

MSAT^{G2} Mobile Satellite Radio



INSTALLATION GUIDE

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Introduction

The purpose of this guide is to provide assistance to personnel installing the new MSAT-G2 mobile satellite radio equipment. The guide starts off by providing installation-specific information on each component of the radio. Installation tips are then offered for fixed-site and vehicular scenarios. A section on commissioning instructions follows. The guide concludes with a troubleshooting section.



Installation Warning

This product is to be installed by Authorized Service Personnel. **Damages resulting in the failure to conform to the instructions found herein, as well as standard installation practices, will be the responsibility of the installer.**

MSAT-G2 Mobile Satellite Radio

The MSAT-G2 mobile satellite radio is comprised of three core component parts: the transceiver unit (the small black box), the antenna system (white domes), and the handset.



Figure 1 – MSAT-G2 Mobile Satellite Radio Components

An optional external speaker may be connected to the TU for remote monitoring. Serial and ethernet ports are provided for external interfacing, debugging, software upgrading, and future expansion capabilities.

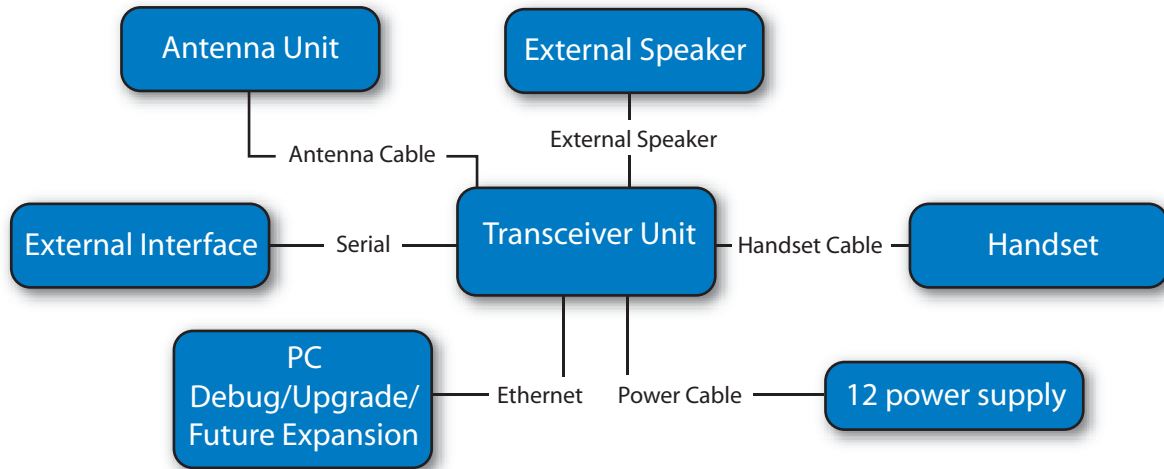


Figure 2 – System Overview

Transceiver Unit (TU)

The TU provides the interface for the handset and antenna unit (AU) and manages the communications over the MSV network. It also distributes power to the handset and Antenna Unit (AU).

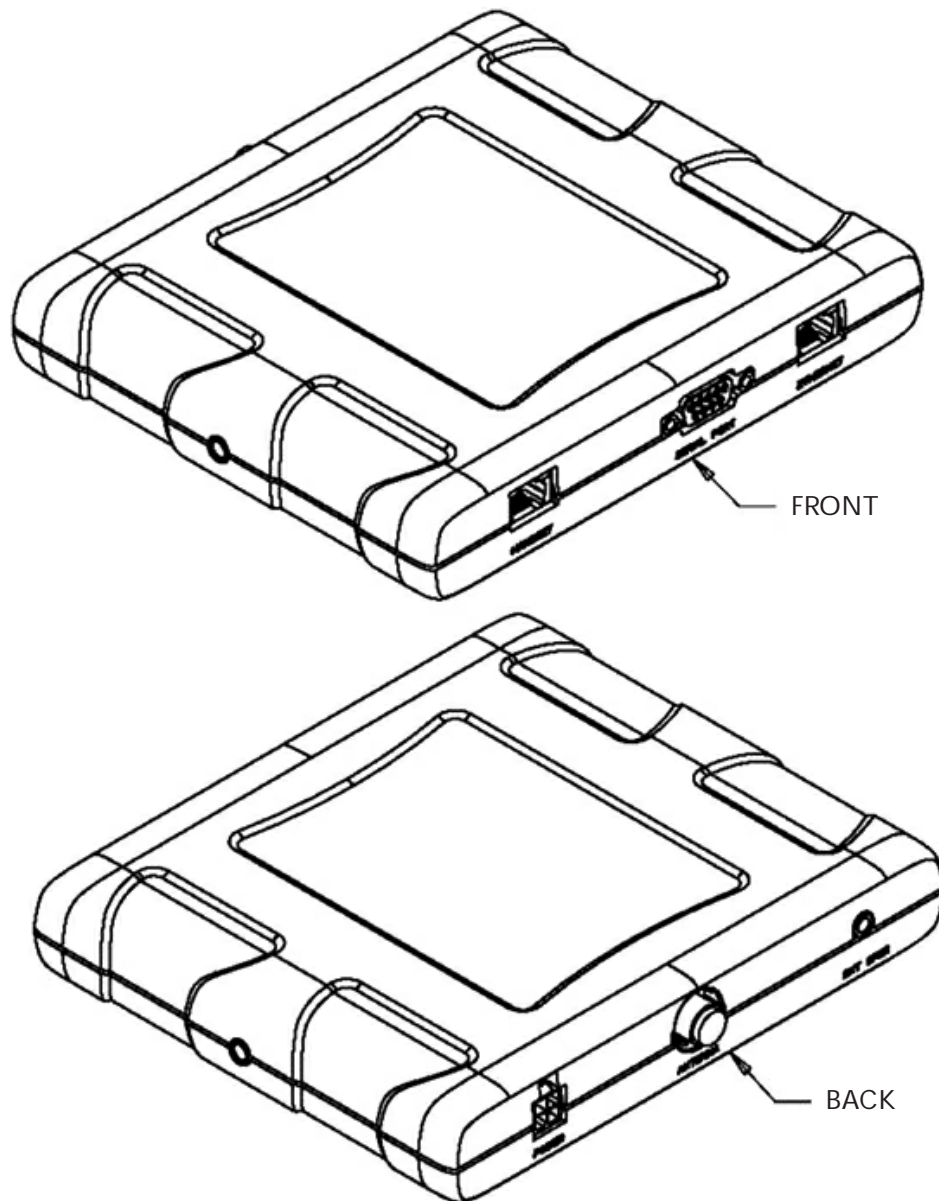
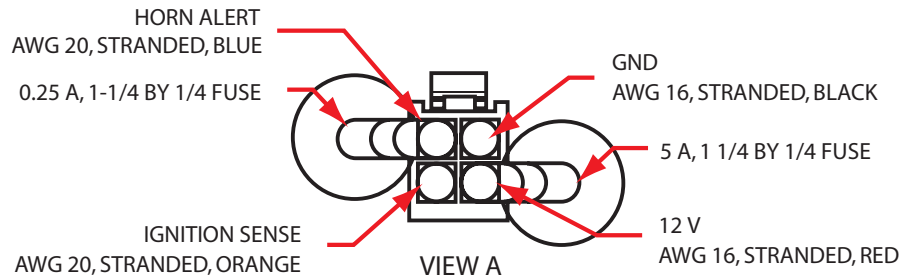


Figure 3 - Transceiver Unit w/o Mounting Bracket

The TU is equipped with the following ports:

Power Port

The power port is the connection from the power supply (vehicle battery or some other 12 VDC power source) to the TU. The power cable has a +12V power line, a +12V ignition sense line, a horn alert line, and a ground line.



