GPSdome Rev 1.01/1.01-DF

Installation Manual

Contents

Read instructions carefully before attempting to install GPSdome. Retain instruction for future reference.

Introduction

This guide details a generic instruction for the installation and operation of the GPSdome module. This guide has been written for both static and in-vehicle applications although GPSdome may be used in a range of applications.
This manual is written for both GPSdome 1.01 and GPSdome 1.01-DF

Overview

GPSdome (see Figures 1a, 1b and 2) is a compact, light-weight GPS anti-jamming module, designed to prevent loss of position fix and time in the presence of certain types of jammers. The unit may be installed on a range of installations that rely on GPS and it connects between the antenna and the GPS receiver.

Two active GPS antennas, with nominal gain of 26dB, are connected to the SMA RF input connectors; the primary and auxiliary antenna inputs. The SMA RF output connector provides connection to the input of the GPS Receiver.

Figure 1a: GPSdome 1.01 – General view

Figure 1b: GPSdome 1.01-DF – General view

Cautions

(1) **The GPSdome module should be mounted on a flat surface where possible and secured using the mounting holes provided.**
(2) **To prevent damage to any cable assemblies used in this installation, ensure that cables are not bent, deformed or snagged to cause damage to the internal wiring or the connector ends.**
(3) **This product is a high-tech electronics module; we recommend installation is undertaken by a professional.**
(4) During installation, ensure there is NO power applied to the module OR the GPS receiver.
(5) When making power connections to the GPSdome 1.01-DF, verify correct polarity. Connecting power with reverse polarity will damage the unit and void warranty.

Installation

Installation Kit

Open the GPSdome package to check that the contents of the kit had been supplied as shown in Figure 2 and Table 1. Refer to the specifications details on page 13.

Item 1:
GPSdome 1.01 or 1.01-DF unit

Item 2:
TAOGLAS Antenna (QTY x2)

Figure 2: GPSdome Box Contents

Item No.	Description	Qty.
1	GPSdome 1.01 or GPSdome 1.01-DF	1
2	Taoglas AA.105.301111, Reference Antennas*	2
3	Installation & User Guide (this Guide as required)	1

Table 1: GPSdome Box Contents

** Note: The Taoglas antenna are supplied for initial units only. For series units they may be supplied on specific requests only.*

GPS Receiver System with GPSdome

The GPSdome module is integrated into the static or vehicle GPS receiver as shown in Figure 3a and 3b. Two antennas are connected to the module (supplied antennas or locally purchased for permanent installation); the GPS antenna connects to primary input 'P' and an additional antenna connects to the auxiliary input 'A.'

