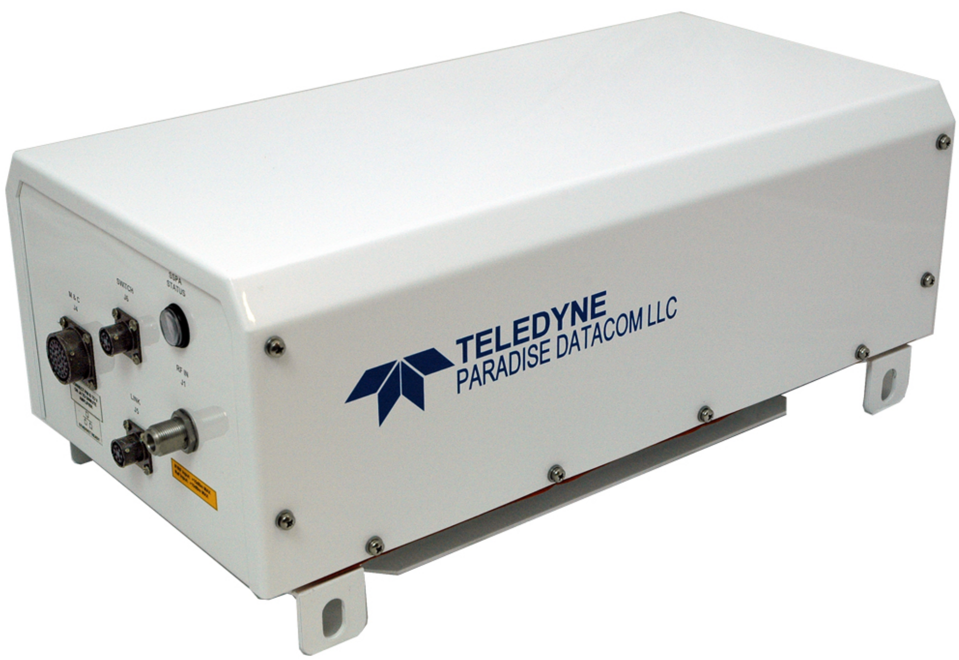
TELEDYNE
PARADISE DATACOM
A Teledyne Technologies Company

Compact Outdoor
Solid State Power Amplifier Operations Manual



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Teledyne Paradise Datacom, a division of Teledyne Wireless LLC, is a single source for high power solid state amplifiers (SSPAs), Low Noise Amplifiers (LNAs), Block Up Converters (BUCs), and Modem products. Operating out of two primary locations, Witham, United Kingdom, and State College, PA, USA, Teledyne Paradise Datacom has a more than 20 year history of providing innovative solutions to enable satellite uplinks, battlefield communications, and cellular backhaul.

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1.0 Introduction

This section provides the general information for the Teledyne Paradise Datacom line of Compact Outdoor Solid State Power Amplifiers. The Compact Outdoor SSPA has been designed and manufactured to be an extremely robust and reliable amplifier. It is well suited for harsh outdoor environments.

1.1 Description

The Compact Outdoor SSPA is a one-piece integrated Satcom amplifier system. It includes the AC/DC power supply, microwave amplifier module, microprocessor based monitor and control circuitry, and an efficient thermal management system.

The Compact Outdoor SSPA is very well suited for environmentally demanding conditions where reliability is paramount. At the heart of the amplifier system is a multifunction solid state power amplifier (SSPA) module. It has a full compliment of parallel I/O monitor and control signals as well as serial I/O capability using a PC and host communication software from Teledyne Paradise Datacom.

Proprietary thermal management techniques allow even the highest output power level amplifiers to operate reliably in environments up to 60°C ambient temperature and 100% relative humidity.

The reduced size and weight of this amplifier system allow it to be used in a wide variety of installations; many of which historically precluded the use of Solid State power amplifiers. This amplifier is ideal for mounting on the boom of small antennas or anywhere that size and weight are a major concern.

Features include:

- Compact Size: 10.0 in x 19.5 in x 6.50 in. (254 mm x 495 mm x 165 mm)
- Very light weight: Base units weigh as little as 36 lb. (16.4 kg)
- Auto-Sensing Power Factor Corrected Power Supply
- RF Gain Adjustment: 55 dB to 75 dB minimum with 0.1 dB resolution
- Output Power Detection
- Output Power Sample Port
- Internal 1:1 Redundant Capability
- Optional L-Band Input Capability
- Serial (RS-232 / RS-485), Ethernet or Parallel Monitor & Control Circuitry
- Windows Monitor & Control Software

1.2 Specifications

Refer to **Appendix D** for full specifications of the Compact Outdoor SSPA.

1.3 Equipment Supplied

The following equipment is supplied with each unit:

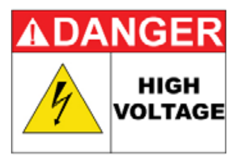
- The Compact Outdoor Amplifier Assembly;
- Prime power mating connector: AC - MS3106E20-3S; DC - MS3106F20-29S
- Quick Start Serial (Ethernet) Communication Cable, L207755-2, **-OR-**
  Quick Start Serial (RS-232 / RS-485) Communication Cable, L207998-2
- Product Guide CD with SSPA Monitor & Control Software
- Operations Manual, HPA2, Compact Outdoor SSPA (208495; this manual)
- M&C (J4) Mating Connector, MS3116F18-32P
- Waveguide gaskets (dependent on frequency band)
- Sealing tape (87F730)

1.4 Safety Considerations

Potential safety hazards exist unless proper precautions are observed when working with this unit. To ensure safe operation, the user must follow the information, cautions, and warnings provided in this manual as well as the warning labels placed on the unit itself.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1.4.1 High Voltage Hazards



Only qualified service personnel should service the internal electronic circuitry of the Compact Outdoor Amplifier. High DC voltages (300 VDC) are present in the power supply section of the amplifier. Care must be taken when working with devices that operate at this high voltage levels. It is recommended to never work on the unit or supply prime AC power to the unit while the cover is removed.

1.4.2 RF Transmission Hazards

RF transmissions at high power levels may cause eyesight damage and skin burns. Prolonged exposure to high levels of RF energy has been linked to a variety of health issues. Please use the following precautions with high levels of RF power.

- Always terminate the RF input and output connectors prior to applying prime AC input power.
- Never look directly into the RF output waveguide
- Maintain a suitable distance from the source of the transmission such that the power density is below recommended guidelines in ANSI/IEEE C95.1. The power density specified in ANSI/IEEE C95.1-1992 is 10 mW/cm^2. These requirements adhere to OSHA Standard 1910.97.
- When a safe distance is not practical, RF shielding should be used to achieve the recommended power density levels.

1.4.3 High Leakage Current

The equipment may have more than 3.5 mA leakage current. Make sure a connection to earth ground is present before applying prime power, and after removing prime power.

1.4.4 High Potential for Waveguide Arcing

As with all systems which utilize high power signals within waveguide, the potential exists for an electric arc to form. To minimize this risk, Teledyne Paradise Datacom requires all waveguide be pressurized and dehydrated.

1.5 Certifications

The Compact Outdoor SSPA has been rigorously tested to meet the following standards:

- CISPR 11:2007 (Radiated and Conducted Emissions)
- IEC 61000-4-2:2005 (Immunity)
- 2002/95/EC (Restriction of Hazardous Substances)
- 2002/96/EC (Waste Electrical and Electronic Equipment)
- 1907/2006/EC (Regulation, Evaluation, Authorization and Restriction of Chemicals)
- 2006/95/EC (Low Voltage Directive)
- MIL-STD-461F (EMI/EMC for Mil Grade Systems)
- MIL-STD-810F (Environmental Exposure for Mil Grade Systems)
- IEC 60529 (Ingress Protection, IP54)

1.6 Comparisons Between Standard and Mini Compact Outdoor SSPAs

In 2010, Teledyne Paradise Datacom introduced a smaller outdoor SSPA package based on the standard Compact Outdoor SSPA described in this manual.

While similar in function, there are some differences that prevent immediate substitution of a Standard Compact Outdoor unit type with a Mini Compact Outdoor unit in a system. Some of the differences between the Standard and Mini Compact Outdoor amplifiers are outlined below:

- AC Mains connector
- Slight variation in protocol
- No analog gain control on J4 in Mini Compact Outdoor SSPA
- No RF Power Detector analog output on J4 in Mini Compact Outdoor SSPA
- No Low RF Fault output on J4 in Mini Compact Outdoor SSPA
- No BUC Alarm output on J4 in Mini Compact Outdoor SSPA
- No Spare Input on J4 in Mini Compact Outdoor SSPA

Due to the size differences between the standard Compact Outdoor SSPA and the Mini

Compact Outdoor SSPA, the following form factors also differ:

- Mounting kit configuration
- Waveguide center line measurements
- Location of connectors

1.7 Waveguide Pressurization and Dehydration

When working with high power amplifier systems that operate into waveguide, the inadvertent creation of arcs is always a concern. An arc in waveguide is the air discharge breakdown due to the ionization of the air molecules by electrons. This breakdown in waveguide occurs when the rate of electron production becomes greater than the loss of electrons to diffusion to the surrounding walls.

It is extremely difficult to precisely predict the power levels at which the breakdown occurs. It is dependent on a variety of factors but the primary factors are:

- Waveguide temperature and atmospheric pressure
- Components in the Waveguide Transmission System such as: Flanges, Bends, Tees, Combiners, Filters, Isolators, etc.
- Load VSWR presented to the amplifier.

When operating such a high power amplifier system it is imperative that the waveguide transmission system be dehydrated and pressurized. Operation with an automatic air dehydrator will provide dry pressurized air to ensure that condensation cannot form in the waveguide. Also the higher the pressure that can be maintained in the waveguide; the higher the power handling is in the waveguide system. Most commonly available air dehydrators are capable of providing pressures of 0.5 to 7.0 psig (25-362 mmHg).

At low power levels (uniform field distribution), low pressure can give good results. For non-uniform conditions, highly localized breakdown can occur. In this case the waveguide system will require much higher pressure. This occurs with bends, waveguide flange joints. If line currents flow across a small gap introduced by poor tolerances, flange mismatch, poorly soldered bends, field strengths in excess of that in the main line can occur in the gap. Pressurization with air or high dielectric gases can increase the power handling by factors of 10 to 100.

In High Power Amplifier systems an arc will travel from where it is ignited back to the amplifier. Typical arc travel speed is on the order of 20 ft/sec. Increasing the waveguide pressure can reduce the speed of arc travel. It is difficult to get an accurate calculation of the amount of pressurization needed, but it is a good practice to get as much pressure as your system can handle. All high power systems that meet the criteria of **Table 1-1** are pressure tested at the factory to 1.5 psig. As a guide we recommend using the power levels in **Table 1-1** as the threshold levels where special attention should be given to dehydration and the overall simplification of waveguide system design.

Table 1-1: Recommended Output Power Thresholds for Waveguide System Pressurization

Satcom Band	Frequency Range	Amplifier Output Power	Waveguide
S Band	1.7-2.6 GHz	> 10 kW	WR430
C-Band	5.7 - 6.7 GHz	> 2 kW	WR137
X-Band	7.9-8.4 GHz	> 1kW	WR112
Ku-Band	13.75-14.5 GHz	> 500W	WR75
Ka-Band	27-31 GHz	> 100W	WR28

It is a common misconception to look up the maximum theoretical power handling of a particular type of waveguide and assume that this is the maximum power handling. This may be the case for a straight waveguide tube with ideal terminations but these values must be significantly de-rated in practical systems. Phase combined amplifier systems can be particularly sensitive to the potential for waveguide arcing. This is due to the numerous bends, magic tees, multiple waveguide flange joints, and other waveguide components. **Table 1-2** shows the power handling capability of some popular waveguide components normalized to the waveguide power rating. From this table, we can see how a practical waveguide system's power handling will de-rate significantly.

Table 1-2: Relative De-rating of Popular Waveguide Components Relative to Straight Waveguide

Waveguide Component	Relative Power Rating
H Plane Bend	0.6 to 0.9
E Plane Bend	0.97
90^{o} Twist	0.8 to 0.9
Magic Tee	0.80
E-Plane Tee	0.06
H-Plane Tee	0.80
Cross Guide Coupler	0.21

Most waveguide systems have many of these components integrated before reaching the antenna feed. It is not uncommon for a Satcom waveguide network to de-rate to 5% of the straight waveguide power rating.

The load VSWR also has an impact on the breakdown threshold in waveguide networks. Standing waves degrade the power handling of any transmission line network. The graph of **Figure 1-1** shows the rapid degradation of waveguide breakdown vs. load VSWR. The chart shows that for a 2.0:1 load VSWR, the breakdown potential will be half of what it would be with a perfectly matched load. This can degrade even more when high Q elements such as band pass filters are included in the waveguide network.

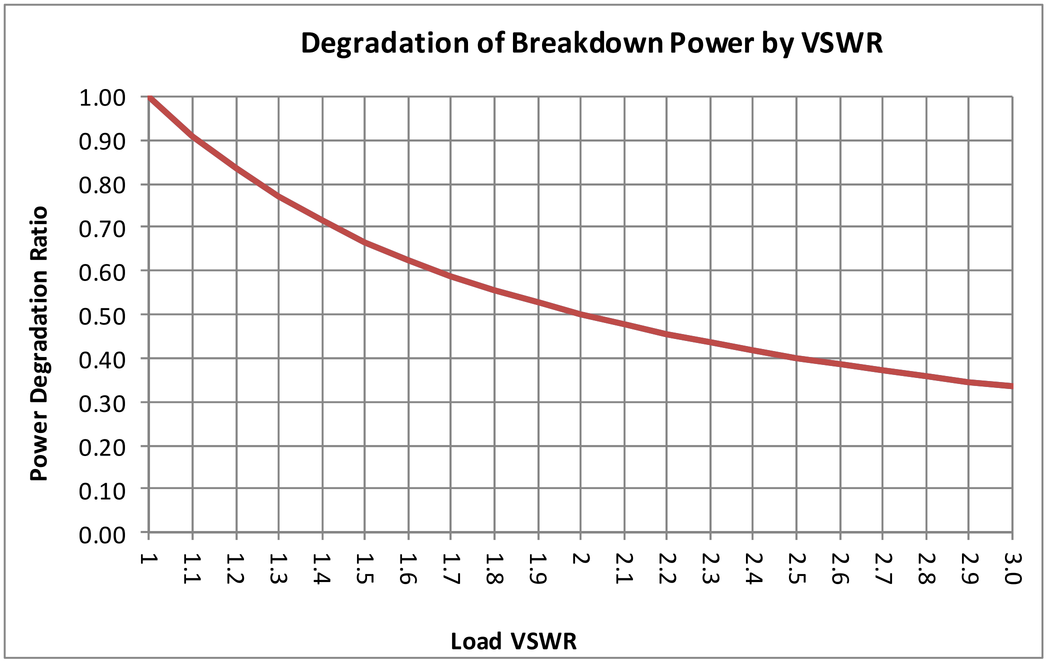


Figure 1-1: Degradation of Breakdown Power by VSWR

There are many factors to consider with high power amplifier systems in terms of the output waveguide network. Especially when using HPA systems with output power levels of **Table 1-1**, it is imperative to ensure that the output waveguide network is pristinely clean and dry. An appropriate dehydrator should be used with capability of achieving adequate pressure for the system's output power. Take extra precaution to make sure that any waveguide flange joints that are not already in place at the factory are properly cleaned, gasket fitted, and aligned. A properly designed and maintained waveguide network will ensure that no arcing can be supported and will provide many years of amplifier service life.

2.0 Introduction

This section provides information for the initial inspection, installation, external connections, and shipment of the Compact Outdoor SSPA unit.

2.1 Inspection

When the unit is received, an initial inspection should be completed. Ensure that the shipping container is not damaged. If it is, have a representative from the shipping company present when the container is opened. Perform a visual inspection of the Compact Outdoor Amplifier to make sure that all items on the packing list are enclosed. If any damage has occurred or if items are missing, contact:

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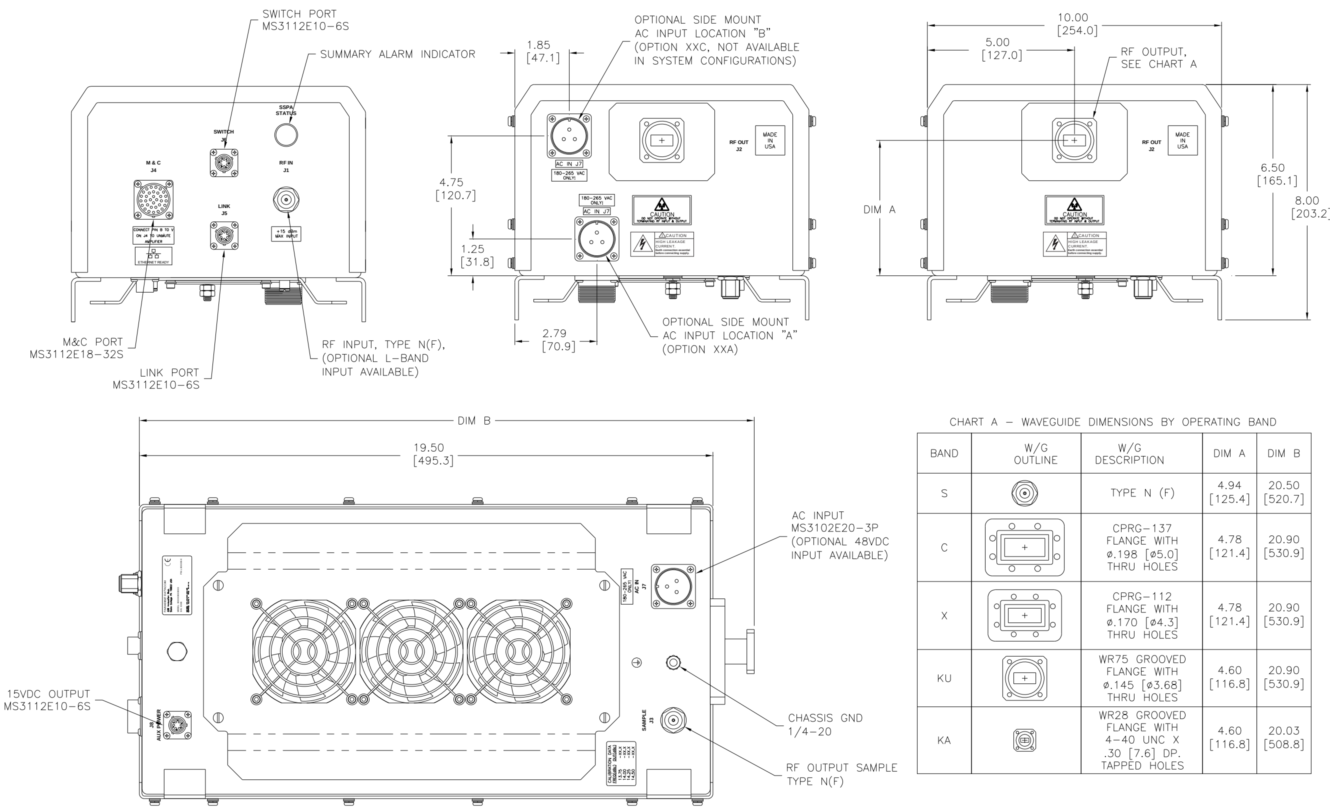
2.2 Connector Pin-Outs

The following section details the connector pin-outs for the Mini Compact Outdoor SSPA. **Figure 2-1** shows the overall dimensioned outline of a Compact Outdoor Amplifier.



BAND	W/G OUTLINE	W/G DESCRIPTION	DIM A	DIM B
S		TYPE N (F)	4.94 [125.4]	20.50 [520.7]
C		CPRG-137 FLANGE WITH ø.198 [ø5.0] THRU HOLES	4.78 [121.4]	20.90 [530.9]
X		CPRG-112 FLANGE WITH ø.170 [ø4.3] THRU HOLES	4.78 [121.4]	20.90 [530.9]
KU		WR75 GROOVED FLANGE WITH ø.145 [ø3.68] THRU HOLES	4.60 [116.8]	20.90 [530.9]
KA		WR28 GROOVED FLANGE WITH 4-40 UNC X .30 [7.6] DP. TAPPED HOLES	4.60 [116.8]	20.03 [508.8]

Figure 2-1: Outline, Compact Outdoor Solid State Amplifier

2.2.1 RF Input (J1) [N-type (F)]

The RF Input connector is a type N female connector. The Compact Outdoor SSPA has a default maximum nominal gain of 75 dB minimum. Therefore the maximum input signal required to saturate the amplifier can be calculated as:

$$\text{Input Power} = P_{sat} - 75 \text{ dB}$$

For example, if a 50 W Ku-Band Compact Outdoor amplifier is used in a system it has a P_{sat} = 47.0 dBm. Therefore the maximum input power should be limited to -28 dBm. Slightly higher input power levels will not damage the amplifier but will result in higher levels of distortion in the output signal.

> **WARNING! The maximum input level should be limited to +15 dBm to avoid damaging the amplifier.**

Figure 2-2 shows the input side of the Compact Outdoor Amplifier. This side contains the RF input (J1), M&C input (J4), and the Interface connections (J5, J6).

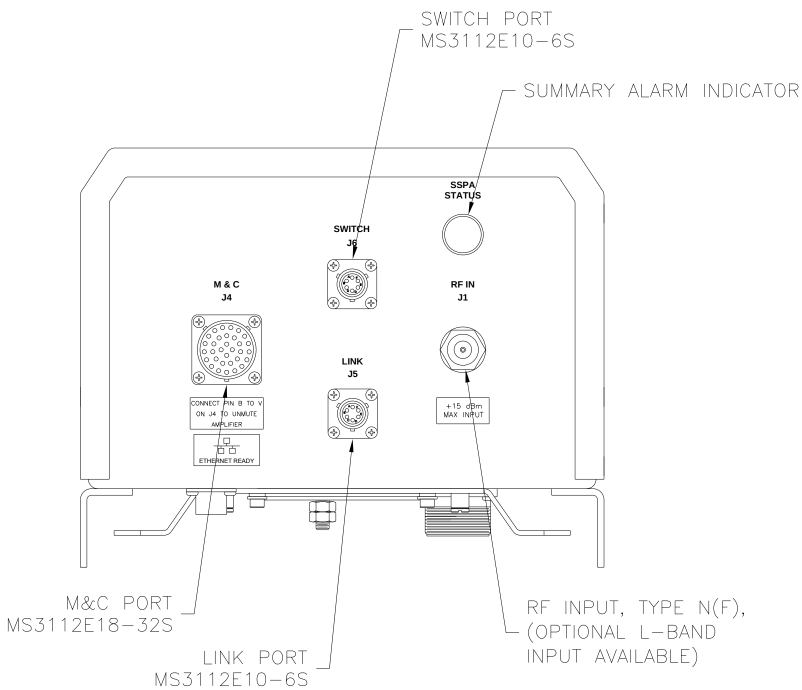


Figure 2-2: Input Side, Compact Outdoor Amplifier

2.2.2 RF Output (J2)

The RF Output is brought out through waveguide in the Compact Outdoor Amplifier. **Figure 2-3** shows the output of a C-Band Compact Outdoor Amplifier. The Ku-Band amplifiers have a WR75 grooved flange, while the C-Band and X-Band amplifiers have CPR style grooved flanges (CPRG-137 for C-Band; CPRG-112 for X-Band). Ka-Band amplifiers utilize a WR28 grooved flange. S-Band units are fitted with Type N (F) connectors at the RF Output.

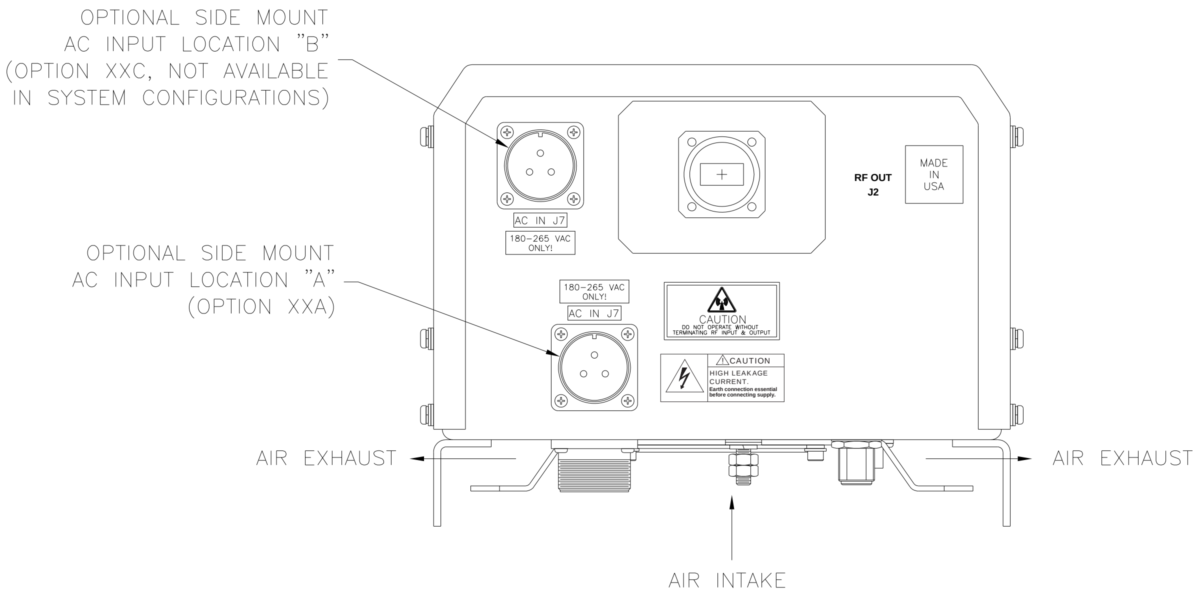
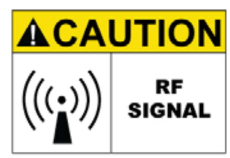


Figure 2-3: RF Output Side of Ku-Band Compact Outdoor SSPA

Caution should be observed here to ensure that the antenna or a suitable termination is connected to this port before operating the amplifier. The amplifier is protected against full reflection but dangerous levels of microwave energy can be present at this port.

WARNING! Radiation hazard when un-terminated. Do not operate the SSPA without terminating the RF Output (J2). Do not look directly into the RF Output waveguide.



2.2.3 RF Output Sample Port (J3) [N-type (F)]

The RF Output Sample port, J3, is located on the bottom of the amplifier as shown in **Figure 2-4**. This connector provides a -40 dBc sample of the amplifier’s output signal. It is a N-type female connector.

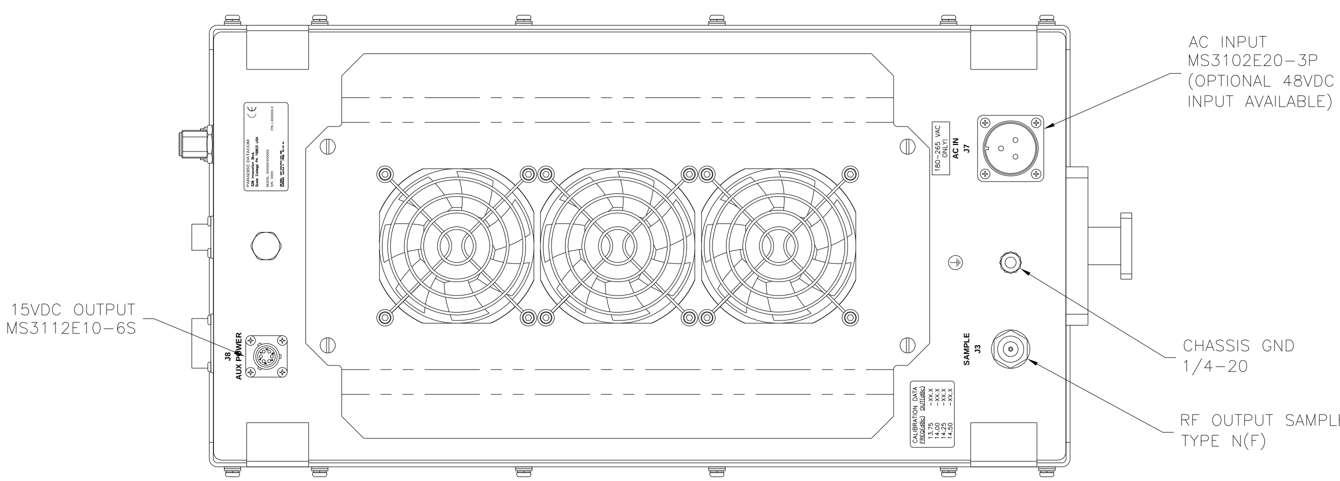


Figure 2-4: Bottom View, Compact Outdoor Amplifier

2.2.4 Monitor & Control Connector (J4) [MS3112E18-32S]

The M&C, Monitor and Control, connector is the primary input for controlling the amplifier and monitoring fault conditions. It is a 32-pin circular connector, MS3112E18-32S. It requires a mating connector, MS3116F18-32P, which is supplied with the unit. The pin-out for this connector is described in **Tables 3-1** and **3-2**.

> **Note**: Different manufacturers of the MS3116F18-32P circular connector use different labeling conventions, and pin “j” may appear to be pin “I”. This manual uses the convention of pin “j”.

2.2.5 Link Port (J5) [MS3112E10-6S]

The interface connector is used to connect between two Compact Outdoor Amplifiers when used in a 1:1 redundant system. It is a 6 pin circular connector, MS3112E10-6S. It requires a mating connector, MS3116F10-6P. A link cable is provided with a 1:1 Redundancy Kit which can be purchased separately. See **Table 2-1**.

Table 2-1: Link Port (J5) Pin-Outs

Pin # on J5	Connection	Pin # on J5	Connection
A	LINK OUT	D	N/C
B	LINK IN	E	N/C
C	N/C	F	GND

2.2.6 Switch Port (J6) [MS3112E10-6S]

When used in a 1:1 redundant system, the waveguide switch must be connected to the switch port of each amplifier (MS3112E10-6S). See **Table 2-2**. It mates with MS3116F10-6P.

Table 2-2 Switch Port (J6) Pin-Outs

Pin # on J6	Connection	Pin # on J6	Connection
A	N/C	D	N/C
B	N/C	E	POS 2
C	+28 VDC	F	POS 1

2.2.7 Prime Power Connection (J7) [MS3102E20-3P]

The AC Input connector, J7, is located on the bottom side of the Compact Outdoor Amplifier package (see **Figure 2-4**). There are also two alternate placements for this connector on the RF Output end of the amplifier as shown in **Figure 2-3**. This connector is a 3-pin circular connector, MS3102E20-3P. The mating connector (MS3106E20-3S) is shipped with the unit. The pin out for this connector is given in **Table 2-3**.

Table 2-3: AC Line Input Connector

Pin # on J7	Connection
A	L1
B	GND
C	L2/N

WARNING! Always terminate the RF input and output connectors prior to applying prime AC input power!

The power supplies provide universal AC input by using auto-sensing power supplies. The AC input can operate over a range of 90-265 VAC, at 47 to 63 Hz. The power supply is also power factor corrected, enabling the unit to achieve a power factor greater than 0.93.

Refer to the specification sheet in **Appendix D** for information regarding prime power vs. RF output power. The specification sheet shows whether your unit operates at 90-265 VAC or 180-265 VAC. An option for 110 VAC prime power is available for the higher-powered units.

Leakage current may exceed 3.5 mA. A connection to earth ground must be made prior to connecting AC mains. Likewise, when removing AC mains, keep earth ground connected.

For the connection to earth ground, use a 12 AWG cable, UL rated for outdoor use. Connect to the chassis ground stud using the supplied hardware. Tighten all hardware securely with a wrench.

2.2.7.1 AC Power Cable Construction

Construct an AC power cable using the supplied MS3106E20-3S mating connector for J7. Use a three-conductor, 25A, 12 AWG cable, UL rated for outdoor use. When constructing the cable, discard the connector grommet, but keep the plastic ferrule. Connect the black conductor to terminal A (L1) of the connector, the white conductor to terminal C (L2/N) of the connector, and the green (protective earth ground) connector to terminal B (GND) of the connector. Tighten the metal end-bell and fill with potting compound.

Warning! The protective earth pin B must be connected to AC mains earth for both safety and EMC regulation compliance.

Note: For safety purposes, an isolation switch may be included in the power cable to serve as a disconnect device in the event of an emergency or for unit servicing. The amplifier itself has no on/off switch. As soon as AC power is applied to the unit, the unit's power supplies and microcontroller are enabled. The internal amplifier module is disabled until the Mute Line Input (J4, Pin B) is pulled to Ground (J4, Pin V). See **Section 3.1.1**.

2.2.7.2 DC Input Option [MS3102E-20-29P]

The Compact Outdoor Amplifier can also be configured with a DC Input Voltage power supply. The DC Input Voltage can range from 42-60 VDC. When using a DC input voltage the input power connector, J7, is configured per **Table 2-4**. The mating connector (MS3106F20-29S) is supplied with the unit.

Table 2-4: DC Input Connector, MS3102E-20-29P

Pin # on J7	Connection	Pin # on J7	Connection
B	+48 V	L	-48 V
C	+48 V	M	-48 V
D	+48 V	N	GND
K	-48 V		

2.2.7.3 DC Input Option, 300W C-Band Unit

The 300W C-Band Compact Outdoor SSPA can be configured with a DC Input Voltage power supply. The DC Input Voltage can range from 42-60 VDC. When using a DC input voltage, the circular MIL connector (MS3102E-20-15P), J7, is configured per **Table 2-5**. The mating connector (MS3106F20-15S) is supplied with the unit.

Table 2-5: DC Input Connector, MS3102E-20-15P, 300W C-Band SSPA

Pin # on J7	Connection	Pin # on J7	Connection
A	No Connection	E	-48 V
B	+48 V	F	No Connection
C	+48 V	G	GND
D	-48 V		

2.2.8 15 VDC Output Port (J8) [MS3112E10-6S]

The 15 VDC Output, J8, is located on the bottom side of the amplifier as shown in **Figure 2-3**. This provides +15 VDC and up to 1 Amp current to any external equipment. It is a 6-pin MS-type connector (see **Table 2-6** for pin-outs) and mates with MS3116F10-6P.

Table 2-6: +15 VDC Output Port (J8) Pin-Outs

Pin # on J8	Connection	Pin # on J8	Connection
A	EXTERNAL FAULT IN	D	GND
B	FAULT PULLUP	E	+15V EXTERNAL
C	+15V LNA	F	GND

2.2.9 Chassis Ground Terminal

A Chassis ground terminal is provided on the bottom side of the amplifier. A ¼ - 20 threaded terminal and connecting hardware is provided for equipment grounding.

2.3 Physical Features

In addition to the I/O connectors, the Compact Outdoor user-friendly features include a summary alarm indicator and removable fan tray.

2.3.1 Summary Alarm Indicator

A summary alarm indicator LED is located on the input side of the amplifier. When the SSPA is online, this indicator illuminates GREEN. When the unit experiences a fault condition, the indicator illuminates RED.

2.3.2 Airflow and Removable Fan Tray

The Compact Outdoor Amplifier's cooling system represents a landmark in microwave telecommunication amplifiers. It features a unique system of heatsinks that have been computer optimized to provide extremely efficient cooling of all of the system's functional blocks. This high efficiency cooling system is primarily responsible for the small overall package size and reduced weight of the unit (approximately 36 lbs or 16.4 kg).

The cooling system is based on a forced convection technique in which the system fans provide the air intake while the exhaust is brought out around the outer perimeter of the fans. The air intake and exhaust are both located on the bottom side of the amplifier. The intake is brought through three fans while the exhaust is along the two rows of heatsink fins as seen in **Figure 2-3**.

A minimum clearance of 6 inches (152 mm) should be maintained between the bottom of the amplifier and any mounting surface. This will ensure that there is no forced re-circulation of airflow from exhaust to intake.

> **WARNING! The Compact Outdoor SSPA should NEVER be mounted with the fans facing up!**

The fans should be examined periodically and any obstruction or debris should be cleared. Inadequate air flow can cause the amplifier to overheat and cause a temperature fault. See **Section 7** for instructions on how to clean the fan assembly and heatsink.

In system configurations, ensure that each unit in the system has sufficient ambient airflow, and adequate space to maintain the fans for each unit. **Figure 2-5** shows an improper method for mounting a Compact Outdoor SSPA system. Not only do the fans oppose each other, thereby potentially causing thermal issues, but the configuration leaves insufficient space to remove the fans to periodically clean the heatsink.

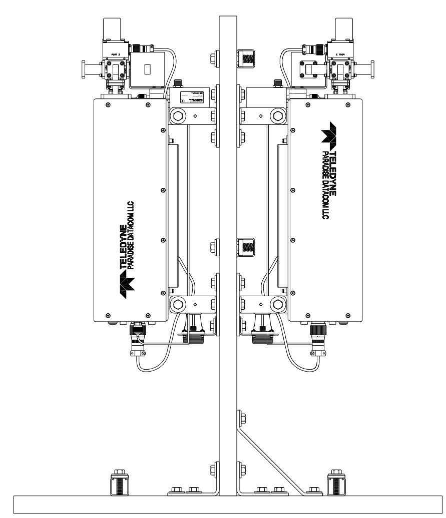


Figure 2-5: Improper mounting

2.4 Unit Weights

The Compact Outdoor SSPA is available in a variety of frequency bands and power levels, and have a multitude of options which makes each unit weigh slightly different from another.

The following chart, **Table 2-7**, outlines the weights for the most common power levels of Compact Outdoor SSPA and additional weight add-ons for common options.

Table 2-7: Compact Outdoor SSPA Weights

Band	Power Level	Base Weight lbs (kg)	With zBUC lbs (kg)	With 110 VAC Option lbs (kg)
C-Band	< 100W	36.5 (16.6)	+1.7 (+0.8)	N/A
	100W	36.8 (16.7)	+1.7 (+0.8)	N/A
	140W	37.0 (16.8)	+1.7 (+0.8)	+1.9 (+0.9)
	200W	37.8 (17.2)	+1.7 (+0.8)	+1.2 (+0.6)
	250W	45.4 (20.6)	+1.7 (+0.8)	+1.2 (+0.6)
	300W	46.9 (21.3)	+1.7 (+0.8)	N/A
Ku-Band	< 40W	35.1 (16.0)	+1.7 (+0.8)	N/A
	40W	35.3 (16.1)	+1.7 (+0.8)	N/A
	50W - 70W	35.7 (16.2)	+1.7 (+0.8)	N/A
	100W - 125W	42.5 (19.3)	+1.7 (+0.8)	+1.2 (+0.6)
X-Band	60W	46.3 (21.1)	+1.7 (+0.8)	N/A
	75W - 100W	46.7 (21.2)	+1.7 (+0.8)	N/A
	140W	47.5 (21.6)	+1.7 (+0.8)	+1.2 (+0.6)
	200W	54.9 (25.0)	+1.7 (+0.8)	+1.2 (+0.6)
	250W	56.4 (25.6)	+1.7 (+0.8)	N/A
S-Band	50W - 100W	36.0 (16.4)	N/A	N/A
	200W - 300W	44.0 (20.0)	N/A	N/A
Ka-Band	40W	44.3 (20.2)	+1.7 (+0.8)	N/A
	80W	44.3 (20.2)	+1.7 (+0.8)	N/A

2.5 Compact Outdoor Mounting Kit Installation

These instructions outline how to install a Teledyne Paradise Datacom Compact Outdoor SSPA unit onto an antenna boom, using a Universal Compact Outdoor Mounting Kit. This kit allows installation of the Compact Outdoor SSPA on antenna booms up to 10” thick.

2.5.1 Safety Considerations

These instructions are designed to be used by a single operator. As such, several safety issues should be kept in mind during the installation.

1. The Teledyne Paradise Datacom Compact Outdoor SSPA unit weighs approximately 36 lbs., and should be handled with care to avoid scratching the exterior coating and compromising the unit’s corrosion resistance.
2. All bolts should be tightened to within reasonable limits to avoid stripping the threads.
3. The section of antenna boom the unit is to be mounted on should be straight, dry, and free from corrosion or defects.

2.5.2 Inspection

On receiving the Universal Compact Outdoor Mounting Kit, inspect the contents to ensure all parts listed in **Table 2-8** are present.

Table 2-8: Mounting Kit Parts List

Item #	Qty	Description	Part No.
1	4	Bracket, Mounting	L201394-1
2	4	Uni-Strut, 13.5” Lengths	L201393-1
3*	4	1/2”-13 All Thread Stud, SS	188FTS 8-11 or -15
4	4	1/2” Lock Washer	50LW188
5	16	Nut, Hex, 1/2”-13	1/2-13 Nut
6	16	Washer, Flat, Std. 1/2”	MS15795-819
7	4	Bolt, Hex, 1/2”-13 x 1.25, SS	MS35307-411

* Kits are supplied with two different All Thread lengths (11.0” or 15.0”) depending on the installation. The 11-inch All Thread allows mounting on booms up to 6” diameter. The 15-inch All Thread allows mounting on booms up to 10” diameter.

2.5.3 Installation

1. Locate the mounting studs on the bottom of the Compact Outdoor SSPA unit. Using a **½" bolt**, two **flat washers**, and a **½" nut**, firmly bolt one **mounting bracket** to each mounting stud, as shown in **Figure 2-6**. Be sure each bracket is vertical, and the top flange of the mounting bracket points away from the unit.

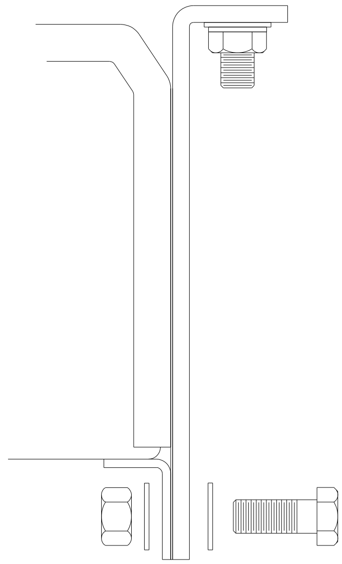


Figure 2-6: Bolt Mounting Bracket to Unit

2. Place one piece of Uni-Strut (open channel up) at each end of the CO unit, across the flanges of the mounting brackets, lining up the holes. For each **All-Thread stud**, run on a **½" nut** approximately 1" from the rod end. Slip on a **lock washer**, and thread the short end of the stud through the Uni-strut and mounting flange. Secure firmly in place with a **flat washer** and **nut**. The unit should now look as shown in **Figure 2-7**.

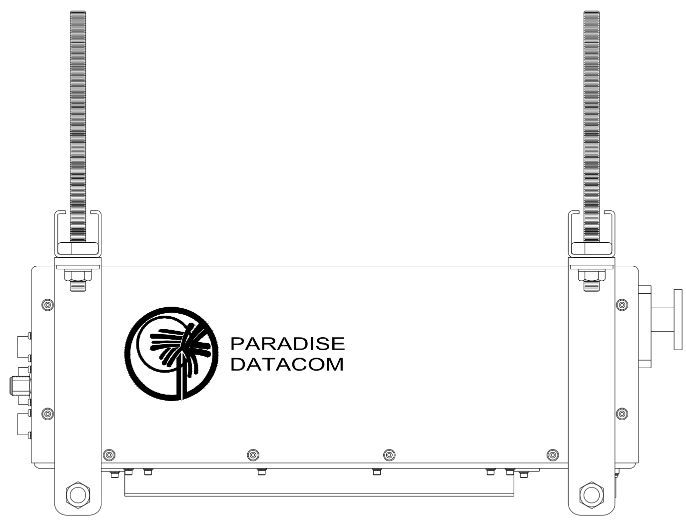


Figure 2-7: Unit Ready for Boom Installation

3. Bring the unit up tight under the boom (with the long axes parallel), sliding the All-Thread studs past the sides of the boom to show above the boom top. Place the remaining pieces of Uni-strut (open channel down) across the boom, onto the protruding All-Thread stud ends. Secure firmly with a flat washer and ½” nut on each of the four All-Thread stud ends. Looking from the end of the boom, the mounted unit should look as shown in **Figure 2-8**.

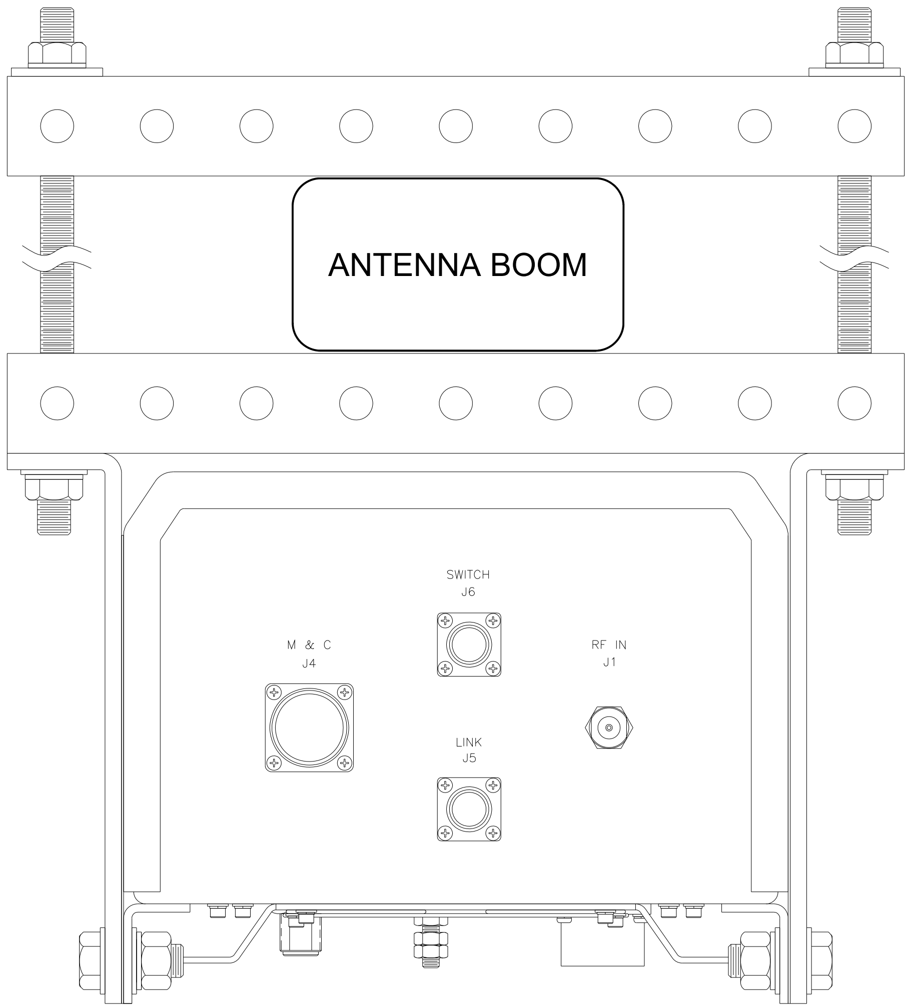


Figure 2-8: Compact Outdoor SSPA Mounting Completed

4. Connect all cables to the Compact Outdoor SSPA unit as directed.
5. All cable connections should be properly sealed against water intrusion. Any moisture in a microwave coaxial connection will have adverse effect on the operation of the equipment. Apply self-amalgamating tape or putty from the plug/socket connection (MS-type) to as close as possible to the cable sheath. Cover all connector junctions (N-type; SMA) so that no water can creep into the thread between the plug and socket. Prior to taping a connect-or, remove all traces of oil or grease from the connector by using an alcohol-based clean-ing solution. Ensure that the connector is clean and dry

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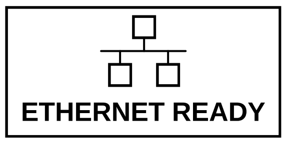
3.0 Introduction

The Compact Outdoor SSPA is available with a standard RS-232/RS-485 serial communications interface or an optional Ethernet & RS-232/RS-485 interface. This section summarizes the connections to a remote computer for various remote communications. **Table 3-1** summarizes the hardware connections of Port J4 for Ethernet-capable units; **Table 3-2** displays the hardware connections of Port J4 for non-Ethernet-capable units.