Line Type	Colour
+12VDC	Red
Ground	Black
Ignition Sense	Orange
Horn Alert	Blue

Figure 4 – Power Port Cable Colour Reference

Ethernet and Serial Ports

RJ 45 Ethernet Port

The RJ 45 Ethernet port is available for upgrade and future expansion of functionality. The port supplies standard Ethernet line levels and supports all defined control line signaling. The pinout of the port supports a direct straight-through connection to a PC with a standard Ethernet cable. The PC shall be supplied with a dynamic local IP address using a standard DHCP exchange.

Pin	
1	RX+
2	RX-
3	TX+
6	TX-

Figure 5 – Ethernet Port Pinout

Serial Port

The serial port is a female DB-9F RS 232 and can be used for NMEA output (GPS) and crossbanding.

Pin	Data (currently not supported)	GPS	Crossband
1	CD (Carrier Detect)		COR (Carrier Operated Relay)
2	RD (Receive Data)	RD (Receive Data)	
3	TD (Transmit Data)		
4	DTR (Data Terminal Ready)		
5	GND (Signal Ground)	GND (Signal Ground)	GND (Signal Ground)
6	DSR (Data Set Ready)		
7	RTS(Request To Send)		PTT (Push To Talk)
8	CTS (Clear To Send)		CTT (Clear To Transmit)
9	RI (Ring Indicator)		

Figure 6 – Serial Port Pinout

Antenna Port

The antenna port is a 50 Ohm female TNC. This line carries RF, signaling, and DC power for the antenna. **Note: Grounding the center conductor while power is applied to the transceiver can cause permanent damage to the transceiver. Always remove power from the transceiver before disconnecting either end of the RF cable. No modifications should be made to the RF cable under any circumstances.**



Figure 7 – Antenna Port Detail

Handset Port

The RJ45 handset port is used to connect the handset to the TU. The connector type is a modular 8 position and 8 conductor RJ45. The pinout is as follows:

Pin Number	Signal Name
1	Audio TX + Microphone
2	Audio TX – Microphone
3	Data TX – TU Send
4	Data RX – TU Receive
5	+ 12VDC
6	Ground
7	Audio RX + Speaker
8	Audio RX - Speaker

Figure 8: Handset Connector Pin-out

External Speaker

A 3.5 mm mono connection is provided for a 4W 8Ohm speaker.

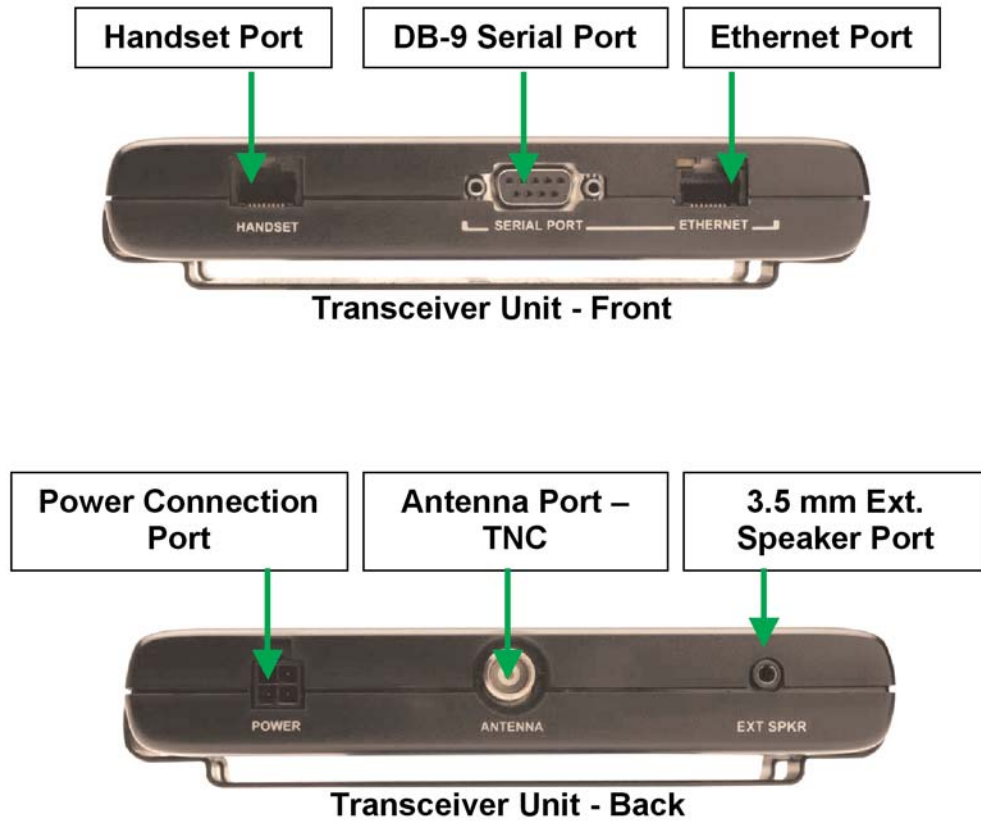


Figure 9 – Transceiver Unit Front & Back

System Power Requirements

There is only one power connection for the entire radio. This must be connected to a 12 VDC power supply.

Power requirements and consumption are as follows:

Voltage Input Minimum	11.5 V DC
Voltage Input Maximum	15.6 V DC
Total Current for AU, TU & Handset (Max.)	3A
Required Fuse	5A

