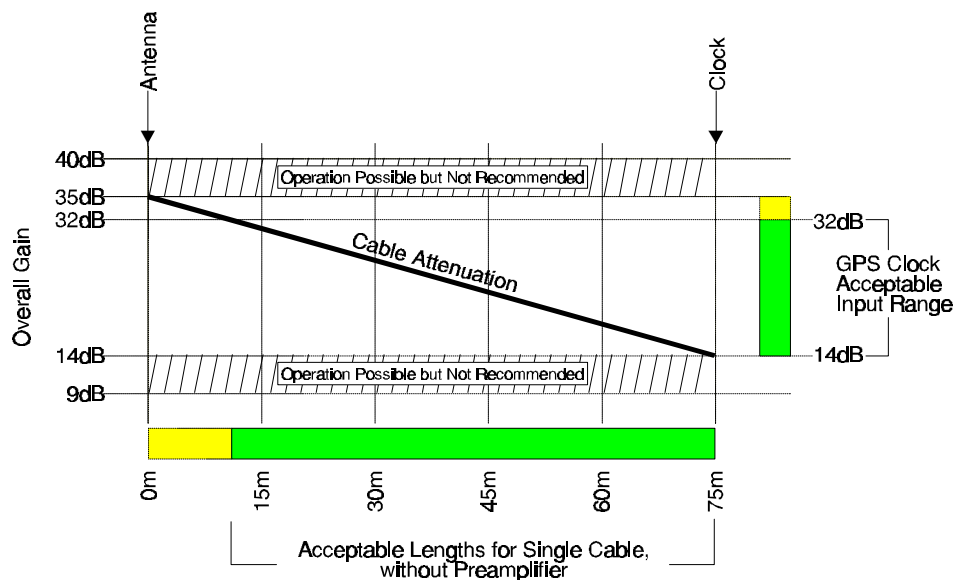
The following cautionary points should be considered when installing the preamplifier:

- Turn off power to the clock (or other power source) prior to connecting the preamplifier. The F-style connector on the antenna cable can be easily short-circuited when it is not mated with another F connector. Although the GPS clock is protected against short-circuits, it is best to avoid this condition when possible.
- In order to function, the preamplifier must be oriented so that the connector labeled “RCVR” is connected to the clock, and the connector labeled “ANT” is connected to the antenna.
- Avoid subjecting the preamplifier to mechanical shock or stress. When installing a preamplifier/cable assembly in a conduit, refer to the related section of this document.
- Use caution when connecting the preamplifier to clocks or other instruments not manufactured or approved by Arbiter Systems. The operating voltage, polarity, and current capability of the power supply must be compatible with the preamplifier. Disregarding this precaution could result in severe damage to the preamplifier, or to the instrument powering it.

## Gain and Cable Length Considerations

In order to ensure proper overall antenna system performance, the following guidelines should be observed when placing the preamplifier in line with the antenna cable:

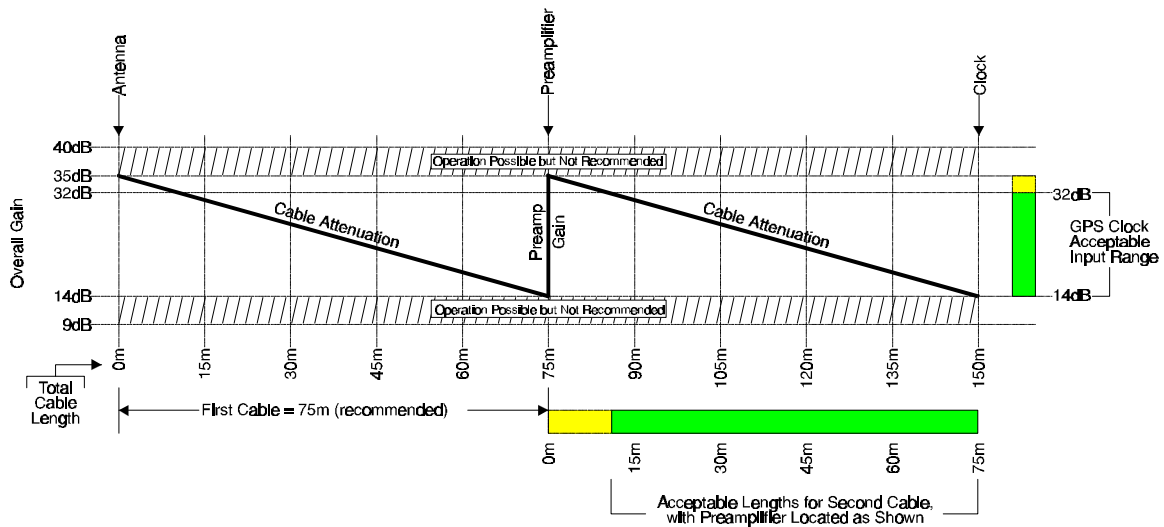
**Minimum Gain Requirement.** Arbiter Systems GPS-Controlled Clocks, when used with the included antenna, are designed to operate with a total antenna cable loss of up to 21dB. With the standard cable type, this translates to 75 meters (250 feet). Figure 2 shows the attenuation characteristics of the various standard cables for Arbiter Systems clocks, and the acceptable range of overall antenna cable length for installations not using a preamplifier.