3.0.1 Remote Communications Connections

Ethernet ready Compact Outdoor SSPAs can be identified by either serial number or label. Compact Outdoor SSPAs with serial numbers greater than 300,000 are Ethernet ready. Also Ethernet ready units have the following label affixed adjacent to the M&C connector, J4.



Ethernet ready units can be configured for either RS-232, RS-485, or Ethernet communications. The units cannot be used with multiple communication protocols simultaneously. The user must select one of the three formats. Non-Ethernet units can be configured for either RS-232 or RS-485 communications. The following figures show the proper configuration of J4 for each of the three communication formats.

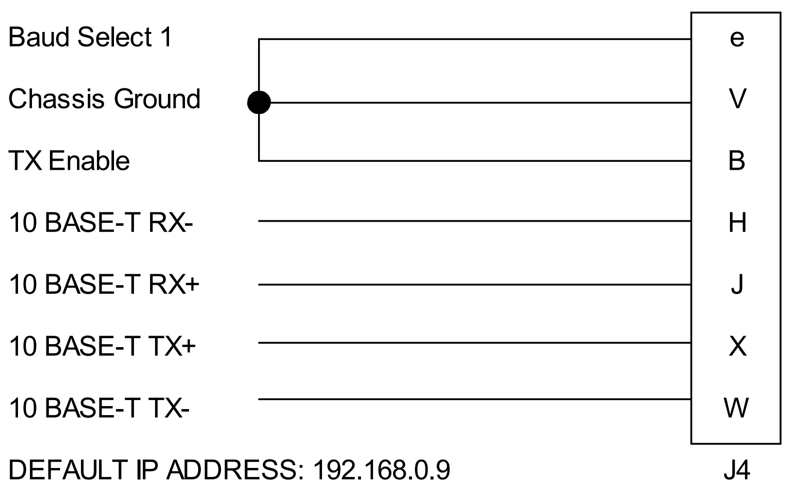


Figure 3-1: J4 Connections for Ethernet Communications

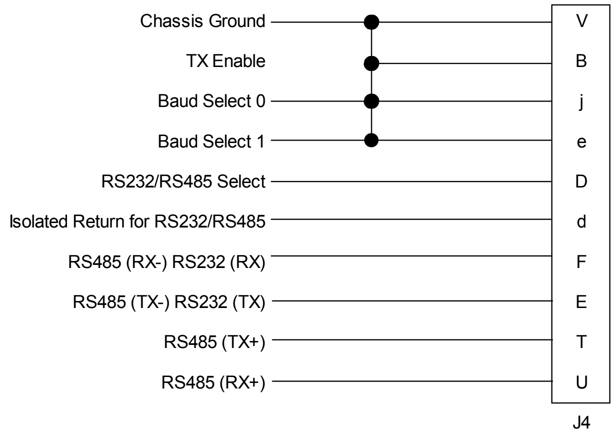


Figure 3-2: J4 Connections for RS-485 Communications

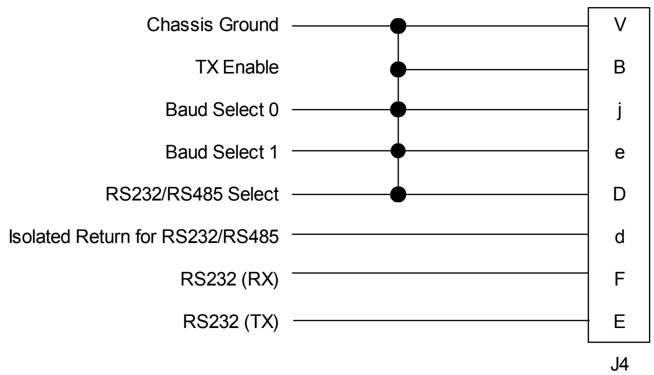


Figure 3-3: J4 Connections for RS-232 Communications

3.0.2 Legacy Compact Outdoor SSPAs

Compact Outdoor SSPAs with serial numbers of less than 300,000 did not include isolated grounds for RS-232/RS-485 serial communications. The remote communication connections are slightly different and outlined in **Figures 3-4** and **3-5**.

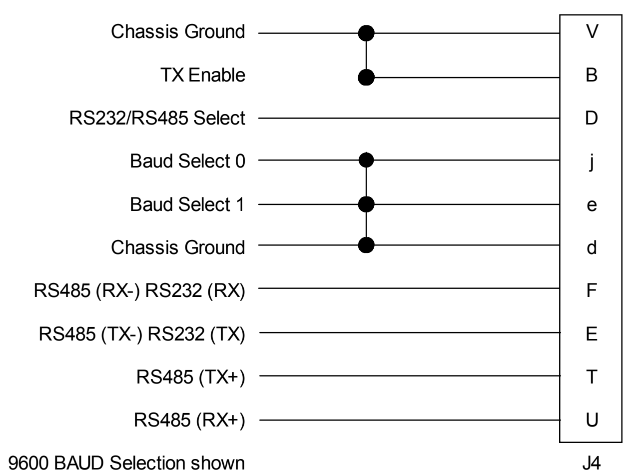


Figure 3-4: J4 Connections for RS-485 Communications for Serial Numbers <300,000

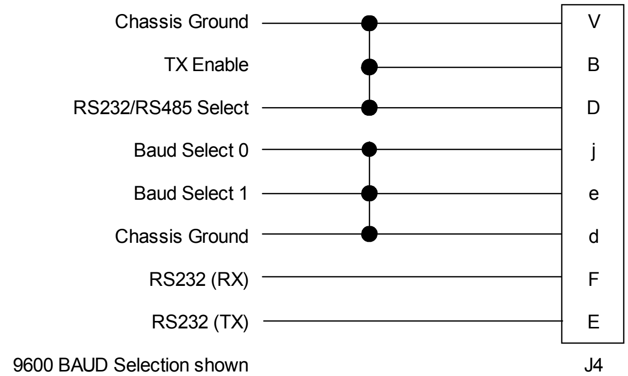


Figure 3-5: J4 Connections for RS-232 Communications for Serial Numbers <300,000

3.0.3 Compact Outdoor SSPAs in Legacy Systems

The isolated return for RS-232/RS-485 systems that exists on Compact Outdoor SSPAs with serial numbers 300,000 and above will require an additional connection on J4 when used in systems that have Monitor and Control cables designed to be used with units with serial numbers < 300,000.

Figure 3-6 shows the required connection between the chassis ground and the isolated ground (pin V to pin d).

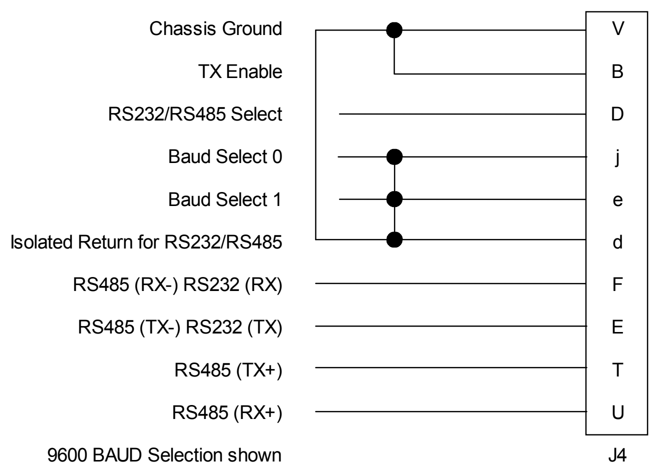


Figure 3-6: J4 Connections for RS-485 Communications for Compact Outdoor SSPAs of Serial Numbers >300,000 in systems with M&C cables designed for Compact Outdoor SSPAs of Serial Numbers <300,000

If it is not possible to modify the existing cable harness or otherwise externally connect the chassis ground Pin V to the isolated return at Pin d as shown in **Figure 3-6**, consult the factory for other options.

3.1 Port J4 Pin-Outs

Table 3-1 shows the pin-outs for the J4 Monitor & Control Connector for Ethernet capable units.

Table 3-1: Monitor & Control Connector (J4) Pin-Out (Ethernet capable)

Signal	Type	Function	Pin	Notes
Mute Input	Closure to Ground	Disables DC Power to SSPA	B	Unit powers up muted; This line must be pulled to ground (V) to enable amplifier
Auxiliary Input	Closure to Ground	Auxiliary Input	P	
Summary Alarm	Form C Relay	Closed on Fault Common Open on Fault	L a b	L-a : normally open a-b : normally closed
Auxiliary Alarm	Form C Relay	Closed on Fault Common Open on Fault	N Z M	N-Z : normally open Z-M: normally closed
Low RF Fault Output	Open Collector	High on Fault	G	Requires external pull-up
10 Base-T TX-			W	See **Section 10**
10 Base-T RX-			H	
10 Base-T RX+			J	
10 Base-T TX+			X	
Spare Input	Analog Input		S	+5V max.
RF Power Detector OR Fan Speed Control [1]	Analog Output	Relative Indication of RF Output Power OR Fan Speed Control	R	+4.0 VDC at Psat (RF Power Detector) OR No connection (Fan Speed Control)
Gain Adjust Input	Analog Input	Adjusts Amplifier Gain over 20dB range	A	2.5 vdc = Max Gain 75 dB 0.5 vdc = Min Gain 55 dB
Block Up Converter Alarm	Open Collector	High on Fault	f	Requires external pull-up
RS232 / RS485 Select	Closure to Ground	Selects Serial Communication	D	Default is RS 485; pull to ground (d) to enable RS 232
RS 485 TX- or RS232 OUT	Serial TX Output	Serial Link Data Port	E	See **Section 10**
RS 485 RX- or RS232 IN	Serial RX Input	Serial Link Data Port	F	
RS 485 TX+	Serial TX Output	Serial Link Data Port	T	
RS 485 RX+	Serial RX Input	Serial Link Data Port	U	
GND	Signal Ground	Common Signal Return	V	Chassis ground
GND	Signal Ground	Isolated Comm Ground	d	Ground for Signals D, E, & F
Baud Select 0	Closure to Gnd	Select Baud Rate & Protocol	j	Refer to **Table 10-1**
Baud Select 1	Closure to Gnd	Select Baud Rate & Protocol	e	Refer to **Table 10-1**
PGM Switch		Flash Firmware Port	g	Reserved for Programming
PGM CLK		Flash Firmware Port	c	Reserved for Programming
PGM-Sout		Flash Firmware Port	K	Reserved for Programming
PGM-Sin		Flash Firmware Port	Y	Reserved for Programming
PGM +5V		Flash Firmware Port	h	Reserved for Programming
PGM Enable		Flash Firmware Port	C	Reserved for Programming

[1] All GaN Compact Outdoor SSPAs are fitted with the Fan Speed Control option.

Table 3-2 shows the pin-outs for the J4 Monitor & Control Connector for units that cannot communicate via Ethernet (units with serial numbers prior to 300,000).

Table 3-2: Monitor & Control Connector (J4) Pin-Out (Non-Ethernet)

Signal	Type	Function	Pin	Notes
Mute Input	Closure to Ground	Disables DC Power to SSPA	B	Unit powers up muted, This line must be pulled to ground (V or d) to enable amplifier
Auxiliary Input	Closure to Ground	Auxiliary Fault Input	P	
Summary Alarm	Form C Relay	Closed on Fault Common Open on Fault	L a b	L-a : normally open a-b : normally closed
Auxiliary Alarm	Form C Relay	Closed on Fault Common Open on Fault	N Z M	N-Z : normally open Z-M: normally closed
	Open Collector	High on Fault	W	Reserved
Auxiliary Alarm	Open Collector	High on Fault	G	Requires external pull-up
Voltage Alarm	Open Collector	High on Fault	H	Requires external pull-up
Current Alarm	Open Collector	High on Fault	J	Requires external pull-up
Temperature Alarm	Open Collector	High on Fault	X	Requires external pull-up
Spare Fault	Open Collector	High on Fault	S	Requires external pull-up
RF Power Detector	Analog Output	Relative Indication of RF Output Power	R	+4.0 vdc at Psat
Gain Adjust Input	Analog Input	Adjusts Amplifier Gain over 20dB range	A	2.5 vdc = Max Gain 75 dB 0.5 vdc = Min Gain 55 dB
Block Up Converter Alarm	Open Collector	High on Fault	f	Requires external pull-up
RS232 / RS485 Select	Closure to Ground	Selects Serial Communication	D	Default is RS 485; pull to ground (V) to enable RS 232
RS 485 TX- or RS232 OUT	Serial TX Output	Serial Link Data Port	E	
RS 485 RX- or RS232 IN	Serial RX Input	Serial Link Data Port	F	9600 default Baud Rate
RS 485 TX+	Serial TX Output	Serial Link Data Port	T	
RS 485 RX+	Serial RX Input	Serial Link Data Port	U	
GND	Signal Ground	Common Signal Return	V, d	
Baud Select 0	Closure to Gnd	Select Baud Rate & Protocol	j	Refer to **Table 10-1**
Baud Select 1	Closure to Gnd	Select Baud Rate & Protocol	e	Refer to **Table 10-1**
PGM Switch		Flash Firmware Port	g	Reserved for Programming
PGM CLK		Flash Firmware Port	c	Reserved for Programming
PGM-Sout		Flash Firmware Port	K	Reserved for Programming
PGM-Sin		Flash Firmware Port	Y	Reserved for Programming
PGM +5V		Flash Firmware Port	h	Reserved for Programming
PGM Enable		Flash Firmware Port	C	Reserved for Programming

3.1.1 Amplifier Enable (Mute/Unmute) (J4)

The Compact Outdoor Amplifier has no on/off switch or circuit breaker in the AC Input path. As soon as AC power is applied to J7, the unit's power supplies and microcontroller are enabled. The operator will be able to observe the forced convection cooling fans running. However, the internal amplifier module is disabled until the Mute Line Input (J4, Pin B) is pulled to Ground (J4, Pin V).

If it is desired to have the RF enabled every time the AC input is applied, a permanent connection can be made from J4-Pin B and Pin V.

3.1.2 Gain Adjust Input (J4)

The Compact Outdoor Amplifier is equipped with an internal attenuator, allowing up to 20.0 dB of attenuation to be applied to the RF signal path, with 0.1 dB accuracy. Typically it will allow user to set SSPA linear gain from maximum 75 dB to minimum 55 dB (refer to the product spec sheet for details).

The SSPA attenuator can be controlled by several methods:

1. Attenuation level controlled over remote interface (factory default mode);
2. Attenuation level set by analog voltage between pins A and V on the Port J4 M&C connector;
3. Attenuation level automatically controlled by ALC (Automatic Level Control) function;

The desired method of attenuation control mode must be set over remote interface.

Attenuation control over remote interface (Serial, IP, Web or SNMP) is the default method of controlling SSPA linear gain. In this method of control, the specific attenuation is selected using the Embedded Web page or Universal M&C GUI, or sent as a remote control command. The SSPA will retain the selected attenuation level in non-volatile internal memory until a new command or selection is issued by the user.

In analog voltage control mode, the user needs to apply positive voltage between (J4, Pin A) and Ground (J4, Pin V) from an external source. The applied voltage will be translated to the SSPA attenuation level and will determine the linear gain of SSPA unit as follows:

2.5 VDC = Maximum Gain: 75 dB (Attenuator set to 0 dB);
0.5 VDC = Minimum Gain: 55 dB (Attenuator set to 20 dB);

Voltage increments by 0.1V in a range between 0.5 to 2.5V will reduce the amount of attenuation by 0.1 dB steps. Voltages below and above this limit will be treated as lower and upper limits of adjustment range. Gain adjust input typically has 20 kOhm pull down to the signal ground. Hence, with no external voltage applied, the SSPA will default to minimum gain (55 dB).

Beginning with firmware version 6.40, the user may operate the SSPA in Automatic Level Control (ALC) mode.

When enabled, the Automatic Level Control function will take control of the amplifier's attenuation settings to maintain the desired RF output power level and will not allow any attenuation adjustments via other methods.

The ALC circuit will have the greatest ability to adjust for positive and negative RF input level changes when the amplifier's gain level is typically in midrange of 65 dB (Internal attenuator set to 10 dB).

By following the steps below, the optimum ALC RF input level can be set quickly.

1. Make sure the amplifier is not in ALC mode;
2. Set the amplifier attenuation level to 10 dB;
3. Apply a RF input signal to the amplifier;
4. Use SSPA power indicator or external power meter to measure the RF output power of the amplifier;
5. Adjust the RF input level until the desired output power level is achieved;
6. Activate the ALC control by using remote control GUI interface or issuing a remote control command.

Upon activation, the ALC function will take over control of the internal attenuator and maintain the RF output level set point. The Forward RF alarm level will be set automatically to the selected ALC output. Forward RF alarm function will also be set to 15% Window mode. If the Forward RF alarm is not needed, it could be deactivated or set to a different level or function after ALC mode is set.

The ALC function has the ability to accurately control the RF output power over a 15 dB range from P_{sat}. The ALC will operate over a 20 dB range, but the accuracy of the last 5 dB will suffer. For example, if the saturated power from the amplifier is 59 dBm, the lowest accurate power setting during ALC control is 44 dBm.

3.1.3 Alarms (J4)

A variety of alarm signals are present at the M&C connector, J4. Both Form-C relays and open collector outputs are available. An amplifier summary alarm is available in both Form C relay and open collector output. Detailed internal faults are available in open collector form and include: voltage, current, and over-temperature.

3.1.3.1 Summary Alarm (J4) Form C Contacts

The Summary Alarm is accessible in both Form C relay and open collector format. The form C relay is “energized” under normal operating conditions and “deenergized” when a fault condition exists.

3.1.3.2 Auxiliary Alarm (J4) Form C Contacts

The Auxiliary Alarm relay is an end user alarm that can be used to signal an alarm condition that is dependent on the state of the Auxiliary Input (J4, Pin P).

The Auxiliary Input is a contact closure to ground. When this input is pulled to ground the Auxiliary Alarm relay is energized (Normal State). When the Auxiliary Input is open circuited the Auxiliary Alarm relay is de-energized (Alarm State).

One example usage of the Auxiliary Alarm is that it could be used to signal one of the detail alarms (voltage, current, or temperature) by connecting the appropriate open collector alarm output to the Auxiliary Input. This programs the Auxiliary Alarm relay to be either a voltage, current, or temperatue Form C relay alarm.

3.1.3.3 Open Collector Alarm Outputs (J4)

The open collector alarm outputs will require external pull-up resistors (unless connected to the Auxiliary Input). They are capable of sinking up to 20 mA current at 30 VDC. The open collector outputs are pulled to ground under normal operating conditions and switch to high impedance state during an alarm condition.

Low RF Alarm: follows state of Auxiliary Input as described above
BUC Alarm: high when amplifier's internal regulator voltage falls below its acceptable level

3.1.4 RF Power Detector (J4, Pin R)

The RF Power Detector is an analog output voltage that is proportional to the RF output power. The maximum output voltage is 4.0 VDC which corresponds to the maximum (saturated) output power from the amplifier. This detected voltage is useful over a 20 dB range of output power. This feature is available in units with serial numbers between 300,000 and 399,999.

3.1.5 Fan Speed Control (J4, Pin R)

Units with serial numbers greater than 399,999 are equipped with a Fan Speed Control option. The fan speed control circuit is shared with the RF power detector analog output (J4, Pin R). This pin remains not connected on units with the fan speed control option installed.

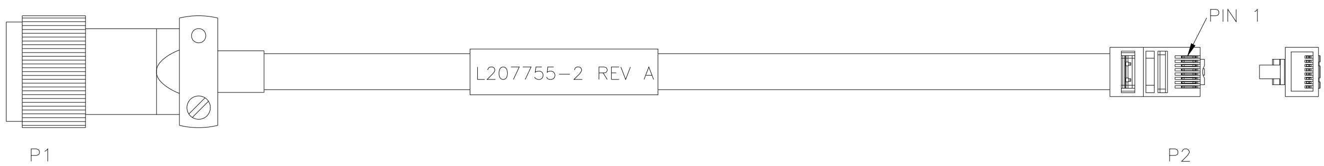
Available control options: Auto, High, Low, and Default/Off

Auto: This setting allows the unit to control the cooling fan speed according to the internal RF module temperature. If the module plate temperature remains below 50 °C, the fan speed will be set to minimum. If the registered module plate temperature is above 50 °C, unit will gradually increase the fan speed. Fan speed will reach maximum at a plate temperature of 65 °C.
High: This option sets the fan speed to maximum. Air velocity will remain at the same level regardless of other operation parameters.
Low: This option sets the fan speed to minimum. Air velocity will remain at the same level regardless of other operation parameters.
Default/Off: This setting should be set on units without the fan speed control option. It will allow proper functioning of the RF power monitor analog output. Applying this setting on units with the fan speed control option allows the fan speed to be proportional to the output RF level. Fan speed will be set at the minimum when output RF is below

a detectable level. Fan speed will gradually increase when RF output increases within the detectable RF range. Fan speed will be at maximum level when unit reaches saturated power (P_{sat}).

3.2 Quick Start Cables

For convenience all Compact Outdoor Amplifiers ship with a ‘Quick-Start’ communications cable. This allows the user to immediately connect the amplifier to a PC and begin operation. Ethernet ready units ship with a Quick Start cable fitted with a 10-base T connector as shown in **Figure 3-7**.



WIRING CHART						
FROM		TO				
CONNECTOR	TERMINAL	CONNECTOR	TERMINAL	COLOR	AWG	LENGTH
P1	H	P2	2	GRN	N/A	10 FT.
P1	J	P2	1	WHT/GRN	N/A	10 FT.
P1	X	P2	3	WHT/ORG	N/A	10 FT.
P1	W	P2	6	ORG	N/A	10 FT.
P1	e	P1	V	BLK	24	3 IN.
P1	V	P1	B	BLK	24	3 IN.

Figure 3-7: Ethernet Quick Start Cable, 207755

Non Ethernet ready units are shipped with a Quick Start cable fitted with a 9-pin D-sub connector and are configured for RS-232 communications as shown in **Figure 3-8**.

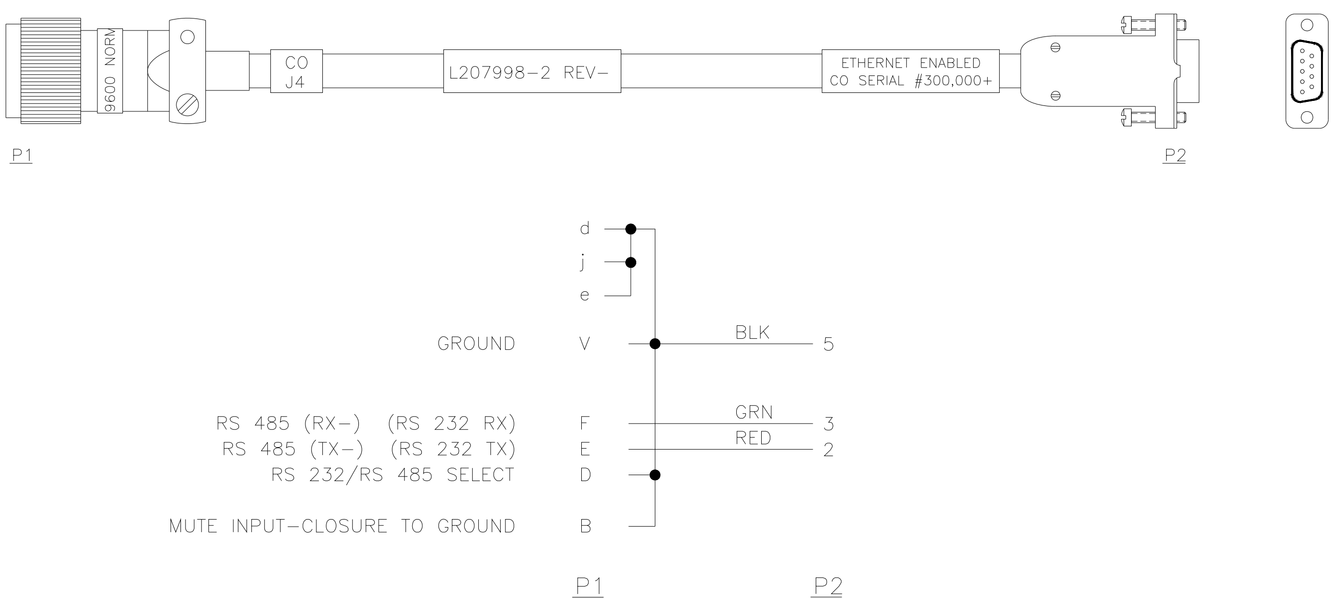


Figure 3-8: RS-232 Quick Start Cable, 207998

3.3 Quick Start Connections

This section describes the necessary steps to communicate with a Compact Outdoor SSPA using either the Ethernet or RS-232 Quick Start cables and the Universal M&C Software. The Teledyne Paradise Datacom Universal M&C Software is a free Windows-based application that can be downloaded from the company web site, www.paradisedata.com. Download version 4.4.3 or later.

3.3.1 Set PC Configuration

To set your Windows-based PC to remotely communicate with the Compact Outdoor unit, perform the following steps:

If using Windows XP:

1. Open the PC's **Control Panel** (*Start Menu → Settings → Control Panel*);
2. Double-click on the **Network Connections** icon;
3. Right-click on the **Local Area Connection** icon and select *Properties*;
4. Select **Internet Protocol (TCP/IP)** and click on the *Properties* button;
5. Select "*Use the following IP address*" and enter the following information:
   IP address: 192.168.0.1
   Subnet mask: 255.255.255.0
6. Click the "*OK*" button and close out of the **Control Panel** windows.

If using Windows Vista or Windows 7:

1. Click on the Windows icon in the lower left corner and select **Control Panel**;
2. Click on the **Network and Sharing Center** link;
3. Click on the **Local Area Connection** link;
4. Click on the *Properties* button;
5. Select **Internet Protocol Version 4 (TCP/IP v4)** and click on the *Properties* button;
6. Select "*Use the following IP address*" and enter the following information:
   IP address: 192.168.0.1
   Subnet mask: 255.255.255.0
7. Click the "*OK*" button and close out of all of the **Control Panel** windows.

3.3.2 Quick Start Ethernet Connection

The following steps outline how to quickly connect to your Compact Outdoor SSPA using the Ethernet Quick Start cable.

1. Unpack the amplifier and connect the RF Input and RF Output.
2. **Ensure the J2 RF Output port is properly terminated.**
3. Connect the AC input power to connector J7.
4. **When shipped from the factory, the Compact Outdoor SSPA is set to start up muted.**
5. Connect the supplied "Quick-Start" Control Cable from Port J4 to the Ethernet port on your computer. This connection will unmute the amplifier. Review the cable schematic in **Figure 3-7**.
6. Launch the Windows-based Teledyne Paradise Datacom Universal M&C Software.

NOTE: If the Compact Outdoor unit is powered up with the Ethernet Quick Start Cable connected to Port J4, the following default conditions apply to the unit (refer to Table 10-1 and Table 10-2):

- **IPNET Interface**
- **Gateway: 192.168.0.1**
- **IP Address: 192.168.0.9**
- **Subnet Mask: 255.255.255.0**
- **Local Port: 1007**
- **IP Lock: 255.255.255.255**
- **Web password: paradise**
- **Read Community: public**
- **Write Community: private**
- **Amplifier is un-muted**

3.3.3 Quick Start RS-232 Connection

The following steps outline how to quickly connect to your Compact Outdoor SSPA using the RS-232 Quick Start cable.

1. Unpack the amplifier and connect the RF Input and RF Output.
2. **Ensure the J2 RF Output port is properly terminated.**
3. Connect the AC input power to connector J7.
4. **When shipped from the factory, the SSPA is set to start up muted.**
5. Connect the supplied "Quick-Start" Control Cable from Port J4 of the SSPA to one of the COM ports on your computer. This connection will unmute the amplifier. Review the cable schematic in **Figure 3-8**.
6. Launch the Windows-based Teledyne Paradise Datacom Universal M&C Software.

NOTE: If the Compact Outdoor unit is powered up with the RS-232 Quick Start Cable connected to Port J4, the following default conditions apply to the unit (refer to Table 10-1 and Table 10-2):

- **Normal Protocol**
- **RS-232 Communication**
- **Gateway: 192.168.0.1**
- **IP Address: 192.168.0.9**
- **Subnet Mask: 255.255.255.0**
- **Local Port: 1007**
- **IP Lock: 255.255.255.255**
- **Web password: paradise**
- **Read Community: public**
- **Write Community: private**
- **Baud rate: 9600**
- **Amplifier is un-muted**

Communication Links using RS-232 are typically good up to 30 ft. (9 m) in length. Installations exceeding this length can use the RS-485 mode which will allow serial control up to 4000 ft. (1200 m).

3.3.4 Setting Custom IP Address

The following steps show how to set custom IP settings to your Compact Outdoor SSPA. This procedure assumes the user has downloaded and installed the Teledyne Paradise Datacom Universal M&C application.

1. Remove power to the unit.
2. Connect the Quick Start cable between Port J4 of the unit and the Ethernet port on your computer.
3. **Ensure the J2 RF Output port is properly terminated.**
4. Connect the AC input power to connector J7.
5. The amplifier will power up with the default IP settings.
6. Launch the Universal M&C application.
7. Connect to the unit as described in **Section 3.4**.
8. Navigate to the **Settings** tab.
9. Set the Protocol to IPNet. With the Quick Start cable attached, the setting will show that it is set already set to IPNet. You will need to re-select IPNet.
10. Navigate to the **IP Setup** tab.
11. Modify the IP settings (IP Address, Gateway Address, Subnet Mask, Local Port, IP Lock Address) to those that will work within your network.
12. Click on the “Change IP Settings” button.
13. Remove the Quick Start cable.
14. Cycle power to the unit.
15. Reconnect the Quick Start cable or other cable to Port J4 of the unit.

NOTE: If the Quick Start cable is attached to Port J4 of the unit before power is applied, the unit will always start up with the default IP settings. Teledyne Paradise Datacom recommends that the operator build a custom cable that leaves Port J4 pins “j” and “e” unpopulated. This custom cable will prevent the default settings from being used if the unit experiences an unexpected power cycle.

3.4 Universal M&C Operation

1. Run the Teledyne Paradise Datacom Universal Monitor and Control Program from the Programs Menu of your PC.
2. Select [Action] → [Add Unit] from the main menu of the Universal M&C Program and select [Compact Outdoor SSPA] from the menu choices. See **Figure 3-9**.

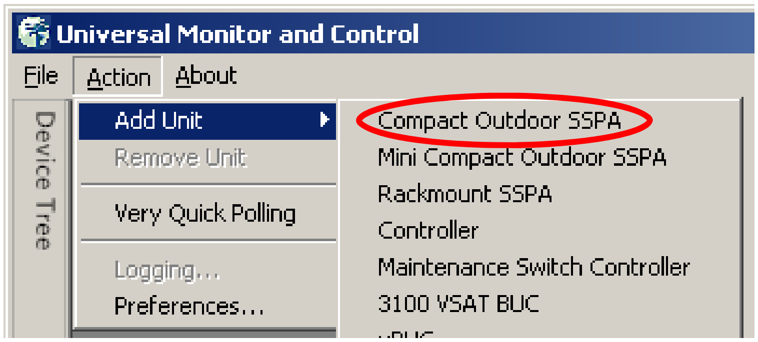


Figure 3-9: Universal M&C Add Unit menu

3. A new dialog window will open (see **Figure 3-10**). Enter the following information where applicable: Unit ID; if using a RS-232 Connection, the Serial Port and Baud Rate; or if using an Ethernet Connection, the unit's IP Address.

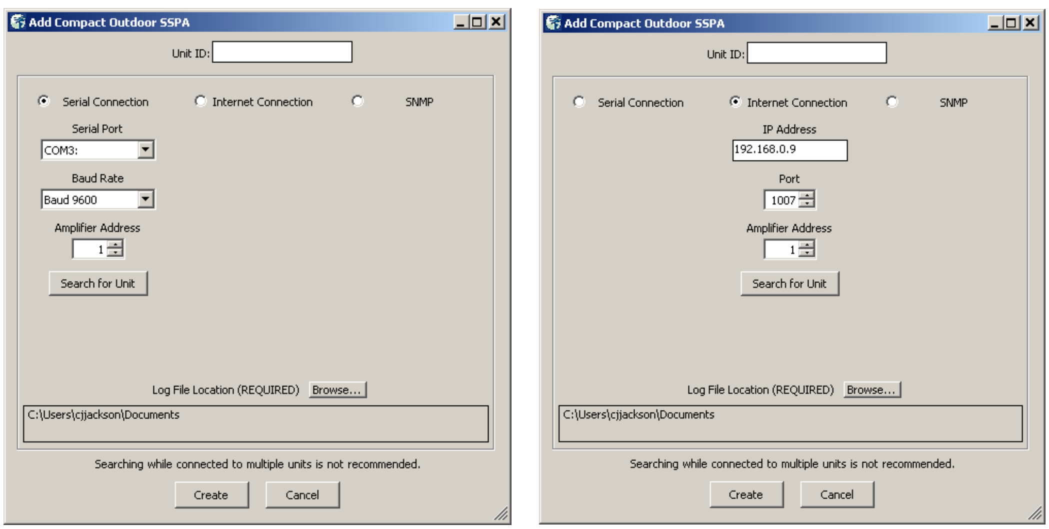


Figure 3-10: Add Compact Outdoor SSPA window, via Serial (left) or Internet (right)

4. Specify the unit's Address in the Amplifier Address box. If you don't know the address of the unit you may search for it. Be aware that this search feature is only useful when you have only one unit connected to your PC at a time.
5. If you wish to change the log file location, click on the [Browse] button and navigate to the desired location. See **Section 3.4.4** for more information about the log file.
6. Click on the [Create] button to generate the operation window for this unit.

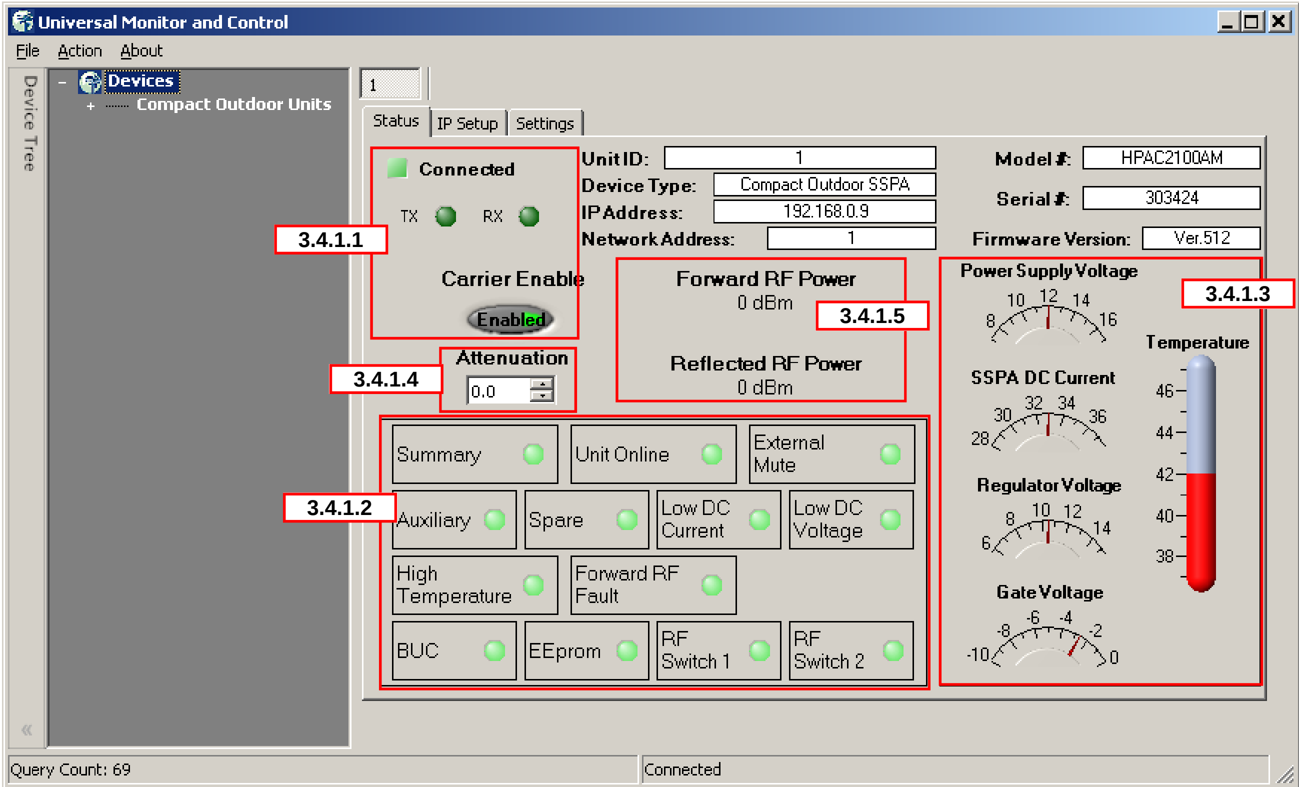


Figure 3-11: Universal M&C Status Window

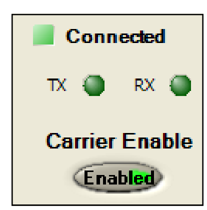
3.4.1 Universal M&C Status Window

The Universal M&C Software will initialize and open to the Status Window, the main monitoring display. See **Figure 3-11**. The Status Window shows the the current conditions (or state) of the Compact Outdoor SSPA. In addition, the status screen allow the user to alter the Mute condition of the carrier and adjust the on-board Attenuator for gain control.

Upon connection with a unit, the M&C application obtains and displays the unit ID, the amplifier's model number and serial number. The SSPA module's firmware version number is also displayed here for convenience.

The unit's network address and serial COM or IP address are also listed, which can be helpful in optimizing serial communications.

3.4.1.1 Signal Indicators



Three rows of indicators show the connection status of the connected amplifier. Top-most is an indicator that displays a green square when Connected, or a red square when Disconnected. Immediately below are two indicators for the TX and RX paths. The third row displays the mute state (Carrier Enable). The operator may click on the indicator to toggle between enabling or muting the amplifier.

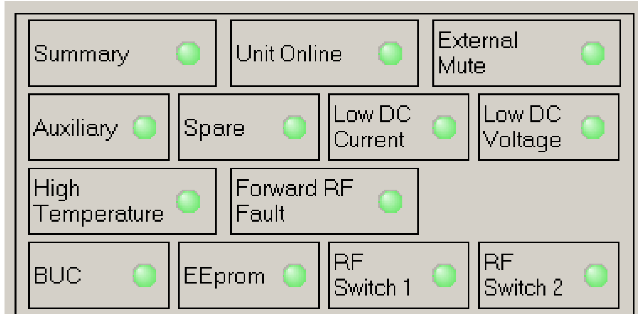


Figure 3-12: Fault Indicators

3.4.1.2 Fault Status Indicators

The Fault Status frame in the lower left side of the Status Window contains a 3x4 grid of SSPA fault lights. See **Figure 3-12**.

Summary Alarm: The Summary Alarm is simply a logical 'OR' of any major alarm indicators.

Unit Online: This is a status indicator that illuminates green when the unit is online.

External Mute Alarm: The External Mute line gives an indication that the SSPA has been externally muted by J4-Pin B. This alarm can be configured to trigger a summary alarm if desired. Factory default is to signal a External Mute fault but no summary alarm.

Auxiliary & Spare Alarms: The Auxiliary and Spare Alarms are configurable from the Settings Window. These alarms can be configured to trigger a summary alarm. See **Section 3.4.2**.

Low DC Current Alarm: The Current Fault is factory preset to alarm if the SSPA module current falls below 60% of its nominal value. This alarm will also trigger a summary alarm.

Low DC Voltage Alarm: The Voltage Alarm is factory preset to alarm if the SSPA module current falls below 80% of its nominal value. This alarm will also trigger a summary alarm.

High Temperature Alarm: The Temperature Fault indicator is factory preset to alarm at 80°C. The amplifier will continue to operate up to 90°C. Beyond 90°C the DC power will be interrupted to the SSPA module. This measure will protect the sensitive microwave transistors from catastrophic failure. The fans and monitor and control circuitry will continue to operate normally. This function has approximately a 5°C hysteresis window which will allow the amplifier to re-enable itself when the ambient temperature is reduced by 5°C. This alarm will also trigger a summary alarm.

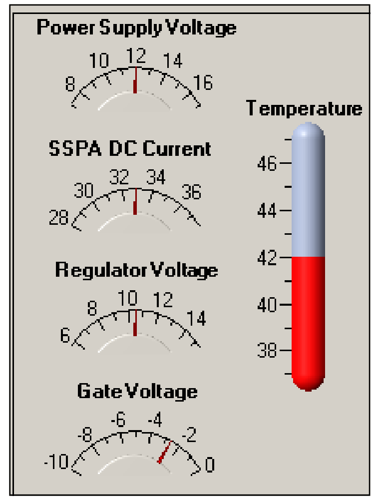
Forward RF Alarm: The Forward RF Fault Alarm indicates when the RF output of the amplifier falls below the threshold set in the Settings Window.

BUC Alarm: The BUC fault is only active in units that are supplied with an optional L-Band Block Up Converter module. If the Up Converter's phase locked local oscillator loses lock, a BUC alarm is set and the amplifier is muted so that spurious RF cannot be transmitted. This alarm can be configured to trigger a summary alarm.

EEPROM Alarm: The EEPROM Alarm is primarily used as a Fiber RX Link alarm for Compact Outdoor SSSPA units configured with a fiber-optic interface.

RF Switch Alarms: The RF Switch 1 Alarm is only active if a 1:1 Redundant System has been configured in the M&C program. The RF Switch 2 Alarm is only active is a 1:2 Redundant System has been configured. These configurations are covered in **Section 8**.

3.4.1.3 Voltage, Current and Temperature Display



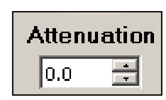
On the right side of the Status window is a thermometer display that reports the present baseplate temperature of the amplifier. The baseplate temperature typically experiences a 20-30 degree rise above ambient on the highest power Compact Outdoor amplifiers and 15-20 degree rise on lower power units.

To the left of the thermometer display are several indicators that show various operating conditions of the Compact Outdoor Amplifier in real time. These indicators are helpful for any diagnostic procedures and consist of:

- Power Supply Voltage monitor
- SSPA DC Current monitor
- Regulator Voltage monitor
- Gate Voltage monitor

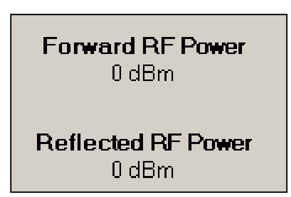
The Power Supply voltage indicator displays the primary 12 volt power supply output. SSPA DC Current is the total current drawn by the microwave transistors. Regulator Voltage is the DC voltage of the drain circuitry that feeds the GaAs transistors. The Gate Voltage indicator monitors the DC voltage of the gate circuitry of the microwave GaAs transistors. These indicators provide direct access to the active device operating characteristics.

3.4.1.4 Gain Adjustment



The Gain Attenuation Control is located above the Fault Condition Indicators and below the Carrier Enable status. The gain can be adjusted by setting the Attenuation Control. An Attenuation Control of 0 dB is the maximum gain (75 dB) setting on the amplifier. By setting the Attenuation Control to 20 dB; the gain is set to 55 dB. The Attenuation Control can be varied using the control knob or the forward/reverse buttons to the right of the displayed value.

3.4.1.5 Forward and Reflected RF Power Indicators



The Forward RF Power is displayed in the central part of the Operation window. This indicator reports the approximate forward output power of the amplifier. It uses the voltage from the RF Power Detector to determine a corresponding power level in dBm. The accuracy of the power indicator is ±1 dB at the mid-point of the specified band, with a single CW or QPSK carrier.

Units with the reflected power meter option also display the Reflected RF Power.

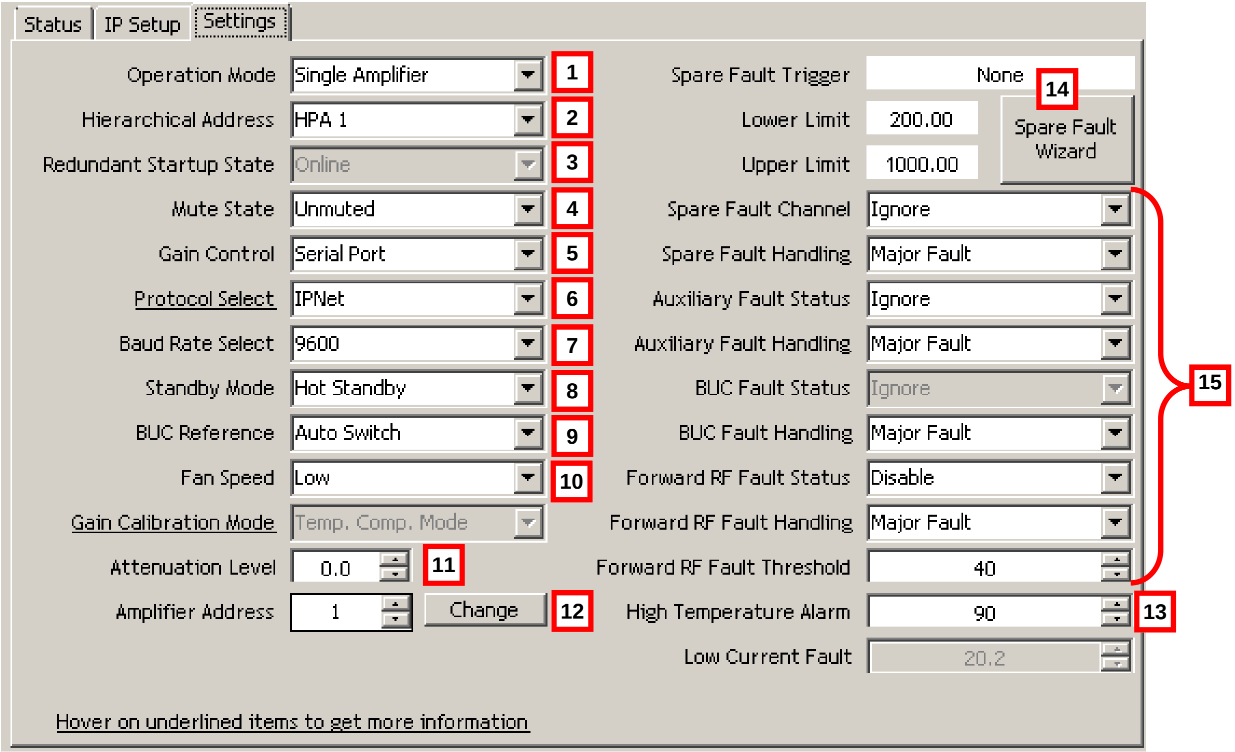


Figure 3-13: Universal M&C, Settings Tab

3.4.2 Universal M&C Settings Window

Figure 3-13 shows the Settings tab of the Universal M&C Software. The Settings tab contains many of the global settings that are available in the SSPA.