Figure 10 – System Power Requirements

Power Cable

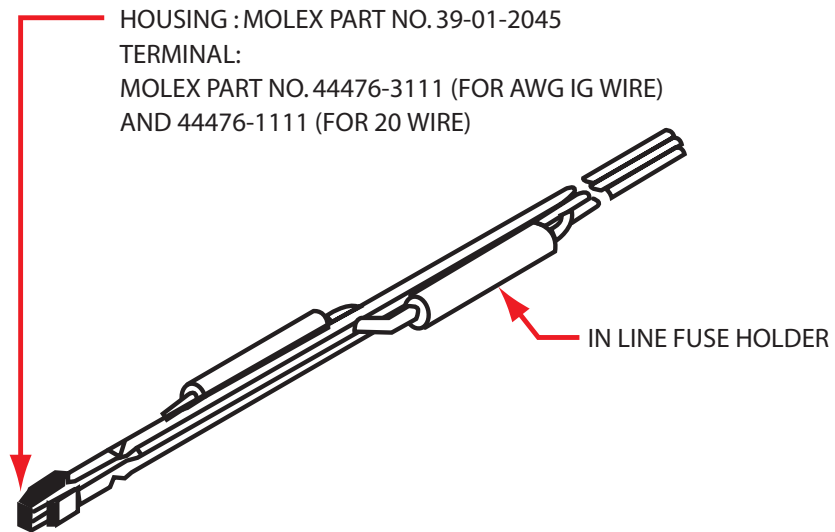
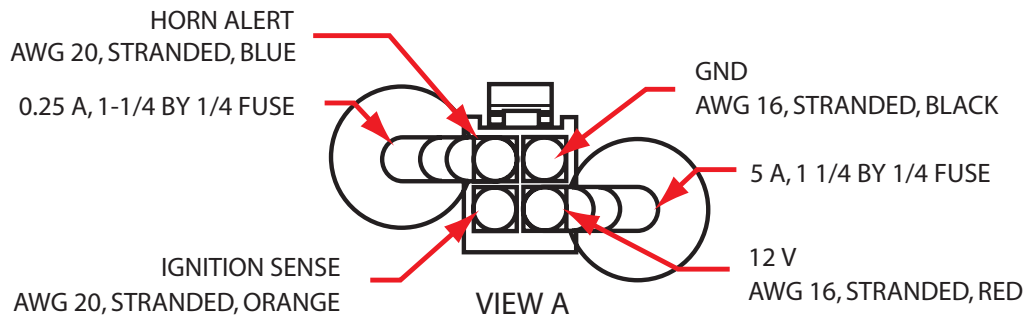
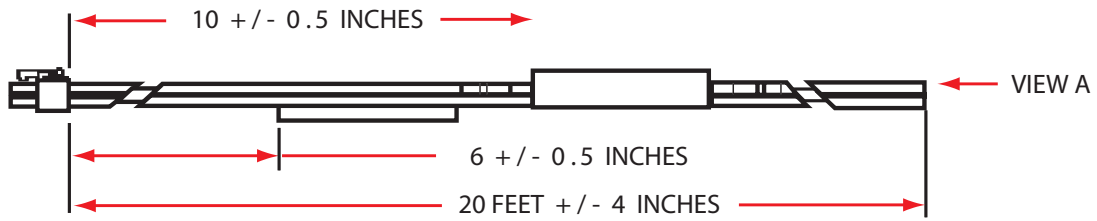


Figure 11 - Power Cable Details

Standard Cable Connections

In addition to the DC power connection, optional horn alert and ignition sense connections may be made. These are all done using the four wire power cable. In the case of a vehicle installation, the power source is typically the vehicle battery. Cables should be routed appropriately and cable ties and clamps should be used as required to ensure that vibration and/or rubbing of the cables does not occur.

Horn Alert (Blue Wire - Optional Installation)

To install the Horn Alert, route and splice the blue wire (Horn Alert) as shown below. **Note that the Horn Alert option is not available in Dispatch Radio mode.**

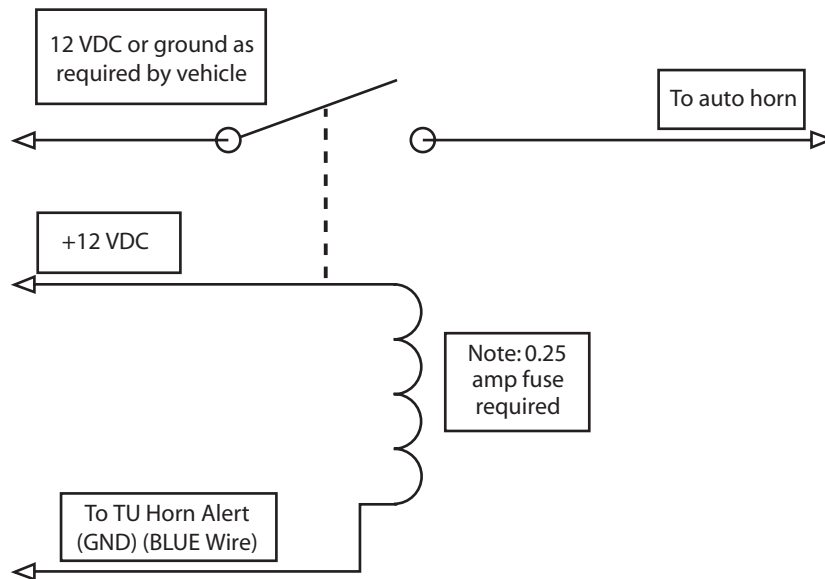


Figure 12 - Horn Alert Wiring Diagram

Ignition Sense (Orange Wire)

Route and connect the orange wire (Ignition Sense) to a switched 12 VDC source, such as ignition switch or fuse block. Extended use of ignition sense in accessory position (ACC) by the end user may lead to a discharged car battery.

NOTE: Ensure that the connection is a switched source-OFF when ignition is off or in start and ON only when ignition switch is in ACCESSORIES or RUN position.

Basic Installation Procedure

While the installation of the MSAT-G2 mobile satellite radio is straightforward, it is essential that the installation be done correctly.

The basic installation procedure is as follows:

1. Decide where you are going to install the antenna, TU and handset.
2. Ensure that the TU is located inside the vehicle or a building and that it is attached to something structurally sound. Loose mounts that vibrate will degrade performance.
3. Determine the cabling required for the installation of each component.
4. Perform the installation of the antenna, TU and handset.
5. Connect the antenna and the handset to the TU.
6. Connect the power to the TU.
7. Power up and commission the radio.

Fixed-site Installation

Choosing a Location

It is important to choose a location for the antenna that will have a clear line-of-site to the satellite(s). Preferably, avoid all obstructions within three (3) meters of the antenna.

Installation during windy conditions may be dangerous. The owner and installer assume all responsibility to ensure that the equipment is properly installed with adequate structural stability of mounting surface to withstand all loads (wind, weight, ice, etc.) and is properly sealed to avoid leaks.

DO NOT ATTEMPT TO INSTALL OR DISMANTLE THE EQUIPMENT NEAR ANY TYPE OF POWER LINE.

Safety Rules:

1. Select your installation site with safety as well as performance in mind.
2. Plan your installation carefully before beginning. Perform as many tasks as possible while on the ground.
3. If any part of the equipment (i.e. antenna assembly) comes into contact with a power line, do not try to remove it yourself. Contact your local power company.
4. When installing an antenna assembly, do not use a metal ladder.
5. If the antenna assembly starts to drop, get away from it and let it fall.
6. Verify that the antenna is properly grounded.

Instructions for the installer:

1. The mounting bracket should be used for mounting the TU.
2. Mount the mounting bracket onto a flat surface using at least four (4) screws (not supplied). Use screws with diameter between 3 to 4.5 mm. Vibration resistant screws or lock washers should be used.
3. Choose any suitable holes and slots on the base of the mounting bracket for mounting the screws. If space is available on the mounting surface, the screws should be spaced as far as possible towards the corners of the mounting bracket to provide good stability.
4. Place the TU on the mounting bracket so that the holes on the side flanges of the mounting bracket are aligned with the threaded inserts on the TU. Use only the two screws and spring washers provided to secure the TU to the mounting bracket. Not using the supplied bracket screws could result in damage to the TU (especially if screws are too long).

