ANACOM, INC.

AnaSat® SSPA Series

Operating Manual

Ku-Band
SEKu-Band
EC-Band
SEC-Band

You have just received an AnaSat® SSPA (Solid-State Power Amplifier), a *cost-effective* product with no compromise on *quality* and *reliability*. This product should provide tireless performance in any reasonable operating environment. Note that this product is transmit only, and does not include a Block Down-Converter, which will have to be obtained separately.

We, at ANACOM, have taken great care to provide a convenient, easy-to-use product in a single package. Should a situation arise beyond the operator's control, just give us a telephone call. Many situations can be diagnosed and solved by ANACOM's trained customer-service personnel over the phone.

If you have any questions, require technical assistance or training please call ANACOM directly at (408) 748-7800 or FAX to us at (408) 748-7801. You can also send e-mail to techsupport@anacominc.com and one of our engineers will contact you.

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Operating Manual
for the
AnaSat®-Series SSPA

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AnaAat® SSPA Quick Start Guide

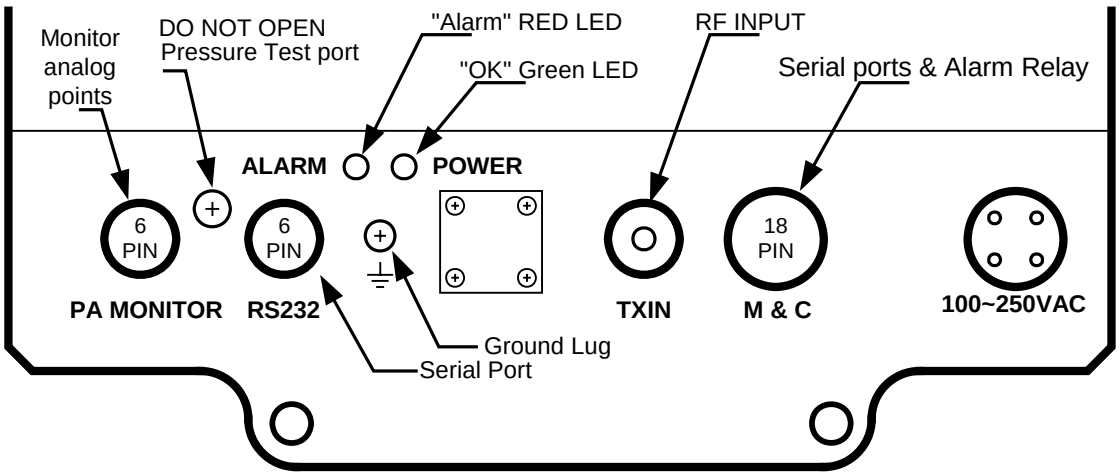
1. Mount the SSPA on the antenna.
2. Connect the cables for RF input, and RF output (waveguide).
3. If needed, connect the M&C or PA MONITOR to the driver or Protection Switch.
4. Connect AC power, nominal 120 or 240 VAC.

There are no settings that need adjustment.
The SSPA is factory set for a gain equal to the P1dB value.

For monitoring the performance of the SSPA, there are two methods

1. Connect a computer to the RS232 port using the cable provided, and the Supervisor software. Now you can see a status of the SSPA digital and analog monitored points. The gain is fixed and cannot be changed. You can MUTE the SSPA with the command TX OFF/ON.
2. Connect a cable (user provided) to the PA MONITOR connector. This will provide:
   A. Pin 1 is used to MUTE the SSPA by grounding this pin.
   B. Pin 2 is used to show a summary fault in the SSPA (0 volts). 5 volts is normal.
   C. Pin 3 is used to show an analog voltage that changes as output power changes.
   D. Pin 4 is used to show the SSPA internal temperature in analog form.
   E. Pin 5 is not used.
   F. Pin 6 is ground.

Drawing of required cable connections



Introduction

The AnaSat® VSAT series of SSPAs are designed for continuous outdoor duty in all types of environments. Ideally suited for SCPC, MCPC, DAMA, and VoIP applications. Designed to interface with a 0 dBm driver, the AnaSat® VSAT SSPA may be used in a wide variety of communication networks.

The C-band members of the AnaSat® SSPA family transmit in the 6 GHz frequency range. The Ku-band members of the SSPA® SSPA family transmit in the 14 GHz frequency.

The AnaSat® VSAT SSPAs incorporate a solid-state power amplifier, M&C function, and a universal power supply, all in a small, highly integrated outdoor package. The only cabling required to the indoor plant are the RF and AC power cables.

The Power Amplifier (PA) uses Internally-Matched Field-Effect Transistors (IMFET) to achieve highly linear power and gain with minimal intermodulation distortion (IMD) products.

AnaSat® SSPAs use a wide input voltage (100 to 240VAC, 47 to 63Hz) switching power supply to develop the +13V used as the internal power source for the Power amplifier. An internal circuit senses the input voltage range being used and automatically switches to the appropriate mode. The AC input is connected via a 4-pin circular connector.

Shown in Figure 1 below is a 125W Ku-Band AnaSat® SSPA.

