



GPS Antenna Mounting Guide

Revision D

User's Guide

8500-0080

June, 2002

GPS Antenna Mounting Guide

Document 8500-0080, Rev D, June 2002

INTRODUCTION

Datum makes a variety of GPS timing instruments, and one of the questions most often asked by customers is, "Do you have any tips on installing the antenna?" Our answer is, "Yes." This document provides guidance for all antennas furnished with Datum timing instruments.

The Global Positioning System (GPS) comprises a constellation of 24 satellites in six (6) orbital planes approximately 10,000 miles above the Earth. There are four (4) satellites in each orbital plane, and each plane is inclined approximately 56°. The satellites orbit the Earth approximately every twelve (12) hours. What this means is that the further north you are in the Northern Hemisphere, the probability is greater that the satellites will be passing to the south of your position. Conversely, Southern Hemisphere installations favor views of the northern sky. GPS antenna placement is important in planning, and must consider the satellite's location.

UNPACKING

Unpack all items in the box and inspect. If there is any damage, please contact Datum (800/348-0648) immediately so a proper claim and/or replacement can be initiated. Depending on the type of product you have purchased, the Antenna Mounting Kit will be one of the following:

- 912000 – Used with ExacTime products, this kit includes a Bullet antenna, a 50 foot antenna cable, and a mounting pipe with accessories.
- 912001 – Used with the StarTime and TymServe 2100X products, this kit includes a Bullet antenna, a 50 foot antenna cable, and a mounting pipe with accessories.
- 912002 – Used with an optional antenna, this kit includes only a mounting pipe with accessories.
- 912003 – Used with the bus module time products, this kit includes an Acutime antenna/receiver, a 50 foot antenna cable, and a mounting pipe with accessories.
- 912004 – Used with the 97XX products, this kit includes an Acutime antenna/receiver, a 50 foot antenna cable, and a mounting pipe with accessories.

- 912005 – Used with the bc637PCI Time and Frequency Processor, this kit includes a Bullet antenna, a 50 foot antenna cable, and a mounting pipe with accessories.
- 912006 – Used with the bus module time products, this kit is identical to the 912003 kit, except that the newer Acutime 2000 antenna/receiver is provided.
- 912007 – Used with the bus module time products, this kit is identical to the 912006 kit, except that a different cable is provided.

Refer to Figures 1 through 7a for the applicable parts.

INSTALLATION INSTRUCTIONS

Antenna placement and cable routing are the most troublesome aspects of installing a GPS based instrument. However, for new users, it is important to get the GPS unit up and running quickly as possible to verify its operation and become familiar with the equipment..

For this reason, we have divided the installation instructions into “Quick Initial Setup” and “Permanent Installation” sections. We recommend that new users follow the “Quick Initial Setup” instructions first before proceeding to a permanent installation.

QUICK INITIAL SETUP

Set up the unit on a desk if practical or if it is a bus level product, install it in the appropriate chassis. Refer to the User’s Guide or Instruction Manual for initial installation and turn-on procedures. Connect the antenna cable to the unit and to the antenna. Simply run the antenna outside the building or set it on a windowsill. However, depending on the lead content of the glass, it may be necessary to go outside. Turn on the unit and verify its operation.

PERMANENT ANTENNA INSTALLATION

Choosing a Location:

- The antenna should be located with an unobstructed clear view of the sky from horizon to horizon for optimum tracking conditions. Get the most visibility of the sky as possible. However, if the antenna must be located on the side of a building, the satellite orbits must be considered. If your location is in the Northern Hemisphere, your antenna should face South. If you are in the Southern Hemisphere, your antenna should face North. Use the corner of the building if it is available.
- Choose a location for the antenna that allows the antenna mast to be installed as close as possible to vertical. If you plan to install the antenna in a partially enclosed environment, test the ability of your antenna to receive satellite signals before committing to a permanent installation. On vehicles (vans, ships, etc.), select a location that will be safe from damage during normal operation of the host vehicle.



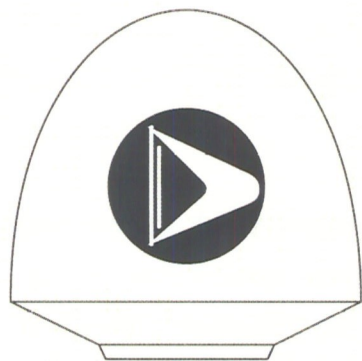
NOTE ...

For installations exposed to shock and/or vibration, use a mounting scheme that isolates the antenna from the excessive shock and/or vibration.

For optimal performance, avoid locating the antenna within two feet of other antennas. Choose a location that is not near radar installations, satellite communication equipment, and/or microwave dishes to prevent RF jamming. If that is not possible, move as far away from the radiating source as possible, and attempt to shadow the GPS antenna from the radiation, blocking as little of the sky as possible. Mount the antenna below and at least 10 feet away from satellite communication equipment. Shield the unit from back-scatter microwave radiation. Protection can be afforded by the use of a ground plane, a metallic shield that is mounted below the desired minimum viewing angle of the antenna.

- The GPS antenna is designed to withstand the full rigors of the elements in an exposed external location. However, performance is not warranted below -40° C. The shape of the antenna has been designed to minimize the accumulation of rain, snow, and ice. If snow or ice does accumulate, the antenna will perform when partially covered with snow, provided the snow is dry. Accumulation of ice will eventually shut off performance. However if the ice sheet is not continuous, it is possible that enough signal will be received to provide normal operation.
- The antenna can receive satellite signals through glass (depending on lead content), canvas or thin fiberglass. The antenna **cannot** receive signals through dense wood (including trees and shrubbery) or metal structures.

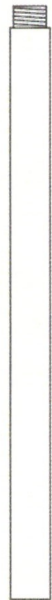
Figure 1
GPS Antenna Mounting Kit for ExacTime 6000 & ET6000L
Part No. 912000