MOUNTING HOLE DIMENSIONS MOUNTING BRACKET, MSV

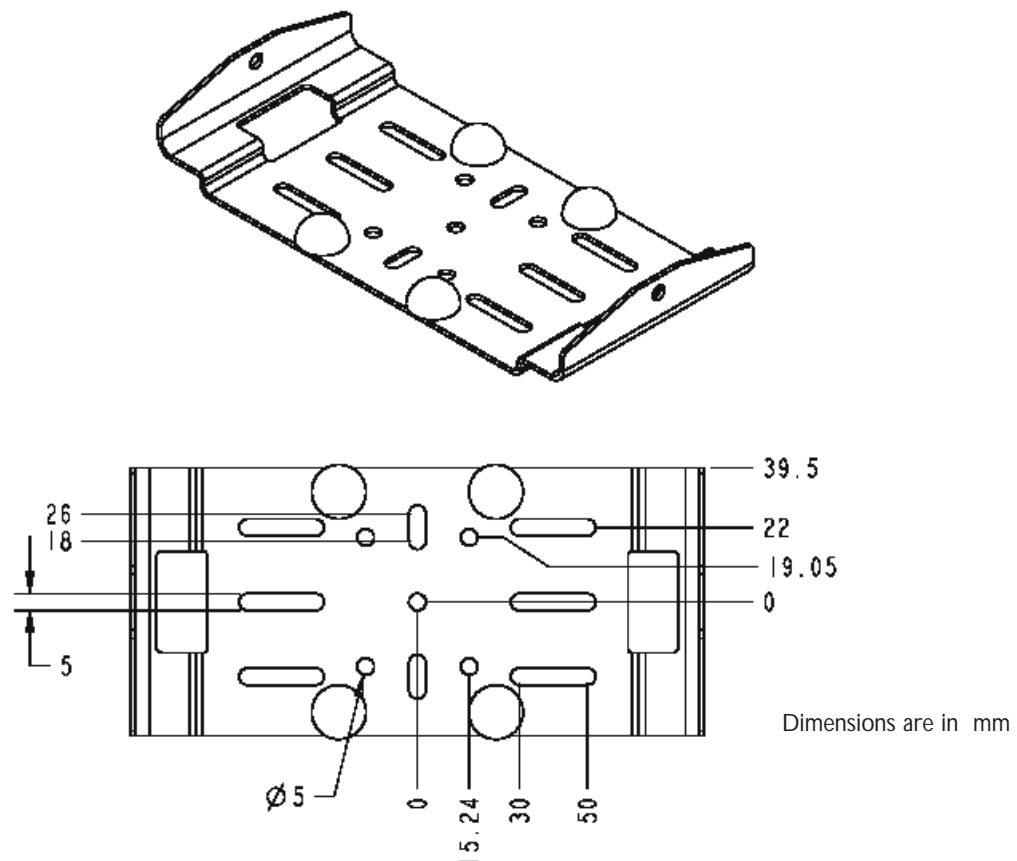


Figure 13 - Transceiver Unit Mounting Bracket Dimensions

**DIMENSIONS WITH MOUNTING BRACKET
MSV TRANSCEIVER UNIT**

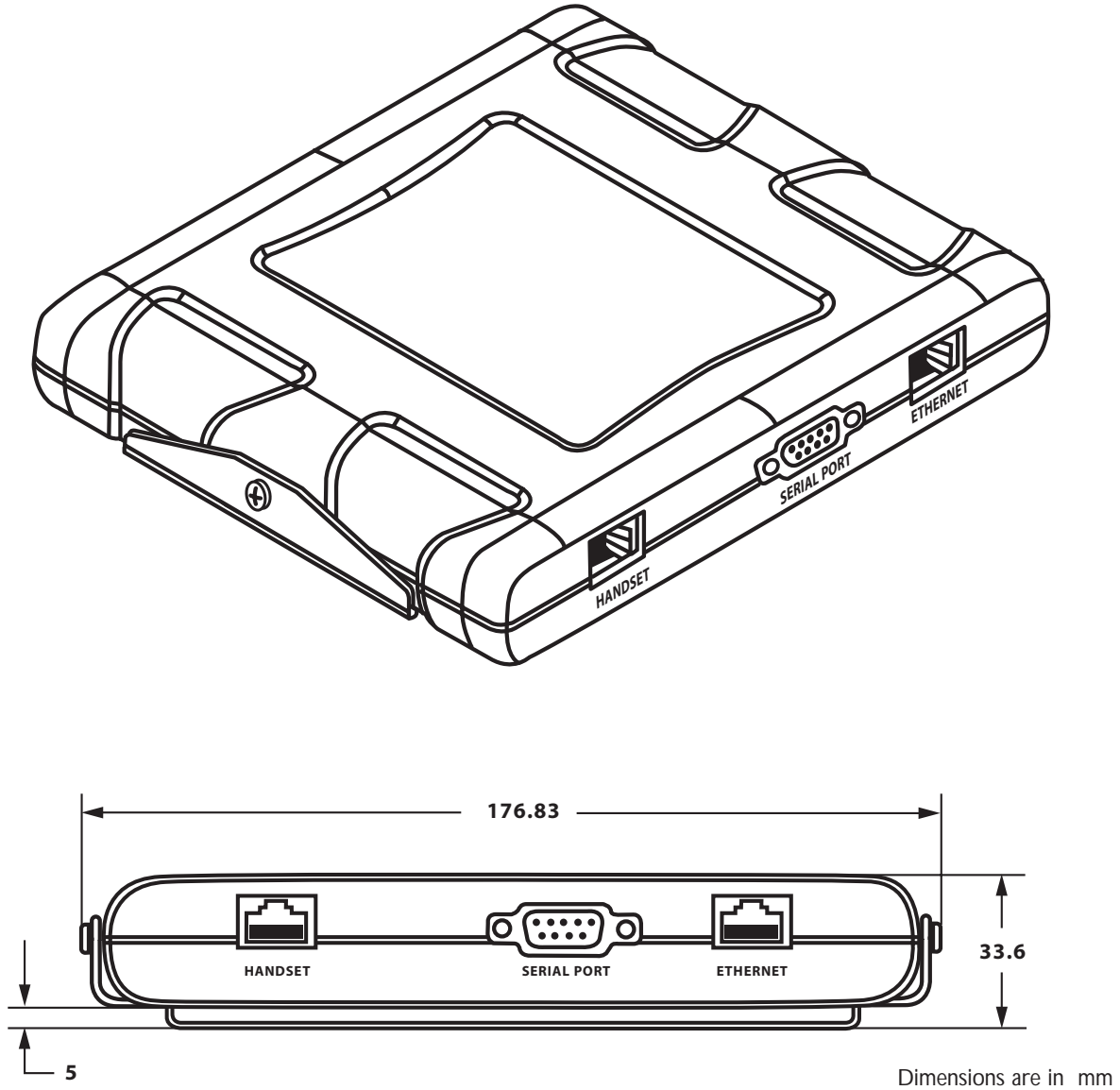


Figure 14 - Transceiver Unit w/ Mounting Bracket

The Antenna Unit (AU)

The antenna unit is composed of the antenna element array, necessary high power and low noise amplifier systems, and a tracking system.

Two AU versions exist: a 2-axis unit intended for land-mobile and fixed-site installations and a 3-axis unit for the maritime environment.

Connection to both AUs is made by a TNC connector. The single co-axial cable carries RX, TX, power and tracking information.

Antenna Cable Lengths and Types

The radio has been type approved for use with the following cable lengths and types:

Cable Length Antenna to Radio	Cable Type
20 ft	RG223/U
60 ft	LMR240 (Equiv.)
150 ft	LMR600 (Equiv.)