3.4.2.1 Power Up Settings

The Compact Outdoor amplifier will power up with the “last-state” settings before the unit was powered down. Whatever attenuation setting or mute state the amplifier was in when powered down will be the restored settings when the amplifier is powered back on.

[1] **Operation Mode:** Select between stand-alone (single unit), Dual 1:1 mode, 1:1 Redundant mode, or Maintenance Switch mode. See **Appendix C** for more on the Maintenance Switch mode.

[2] **Hierarchical Address:** Identifies each amplifier in a redundant system as HPA 1 or HPA 2.

[3] **Redundant Startup State:** Selects whether the unit should start up as the online amplifier or the standby amplifier. When in a redundant system configuration, if the amplifier Redundant Startup State is changed from the Online state to the Standby state, the system will drive the switch so that another amplifier in the system is in the Online state. Only the Online amplfier can give away its Online state. This setting is saved upon unit shut-down, and the unit will start up in the last saved state.

[4] **Mute State:** Determines if the unit should start up muted (transmit disabled) or mute cleared (transmit enabled).

[5] Gain Control: Select between serial communication control of the unit's gain or analog voltage gain control via J4.

[6] Protocol Select: The operator may select either the standard string protocol described in **Section 10** or older generation binary based protocol. The operator will be asked to verify that the change in Protocol. Communication with the amplifier may be affected.

[7] Baud Rate Select: Sets the baud rate of the unit. The supported baud rates include: 2400, 4800, 9600, 19200, and 38400 baud. The factory default baud rate is 9600. **You will be asked to verify that you wish to change the Baud Rate. Communication with the amplifier may be affected.**

[8] Standby Mode: Selects between Hot and Cold standby mode for units in redundant systems.

[9] BUC Reference: Selects between an Internal or External reference for an optional block up coverter integrated with the unit, or allows the unit to Auto-switch between Internal and External reference.

[10] Fan Speed: Selected GaN units are equipped with a Fan Speed Control option. The fan speed control circuit is shared with the RF power detector analog output (pin R on M&C connector J4). This pin remains not connected on units with the fan speed control option installed. Available control options: Auto, High, Low, Default/Off

> **Auto** – This setting allows the unit to control the cooling fan speed according to the internal RF module temperature. If the module plate temperature remains below 50 °C, the fan speed will be set to minimum. If the registered module plate temperature is above 50 °C, unit will gradually increase the fan speed. Fan speed will reach maximum at a plate temperature of 65 °C.
>
> **High** – This option sets the fan speed to maximum. Air velocity will remain at the same level regardless of other operation parameters.
>
> **Low** – This option sets the fan speed to minimum. Air velocity will remain at the same level regardless of other operation parameters.
>
> **Default/Off** – This setting should be set on units without the fan speed control option. It will allow proper functioning of the RF power monitor analog output. Applying this setting on units with the fan speed control option allows the fan speed to be proportional to the output RF level. Fan speed will be set at the minimum when output RF is below a detectable level. Fan speed will gradually increase when RF output increases within the detectable RF range. Fan speed will be at maximum level when unit reaches saturated power (Psat).

[11] Attenuation Level: The Gain Adjustment of the unit is adjustable here, from 0 to 20 in 0.1 db steps.

[12] Amplifier Address: Sets a network address for the unit. Range is 0 to 255. **You will be asked to verify that you wish to change the Amplifier Network Address. Communication with the amplifier may be affected.**

[13] Fault Thresholds: Allows the user to set the limit for triggering the unit's Current Fault or High Temperature Fault.

High Temperature Alarm Threshold: Range is 0 to 125 °C.
Low Current Fault Threshold: This setting is factory pre-set.

[14] Fault Setup: This feature allows the user to set the Spare Fault Trigger using the Spare Fault Wizard.

Click on the Spare Fault Wizard button, which opens a new window. See **Figure 3-14**. Select between the following fault triggers: Analog Gain Adjust Voltage, Gate Voltage, Regulator Voltage, Power Supply Voltage, SSPA Current, External Mute, or None.

Set the range of thresholds (maximum and minimum) that would trigger the selected fault, and configure the fault handling via a pull-down menu (Major Fault, Minor Fault, Major Fault plus Mute).

Click the **OK** button to set the fault trigger for the Spare Fault.

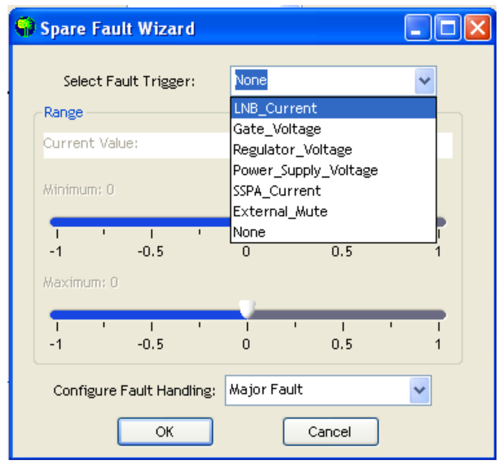


Figure 3-14: Spare Fault Wizard

[15] Fault Setups: The user may also adjust the Spare, Auxiliary, BUC, and Forward RF Fault Status and Handling via the appropriate pull-down menus on the Settings Window.

Spare/Auxiliary/BUC/Forward RF Fault Handling: Selects whether the associated fault should be a major or minor fault, and whether the fault should mute the unit. A minor fault will trigger a Spare/Auxiliary/BUC/ Forward RF Fault alarm but not trigger a Summary Fault. A major fault will trigger both an Spare/Auxiliary/BUC/Forward RF Fault and a Summary Fault.
Spare/Auxiliary/BUC Fault Status: Determines if the associated fault input should be ignored or enabled based on the available selections.
Forward RF Threshold: Allows the user to assign the threshold at which a Forward RF Fault will be triggered.

3.4.3 IP Setup Window

If the user wishes to set up the networked Compact Outdoor SSPA with custom IP settings, the internal IP settings need to be modified. Click on the IP Setup Tab. See **Figure 3-15**.

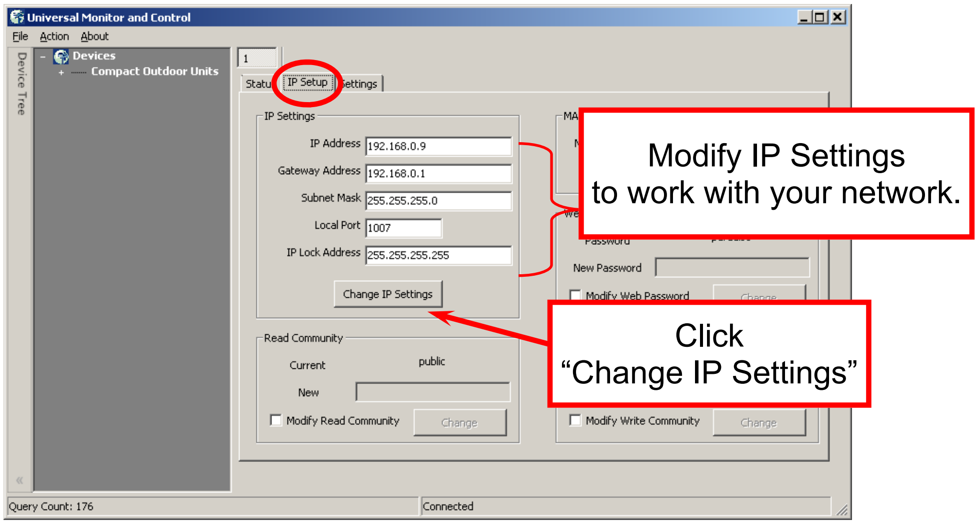


Figure 3-15: Universal M&C, IP Setup

- The SSPA will use the default settings until the unit is reset by removing its AC power. Unplug the Quick Start cable from the M&C connector. (**If the unit is restarted with the Quick Start cable connected, it will always come up with default IP settings**). Apply power to the SSPA. Re-plug the Quick Start cable into J4, and check connectivity with the custom IP settings.
- Make sure that the Protocol setting in the Settings tab of the Universal M&C is set to **IPNet**, as shown in **Figure 3-13**.
- If custom IP settings will be used in normal operation, the user will need to construct an IP cable or modify the Quick Start Cable by disconnecting the interface control pins (pins **j** and **e**, Baud Select 0 and Baud Select 1) from ground. In this configuration, the SSPA will always use the saved communication control settings rather than the default configuration.
- The **IP Lock Address** allows the operator to set the IP address from which the amplifier will accept requests. This selection gives the operator the ability to increase the security measure for the IPNet protocol. The SSPA will only answer a request which comes from the assigned IP address. To disable this feature in firmware versions prior to 6.00, set the Lock IP Address value to **0.0.0.0** or **255.255.255.255**.
  The Lock IP address function was updated in firmware version 6.00 to allow "Binding" and "Masking" functions. "Binding" means that the first datagram retrieved for this socket will bind to the source IP address and port number. Once binding has been set, the SSPA will answer to the bound IP source until the unit is restarted or reset. Without binding, the socket accepts datagrams from all source IP addresses. Address **0.0.0.0** allows all peers, but provides binding to the first detected IP source; Address **255.255.255.255** accepts all peers, without binding. If the Lock IP Address is a multicast address, then the amplifier will accept queries sent from any IP address of the multicast group.

3.4.4 Universal M&C Preferences

The user can adjust certain preferences of the Universal Monitor and Control Software. See **Figure 3-16**.

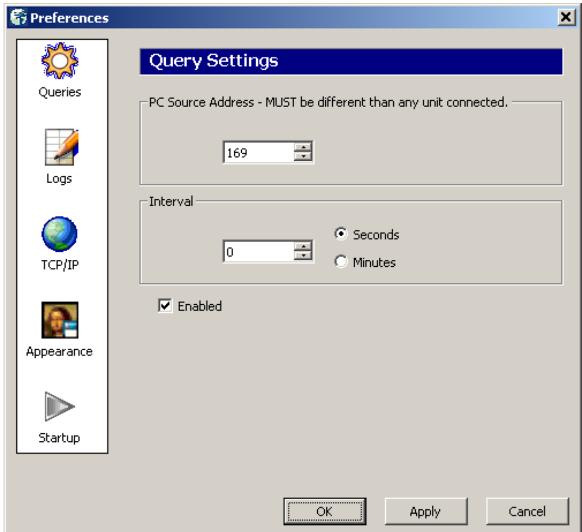


Figure 3-16: Preferences Window

Queries: Enable and adjust the interval that the software queries the unit. Note that if queries are disabled, there will be no communication with the unit at startup.
Logs: Enable various parameters to be logged, and adjust the interval that selected parameters are recorded. **Figure 3-17** shows the New Log Items window, in which the user can select the parameters to be logged.

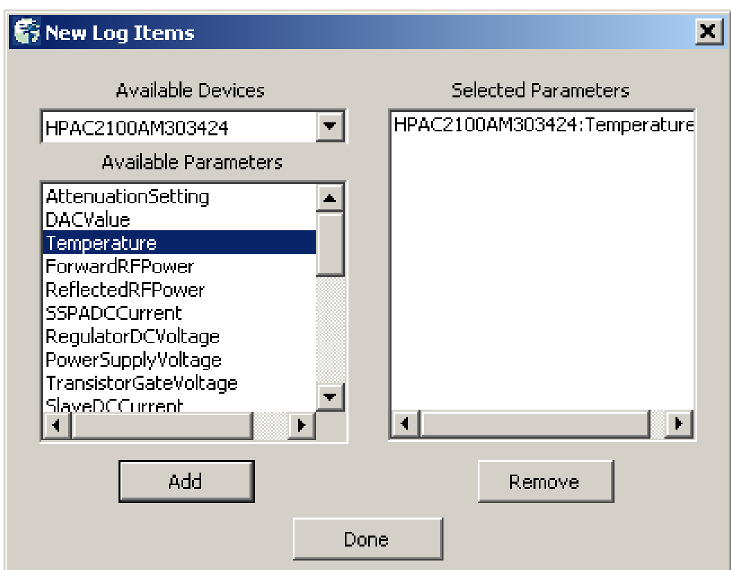


Figure 3-17: Example, Log entry

TCP/IP: Select the Local UDP Port (the software must be restarted to take effect). Note that each UDP address must be unique.
Appearance: Set the transparency of the M&C Windows.
Startup: Enable or disable auto-loading of the last device configuration.

3.5 Web-based M&C

The most basic method of communication with the Compact Outdoor SSPA is via a web browser, which accesses the built-in web pages served from the amplifier's embedded web server. Starting with firmware version 6.40, the application no longer requires Java.

The web interfaces uses a standard hypertext transfer protocol on port 80. The web interface is compatible with most modern web browsers, such as Firefox, Chrome or Internet Explorer, which support asynchronous JavaScript XML transactions (aka AJAX).

Once the host PC has been configured and connected to the amplifier using the Quick Start cable, the user may open a web browser page, select File > Open, and enter the IP address of the networked amplifier into the browser's address field. The default IP address is **192.168.0.9**. See **Figure 3-18**.

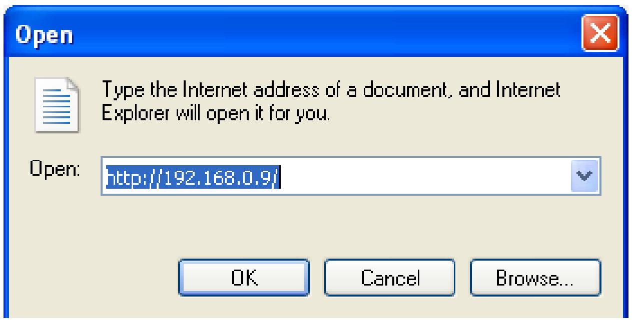


Figure 3-18: Enter IP address for Compact Outdoor SSPA (default is 192.168.0.9)

A security login window will appear. Enter the default username (**admin**) in the User Name field. See **Figure 3-19**. The User Name is fixed and cannot be changed by the operator. In the Password field, enter the web password assigned to the unit. The factory default password is **paradise**. The User Name and Password are case sensitive. The password may be changed at any time and may comprise up to 15 alpha-numeric characters. If you forget the password you will need to connect to SSPA via universal M&C to verify it.

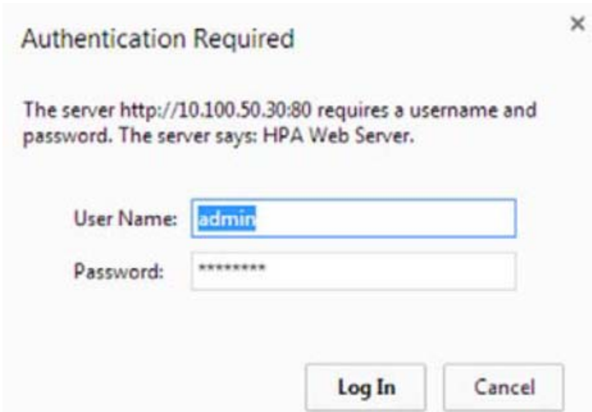


Figure 3-19: Web Interface Login Window

Click on the [Log In] button to open the M&C control in the web browser (**Figure 3-20**).

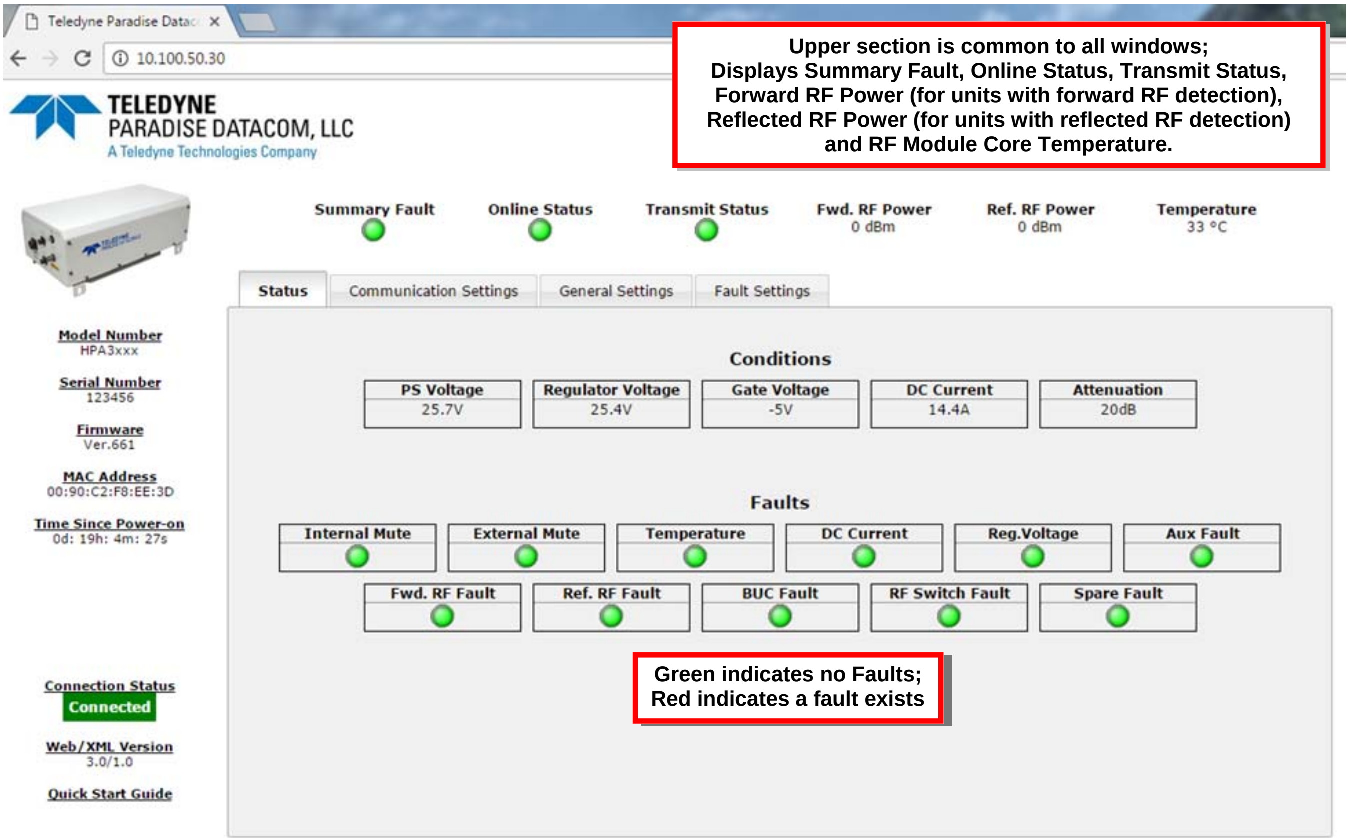


Figure 3-20: Status and Faults Window

3.5.1 Navigating the Web M&C

The top bar of SSPA Monitor and Control application shows whether the connected unit is exhibiting a summary fault, and also displays the device's online status, transmit status, Forward and Reflected RF power (if available) and RF module core temperature.

The left side of the window displays unit model and serial number, firmware build, device MAC address and device up time since last I/O card power up or reboot. The connection status is also displayed, along with the Web/XML version, and a link to the quick-start guide.

Additional information is displayed in multipage insert in the middle of the screen:

- **Status tab**: A Read-Only view of critical device operation conditions (voltages, current consumption, attenuation) and fault alarm statuses.
- **Communication Settings tab**: Read/Write listings of communication related parameters, including: IP, SNMP, Web settings as well as serial port settings.
- **General Settings tab**: Read/Write listings of all redundancy and amplifier specific settings.
- **Fault Settings tab**: Read/Write listing of fault operation related settings;

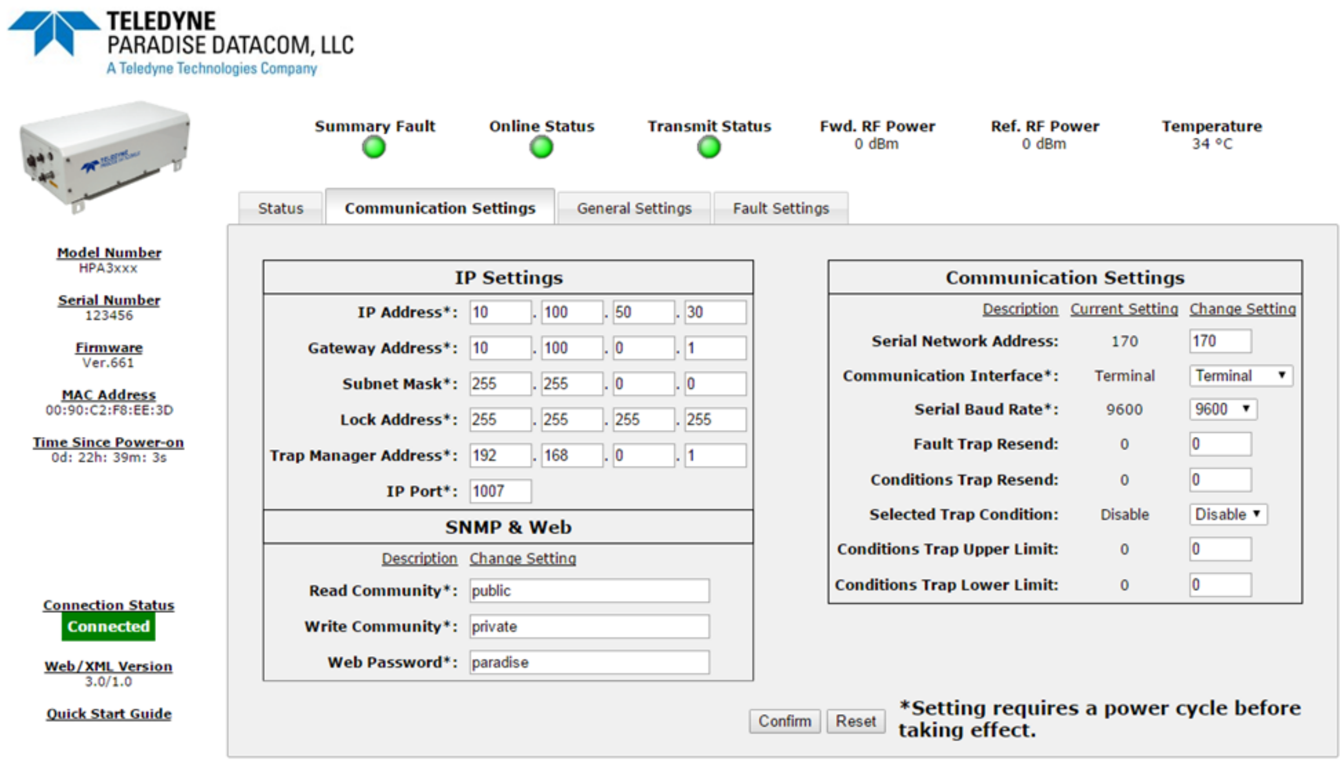


Figure 3-21: Communication Settings Window

The Communication Settings window, shown in **Figure 3-21**, displays the current values of the following parameters:

- IP Settings (IP Address, Gateway Address, Subnet Mask, Lock Address, Trap Manager Address and IP Port)
- SNMP Read/Write Communities and Web Password
- Serial Network Address
- Communication Interface Type
- Baud Rate
- SNMP Trap Conditions

Changes to certain settings (marked with an asterix) require a power cycle of the unit before the new setting will take effect.

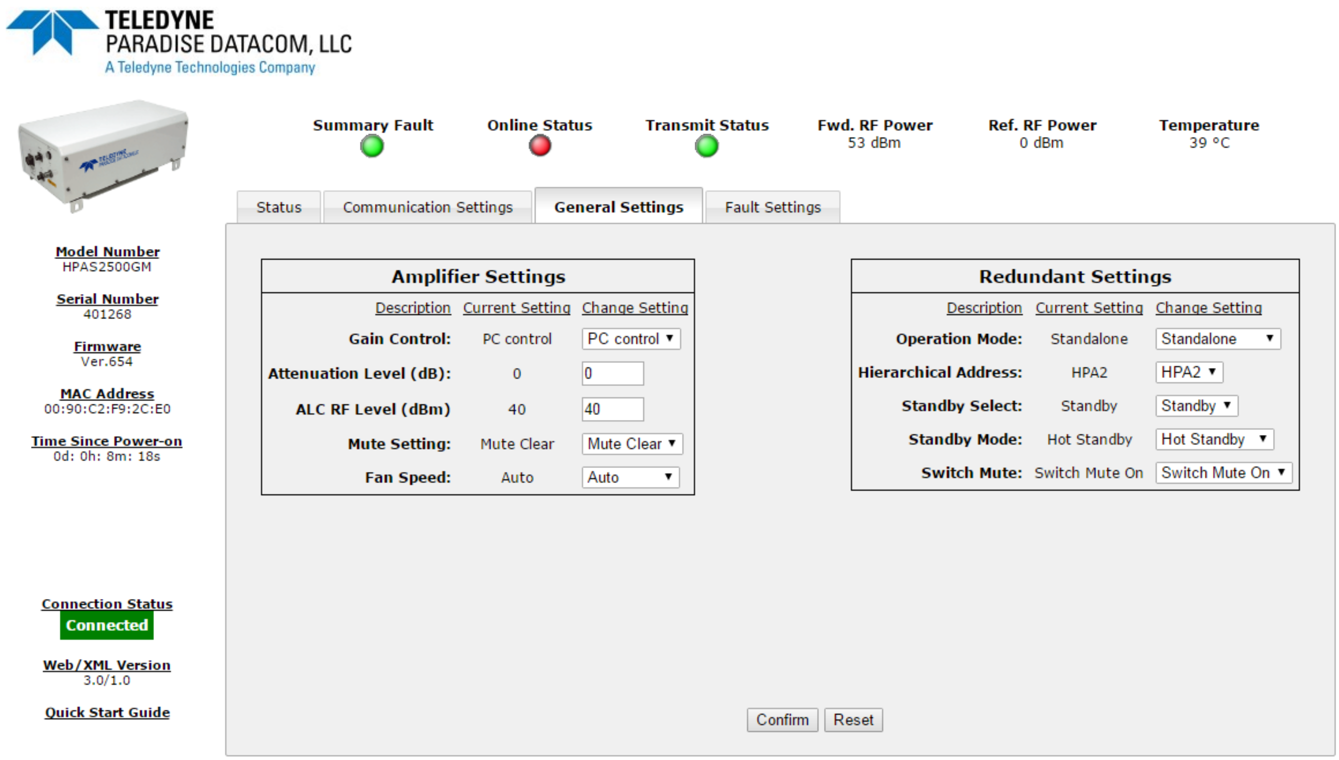


Figure 3-22: General Settings Window

The General Settings window, as shown in **Figure 3-22**, displays the Amplifier and Redundancy Settings. Amplifier Settings include: Gain Control; Attenuation Level adjustment (in dB); Automatic Level Control (ALC) RF Level (in dBm); Mute Setting (Mute clear or Mute set); and Fan Speed selection (High, Low or Auto).

> **Note:** The Compact Outdoor SSPA initially starts up in the Muted state; Change the Mute Setting in the General Settings tab to enable Transmit RF.

Redundancy Settings include: Operation Mode (Standalone, 1:1 Redundant, Dual 1:1, or Maintenance Switch); Hierarchical Address (HPA1 or HPA2); Standby Select (Online or Standby); Standby Mode (Hot Standby or Cold Standby); and Switch Mute (Switch Mute On or Switch Mute Off).

> **Note:** The Standby Select setting allows the operator to select whether the unit should start up as the on-line amplifier or the standby amplifier. When in a redundant system configuration, if the Standby Select setting is changed from the Online state to the Standby state, the system will drive the switch so that another amplifier in the system is in the Online state. Only the Online amplifier can give away its Online state. This setting is saved upon unit shut-down, and the unit will start up in the last saved state.

> **Note:** When multiple Compact Outdoor SSPAs of certain high RF power levels are set up in a redundant configuration, the Switch Mute setting should be turned on. See **Section 8.1.2.2**.

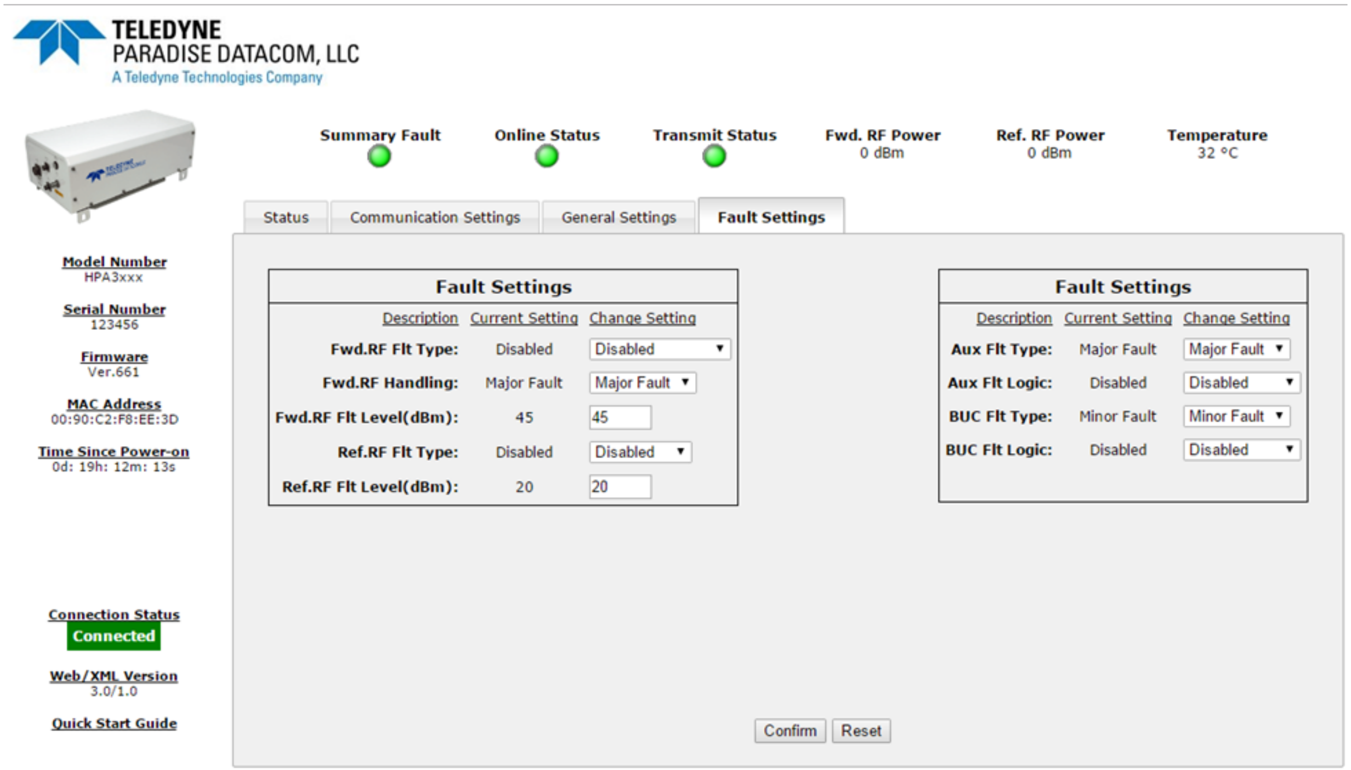


Figure 3-23: Fault Settings Window

The Fault Settings window, as shown in **Figure 3-23**, allows the user to adjust the fault settings for the connected Compact Outdoor SSPA.

Use the pull-down menus to select the desired Fault Type, Handling, or Logic parameters. Enter new values for the Forward or Reflected RF Fault thresholds and click the “Confirm” button.

4.0 Block Up Converter Overview

The Compact Outdoor SSPA is available with various L-Band up converter options. The primary up converter option is the Zero dBm Block Up Converter, ZBUC. The zBUC® converter is offered in C-Band, X-Band and Ku-Band configurations. See **Table 4-1** for specifications for the respective models. The ZBUC converter offers ultra low phase noise for applications where phase noise is an overriding factor.

The type of BUC housed within your Compact Outdoor SSPA is indicated by its model number, as shown in **Figure 4-1**. The example in **Figure 4-1** shows a 140W C-Band Compact Outdoor SSPA with Internal Reference ZBUC. For a full description of this configuration matrix, refer to the Compact Outdoor SSPA specification sheet (205485).

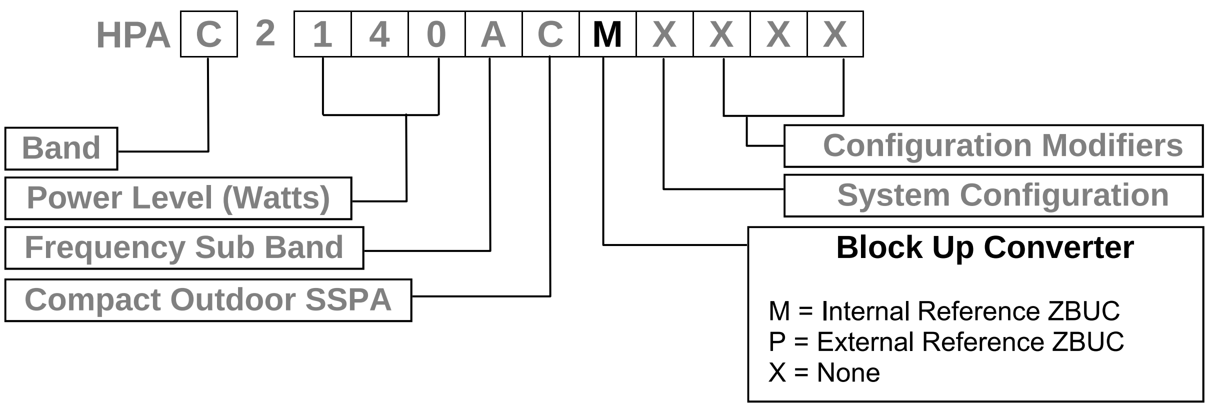


Figure 4-1: Configuration Matrix, Compact Outdoor SSPA, BUC Options

The block up converters are high performance frequency translation devices which provide excellent phase noise and spurious performance. The ZBUC converter also supports FSK communications for remote M&C capability. The FSK is a 650 KHz signal that is multiplexed onto the L-Band input of the unit.

The zBUC converter utilizes Teledyne Paradise Datacom's proprietary "Smart Reference Technology". Smart Reference Technology allows the system user to change reference frequency and power level or choose internal or external reference without requiring any system configuration. An internal BUC adds about 1.7 pounds to the overall weight of the Compact Outdoor unit.

The schematic of **Figure 4-2** shows the electrical position of the block up converter. It is powered from a +15 VDC supply available on the Fan Boost Converter board assembly. The Block Up Converter is simply cascaded with the SSPA at the input of the amplifier.

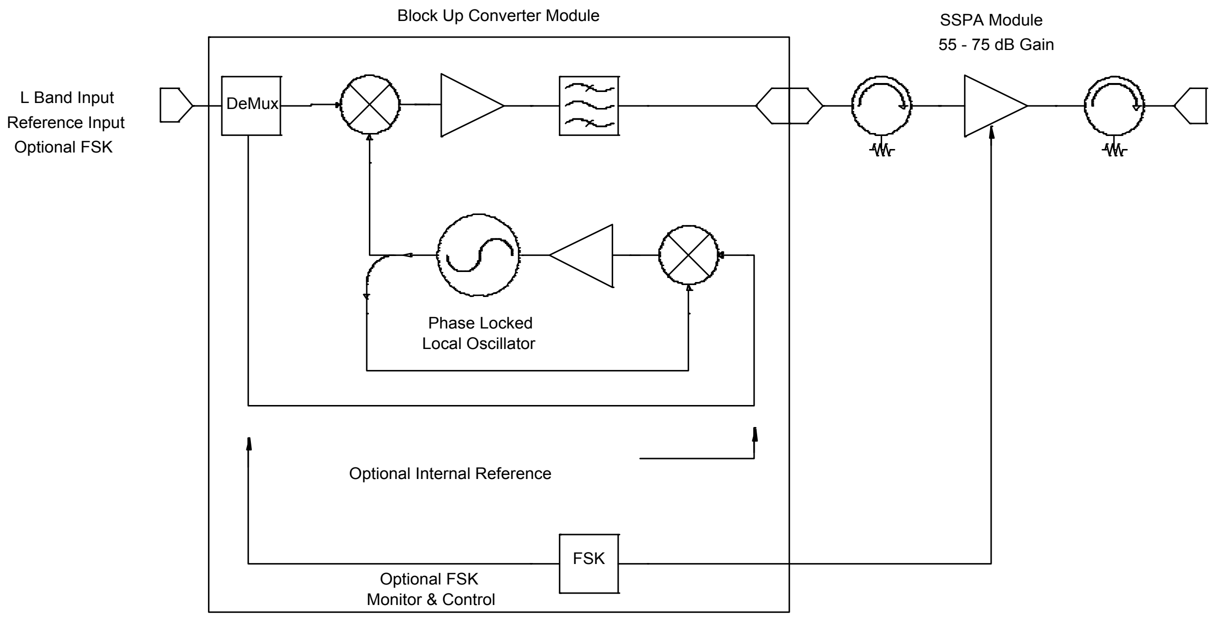


Figure 4-2: Compact Outdoor Block Diagram of BUC / SSPA System

It is important to remember the requirement of a 10 MHz reference oscillator when operating an SSPA with BUC (SSPB). If the 10 MHz reference is not present, the M&C will report a BUC alarm and the SSPA module will mute. This ensures that no spurious or 'off frequency' transmission could originate from the amplifier.

Note: Unless the BUC has the built-in internal reference option, if there is no 10 MHz reference signal on the IFL input there will be no output signal from the SSPA.

4.1 ZBUC Features

The zBUC converter is available as an option for the Compact Outdoor SSPA. **Table 4-1** shows the specifications for the respective models.

Table 4-1: zBUC Converter Frequency Specifications

Band	Frequency Plan	IF Input	LO Frequency	RF Output
C	Sub-Band "A"	950 - 1525 MHz	4.900 GHz	5.850 - 6.425 GHz
C	Sub-Band "B"	950 - 1825 MHz	4.900 GHz	5.850 - 6.725 GHz
C	Sub-Band "C"	950 - 1870 MHz	4.800 GHz	5.750 - 6.670 GHz
C	Sub-Band "E"	950 - 1250 MHz	5.475 GHz	6.425 - 6.725 GHz
C	Sub-Band "F"	950 - 1250 MHz	5.775 GHz	6.725 - 7.025 GHz
C	Sub-Band "G"	950 - 1675 MHz	4.800 GHz	5.750 - 6.475 GHz
C	Sub-Band "L"	950 - 1550 MHz	3.450 GHz	4.400 - 5.000 GHz
X	Sub-Band "A"	950 - 1450 MHz	6.950 GHz	7.900 - 8.400 GHz
X	Sub-Band "J"	1025 - 1800 MHz	6.100 GHz	7.125 - 7.900 GHz
Ku	Sub-Band "A"	950 - 1450 MHz	13.050 GHz	14.00 - 14.50 GHz
Ku	Sub-Band "B"	950 - 1700 MHz	12.800 GHz	13.75 - 14.50 GHz
Ku	Sub-Band "D"	1350 - 1650 MHz	13.750 GHz	15.10 - 15.40 GHz
Ku	Sub-Band "E"	1200 - 1450 MHz	11.800 GHz	13.00 - 13.25 GHz
Ku	Sub-Band "F"	950 - 1450 MHz	11.800 GHz	12.75 - 13.25 GHz

4.2 ZBUC Converter Theory of Operation

The zBUC converter is a low gain block up converter with a P_{1dB} of 0 dBm. This topology allows the system to be integrated with little impact on the general electrical specifications of the SSPA module.

The zBUC converter utilizes single up conversion from L-Band to the desired RF band. The local oscillator circuits are designed to maintain the lowest possible output phase noise. The frequency synthesizer utilizes industry leading technology which allows for phase noise performance previously unattainable in PLL design. Typical phase noise specifications are outlined in **Table 4-2**.

Table 4-2: zBUC RF Output Phase Noise Specification

Offset	Guaranteed Maximum	C-Band (Typical)	X-Band (Typical)	Ku-Band (Typical)	Ka-Band (Typical)	Units
10 Hz	-30	-60	-58	-56	-60	dBc/Hz
100 Hz	-60	-74	-70	-67	-72	dBc/Hz
1 KHz	-70	-84	-80	-78	-75	dBc/Hz
10 KHz	-80	-100	-94	-91	-88	dBc/Hz
100 KHz	-90	-105	-97	-94	-112	dBc/Hz
1 MHz	-90	-125	-122	-120	-122	dBc/Hz

Band selectivity is accomplished using the most aggressive filtering possible while maintaining specified power and spurious performance.

4.3 Smart Reference Technology

Teledyne Paradise Datacom's new zBUC converter comes standard with smart reference technology. Smart reference technology allows the system operator to change external system reference frequency without any system configuration required. The zBUC converter will automatically sense and lock to a 10 MHz or 50 MHz system reference frequency. With the internal reference option installed the zBUC converter will operate with no external reference applied. In the event the system operator wishes to operate on external reference, the zBUC converter will automatically sense the presence of an external reference and switch to external reference mode. With the internal reference option installed, the internal reference also becomes a backup reference which will become active in the event that external system reference is lost.

External reference is applied to the zBUC converter via the L-Band input IFL and is routed to the frequency synthesizer using the built-in demux circuitry.

Notes:

1) ***The external reference option requires the system operator to provide system reference to the zBUC/SSPB. The system will not lock and will have no output without external reference applied.***
2) ***Internal reference option allows for either internal or external reference operation.***

4.3.1 Bypassing the Internal Reference for Alarm Purposes

For units which include the internal reference option, there may be cases where it is not desirable to allow the unit's internal reference to be selected automatically in the absence of an external reference. Perform the following steps to bypass the internal reference:

1. Launch the Universal M&C application and connect to the unit over RS232 or RS485 comms.
2. Select the Settings tab in the Universal M&C window.
3. Change the BUC Reference setting to External.
4. Cycle power to the unit to save the new setting.

Note: Changing this setting when communicating over IPNET will not work properly. Communication must be over RS232 or RS485!

4.3.2 Specifications of Internal Reference Crystal

The 10 MHz crystal reference used in the internal reference of the zBUC converter has the following specifications:

Frequency Stability:	$\le \pm 3 \cdot 10^{-8}$ over the temperature range –20 to +85 °C	
	$\le \pm 1 \cdot 10^{-9}$ aging per day (after 30 days)	
	$\le \pm 6 \cdot 10^{-8}$ aging per year (after 30 days)	
Warm up time:	20 minutes @ 25 °C for better than $\le \pm 1 \cdot 10^{-8}$	
Phase Noise:	10 Hz	-120 dBc/Hz
	100 Hz	-140 dBc/Hz
	1 KHz	-145 dBc/Hz
	10 KHz	-152 dBc/Hz
	100 KHz	-155 dBc/Hz
Frequency Accuracy:	Factory preset to $\pm 3 \cdot 10^{-8}$	

4.4 ZBUC FSK Monitor and Control

FSK Monitor and control comes standard with the ZBUC converter. This allows the Compact Outdoor SSPB to be fully and remotely monitored and controlled through the system’s IFL. An embedded controller enables remote communication and fault detection via the IF input between the SSPA and a Teledyne Paradise Datacom Evolution Series L-Band modem. This signal consists of a 650 KHz Frequency Shift Keyed carrier that is multiplexed onto the L-Band input IFL along with the 10 MHz reference signal. The M&C functionality is explained in detail in **Section 10**.

The FSK input has a center frequency of 650 KHz with a ±5% tolerance. The FSK deviation is ±60 KHz, with +60 KHz being a “mark” and -60 KHz being a “space”. The FSK input will work over an input power range of -5 to -15 dBm. The FSK characteristics are summarized below:

Frequency	650 kHz ± 5%
FSK Deviation	± 60 kHz nominal (+60 kHz mark)
Deviation Tolerance	± 50 kHz minimum, ± 70 kHz maximum
Locking Range	± 32.5 kHz
Input Level Range	-5 to -15 dBm
Start Tone Time	10 ms minimum

See Teledyne Paradise Datacom document number **201410** for a full description of the VSAT BUC Protocol.

4.5 Typical System Configuration

This section shows the Compact Outdoor SSPB in a common system application. **Figure 4-3** shows the Compact Outdoor used with a Teledyne Paradise Datacom Evolution Series PD25 modem.

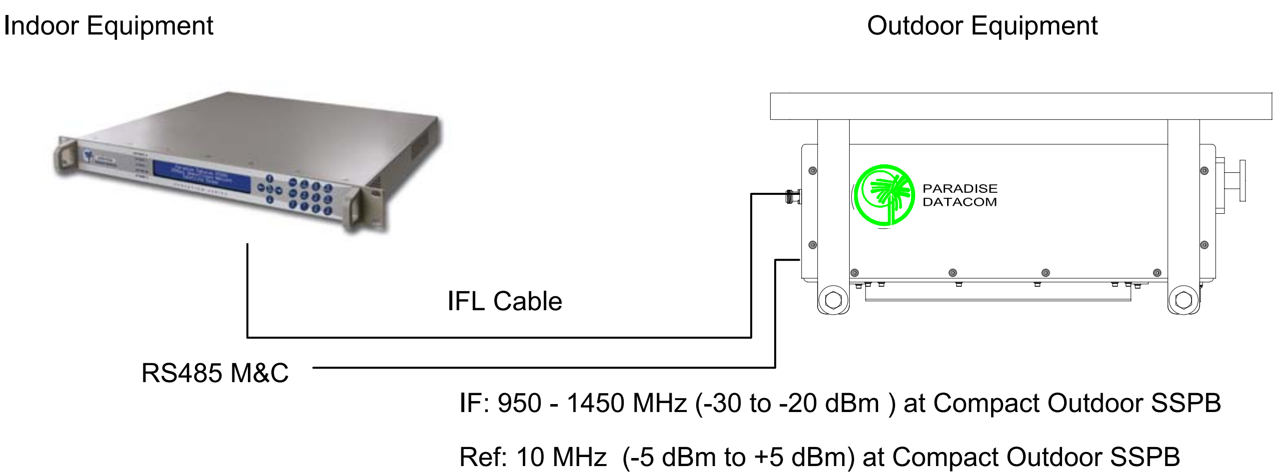


Figure 4-3: Compact Outdoor SSPB with PD25 Evolution Modem

4.6 IFL Cable Considerations

Consideration should be given to using a high quality IFL between the indoor equipment and Compact Outdoor SSPB. The system designer must always consider the total cable loss for a given length and also the implications of the slope of attenuation across the 950 to 1450 MHz bandwidth. **Table 4-3** gives the approximate attenuation vs. frequency for a variety of cable types.

Table 4-3: Common Coaxial Cable Characteristics

Cable Type	Center Conductor DC Resistance per 1000 ft.	Outer Diameter (inches)	Attenuation at 950 MHz dB per 100 ft.	Attenuation at 1450 MHz dB per 100 ft.	Slope across band for 100 ft. cable (dB)	Slope across band for 300 ft. cable (dB)
RG-214	1.7	.425	7.8	11.3	3.5	10.5
Belden 8214	1.2	.403	6.8	9.2	2.4	7.2
Belden 7733	.9	.355	5.8	8.3	2.5	7.5
Belden 9914	1.2	.403	4.5	6.3	1.8	5.4
Belden 9913	.9	.403	4.2	5.6	1.4	4.2

It is recommended to use a quality grade of 50 ohm cable such as Belden 9913, 9914, or 7733. Check the manufacturer’s technical data to make sure that the insulation is sufficient for the particular installation including the cable’s temperature range. Also make sure the coaxial connector from the IFL cable to the Compact Outdoor input is wrapped with a weather sealing tape to prevent water intrusion into the coaxial cable.