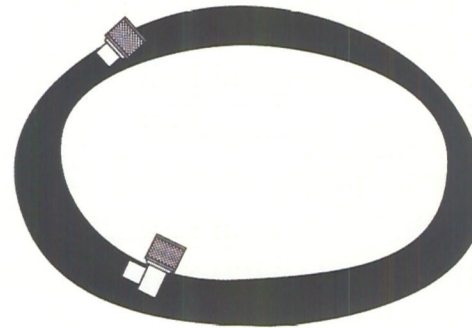
Bullet Antenna
5000-0001



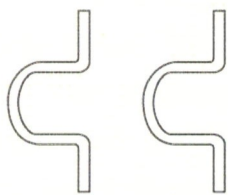
Type F-to-N
Connector Adapter
1704-9389



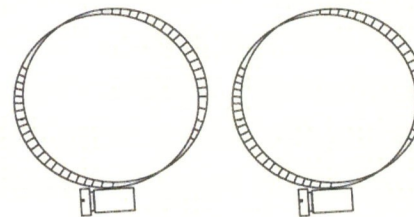
Antenna
Mast
711700



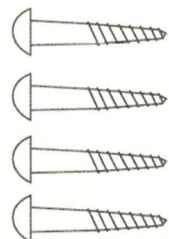
50 ft RG-58/U
Antenna Cable
812267



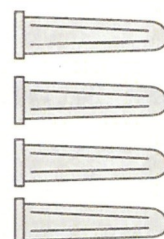
Pipe Straps
2325-9294-14