**Figure 2**  
**Cable Lengths for Installations Not Using a Preamplifier**

Longer cable runs require use of the preamplifier, or lower-loss cable. Since adding a preamplifier increases the gain a minimum of 21dB, a second cable of up to 75 meters can be added, for a total antenna cable length of 150 meters (500 feet) and an overall loss of 21dB.

**Preamplifier Placement.** The main factors affecting the decision of where to place the preamplifier within the antenna cable are signal-to-noise ratio, overload, and cable dc resistance. Extensive design efforts have led to the determination of the optimum cable types and lengths for use with Arbiter Systems clocks. The graph in Figure 3 illustrates the relationship between antenna cable length and loss for systems using a preamplifier and an antenna cable greater than 75 meters in length.



**Figure 3**

### Gain vs. Length of Second Cable for Installations Using a Preamp

A single 75 meter cable should be placed between the antenna and the preamplifier. This provides the optimum amount of attenuation, and will prevent overloading of the preamplifier. As illustrated by Figure 3, any of the standard cable lengths may be used for the connection between the preamplifier and the clock. However, this cable should be *at least* 15 meters long, to prevent overloading of the antenna input on the clock.

**Cable Delay.** The electrical delay caused by extended antenna cable lengths can have a significant effect on the accuracy of the GPS clock, and must be accounted for. Refer to the section on antenna cable delay in the operation manual for the clock.

**Preamplifier Delay.** The delay incurred by introducing the preamplifier into the antenna circuit is well under a nanosecond. No adjustment of the clock antenna delay need be made specifically to compensate for the preamplifier.

### Installation Instructions

Installation of the preamplifier is a simple process, consisting of the following steps:

1. **Turn off the power** to the GPS clock or other instrument to be connected to the preamplifier. Connecting the preamplifier to a live circuit risks damage to the preamplifier and/or the instrument powering it.
2. If the antenna cables to be used are different lengths, refer to the preceding section covering gain and cable length considerations. The cable between the antenna and the preamplifier should be at least 75 meters (250 feet) long.
3. Connect the cable from the antenna to the jack on the preamplifier labeled “ANT”.

4. Connect the cable from the GPS clock to the jack on the preamplifier labeled “RCVR”.
5. Tighten both connections firmly by hand.
6. When all connections have been made to the preamplifier, the antenna, and the clock, restore power to the clock and verify proper operation.
7. Adjust the antenna cable delay settings on the clock to account for the increased cable length.

### Installing the Preamplifier/Cable Assembly in a Conduit

To reduce the possibility of damage to the preamplifier or cables, pulling the preamplifier through a conduit as part of a cable assembly should be avoided. However, if the antenna cable in an installation *must* be routed through conduit, observe the following guidelines:

- If possible, route the antenna cables through the conduit first, and then join them together (using the preamplifier) in a junction box.
- When pulling through a conduit, cover the entire preamplifier assembly (cables attached) with thin-walled heat-shrink tubing. This will reduce the likelihood that parts of the assembly will become snagged on unions or other surface irregularities within the conduit.
- Avoid pulling the preamplifier assembly through excessively tight corners or small-radius sweeps.
- Consistent tension should be applied; avoid sudden jerking.

### Preamplifier Specifications

Parameter	Min	Typ	Max	Units
Small Signal Gain	21	23	26.5	dB
Saturated Output Power		11.5		dBm
Noise Figure		5		dB
Supply Voltage	4.5	5.0	5.5	V
Input Current (no signal)	19	25	32	mA
Operating Temperature Range	-40		+85	°C
Gain-Temperature Coefficient		-0.002		dB/°C