5.0 Fiber-Optic Option Overview

The Compact Outdoor Solid State Power Amplifier is available with an external fiber-optic conversion box. This configuration requires the addition of a 1RU RCPF-1000 Fiber Optic Control Panel. The Fiber-Optic Option is not available in S-Band units.

5.0.1 RCPF-1000 Fiber Optic Controller

The RCPF-1000 Fiber Optic Controller provides easy remote monitor and control of the Compact Outdoor SSPA with integrated or external fiber-optic interface. Control of the RCPF-1000 can be handled through front panel operation or remotely via parallel or serial communication to a remote computer running Teledyne Paradise Datacom's Universal M&C software.

The RCPF-1000 front panel includes 10 LEDs that indicate the internal state of the Compact Outdoor SSPA. Five fault condition LEDs on the left side of the front panel indicate any SSPA major faults, in addition to a summary fault state.

Figure 5-1: RCPF-1000 front, rear panels

A 2 line by 40 character LCD provides an extremely user friendly interface. Virtually all of the controller's setup and adjustments are accessible from the LCD. Four navigation buttons and a separate Enter key allow the user to navigate the firmware menu on the LCD. Separate buttons have been provided for frequently used functions. A range of RF hardware options is offered to meet specific system requirements.

The rear panel features ports for Serial Main (J4), Serial Local (J5) and Parallel I/O connections, as well as N-type connectors for L-Band Tx and Rx paths, and FC/APC connectors for Fiber Tx and Rx paths.

A complete description of the operation of the RCPF-1000 Fiber Optics Controller can be found in its operations manual, Teledyne Paradise Datacom document number **209872**.

5.0.2 External L-Band to Fiber Interface

The External L-Band to Fiber Interface is a machined aluminum watertight enclosure, with N-type connectors for L-Band RX and TX and fiber-optic connectors for the Fiber TX and RX signals. The enclosure is powered via a +15 VDC Input port connected to a Compact Outdoor SSPA's 15VDC Output port (J8). An outline drawing of the enclosure is shown in **Figure 5-2**.

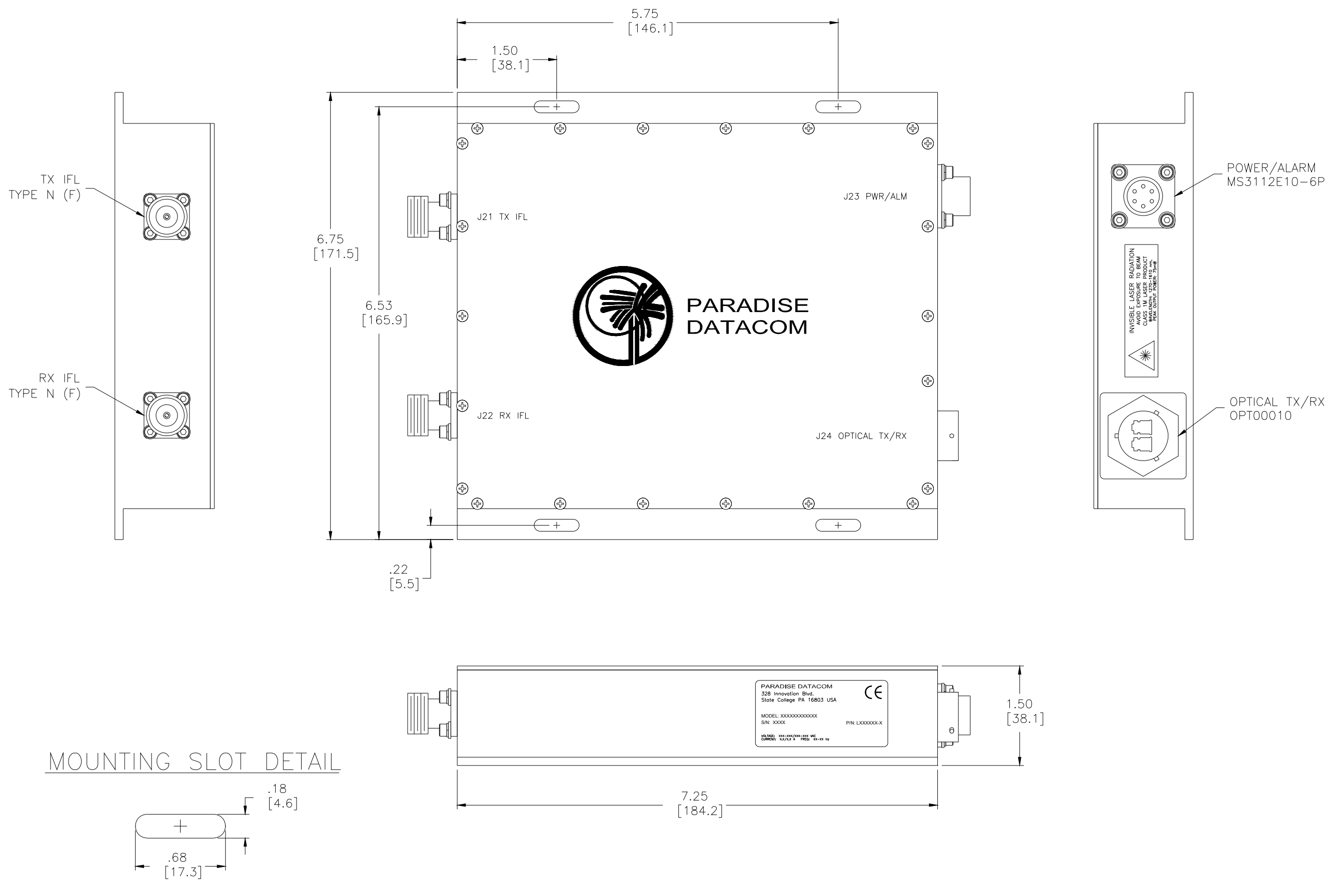


Figure 5-2: Outline Drawing, External L-Band to fiber interface

The external interface allows connection between a Teledyne Paradise Datacom Compact Outdoor SSPA with integrated Block Up Converter and a RCPF-1000 Fiber-Optic Control Panel via a fiber-optic cable run.

Figure 5-3 shows a block diagram of a Compact Outdoor SSPA with an external L-Band to fiber enclosure connected to a RCPF-1000 controller.

Figure 5-4 shows an example of a transceiver system utilizing an Evolution Series L-Band modem, an RCPF-1000 fiber-optic controller, an external fiber to L-Band converter and a Compact Outdoor SSPA with integral ZBUC. This example allow an optional connection to a remote PC via RS-485, RS-232 or 10Base-T Ethernet connection.

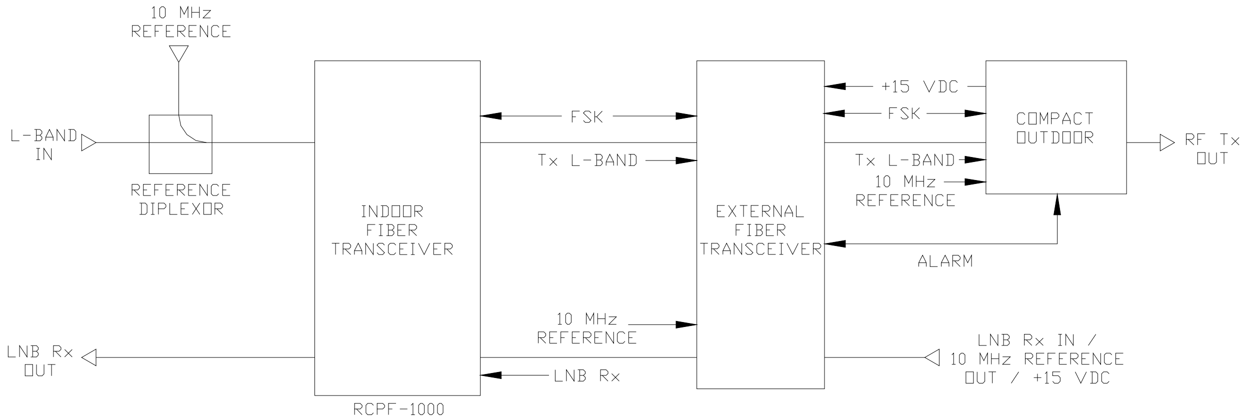


Figure 5-3: Block Diagram, Compact Outdoor with external fiber transceiver

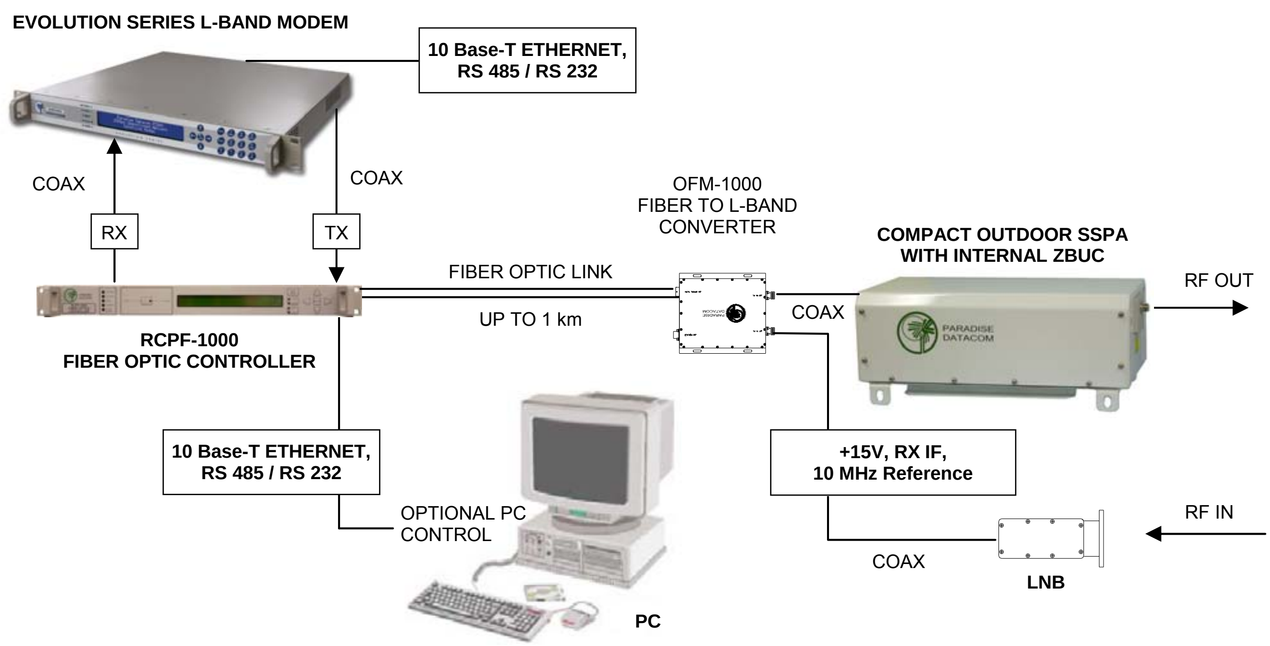


Figure 5-4: System example, SSPA with External Fiber to L-Band Converter

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6.0 Introduction

This section describes some of the tests performed on production amplifiers before shipment. Where possible, Teledyne Paradise Datacom maintains computer automated RF test stations to ensure a high level of accuracy and consistency to production amplifier testing.

6.1 Standard tests

All Teledyne Paradise Datacom Compact Outdoor amplifiers must meet rigid specifications and undergo the following tests. Copies of the final test data are shipped along with the unit and/or system. **Figures 6-1** through **6-3** show examples of the final test data for a 140W C-Band Compact Outdoor amplifier with an integrated block up converter.

6.1.1 Swept Gain

The amplifier gain is swept over the operating frequency range under small signal conditions to confirm the minimum gain and gain flatness specifications. The entire Compact Outdoor amplifier is tested in a temperature chamber from -40 °C to +55 °C and the gain is recorded. See **Figure 6-1, item [1]**.

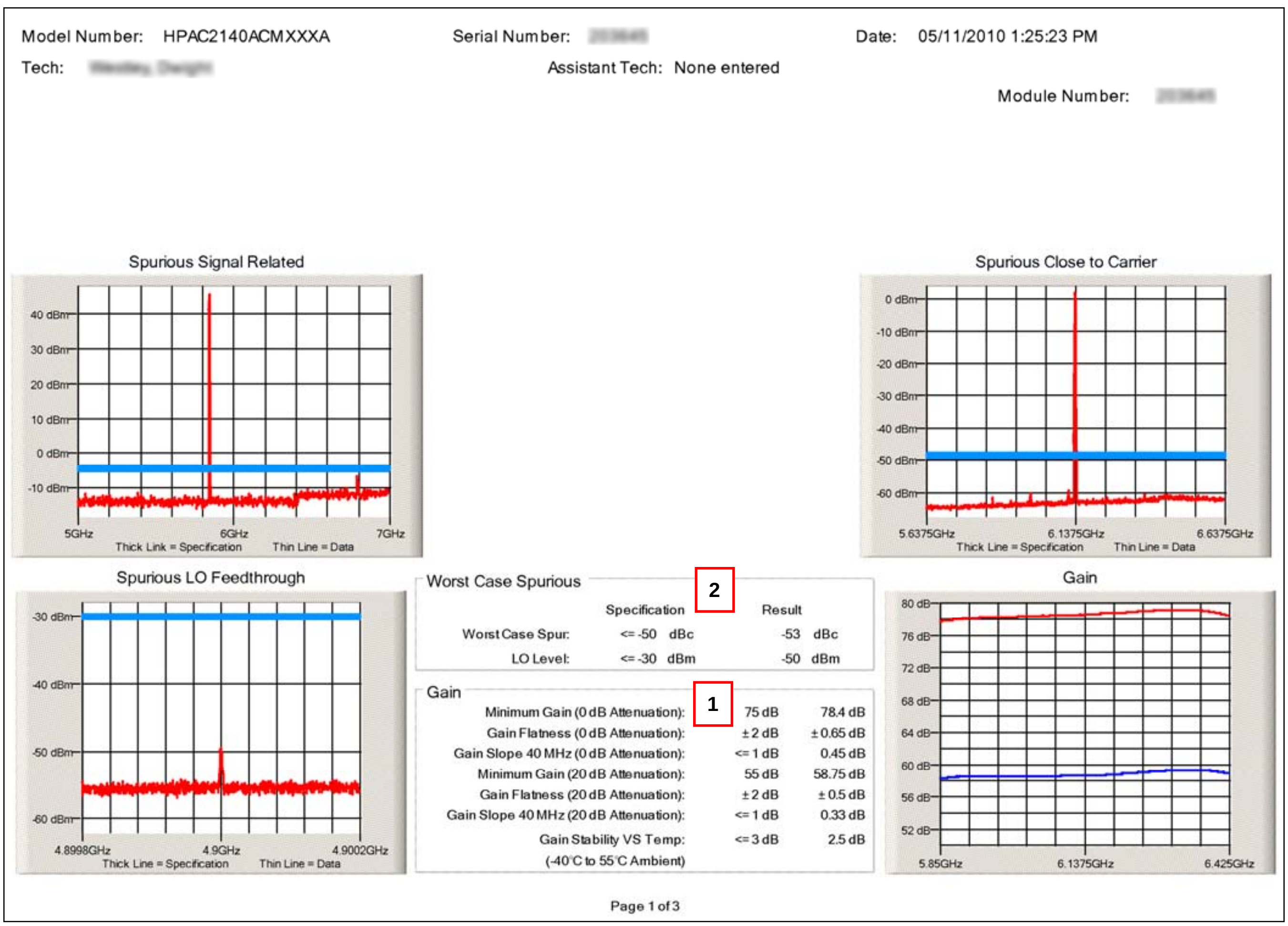


Figure 6-1: Spurious and Gain Data

6.1.2 Spurious

Spurious signals are undesirable byproducts of amplifiers caused by nonlinearities within the amplifier and other system level components such as switch mode power supplies. These unwanted signals cause signal management problems in system applications. Out of band spurious signals cause interference to other pieces of equipment. See **Figure 6-1, item [2]**.

6.1.3 Input Return Loss

The input return loss is measured in all production amplifiers. This is a measure of how closely the amplifier is matched to its characteristic impedance. The input impedance of the amplifier is a nominal 50Ω. See **Figure 6-2, item [1]**.

6.1.4 Output Return Loss

The output return loss is measured in all production amplifiers. This is a measure of how closely the amplifier is matched to its characteristic impedance. The output impedance of the amplifier is matched to the waveguide complex impedance. See **Figure 6-2, item [2]**.

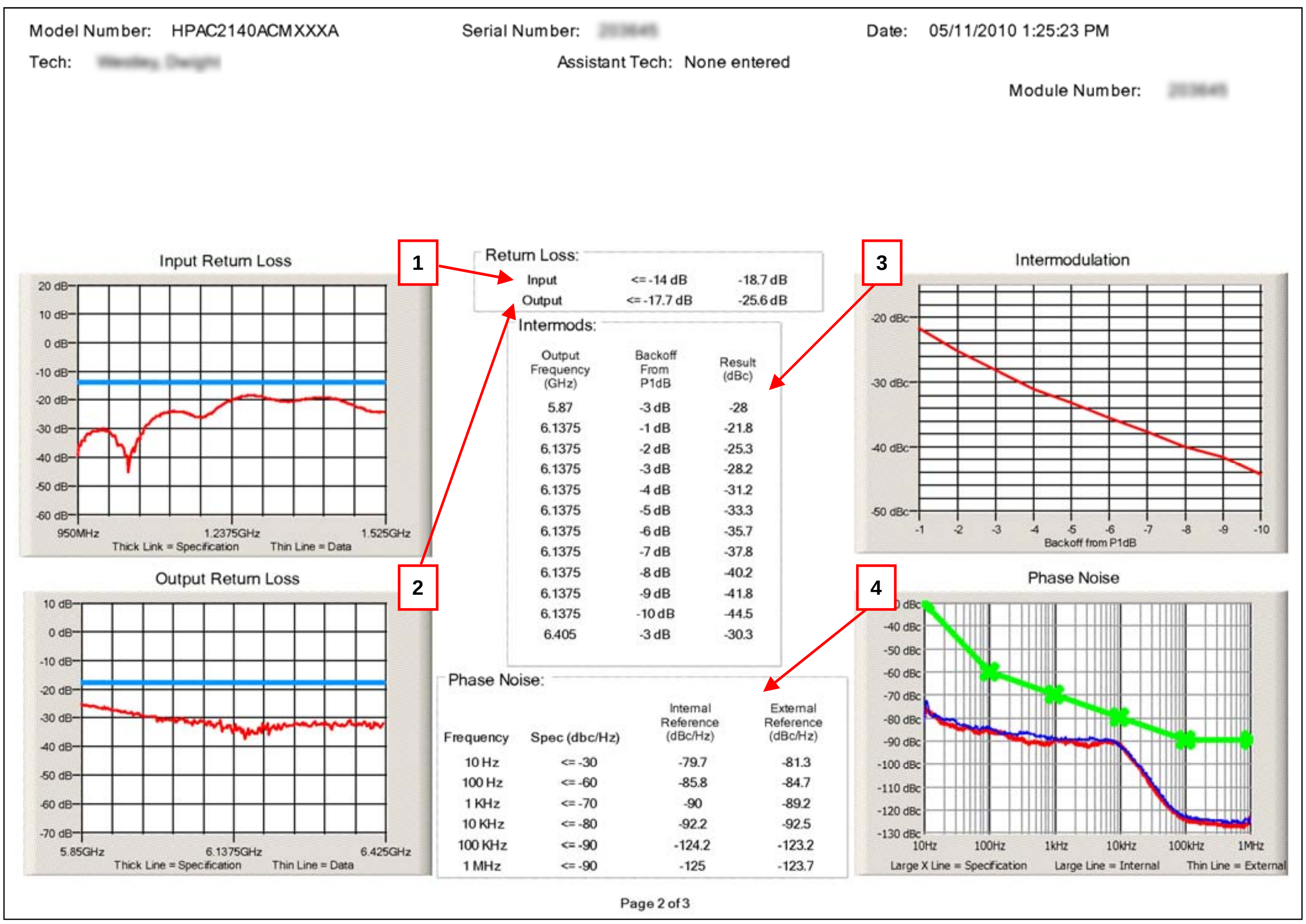


Figure 6-2: Return Loss, Intermodulation and Phase Noise Data

6.1.5 Intermodulation Distortion

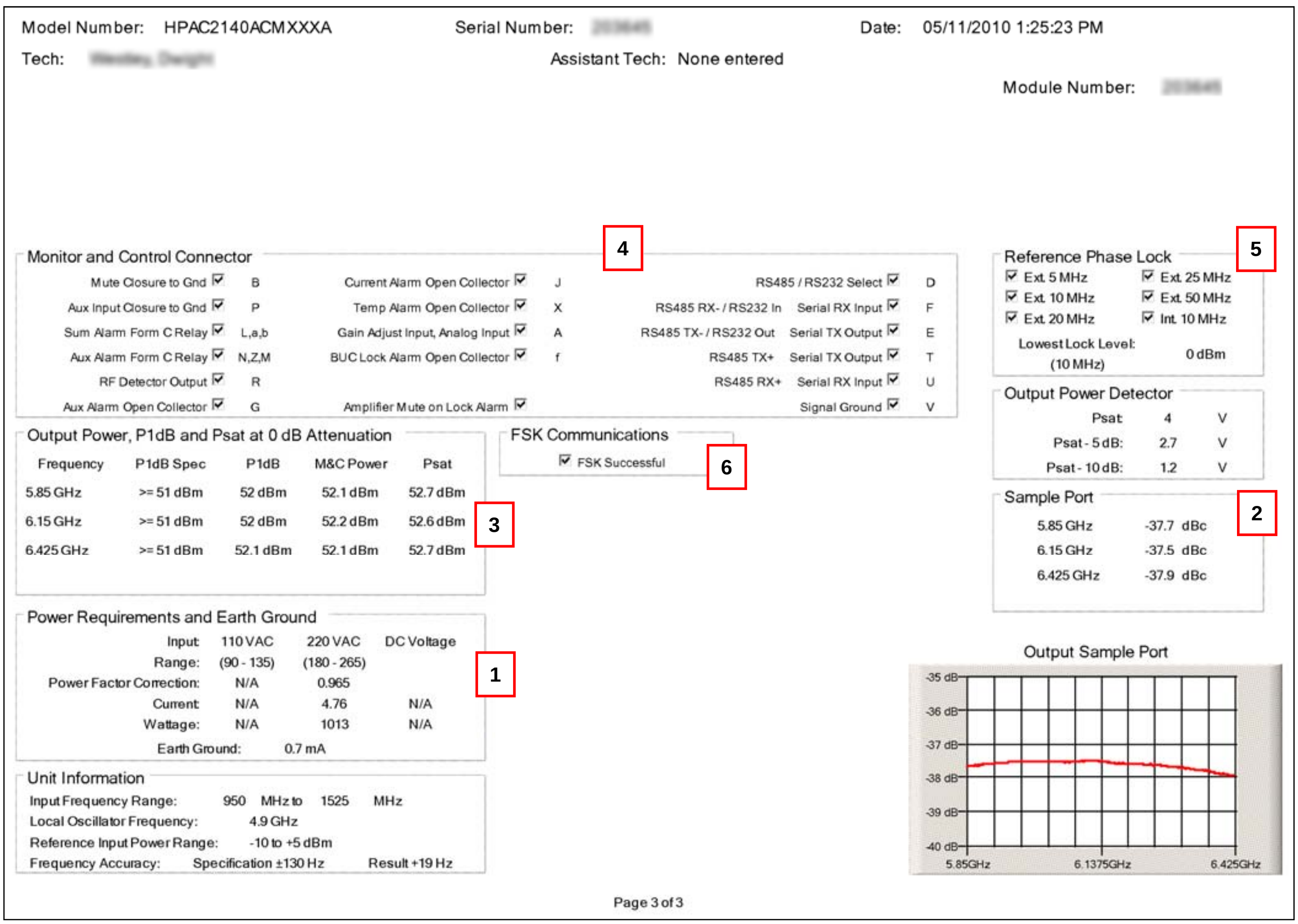
Intermodulation distortion is one of the most important characteristics of a Solid State power amplifier system. Satellite communication systems must comply to certain distortion levels depending on the service involved. All production amplifiers are subjected to automated intermod testing. This is based on a standard two-tone intermod test in which the intermod level (IMD) is measured in dBc with respect the main tones and the highest third order intermod products.

Satcom amplifiers are typically used in some 'back-off' condition. This is the operating point at which the composite output power is 'backed-off' from the amplifier's P_{1dB}, compression point. A curve of back-off vs. IMD level is especially useful in the selection of a power amplifier or determining the proper output power setting in a Satcom system.

Teledyne Paradise Datacom recognizes the importance of this back-off characteristic and provides a plot of back-off vs. IMD from 1 dB to 10 dB back from the amplifier's compression point. **Figure 6-2, item [3]**, shows a typical back-off curve from a production test set.

6.1.6 Power Requirements

This test measures the power requirements of the unit over the various voltages appropriate for the unit under test. See **Figure 6-3, item [1]**.



Model Number: HPAC2140ACMXXXA Serial Number: [redacted] Date: 05/11/2010 1:25:23 PM

Tech: [redacted] Assistant Tech: None entered

Module Number: [redacted]

Monitor and Control Connector (4)

Mute Closure to Gnd ☑	B	Current Alarm Open Collector ☑	J		RS485 / RS232 Select ☑	D
Aux Input Closure to Gnd ☑	P	Temp Alarm Open Collector ☑	X	RS485 RX- / RS232 In	Serial RX Input ☑	F
Sum Alarm Form C Relay ☑	L,a,b	Gain Adjust Input, Analog Input ☑	A	RS485 TX- / RS232 Out	Serial TX Output ☑	E
Aux Alarm Form C Relay ☑	N,Z,M	BUC Lock Alarm Open Collector ☑	f	RS485 TX+	Serial TX Output ☑	T
RF Detector Output ☑	R			RS485 RX+	Serial RX Input ☑	U
Aux Alarm Open Collector ☑	G	Amplifier Mute on Lock Alarm ☑			Signal Ground ☑	V

Reference Phase Lock (5)

☑ Ext. 5 MHz	☑ Ext. 25 MHz
☑ Ext. 10 MHz	☑ Ext. 50 MHz
☑ Ext. 20 MHz	☑ Int. 10 MHz

Lowest Lock Level: (10 MHz) 0 dBm

Output Power, P1dB and Psat at 0 dB Attenuation (3)

Frequency	P1dB Spec	P1dB	M&C Power	Psat
5.85 GHz	>= 51 dBm	52 dBm	52.1 dBm	52.7 dBm
6.15 GHz	>= 51 dBm	52 dBm	52.2 dBm	52.6 dBm
6.425 GHz	>= 51 dBm	52.1 dBm	52.1 dBm	52.7 dBm

FSK Communications (6)

☑ FSK Successful

Output Power Detector

Psat:	4	V
Psat - 5 dB:	2.7	V
Psat - 10 dB:	1.2	V

Sample Port (2)

5.85 GHz	-37.7 dBc
6.15 GHz	-37.5 dBc
6.425 GHz	-37.9 dBc

Power Requirements and Earth Ground (1)

Input:	110 VAC	220 VAC	DC Voltage
Range:	(90 - 135)	(180 - 265)	
Power Factor Correction:	N/A	0.965	
Current:	N/A	4.76	N/A
Wattage:	N/A	1013	N/A

Earth Ground: 0.7 mA

Unit Information

Input Frequency Range: 950 MHz to 1525 MHz

Local Oscillator Frequency: 4.9 GHz

Reference Input Power Range: -10 to +5 dBm

Frequency Accuracy: Specification ±130 Hz Result +19 Hz

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Figure 6-3: M&C, Output Power, Ground, Phase Lock and Misc. Data

6.1.7 Earth Ground

This test measures the leakage current and verifies that each pin on J8 is connected correctly. If the ISO/GND compatibility jumper is equipped, it verifies the jumper position. See **Figure 6-3, item [1]**.

6.1.8 Sample Port

The RF Sample Port is measured at discrete frequencies across the band and a calibration label is placed near the Type N connector on the bottom of the unit. The sample port is approximately -40 dB from the RF output level. A label with the exact coupling ratio is attached to the amplifier chassis. See **Figure 6-3, item [2]**.

6.1.9 P_{1dB} and P_{sat}

The 1dB Gain Compression Point is measured at discrete frequencies across the band to characterize the output power over the operating frequency range. The P_{1dB} measurement is a guaranteed minimum specification.

As the input power increases, the output power limits to some maximum level. This is defined as the saturated output power or P_{sat}. The P_{sat} specification is a typical value and is not guaranteed. This is due to the variation that exists among microwave power semiconductors. The saturated output power is typically 0.5 dB to 1.0 dB above the P_{1dB} value. See **Figure 6-3, item [3]**.

6.1.10 I/O Test

This test verifies that the unit has the correct wiring on the MS connectors by testing faults, communications, and redundancy. See **Figure 6-3, item [4]**.

6.1.11 Ethernet (if equipped)

Tests Ethernet communication, web monitor and control, and assigns a MAC address to the unit.

6.2 Tests for Units with Integrated zBUC

If the Compact Outdoor amplifier includes a block up converter (zBUC), the following tests are included.

6.2.1 Reference Lock

This test checks the external/internal references (if equipped), as well as lowest locking level at 10 MHz. See **Figure 6-3, item [5]**.

6.2.2 FSK

Verifies FSK communication with the zBUC. See **Figure 6-3, item [6]**.

6.2.3 Phase Noise

Tests phase noise using external and internal (if equipped) references. The unit is required to meet at each decade, as well as fall below the spec line determined by the decades. See **Figure 6-2, item [4]**.

6.2.4 Microphonics

A spectrum analyzer is connected to the unit and is set to perform a max hold on the trace. A vibration is introduced to the unit, and the sidebands must meet the specification of ≤ -20 dBc.

6.3 Optional Tests

The following tests are performed on units at the request of the customer, usually to verify specific customer requirements.

6.3.1 Noise Figure

Using a noise figure meter, the unit is tested to verify it operates within specification.

6.3.2 Group Delay

The testing software measures the linear, parabolic, and ripple components to verify the unit is within specification.

6.3.3 AM/PM

The testing software measures the slope of the amplifier's insertion phase vs. output power.

6.3.4 Noise Power

Noise power is the total noise per bandwidth at the output of the unit when a signal is not present.

6.3.5 Harmonics

The testing software measures the 2^{nd} and 3^{rd} harmonics of the unit (as long as the frequency range is within the capabilities of the equipment).

7.0 Introduction

This section describes some of the standard maintenance practices that can be performed on the Compact Outdoor Amplifier and tips to troubleshoot common customer issues.

7.1 Cooling System Maintenance

It is recommended that the cooling system be checked at least once per month. This involves visually inspecting the fan intakes to make sure that there is no obstructions over the intake. The Windows-based M&C program can be used to check the amplifier base plate temperature. The base plate temperature should normally not exceed a 30°C to 35°C rise above the current outside ambient temperature. If the base plate temperature exceeds this temperature rise, it is one indicator that the system's airflow requires maintenance.

The heatsink fins in the exhaust path can be visually inspected for excessive dirt and debris buildup. If it appears there is excessive debris in the heatsink; the fan tray can be removed for easy cleaning. **Failure to keep the fans and heatsink clear of debris will void your warranty.**

7.2 Fan Removal and Heatsink Cleaning

It is recommended to remove prime AC power from the amplifier when the fan tray is being removed. However, if necessary, the fan tray can be removed while the amplifier is operating. Caution should be used to make sure that no clothing or fingers are caught in the fan blades. Simply remove the four screws from the fan tray and the fan assembly can be removed from the bottom of the amplifier assembly.

The fans are connected to their power source by weatherized in-line circular connectors. A replacement fan with connector can be provided for replacement. While the fan tray is removed, the heatsink fins can be cleaned by spraying compressed air throughout the finned area. A can of dust remover spray such as that which is found at a computer or electronics shop will work fine. All debris should be removed before installing the fan tray.

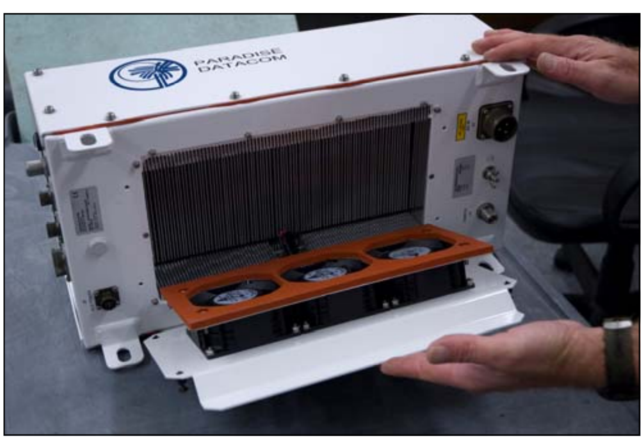

Figure 7-1: Fan Removal from Amplifier Assembly

7.2.1 Fan Replacement

Older models of the Compact Outdoor SSPA were fitted with a two fan cooling fan assembly. The newer models utilize a three fan cooling fan assembly.

While the fan interface connectors for the two fan and three fan tray assemblies are identical, they should not be used interchangeably.

If your Compact Outdoor SSPA was shipped from the factory with the three fan air intake tray, any maintenance requiring replacement of the fans should only use the three fan kit (L205192 -1). The three fan kit requires 12 VDC directly from the buss bar and draws 5.9 A (70 W).

If your Compact Outdoor SSPA was shipped from the factory with the two-fan air intake tray, any maintenance requiring replacement of the fans should only use fan kit (L201814-1). This kit replaces one fan on the fan tray assembly. The two fan kit requires 28 VDC from the booster circuit card assembly and draws 0.7 A (19 W).

Note: Failure to use the proper fan tray will damage your amplifier!

It is possible to modify an older Compact Outdoor SSPA to be fitted with a three fan cooling fan assembly in place of a two fan assembly. This should be done by a Teledyne Paradise Datacom technician, using the procedure outlined in drawing number **206573**.

7.3 Firmware Upgrade Procedure

Teledyne Paradise Datacom digital engineers continually strive to improve the performance of CO SSPA software and firmware. As this occurs, software and firmware upgrades are made available. The web upgrade is performed over the SSPA IP port and does not require any special software. It can be performed through any suitable web browser.

7.3.1 Web Upgrade Procedure

Important! Upgrading unit with incompatible firmware image may damage the equipment hardware. To ensure the proper firmware image file is used, contact Teledyne Paradise Datacom technical support. Write down your current firmware version. You may want to request an image file of the current firmware in case it becomes necessary to revert back to the original.

1. Connect the SSPA to PC 10/100 Base-T network adapter via a Quick-start Ethernet cable. See **Section 3.3**. With a Quick-start cable connected, the SSPA will use a fixed IP address, 192.168.0.9. Advanced users may use a custom cable and custom IP address. However, this procedure only covers connection over a fixed IP address.
2. Make sure unit is power cycled with Quick-start cable plugged in. It will ensure unit assumes fixed address, 192.168.0.9
3. Open a web browser window (Chrome, Firefox or IE are preferred). Enter the following address in the location window of the browser: **192.168.0.9/fw**

4. The Upload Form is password protected. An authentication window should come up to ensure authorization. Use **admin** as user name and the HPA web login password (default password is **paradise**). Click the “Log in” button (see **Figure 7-2**).

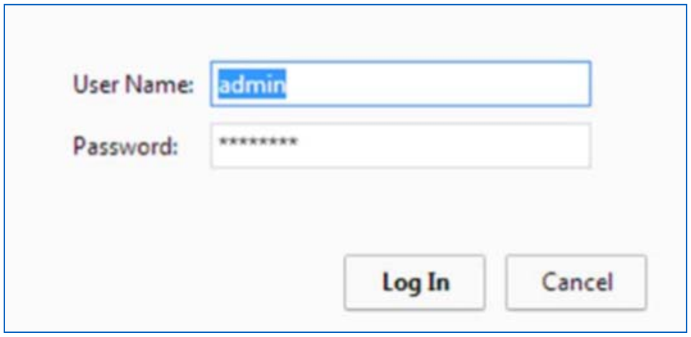

Figure 7-2: Web Upgrade Authentication Window

5. The firmware upload form will load in the browser window (See **Figure 7-3**). Click the “Choose File” button and select the firmware image code.bin file provided by technical support.

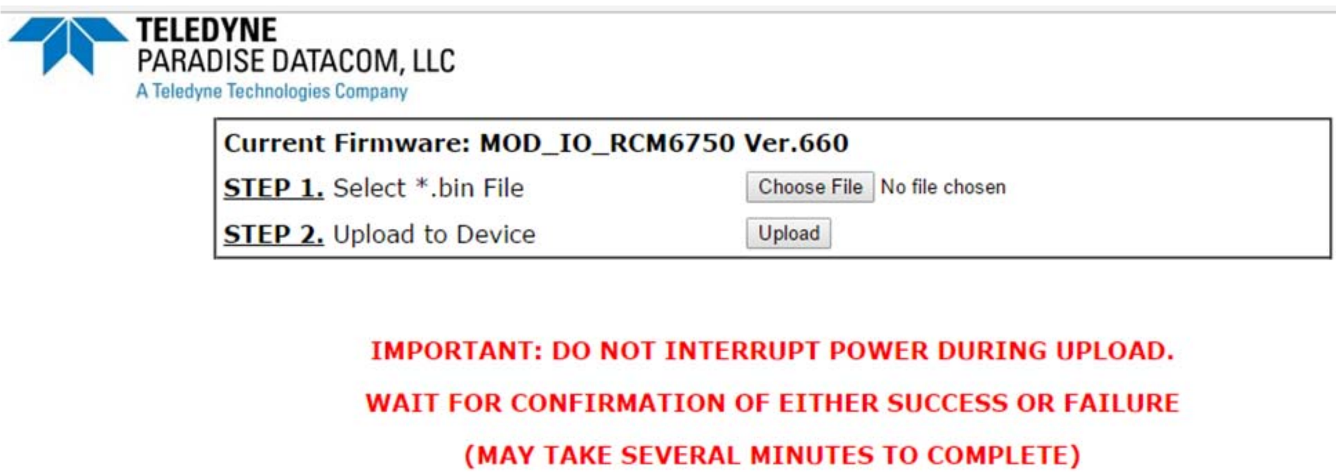

Figure 7-3: Firmware Upload Form

6. Click the “Upload” button. A warning message will appear; click the “OK” button (See **Figure 7-4**).

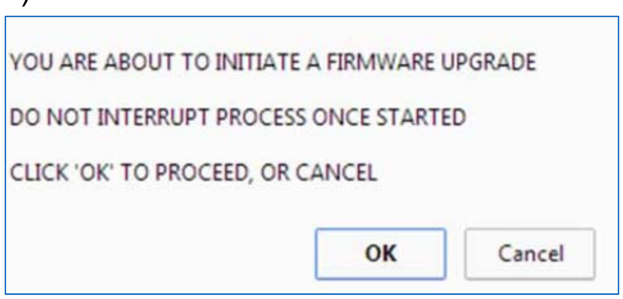

Figure 7-4: Proceed with Web Upgrade Prompt

7. The upload process will begin and the form will be informing about loading process (See Figure 3-15). Do not interrupt this process and wait until its completion with positive or negative result. The process may take up to 15 minutes. When completed, the form will notify about end of process. See **Figure 7-5**.

Figure 7-5: Upload Completed Message

8. During the upgrade process, the HPA remains fully functional. The new firmware will stay dormant until the next reboot of the HPA control card. Reboot the controller card by cycling AC power to the HPA. Check installed version by logging to SSPA embedded web page.

7.4 Troubleshooting Guide

The following section describes solutions for some of the most common issues with the operation of the Compact Outdoor SSPA.

7.4.1 Unit doesn't power up

Cooling fans do not spin, and alarm LED lamps are off.

Possible causes: AC power is off; Unit which requires 220V AC operation is being powered from 110V AC grid; Unit is connected to an inadequate circuit breaker. Unit has no connection between chassis and earth ground or has inadequate earth ground.

Possible solutions: Check SSPA unit datasheet for AC power requirements. Provide the specified AC power for the unit. Re-check continuity between unit's chassis ground and earth ground. Earth ground connection is required for normal SSPA operation!

7.4.2 Unit powers on, LED lamp glows red

Possible causes: SSPA peripheral alarms (Auxiliary, Spare, Forward RF etc) are set as Major alarms. Summary Alarm is caused by external reference BUC module.

Possible solutions: Connect to the SSPA unit via the Universal M&C software and disable peripheral alarms. In the case where the unit is equipped with an externally referenced BUC, provide the specified reference signal to the SSPA IF input.

7.4.3 SSPA unit powers up, LED lamp glows green, but no RF output signal is present

Possible causes: The SSPA is muted by an external signal or by an internal setting. The input RF signal is too low. The input signal is out of band.

Possible solutions: Make sure the J4 connector has a jumper installed between pins B and V (refer to **Table 3-1** or **Table 3-2**). Connect to the unit via the Universal M&C and set the Mute setting to Off. Check the input RF signal level and frequency. Make sure the signal properties are appropriate for the unit. If Switch Mute is enabled, make sure unit is connected to a RF switch; otherwise, disable the Switch Mute option.

7.4.4 Cannot connect to SSPA through remote control interface

Possible causes: The SSPA remote control is set to a different interface setting. The interface cable is not wired properly or has a broken wire harness. A PC interface port malfunction. An incorrect version of the software is being used to control the unit. The selected SSPA protocol is no longer supported by the SSPA firmware. In the case of RS232 interface: the wire harness is using the Chassis ground rather then a Com ground pin. In case of IPNet or SNMP interface: PC ARP cache entry is set for different MAC/IP address pair.

Possible solutions:

a) In the case where SSPA communication settings have been accidentally set to a random configuration, establish a connection to the unit with a L207755 Quick Start cable in conjunction with the Universal M&C software (see *Section 3.3.2*). After establishing a communication link with the unit, adjust the following settings to the desired configuration: Serial Network address, Protocol Select, Baud rate (if Normal protocol was set in in the Protocol configuration), IP address, Subnet, Gateway, IP port and IP lock address (if IPNet or SNMP protocols were selected), Community Set and Community Get strings (if SNMP protocol was selected), web password (if IPNet was selected).
   Disconnect the Quick start cable, and cycle AC power to the unit with the custom cable harness plugged into the J4 M&C connector. Recheck custom control link.
b) In the case of a RS232 interface, make sure to use communication ground pin **d** from the J4 connector as the RS232 ground. The SSPA RS232 port is electrically isolated from chassis ground. In order to use the Quick Start cable from previous generations of Compact Outdoor SSPAs (PN L202151), the cable harness will need to be modified. To do so, open the MS connector shell and connect the chassis and communication ground pins together (Pins **V** and **d**).
c) In the case of IPNet, use 10Base-T approved cables (CAT5, CAT6) to make a connection to the unit. Maximum cable length should not exceed 300 ft. Use **Figure 3-7** as a wiring guideline. If an IP connection with custom IP addressing is desired, don't make any connection to interface selection pins j and e.
d) In the case of SNMP interface, make sure that the SNMP community strings match between the SNMP NMS software and the unit. Default values for these strings are: Public and Private. Connect to the unit via the Universal M&C to check or change string values.
e) In the case of IPNet or SNMP protocols, clear the PC ARP cache by issuing the following command in a Windows command line interface: **arp –d**.
f) Binary and Terminal protocols are no longer supported by Compact Outdoor units. Use the currently available interfaces instead.

7.4.5 The FSK link between a modem and the SSPB unit is not working

Possible cause: The unit is set to use Terminal Mode protocol.

Possible solution: Set the SSPB protocol setting field to “Normal” protocol or (and) remove any connection to SSPB interface select pins j and e on the J4 connector. Reset AC power.

8.0 Redundant System Concepts

The Compact Outdoor Amplifier is capable of operating in a variety of redundant system configurations. These include 1:1 and 1:2 as well as 1:1 with L-Band Block Up Converters. The Compact Outdoor Amplifier has a built-in 1:1 redundancy controller, allowing it to be used in 1:1 redundant systems without a separate external controller. When used in a 1:2 redundant system a separate controller, RCP2-1200, is required. The three most common forms of 1:1 redundant system are shown in **Figures 8-1** through **8-3**.

Figure 8-1 shows a standard 1:1 system in which the RF input is transmitted through a transfer switch along with the output. Using this configuration the standby amplifier carries no traffic and simply is terminated by a 50 ohm resistive load at its input and by a waveguide termination at its output.

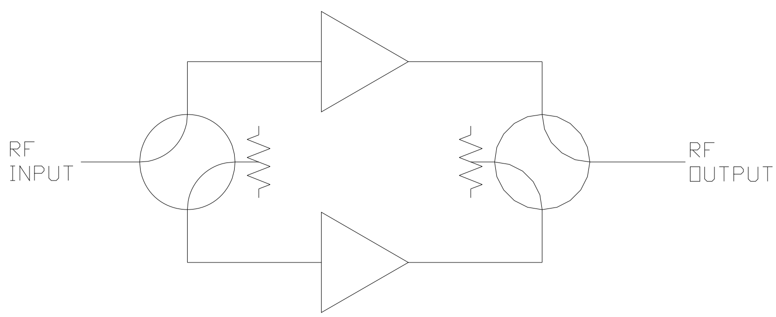

Figure 8-1: Standard 1:1 Redundant System with input (coaxial) switch and output (waveguide) switch

With the system configured as in **Figure 8-2**, the RF input is passed through a microwave splitter. This keeps 'live' traffic on the standby amplifier and is useful for observing the traffic via the RF sample port on the standby amplifier.

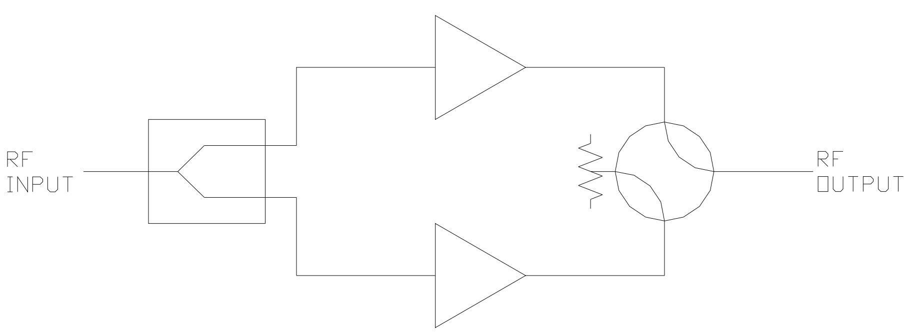

Figure 8-2: 1:1 Redundant System with input splitter substituted for input switch

The system shown in **Figure 8-3** uses the same concept of the power splitter on the RF input. In this case the Compact Outdoor amplifiers are equipped with L-Band block up converters. L-Band input amplifiers use phase locked oscillators as the local oscillator to the up converter. Such systems must use a splitter at the input instead of a switch so that the reference input is always available to the standby amplifier. If the reference signal is lost the standby amplifier would report a BUC (Block Up Converter) fault.