Hose Clamps
2325-5415-34



Wood Screws
2315-0100-1



Screw Anchors
2325-0130

Figure 2
GPS Antenna Mounting Kit for TymServe & StarTime
Part No. 912001

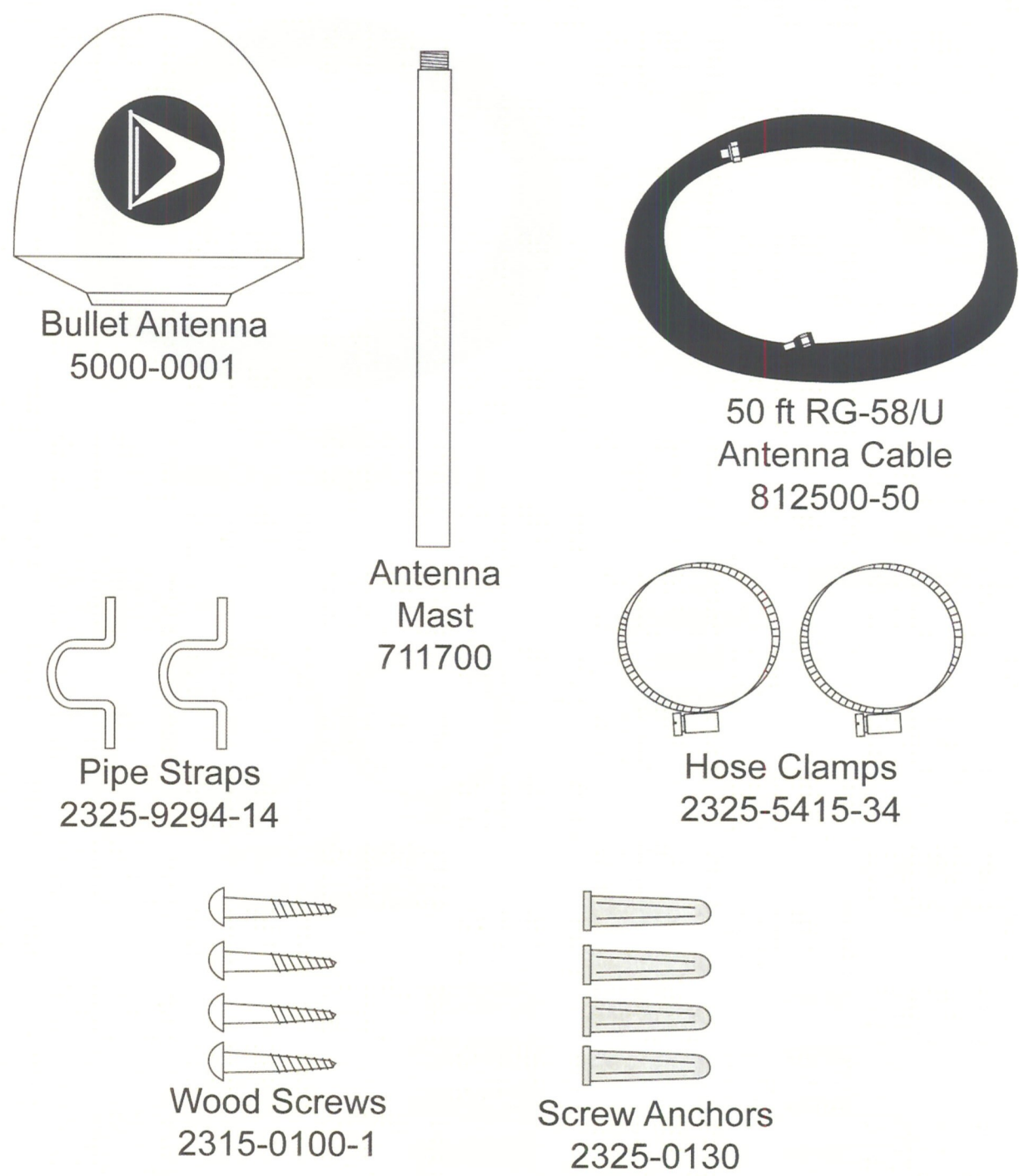


Figure 3
GPS Antenna Mounting Kit – Without antenna or cable
Part No. 912002

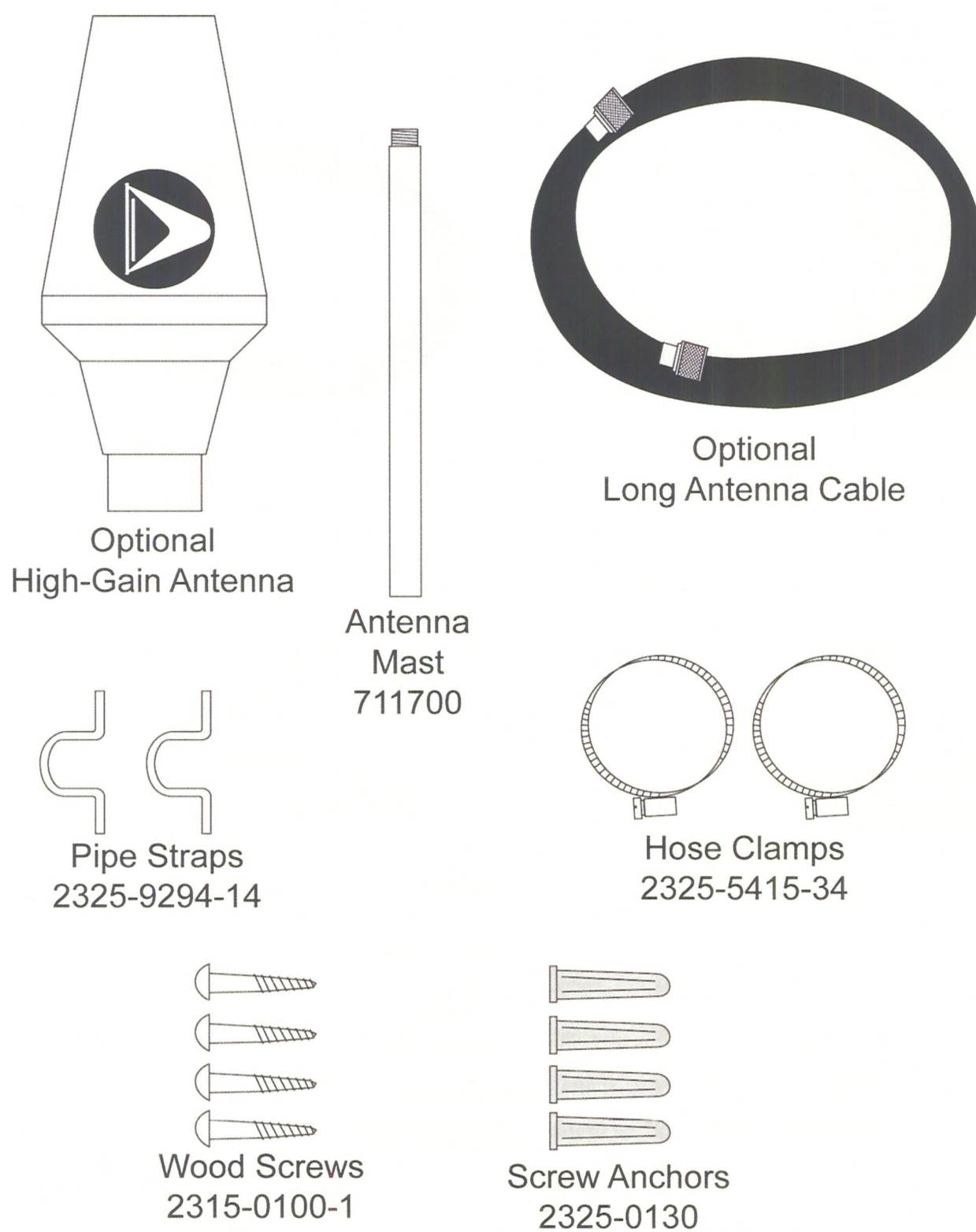


Figure 4
GPS Antenna Mounting Kit for Bus Level Modules