Figure 15 – Antenna Cable Lengths and Types

Installing the Antenna



WARNING: Avoid exposure to microwave radiation. Keep a safe distance of minimum one 1 meter (39 inches) to the side and above the antenna. Always power the MSAT-G2 down prior to disconnecting or connecting the antenna.

The antenna port is a 50 Ohm female TNC. This line carries RF, signaling, and DC power for the antenna. **Note: Grounding the center conductor while power is applied to the transceiver can cause permanent damage to the transceiver. Always remove power from the transceiver before disconnecting either end of the RF cable. No modifications should be made to the RF cable under any circumstances.**

Keep a clear line-of-sight to the satellite. Preferably, avoid all obstructions within three (3) meters of the antenna. Obstructions less than 15 cm (6 inches) in diameter can be ignored beyond this distance.

If the antenna is being mounted on a vehicle it is important to ensure there is a clear line-of-site to the satellite(s) in all directions. After the radio is commissioned and operational it is recommended that the signal strength be checked while the vehicle is slowly driven in a 360° circle. The signal strength should not vary significantly or be degraded in any particular direction.

Do not locate the antenna close to interfering signal sources or receivers. It is recommended that no other antennas be located within three (3) meters of the MSAT-G2 antenna. If there is other equipment installed near the MSAT-G2 satellite radio it is recommended to operate all equipment simultaneously and verify there is no co-interference.

SpaceCom SPAC-AS-MSV220 Land-Mobile / Fixed-site Antenna

Magnetic (Temporary) Mounting option

For temporary use – or where drilling of holes is to be avoided – a Magnetic Mount Installation Kit is offered. SpaceCom part no: SPAC-AC-1016.

Three (3) magnetic mounts each with an adhesive force of at least 420 N (Newton) are required to secure the MSV220 antenna.

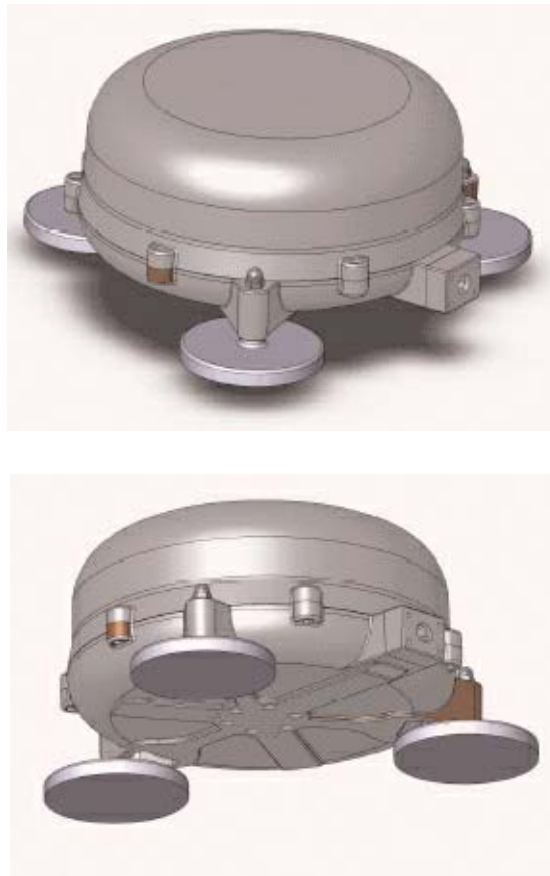


Figure 16 – SPAC-AS-MSV220 2-axis Antenna W/ Magnetic Mounts

Magnetic Mount Installation

The Magnet Mount consists of three (3) individual high intensity magnets with rubber coating. Each magnet has a stainless steel M5 center bolt.

First attach the magnets to the antenna. There are three (3) “legs” on the antenna where the magnets are placed. Note the position of the two nylon (plastic) washers just below and above each “leg”, the stainless steel washer above the upper nylon washer and the M5 protective nut on top.

Now place the antenna with magnets on the roof of the car.

When installing the antenna cable, it’s important to protect against moisture – using self amalgating tape, or similar, wrapped around the coaxial connector. Also be careful with the cable run from the antenna and secure it at short intervals. An unsupported length of cable will vibrate when driving and could negatively affect the connection over time.

Dismounting:

Grab the antenna near one of the magnets and lift. When one magnet is loose, the other two are easy to “break off”. In some situations the force of the magnet may be too great and it will be necessary to unscrew the antenna first and remove the magnets separately.

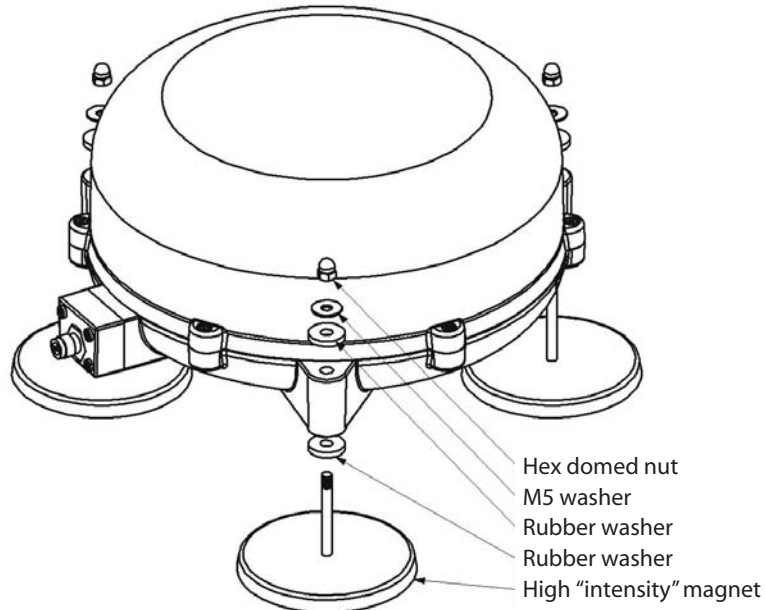


Figure 17 – SPAC-AS-MSV220 2-axis Antenna W/ Magnetic Mounts

Permanent (Mast) Mounting

For permanent mounting of the SPAC-AS-MSV220, a special Pole Mount Installation Kit is available. SpaceCom part no.: SPAC-AC-1017. Designed for easy installation, it ensures proper drainage of the antenna, galvanic insulation and is able to withstand the rigid mechanical stress.



Figure 18 – SPAC-AS-MSV220 2-axis Antenna W/ Optional Pole Mount

SPAC-AS-MSV220 Antenna Pole Mount Installation

The Pole Mount is made of stainless steel. The antenna is placed on the triangular top and the pole fixed using the U-clamps. (To a short mast or similar)

First mount the antenna on top of the pole with three (3) pcs. M6x50 mm bolts. The (6) six pcs. nylon washers are used just below and above the antenna “legs”.

The 44 mm U-clamps are placed around the pole mount, leaving the 50 mm U-clamps for the mast. Small tolerances in the mast diameter can be compensated by simply bending the U-clamps slightly.

When installing the antenna cable, it is important to protect against moisture – using self amalgating tape, or similar, wrapped around the coaxial connector. Also be careful with the cable run from the antenna and secure it at short intervals. An unsupported length of cable will vibrate in strong winds and could negatively affect the connection over time.