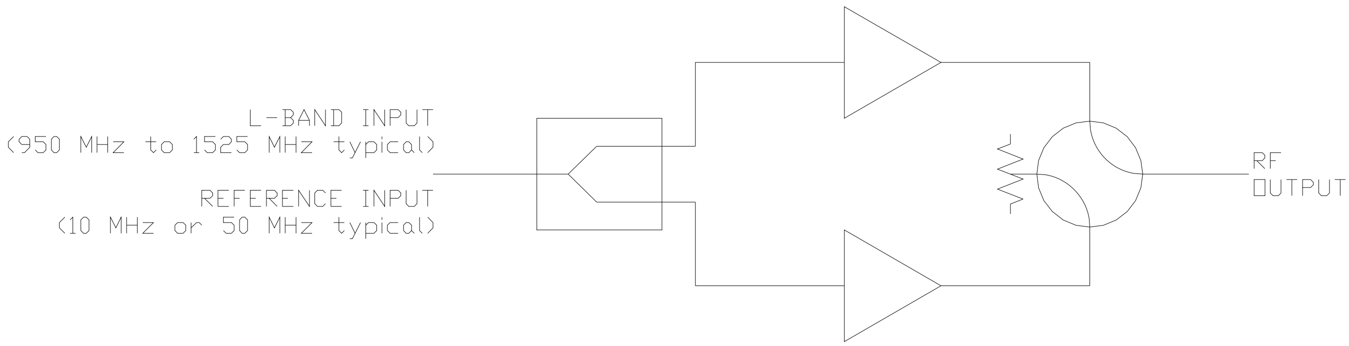

Figure 8-3: 1:1 Redundant System with L Band input

Care must be taken when selecting the splitter for an L-Band input system. The splitter must be a wide band design capable of passing the 10 MHz or 50 MHz reference signal along with the 950 MHz to 1525 MHz traffic input. The reference frequency power level must be at least -10 dBm into each Compact Outdoor Amplifier.

8.1 Compact Outdoor Amplifier in 1:1 Redundancy

The Compact Outdoor Amplifier is ideally suited for a self-contained and cost effective 1:1 redundant system. Each Compact Outdoor Amplifier has a built-in 1:1 redundant controller. The controller is activated via computer command from the Teledyne Paradise Datacom Universal M&C application. The Compact Outdoor Amplifier may be purchased as a redundant system or upgraded in the field from a single thread amplifier to a 1:1 redundant system.

A redundancy kit may be purchased separately which includes the following components:

- Mounting Frame
- Waveguide Switch / Mounting Bracket
- Input Splitter
- Waveguide bends from amplifier to switch
- High Power Waveguide Termination
- Coaxial cables from splitter to Amplifier input
- Link Cable
- Switch Cable

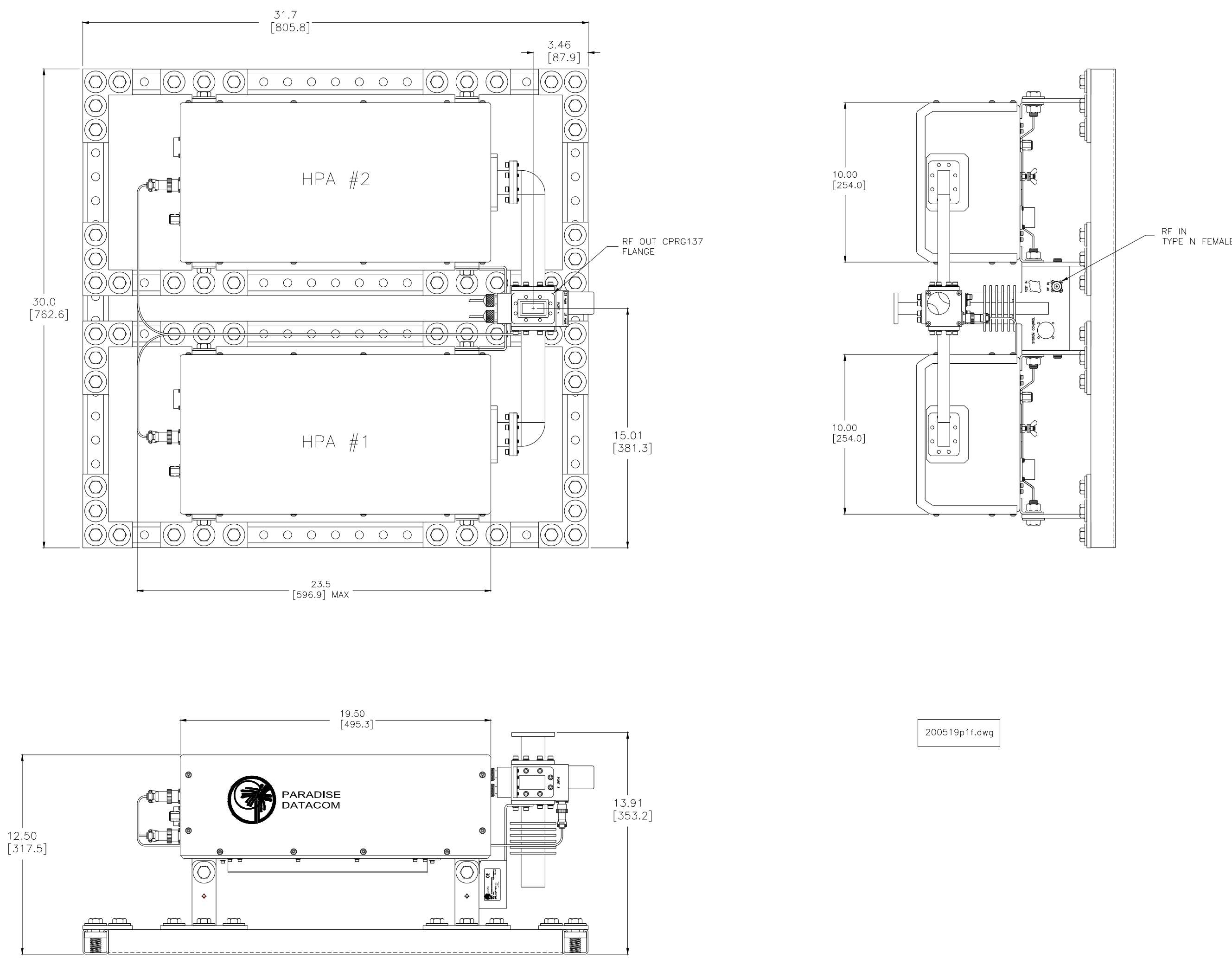

Figure 8-4: Typical 1:1 Redundant System Outline

8.1.1 Hardware Setup

The hardware setup for a Compact Outdoor 1:1 Redundant System is very simple and involves the addition of (2) cables along with a redundancy switch. A schematic diagram of the redundancy setup is shown in **Figure 8-5**.

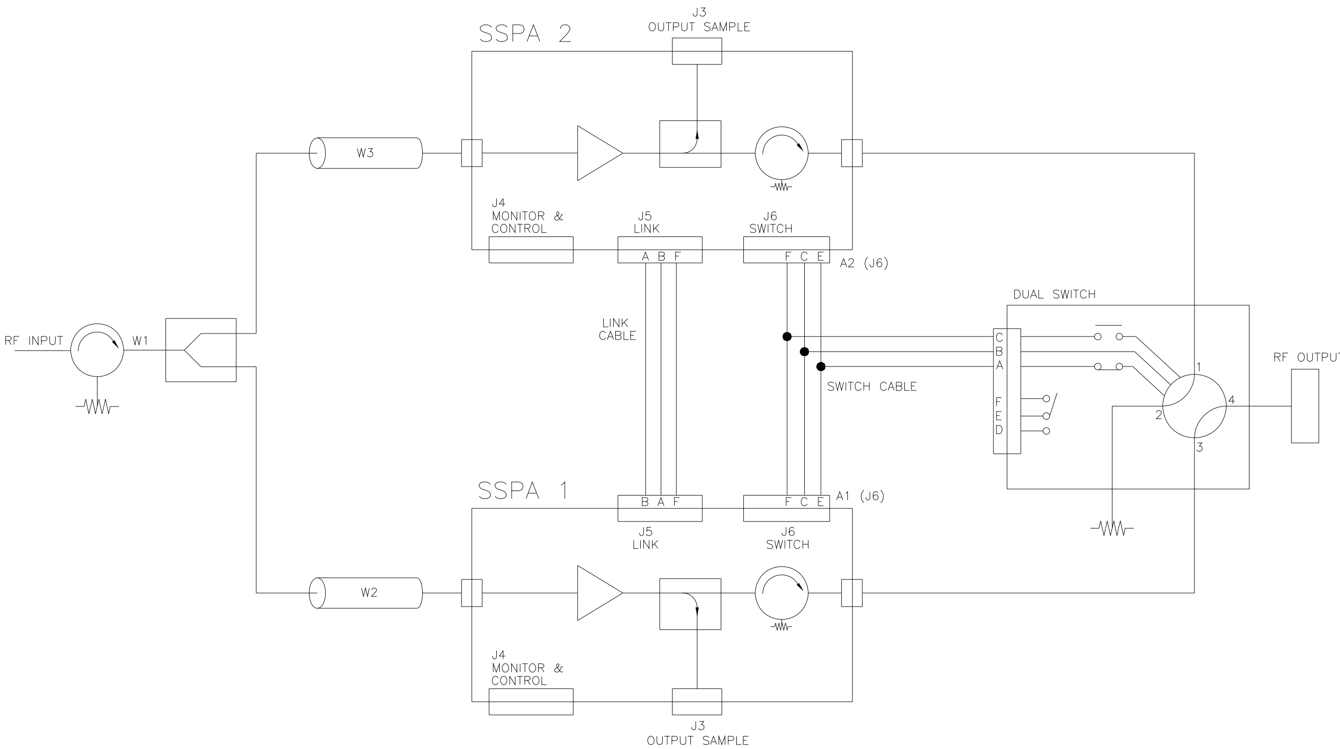

Figure 8-5: 1:1 Redundant System with Link Cable and Switch Cable installed

The Link Cable is a simple (3) conductor crossover cable that allows the system to pass command and control between amplifiers. With the redundancy kit, this cable is supplied in a 26 inch (660 mm) length.

The Switch Cable is a “Tee” configuration and connects between each amplifier and the redundancy switch. The Redundancy Switch is a -28 VDC type. Therefore the controller in each Compact Outdoor Amplifier is capable of supplying +28 VDC to the common voltage input. Either controller may then provide a (sink) return to engage either position 1 or position 2 of the redundancy switch.

Care must be observed when connecting this cable to the amplifiers. The cable end labeled “A1” must be connected to the amplifier whose output is connected to Port 3 of the waveguide switch. Likewise the cable end labeled “A2” must be connected to the amplifier whose output is connected to Port 1 of the waveguide switch. This is for proper identification purposes of the Redundancy Control Firmware used by each Compact Outdoor Amplifier.

8.1.2 Software Setup

To instruct the Compact Outdoor Amplifier to operate in redundancy it is necessary to temporarily connect it to a PC running the Teledyne Paradise Datacom Monitor and Control Software to set up the redundant configuration. There are three basic modes of Redundant System communication.

1. Stand-Alone 1:1 Redundant System—No Computer Control
2. PC Control using RS-232 and Paradise M&C Software
3. PC Control using RS-485 and Paradise M&C Software

8.1.2.1 Stand-Alone 1:1 Redundant System

As Method 1 implies, it is possible to have a 1:1 system operate with no PC monitor and control. Initially, however, it is necessary to connect each amplifier up to a PC to configure it for redundant operation. **Figure 8-6** shows the redundant system with each amplifier enabled to use RS-232 communication with a PC. Every Compact Outdoor amplifier is shipped from the factory with a “Quick Start” cable that can be used for this purpose. If the Compact Outdoor Amplifiers are purchased as a 1:1 Redundant System, this Software Setup procedure will have been set at the factory and it is not necessary to repeat this process.

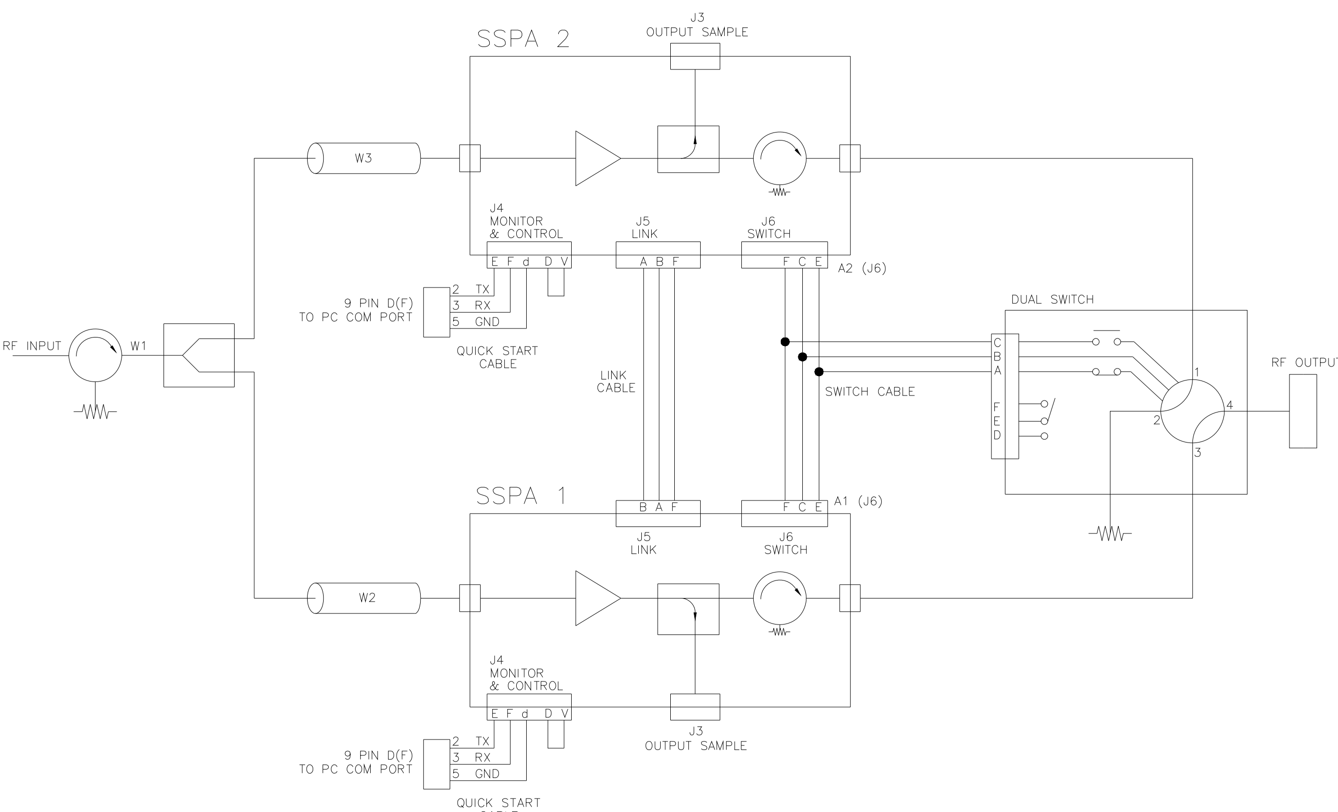

Figure 8-6: 1:1 System with RS-232 Communication to each Amplifier

Each amplifier can be configured for redundancy by the Teledyne Paradise Datacom Universal M&C software that ships along with each unit. Using the Quick-Start cable, connect each amplifier to the PC and run the M&C program. Select the “Settings” tab from the main form. The “Settings” window will appear as shown in **Figure 8-7**.

1. System Mode: Each SSPA’s System Mode must be set to “1:1 Redundant Mode”

2. Choose a Hierarchical Address for each amplifier. HPA 1 means this SSPA will use the RF switch position 1 as its On Line state position. HPA 2 will then use RF switch position 2.

3. Redundancy Startup State: The amplifier which is desired to be on line should be set “On Line”. The other amplifier should be set as “Standby”. Once the system is operating, changing the state of the “OnLine” amplifier to “Standby” will cause the system to drive the switch so that the other amplifier is in the “OnLine” state. Attempting to change the “Standby” amplifier to the “OnLine” state will have no effect. This setting is saved upon unit shut-down, and the unit will start up in the last saved state.

All settings are valid as soon as the operator sets them on the SSPA Settings window. The SSPA’s redundant operation can be verified by monitoring the RF Switch Fault indicator as shown in **Figure 8-15**.

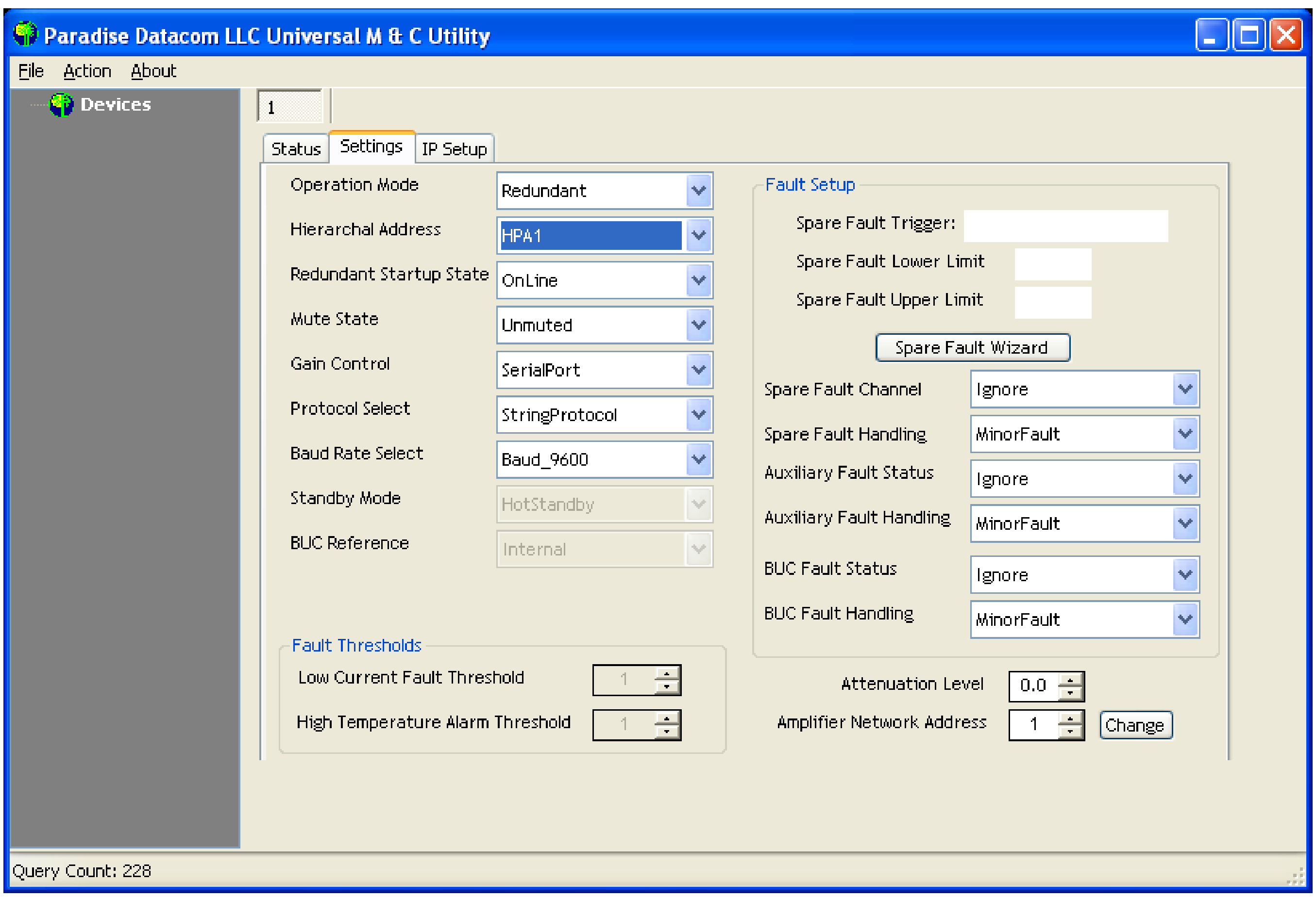

Figure 8-7: M&C Program “SSPA Settings” window

The Standby amplifier can be muted to have a “Cold Standby” condition. It keeps the SSPA module powered down for power savings while the microprocessor and fans remain operational. SSPAs with Parallel I/O board firmware version 3.50 or beyond are provided with a true cold standby mode. In this mode, the SSPA will be muted automatically. Cold standby mode has to be selected through a serial control interface (For details, see **Table 10-9**, data address 20).

If the Standby amplifier switches to the Online state, it will automatically un-mute and transmit traffic. If the operator attempts to mute the Online amplifier a warning message will be displayed “You are about to mute the Online unit. Proceed with Mute?”

Similarly, connect the second amplifier to the computer’s COM port and perform the 1:1 selections on the SSPA Settings window. Just as with the first amplifier, make sure that the System mode is set to 1:1 redundant. Select a hierarchical address, HPA 1 or HPA 2 and a startup state.

The amplifiers may then be disconnected from the computer’s COM port as the Compact Outdoor Amplifiers’ microcontroller is now programmed for 1:1 redundancy control. It is not necessary to run the Windows based M&C software with the redundant system. The M&C software is only a convenience for remote monitoring and control of the redundant system.

8.1.2.2 Switch Mute

The Switch Mute option was introduced into the SSPA control setup to overcome a problem with microwave arcing, which may potentially damage a switching component if switching RF power exceeds 400 Watts. This particular problem becomes a critical issue if coaxial RF pass switches are used.

When this mode is selected, the amplifier is momentarily muted during switchover to prevent arcing in the waveguide. The SSPA also will be forced to the mute state if the transfer switch malfunctions, is disconnected from SSPA or gets stuck between positions.

In general, all Teledyne Paradise Datacom SSPAs are well protected against high reflected power conditions which may take place during output microwave switchover. But with certainty, waveguide or coaxial switches will develop an internal electrical arc during switchover if the output power is significant. Such conditions will not lead to instant failure, but over time may diminish some critical RF switch characteristics.

If the switch mute feature is enabled, the system ability to output RF power will be bonded to the switch position sensing circuitry. This circuitry consists of the following components: a SSPA electronic switch position detector; a wiring harness between the SSPA and RF switch; and RF switch position sensors. Failure of any of these components will lead to a break in transmission.

In addition, a SSPA with the switch mute feature enabled will be forced to the mute state when used in standalone mode without a connected RF switch. Standalone units must be set with the switch mute option disabled, or set up in Standalone mode operation prior to using a SSPA without a connected RF switch.

8.1.2.3 PC Control using RS232 and Paradise M&C Software

In applications requiring remote monitor and control of the redundant system, the Teledyne Paradise Datacom Universal M&C program has a control panel that can be used for this purpose. To enable the 1:1 system to operate with the remote control software, first configure each amplifier for 1:1 redundant operation as previously described in the Stand-Alone 1:1 Redundant System section.

When using RS232, a separate COM port will be required for each amplifier. Therefore a computer with at least two COM ports is required for such a system. Systems using RS232 are limited by the length of the communication cable from the amplifiers to the computer. This is typically a maximum of 30 ft. (9 m) for most RS-232 device drivers. Systems requiring longer communication cable links should use RS-485 communication.

After starting the M&C program, select [Action] Œ [Add Unit] Œ [Compact Outdoor SSPA]. See **Figure 8-8**. The Add New SSPA window will appear as shown in **Figure 8-9**.

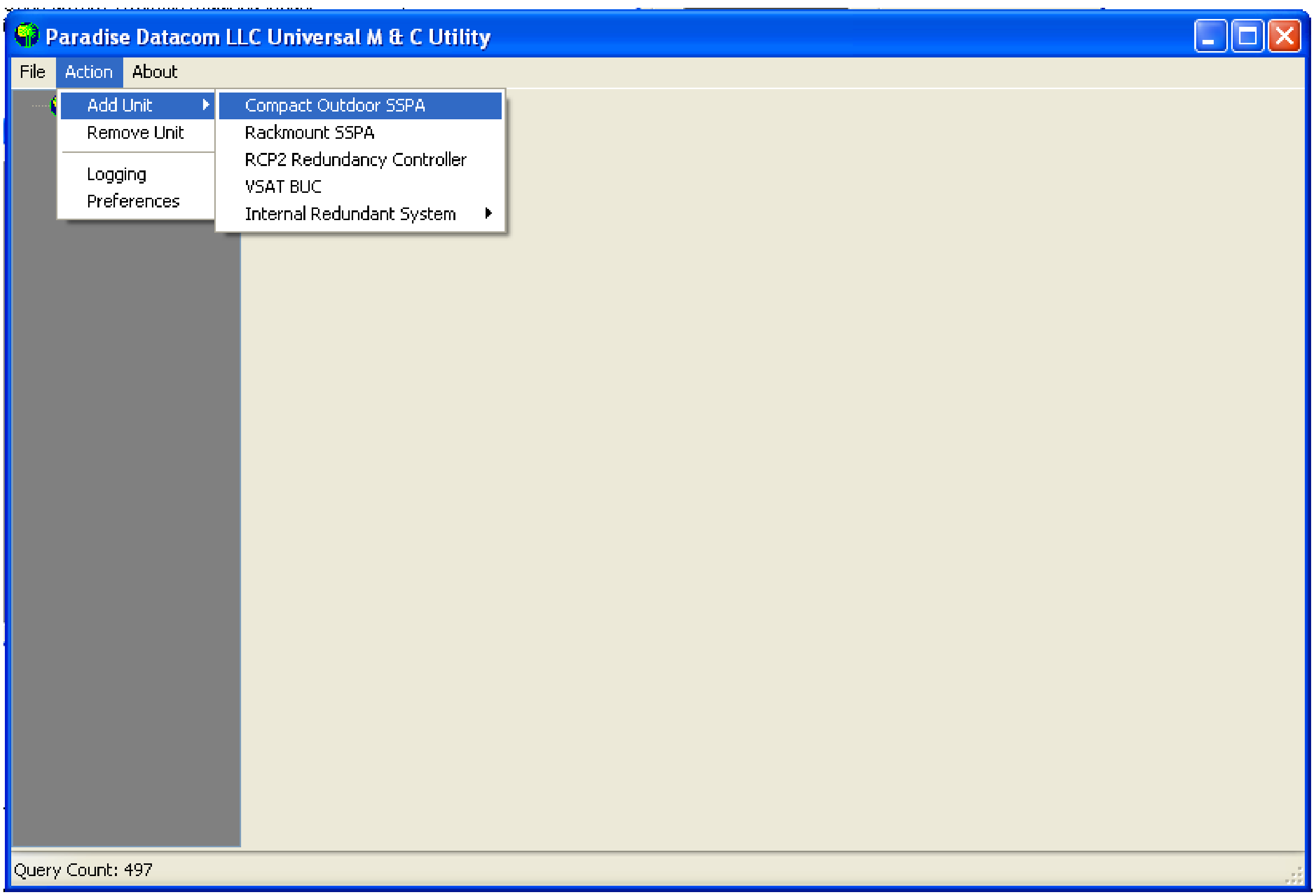

Figure 8-8: Adding a SSPA Monitor and Control Window

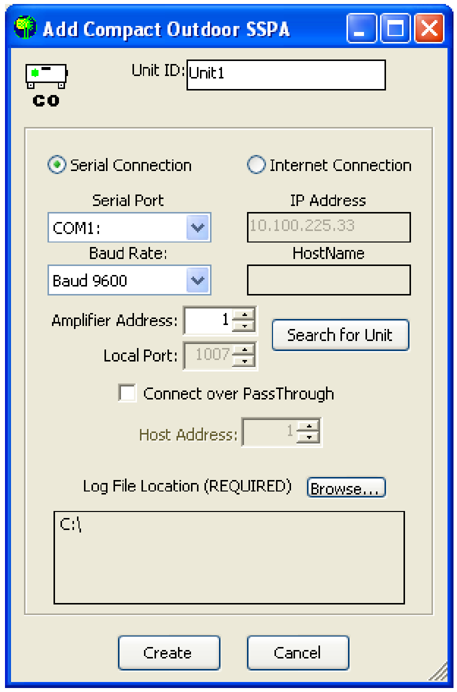

Figure 8-9: Add New Compact Outdoor SSPA window

From this screen choose the COM port and baud rate. The factory default baud rate is 9600. If a single SSPA is used the Global network address setting should be used.

After the COM port has been selected the "Operation" window will be displayed. If the SSPA is connected to a power source and turned on, the SSPA will begin communicating with the M&C program and its operating parameters will be displayed, as shown in **Figure 8-10**.

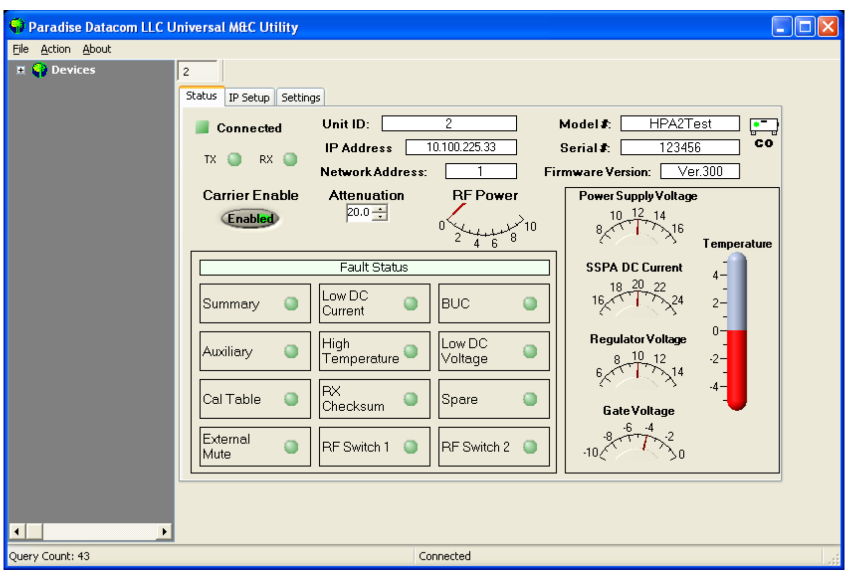

Figure 8-10: Individual SSPA Operation Window

Go back to the "Add New Local SSPA" window and select the correct COM port for the second amplifier. Its operation window will appear on the M&C program display. If either of the amplifiers is not communicating with the M&C Operation screen, debug the system to find the problem. Check the RS-232 connection from each amplifier to the appropriate COM port of the PC.

Once reliable communication has been established between each amplifier and the computer, the Redundancy Control Panel can be displayed. From the M&C program's main window, choose [Action] Œ [Internal Redundant System] Œ [1:1 Compact Outdoor SSPA System]. See **Figure 8-11**.

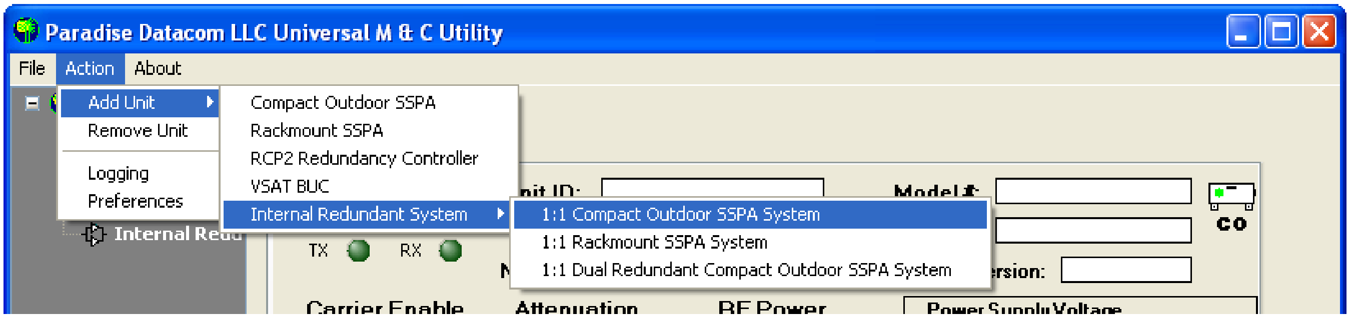

Figure 8-11: Universal M&C, Add Unit Menu Tree

The Redundant Control Panel window will then be displayed as in **Figure 8-12**. Note that once the Redundant Control Panel is enabled, the Main Menu on the M&C program changes.

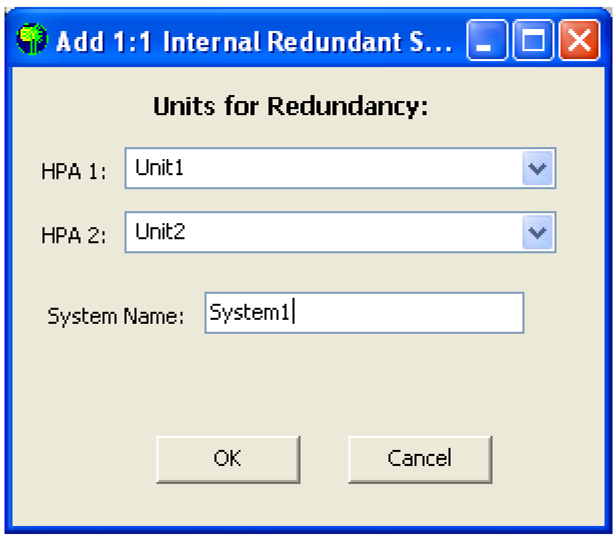

Figure 8-12: Universal M&C, Add 1:1 Redundant System Window

The Control Panel must be configured by selecting "Set Redundancy System" and choosing an amplifier for SSPA 1 and SSPA 2. Either amplifier may be designated as SSPA 1 or SSPA 2. Each amplifier is identified by its ID number. The ID number is a fixed number and cannot be changed. It is a unique encoded value determined by the particular amplifier's model number and serial number. If the ID number is forgotten, refer to the System Watcher window. This window continuously displays which amplifier, by ID number, is connected to each specific COM port. After the Control Panel has been configured the display will change to the view shown in **Figure 8-13**.

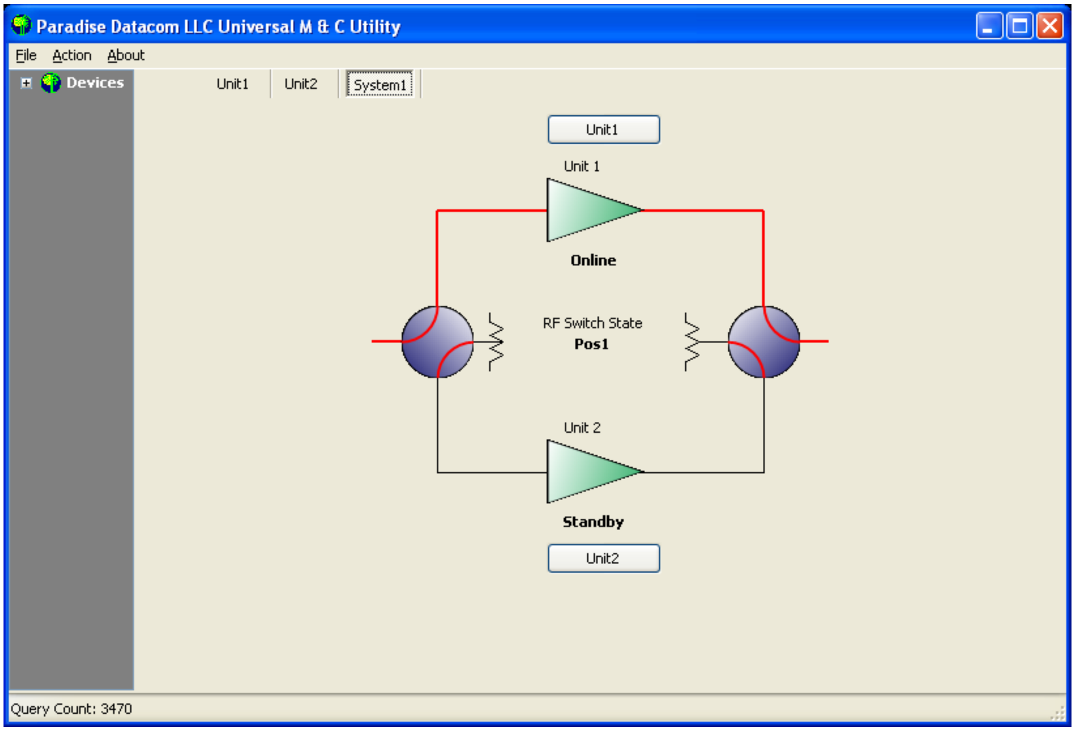

Figure 8-13: Universal M&C, showing a configured 1:1 Redundant System

From the Control Panel display all typical 1:1 system functions can be monitored and controlled. A particular SSPA can be put on line be selecting the command button for either amplifier. The online amplifier will be indicated by the "Online" notation. The standby amplifier will be listed as such as shown in **Figure 8-13** (Unit 2).

A particular redundant configuration can be saved by going to the "File" menu and selecting "Save Configuration". Thus if the program is terminated and then restarted, it will immediately boot up with the Redundancy Control Panel display.

Each individual amplifier's characteristics can still be monitored and controlled from its respective "Operation" window. If the user attempts to Mute an on-line amplifier, a warning window will pop-up asking if this is a valid request. See **Figure 8-14**.

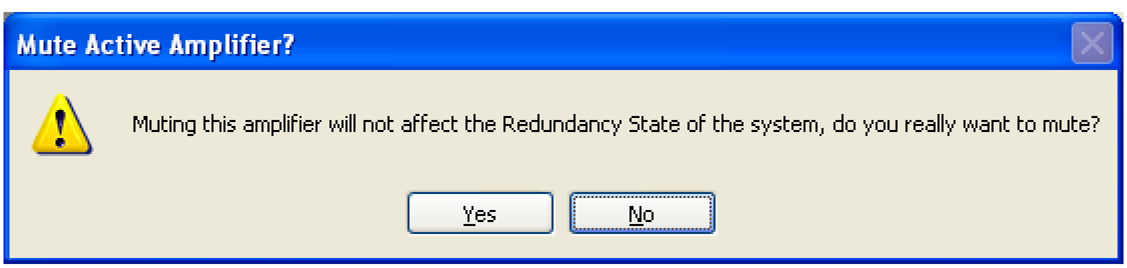

Figure 8-14: Dialog window, Affirm mute of on-line amplifier

If the online amplifier enters a fault condition, the redundant switch will automatically route the signal to the Standby amplifier. The faulted amplifier will be colored red in the Redundancy Control Panel display. See **Figure 8-15**.

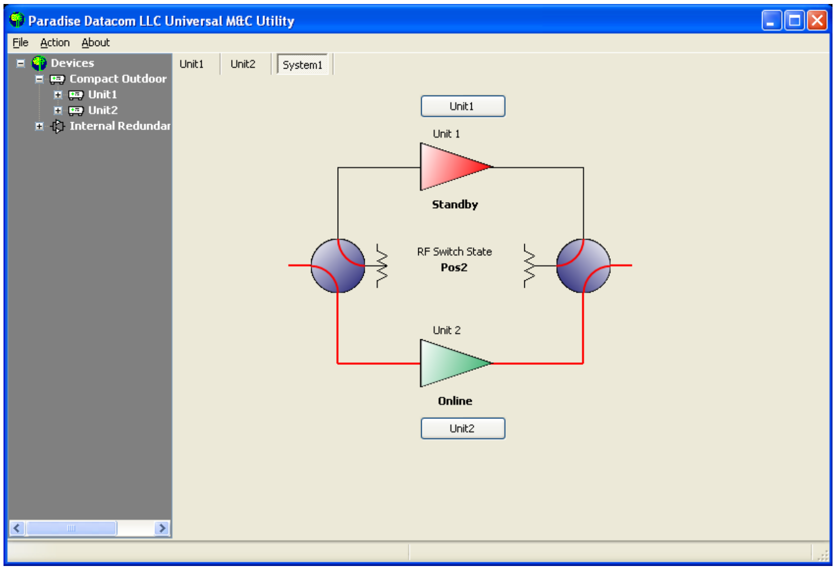

Figure 8-15: Control Panel showing Unit 1 faulted and signal routed to Unit 2

By clicking on the [Unit1] button (which will be labeled to correspond to the unit's name), the M&C Status window for Unit1 is activated, so the user may determine the cause of the fault. See **Figure 8-16**. Once the fault is cleared, Unit1 can be reactivated as the online unit by clicking on the triangular amplifier symbol for Unit2 in the System1 control panel.

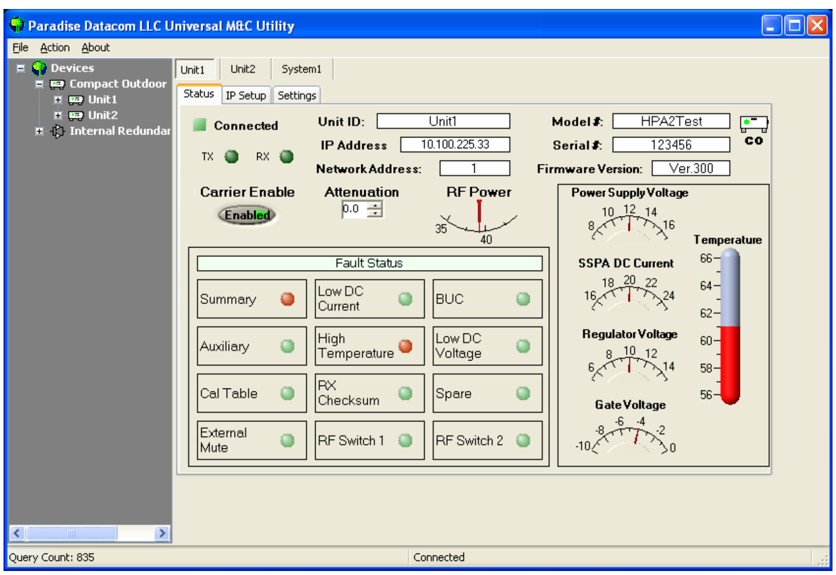

Figure 8-16: Unit1 Status panel showing Summary and Temperature Faults

If the redundant switch is manually rotated to the offline amplifier in a redundant system, an RF switch fault will occur. The system will not attempt to switch back to its original position. On the Redundancy Control Panel, both amplifiers will be colored red. The switch must be manually rotated back to the online amplifier.

8.1.2.4 PC Control using RS-485 and Paradise M&C Software

Applications requiring long cable runs between the computer and the 1:1 Redundant System may use RS-485 communication. The Compact Outdoor Amplifier's firmware supports networking on a RS-485 bus. This type of network can be used to support the 1:1 Redundant System.

The RS-485 link can typically be run up to 4000 ft. (1200 m) lengths. A good quality twisted pair cable should be used along with proper line terminations. There are no parallel end terminations in the amplifier's RS-485 interface. Any required cable terminations have to be added externally. Either full or half duplex RS-485 communication is supported. Schematics showing the proper wiring of each version are shown in **Figures 8-17** and **8-18**.

As in the stand-alone redundant system of **Section 8.1.2.1**, each Compact Outdoor SSPA must be programmed for Redundant System operation by using the RS-232 interface and M&C program. Similarly when networking SSPAs on a RS-485 network, each amplifier's address must be set before they can communicate over the network. Both of these steps should be performed together as part of the initial system setup.

Figure 8-17 shows a typical 1:1 Redundant System with RS-485 Full Duplex Communication. **Figure 8-18** on the following page shows a typical 1:1 Redundant System with RS-485 Half Duplex Communication.

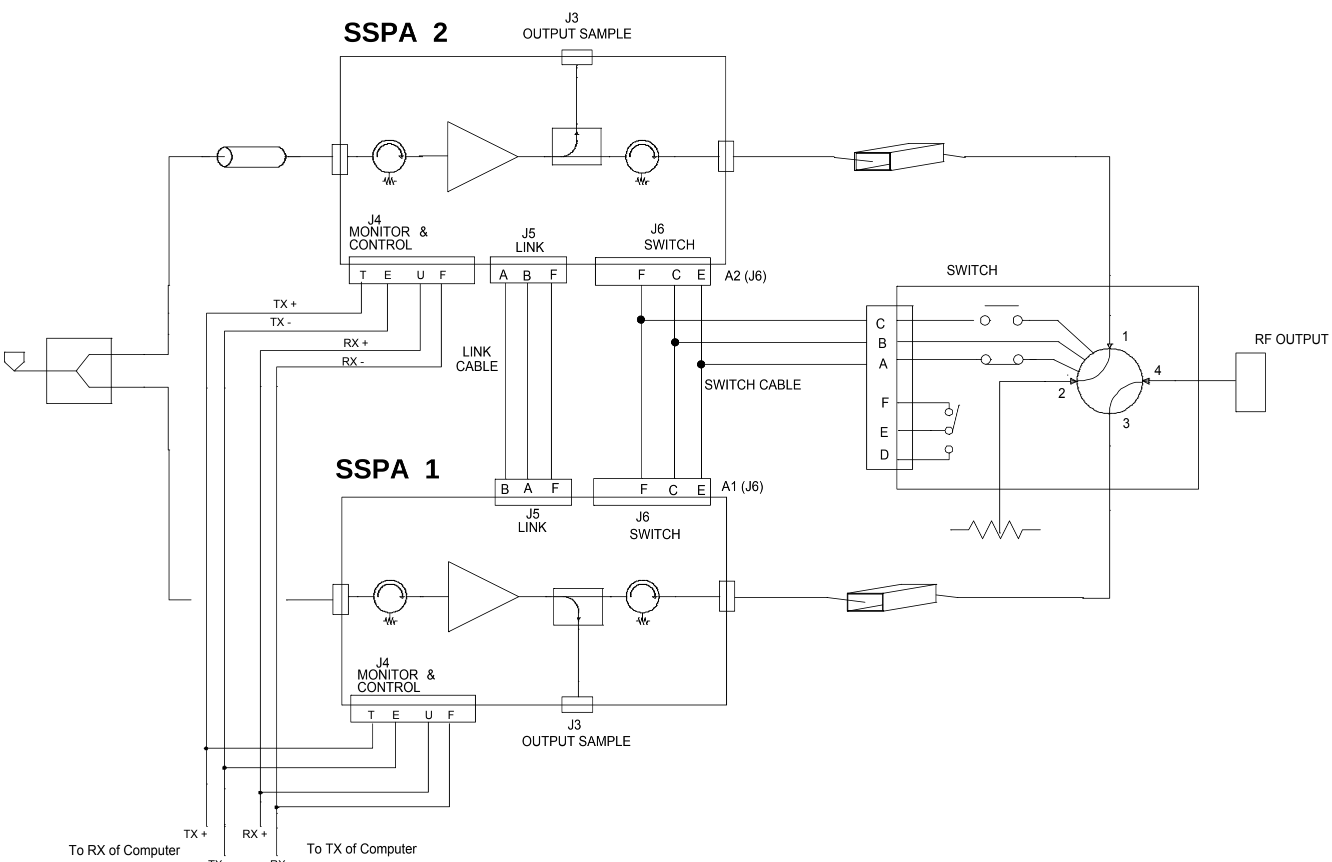

Figure 8-17: 1:1 Redundant System with RS-485 Full Duplex Communication

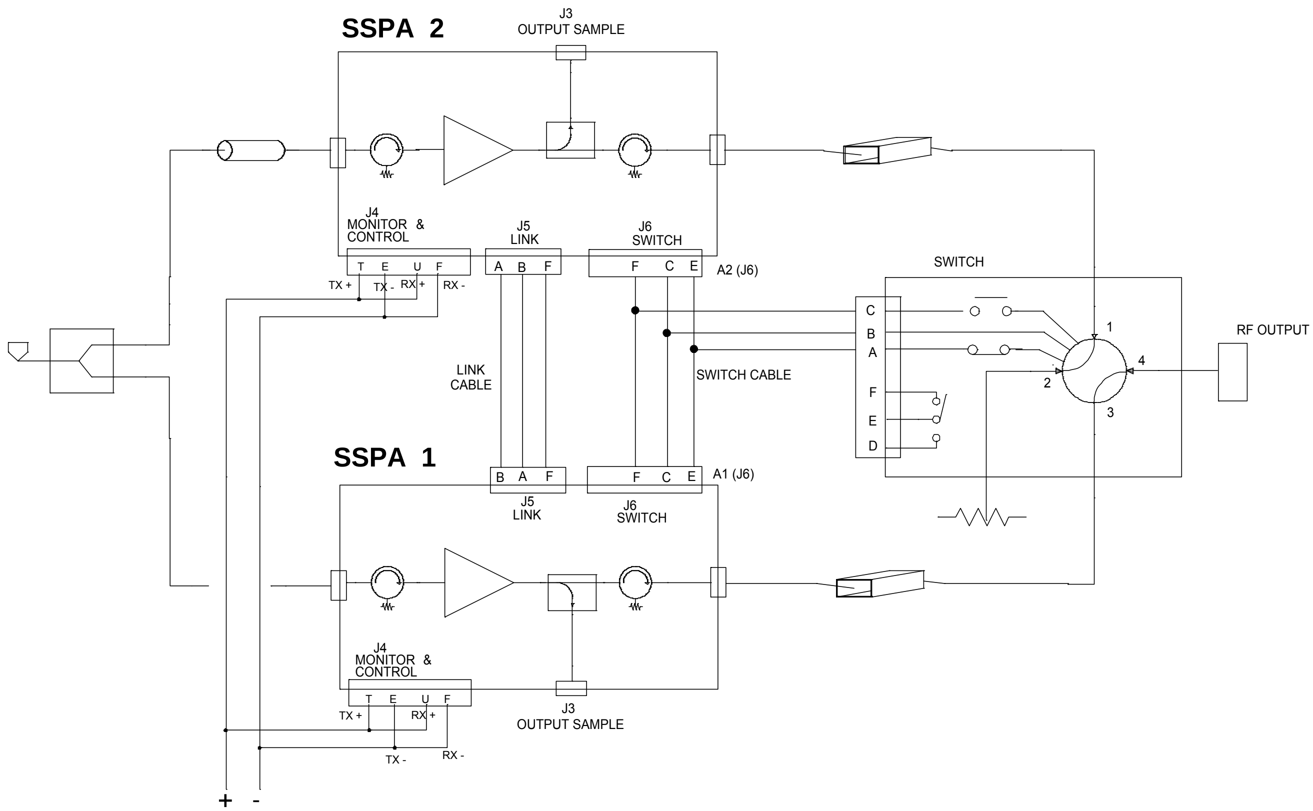

Figure 8-18: 1:1 Redundant System with RS-485 Half Duplex Communication

8.2 1:2 Redundant Systems

The Compact Outdoor Amplifier can also be configured in 1:2 Redundant Systems. The major difference being that the amplifier's internal controller can not be used for system control. Instead a separate RCP2-1200 Redundant System controller is used to provide system control. The controller can be remotely located from the amplifiers up to 500 ft. **Figures 8-19** through **8-22** show a 1:2 Compact Outdoor Amplifier Redundant System.