Figure 1 - 125 Watt Ku-Band SSPA

Typical Operating Parameters – AnaSat SSPAs

EC/SEC-Band			Ku/SEKu-Band		
1 dB Compression Point	**10W**: 40 dBm	40 dB TX Gain	1 dB Compression Point	**8W**: 39 dBm	39 dB TX Gain
	20W: 43 dBm	43 dB		**16W**: 42 dBm	42 dB
	30W: 44.8 dBm	44.8 dB		**20W**: 43 dBm	43 dB
	40W: 46 dBm	46 dB		**23W**: 43.6 dBm	43.6 dB
	50W: 47 dBm	47 dB		**25W**: 44 dBm	44 dB
	60W: 47.8 dBm	47.8 dB		**40W**: 46 dBm	46 dB
	70W: 48.5 dBm	48.5 dB		**50W**: 47 dBm	47 dB
	80W: 49 dBm	49 dB		**60W**: 49 dBm	49 dB
	100W: 50 dBm	50 dB		**80W**: 49.75 dBm	49.75 dB
	125W: 51 dBm	51 dB		**100W**: 50 dBm	50 dB
	150W: 51.8 dBm	51.8 dB		**125W**: 51 dBm	51 dB
	180W: 52.6 dBm	52.6 dB			
	200W: 53 dBm	53 dB			
TX Level Flatness		6dBp-p max / 500 MHz			
TX Input		N-Type Connector			
TX Input RF Impedance		50 Ω (75 Ω is optional)			
TX Input Level		0 dBm			
Transmit RF	EC - 5.850 to 6.425 GHz SEC - 5.850 to 6.650 GHz		Transmit RF	Ku - 14.0 to 14.5 GHz SEKu – 13.75 to 14.5 GHz	
CPR-137 Flange (Threaded & Grooved): 30W, 50W and higher N-Type Connector: 10W, 20W, 40W			WR-75 Flange (Threaded & Grooved) all power levels		
Spurious		-50 dBc max, + - 500 Hz: - 45 dBc			
Alarm Relays		FORM C for Summary Alarm; Isolated			
Temperature Range		-40C to +50C operational -40C to +75C storage			
Altitude		10,000 feet (3,048 meters) max			
Rain		20 inches per hour			
Wind		150 miles per hour			
Vibration		1.0 g random operational, 2.5 g random survival			
Shock		10 g operational, 40 g survival			
Power		100 to 250 VAC; 47 to 63 Hz			
Typical Power Consumption / Weight			Typical Power Consumption / Weight		
10W: 125VA / 32 lb. (15kg)	**70W**: 570VA / 57 lb. (27kg)		**8W**: 160VA / 28 lb. (13kg)	**40W**: 770VA / 67 lb. (31kg)	
20W: 230VA / 39 lb. (18kg)	**80W**: 570VA/ 60 lb. (28kg)		**16W**: 270VA / 37 lb. (17kg)	**50W**: 800VA / 67 lb. (31kg)	
30W: 280VA / 57 lb. (26kg)	**100W**: 760VA / 75 lb. (34kg)		**20W**: 290VA / 40 lb. (18kg)	**60W**: 850VA / 67 lb. (31kg)	
40W: 390VA / 45 lb. (21kg)	**125W**: 1070VA / 100 lb. (46kg)		**23W**: 300VA / 40 lb. (18kg)	**80W**: 1430VA / 125 lb. (57kg)	
50W: 390VA / 57 lb. (26kg)	**150W**: 1070VA / 100 lb. (46kg)		**25W**: 300VA / 40 lb. (18kg))	**100W**: 1600VA / 125 lb. (57kg)	
60W: 400VA / 57 lb. (26kg	**180W**: 1400VA / 134 lb. (61kg)			**125W**: 1640VA / 125 lb. (57kg)	
	200W: 1400VA / 134 lb. (61kg)				
SSPA Size			SSPA Size		
10W	21.6" x 9" x 11.6"	(549 x 229 x 295 mm)			
20W	21.6" x 9" x 13.5"	(549 x 229 x 343 mm)	**8W**	21.6" x 9" x 11.6"	(549 x 229 x 295 mm)
40W	21.6" x 9" x 14"	(549 x 229 x 356 mm)	**16W, 20W, 23W, 25W**	21.6" x 9" x 13"	(549 x 229 x 330 mm)
30, 50, 60, 70W	21.6" x 9" x 15"	(549 x 229 x 381 mm)	**40W, 50W, 60W**	21.6" x 13" x 13.6"	(549 x 330 x 353 mm)
80W	21.6" x 9" x 16"	(549 x 229 x 407 mm)	**80W, 100W, 125W**	38" x 13" x 12.5"	(965 x 330 x 318 mm)
100W	21.6" x 13" x 14"	(549 x 330 x 356 mm)			
125,150,180,200W	38" x 13" x 12.5"	(965 x 330 x 381 mm)			

Installation

Removal of any cover may jeopardize the weather seal, which may cause problems later.

Unpacking

Check to make sure that the SSPA has not suffered any damage in shipment. Compare contents of the crate to ensure items received match those listed on the packing slip. Retain all shipping containers for future use.

Tools and Test Equipment

Have on-hand a standard electrician's tool kit and any tools listed in your antenna installation instructions.

Safety Precautions

General

Observe normal safety precautions when operating this equipment.

Ensure the AnaSat® SSPA is properly grounded. Do not rely on coaxial cable shields for the ground connection.

If the cover is removed from any ANACOM product, ensure that all:

- gaskets are intact and free of damage prior to reinstallation
- mounting screws are properly installed

Ensure all connectors are properly waterproofed.

Power Supply

We strongly recommend that this equipment not be opened in the field, and the warranty will be void if the housing is opened without authorization, but should you choose to do so, confirm that AC Power is **disconnected** before removing the SSPA cover.

Transmitter

Take adequate precautions to ensure the AnaSat® SSPA output does not transmit a signal until it has been properly connected and set up for authorized frequencies and power levels.

Transmitter RF output power levels are adequate to cause blindness or other serious injury to body tissues. Use caution when working around the SSPA or antenna when the system is active.

Power Amplifier

Be sure the SSPA TX OUT port is properly terminated prior to operation. Ensure all the correct waveguide gaskets are used to prevent water damage.

TO ENSURE PROTECTION OF PERSONNEL AND EQUIPMENT, USE CARE DURING ANTENNA INSTALLATION AND WHENEVER WORKING ON OR AROUND THE SYSTEM.

Site Considerations

The installation requirements of any particular site are the responsibility of the system operator. AnaCom offers an optional installation mounting kit, that can be used at most sites. Contact AnaCom for details.

Antenna

The SSPA must be attached to some form of mounting structure which is usually the antenna feed boom or the antenna support structure. Specific mounting procedures will depend on the antenna used. The AnaSat® SSPA is designed to be mounted on most antennas. Locate and install the antenna according to the antenna manufacturer's instructions. Choose an area that is free of extraneous interference from motors and electronic equipment and has a clear line-of-sight from the antenna to the satellite.

Lightning arrestors should be used at the site to protect personnel and equipment. Size 3/0 or 4/0 stranded copper wire should be used to bond the SSPA to the antenna frame and to the lightning protection ground rod.