Part No. 912003

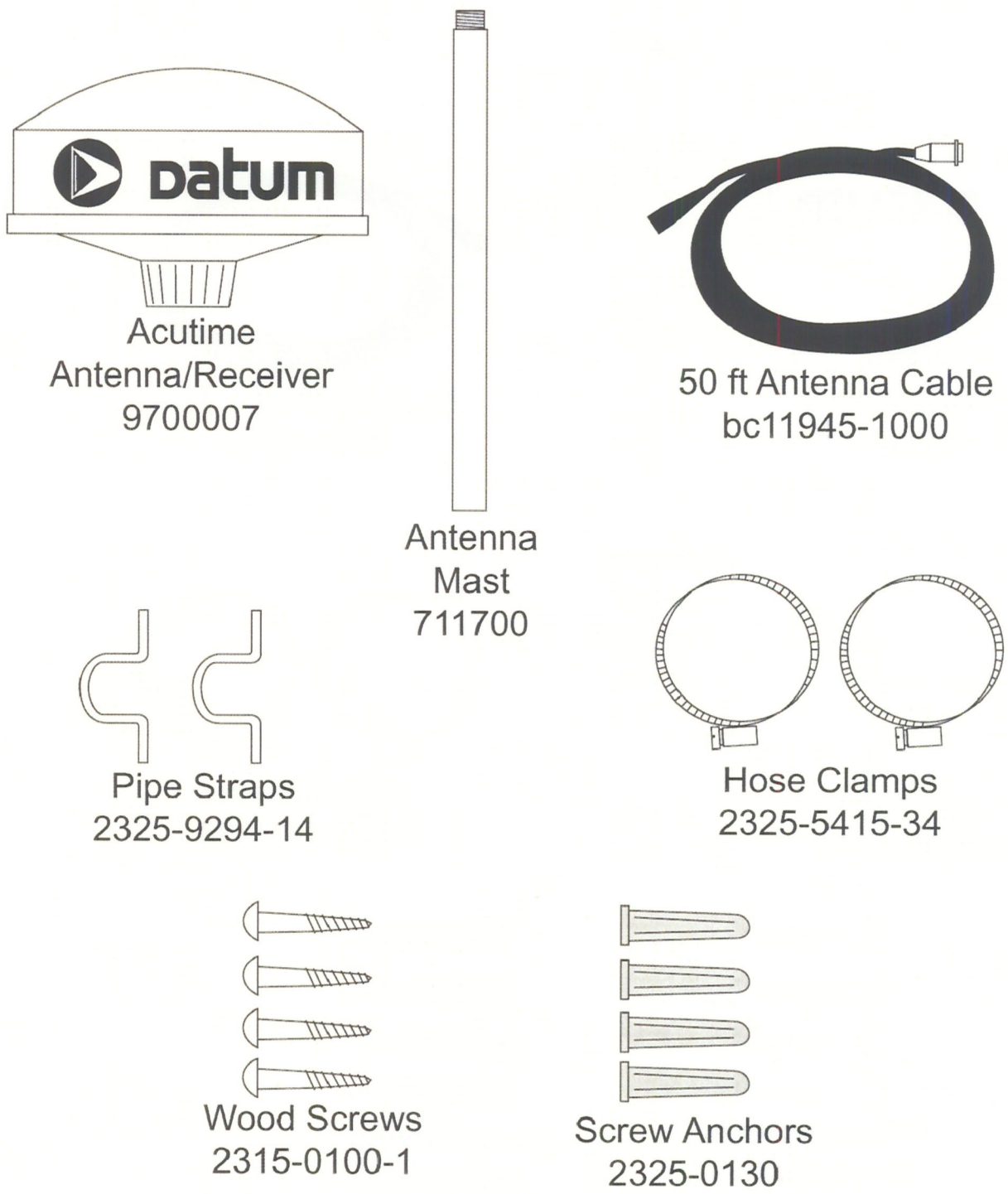


Figure 5
GPS Antenna Mounting Kit for Series 9700
Part No. 912004

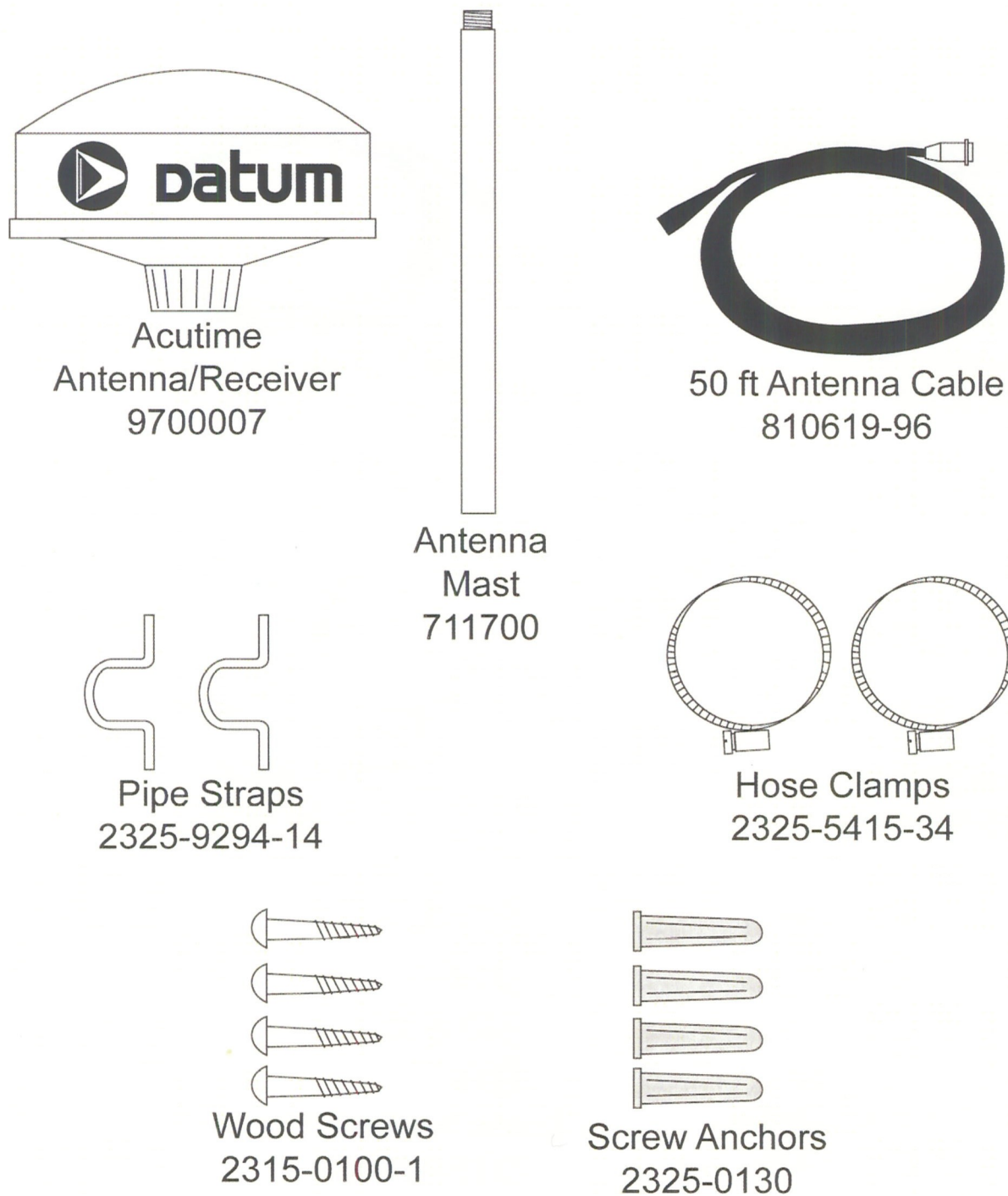


Figure 6
GPS Antenna Mounting Kit for bc637PCI
Part No. 912005

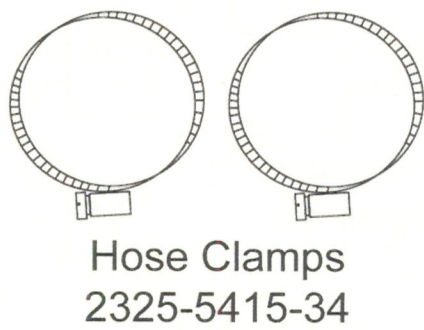
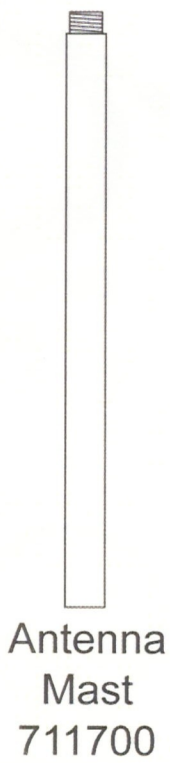
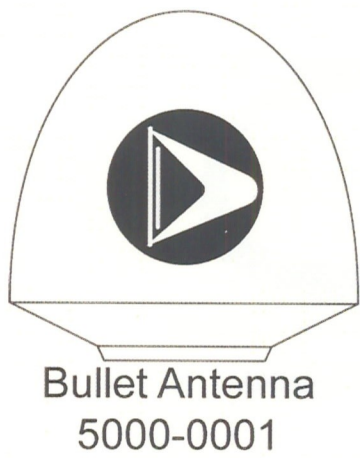


