Larus

electronics for telecommunications

Larus Corporation 1560 Berger Drive, San Jose, CA 95112 (408) 494-1500 FAX (408) 494-0735

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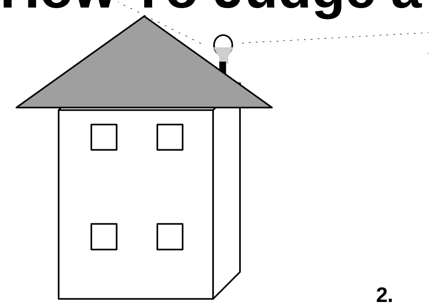
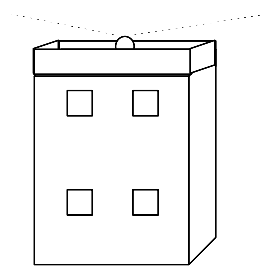
APPLICATIONS NOTE
Siting GPS Timing In Difficult Situations

Larus GPS-based timing systems are normally installed in the Central Office with rooftop GPS antenna units connected to the equipment with well-engineered coaxial cables. Such a rooftop antenna typically has an excellent “view of the sky” with few significant obstructions such as nearby buildings or trees. These installations may be configured either as single receivers or else fully redundant receivers. There is a trend to place such systems into customer locations and buildings where rooftop access may be difficult, expensive, or undesirable. In these cases, a limited view of the sky may be tolerable, but precautions must be taken.

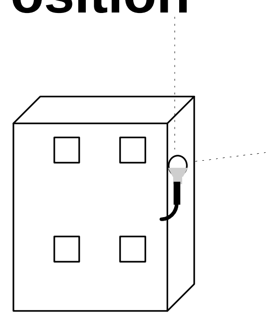
How To Judge a GPS Antenna Position



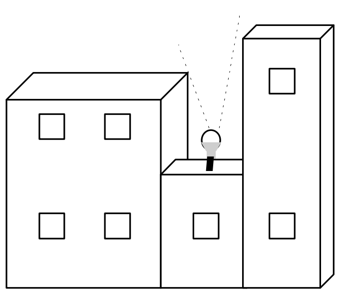
1. Ordinarily, mounting a GPS antenna in a convenient spot around the roof is best. The antenna may have a virtually unobscured view from horizon to horizon.



2. Mounting a GPS antenna low on the roof surface might have the desired effect of blocking RF interference coming from ground level, if that were a concern.

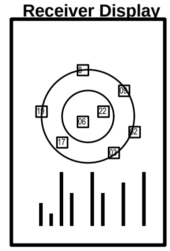


3. Mounting a GPS antenna on the side of a building can get unpredictable results. Often 50% of the sky will be blocked by this, leading to difficult signal acquisition or possibly signal losses for short periods of time.



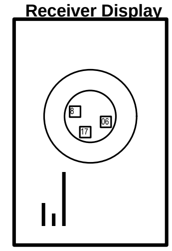
4. Mounting a GPS antenna between tall buildings can get unpredictable results. If the view of the sky is narrowly limited, then signal acquisition may be very difficult and signal losses may exist for long periods of time.

Handheld GPS Receiver Display



5. Many handheld GPS receivers display a screen of satellite signal status. If the strong satellites are scattered all over the sky, then this is a good indicator for permanent operation.