Power Requirements

The AnaSat® SSPA contains an internal universal AC power supply that supplies the Monitor & Control functions, (M&C,) and PA internal subassemblies.

The AnaSat® SSPA requires 110 VAC or 220 VAC at 50 or 60 Hz, through a circuit breaker. The size of the circuit breaker depends on model. To assure uninterrupted service, some method of back-up AC power is recommended. Installing surge arrestors and AC power line filters will reduce voltage surges from the AC power input. Provide an isolation filter to clean up power line interference and/or voltage variations, as required.

NOTE: AC TRANSIENTS AND SURGES MAY CAUSE DATA TRANSMISSION ERRORS AND LOSS OF SYNCHRONIZATION IN THE 0 DBM SYNTHESIZERS AND/OR THE EXTERNAL MODEM EQUIPMENT.

SSPA Mounting Considerations

The AnaSat® SSPA must be mounted such that:

1. Sufficient support is afforded the Block Up-Converter to minimize the effects of antenna sway in strong winds.
2. Air movement is possible across the heat sink fins. Ideally, the fins should be aligned vertically, but this is not required.

NOTE: The length (and associated RF losses) of the interconnecting cables must be considered when determining the location of the AnaSat® SSPA.

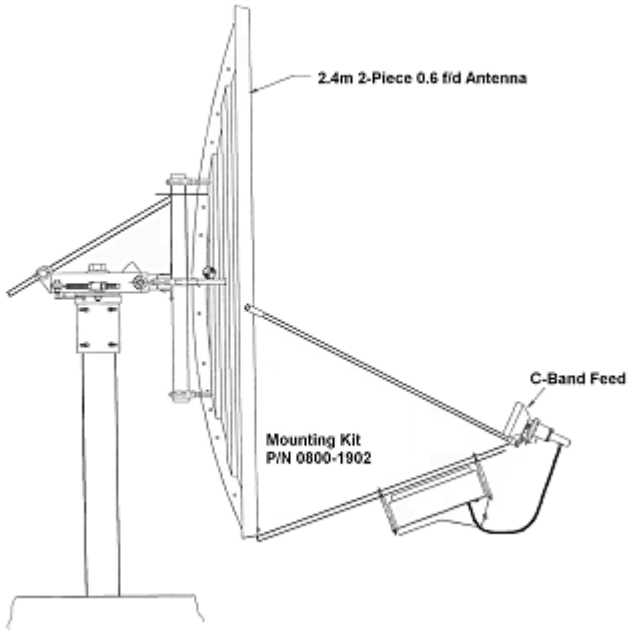
SSPA Mounting

The AnaSat® SSPA is designed for mounting in any position.

Figure 2 shows a common installation example where the SSPA is mounted on the antenna feed support arm.

When mounting the SSPA, allow enough room to adjust the antenna's azimuth and elevation. Throughout installation and during any polarization, azimuth, or elevation adjustment, ensure the cables and waveguide are not crimped or pinched.

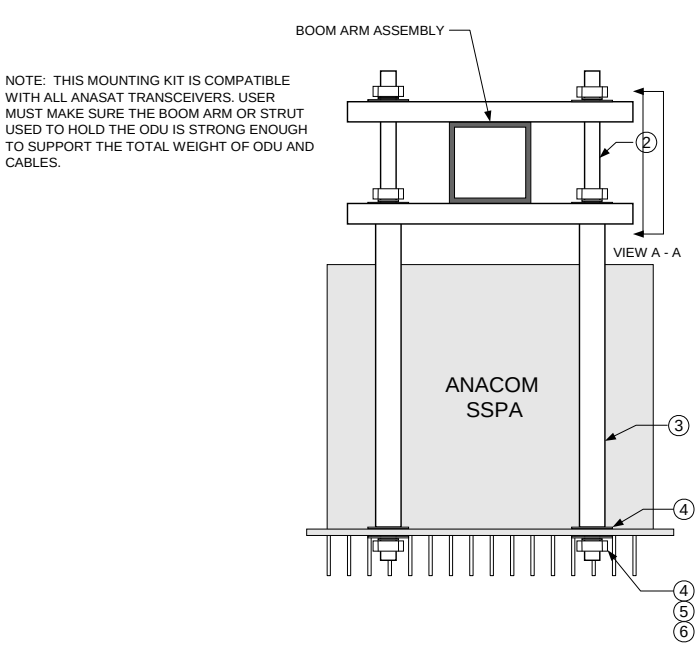
Figure 3 on the next page shows the SSPA mounting for single thread.

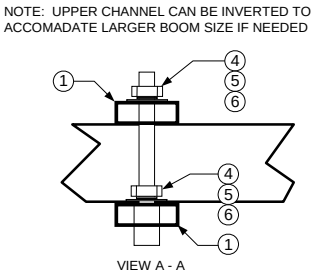


Grounding

Electrical bonding (grounding) of the SSPA is required to prevent possible damage from lightning or other induced electrical surges.

The SSPA is provided with both an M3, and a #8 ground point. It is recommended that 000 AWG minimum copper wire or copper braid be used to bond this unit to the earth ground (grounding rod) using the most direct (shortest) route possible.





Single Universal Mounting Kit Parts List _ 12104		
ITEM	**Description**	**QTY**
1	Channel	4
2	Threaded 3/8 rod, SS, 12in long	4
3	Tube, 7in x 0.7in dia, steel	4
4	Washer, flat, 3/8 SS	16
5	Washer, split, 3/8 SS	12
6	Nut, 3/8 SS	12