Figure 7
GPS Antenna Mounting Kit for Bus Level Modules
Part No. 912006

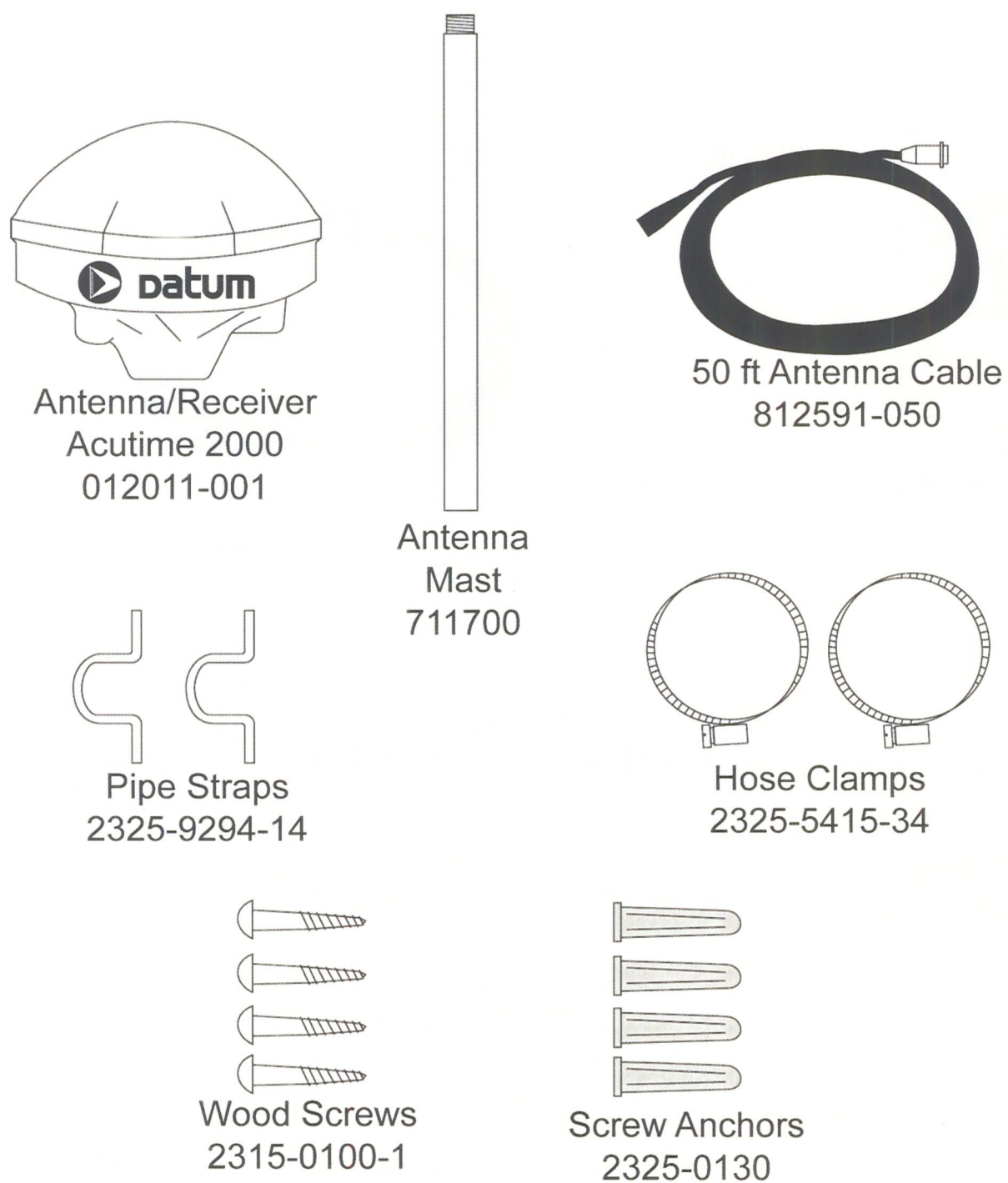
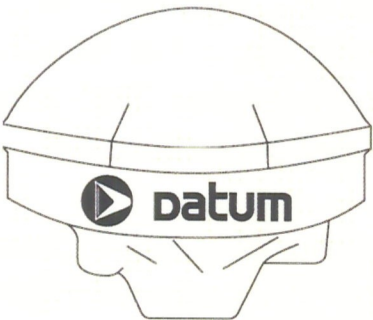


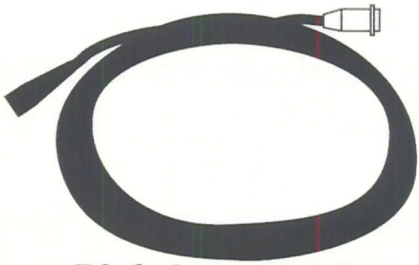
Figure 7a
GPS Antenna Mounting Kit for Bus Level Modules
Part No. 912007



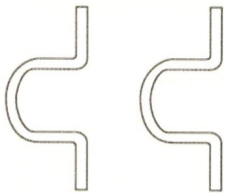
Antenna/Receiver
Acutime 2000
012011-001



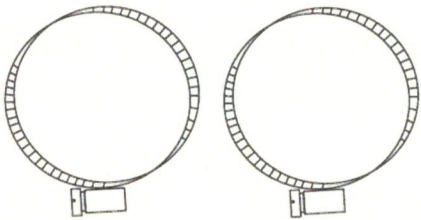
Antenna
Mast
711700



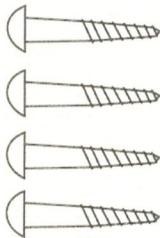
50 ft Antenna Cable
812597-050



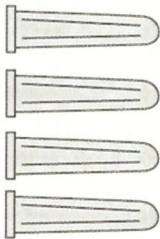
Pipe Straps
2325-9294-14



Hose Clamps
2325-5415-34



Wood Screws
2315-0100-1



Screw Anchors
2325-0130

Antenna/Cable Losses

In GPS antenna installations using the Bullet antenna (or other antennas with built-in preamps), it is necessary to consider the signal loss (in dB) introduced between the GPS antenna and the GPS Receiver Module (located inside the ExacTime, StarTime, or TymServe unit). This signal loss is incurred in the antenna cable, adapters, and adapter cables. Figure 6 shows some typical antenna configurations. The actual antenna cable, adapters, and adapter cables may vary. It is recommended that you calculate the antenna/cable losses for your actual components as described below.

Table 1 provides calculated losses for different types and lengths of cables and adapters used with the antenna. The signal gain for the Bullet and the optional High Gain antennas are shown on the first two rows. Losses produced by various types of antenna cables, adapters, and adapter cables are shown on the subsequent rows. These losses are summed-up and subtracted from the initial gain, and the resultant is shown on the last row.

For reliable operation of your unit (i.e. the ExacTime, StarTime, or TymServe), the signal level at the input of the unit must be between 15 db and 35 db.

Table 1
Signal Losses (approximate)