Handheld GPS Receiver Display

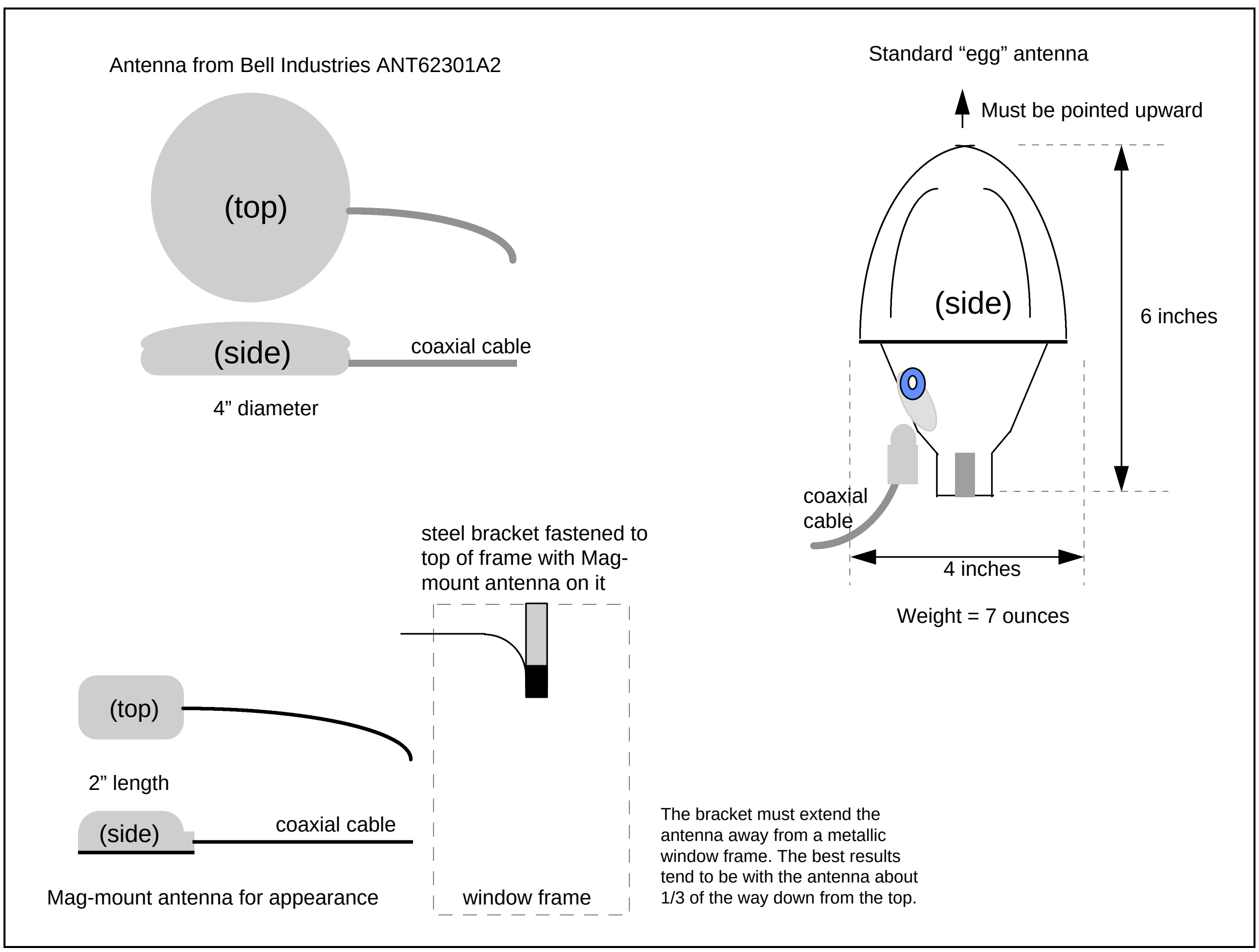


6. If the status display shows a small number of strong satellites (<4), or if the visible satellites are only overhead, then this makes permanent operation much more difficult. This is an indicator of how poorly the permanent receiver may behave.

It is also possible to mount the GPS antenna inside the walls of a building, as long as the antenna can collect sufficient GPS downlink radio energy from satellites that are 11,000 miles in space. This suggests mounting the antenna under a transparent skylight in the roof/ceiling. If the roof structure has no metallic content at all, then even a rigid roof might be transparent to radio frequencies like 1.57 GHz. All of this can be surveyed using a handheld GPS receiver.

Another possibility is the mounting of the GPS antenna inside a normal glass window. Obviously if there is a metallic coating on the glass, then this is a problem (commonly seen in airport terminals). Often an antenna can be placed directly against the glass, facing the outside. In all likelihood a ground-floor window will offer a decreased view of the sky as compared to a window higher up in the building. The higher and larger the window, the better the view. The closer to complete horizon-to-horizon view, the better it is. It must be accepted that a window-mounted antenna will have a maximum of 50% view of the sky. It is generally undesirable to have any large metal surfaces within view of the antenna element, as these might create multipath problems at microwave frequencies.

There is a better constellation of GPS satellites (a better cluster spread) around the Equator, and a poorer constellation toward the North and South Poles. As a result, having the antenna optimized for a view toward the Equator will achieve slightly better results than a view to a random direction. For North American sites, this means a window that faces South. Carefully placing the antenna to see the maximum sky could require either a specialized mounting bracket or else a specialized antenna unit. Larus supplies the standard antenna kit with each GPS product or else an alternative antenna can be arranged.



In a typical GPS installation, the equipment is first powered up with the receiver beginning in “search the sky” mode of operation. This means that the receiver has no stored position and no almanac (where the satellites are), so it cannot effectively use the satellite signals. It first receives this downlink almanac, then it goes to the next step of determining its position. After gathering and averaging this data for a large number of seconds, the final operational step is reached, known position mode. At this time, the indicator for “GPS” is illuminated.

In a poor view of the sky situation, the satellites may be moving into view and then out of view so rapidly that the receiver never gets a full chance of locking in that known position. This can be a problem initially. The remedy calls for a survey of the average position of the antenna using either the $SPOS* command (through the system) or else by using a handheld GPS receiver. Once you can get a good figure of merit for this position (like knowing true position within 20 feet, measured over one hour’s time), then this location can be loaded into the system (if it does not already have it), then the system can be placed into known position mode using the command $TRMO*. The parameter to select is K, which is known position. Then let the system collect more data until the “GPS” light is on. In other words, instead of waiting for the system to automatically lock in its position, the user can force the position into it. In some systems, this may not take too long. With very limited view of the sky, this may take all night. Details about the use of these GPS commands is contained within the Information Management documentation, either in the TL1 language version or else the Menu version.

In a normal rooftop antenna situation, Larus recommends the standard “egg” antenna that is furnished with each GPS receiver product. There are a few isolated situations where an alternative antenna device may be used. The problem is the many of these alternative antenna devices have considerably lower gain compared to the “egg”. If that lower gain is coupled with a large amount of cable loss, then there may be insufficient signal power available at the receiver input. This can be a major problem. In some situations, this can be mitigated with a 20dB in-line amplifier. Selection of such an amplifier and placement of it somewhere along the cable is a topic for discussion with Larus Applications Engineering.