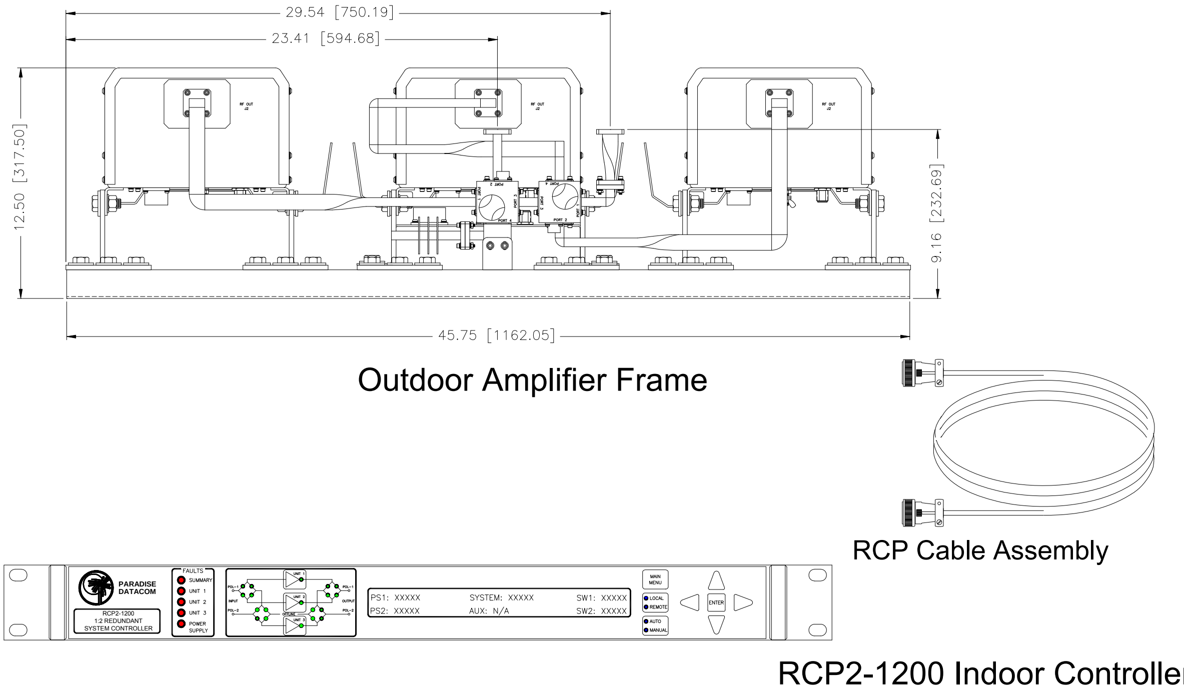

Figure 8-19: 1:2 Redundant System

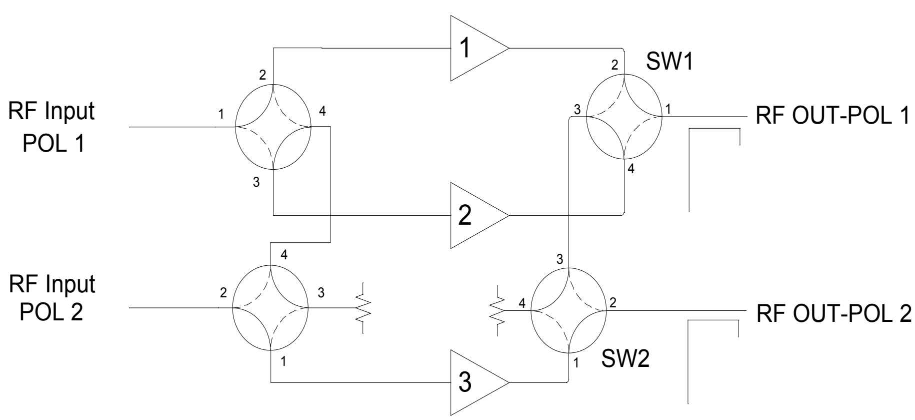

Figure 8-20: 1:2 Redundant System Block Diagram

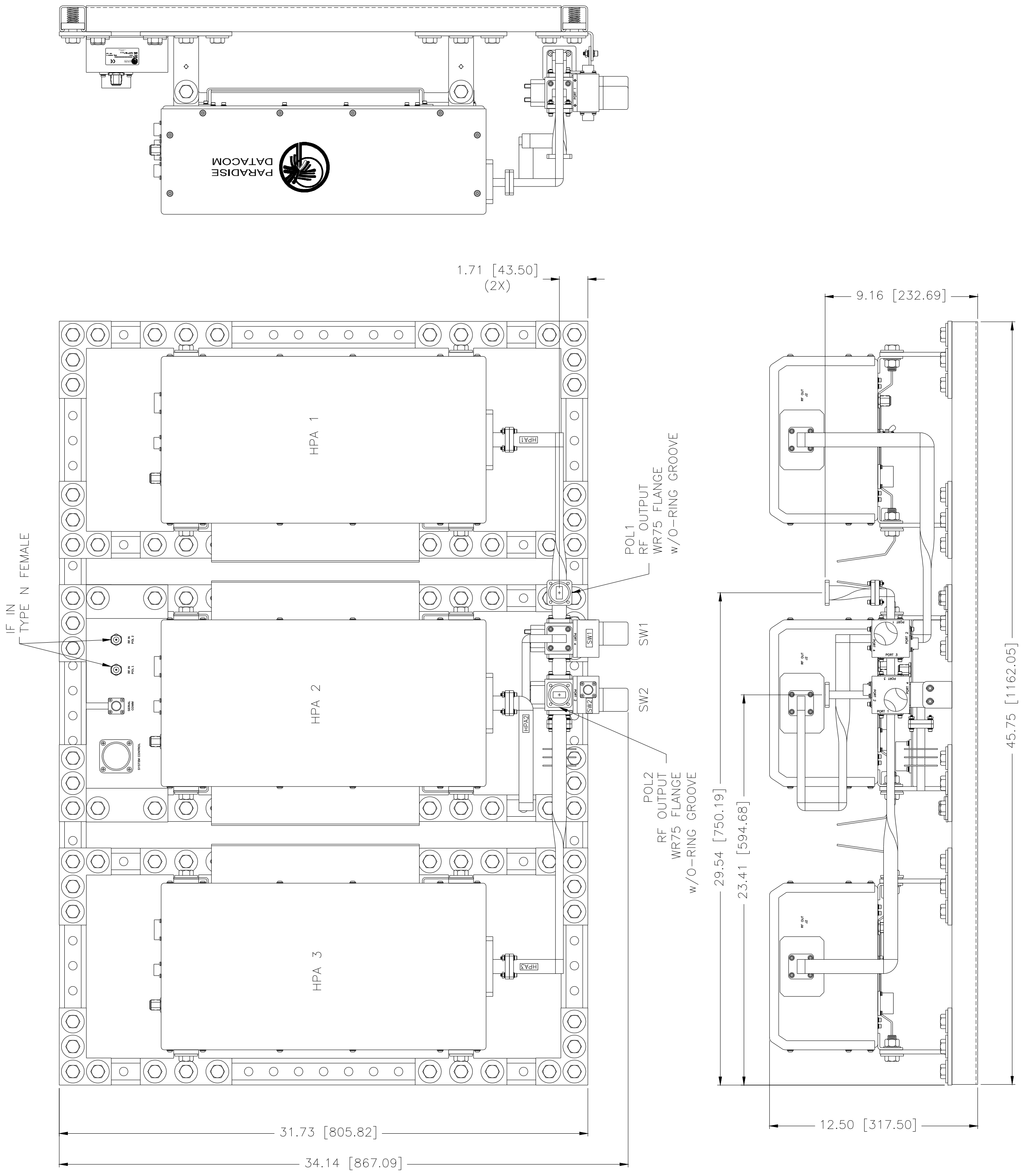

Figure 8-21: Outline, 1:2 Redundant System

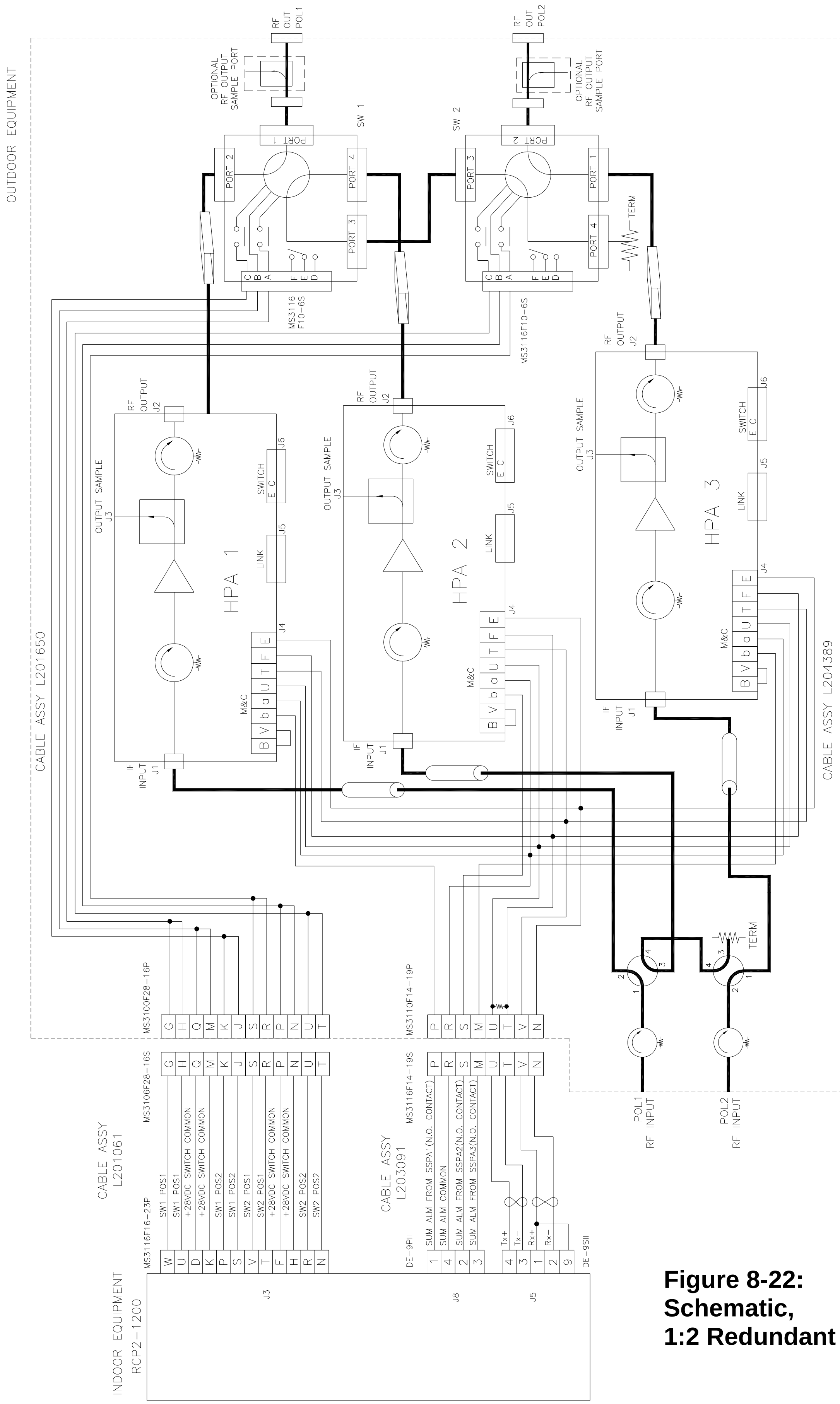

Figure 8-22: Schematic, 1:2 Redundant System

8.3 1:2 Redundant Systems with L-Band Input

The 1:2 Redundant System with L Band Input can be configured with internal Block Up Converters that contain internal 10 MHz reference oscillators or configured for use with an external 10 MHz reference source. Systems configured with internal 10 MHz reference are straightforward extensions of the basic 1:2 architecture. Because the 10 MHz reference is integral to the converter there is no possibility of an interruption of the 10 MHz during switchover. Furthermore the standby amplifier always has 10 MHz reference and will not be faulted. Such a system is shown in **Figure 8-23**.

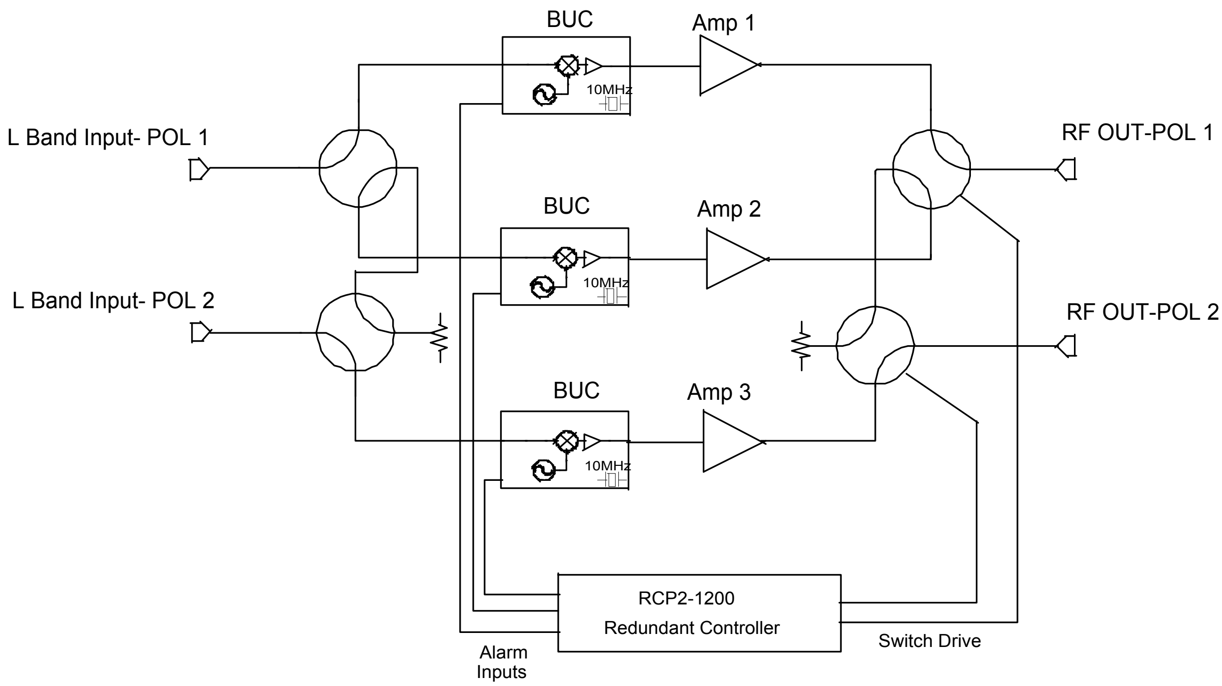

Figure 8-23: 1:2 Redundant System with L Band Input and Internally Referenced Block Up Converters (BUCs)

The Block Up Converters used in Satcom equipment typically use some form of phase locked local oscillator in the converter architecture. The Block Up Converter will signal an alarm condition whenever the oscillator looses phase lock. The amplifier will go into a mute state so that no spurious (off frequency) emissions can be transmitted to the satellite. The alarms from the BUCs and SSPAs are sent to the RCP2-1200 system controller which determines the proper switch conditions for the system.

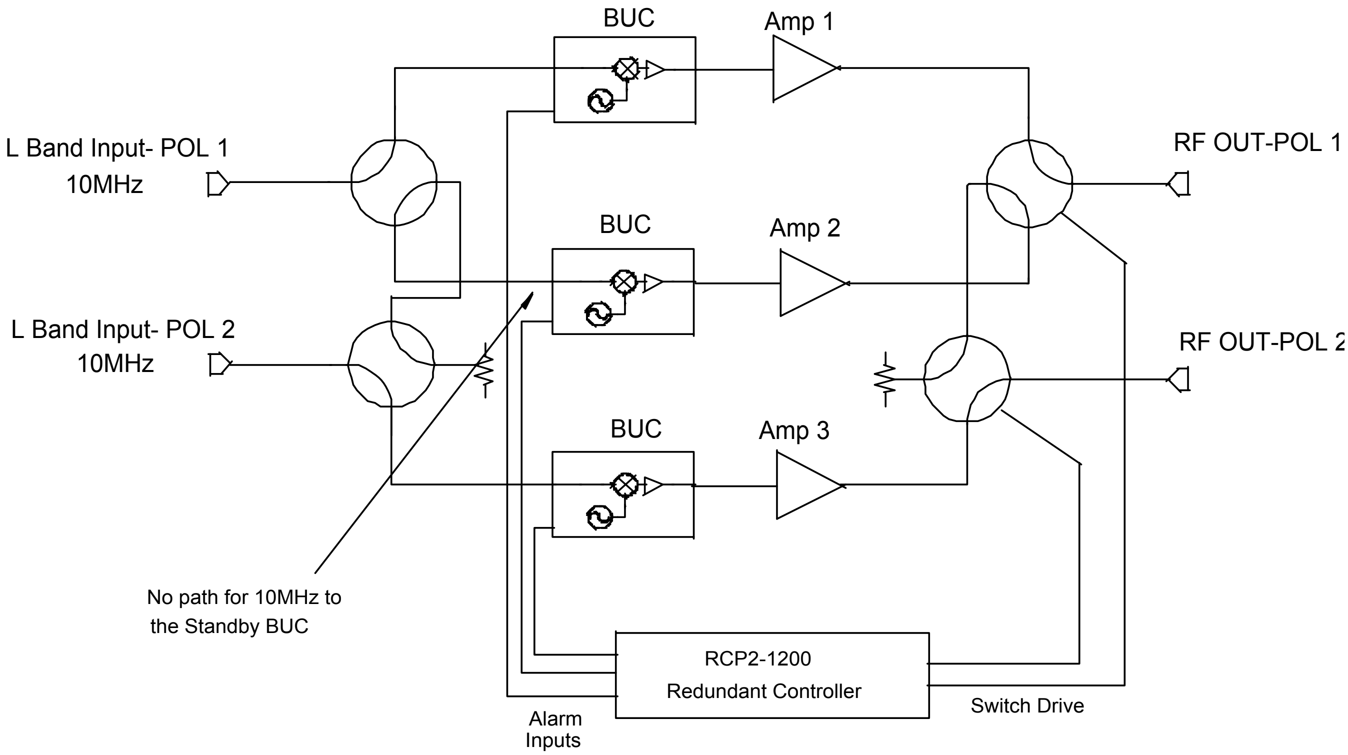

Figure 8-24: 1:2 Redundant System with External Reference showing the absence of 10 MHz reference to the stand-by BUC

A special case of the 1:2 Redundant System exists when an external reference is required of the system. With an external 10 MHz reference input on each polarity input to the system, the standby amplifier will not receive a reference signal and therefore would be in a faulted condition. In this state, the redundant controller will not allow the standby amplifier to come on line if a failure occurs with amplifier #1 or amplifier #3. See **Figure 8-24**.

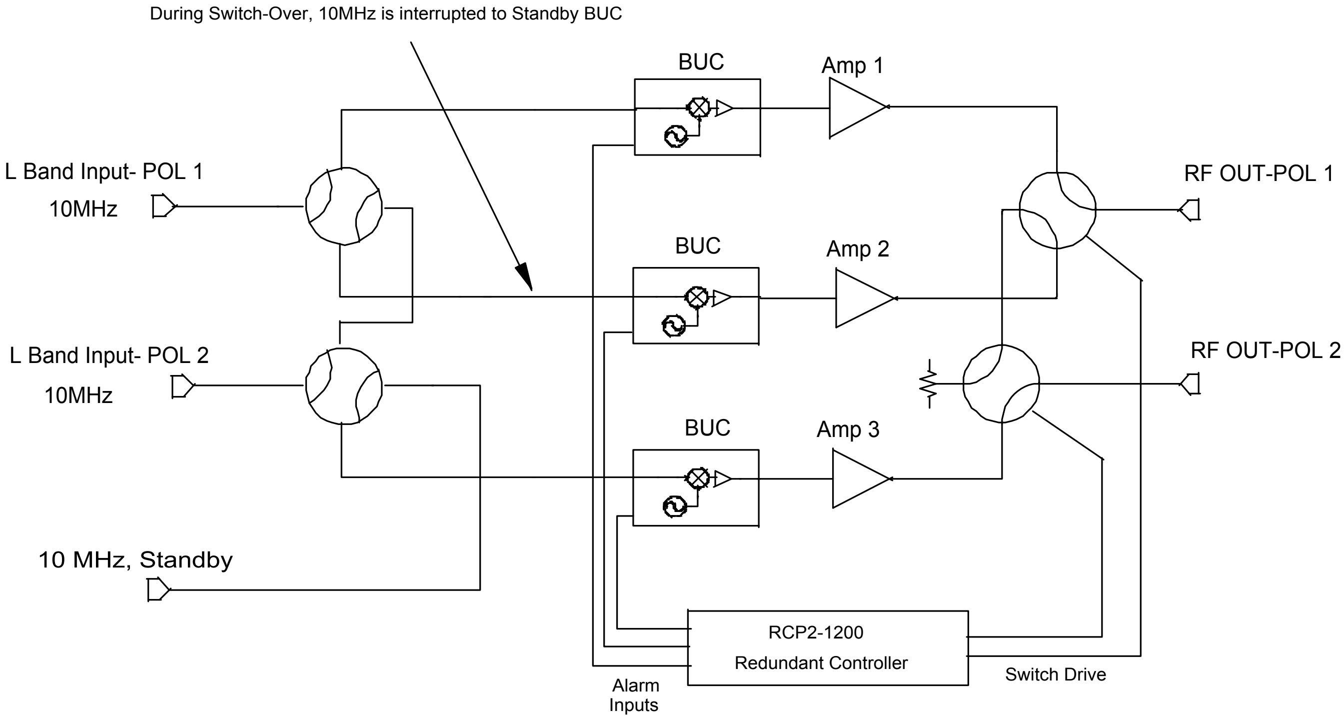

Figure 8-25: 1:2 Redundant System with (3) 10MHz inputs through the input switches. This arrangement allows for unreliable switch-over due to 10 MHz interruption to standby unit

At first it may be thought that a 10 MHz signal could be injected into the normally terminated port of the input switches. While in a normal operating state with all three BUCs operational this would work fine. However in the event of a failure of one of the on-line units, the 10 MHz would also be interrupted to the standby unit, as shown in **Figure 8-25**. Due to the quick determination of a unit fault, the controller will interpret a fault on the standby amplifier and reliable switchover can not be guaranteed.

To overcome the problems that result from interruption of the 10 MHz reference, it is imperative that the reference be injected in the system after the waveguide switches. One technique could be to install a multiplexer on the input of each amplifier that would allow the injection of the 10MHz reference. In this case a separate 10 MHz line would have to be run to the system and a three way splitter could distribute the reference to each amplifier.

The standard Teledyne Paradise Datacom configuration overcomes this issue by using a Reference Combiner assembly.

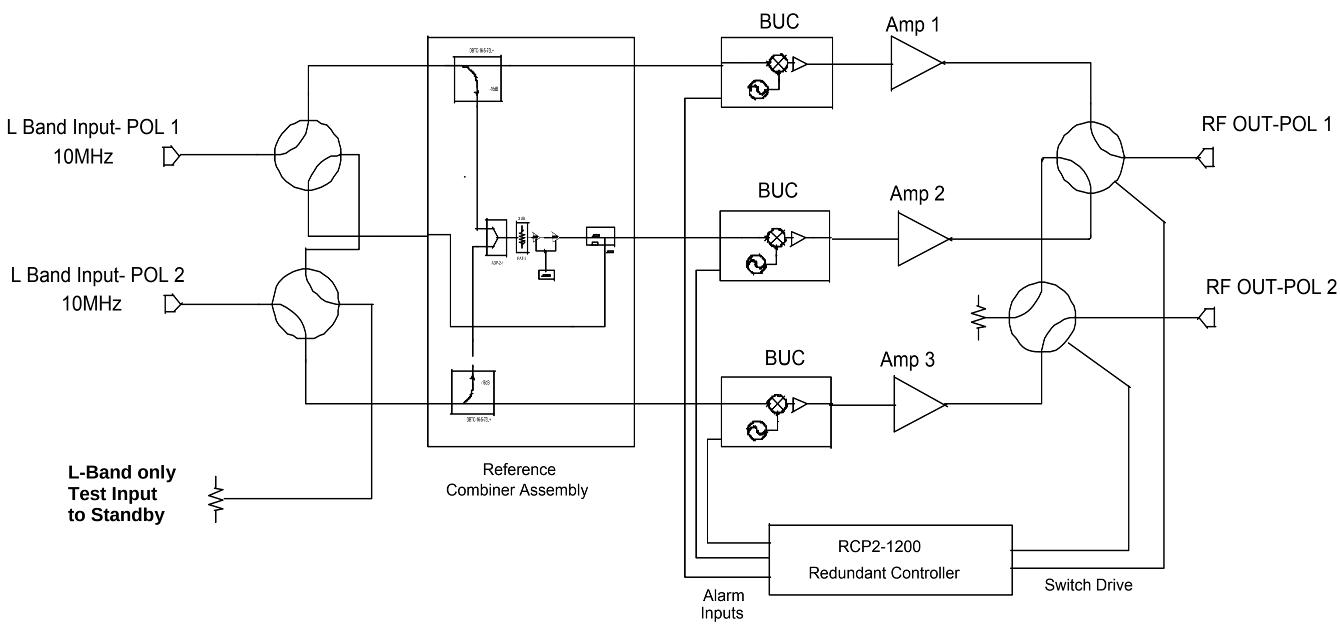

Figure 8-26: Standard 1:2 Redundant System with External 10MHz Reference using the Reference Combiner Assembly.

The Reference Combiner assembly couples a sample of the 10 MHz reference from each of the two polarity inputs. It will then supply the standby amplifier with the reference from either of the two inputs. The reference combiner will arbitrate and decide which 10 MHz signal to supply to the standby amplifier. It will not supply both 10 MHz sources to the standby amplifier. This allows all three amplifiers to be in a normal operating (non faulted) condition and the RCP2-1200 controller can operate the system in normal 1:2 redundancy. This eliminates the need for a separate 10 MHz line going to the system as the 10 MHz reference normally exists on each L-Band cable. See **Figure 8-26**.

Amp 2 is meant to be the standard stand-by amplifier in this configuration. Should Amp 1 or Amp 3 fault, the RCP2-1200 will automatically switch to the stand-by Amp 2. However, when this occurs, this interrupts the 10 MHz reference to the faulted Amp/BUC, which results in a constant BUC fault on that thread. In order to return Amp 2 to the stand-by state, the user will need to clear the fault, switch to manual mode on the RCP2-1200 and then select Amp 2 as stand-by. **Table 8-1** gives a step-by-step guide to returning Amp 2 to stand-by status.

Table 8-1: Returning Amp 2 to Stand-by Mode After Fault on Thread 1 or 3

Step	Action
1	Fault on Thread 1 or Thread 3 causes switchover to Thread 2
2	Determine cause of fault on Thread 1 or Thread 3 and remove fault condition
3	Switch to Manual mode on RCP2-1200
4	Select Amp 2 as stand-by amplifier
5	Switch to Auto mode on RCP2-1200

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9.0 Phase Combining Overview

Phase combining amplifiers has long been a popular means of increasing the output power of an amplifier system. Under high power microwave conditions it is common to utilize some form of waveguide hybrid coupler to combine the output power of two amplifiers. This coupler is generally a waveguide tee such as a four port magic tee. On the input side, common coaxial power splitters can be utilized to divide the power due to the lower power levels at the input of the system.

Figure 9-1 shows a typical block diagram of a phase combined amplifier pair. As long as the electrical delay, phase and amplitude of the two paths are kept within close tolerance of each other, the output power of the system will be twice the output power (+3dB) of a single amplifier.

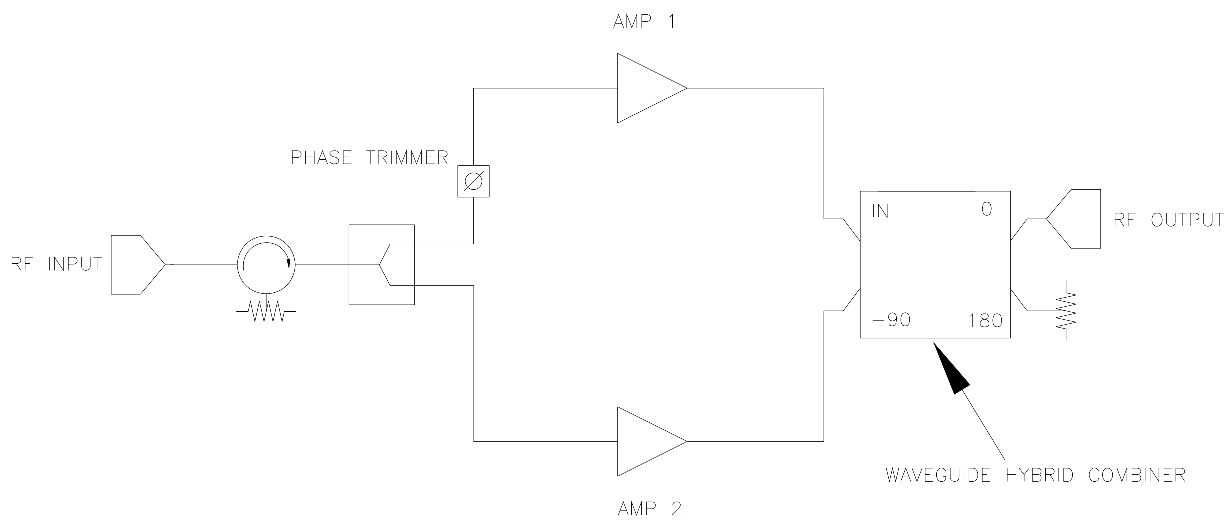


Figure 9-1: Phase Combined Amplifier System

The main drawback of this approach is that in the event of an amplifier failure, the total output power decreases by 6 dB, or a factor of 4. This does not offer the system much in the way of redundant capability with such a large decrease in output power capability. The power decrease is due to the fact that with only one amplifier active, the output combiner acts as a power divider. The output power from the remaining amplifier is divided between the output of the system and the terminated port of the hybrid combiner. Thus only one half of the power from one amplifier reaches the output port which is 6 dB less than the combined output power from both amplifiers.

A high power system requiring a degree of redundancy needs some means of bypassing the combiner in the event of an amplifier failure. This would allow the full output power capacity of the remaining amplifier to reach the output. In this case the total RF output power would only decrease by 3 dB from the phase combined output power. A 3 dB reduction in output power is generally more tolerable to a system's link budget thereby giving the system a degree of redundancy.

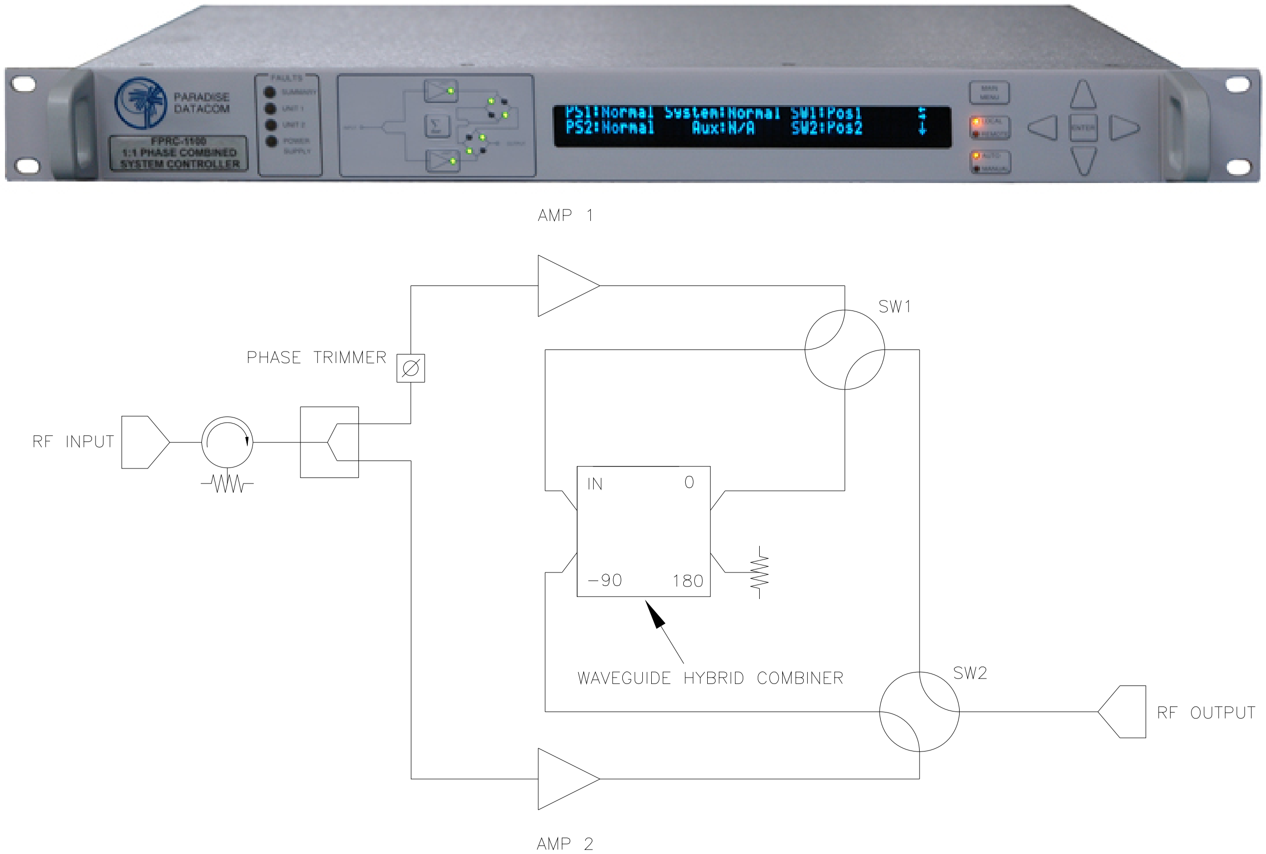


Figure 9-2: 1:1 Fixed Phase Combined System with FPRC-1100 controller

A technique has been developed which accomplishes phase combining and provides redundancy with two waveguide transfer switches. A block diagram of such a system is shown in **Figure 9-2**.

This type of system is sometimes referred to as a “Fixed Phase” combined system to differentiate it from the Variable Phase Combiner (VPC) systems commonly used with TWTAs. In the 1:1 Fixed Phase Combined system, the waveguide switches allow the amplifier outputs to either be directed into the combiner or bypass the combiner and connect directly to the RF output.

Teledyne Paradise Datacom has developed a series of controllers that greatly enhances the operation of the phase combined system. The FPRC-1100 Phase Combined System Controller is designed specifically to control 1 for 1 Fixed Phase Combined redundant amplifier systems. The FPRC-1200 Phase Combined System Controller allows remote control of 1 for 2 Fixed Phase Combined redundant amplifier systems.

Each controller can be used in either manual or automatic mode to monitor the system amplifiers for faults and operate the transfer switches. The controller has a very user friendly interface that allows the operator to monitor the composite output power of the system and adjust the gain of the amplifiers in 0.1 dB increments over a 20 dB range. The controller adjusts each amplifier in the system and keeps the amplitude of each balanced for optimal power combining. To the operator, the system appears as a single amplifier. The operator can choose between using the system as a phase combined system or a traditional redundant system.

9.1 1:1 Fixed Phase Combined System Components

An outline drawing of a 1:1 Fixed Phase Combined Amplifier assembly is shown in **Figure 9-3** on the following page. The system consists of:

- (1) Amplifier Base Assembly, which comprises:
  - (1) Mounting Base (Frame or Plate)
  - (2) Compact Outdoor SSPAs
  - (1) Waveguide Switch Assembly
  - (1) Signal Box Assembly
  - (2) Cable Assemblies between SSPAs and Signal Box
- (1) FPRC-1100 1:1 Phase Combined Redundant Controller
- (2) Cable Assemblies between Signal Box and FPRC-1100
- (2) AC line cables
- (1) Quick Start RS-232 Cable for test / debug

The Amplifier Base Assembly is typically shipped intact. Verify that the hardware is securely tightened for each Compact Outdoor amplifier and make sure to observe the amplifier's position indicator. If facing the RF Output end of the amplifiers, HPA #1 should be on the left hand side and HPA #2 should be on the right hand side as shown in **Figure 9-3**.

Verify that the connections of the Waveguide Switch Assembly mate with the proper SSPA.

9.1.1 Signal Box Assembly

The Signal Box Assembly contains the RF input isolator and splitter that routes the RF to each amplifier. It also routes the monitor and control signals from each amplifier back to the FPRC-1100 system controller.

The signal box also contains a phase shifter. This phase shifter is in cascade with the RF input to HPA #1. This allows the system to achieve optimum power combining and is factory set for optimum combining across the full bandwidth of the amplifier. It should not normally require adjustment in the field unless and amplifier has been replaced.

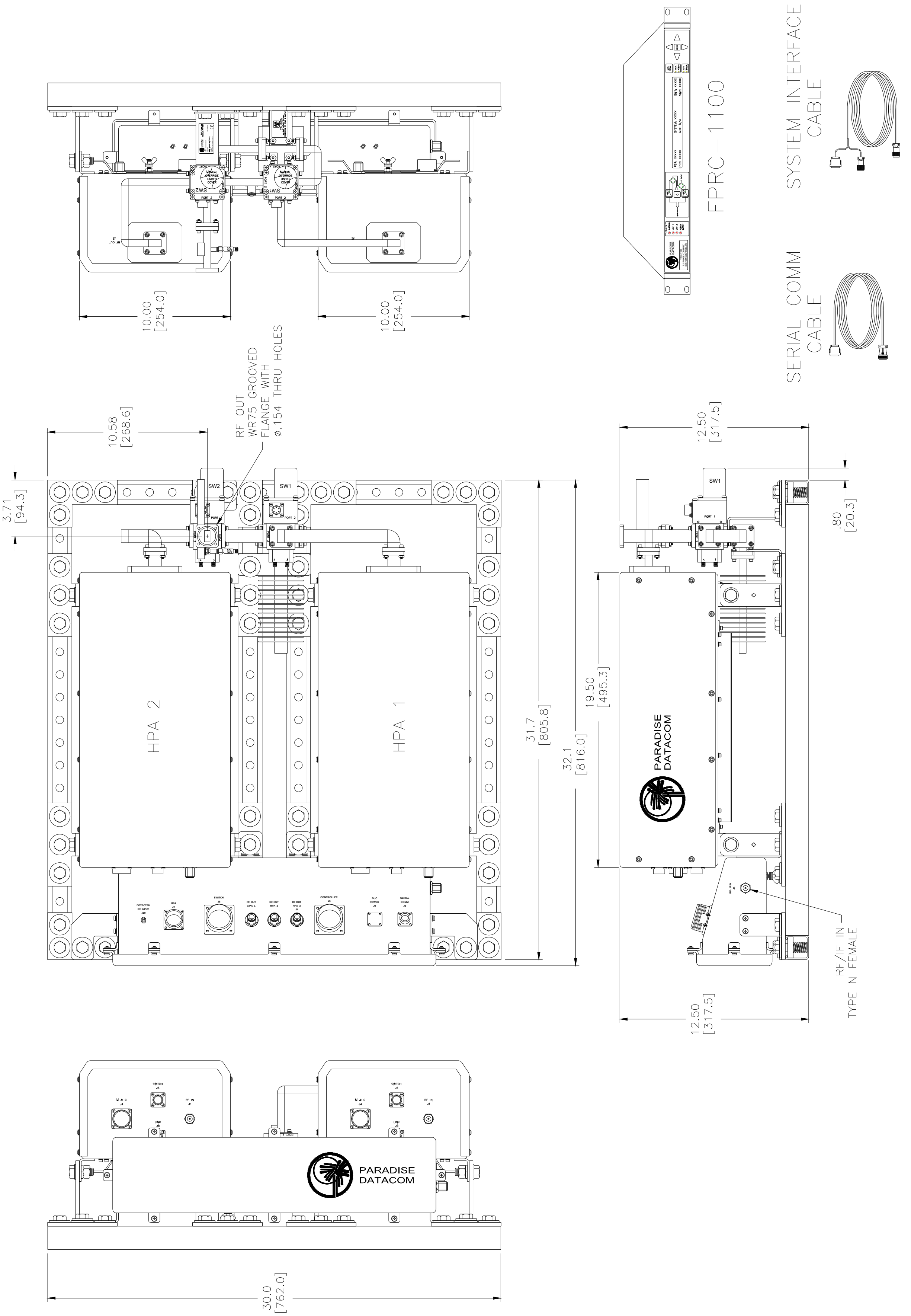


Figure 9-3: Outline, 1:1 Fixed Phase Combined System

9.2 1:1 Fixed Phase Combined System Operation with the FPRC-1100

Under normal system operation, both HPA #1 and HPA #2 are on-line. Their output power is combined at the magic-tee waveguide combiner. The waveguide combiner has an integral RF sampler that provides a sample of the RF output sample at -40 dBc. This port feeds an RF attenuator/diode detector combination. The detector's output voltage is sent back to the Signal box via a coaxial cable and linked to the FPRC-1100 Redundant Controller.

The FPRC-1100 is a 1 RU high indoor controller that can remotely monitor and control the 1:1 Fixed Phase Combined system. The controller has a very user friendly interface that allows the operator to monitor the composite output power of the system and adjust the gain of the amplifiers in 0.1 dB increments over a 20 dB range. The controller adjusts each amplifier in the system and keeps the amplitude of each balanced for optimal power combining.

The FPRC-1100 can be used in automatic or manual mode. In manual mode if a fault occurs in one of the amplifiers, a fault will be indicated on the front panel but no waveguide switch change will occur. In automatic mode the controller will determine the appropriate waveguide switch positions and switch the remaining two amplifiers on line. This will ensure that the system is operating at full output power capability.

Figure 9-4: FPRC-1100 Phase Combined System Controller

The FPRC-1100 front panel is shown in Figure 8-4. In most cases the user will place the controller in Auto mode so that the controller can determine the proper switch position in the event of an amplifier failure. The mimic display shows the position of each waveguide switch by lighting an LED in the waveguide switch path.

Detailed information on the installation and operation of the FPRC-1100 can be found in the unit's operations manual, Teledyne Paradise Datacom drawing #**209351**.

9.3 1:1 Fixed Phase Combined System with L-Band Input

The basic 1:1 Fixed Phase Combined system topology is very similar to a 1:1 redundant system and is shown in **Figure 9-5**. When in Automatic mode, the waveguide switches (SW1 & SW2) either direct each amplifier output to the waveguide phase combiner or, if lower output power is required, bypass the combiner and send an individual amplifier output to the system output. The system shown in **Figure 9-5** utilizes a redundant controller on the BUCs in the signal box, along with the SSPA controller to control the phase combining.