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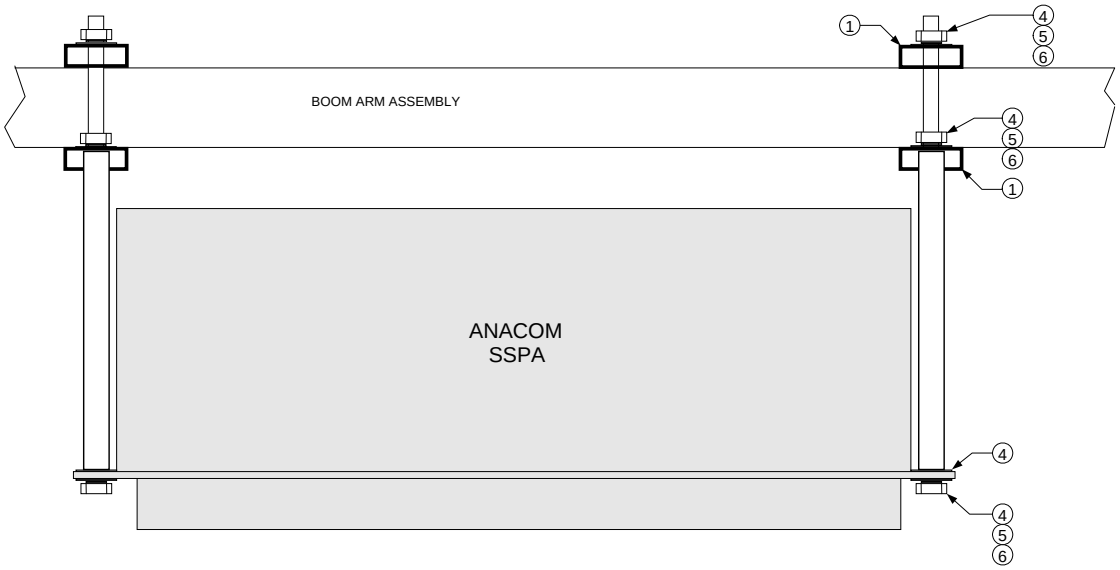

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Title: **ASSEMBLY DRAWING, SINGLE MOUNTING KIT**		
Size: **B**	Document Number: 31626	Rev: 1
Date: 3 FEB 2003	Sheet 2 of 2	