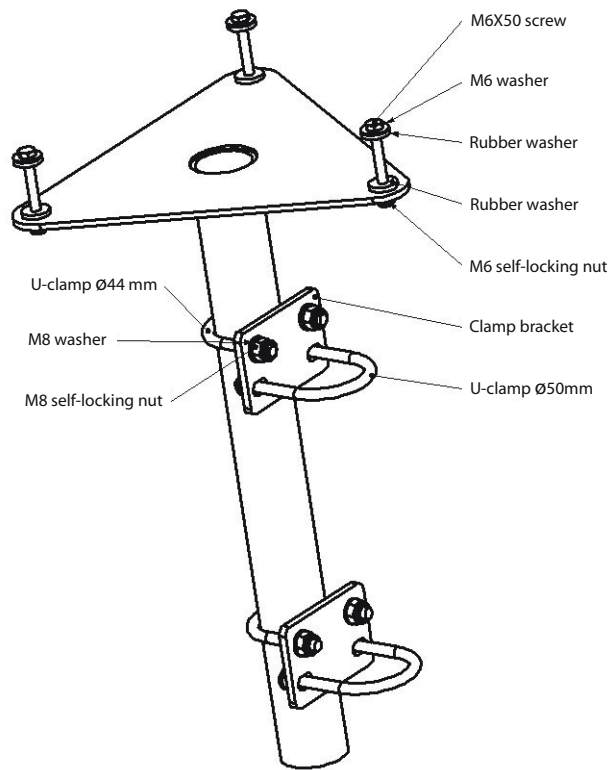


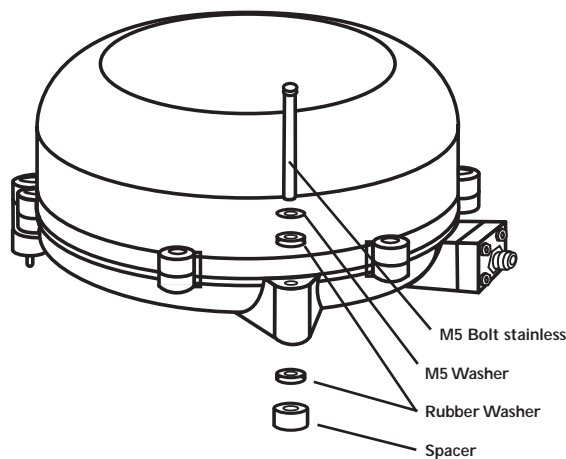
Figure 19 – SPAC-AS-MSV220 2-axis Antenna W/ Optional Pole Mount

Vehicle Mounting

When permanently installing the MSV220 antenna on vehicles, some important guidelines must be followed in order to ensure long and trouble free operation.

Use three (3) stainless steel M5 bolts (or similar) of suitable length for mounting. Place two rubber washers on each bolt, opposite to the radome “leg,” and use nuts, washers, distance pieces as necessary.

Figure 20 – MSV220 Antenna Vehicle Mounting Installation



Draining the Antenna

The antenna is designed with 8 drainage holes in the centre of the bottom portion of the radome. This allows condensation water, if present, to exit the interior of the antenna.

To prevent rainwater from entering, the radome is completely sealed except around the drainage holes.

For the draining system to function, it is vital that the drainage holes remain unblocked. Recommended clearance below the drainage holes is 1 cm. It is equally important that the antenna be mounted horizontally and not on an inclined surface.

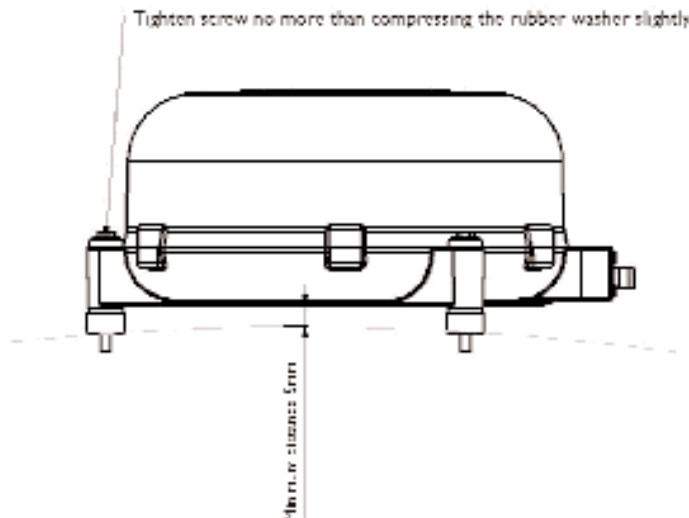


Figure 21 – Draining the Antenna

Antenna Cable

When installing the antenna cable, it is important to protect against moisture using self amalgamating tape (or similar) wrapped around the coaxial connector. Also, be careful with the cable run from the antenna and secure it at short intervals. An unsupported length of cable will vibrate when driving or get entangled with overhead trees etc. This could affect the connection over time.



Figure 22 – Antenna Cable Connector Protection

Cleaning

The antenna can be cleaned together with the vehicle (hosing down or driving through a washing tunnel). When using a pressure washer, do not direct at the antenna from a short distance. Avoid pressure washing at maximum pressure. This could force water around the sealing gaskets.

NEVER direct water, pressurized or not, towards the underside of the radome. Water may be forced up the drainage holes thus filling the radome.

Extreme Conditions

When using the MSV220 Antenna under extreme environmental conditions (unusual amounts of dust, dirt, water etc.) an Antenna supplement protection kit is available.

SPAC-AS-MSV320 Maritime Antenna

When installing a SpaceCom Maritime Antenna on a vessel the following important guidelines must be followed in order to ensure that the antenna will operate trouble-free throughout its service life. The warranty will be void if the guidelines are not followed.

Pole Mount Kit

The installation is based on a pole mounting kit AC-1005 and is shown in FIG.24.

The kit consist of the following components: (subject to change)

- 1pcs. Mounting Pole, Part No. SPAC-M00424
- 1pcs. Rubber Gasket, Part No. SPAC-M00425
- 6pcs. Plastic Bushings, Part No. SPAC-M00227
- 6pcs. Washer, Part No. SPAC-M90-10062
- 6pcs. Screw, Part No. SPAC-M90-10102
- 2pcs. Clamp, Part No. SPAC-M00428
- 2pcs. Clamp, Part No. SPAC-M00429
- 8pcs. Nuts M8, Part No. SPAC-M90-10105
- 2pcs. Flange, Part No. SPAC-M00430
- 1pcs. Plug for Mounting Pole, Part No. SPAC-M00233
- 1pcs. Screw M5*10, Part No. SPAC-M90-10104

These components are shipped in one separate box. The installer, upon receipt of a box, is required to check the contents.



Figure 20 – SPAC-AS-MSV320 Maritime Antenna W/ Optional Pole Mount

Pole Mount Kit Component Description

Mounting Pole Part No. SPAC-M00424 is a piece of standard tubing with a mounting flange welded onto it. The component is made from a stainless steel alloy that is easy to cut, machine and weld. It is part of the ventilating system for the dome. The standard length is 400mm and must not be shortened in maritime applications. Shorter versions for non-maritime applications may be supplied on special request.