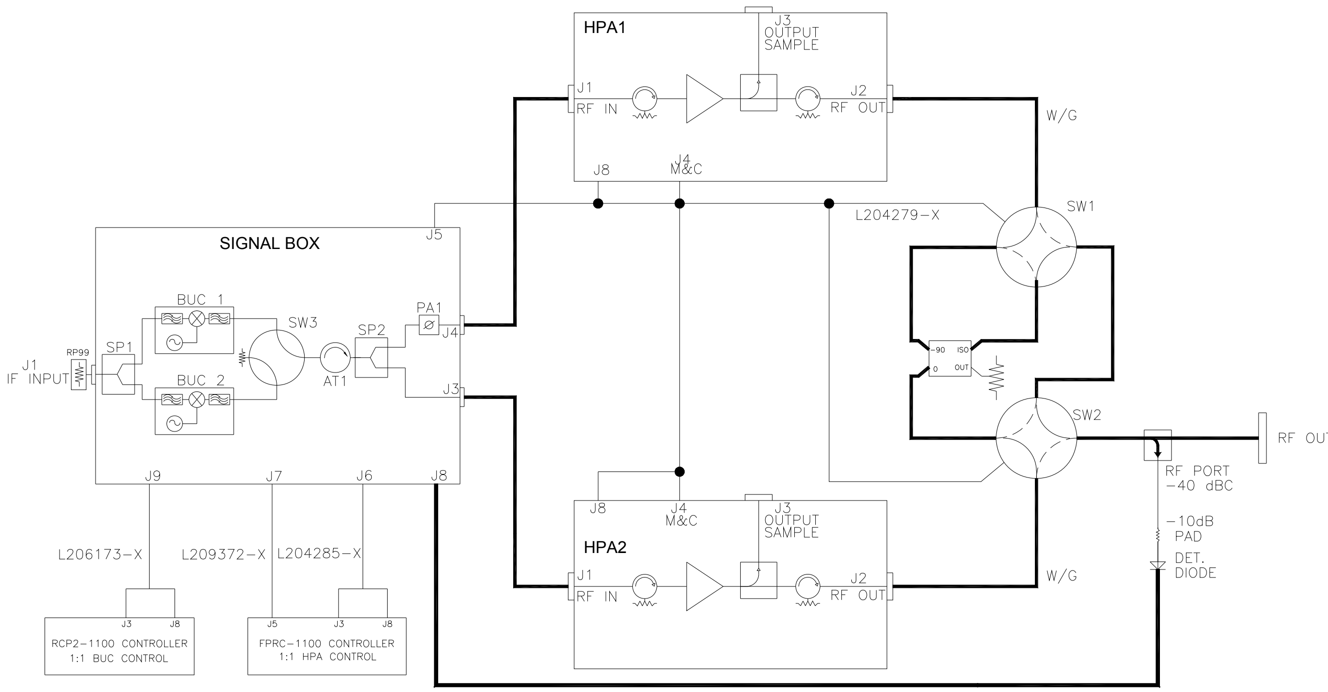


Figure 9-5: 1:1 Phase Combined System with HPA control of BUC redundancy

A FPRC-1100 controller directs the HPA output switches and monitors the amplifiers. While the system is operating in phase combined mode and an amplifier enters a fault condition, the controller will switch the faulted amplifier offline. This provides a soft fail mode and results in a power decrease of 3dB to the system output power.

The BUC switch (SW3) is driven by an indoor unit RCP2-1100 redundant system controller. When a fault is detected, the switch is driven to place the faulted BUC offline without user intervention.

This system may also be operated via manual mode. This mode of operation may offer some benefits over automatic operation. When in manual mode, the amplifiers will not switch out of Phase Combined Mode or switch to the operational amplifier without user intervention if an HPA fault occurs.

However, if a BUC fault occurs, the RCP2-1100 will direct SW3 to place the operational BUC online. A fault indicator will be present on the front panel of the RCP unit, but the system output would be unaffected by the fault.

9.3.1 1:1 Fixed Phase Combined System with L-Band Input Components

An outline drawing of a 1:1 Fixed Phase Combined Amplifier with L-Band Input assembly is shown in **Figure 9-7** on the following page. The system consists of:

- (1) Amplifier Base Assembly, which comprises:
  - (1) Mounting Base (Frame or Plate)
  - (2) Compact Outdoor SSPAs
  - (1) Waveguide Switch Assembly
  - (1) Signal Box Assembly with 1:1 Redundant Block Up Converter System
  - (2) Cable Assemblies between SSPAs and Signal Box
  - (1) Cable Assembly between Signal Box and Waveguide Switch Assembly
- (1) FPRC-1100 1:1 Phase Combined SSPA System Controller
- (2) Cable Assemblies between Signal Box and FPRC-1100
- (1) RCP2-1100 1:1 Redundant Controller for BUC switch
- (1) Cable Assembly between Signal Box and RCP2-1100
- (2) AC line cables
- (1) Quick Start RS-232 Cable for test / debug

9.3.2 Signal Box Assembly

The Signal Box Assembly contains the Redundant BUC Assembly including the coaxial switch, the RF input isolator and splitter that routes the RF to each amplifier. It also routes the monitor and control signals from each amplifier back to the FPRC-1100.

The signal box also contains a phase shifter. This phase shifter is in cascade with the RF input to HPA #1. This allows the system to achieve optimum power combining and is factory set for optimum combining across the full bandwidth of the amplifier. It should not normally require adjustment in the field unless and amplifier has been replaced.

9.3.3 Redundant BUC Operation

With the addition of an RCP2-1100, the BUCs function as an independent, fully redundant 1:1 system that is not affected by the status of the 1:1 phase combined SSPAs.

9.3.4 Adjusting the Phase Combining

The system is phase adjusted for optimum performance across the frequency band at the factory, and no adjustments are typically needed except in the event that a SSPA has been replaced.

The SSPAs are manufactured to a delay specification, but an adjustment may be necessary to achieve the best operation in the system. After installing the replacement amplifier, attach a power meter or spectrum analyzer to the cross-guide coupler at the output of the system after removing the detector and attenuator. See **Figure 9-6**. Measure the power output of the system. Note that this is a –40 dBc sample.

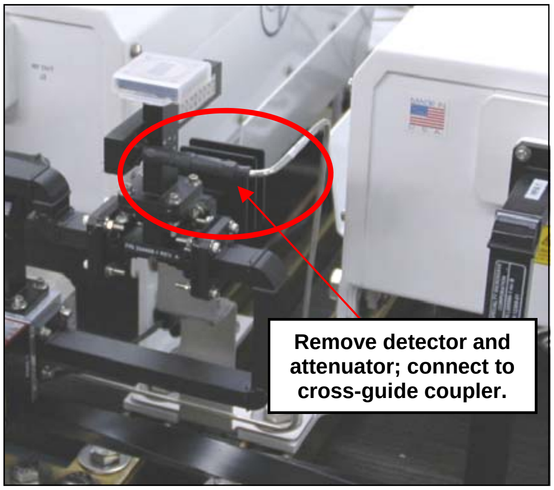


Figure 9-6: Connect to coupler

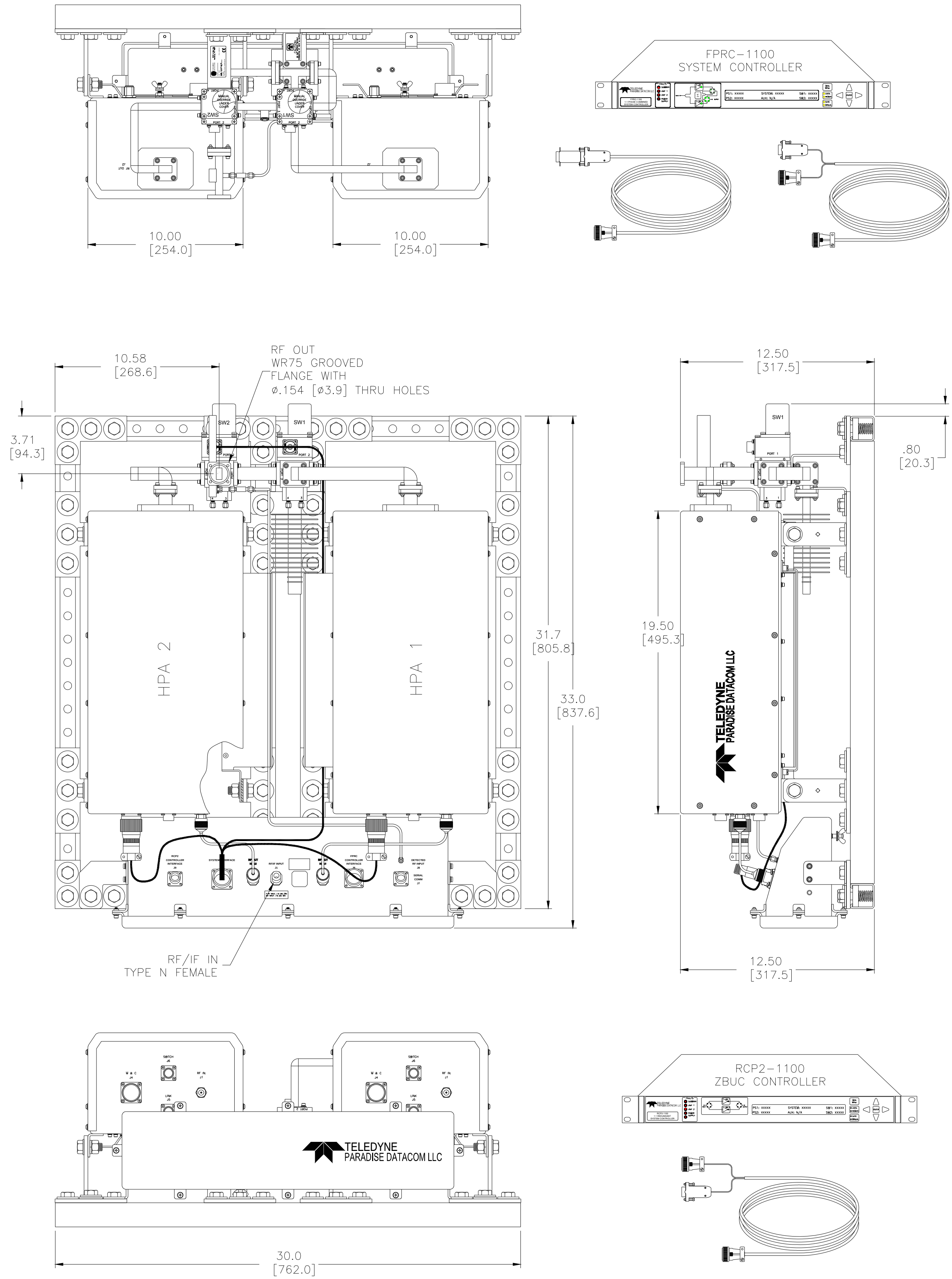


Figure 9-7: Outline, 1:1 Fixed Phase Combined System with L-Band Input

You may alternately use the FPRC-1100 controller's output power display (available by pressing the **Main Menu** key; select **5.Options** and press the **Enter** key; select **6.More** and press the **Enter** key; select **5.SSPA** and press the **Enter** key; select **3.View** and press the **Enter** key. The System Forward RF Output Power is shown in the upper right of the display).

Remove the cover from the Signal Box and loosen the locking nut on the phase adjuster (7/16") and slowly rotate the knob clockwise. See **Figure 9-8**. Continue to rotate the knob until the output power is peaked.

Figure 9-8: Phase adjuster

For optimum performance across the entire frequency range of the SSPA system, choose another frequency near each band edge and repeat the steps above. It may be necessary to find the best compromise in output power for broadband use.

The BUCs are outside the phase combined loop. Therefore, replacing a BUC will not impact the phase combining of the system, and no adjustment of the phase shifter is necessary.

Once the phase adjustments are complete, tighten the locking nut on the phase adjustment knob and securely fasten the cover back on to the Signal Box.

9.4 1:2 Fixed Phase Combined Systems

The 1:2 Fixed Phase Combined Redundant System is a popular system architecture that enables Solid State Power Amplifiers to achieve higher output power levels while building in full-power redundancy. The basic system topology is similar to a 1:2 redundant system and is shown in **Figure 9-9**.

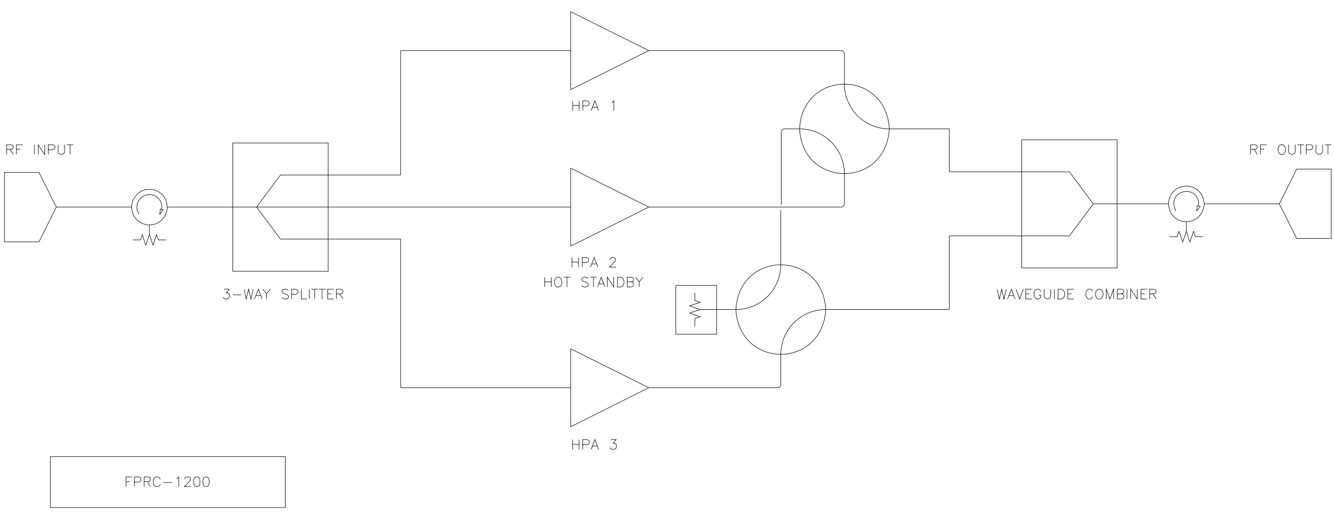


Figure 9-9: Block Diagram, 1:2 Fixed Phase Combined System

In this system, amplifiers #1 and #3 are normally online. The outputs of #1 and #3 are directed by the waveguide switches into a fixed phase combiner such as a waveguide "magic tee" style combiner. In the event of a failure of either on line amplifier, the standby amplifier, #2, can be switched in place of either #1 or #3 and the system maintains full output power.

The 1:2 Fixed Phase Combined Amplifier System can be configured with any of the Compact Outdoor Amplifiers listed in **Appendix D** in either C- or Ku-Band. The output power of the system is two-times the output power of the single SSPA.

System designers find that the 1:2 Fixed Phase Combined Amplifier System topology is a very cost effective solution to realizing higher power amplifier systems. For example, it is less expensive to configure a 1 kW C-Band redundant system using (3) 500W Compact Outdoor Amplifiers in a 1:2 Fixed Phase Combined redundant system than it is to use (2) 1 kW amplifiers in a traditional 1:1 Redundant System.

9.4.1 1:2 Fixed Phase Combined System Components

An outline drawing of a 1:2 Fixed Phase Combined Amplifier assembly is shown in **Figure 9-9**. The system consists of:

- (1) Amplifier Base Assembly, which comprises:
  - (1) Mounting Base (Frame or Plate)
  - (3) Compact Outdoor SSPAs
  - (1) Waveguide Switch Assembly
  - (1) Signal Box Assembly with Integrated Block Upconverters
  - (2) Cable Assemblies between SSPAs and Signal Box
- (1) FPRC-1200 1:2 Phase Combined Redundant Controller
- (2) Cable Assemblies between Signal Box and FPRC-1100
- (3) AC line cables
- (1) Quick Start RS-232 Cable for test / debug

The Amplifier Base Assembly is typically shipped intact. Verify that the hardware is securely tightened for each Compact Outdoor amplifier and make sure to observe the amplifier's position indicator. If facing the RF Output end of the amplifiers, SSPA #3 should be on the left hand side, SSPA #2 should be in the center, and SSPA #1 should be on the right hand side as shown in **Figure 9-10**.

Verify that the connections of the Waveguide Switch Assembly mate with the proper SSPA.

The FPRC-1200 controller is a 1 RU external controller specifically designed to handle such an amplifier system. It not only handles all traditional fault monitoring and switching duties, but also provides an overall system monitor and control facility.

9.4.2 Signal Box Assembly

The Signal Box Assembly contains the RF input isolator and three way splitter that routes the RF to each amplifier. It also routes the monitor and control signals from each amplifier back to the FPRC-1200 system controller.

The Signal Box also contains two phase shifters. These phase shifters are in cascade with the RF input to HPA #1 and HPA #3. These allow the system to achieve optimum power combining and are factory set for optimum combining across the full bandwidth of the amplifier. They should not normally require adjustment in the field unless and amplifier has been replaced.

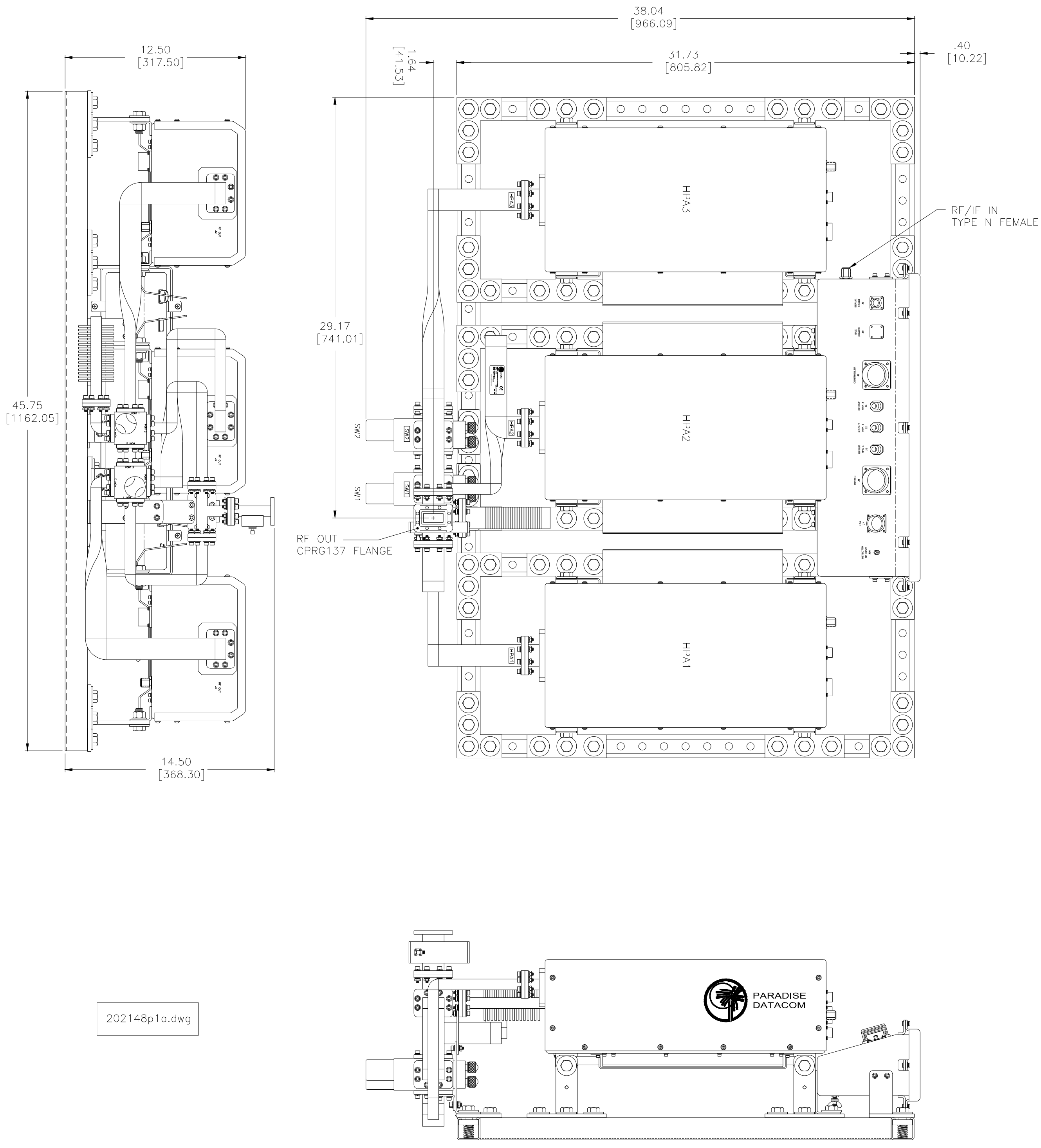


Figure 9-10: Outline, 1:2 Fixed Phase Combined System, C-Band

9.5 1:2 Fixed Phase Combined System Operation with FPRC-1200

Under normal system operation, HPA #1 and HPA #3 are on-line. Their output power is combined at the magic-tee waveguide combiner. The waveguide combiner has an integral RF sampler that provides a sample of the RF output sample at -40 dBc. This port feeds an RF attenuator / diode detector combination. The detector's output voltage is sent back to the Signal box via a coaxial cable and fed to the FPRC-1200 Redundant Controller.

The 1:2 Fixed Phase Combined System is controlled by an FPRC-1200 1:2 Redundancy Controller. Detailed information on the installation and operation of the FPRC-1200 can be found in the unit's operations manual, Teledyne Paradise Datacom drawing #**205933**.

The FPRC-1200 can be used in automatic or manual mode. In manual mode if a fault occurs in one of the amplifiers, a fault will be indicated on the front panel but no waveguide switch change will occur. In automatic mode the controller will determine the appropriate waveguide switch positions and switch the remaining two amplifiers on line. This will ensure that the system is operating at full output power capability.

The FPRC-1200 front panel is shown in **Figure 9-11**. In most cases the user will place the controller in Auto mode so that the controller can determine the proper switch position in the event of an amplifier failure. The mimic display shows the position of each waveguide switch by lighting an LED in the waveguide switch path.

Figure 9-11: FPRC-1200 1:2 Phase Combined Redundant Controller

In normal operation, HPA #2 should be selected as the standby amplifier. HPA #2 is the middle amplifier on the amplifier frame. This allows HPA #1 and HPA #3 to be combined by the waveguide combiner. If HPA #1 or HPA #3 were to ever fail, HPA #2 can be switched in place of either HPA #1 or HPA #3 and the system will still maintain full output power capability over the full operating bandwidth of the amplifier. **Figure 9-12** shows the FPRC-1200 with HPA #2 selected as the standby amplifier.

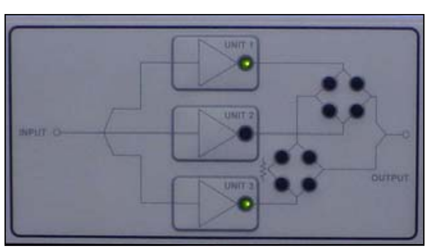


Figure 9-12:
HPA #1 & HPA #3 on line with HPA #2 on standby

9.5.1 Phase Adjustment

Each 1:2 Fixed Phase Combined SSPA System has been factory set for optimal Phase Combining before shipment and should not need adjustment during installation and operation. In the event that an amplifier is replaced, it may then be necessary to make additional phase adjustment.

Connect a power meter or spectrum analyzer to the cross-guide coupler at the output of the system after removing the detector and attenuator. See **Figure 9-13**. You may alternately use the FPRC-1200 controller's output power display, available by pressing the **Main Menu** key; select **5.Options** and press the **Enter** key; select **6.More** and press the **Enter** key; select **5.SSPA** and press the **Enter** key; select **3.View** and press the **Enter** key. The System Forward RF Output Power is shown in the upper right of the display.

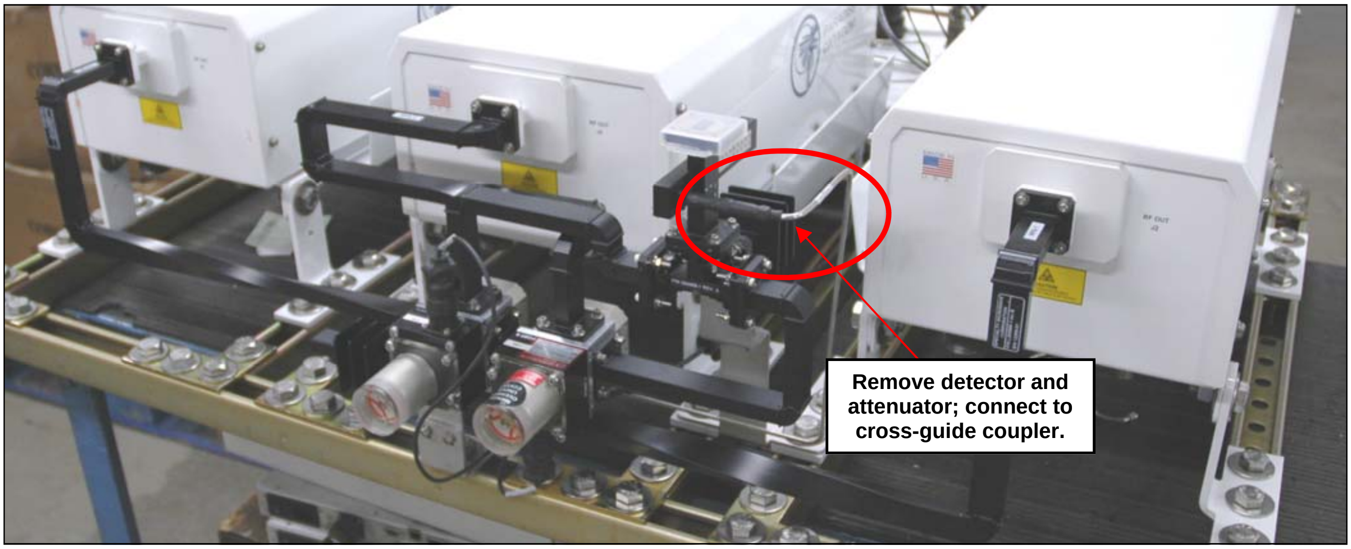


Figure 9-13: Connect to coupler

The two phase adjusters are located inside the Signal Box and are labeled PA1 and PA2. To make adjustments, loosen the 7/16" locking nut at the bottom of the phase adjuster.

To adjust the phase combining, un-mute all amplifiers and, using the FPRC-1200, set HPA #1 as the standby amplifier. Vary phase adjuster 2 (PA2) to peak the power reading on the power meter or spectrum analyzer, or from the FPRC-1200 controller's output power display.

With HPA #2 and #3 power combined, phase adjuster (PA2) will be used to maximize the output power. Next, select HPA #2 as the standby. This combines HPA #1 and HPA #3. Use phase adjuster (PA1) to optimize power.

It may be necessary to repeat the steps above to verify the power with all HPA combinations. Choose the best compromise in power for all combinations so that if switch over on fault does occur there is no noticeable increase or decrease in output power.

After phase combining is complete use the locking nut on each phase adjuster to secure the adjustment knob so no accidental changes to the combining occur.

Before placing the system back in operation, replace the cover to the Signal Box, and reconnect the detector and attenuator to the cross-guide coupler, ensuring the connection is sealed against moisture intrusion.

10.0 Serial Protocol Overview

The Compact Outdoor SSPA can be managed and controlled over a variety of remote control interfaces (see **Figure 10-1**).

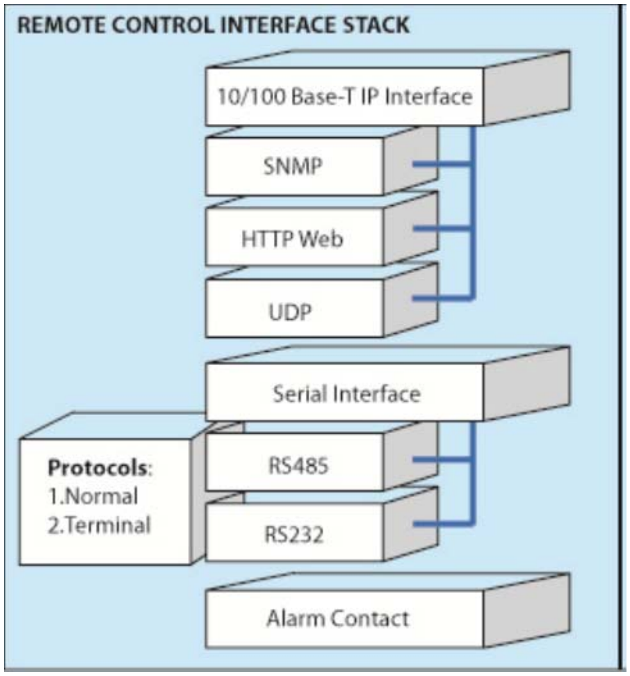


Figure 10-1: Compact Outdoor Remote Control Interface Stack

Serial interface can be selected between RS-232/RS-485, Ethernet 10/100Base-T or FSK over IFL input (FSK interface is available only on units with an optional L-Band block up converter). RS-232/RS-485 interface can be used in conjunction with Paradise CO SSPA serial protocol (aka Normal protocol) or Legacy Paradise VSAT BUC serial protocol (aka VSAT protocol).

Serial protocol format for all serial protocols is set at no parity, 8 bit with 1 stop bit. Baud rate is selectable.

> **Note: Binary protocol used on previous generation units are no longer supported. Terminal protocol was re-introduced starting with version 6.60**

Compact Outdoor SSPAs are capable of supporting simultaneous multiple remote control interfaces. Depending on the protocol selection settings and drive of Baud0 and Baud1 pins on J4 M&C connector. See **Table 10-2** or **Section 3.3**.

The Ethernet interface for units with firmware version 6.0 or later utilizes industry standard 10/100 Base-T IP protocol and supports the IPv4 addressing schema. Units with previous firmware versions use 10 Base-T IP protocol. Normally, straight-through Cat5e/Cat6 cable is used to connect the unit to a network hub, and a crossover Quick-Start cable is used to connect directly to a computer’s Ethernet port.

Note: The supplied Quick Start cable is a crossover cable designed to connect the unit directly to a PC's NIC card. Some network hubs and switches are not equipped with an auto cable sense feature and may not work with this cable!

The selected interface is controlled by a combination of internal SSPA settings and Interface control pins: Baud1 (Pin e) and Baud0 (Pin j) on the J4 M&C connector (See **Table 10-1**). The operator may modify the connections to these pins to have some control over the serial interface, bypassing EEPROM settings for Protocol, Baud Rate or Network Address. This feature becomes important if the operator accidentally selects the wrong protocol or baud rate of the SSPA and wants to revert the unit to a known state

Table 10-1: Interface Selection (Serial Numbers < 400,000)

Baud0 (Pin j) state	Baud1 (Pin e) state	Selected interface
Open	Open	Interface selected by Internal SSPA settings
Closure to Chassis ground	Open	Interface is forced to Ethernet interface. IP address is software selectable. Protocol is forced to Normal (HTTP web supported)
Open	Closure to Chassis ground	Interface is forced to Ethernet interface. IP address is fixed to 192.168.0.9. Protocol is forced to Normal (HTTP web supported)
Closure to Chassis ground	Closure to Chassis ground	Interfaced is forced to 9600 Baud serial.

Note: The state of these pins is sensed by the SSPA unit only at power up! Changing the state of these pins during normal unit operation will not affect the selected type of interface.

Compact Outdoor units with the 4th generation of I/O cards allow the use of multiple concurrent interfaces. These units have serial numbers greater than 400,000 or firmware version 6.00 and above. By default, most available interfaces will be kept on and can be used simultaneously without any limiting factors. Legacy NDSat interface is disabled by default, but is still available as a specific selection.

For compatibility purposes, some legacy protocol selection is still available. Selecting SNMP protocol will disable IPNet operation and internal web page function; Selecting NDSat protocol will disable Normal serial protocol. Terminal mode protocol was re-introduced to the protocol stack with version 6.60. Selecting Terminal mode will disable Normal protocol operation over serial port. IPNet, web and SNMP interfaces will continue to operate normally. It is possible to use Baud Select pins j and e to force specific IP address and protocol. See **Table 10-2**.

Table 10-2: Interface Selection (Serial Numbers > 399,999)

<table>
<tr><th>Baud0 (Pin j) state</th><th>Baud1 (Pin e) state</th><th>Selected interface</th></tr>
<tr><td>Open</td><td>Open</td><td rowspan="2">Interface, Baud Rate and IP Address are all selected by internal SSPA settings.</td></tr>
<tr><td>Closure to Chassis ground</td><td>Open</td></tr>
<tr><td>Open</td><td>Closure to Chassis ground</td><td>IPNet, Web, SNMP and Serial interfaces with Normal protocol will be enabled. IP Address is fixed to 192.168.0.9. Baud rate is selectable by internal SSPA settings.</td></tr>
<tr><td>Closure to Chassis ground</td><td>Closure to Chassis ground</td><td>IPNet, Web, SNMP and Serial interfaces with Normal protocol will be enabled. IP Address is fixed to 192.168.0.9. Baud rate is fixed to 9600.</td></tr>
</table>

Pins j and e on the J4 M&C connector have internal pull-ups and if left disconnected will remain in logic high state. The reverting function of the SSPA is active only on initial power-up. Any alterations to the pins' state after start-up will allow the SSPA to use internal EEPROM settings to select the baud rate and protocol.

Pins j and e on the J4 M&C connector are also used for automatic addressing (for I/O board firmware levels of 3.50 or later).

To turn on automatic addressing:

1. Connect to the SSPA over serial interface;
2. Set the SSPA unique network address to 170 (Hex 0xAA);
3. Cycle the unit's power. The unit will start with default baud rate of 9600 and Standard String Protocol selection. Pins j and e now will determine the SSPA unique address (See **Table 10-3**).

Table 10-3: Unique Network Address Hardware Select [1]

Jumper 1	Jumper 2	SSPA Unique Address
j-d	e-V	1
j-d	none	2
none	e-V	3
none	None	4

1: SSPA address in EEPROM must be set to 0xAA in order to activate this option

If it is ever necessary to revert the SSPA to a known interface state, follow the steps below:

1. Turn off the SSPA;
2. Establish wire jumpers to the M&C connector (J4) according to the desired protocol selection as shown in **Table 10-1** or **Table 10-2**;
3. Turn on the SSPA and remove the jumpers;
4. Connect to the SSPA over serial protocol and use the Universal M&C application to select the desired settings for protocol and baud rate. Settings will take effect on the next SSPA power-up.

FSK interface allows the selection of Normal and VSAT protocols.

Note: For proper FSK interface operation, the SSPA internal settings must be selected to 9600 Baud and Normal protocol. Do not make a connection to interface control pins Baud1 and Baud0!

Note: For maximum ESD protection of a SSPA's Serial interface internal circuit, the RS-232/RS-485 interface is isolated from the SSPA chassis ground. Serial interface has a separate interface ground pin (Pin d on the J4 connector). Connecting this pin to common ground will effectively disable the protection circuit and may cause interface failure.

All interface lines are equipped with transient suppression devices. Adding extra transient protection to communication lines is not required and may cause interface failure!

10.1 Serial communication

This section describes the normal communication protocol between the CO SSPA and a host computer over RS-232/RS-485 serial interface. Serial port settings on the host computer must be configured for 8 bit data at no parity, with 1 stop bit. The baud rate should match the selected baud rate parameter on the SSPA unit.

Selection between the RS-232 and RS-485 interface depends on the state of pin D of the J4 M&C connector. Connect pins D and d to select RS232 interface. Otherwise SSPA will operate in RS485 mode.

The unit will only respond to properly formatted protocol packets. The basic communication packet is shown in **Figure 10-2**. It consists of a Header, Data, and Trailer sub-packet.

HEADER (4 bytes)	**DATA** (6-32 bytes)	**TRAILER** (1 byte)

Figure 10-2: Basic Communication Packet

10.1.1 Header Packet

The Header packet is divided into 3 sub-packets which are the Frame Sync, Destination Address, and Source Address packets, as shown in **Figure 10-3**.

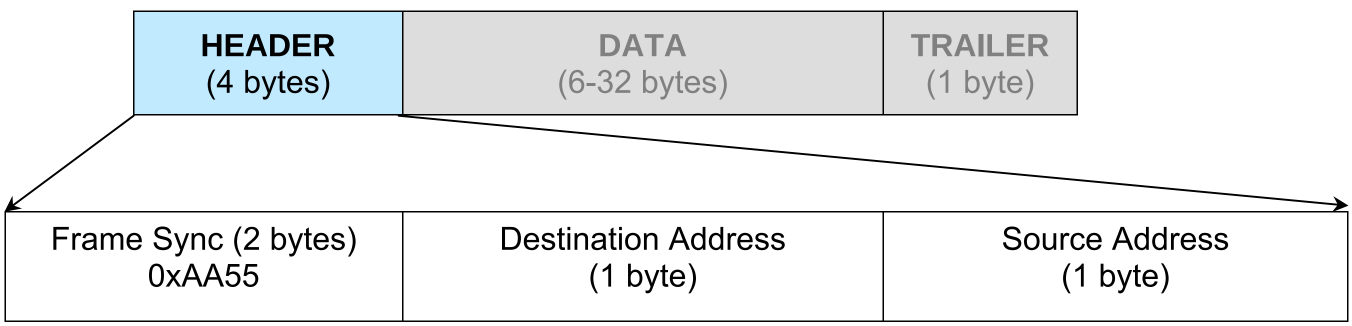


Figure 10-3: Header Sub-Packet

10.1.1.1 Frame Sync Word

The Frame Sync word is a two byte field that marks the beginning of a packet. This value is always 0xAA55. This field provides a means of designating a specific packet from others that may exist on the same network. It also provides a mechanism for a node to synchronize to a known point of transmission.

10.1.1.2 Destination Address

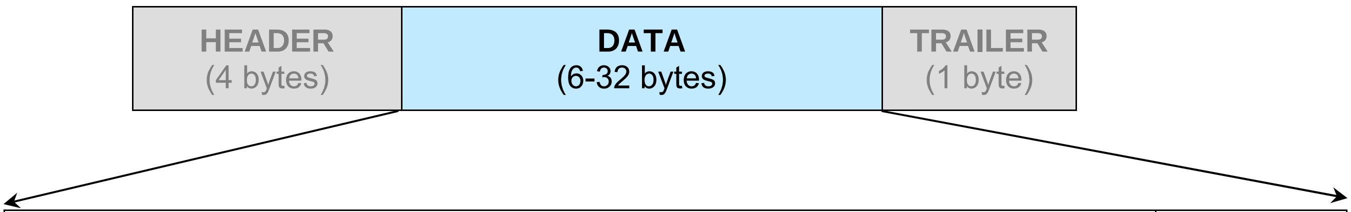
The destination address field specifies the node for which the packet is intended. It may be an individual or broadcast address. The broadcast address is 0xFF (for Indoor units) or 0xAA (for Compact Outdoor SSPA). This is used when a packet of information is intended for several nodes on the network. The broadcast address can be used in a single device connection when the host needs to determine the address of the amplifier. The SSPA unit will reply with its unique address.

10.1.1.3 Source Address

The source address specifies the address of the node that is sending the packet. All unique addresses, except the broadcast address, are equal and can be assigned to individual units. The host computer must also have a unique network address.

10.1.2 Data Packet

The data sub-packet is comprised of 6 to 32 bytes of information. It is further divided into seven fields as shown in **Figure 10-4**. The first six fields comprise the command preamble while the last field is the actual data.



COMMAND PREAMBLE						DATA FIELD
Protocol ID 1 Byte	Request ID 1 Byte	Command 1 Byte	Data Tag 1 Byte	Error Status / Data Address 1 Byte	Data Length 1 Byte	Command Data Sub Structure 0 - 26 Bytes

Figure 10-4: Data Sub-Packet

10.1.2.1 Protocol ID

This field provides backward compatibility with older generation equipment protocol. It should normally be set to zero. This field allows the unit to auto-detect other protocol versions, which may exist in the future.

10.1.2.2 Request ID

This is an application specific field. The amplifier will echo this byte back in the response frame without change. This byte serves as a request tracking feature.

10.1.2.3 Command

The SSPA protocol is a table based protocol. It allows the user to view and modify data tables located on the controlled device. Throughout the remainder of this description, “sender” will refer to the host PC, and “receiver” will refer to the SSPA unit.

Sender and receiver are limited to two commands and two command responses. The Get Request command issued by a command sender allows monitoring of existing conditions and parameters on the receiver. The Get Request frame should not have any bytes in the Data Filed and be no longer than 11 bytes.

The Response frame from the receiver will contain a Get Response designator in the Command field. If the receiver does not detect any errors in the Get Request frame, the requested data will be attached to the response frame. The length of the Get Response frame varies by the amount of attached data bytes. It may contain 11+N bytes where N is the amount of requested data bytes from a particular table, specified in Data Length field.

The Set Request command allows the sender to actively change parameters for the receiver's internal configuration. The Set Request frame must contain a number of bytes in the Data Field as specified in Data length field. The frame size must be 11+N bytes, where N is the length of the attached data structure. The receiver will respond with a frame where the command field will be set to a Set Response designator. The frame length is equal to the Request frame. The byte value for each command is given in **Table 10-4**.

Table 10-4: Command Byte Values

Command Name	Command Byte Value
Set Request	0
Get Request	1
Set Response	2
Get Response	3

10.1.2.4 Data Tag

The SSPA internal structure is organized in several tables, all of which share similar functionality and internal resources. To access the various tables, the data tag must be specified in the request frame. The data associated with certain tags is read only. Therefore only the "Get" command request would be allowed to access these data tags. The SSPA will return an error on attempts to issue a "Set" request to a read-only table tag. Various tables may contain values formatted either in 1 or 2 bytes format. See **Table 10-5**.

Table 10-5: Data Tag Byte Values

Tag Name	Byte Value	Minimum valid length of Data Field	Description
System Tag Settings	0	1 byte	This tag allows accessing various system settings on remote unit. Host access status: Full Read/Write access. Settings can be modified at any time. Some settings may require hardware reset of the remote SSPA unit.
System Threshold Tag	1	2 bytes	This tag allows access to the critical unit thresholds. Host access status: Read Only.
System Conditions Tag	3	1 byte	This tag allows access to the unit's internal conditions flags, such as fault status or current system status. Host access status: Read only. This type of data cannot be set or modified remotely.
ADC Channels Access Tag	4	2 bytes	This tag allows access to the unit's internal Analog to Digital converter. Host access status: Read only. This type of data cannot be set or modified remotely.
Packet Wrapper	6	1 byte	Tag is not used in CO SSPA protocol.
Reserved	2	N/A	This tag is reserved and not used for CO SSPA applications.
Reserved	5	N/A	This tag is reserved for factory usage only.

10.1.2.5 Data Address / Error Status / Local Port Frame Length

This field is a tag extension byte and specifies the first table element of the tagged data. If the Data Length is more than 1 byte, then all subsequent data fields must be accessed starting from the specified address. For example, if the requestor wants to access the amplifier's unique network address, it should set data tag 0 (System settings tag) and data address 8 (see System Settings Details table). If the following Data Length field is more than 1, then all subsequent Settings will be accessed after the Unique Network Address.

Important! In the Response Frame Data Address filed replaced with the Error Status information. The various error codes are given in **Table 10-6**.

Table 10-6: Error Status Bytes

Error Code name	Byte Value	Possible Cause
No Errors	0	Normal Condition, no errors detected
Data Frame Too Big	1	Specified Data length is to big for respondent buffer to accept
No Such Data	2	Specified Data Address is out off bounds for this tag data
Bad Value	3	Specified value not suitable for this particular data type
Read Only	4	Originator tried to set a value which has read only status
Bad Checksum	5	Trailer checksum not matched to calculated checksum
Unrecognizable error	6	Error presented in originator frame, but respondent failed to recognize it. All data aborted.

10.1.2.6 Data Length

This byte value specifies the number of bytes attached in the Data Filed. For the Get command, it specifies the number of data bytes that have to be returned by the SSPA unit to a host PC in the Response frame. For Set commands, the value of this byte specifies the number of data fields to be accessed starting from the address specified in the Data Address byte. In general, the Data Length value plus the Data Address must not exceed the maximum data size particular tag.

10.1.2.7 Data Field

The actual data contained in the packet must be placed in this field. The "Get Request" type of command must not contain any Data Field. "Get Request" will be rejected if any data is present in the Data Field. Generally, the Bad Checksum error code will be added to the response from the unit. In case the data length is 2 bytes, each data word is placed in the frame with its least significant byte first. All data with length of 2 bytes must be represented as integer type with maximum value range from 32767 to (-32767).

10.1.3 Trailer Packet

The trailer component contains only one byte called the Frame Check Sequence. This field provides a checksum during packet transmission. See **Figure 10-5**.

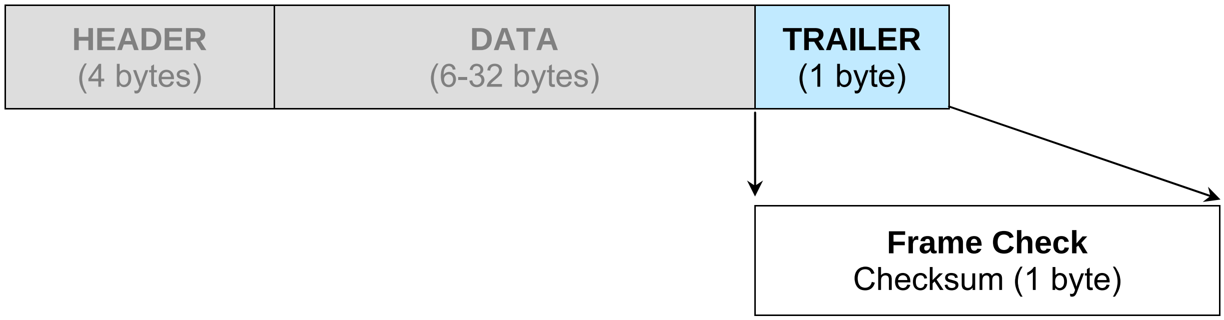


Figure 10-5: Trailer Sub-Packet

10.1.3.1 Frame Check

This value is computed as a function of the content of the destination address, source address and all Command Data Substructure bytes. In general, the sender formats a message frame, calculates the check sequence, appends it to the frame, then transmits the packet. Upon receipt, the destination node recalculates the check sequence and compares it to the check sequence embedded in the frame. If the check sequences are the same, the data was transmitted without error. Otherwise an error has occurred and some form of recovery should take place. In this case the amplifier will return a packet with the “Bad Checksum” error code set. Checksums are generated by summing the value of each byte in the packet while ignoring any carry bits.
A simple algorithm is given as:

```
Chksum=0
FOR byte_index=0 TO byte_index=packet_len-1
        Chksum=(chksum+BYTE[byte_index]) MOD 256
NEXT byte_index
```

10.1.4 Timing issues

There is no maximum specification on the inter-character spacing in messages. Bytes in messages to amplifier units may be spaced as far apart as you wish. The amplifier will respond as soon as it has collected enough bytes to determine the message. Generally, there will be no spacing between characters in replies generated by units. The maximum length of the packet sent to the amplifier node should not exceed 64 bytes, including checksum and frame sync bytes. Inter-message spacing, must be provided for good data transmission. The minimum spacing should be 100 ms. This time is required for the controller to detect a “Line Cleared” condition with half duplex communications. Maximum controller respond time is 200 ms.

10.1.5 Serial Communications Protocol

Tables 10-7 through **10-11** describe the various values of the serial communications protocol.