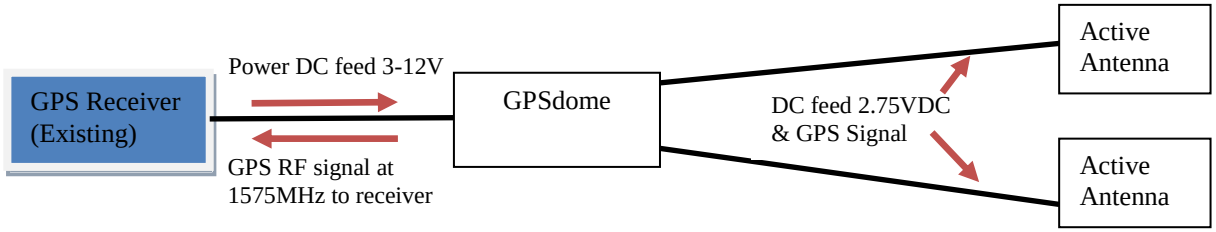

Figure 3a: GPS Receiver with GPSdome 1.01 Integrated

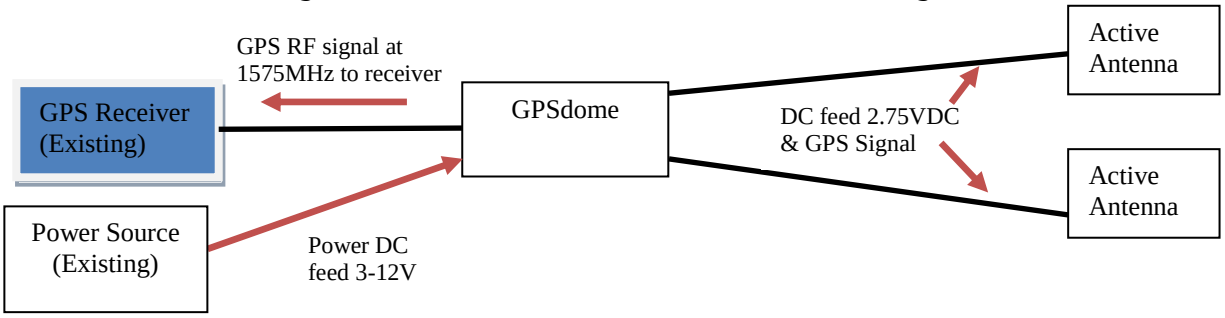

Figure 3b: GPS Receiver with GPSdome 1.01-DF Integrated

SMA Cables Connectors

To prevent the risk of moisture ingress, it is recommended that a cable with high quality sealed SMA connectors (see Figure 4) is used to connect between the GPSdome module and the GPS receiver unit. The cable must be of a high RF specification, and a good double shielded cable is recommended, such as Times Microwave LMR-100A-PVC. Single shielded coaxial cable is not suitable. If alternative antennas are installed the same cable specification and SMA connectors are required.

Figure 4: Unsealed and Sealed SMA Connectors

Installation Procedure

Before commencing the installation procedure read the **CAUTIONS** detailed on page 4. The following instructions are provided to install the GPSdome system:
NOTES:

(1) Installation and methods used to secure the GPSdome system may vary depending on the application.
(2) Use general purpose tools to carry out this installation procedure unless specific tools are called up in text.
(3) The GPSdome module is IP67 certified as long as the recommended SMA connectors are tightened to the correct torque and the cables are sealed using the correct sealant.
(4) The reference antennas (Table 1, Item 2) are supplied with 3m cable lengths and are supplied for test purposes and temporary installations only. We recommend that for permanent/long term installations, magnetic antennas are replaced with locally sourced antennas.

Step 1. With reference to Figure 5, carry out the following:

a) Mark out and drill four holes suitable for M3 screws.

b) Allowing for ease of cable connection, align the GPSdome module to the holes.

c) Secure the GPSdome module using appropriate fixings (not included), such as four self-tapping M3 screws.

Step 2. With reference to physical installation, the location of the two antennas to be fitted is as follows:

- Locate the antennas to a suitable area on a horizontal surface that always faces the sky, e.g. on the roof area.

- Avoid placing the antennas near obstacles including: roof racks, other antennas such as AM/FM and cell phone or air-conditioning devices that could block a clear view of the sky, preventing the satellite signals from reaching the antennas, or cause radiation or vibrations to the antennas.

- Ensure that there is a distance of at least 10cm between the two antennas. Nominal distance is > 25cm.

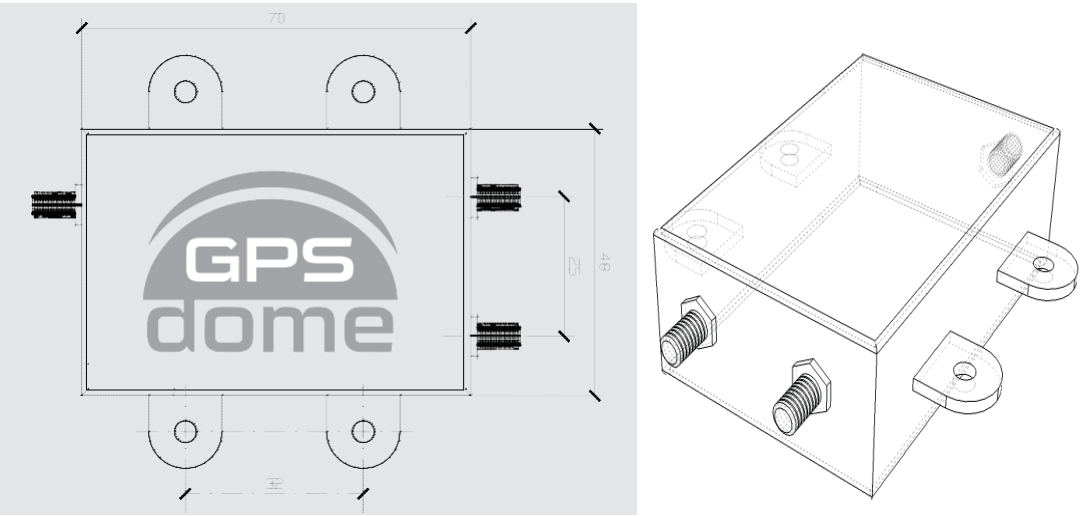

Figure 5: GPSdome Mechanical Interface

NOTE: Step 3 is not mandatory and may vary depending on the application and specification.