Figure 3a - Front and Side Views of Boom Mounted SSPA

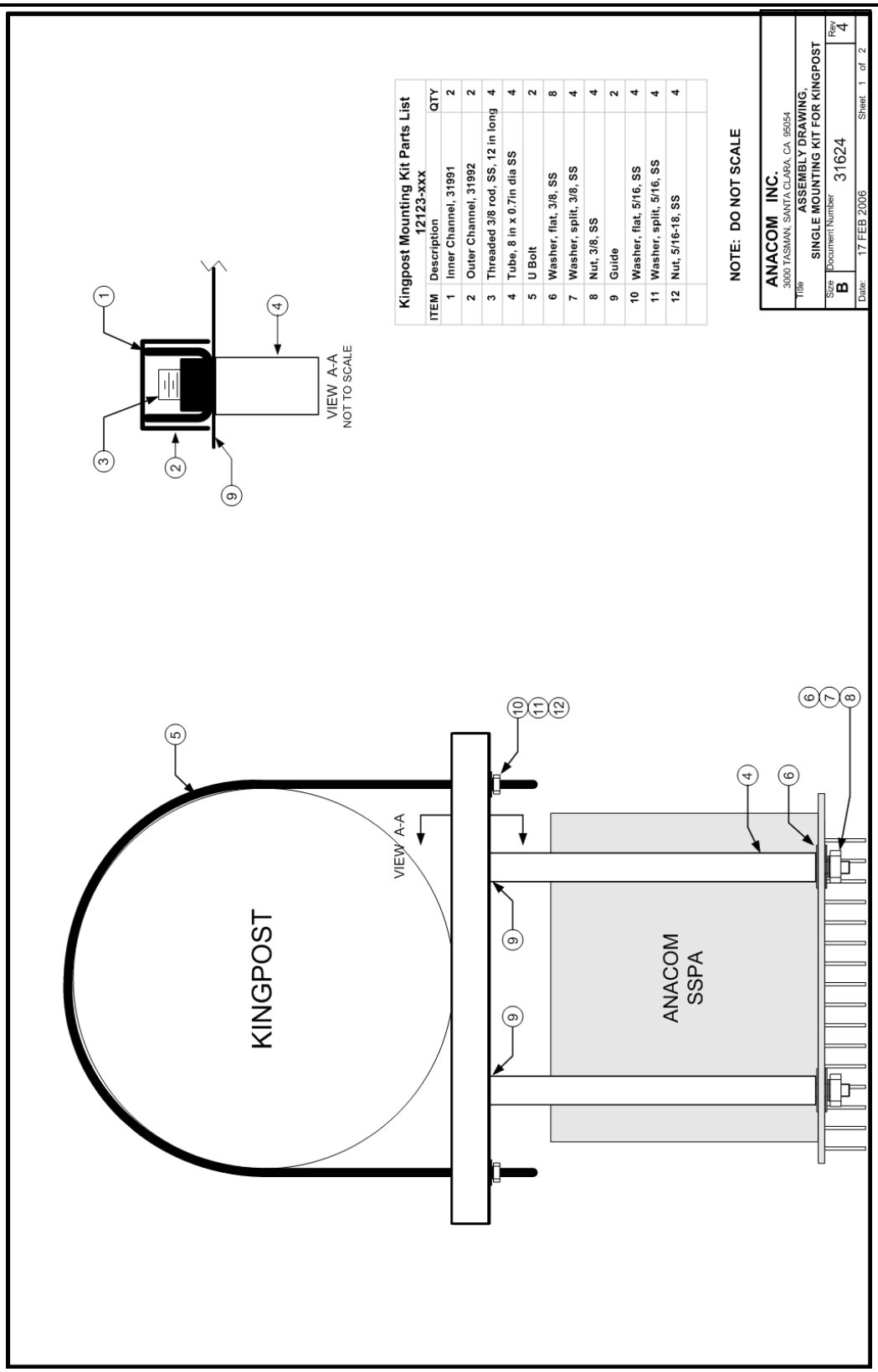


Figure 3b – Single Mount for a Kingpost

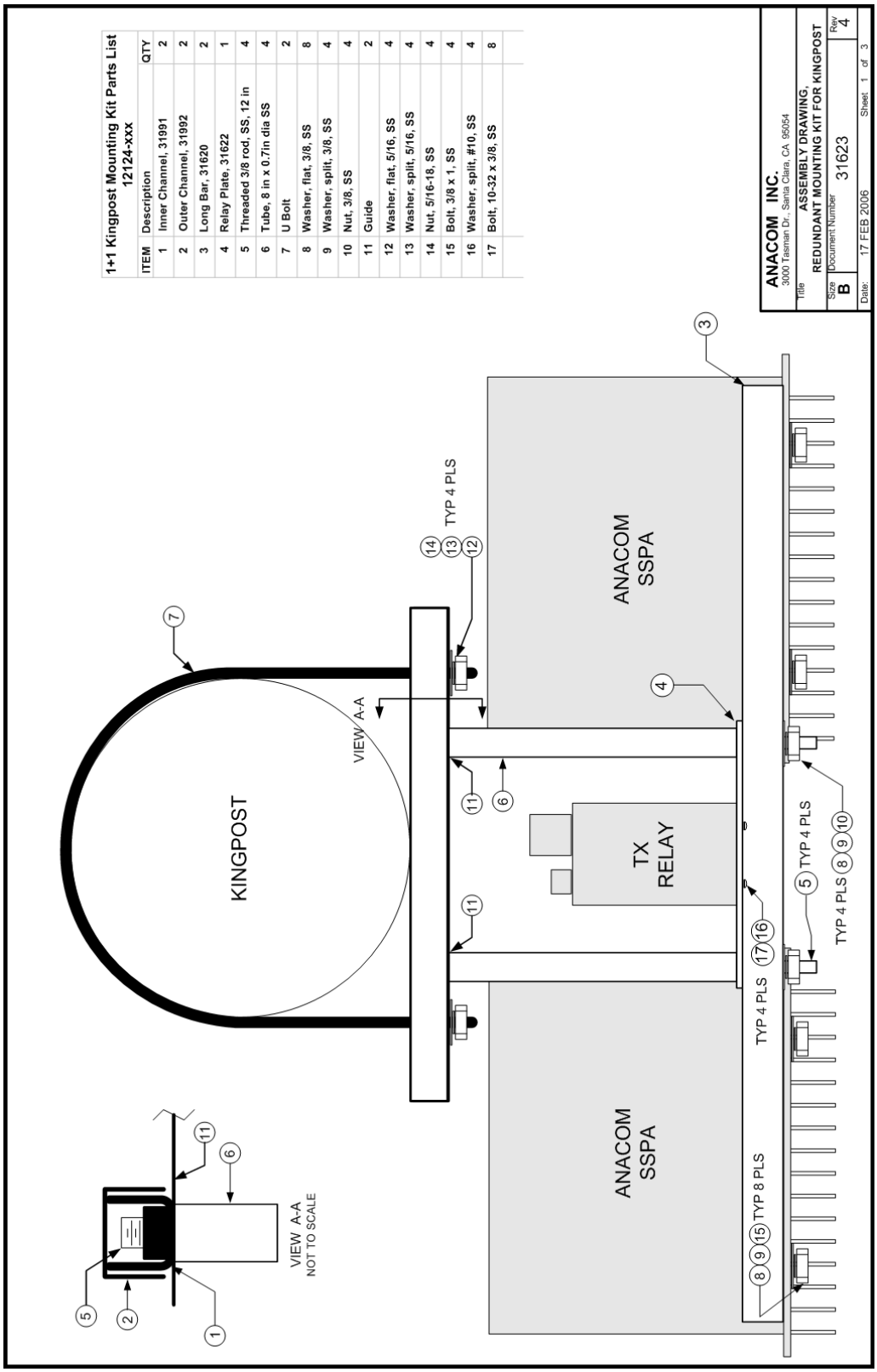


Figure 3c – 1+1 Mount for a Kingpost

Cable and Waveguide Connections

Cabling Requirements

Local regulations may require that cables in occupied buildings be installed in steel conduit. Local government agencies may waive this requirement for the use of Plenum cables, which are standard cables entirely encased in solid Teflon. Check the codes in your area.

NOTE: EQUIPMENT OUTAGES DUE TO FAULTY CABLE MATERIALS OR INSTALLATION ARE NOT COVERED BY YOUR WARRANTY.

AC Power

Attach the AC input cable to the 4-pin connector on the SSPA, shown in Figure 4. Run the AC cable to the power source *but do not attach*. The supplied power cable has a four-pin weather-tight circular connector attached to one end. The other end is terminated with flying leads. Attach the proper AC power connector for your location to the other end of this cable as shown in Figure 5 below.

Color code:
Brown.....AC Hot power lead
Blue.....AC Neutral power lead
Green/Yellow..... Ground