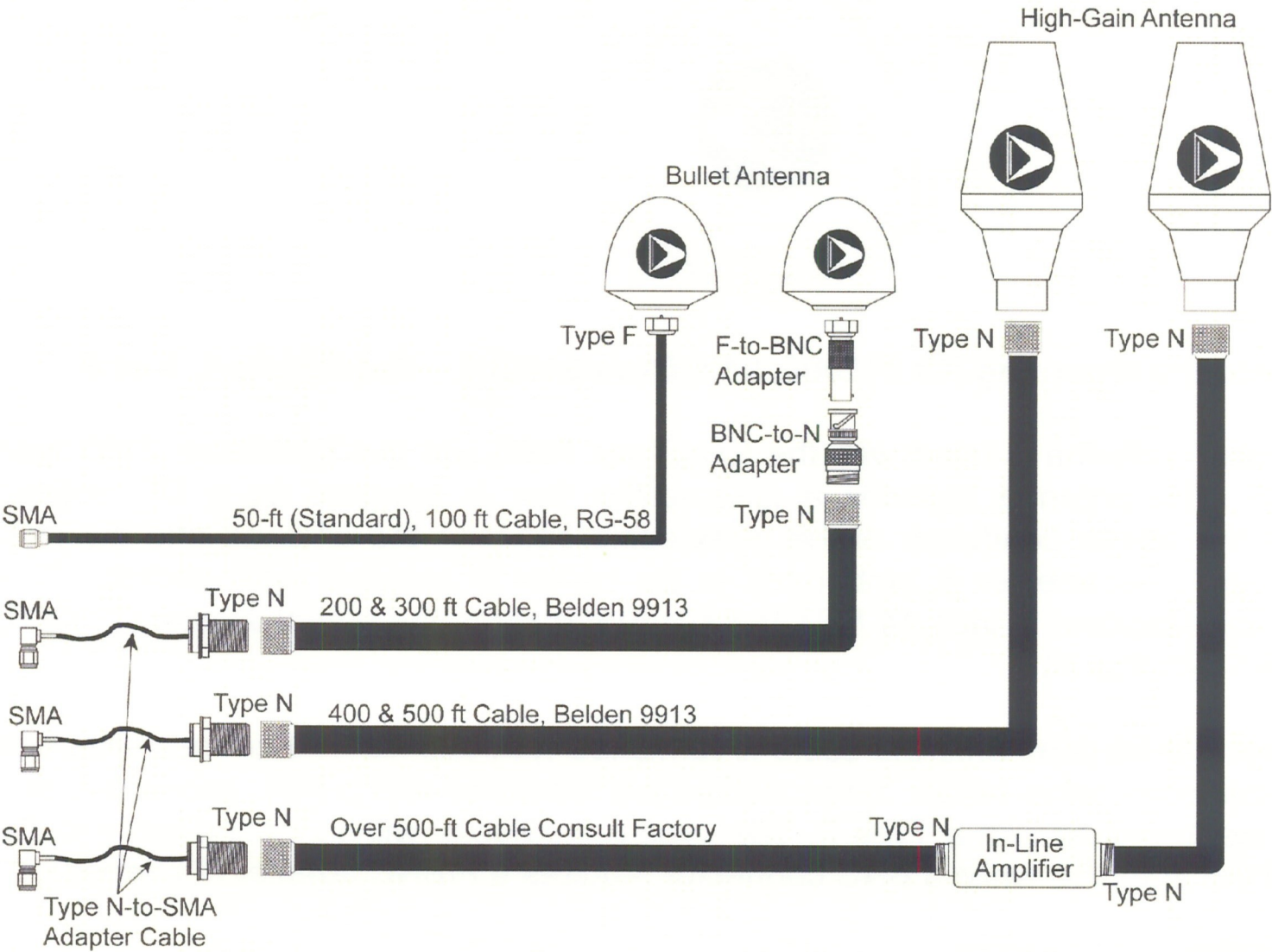
Part Description (dB) / Cable Length	*50 ft	100 ft	200 ft	300 ft	400 ft	500 ft
Standard Bullet Antenna	35 dB	35 dB	35 dB	35 dB		
High Gain Antenna					50 dB	50 dB
Internal GPS Cable (inside unit)	-0.5 dB	-0.5 dB	-0.5 dB	-0.5 dB	-0.5 dB	-0.5 dB
Adapter — N-to-F, etc. (typical)	-0.5 dB	-0.5 dB	-0.5 dB	-0.5 dB	-0.5 dB	-0.5 dB
SMA-to-N Cable Adapter		-0.5 dB	-0.5 dB	-0.5 dB	-0.5 dB	-0.5 dB
BiasT (DC Block)					-1.0 dB	-1.0 dB
Belden 8240 Cable (RG58/U)	-9.5 dB					
Belden 9913 Low Loss Cable		-5.6 dB	-11.2 dB	-16.8 dB	-22.4 dB	-28.0 dB
Gain at Receiver	24.5 dB	27.9 dB	22.3 dB	16.7 dB	25.1 dB	19.5 dB



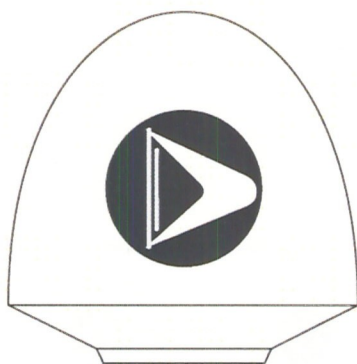
NOTES ...

1. * Indicates standard cable.
2. For cable lengths greater than 500 feet contact Datum.
3. The gain (signal level) at the input of the GPS Receiver Module located inside the unit must be a minimum of 15 dB.
4. The Bias T (DC Block) is only used in 9390-6XXX type units. It is required for the High Gain antenna and is installed inside the chassis.

Figure 8
Antenna Cables and Adapters



Mounting the Bullet Antenna



GPS Antenna Mounting Kit 912000, 912001 or 912005 – See Figure 1, 2 or 6

The “Bullet” antenna is used with the ExacTime 6000 and the TymServe 2100 type products. The antenna includes a preamplifier that is powered by a DC voltage through the center conductor of the coax cable between the antenna and the host unit. A type F connector is embedded in the center of antenna mast socket. This socket has standard $\frac{3}{4}$ inch 14 NPT threads that mate to the antenna mast (711700) furnished with this kit.

A 50 foot RG-58 coax antenna cable is furnished with this kit. The connector at one end of this coax cable varies. Some cables are furnished with a BNC connector, and others are furnished with a Type F. The Type F connector will connect directly to the base of the antenna, while a BNC connector requires a F/BNC adapter (furnished).



NOTE ...

If a cable is required that is longer than 50 feet, a Belden 9913 type coax cable will usually be furnished. This cable has a type-N connector on the antenna end. This will require an N-to-F connector adapter to attach it to the antenna.

The following steps will insure a good installation:

1. Run the antenna cable through the antenna mast and connect the cable to the antenna.
2. Screw the antenna mast into the base of the antenna.



CAUTION ...

Do not over-tighten the antenna mast on to the antenna base as damage to the threads could occur. Also, don't use thread-locking compounds since they can corrode plastic.

3. If you are mounting the antenna mast to a wooden structure, secure the mast to the wood using the two (2) pipe straps and the four (4) wood screws. Refer to Figure 9. Make sure the mast is mounted vertically.