Rubber Gasket, Part No. SPAC-M00425 is used to ensure that water or dust does not enter into the area around the centre hole in the bottom of the dome. The centre hole is part of the ventilating system for the dome and **MUST NOT BE BLOCKED**. The gasket will also protect the TNC-type connector from water and dust.

Bushings, Part No. SPAC-M00227 are used to ensure **NO** electrical contact between the mechanical parts of the antenna (in the dome) and the mounting pole. This isolation is not required in vehicle installations but is required in maritime installations, where the antenna and co-axial cable to the antenna must be isolated from ships structure in order to avoid any circulating DC current that could cause uncontrolled corrosion.

Washers, Part No. SPAC-M90-10062 are used to protect the plastic bushings SPAC-M00227 when the screws SPAC-M90-10102 are tightened to the specified torque. The washers **MUST** be used.

Screws, Part No. SPAC-M90-10102 are M6 (metric), 25mm long screws made from stainless steel (A4) are used for fastening the antenna to the flange on the mounting pole so that the installation will endure vibrations and heavy loads due to wind or surges from rough sea. **DO NOT CHANGE THE LENGTH OF THE SCREWS.**

Clamps, Part No. SPAC-M00428 are used to fasten the flanges SPAC-M00430 to the mounting pole, refer to FIG.24.

Clamps, Part No. SPAC-M00429 are used to fasten the mounting pole to any post with adiameter between 35 and 50 mm, refer to FIG.24.

Nuts, Part No. SPAC-M90-10105 are M8 nuts used for the clamps, refer to FIG.24 Nuts are to be tightened to 5Nm.

Flange, Part No. SPAC-M00430 are used for linking the clamp holding forces.

Plug, Part No. SPAC-M00233 is used for partly closing the bottom of the Mounting Pole so that no surge of water will fill the tube or damage any part of the antenna. Any condensing water within the antenna and/or tube will drop out by the plug. The plug will also prevent the coaxial cable from vibrating in the tube.

Screw, M5*10, Part No. SPAC-M90-10104 is used to secure the plug. The kit offers the following advantages:

- Flexible and easy installation.
- Provides ventilation of the antenna while ensuring compliance with its relevant IP class.
- Protects the co-axial cable going to the antenna and its N-type connector.
- Isolates the antenna from the structure on which it is installed, this is a must in maritime installations where no DC current is allowed to flow through any part of the ship.

SPAC-AS-MSV320 Antenna Installation

Installation of the 3-axis antenna on the mast is done according to FIG 24. The diameter of the post shall preferably be between 35 and 50 mm using the standard clamp supplied in the kit. Note the TORQUES for bolts and nuts.

A small loop should be made on the co-axial cable near the plug SPAC M00233 in order to be able to pull the cable about 15 cm up through the mounting pole, when the antenna is installed or removed.

If a long (e.g. 3m) post is used on board a ship it is recommended that this is fastened to the ship using standard clamps rather than welding. This will enable the post to be laid down in case removal of the antenna is required.

Vibration

The antennas (2- and 3-axis versions) are designed to meet the following operating vibration levels in any of three perpendicular directions measured at the mounting base of the radome i.e. at the flange of the standard mounting pole described above:

<u>Random Vibration</u>	1.05 Grms with the following spectral density
	5-20 Hz.....0.02G ² /Hz
	20-150 Hz.....-3dB/octave

And further,

<u>Single Frequency Vibration</u>	5-10 Hz with amplitude 2.54 mm
	10-15 Hz with amplitude 0.76mm
	15-25 Hz with amplitude 0.40mm
	25-33 Hz with amplitude 0.23mm

Vibration levels in a typical installation are usually much less than the above mentioned values. It is, however, the responsibility of the installer to verify that the cited levels are not exceeded in any mode of operation of the vehicle/vessel. In case of abnormal vibration, typically at a resonance frequency, measures must be taken in order to displace the resonance frequency or to dampen the vibration amplitude.

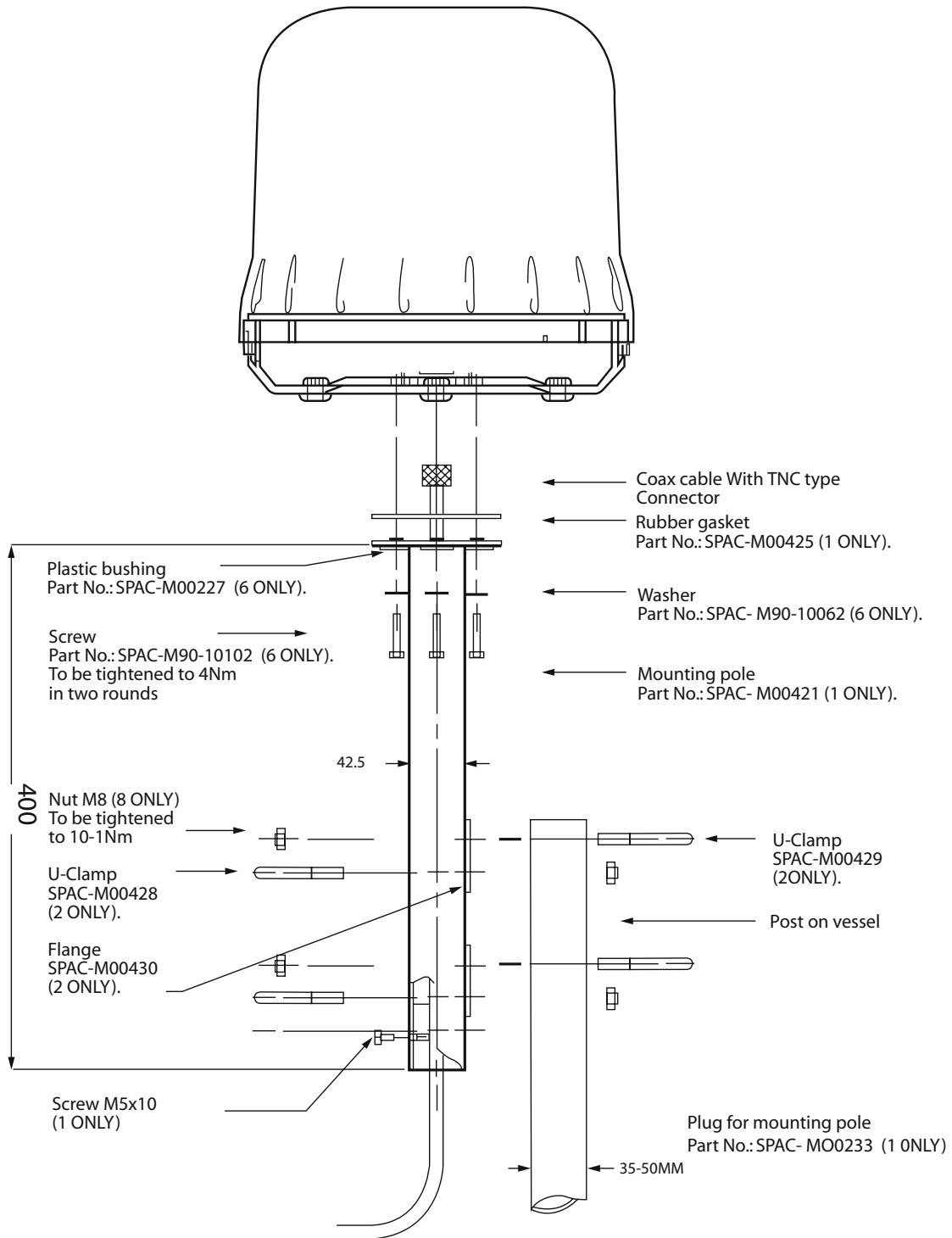


Figure 21 – SPAC-AS-MSV320 3-axis Antenna Installation Details

Installing the Handset

The handset can be mounted using a standard-sized microphone clip mount (included).