Figure 4 - AC Power Connection

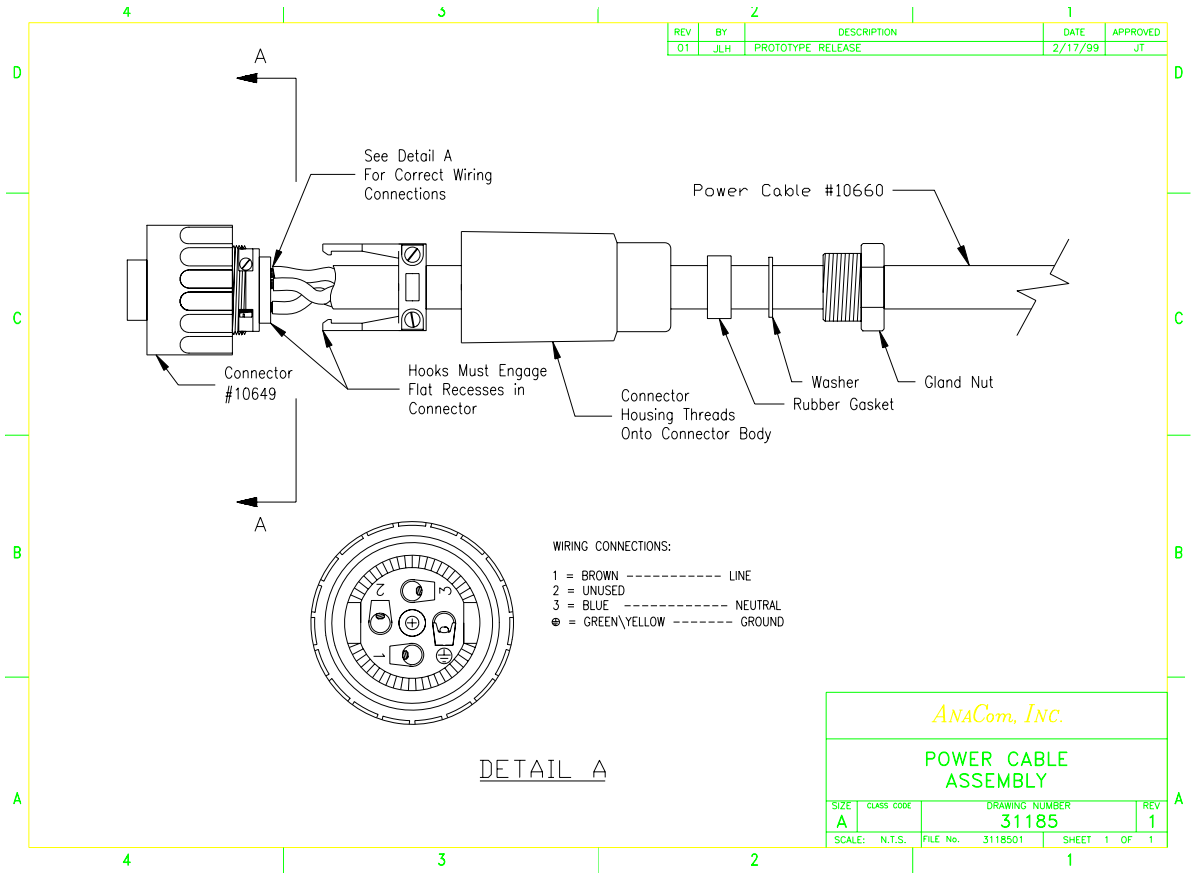


Figure 5 - Diagram of AC power cable

Transmitter Feed

If using an SSPA with an N-type connector output, connect a section of coax between the OMT transmit port and the SSPA's transmit port.

If using a SSPA with a waveguide flange output port, connect a section of waveguide between the OMT transmit port and the SSPA's transmit output, TX OUT. A waveguide should be attached to the antenna feed per manufacturer's instructions. Ensure a gasket is fitted at each flange and that the connections are weather-tight.

Driver Feed

Attach a coaxial cable with male N-connectors between the SSPA's TX RF input and the 0 dBm driver's RF OUTPUT. Make sure that the connections are weather-tight.

Final Check

Recheck all bolts and cabling.

After all other connections have been made (TX RF input, TX RF output, and grounding), connect the AC power cord to an active outlet.

Water Resistance Wrap

The application of moisture-resistant wrap ***(mastic tape)*** to all connectors is recommended to prevent water entry and resultant water damage. See Figure 6. Apply the mastic tape as follows:

1. Ensure that all connectors are tight.
2. Pre-cut the mastic tape to the desired size and remove the protective wax liner from the tape.
3. Center the tape on the connector to be sealed and wrap the tape tightly around the connector. Squeeze the tape tightly and ensure that both ends of the tape have formed around the connector and the cable.
4. Apply the mastic tape to all connectors that may be exposed to moisture.

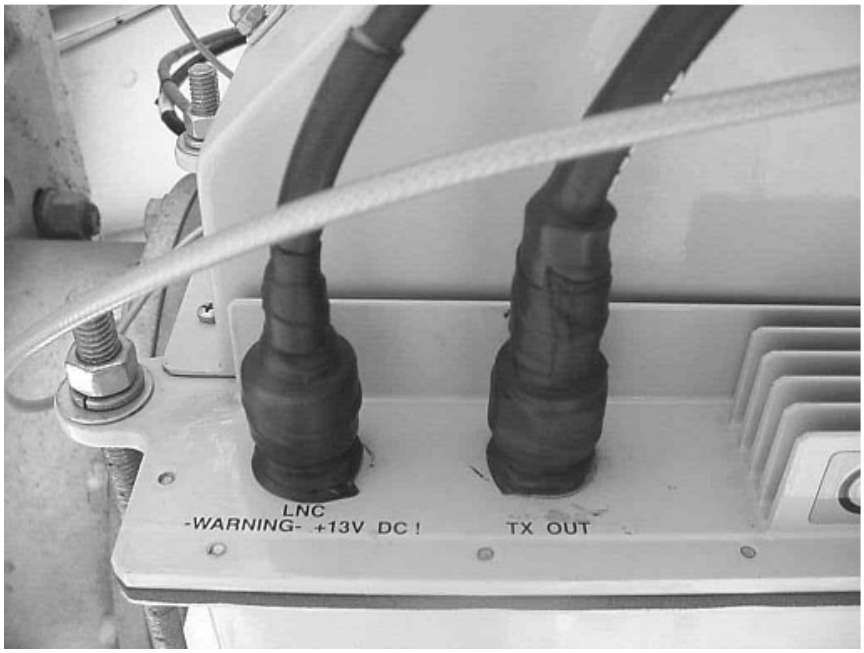


Figure 6 - Mastic Tape Application

Operation

After the AnaSat® hardware is mounted and verified, the antenna must be aimed toward the desired satellite. Follow the antenna/mount manufacturer's instructions, using coordinates provided by the satellite operator. Do not transmit until you have received authorization from the satellite network operation center, and a transmit power level from its engineering staff.

AnaSat SSPA will produce RF output power the moment a modulator/driver is connected and provides input.

Frequency Programming

Transmit operating frequency is set by the up-converter that is driving the SSPA as the SSPA is amplifies an input signal and does not alter the frequency of the signal passing through. Please see the instructions for the driver equipment for setting the frequency of operation.

Antenna Adjustment

Do not transmit while adjusting the antenna position.

Follow the antenna manufacturer's instructions for antenna position adjustment. For final alignment, contact the satellite operator and get the correct polarization, azimuth, and elevation of the satellite and also confirm the desired transponder is operational.

Transmit Power Adjustment

Maintaining proper output power is vital for maximizing signal-to-noise ratios over the radio path. Low power levels produce noisy signals; excessive power robs downlink strength from other stations sharing the transponder.