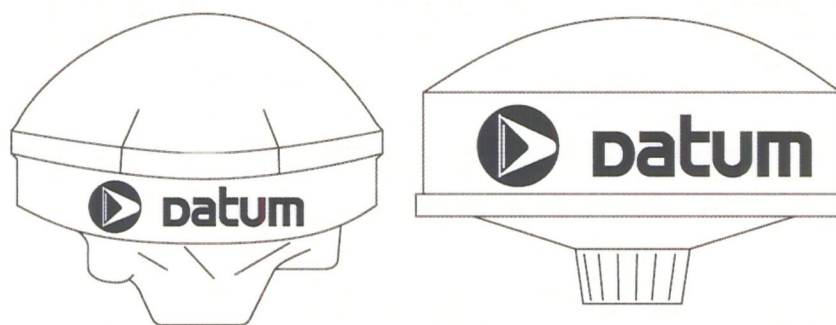
4. If you are mounting the antenna mast to concrete or masonry, drill holes into the concrete and install the plastic screw anchors as shown on Figure 9. Then secure the mast to the concrete using the two (2) pipe straps and the four (4) wood screws. Make sure the mast is mounted vertically.
5. If you are mounting the antenna mast to an existing post or pipe, secure the mast to the post using the two (2) hose clamps as shown in Figure 9.
6. Connect the antenna cable to the unit. Refer to the unit's manual for the antenna cable input connector's location.



NOTE ...

If your installation requires an antenna cable longer than 50 feet, a high gain antenna, and/or a lightning arrestor, consult the factory.

Mounting the Acutime or Acutime 2000 Antenna



GPS Antenna Mounting Kit 912003, 912004 or 912006 – See Figure 3, 4 or 7

The “Acutime” antenna is used with the bus module time products, the 9700 Programmable Time System, and the TymServe 2000 type Network Time Server products. This is an active antenna that contains the GPS Receiver inside the antenna casing. The threaded antenna mast socket accepts the antenna mast (711700) furnished with this kit.

An RS-422 cable is provided with this antenna. The round CONXALL cable connector mates to the base of the Acutime antenna. The D connector on the other end of this antenna cable mates to the host unit.



NOTE ...

Additional cabling options are available for up to 200 feet. Consult the factory for information on these options.

The following steps will insure a good installation:

1. Screw the antenna mast into the base of the Acutime antenna.



CAUTION ...

Do not over-tighten the antenna mast onto the antenna base as damage to the threads could occur. Also, don't use thread-locking compounds since they can corrode plastic.

2. Connect the antenna cable to the antenna.
3. If you are mounting the antenna mast to a wooden structure, secure the mast to the wood using the two (2) pipe straps and the four (4) wood screws. Refer to Figure 7. (Although this drawing shows the Bullet antenna, the mounting concept for the Acutime antenna is essentially the same). Make sure the mast is mounted vertically.
4. If you are mounting the antenna mast to concrete or masonry, drill holes into the concrete and install the plastic screw anchors as shown on Figure 7. Then secure the mast to the concrete using the two (2) pipe straps and the four (4) wood screws. Make sure the mast is mounted vertically.

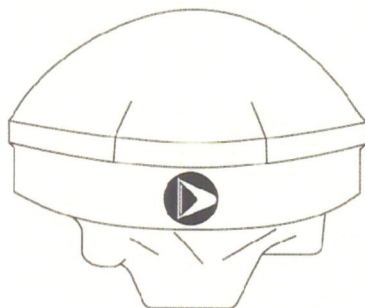
5. If you are mounting the antenna mast to an existing post or pipe, secure the mast to the post using the two (2) hose clamps as shown in Figure 9.
6. Connect the antenna cable to the unit. Refer to the unit's manual for the antenna cable input connector's location.

GPS Antenna Mounting Kit 912002 - See Figure 3

This kit consists of only the antenna mast (711700) and the mounting hardware. Optional antennas such as the High Gain Antenna and longer cables are ordered separately. The mounting instructions are the same as those for the Bullet antenna. See "GPS Antenna Mounting Kit 912000 or 912001 – See Figures 1 or 2."

Upgrading from Acutime to Acutime 2000

In the past, bus level products with GPS capabilities were equipped with the Acutime unit. The cable furnished with these units used a 7-pin molded connector to properly interface with the Acutime connector. Today, these bus level products are being delivered with the Acutime 2000 unit and a cable that properly interfaces with its 12-pin connector. Customers who own Datum bus level products that were equipped with the Acutime unit may upgrade to the new Acutime 2000 unit. The Acutime 2000 unit will be shipped with an adapter cable (GPS ACU/ACU2K) that adapts the 7-pin molded connector to the 12-pin connector on the Acutime 2000. This allows the existing cable to be used by merely attaching the adapter cable. The upgrade kit hardware is illustrated below.