Step 3. With reference to routing each antenna cable, carry out the following:

a) Mark out the required holes for each antenna, at least 10cm apart (nominal distance is >25cm) and drill the appropriately sized holes.

b) Fit the correct size rubber grommet (not supplied) onto each antenna cable.

c) Taking care to avoid sharp objects that can damage the antenna cables, push a cable through each drilled hole.

d) Fit the rubber grommets around the drilled holes.

e) Secure the antennas as appropriate.

To prevent damage to any cable assemblies used in this installation, ensure that cables are not bent, deformed or snagged to cause damage to the internal wiring or the connector ends.

f) Route the antenna cables away from moving parts, under the carpet and behind plastic trim, to the GPSdome module location.

Tips:
It is recommended that the cable between the GPSdome and the GPS receiver is kept short.
The GPS antennas are required to be located as far away from any RF jamming sources as possible.
There are large variations in the performance of GPS receivers supplied by different manufacturers. GPSdome adds an anti-jam capability to all receivers, but the overall anti-jam performance of the combined system will depend on performance characteristics of the receiver.
GPSdome reduces jamming signals that enter the receiver through the antenna port. However, a poorly-designed receiver can also absorb the jamming signal through the body of the receiver itself. A good receiver will have EMC shielding to prevent leakage of RF radiation through its sides; if this is not the case, and a better receiver can't be used, install the receiver in a shielded case.
If possible increase the distance between the GPSdome antennas and any jamming source. For example, if there is a jammer operating from the cigarette lighter socket in the car you need to protect with GPSdome, locate the antennas towards the rear of the vehicle.
If GPSdome is installed in a complex environment, such as a vehicle, experiment with the placement and orientation of the antennas for best results. Due to the complex propagation environments within vehicles, different installation options may produce a higher or lower performance.

Step 4. Connect and secure the following cables to the GPSdome module using an SMA torque spanner set to 1Nm (8.85 in-lbs):

a) Antenna 1 cable connector to the auxiliary antenna input '**A**' connector.

b) Antenna 2 cable connector to the primary antenna input '**P**' connector.

c) The RF output to receiver '**R**' connector using a locally sourced cable, for example, Times Microwave LMR-100A-PVC fitted with high quality sealed SMA connectors. The other end connected into the GPS receiver RF antenna input.

Step 5. Prepare for powering up. For GPSdome 1.01, verify that the DC provided on the receiver cable is 3-12VDC and can provide at least 700mW of power.

For GPSdome 1.01-DF, connect the red and black wires to a power source of 3-32VDC, red wire to +V and the black to common (GND).
If Jamming indication is required, use the white or brown wire (and the same common – black), in accordance with attachment A.

To prevent damage to the unit, make sure the red wire is connected to the + power And the black wire is connected to the – or Ground pole

Step 6. Coil and secure any excess cable into a hidden location, such as under the carpet or tiles, using wire ties (not supplied).

General Operation

The GPSdome module operates without manual intervention.
Two LEDs located on the GPSdome module, provide the following indications:

- LED 1 - When the module is powered ON and operating correctly; a green LED is illuminated.
- LED 2 – When the presence of a jamming event is detected; a red LED is illuminated.

Note:
The LEDs illumination is very dim. If you want to be able to see them, please create a dark environment to the unit.

If the GPSdome system fails to operate correctly refer to Troubleshooting on page 12.

Maintenance

GPSdome does not contain any user-serviceable parts and contains no moving parts. With reference to the CAUTIONS on page 3, no maintenance is required apart from examining all the cable assemblies for secure connection, damage and corrosion.

Troubleshooting

Nothing is working and my GPS receiver does not acquire lock

Complete the following steps, in order:

- Check that there are no obstructions (e.g. buildings, trees or tunnels) around or above the installation; move to another location as necessary.
- Isolate any internal jamming sources; switch off all other electronic devices.
- Check all cable connections for damage, excessive bending and that they are correctly secured.
- Check that the GPS receiver functions correctly when connected directly to ONE antenna, without GPSdome connected. Repeat with the other antenna. If both antennas are confirmed as OK, then reconnect GPSdome.
- Check that the antennas are connected to GPSdome '**P**' and '**A**' connectors, and that the SMA connectors are tightened.
- Check that the GPSdome '**R**' connector is connected to the GPS receiver, and that the SMA connectors are tightened at both ends.
- Check that 3-12V power is connected to GPSdome 1.01 from the receiver and the receiver is capable of providing the required current or, for GPSdome 1.01-DF, the red and black wires are connected properly to an applicable power source (red to + 3-32VDC and black to common/GND).
- Check that the green LED is ON when an active GPS receiver is connected.