Adjust the modulator/driver output level to attain the desired output power level. Use a calibrated watt meter on the output of the SSPA for this task.

When transmitting multiple carriers, run the output power with an output level back-off sufficient to meet the spectral density mask requirements.

Caution: It is recommended that the SSPA not be driven into saturation for long periods of time.

Maintenance

AnaSat® SSPAs are designed for a minimum of maintenance. Periodic scheduled maintenance is not required. Replacement of the weatherized fan after 7 years is recommended however.

Fan Replacement

WARNING
!

The ducted fan shroud should NEVER be removed from the ODU while AC power is connected to the SSPA. Disconnect AC power before replacing fan.

Some units come with a weatherized fan and ducted fan shroud assembly that is attached to the PA heatsink, and is outside the SSPA enclosure. It is fairly easy to remove the shroud from the heatsink in order to replace the fan.

Figure 7 - Fan shroud removed from SSPA

Figure 8 - Underside of fan shroud

The fan comes with a cable and three-prong connector. After the housing has been removed the heatsink, the old fan can be unplugged from the block up-converter heatsink and then removed from the shroud. A replacement fan available from AnaCom, Inc., can then be mounted on the shroud and it's connector plugged into the receptacle on the heatsink. The shroud can then be re-attached to the heatsink using the original screws.

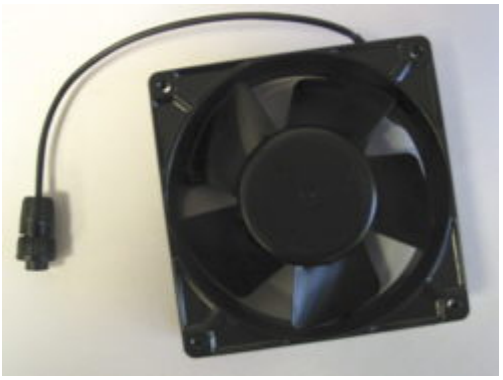


Figure 9 - Integrated fan and cable assembly

Alarm Relay Closure

A mechanical relay is used in the AnaSat® SSPA for alarm indication. The red LED mounted on the SSPA is illuminated whenever a problem exists and the relay has closed.

The alarm relay has normally closed contacts, so it defaults to the alarm state when power is off. The alarm relay is accessible through the 18-pin connector mounted on the SSPA chassis. See Figure 10 for a diagram of the pins in this connector.

Monitored Values

The following analog inputs are monitored and can result in Alarm closure if out of range:

- PA temperature
- -5V DC supply (used as a bias voltage in the power amp stages)
- +5V DC supply
- PA Stage voltages
- Main +13V DC supply

The following digital inputs are monitored:

- Cooling fan failure

Data Terminal Connection

Using a serial cable with a connector on one end that matches y our terminal equipment (either a "dumb" terminal or a computer running terminal emulator or modem software), connect the 6-pin or 18-pin weathertight circular connector to the other end, following figure 10 below.

Terminal Display

The ASCII terminal display gives an accounting of SSPA alarms and status, example:

```
          100W EC-Band SSPA  REV:04 S/N:012345
TXREQ on | TX ON AIR
ALARM:CLEAR
TXG 50.0 TXout  47
         TXpk   48
TEMP: 13C FANERR:clear P12V:13.4 P11V:PA12 P5V: 5.0 N5V:-5.4
PA 1: 0.0 PA 2: 0.0 PA 3: 0.0 PA 4: 0.0 PA 5: 0.0 PA 6:13.0
```

- The top line shows the SSPA model and serial number.
- The second line gives the only changeable operating parameter: ON or OFF. This can be set using the TX command: example **TX ON**, **TX OFF**.

"ON" indicates the SSPA will transmit when all alarms are cleared. This is the normal setting.

"OFF" indicates the SSPA will not turn on even if all alarms are clear.

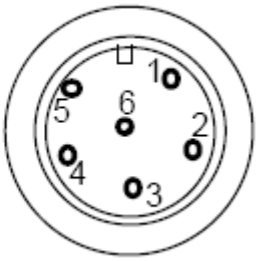
This can be saved across a reboot using the **SAVE** command.

- SSPA status is either "TX ON AIR" or TX OFF AIR".
- The third line gives a summary alarm indication. If there are no alarms, then "CLEAR" will be indicated.
- The fourth line and fifth lines give the gain value, the TX output level, and the peak output level seen in the last 10 seconds. TX Gain is given in dB.

- The sixth line shows the internal temperature in degrees Celcius, alarm status of the cooling fan, and internal power supply voltages such as +12VDC, +5VDC, -5VDC.
- The remaining data gives the voltages for individual stages of the SSPA power amplifier.

RS232 Serial Port Weather-tight Connector

Cable End View



Cable End View

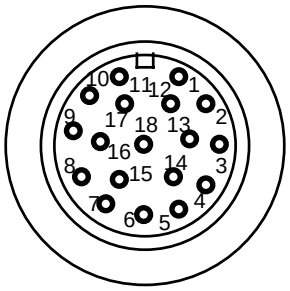
Pin	Signal	Description
4	RXD	Receive Data (RS232)
5	TXD	Transmit Data (RS232)
6	GND	Ground
		Note dimple next to Pin 1

Figure 10 – RS232 6 pin weather-tight connector

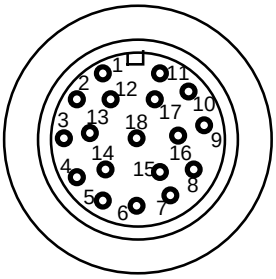
The *Cable End View* refers to looking into the end of the connecting cable; the *Cable Wire View* refers to looking into the connector on the SSPA.

18-Pin Circular Weathertight Connector

An 18-pin circular connector is used for monitoring the alarm C-Form relay. Only some of the pins are used, but the same connector is used to maintain consistency with the protection switch used in the AnaSat® product line.