GPS-ACU2K



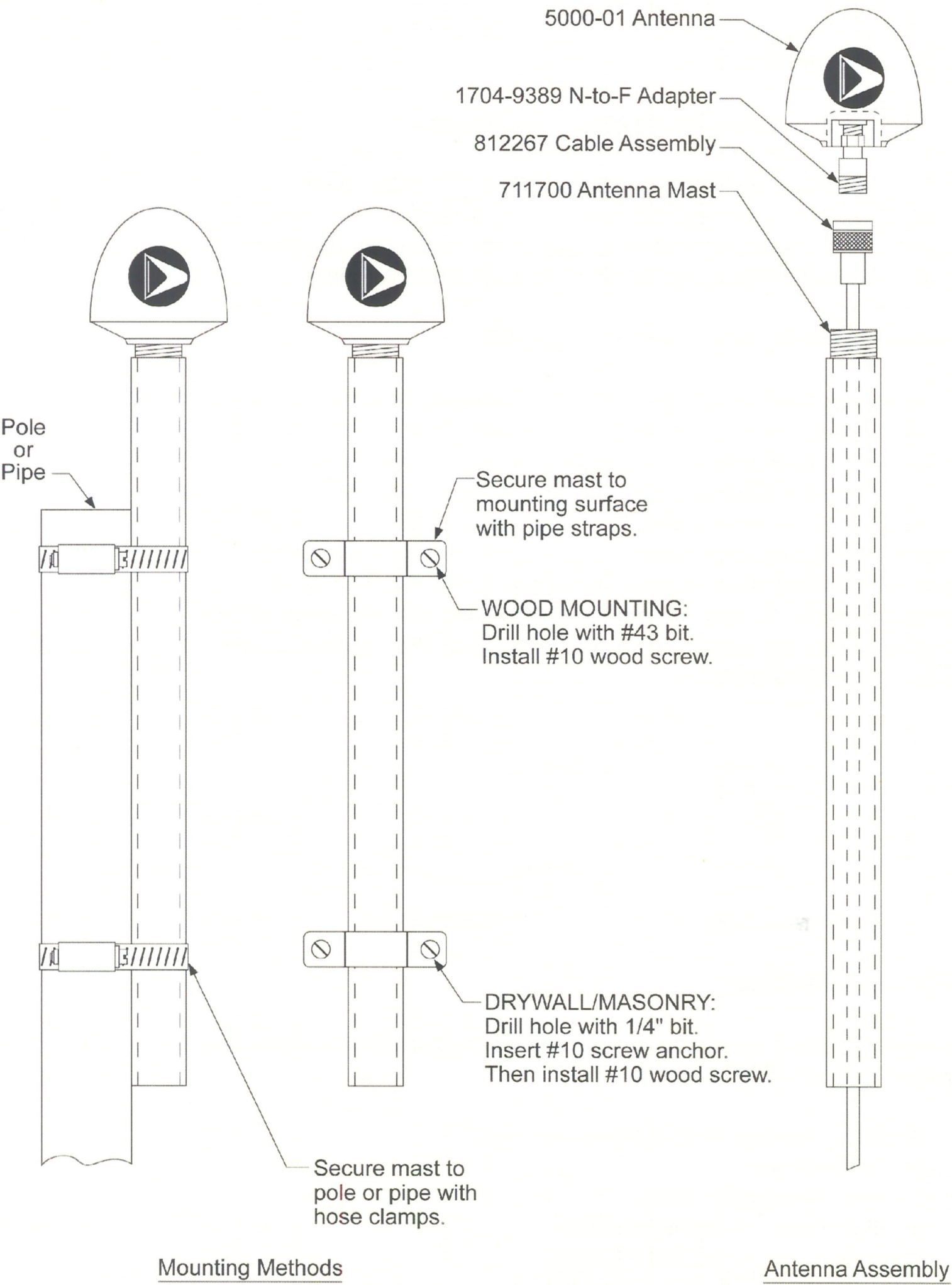
GPS-ACU/ACU2K

If You Have A Problem . . .

Please call Datum if you have any problems or questions concerning the proper installation of your GPS antenna.

Datum – Timing, Test & Measurement
34 Tozer Road
Beverly, MA 01915-5510
US Toll Free: 1-800-938-9888
Phone: +1-978-927-8220
Fax: +1-978-927-4099
E-mail: ttmsales@datum.com

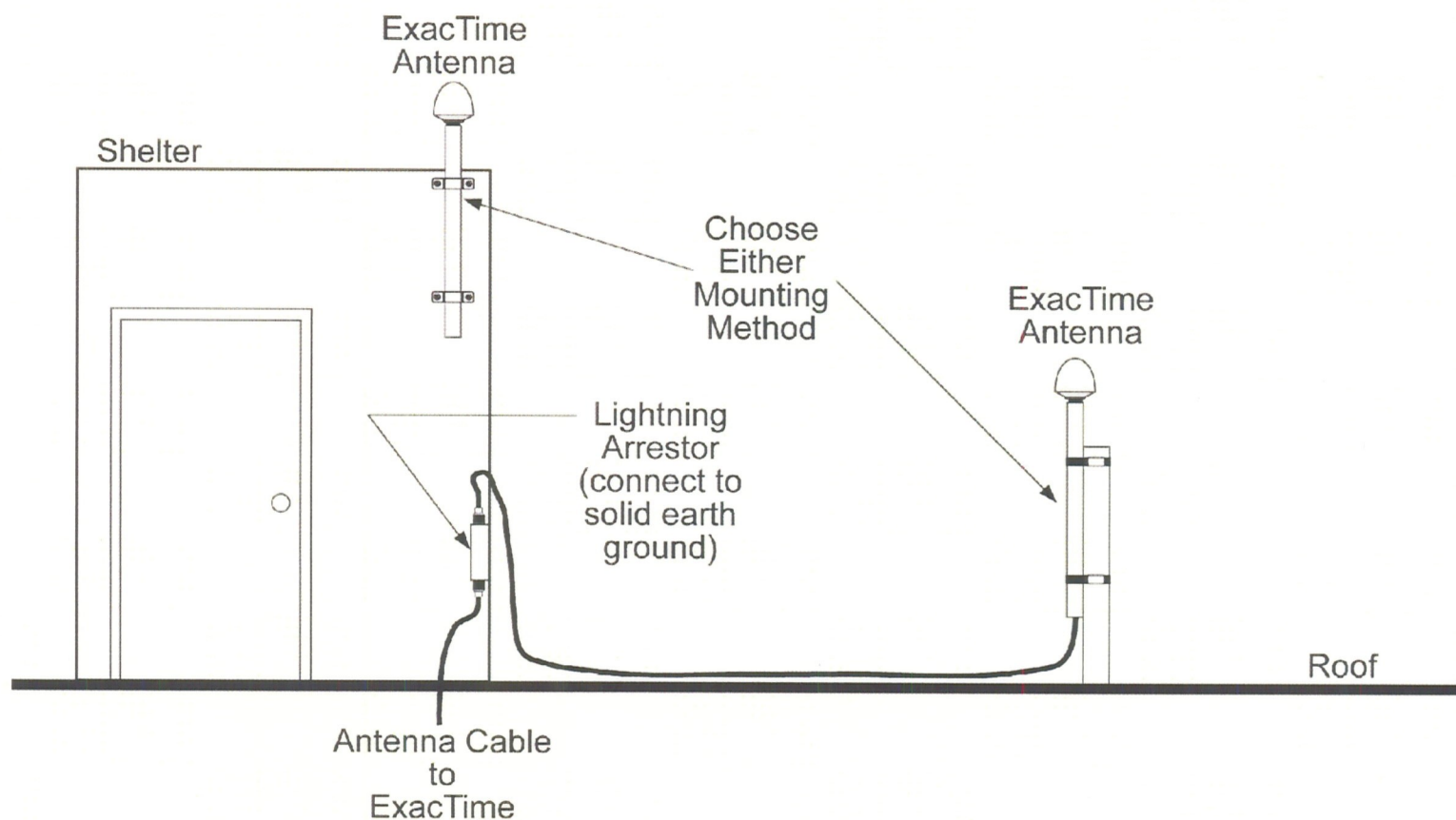
Figure 9
Mounting Methods



INSTALLING THE LIGHTNING ARRESTOR (GPS Option 23)

Although the Lightning Arrestor is designed to withstand the rigors of weather (rain, snow, etc.), it is recommended that it be mounted inside a shelter of some kind for protection.

Figure 10
Lightning Arrestor Installation



The ground stud of the Lightning Arrestor must be connected to a solid earth ground, either through a metal plate or a heavy gage wire.

The Lightning Arrestor is shipped with either a 25 foot length of Belden 9913 cable (Option 23A) or a 50 foot length of Belden 9913 cable (Option 23B). This is the cable that connects the antenna to the Lightning Arrestor.



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Or visit our site on the world wide web at
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product specifications, news and information.