Jammer Rejection Performance is Poor

There are many factors that determine how well GPSdome performs, including:

- Being in an environment where signals are blocked.
- GPS receivers are slow to lock when moving, so it may help to wait for a good signal before driving off.
- The properties of the jamming source (power, waveform, direction).
- The type of GPS receiver being used.
- The GPSdome installation may be incorrect:
    - If only one antenna is connected properly, GPS will be available but anti-jamming capability will be disabled.
    - If the antennas are not > 10cm apart, the anti-jamming capabilities will be very poor.
    - If both antennas are not installed on a levelled surface, the anti-jamming capabilities will be very poor.
- The distance between GPSdome and any jamming sources (the bigger the better).
- The number of jamming sources.
    - GPSdome 1.01/1.01-DF is designed to protect from a single jamming direction.
- The propagation environment (open field, in-vehicle, urban, etc.).

Help and Support

InfiniDome's help and support contact details are listed below:

Phone: +972 (0)4 770 7700
Email: info@infinidome.com

Specifications

Table 2 details the Environmental & Electrical Specifications. All specifications are at nominal supply (3 - 12V) and temperature (+25°C) unless otherwise stated.

Table 2: Environmental & Electrical Specifications

Item	Parameter	Description/notes	Value			Units
			Min.	Typ.	Max	
Physical Operational Environmental						
1	Temperature range		-40	25	+85	°C
Default System Configuration						
RF Specification						
2	Protected frequency	GPS L1		1575.42		MHz
Power Supply Specification						
3	Supply Voltage	Receiver DC line	+3		+32	Volt
4	Supply Consumption	Including antennas		0.75		Watt
5	Antenna Bias	Voltage Current per o/p Self re-setting fuse		2.75 10 200	 25	Volt mA mA

Antenna parameters

Item	Description	Value			Units
		Min.	Typ.	Max.	
Type	Active GPS Patch				n/a
Elements			2		n/a
Gain			28		dB
Noise Figure			2		dB
Supply Voltage			2.75		Volt
Supply Current		2	10	20	mA

Attachment A – Integrating the Jamming Indication

The custom integrated circuit at the core of GPSdome has a diagnostic logic output to indicate the presence of jamming energy. It provides a 'basic indication' of an active jammer being present or not. Its switch point is a function of external antenna LNA gain and so cannot be precisely specified. It is important to note this is an optional output only - the GPSdome anti-jam function operates all the time, with or without this logic signal.

If this optional connection is to be made use of, then the following information will be useful:

- The open drain circuit inside GPS Dome (left hand side of Figure 1) connects to the brown or white wire. In clear reception conditions, the Control FET is off and the jamming detect wire is substantially open circuit for DC voltages applied up to around 3V (i.e. before the onset of Zener leakage). When jamming is detected, the Control FET connects the 4k3Ω resistor to ground.
- External User circuitry to interface to this could take the form of a voltage detector, for example using a 27kΩ pull up resistor to 2.5V supply and driving a FET or Logic gate (as shown in the right hand side of Figure 10). Alternatively, current detection could be used to sense when this logic is asserted.

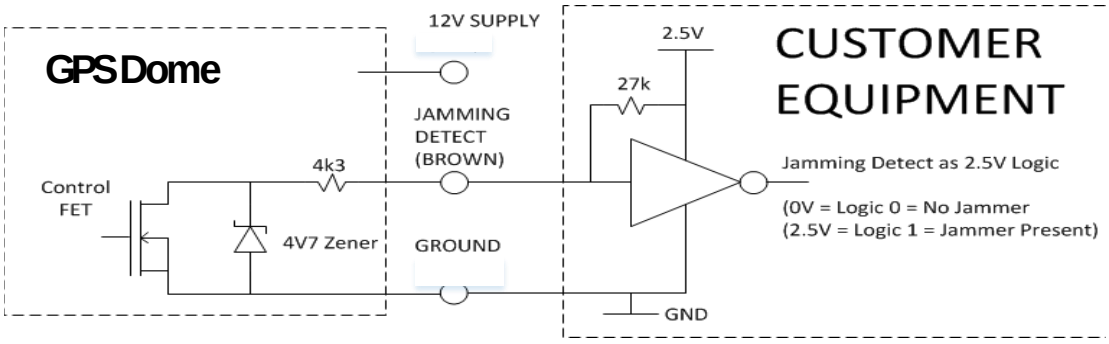

Figure 1: Jamming Detect Output Circuit

Note: The Jamming Detect signal may be on either brown or white wire