Select a mounting position for the handset. The handset should be placed in a location which is easy for the user to see and reach (arm's length) and which does not impede the user's movements or vehicle operation.

The handset is rated for 25 feet of cable. CAT5 or better is recommended. The handset comes equipped with 6 foot coiled type cable.

Commissioning Procedure

In order for the unit to operate on the MSAT Network, it must first be commissioned – authorized for use. This task is generally only performed by qualified service personnel. If the unit has never been commissioned, it will power up in dealer mode. You can also access this function even after the unit has been commissioned if you are authorized to do so.

1. Power up the radio and press the 5 key within 1 second of the appearance of the “**SEARCHING**” message on display.
2. You are prompted to enter the **DEALER PASSWORD** (authorized personnel will have this password). Type it in and press **OK**.
3. You are then prompted to select the antenna type: **TRACKING** (for mobile applications) or **OTHER** (for future applications). Use the arrow keys to scroll to the appropriate option and press **SELECT**.
4. You are then prompted for each of the Commission Parameters: Control Channel Frequency (**CFC**), Pilot Channel Frequency (**PFC**), and Security Access Code (**SASK**). In each case, you are asked to type in the parameter and then press **STORE** to go onto the next parameter.
5. After you enter the set of values, a **CONTINUE?** Prompt asks you if you want to proceed with commissioning. Press **YES** to continue or **NO** to cancel the commissioning process. If you choose to proceed, two screens are displayed in succession:
 - **COMMISSIONING**: indicates the general commissioning process is underway
 - **COM: PVT** indicates the Performance Verification Test is underway.

If the entire commissioning process is successful a **COM: SUCCESS** screen is displayed. Control then reverts to the initial Idle Mode screen.

If commissioning is not successful, you will receive a failure message (Network indicates that commissioning has failed, refer to figure 22 – Error Code Diagnostics on the following pages). Contact your Service Provider for assistance.

Error Code Diagnostics

The following error messages may be displayed on the handset.

Error Condition	Definition	Action
FAILED TO COMMISSION	The radio has been shutdown by the network.	Contact MSV Customer Support.
COM: NO RESP - RETRY?	Signifies that the network did not respond to the commissioning procedure initiated by the user.	Ensure that you have a clear view of the southern sky and select YES to re-initiate the commissioning procedure. Contact MSV Customer Support if the radio fails to commission after several attempts
COM: FAILURE - RETRY?	The commissioning process failed.	Select YES to re-initiate the commissioning procedure. Contact MSV Customer Support if the radio fails to commission after several attempts.
INVALID SASK	Signifies the user has entered an invalid SASK while in the process of initiating the commissioning procedure.	Check that you correctly entered the SASK. If the problem persists, contact MSV Customer Support to obtain the proper SASK value.
SEARCHING...	If signal strength bars are seen, the radio is in the process of connecting to the MSAT network. If signal strength bars are not seen, the radio cannot receive a satellite signal.	If the condition persists, check the radio has a clear view of the southern sky and that the antenna is connected and is functioning (e.g. can hear the servo motor in the antenna).
WAIT...	Signifies that the radio has not received a response to the PTT request from the MSAT network and is attempting several retries.	Continue to press the PTT key. If the call is successful, USER ON will be displayed. In the event a call fails, a PTT FAIL message will appear requiring the user to release the PTT key and try again.
PTT FAIL	Signifies the radio failed to receive a response to the PTT request from the MSAT network.	Release the PTT key and try again. If this message continues, contact MSV Customer Support.
PRESSPT	Signifies the PTT key was been pressed then released just before the radio received the confirmation from the network.	Press and hold the PTT key in order to talk.

INVALID DN	Signifies the user has entered a Directory Number (DN) that is not a member of the private mode talk group currently active on the radio.	Ensure a valid DN is entered in tag position 00.
NOTG	No talk groups have been downloaded to the radio.	If this condition persists, contact MSV Customer Support.
BLOCKED	Signifies that the radio's antenna signal to the satellite is blocked.	Ensure that the antenna has a clear line-of-sight to the satellite.
X-OVER FAILURE	Signifies that the user has initiated a manual beam cross-over to a beam that is not accessible. Following the appearance of the failure message the user will be returned to the beam options list.	Ensure that the appropriate adjacent satellite beam is chosen when initiating a manual beam cross-over.
RF POWER FAILURE	The radio detected a problem with its RF transmissions and disabled that transmitter.	Power cycle the radio. If this condition persists, contact MSV Customer Support.
ANTENNA FAILURE	This indicates the radio has detected a fault in the antenna and shut it down.	Power cycle the radio. If this problem persists, contact MSV Customer Support
WARNING! OVERHEAT	Signifies that the radio is overheating. This message will appear at 10 second intervals until the temperature is reduced. If the temperature continues to increase then the radio will shutdown.	Move the radio to a cooler place. If the radio powers off, allow it to cool down before re-initiating the power-up sequence.
INVALID PASSWORD	Signifies the user has entered the wrong Dealer or SYSTEM Menu password.	Enter the correct password. If the password is unknown, contact MSV Customer Support with the radio's ESN. Customer Support can provide a new SYSTEM password.
WRONG LOCK CODE	Signifies the user has entered the wrong Handset Lock code.	If you cannot remember the lock code (default is 0000), enter the SYSTEM password (default 1234) when prompted to enter the code.

Figure 22 – Error Codes

MSAT-G2 Technical Specifications

Weight	HUGHES 2100 TU = 0.8 lbs DT-200 Handset = 0.6 lbs SPAC-AS-MSV220 Antenna = 4.6 lbs SPAC-AS-MSV320 Antenna = 10.3 lbs
Dimensions	HUGHES 2100 TU = (W) 6.5" x (H) 1.1" x (D) 5.6" DT-200 Handset = (W) 2.9" x (H) 1.4" x (D) 6.8" SPAC-AS-MSV220 Antenna = (Diameter) 9.8" x (Height) 3.9" SPAC-AS-MSV320 Antenna = (Diameter) 11" x (Height) 11"
Power	Input voltage: 11.5 to 15.6 VDC Input current: 3 Amps max.
Fuses	Power cable assembly 3004028-0001 Battery (red wire): 5 Amp / 250 Volt Horn Alert (blue wire): 0.25 Amp / 250 Volt CAUTION: For continued protection against risk of fire, replace only with same type and rating of fuse
Humidity	98% at 100.4°F (38°C)
Operating Temperature	Antenna = -22°F(-30°C) to +109°F(+43°C) TU = -22°F(-30°C) to +131°F(+55°C)
Dust	In Accordance with SAE J1455 section 4.7
Rain	Antenna = Precipitation rate of 2" /hour

Figure 23 – Technical Specifications



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