Cable End View



Cable Wire View

Pin	Signal	Description	
4	NO	Alarm Normally Open	
5	NC	Alarm Normally Closed	
6	C	Alarm Common	
7	P13V	+13V CD Power (powers protection switch)	
8	TX+	Differential Transmit Data (RS485)	
9	TX-	Differential Transmit Data (RS485)	
10	RX+	Differential Transmit Data (RS485)	
11	RX-	Differential Transmit Data (RS485)	
12	RS485	Grounded for RS485 operation	
13	TXMUTE	Grounded to mute transmit function	
16	RXD	Receive Data (RS232)	
17	TXD	Transmit Data (RS232)	
18	GND	Ground	**Note dimple next to Pin 1**

Figure 11 - 18 pin weather-tight connector

The *Cable End View* refers to looking into the end of the connecting cable; the *Cable Wire View* refers to looking into the connector on the SSPA.

RS485/RS232 Selection

Pin 12 on the 18-pin weathertight circular connector is the RS485/RS232 mode select jumper pin. Connect pin 12 to ground (pin 18) for RS485 operation. Leave open for RS232 operation. This has no effect on the other serial port (if installed.)

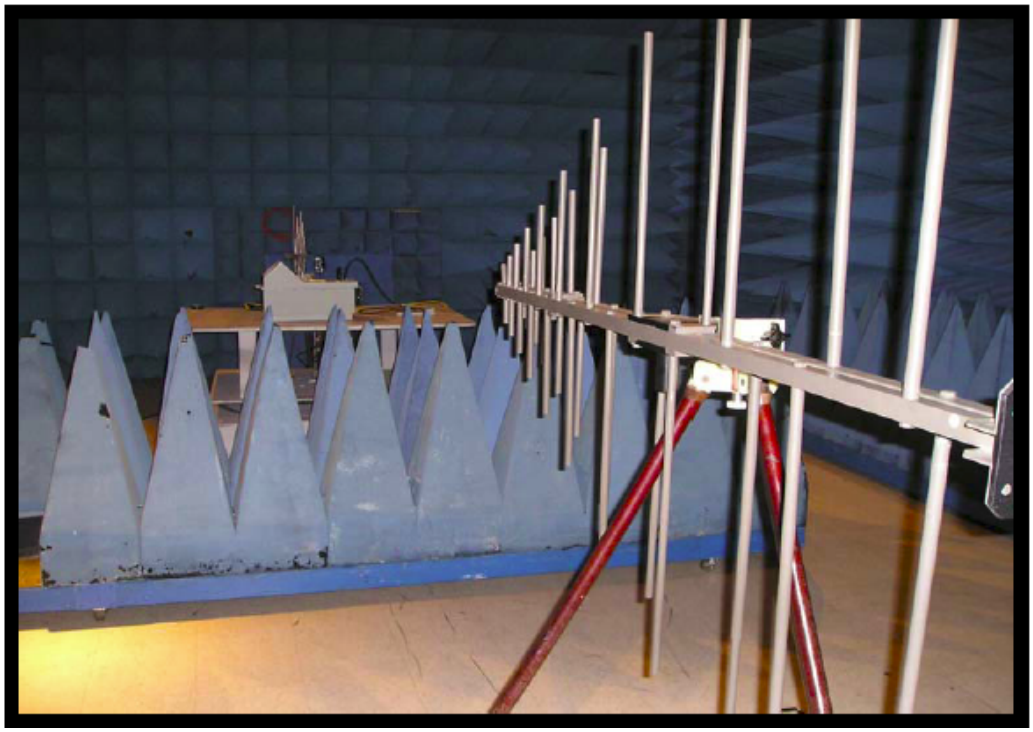
Emissions and Immunity Regulation Conformance

AnaCom SSPA products conform to the following CE standards listed below:

Standards Met:

Emissions Regulations
1. Power Line Conducted Emissions per EN55022: 2003 Class A
2. Open Field Radiated Emissions per EN55022: 2003 Class A
3. EN 61000-3-2: 2001, Limits for harmonic current emissions
4. EN 61000-3-3: 2002, Limits for voltage fluctuations and flicker

Immunity Regulations
5. EN 61000-4-2: 2003, Electrostatic discharge immunity test.
6. EN 61000-4-3: 2004, Radiated, radio-frequency, electromagnetic field immunity test.
7. EN 61000-4-4: 2004, Electrical fast transient/burst immunity test.
8. EN 61000-4-5: 2004, Surge immunity test.
9. EN 61000-4-6: 2004, Immunity to conducted disturbances, induced by radio-frequency fields
10. EN 61000-4-11: 2004 Power line dips and brownouts



LIMITED WARRANTY

If this product should fail due to defects in materials or workmanship, AnaCom, Inc., will, at its sole option, repair or replace it with new or rebuilt parts free of charge for a period of two (2) years from the date of shipment from the AnaCom factory. This warranty covers only failures due to defects in materials and workmanship that occurs during the period of the warranty. It does not cover damage that occurs during shipment, failure caused by operation of the product outside the published electrical or environmental specifications, or malfunctions caused by misuse of the product. Expendable components are not covered under this warranty.

In order for the customer to exercise their rights to repairs under the warranty, the customer must first contact AnaCom to obtain a repair authorization number (RMA). If it is necessary to return the product for repair, the customer is responsible for paying the cost of shipping it to AnaCom. AnaCom will pay the cost of shipping the product back to the customer when the repairs are completed. All import duties, customs fees, taxes of any kind, or any related fees are the sole responsibility of the customer.

Spare parts, repairs, or replacements are warranted to be free from defects in material or workmanship for ninety (90) days or the remainder of the limited warranty period, whichever is longer.

There are no express or implied warranties except as listed above. In no event shall AnaCom be liable for special, incidental, or consequential damages arising from the use of this product, or arising out of any breach of this warranty. All express and implied warranties, including the warranties of merchantability and fitness for a particular purpose, are limited to the applicable warranty period set forth above. No employee or representative of AnaCom is authorized to modify this warranty or AnaCom's standard warranty for any product.

Non-warranty repair service is available from AnaCom for a nominal charge. Non-warranty repair service can be obtained by contacting AnaCom and requesting a return authorization number (RMA), as described above. The customer is responsible for paying the cost of the shipping to and from AnaCom for any non-warranty repairs. Non-warranty repair service will be available for any AnaCom product for a minimum of five years from the date of its first shipment from AnaCom's factory.