Table 10-7: Request Frame Structure

Byte position	Byte Value (Hex)	Description
1	0xAA	Frame Sync 1
2	0x55	Frame Sync 2
3	Destination Address	-//-
4	Source Address	-//-
5	Protocol Version	Protocol compatibility hole, must be set to 0
6	Request ID	Service Byte
7	Command	0, Set Request; 1, Get Request
8	Data Tag	0, System Settings (see **Table 10-9**); 1, System Thresholds (see **Table 10-10**); 2, Temperature Sensor Settings; 3, System Conditions (see **Table 10-11**); 4, ADC Data (reserved for factory use)
9	Data Address	Setting number, Sensor command, EEPROM address
10	Data Length	Total length of the data, valid values 1-30
11+N	Data	Actual Data
11+N+1	Checksum	Dest. Address + Source Address + Protocol Version + Request ID + Command + Data Tag + Data Address + Data Length + Data

Table 10-8: Response Frame Structure

Byte position	Byte Value (Hex)	Description
1	0xAA	Frame Sync 1
2	0x55	Frame Sync 2
3	Destination Address	-//-
4	Source Address	-//-
5	Protocol Version	Protocol compatibility hole, must be set to 0
6	Request ID	Service Byte
7	Command	2, Set Response; 3, Get Response
8	Data Tag	0, System Settings (see **Table 10-9**); 1, System Thresholds (see **Table 10-10**); 2, Temperature Sensor Settings; 3, System Conditions (see **Table 10-11**); 4, ADC Data (reserved for factory use); 5, Raw NVRAM/RAM Data (reserved for factory use)
9	Error Status	0, No Errors; 1, Too Big; 2, No Such Data; 3, Bad Value; 4, Read Only; 5, Bad Checksum; 6, Unrecognized Error
10	Data Length	Total length of the data, valid values 1-30
11+N	Data	Actual Data
11+N+1	Checksum	Dest. Address + Source Address + Protocol Version + Request ID + Command + Data Tag + Data Address + Data Length + Data

Table 10-9: System Settings Data Values

Data Address	# Bytes	Description	Limits and Byte Values
1	1	System Operation Mode	Single Amplifier = 255; 1:1 Redundant = 0; Dual 1:1 = 1 (version 3.60); Maintenance Switch =2 (version 5.05)
2	1	System Hierarchical Address	HPA 1= 0; HPA 2= 255
3	1	Unit Start Up State (in Redundancy)	Standby Amplifier = 0; On Line Amplifier = 1
4	1	Mute State	Mute Clear (Transmit Enable) = 255 Mute Set (Transmit Disable) = 0
5	1	Attenuation Level (dB down from maximum gain)	[1 bit for every 0.1 dB] 0 dB attenuation = 0; 20 dB attenuation = 200
6	1	Module Gain Control Authority	Serial Port Gain Control = 255 External Analog Voltage Gain Control = 0 ALC Control = 1 (version 6.40)
7	1	Amplifier Network Address	0 to 255
8	1	High Temperature Alarm Threshold	0 to 125 (in °C)
9	1	SSPA Module Calibration Mode	Temperature Compensated = 255 (normal state) Calibration Mode = 0 [NOTE 1]
10	1	SSPA Spare Fault Status	Ignore Spare Fault = 255 Fault on value of window on ADC channel = 0 to 7 Fault on External Mute = 8
11	1	SSPA Spare Fault Handling	Minor Fault (no effect on Summary Fault) = 255 Major Fault (Triggers Summary Fault) = 0 Major Fault with Mute (Transmit Disabled) = 1
12	1	SSPA Auxiliary Fault Status	Ignore Auxiliary Fault = 255 Fault on Logic Low State = 1 Fault on Logic High State = 0 Startup in Low Z State = 2 Startup in High Z State = 3 (version 3.50 - See SierraCom Protocol for details)
13	1	SSPA Auxiliary Fault Handling	Minor Fault (No effect on Summary) = 255 Major Fault (Triggers Summary Fault) = 0 Major Fault with Mute (Transmit Disabled) =1 Minor Fault with Mute = 2 (version 3.50)
14	1	Block Up Converter Fault Status	Ignore BUC Fault = 255 Fault on Logic Low State = 1 Fault on Logic High State = 0
15	1	Block Up Converter Fault Handling	Minor Fault (no effect on Summary Fault) = 255 Major Fault (Triggers Summary Fault) =0 Major Fault with Mute (Transmit Disabled) = 1
16	1	Protocol Select	Normal Protocol = 255 Terminal Protocol = 0 (version 6.60) NDSat Protocol = 2 (version 3.50; compatible with SierraCom VSAT BUC and NDSat SkyWAN modem) IPNet (Ethernet UDP + Web M&C) = 3; SNMP V1 = 4
17	1	Baud Rate Select	9600 = 255; 38400 = 0; 19200 = 1; 4800 = 2; 2400 = 3
18	1	Reflected RF Fault Handling	Minor Fault = 0; Major Fault = 1; Disabled =255 (version 6.05)
19	1	Reflected RF Fault Threshold	0 - 80 dBm. Value used as High threshold. (version 6.20)
20	1	Standby Mode	Hot standby=255; Cold standby=0 (version 3.50)
21	1	BUC Reference	Autoswitch = 0; External = 1; Internal = 2 (version 3.60)

NOTE 1: SSPA Module Calibration Mode should never be set to "0" Calibration Mode, except at the factory.

(continued)

Note: Data length must be at least two bytes to form integer with the lower byte sent first. If an odd number of bytes is received, the last byte will be saved as the lower byte of the integer and the upper part will be zero.

Table 10-9: System Settings Data Values (continued)

Data Address	# Bytes	Description	Limits and Byte Values
22	1	Forward RF Fault Status	Disabled =255; Fault on low RF threshold = 0 10% Forward RF power window = 1 15% Forward RF power window = 2 Fault on High RF threshold = 3
23	1	Forward RF Fault Handling	Minor Fault (no effect on Summary Fault) = 255 Major Fault (Triggers Summary Fault) = 0 Fault Online Unit Only = 1 (version 6.30) Major Fault + Mute = 2 (version 6.37)
24	1	Forward RF fault threshold	0—80 dBm. Value used as Low, Window center point or High threshold, depending on Forward RF Fault status setting.
25	1	Fan Speed Control	Fan Speed Low = 0; Fan Speed High = 1; Fan Speed Auto = 2; Off/Default (RF Level Control) = 255 (Firmware version 6.10, GaN units only)
26	1	Switch Mute	Switch Mute Off = 255; Switch Mute On = 0 (Firmware version 6.54)
27—28	2	Reserved locations, Factory use only	1-255
29—32	4	SSPA IP address	1-255, Bytes alignment High to Low
33—36	4	SSPA IP Gateway Address	1-255, Bytes alignment High to Low
37—40	4	SSPA IP Subnet Mask	1-255, Bytes alignment High to Low
41—42	2	SSPA IP port	1-255, Bytes alignment High to Low
43—46	4	SSPA IP Lock address	1-255, Bytes alignment High to Low

Table 10-10: System Threshold Data Values

Data Address	# Bytes	Description	Limits and valid values
1	2	Low Current Fault Threshold (Master Side)	Minimum value = 0 Maximum value = 1023
2	2	Spare Fault Window Lower Limit	Minimum value = 0 Maximum value = 1023
3	2	Spare Fault Window Upper Limit	Minimum value = 0 Maximum value = 1023
4	2	Low Current Fault Threshold (Slave Side)	Minimum value = 0 Maximum value = 1023
5	2	Low Regulator Voltage Thresh-old (Master Side)	Minimum value = 0 Maximum value = 1023
6	2	Low Regulator Voltage Thresh-old (Slave Side)	Minimum value = 0 Maximum value = 1023
7	2	ALC Level dBmx10 (v6.40)	Minimum value = 0 Maximum value = 800

Table 10-11: System Condition Addressing

Data Address	# Bytes	Description	Limits and valid values
1	2	Tempcomp DAC value readout	0 to 1023
2	2	Present Temperature	± 125
3	2	Fault, Mute, and State Conditions	2-Byte Value 0 fault clear; 1 fault set 0 mute clear; 1 mute set 0 standby state, 1 on line state **Lower Byte** Bit 0 = Summary Fault Bit 1 = High Temp Fault Bit 2 = Low DC Current Fault Bit 3 = Low DC Voltage Fault Bit 4 = External Mute Status Bit 5 = Internal Mute Status Bit 6 = Forward RF Fault Bit 7 = Reflected RF Fault **High Byte** Bit 0 = Block Up Converter Fault Bit 1 = Spare Fault Bit 2 = Auxiliary Fault Bit 3 = Reserved Bit 4 = RF Switch Control 1 state Bit 5 = RF Switch Control 2 state Bit 6 = Control board configuration 1—Single control board 0—Master/Slave configuration Bit 7 = Unit On Line State
4	2	Present Attenuation Level	1bit per 0.1 dB attenuation Low Byte: 0 to 200 High Byte: always 0
5	2	Present RF Power Level Output is dBm x 10 (i.e. 455 = 45.5 dBm)	0 to 1023
6	2	SSPA DC Current	200 Amp maximum 1 value = 0.1 Amp
7	2	Regulator DC Voltage	48 Volt maximum 1 value = 0.1 Volt
8	2	Power Supply Voltage	60 Volt maximum 1 value = 0.1 Volt
9	2	Transistor Gate Voltage	±10 volt max Use 2s compliment integer math 1 value = 0.1 Volt
10‡	2	SSPA DC Current (Slave Side)	240 Amp maximum 1 value = 0.1 Amp
11‡	2	Regulator DC Voltage (Slave Side)	48 Volt maximum 1 value = 0.1 Volt
12‡	2	Power Supply Voltage (Slave Side)	60 Volt maximum 1 value = 0.1 Volt
13‡	2	Transistor Gate Voltage (Slave Side, High Power stages)	±10 volt max Use 2s compliment integer math 1 value = 0.1 Volt
14‡	2	Transistor Gate Voltage (Slave Side, Pre-Amp stages)	±10 volt max Use 2s compliment integer math 1 value = 0.1 Volt

(continued)

Table 10-11: System Condition Addressing (continued)

Data Address	# Bytes	Description	Limits and valid values
15	2	SSPA DC Current (Master Side) (Ver.6.10 or better)	240 Amp maximum 1 value = 0.1 Amp
16	2	Reflected RF Power Level (Ver.6.20) (Unit must be equipped with reflected power monitor option, otherwise value is irrelevant)	0 to 1023 1 value = 0.1 dBm (i.e. 455 = 45.5 dBm)

‡ Data Addresses 10 - 14 are valid only for Master/Slave control board configuration (see System Condition Data Address 3, Bit 6)

10.1.6 Serial Communication Examples

The following shows an example of a communication exchange between a PC and Compact Outdoor Amplifier, assuming the following:

- SSPA Network Address = 5
- Host Computer Network Address = 10
- Request ID = 0x6F

The Host PC Request String is: (refer to **Table 10-7**)

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	5	Destination Address of Compact Outdoor SSPA
4	A	Source Address of PC sending Request String
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Request ID byte is set by originator, will be echoed back by respondent
7	1	Command field for “Get” type request
8	0	“SSPA Settings” tag indicates which data from respondent is required in response frame
9	1	Data Address field indicates the beginning data address inside of the “SSPA Settings” data set to 1 (first element)
10	A	Data Length field indicates how many data bytes of the “SSPA Settings” requested from the amplifier
11	8A	Arithmetic checksum of bytes number 3 through 10

The Compact Outdoor SSPA responds with the following Response String: (refer to **Table 10-8**)

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	A	Destination Address of PC request originator
4	5	Source Address of Amplifier sending Response String
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Echo of originator's Request ID byte
7	3	Command field for "Get" type request
8	0	"SSPA Settings" tag indicates which data from respondent is required in response frame
9	0	Data Address field omitted and replaced with Error Status code. 0 in this field indicates the absence of errors.
10	A	Data Length field indicates how many data bytes of the "SSPA Settings" requested from the amplifier.
11	0	Data field 1 contains data element 1 of "System Conditions" data type
12	255	Data field 2 contains data element 2 of "System Conditions" data type
13	1	Data field 3 contains data element 3 of "System Conditions" data type
14	255	Data field 4 contains data element 4 of "System Conditions" data type
15	0	Data field 5 contains data element 5 of "System Conditions" data type
16	255	Data field 6 contains data element 6 of "System Conditions" data type
17	5	Data field 7 contains data element 7 of "System Conditions" data type
18	50	Data field 8 contains data element 8 of "System Conditions" data type
19	0	Data field 9 contains data element 9 of "System Conditions" data type
20	3	Data field 10 contains data element 10 of "System Conditions" data type
21	8F	Arithmetic checksum of bytes 3 through 20

To change the attenuation of the connected amplifier, the Host PC sends the following Request String: (refer to **Table 10-7**)

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	5	Destination Address of Compact Outdoor SSPA
4	A	Source Address of PC sending Request String
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Request ID byte is set by originator, will be echoed back by respondent
7	0	Command “Set request” designator
8	0	Data tag “0” indicates access to SSPA Settings
9	5	Data address 5 indicates access to SSPA attenuation
10	1	Data length is 1 byte
11	C8	Data 200 - 20.0 dB x 10 attenuation
12	4C	Arithmetic checksum of bytes 3 through 11

The Compact Outdoor SSPA responds with the following Response String (see **Table 10-8**):

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	A	Destination Address of PC Request originator
4	5	Source Address of SSPA sending Response String
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Echo of the originator Request ID byte
7	2	Command “Set response” designator
8	0	Data tag “0” was accessed
9	0	Data address omitted and replaced with Error status; 0 = no errors
10	1	Data length is 1 byte
11	C8	Data 200 - 20.0 dB x 10 attenuation successfully set
12	49	Arithmetic checksum of bytes 3 to 11

To check the status of SSPA faults and conditions, the Host PC sends the following Request String:

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	5	Destination Address of Compact Outdoor SSPA
4	A	Source Address of PC sending Request String
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Request ID byte is set by originator, will be echoed back by respondent
7	1	Command “Get request” designator
8	3	Data tag “3” indicates access to SSPA Conditions
9	1	Data address 1 indicates access to the beginning of the Conditions table
10	12	Data length is 18 byte (entire length of Conditions table)
11	95	Arithmetic checksum of bytes 3 to 10

The Compact Outdoor SSPA responds with the following Response String:

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	A	Destination Address of PC Request originator
4	5	Source Address of SSPA sending Response String
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Echo of the originator Request ID byte
7	3	Command “Get response” designator
8	3	Data tag “3”, Systems Conditions access
9	0	Error status; 0 = no errors
10	12	Data length is 18 bytes
11	47	Tempcomp attenuator DAC value, Low Byte
12	2	Tempcomp attenuator DAC value, High Byte; DAC value = 583
13	1C	SSPA internal core temperature, Low Byte
14	0	SSPA internal core temperature, High Byte; Temp. = 28 °C
15	0	SSPA Fault Status, Low Byte (see **Table 10-11, data address 3**)
16	80	SSPA Fault Status, High Byte (see **Table 10-11, data address 3**)
17	C8	SSPA Attenuation Level, Low Byte
18	0	SSPA Attenuation Level, High Byte; Attenuation = 200, or 20.0 dB
19	82	Forward RF Output, Low Byte
20	1	Forward RF Output, High Byte; Forward RF = 386, or 38.6 dB
21	B6	SSPA DC Current, Low Byte
22	2	SSPA DC Current, High Byte; DC Current = 694, or 69.4 Amps
23	67	SSPA Regulator DC Voltage, Low Byte
24	0	SSPA Regulator DC Voltage, High Byte; Voltage = 103, or 10.3 Volts
25	95	SSPA Power Supply Voltage, Low Byte
26	0	SSPA Power Supply Voltage, High Byte; Voltage = 149, or 14.9 Volts
27	D3	SSPA Gate Drive Voltage, Low Byte
28	FF	SSPA Gate Drive Voltage, High Byte; Voltage = -45, or -4.5 Volts
29	4C	Arithmetic checksum of bytes 3 through 28

10.2 Ethernet Interface

10.2.1 Overview

The Compact Outdoor SSPA supports several IP network protocols to provide a full featured remote M&C interface over an Ethernet LAN:

- IPNet protocol – redirection of standard Teledyne Paradise Datacom serial protocol over UDP transport layer protocol. This protocol is fully supported in Teledyne Paradise Datacom's Universal M&C software.
- SNMPv1 protocol - protocol intended for integration into large corporate NMS architectures.

In order to utilize either of the protocols listed above, the relevant interface option has to be turned on. Refer to **Section 10.2.2** *IPNet interface* and **Section 10.2.4.5** *Configuring SSPA unit to work with SNMP protocol* for details.

Of course, standard IP level functions such as ICMP Ping and ARP are supported as well. There is currently no support for dynamic IP settings, all IP parameters.

10.2.2 IPNet Interface

10.2.2.1 General Concept

Satcom system integrators are recognizing the benefits of an Ethernet IP interface. These benefits include:

- Unsurpassed system integration capabilities;
- Widely available, inexpensive support equipment (network cable; network hubs);
- Ability to control equipment over Internet;
- Ease of use

Implementation of the raw Ethernet interface is not practical due to the limitations it places on M&C capabilities by the range of a particular LAN. It is more practical to use an Ethernet interface in conjunction with the standard OSI (Open System Interconnect) model to carry a stack of other protocols. In an OSI layered stack, an Ethernet interface can be represented as a Data Link layer. All upper layers are resolved through a set of IP protocols. In order to keep data bandwidth as low as possible (which is important when M&C functions are provided through a low-bandwidth service channel) the IP/UDP protocol set is used as the Network/ Transport layer protocol on Teledyne Paradise Datacom SSPAs.

UDP (User Datagram Protocol) was chosen over TCP (Transmission Control Protocol) because it is connectionless; that is, no end-to-end connection is made between the SSPA unit and controlling workstation when datagrams (packets) are exchanged.

Teledyne Paradise Datacom provides a Windows™-based control application to establish UDP-based Ethernet communication with the SSPA. The control application manages the exchange of datagrams to ensure error-free communication. An attractive benefit of UDP is that it requires low overhead resulting in minimal impact to network performance. The control application sends a UDP request to SSPA unit and waits for response. The length of time the control application waits depends on how it is configured. If the timeout is reached and the control application has not heard back from the agent, it assumes the packet was lost and retransmits the request. The number of the retransmissions is user configurable.

The Teledyne Paradise Datacom SSPA Ethernet IP interface can use UDP ports from 0 to 65553 for sending and receiving. The receiving port needs to be specified through the front panel menu. For sending, it will use the port from which the UDP request originated. Of course, it is up to the user to select an appropriate pair of ports that are not conflicting with standard IP services. Teledyne Paradise Datacom recommends usage of ports 1038 and 1039. These ports are not assigned to any known application.

As an application layer protocol (which actually carries meaningful data), the standard SSPA serial protocol was selected. This protocol proves to be extremely flexible and efficient. It is also media independent and can be easily wrapped into another protocol data frame. An example of the UDP frame with encapsulated Teledyne Paradise Datacom protocol frame is shown on **Figure 10-6**.

UDP Header (8 bytes)	**SSPA Serial Protocol Frame** (11+N Bytes, 0<N<128)	**CRC 16** checksum

Figure 10-6: UDP Redirect Frame Example

A detailed OSI model for the RM SSPA M&C interface is represented in **Table 10-12**.

Table 10-12: OSI Model for Compact Outdoor SSPA Ethernet IP Interface

OSI Layer	Protocol	Notes
Application	Paradise Datacom CO SSPA Serial Protocol	Frame structure described in **Section 10.0**
Transport	UDP	Connectionless transport service. MTU on target PC must be set to accommodate largest SSPA Serial Protocol Frame. Set MTU to a value larger than 127 bytes.
Network	IP	ARP, RARP and ICMP Ping protocols supported by RM SSPA controllers. Static IP Address only, no DHCP support.
Data Link	Ethernet	10/100 Base-T Network
Physical	Standard CAT5 (CAT 6) Network Cable	Maximum node length 100 m

This set of Ethernet IP protocols is currently supported by Teledyne Paradise Datacom Universal M&C package (Compact Outdoor SSPA). The software is supplied on CD with the unit, or can be downloaded by registered users from http://www.paradisedata.com.

10.2.2.2 Setting IPNet Interface

To set up the Compact Outdoor SSPA with custom IP parameters, the internal IP settings need to be modified by using Teledyne Paradise Datacom's Universal M&C, version 4.4.3 or later. See **Section 3.3.3.3**.

10.2.2.3 Troubleshooting IP Connectivity

Check IP connectivity to the SSPA unit. To do so on a Windows-based PC, open a Command Prompt window and type the following command: `PING 192.168.0.9`, then press the Enter key. If the unit is successfully found on the network, the request statistic will be displayed.

```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Ping 192.168.0.9

Pinging 192.168.0.9 with 32 bytes of data:

Reply from 192.168.0.9: bytes=32 time<1ms TTL=128
Reply from 192.168.0.9: bytes=32 time<1ms TTL=128
Reply from 192.168.0.9: bytes=32 time<1ms TTL=128
Reply from 192.168.0.9: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.0.9:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

If this step is successfully completed, a default Ethernet connection is set and ready to use.

If the unit does not answer on the ping command, check all hardware connections. Consult your network administrator for further details.

10.2.4 SNMP interface

SNMP-based management was initially targeted for TCP/IP routers and hosts. However, the SNMP-based management approach is inherently generic so that it can be used to manage many types of systems. This approach has become increasingly popular for remote management and control solutions for various SSPA systems.

Teledyne Paradise Datacom devices with Ethernet interface support the most popular SNMPv1 format (SMIv1, RFC1155), SNMP Get, SNMP GetNext and SNMP Set commands. SNMP Traps are currently unsupported.

In order to utilize SNMP protocol, the user has to enable this feature through remote serial protocol. SNMP uses the UDP fixed port 161 for sending and receiving requests.

The definition of managed objects is described in the MIB. The MIB file is available for download from the Downloads section of the company web site, www.paradisedata.com.

The Teledyne Paradise Datacom MIB is a table-based MIB, and is the same for all devices. The MIB table is designed to follow the same pattern as the tables for serial protocol. For additional information about OID values, refer to **Tables 10-11** to **10-13**.

The text values in the tables help automatic value parsing within NMS or make the values readable through an MIB browser. All text value OIDs follow the same pattern:

1. For settings or parameters with discreet values:
   SettingName'ValueName1=xxx, ….,ValueNamex=xxx
   Example: SystemMode'1:1=0,Dual 1:1 = 1,MSwitch=2,StandAlone=255

2. For settings or parameters with continuous values:
   SettingName'LowLimit..HighLimit
   Example: NetworkAddress'0..255

Note: See **Section 10.3** for a description of connecting to a Compact Outdoor SSPA via a MIB Browser.

10.2.4.1 SNMP MIB Tree

```
--paradiseDatacom(1.3.6.1.4.1.20712)
  |
  +--deviceINFO(1)
  |  |
  |  +-- r-n OctetString deviceID(1)
  |  +-- rwn OctetString deviceLocation(2)
  |  +-- r-n OctetString deviceRevision(3)
  |  +-- r-n Enumeration deviceType(4)
  |
  +--devices(2)
     |
     +--paradiseDevice(1)
     |  |
     |  +--settings(1)
     |  |  |
     |  |  +--settingsEntry(1) [settingIndex]
     |  |     |
     |  |     +-- rwn Integer32   settingIndex(1)
     |  |     +-- rwn Integer32   settingValue(2)
     |  |     +-- r-n OctetString settingTextValue(3)
     |  |
     |  +--thresholds(2)
     |  |  |
     |  |  +--thresholdsEntry(1) [thresholdIndex]
     |  |     |
     |  |     +-- rwn Integer32   thresholdIndex(1)
     |  |     +-- r-n Integer32   thresholdValue(2)
     |  |     +-- r-n Enumeration thresholdStatus(3)
     |  |     +-- r-n OctetString thresholdText(4)
     |  |
     |  +--conditions(3)
     |     |
     |     +--conditionsEntry(1) [conditionsIndex]
     |        |
     |        +-- rwn Integer32   conditionsIndex(1)
     |        +-- r-n Integer32   conditionsValue(2)
     |        +-- r-n Counter     conditionsEventCount(3)
     |        +-- r-n OctetString conditionsText(4)
     |
     +--paradiseDeviceA(2)
     |
     +--paradiseDeviceB(3)
     |
     +--paradiseDeviceC(4)
     |
     +--modem(5)
```

10.2.4.2 Description of MIB Entities

deviceINFO - This field includes general device information.

deviceID - Octet string type; maximum length -60; field specifies device model and serial number; read only access; OID -1.3.6.1.4.1.20712.1.1

deviceLocation - Octet string type; maximum length 60; filed allow customer to store information about device physical location or any other textual information related to the device; read/write access; OID -1.3.6.1.4.1.20712.1.2

deviceRevision - Octet string type; maximum length 60; field specifies device firmware revision; read only access; OID -1.3.6.1.4.1.20712.1.3

deviceType - Enumeration, integer type; field allows simple detection of SNMP device type. Values: rmsspa(1), cosspa(2), rcp2fprc(3), rcp21000co(4), rcp21000rm(5), rcp21000rcp(6), buc(7), rbc(8), minicosspa(9); read/write access. Setting the ID to any other value will default type to cosspa. OID -1.3.6.1.4.1.20712.1.4

devices - This field is subdivided into 5 branches: paradiseDevice, paradiseDeviceA, paradiseDeviceB paradiseDeviceC and modem. paradiseDevice branch currently is used for all Paradise Datacom SNMP enabled devices except Modems. See the Evolution Modem manual for specific MIB information. Branches for Devices A, B and C are reserved for future use.

paradiseDevice - Field contents tables hold specific device information: Settings, Thresholds and Conditions. All table formats follow a common pattern: Index, Value, TextValue. The threshold table has an additional column for parameter validation. The conditions table has an extra column for event counters.

The Index column provides general table indexing; the Value column presents the current value of the relevant parameter; the TextValue column provides information about parameter name, measurement units and limits.

Value “1” in the validation column of the thresholds table indicates that relevant parameter is valid under the current system configuration; value “2” indicates that parameter is invalid or “Not available”.

The event counter column of the conditions table indicates how many times a value of a relevant parameter changed its state since system power-up.

settings - Table contents current device configuration and provides device management. For detailed settings table info for SNMP device see **Table 10-13** for deviceType = cosspa. Read/write access for settingsValue column.

thresholds - Table provides information about device internal limits and subsystems info. For detailed table information refer to **Table 10-14**. Read only access.

conditions - Table contents device fault status information. Read only access. For detailed conditions table info see **Table 10-15**.

10.2.5 Extended SNMP for GaN Compact Outdoor SSPAs

GaN Compact Outdoor units which use the 4th Generation control card (models with serial numbers > 399,999) feature an extended SNMP MIB and SNMP traps. This extended MIB covers several OID objects related to SNMP trap functions.

These units allow independent functioning of two SNMP traps (asynchronous notifications): Fault trap and Conditions trap. Both traps can be enabled or disabled by the user. The user can also specify how many times the same trap notification will be sent back to the SNMP manager.

The SNMP manager IP address is also selectable by the user. This IP address must be specified in the relevant OID branch.

Every trap message is marked by the fixed trap community string: “trap”. This community name is not user selectable.

The Fault Trap allows asynchronous notification of the SSPA fault state change. When enabled, trap notification will be sent to a manager every time either the summary fault state or a fault type is changed. The Last Fault Time ticks counter will be reset each time the summary fault changes its state to “Alarm” or when a new fault condition is detected. This counter also resets itself during device power-up. If no faults are present after device power-up, Fault Trap will issue a “Cold Start” notification to the manager.

The Condition Trap allows the unit to generate asynchronous notifications independent from the unit fault state. Currently, the following conditions can be used for this trap triggering: Forward RF Level, Reflected RF Level (for units equipped with a Reflected RF sensor), DC Current level, PS Voltage level, module plate temperature, LNA current (if an external LNA is powered through the SSPA auxiliary power port).

To enable this trap, set the Condition Trap Resend option to a non-zero value and determine the upper and lower limits for the condition window. Window values must be selected according to the relevant selected condition measured by the unit. For example: Temperature must be selected in degrees, RF power in tenth of dBms, etc.

After successful configuration, the SSPA will generate a notification every time the selected condition is outside the selected measurement window. For units with multiple measured parameters, the relevant condition location must be selected (i.e., units with two power supplies use 1 for PS1, and 2 for PS2). For other conditions, this value is “don’t care”.

Both traps will send a “Device Up Time” time stamp with every trap notification.

10.2.5.1 Extended SNMP MIB Tree

```
--paradiseDatacom(1.3.6.1.4.1.20712)
  |
  +--deviceINFO((1.3.6.1.4.1.20712.1)
  |  |
  |  +-- r-n OctetString deviceID(1.3.6.1.4.1.20712.1.1)
  |  +-- rwn OctetString deviceLocation(1.3.6.1.4.1.20712.1.2)
  |  +-- r-n OctetString deviceRevision(1.3.6.1.4.1.20712.1.3)
  |  +-- r-n Enumeration deviceType(1.3.6.1.4.1.20712.1.4)
  |  +--deviceTimeTicks(1.3.6.1.4.1.20712.1.5)
  |  |  |
  |  |  +-- r-n TimeTicks deviceUpTime(1.3.6.1.4.1.20712.1.5.1)
  |  |  +-- r-n TimeTicks deviceFaultTime(1.3.6.1.4.1.20712.1.5.2)
  |  |
  |  +--deviceCounters(1.3.6.1.4.1.20712.1.6)
  |  |  |
  |  |  +-- r-n Counter   deviceSFaultCounter(1)
  |  |
  |  +--deviceFaultState(1.3.6.1.4.1.20712.1.7)
  |  |  |
  |  |  +-- r-n Enumeration deviceSummaryFault(1)
  |  |  +-- r-n Enumeration deviceLastFault(2)
  |  |
  |  +--deviceTrapedCondition(1.3.6.1.4.1.20712.1.8)
  |  |  |
  |  |  +-- r-n Integer32 deviceTrappedConditionValue(1)
  |  |
  |  +--deviceTrapControl(1.3.6.1.4.1.20712.1.9)
  |  |  |
  |  |  +-- rwn IpAddress   deviceManagerIP(1)
  |  |  +-- rwn Integer32   deviceFaultsTrapResend(2)
  |  |  +-- rwn Integer32   deviceConditionTrapResend(3)
  |  |  +-- rwn Enumeration deviceConditionToMonitor(4)
  |  |  +-- rwn Integer32   deviceConditionULimit(5)
  |  |  +-- rwn Integer32   deviceConditionLLimit(6)
  |  |  +-- rwn Integer32   deviceConditionLocation(7)
  |  |
  |  +--deviceTraps(1.3.6.1.4.1.20712.1.10)
  |     |
  |     +-- (1.3.6.1.4.1.20712.1.10.0)
  |        |
  |        +--deviceFaultsTrap(1.3.6.1.4.1.20712.1.10.0.11)
  |                [deviceUpTime,deviceSummaryFault,deviceLastFault]
  |        |
  |        +--deviceConditionTrap(1.3.6.1.4.1.20712.1.10.0.12)
  |                [deviceUpTime,deviceConditionToMonitor,deviceTrappedConditionValue]
  |
  +--devices(2)
     |
     +--paradiseDevice(1)
     |  |
     |  +--settings(1)
```

```
| | |
| | +--settingsEntry(1) [settingIndex]
| |    |
| |    +-- rwn Integer32   settingIndex(1)
| |    +-- rwn Integer32   settingValue(2)
| |    +-- r-n OctetString settingTextValue(3)
| |
| +--thresholds(2)
| | |
| | +--thresholdsEntry(1) [thresholdIndex]
| |    |
| |    +-- rwn Integer32   thresholdIndex(1)
| |    +-- r-n Integer32   thresholdValue(2)
| |    +-- r-n Enumeration thresholdStatus(3)
| |    +-- r-n OctetString thresholdText(4)
| |
| +--conditions(3)
|   |
|   +--conditionsEntry(1) [conditionsIndex]
|      |
|      +-- rwn Integer32   conditionsIndex(1)
|      +-- r-n Integer32   conditionsValue(2)
|      +-- r-n Counter     conditionsEventCount(3)
|      +-- r-n OctetString conditionsText(4)
|
+--paradiseDeviceA(2)
|
+--paradiseDeviceB(3)
|
+--paradiseDeviceC(4)
|
+--modem(5)
```

10.2.5.2 Extended SNMP MIB Tree Elements in Detail

deviceRevision - Octet string type; maximum length 60; field specifies device firmware revision; read only access; OID -1.3.6.1.4.1.20712.1.3

deviceUpTime - Device total up time in hundredths of a second;

deviceFaultTime - Time elapsed since deviceLastFault last state change in hundredths of second;

deviceSFaultCounter - Counts number of Summary alarms since device power up;

deviceSummaryFault - Enumerated value of device last detected fault condition. The Following enumerated values are possible: coldStart(1), overTemp(2), badRegltr(3), lowDCCur(4), aux(5), buc(6), lna(7), hpa(8), lowFwdRF(9), highRefRF(10), nPlusOne (11), badPS(12), timeOut(13), other(14), noFaults(15);

deviceTrappedConditionValue - Condition value trapped by deviceConditionTrap;

deviceManagerIP - Trap recipient IP address;

deviceFaultsTrapResend - Defines how many times deviceFaultsTrap will repeat the message. 0 - Disables trap triggering;

deviceConditionTrapResend - Defines how many times condition trap will repeat the message. 0 - Disables trap triggering

deviceConditionToMonitor - Enumerated value. Object defines which condition to trap. The following enumerations are possible: fwdRF(1), dcCurrent(2), voltagePS(3), temperature(4), lnaCur(5), refRF(6);

deviceConditionULimit - Conditions upper trap limit. Trap will be sent when the condition exceeds this limit.

deviceConditionLLimit - Conditions lower trap limit. Trap will be sent when condition falls below this limit.

deviceConditionLocation - Parameter specifying condition measuring location in device containing multiple location of the same type (multiple PS, RF modules, LNAs etc.). Set to 0 for system-wide conditions, 1, ... n for relevant unit. For devices with single condition location parameter is “don’t care”.

deviceFaultsTrap - Trap fires deviceFaultsTrapResend times when deviceLastFault or deviceSummaryFault state changes.

deviceConditionTrap - Trap fires deviceConditionTrapResend times when value specified by deviceConditionToMonitor is outside of the window specified by deviceConditionULimit and deviceConditionLLimit. In the case of a device with multiple conditions of the same type, specify measurement location in deviceConditionLocation.

Table 10-13: Detailed Settings for CO SSPA mode (Device Type=2)

settingIndex/settingValue	settingTextValue	Value OID	Description
1/INTEGER	SystemMode'1:1=0,Dual 1:1 = 1,MSwitch=2,StandAlone=255	1.3.6.1.4.1.20712.2.1.1.1.2.1	System Operation mode
2/INTEGER	SystemHierarchicalAddress'HPA1=0,HPA2=255	1.3.6.1.4.1.20712.2.1.1.1.2.2	System Hierarchical Address
3/INTEGER	CurrentState'UnitStandby=0,UnitOnline=255	1.3.6.1.4.1.20712.2.1.1.1.2.3	Unit Start Up State in Redundancy
4/INTEGER	Mute'On=0,Off=255	1.3.6.1.4.1.20712.2.1.1.1.2.4	Mute State
5/INTEGER	SSPAAttenuation(dBx10)'0..200	1.3.6.1.4.1.20712.2.1.1.1.2.5	Attenuation Level
6/INTEGER	GainControl'Analog=0,ALC=1,Serial=255	1.3.6.1.4.1.20712.2.1.1.1.2.6	Module Gain Control Authority
7/INTEGER	NetworkAddress'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.7	Amplifier Network Address
8/INTEGER	HighTempAlarmThreshold(C)'0..100	1.3.6.1.4.1.20712.2.1.1.1.2.8	High Temperature Alarm Threshold
9/INTEGER NOTE 1	CalibrationMode'On=0,Off=255	1.3.6.1.4.1.20712.2.1.1.1.2.9	SSPA module Calibration Mode
10/INTEGER	SpareFaultCheck'ADCCh0-7=0..7,Ext.Mute=8,Ignore=255	1.3.6.1.4.1.20712.2.1.1.1.2.10	SSPA Spare Fault Status
11/INTEGER	SpareFaultAction'MajorFault=0,Fault+Mute=1,MinorFault=255	1.3.6.1.4.1.20712.2.1.1.1.2.11	SSPA Spare Fault Handling
12/INTEGER	AuxFaultCheck'LogicHigh=0,LogicLow=1,Ignore=255	1.3.6.1.4.1.20712.2.1.1.1.2.12	SSPA Auxiliary Fault Status
13/INTEGER	AuxFaultAction'MajorFault=0,Fault+Mute=1,MinorFault=255	1.3.6.1.4.1.20712.2.1.1.1.2.13	SSPA Auxiliary Fault Handling
14/INTEGER	BUCFaultCheck'LogicHigh=0,LogicLow=1,Ignore=255	1.3.6.1.4.1.20712.2.1.1.1.2.14	Block Up Converter Fault Status
15/INTEGER	BUCFaultAction'MajorFault=0,Fault+Mute=1,MinorFault=255	1.3.6.1.4.1.20712.2.1.1.1.2.15	Block Up Converter Fault Handling
16/INTEGER	ProtocolSelect'Terminal=0,NDSat=2,IPNet=3,SNMP=4,Normal=255	1.3.6.1.4.1.20712.2.1.1.1.2.16	Protocol Select
17/INTEGER	BaudRate'38400=255,19200=1,4800=2,2400=3,9600=255	1.3.6.1.4.1.20712.2.1.1.1.2.17	Baud Rate Select
18/INTEGER	RefRFCheck'MinorFault=0,MajorFault=1,Disabled=255	1.3.6.1.4.1.20712.2.1.1.1.2.18	Field reserved for factory use
19/INTEGER	RefRFFaultThreshold(dBm)'0..80	1.3.6.1.4.1.20712.2.1.1.1.2.19	Field reserved for factory use
20/INTEGER	StandbyMode'ColdStandby=0,HotStandby=255	1.3.6.1.4.1.20712.2.1.1.1.2.20	Standby Mode
21/INTEGER	BUCReference'Autoswitch=0,External=1,Internal=2,NA=255	1.3.6.1.4.1.20712.2.1.1.1.2.21	BUC Reference
22/INTEGER	FwdRFCheck'LowRF=0,Window10%=1,Window15%=2, HighRF=3,Dis=255	1.3.6.1.4.1.20712.2.1.1.1.2.22	Type of forward RF fault
23/INTEGER	RFFaultAction'Major=0,MajorOnlineOnly=1,Major+Mute=2,Minor=255	1.3.6.1.4.1.20712.2.1.1.1.2.23	Forward RF fault handling
24/INTEGER	FrwdRFFaultThreshold(dBm)'0..80	1.3.6.1.4.1.20712.2.1.1.1.2.24	Forward RF Fault threshold level in dBm
25/INTEGER	FanSpeed'Low=0,High=1,Auto=2,RFLevelCtrl=255	1.3.6.1.4.1.20712.2.1.1.1.2.25	Fan Speed Control (HPA_4 units only)
26/INTEGER	SwitchMute'On=0,Off=255	1.3.6.1.4.1.20712.2.1.1.1.2.26	Switch Mute (Ver6.54)
27/INTEGER	Reserved'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.27	Field reserved for future use
28/INTEGER	Reserved'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.28	Field reserved for future use

Note 1: Address 9, SSPA Module Calibration Mode, should never be set to "0" Calibration Mode, except at the factory.

Table 10-13: Detailed Settings (continued from previous page)

settingIndex/ settingValue	settingTextValue	Value OID	Description
29/INTEGER	IPAddressByte1'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.29	Device IP address byte1 (MSB)
30/INTEGER	IPAddressByte2'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.30	Device IP address byte2
31/INTEGER	IPAddressByte3'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.31	Device IP address byte3
32/INTEGER	IPAddressByte4'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.32	Device IP address byte4 (LSB)
33/INTEGER	IPGateWayByte1'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.33	Device Gateway address byte1 (MSB)
34/INTEGER	IPGateWayByte2'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.34	Device Gateway address byte2
35/INTEGER	IPGateWayByte3'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.35	Device Gateway address byte3
36/INTEGER	IPGateWayByte4'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.36	Device Gateway address byte4 (LSB)
37/INTEGER	IPSubnetByte1'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.37	Device Subnet Mask byte1 (MSB)
38/INTEGER	IPSubnetByte2'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.38	Device Subnet Mask byte2
39/INTEGER	IPSubnetByte3'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.39	Device Subnet Mask byte3
40/INTEGER	IPSubnetByte4'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.40	Device Subnet Mask byte4 (LSB)
41/INTEGER	IPPortByte1'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.41	Device Port address byte1 (MSB) (required only for IPNet Interface)
42/INTEGER	IPPortByte2'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.42	Device Port address byte2 (LSB) (required only for IPNet Interface)
43/INTEGER	IPLockByte1'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.43	Device IP lock address byte1 (MSB) (required only for IPNet Interface)
44/INTEGER	IPLockByte2'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.44	Device IP lock address byte2 (required only for IPNet Interface)
45/INTEGER	IPLockByte3'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.45	Device IP lock address byte3 (required only for IPNet Interface)
46/INTEGER	IPLockByte4'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.46	Device IP lock address byte4 (LSB) (required only for IPNet Interface)

Table 10-14: Detailed Thresholds

thresholdIndex/ thresholdValue	thresholdTextValue	Value OID	Description
1/INTEGER	LowCurrentThresholdMaster'0..1023	1.3.6.1.4.1.20712.2.1.2.1.2.1	Master side Low DC Current alarm threshold (Amps x10)
2/INTEGER	SpareFaultLowLimitThreshold'0..1023	1.3.6.1.4.1.20712.2.1.2.1.2.2	Spare Fault alarm low threshold
3/INTEGER	SpareFaultHighLimitThreshold'0..1023	1.3.6.1.4.1.20712.2.1.2.1.2.3	Spare Fault alarm high threshold
4/INTEGER	LowCurrentThresholdSlave'0..1023	1.3.6.1.4.1.20712.2.1.2.1.2.4	Slave side Low DC current alarm threshold (Amps x10)
5/INTEGER	LowVoltageThresholdMaster'0..1023	1.3.6.1.4.1.20712.2.1.2.1.2.5	Master side Low Regulator voltage alarm threshold (Volts x10)
6/INTEGER	LowVoltageThresholdSlave'0..1023	1.3.6.1.4.1.20712.2.1.2.1.2.6	Slave side Low Regulator voltage alarm threshold (Volts x10)
7/INTEGER	ALCLevel(dBmx10)'0..800	1.3.6.1.4.1.20712.2.1.2.1.2.7	ALC set level (dBm x10)

Table 10-15: Detailed Conditions

conditionIndex/ conditionValue	conditionTextValue	Value OID	Description
1/INTEGER	DACCount'0..1023	1.3.6.1.4.1.20712.2.1.3.1.2.1	Tempcomp DAC control output
2/INTEGER	SSPACoreTemperature(C)'-100..100	1.3.6.1.4.1.20712.2.1.3.1.2.2	SSPA core temperature
3/INTEGER	FaultStateAgregateValue'0-65535	1.3.6.1.4.1.20712.2.1.3.1.2.3	Aggregate Fault State of SSPA
4/INTEGER	SSPAAgregateAttenuation(dBx10)'0..200	1.3.6.1.4.1.20712.2.1.3.1.2.4	Current SSPA Attenuation Level
5/INTEGER	ForwardRFPower(dBmx10)'0..800	1.3.6.1.4.1.20712.2.1.3.1.2.5	Forward RF Forward output in dBm
6/INTEGER	SSPADCCurrent(Ampx10)'0..10000	1.3.6.1.4.1.20712.2.1.3.1.2.6	SSPA DC current consumption
7/INTEGER	RegulatorVoltage(Voltx10)'0..600	1.3.6.1.4.1.20712.2.1.3.1.2.7	DC Regulator Output Voltage
8/INTEGER	PSVoltage(Voltx10)'0..600	1.3.6.1.4.1.20712.2.1.3.1.2.8	Main Power Supply Voltage
9/INTEGER	GASFETGateVoltage(Voltx10)'0..200	1.3.6.1.4.1.20712.2.1.3.1.2.9	RF FET Bias Gate voltage
10/INTEGER	SSPADCCurrentSlave(Ampx10)'0..10000	1.3.6.1.4.1.20712.2.1.3.1.2.10	SSPA DC current consumption (Slave side only, if not present always 0)
11/INTEGER	RegulatorVoltageSlave(Voltx10)'0..600	1.3.6.1.4.1.20712.2.1.3.1.2.11	DC Regulator Output Voltage (Slave side only, if not present always 0)
12/INTEGER	PSVoltageSlave(Voltx10)'0..600	1.3.6.1.4.1.20712.2.1.3.1.2.12	Slave side Power Supply Voltage (if not present always 0)
13/INTEGER	GASFETGateVoltageSlave(Voltx10)'0..200	1.3.6.1.4.1.20712.2.1.3.1.2.13	RF FET Bias Gate voltage (Slave side, if not present always 0)
14/INTEGER	GASFETGateVoltagePreAmp(Voltx10)'0..200	1.3.6.1.4.1.20712.2.1.3.1.2.14	RF FET Bias Pre-Amp Gate voltage (Slave side, if not present always 0)
15/INTEGER	MasterCurrent(Ampx10)'0..10000	1.3.6.1.4.1.20712.2.1.3.1.2.15	SSPA DC Current (Master Side) (Ver.6.10 or better)
16/INTEGER	RefRFPower(dBmx10)'0..800	1.3.6.1.4.1.20712.2.1.3.1.2.16	Reflected RF Power Level (Ver.6.20) (Unit must be equipped with reflected power monitor option, otherwise value is irrelevant)

10.3 M&C via SNMP

Set up the Compact Outdoor SSPA with custom IP parameters by modifying the internal IP settings using Teledyne Paradise Datacom's Universal M&C, version 4.4.3 or later. Use the default Read and Write Community settings, or check the boxes to modify them. See **Figure 10-7**.

The Protocol setting in the Settings tab of the Universal M&C needs to be set to SNMP, as shown in **Figure 10-8**.

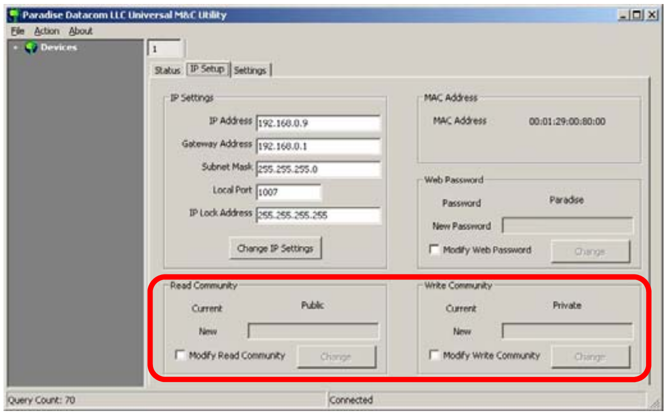


Figure 10-7: Universal M&C, IP Setup tab

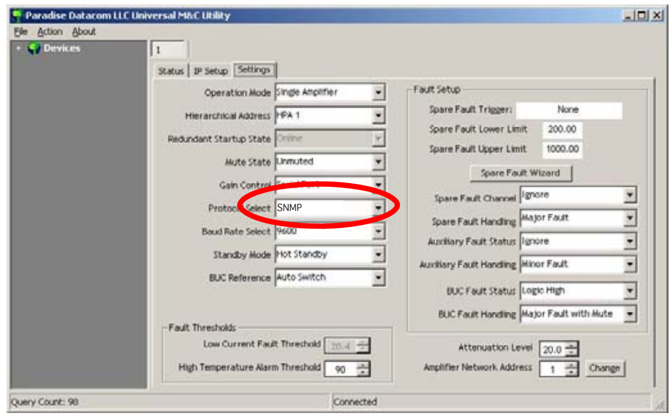


Figure 10-8: Universal M&C, Settings tab

After the desired IP address, Subnet mask and Gateway parameters have been set, the unit will still use its default parameters. To make the new parameters active, reset the Compact Outdoor SSPA by removing its AC power. Unplug the Quick Start cable from the M&C connector. (**If the unit is restarted with the Quick Start cable connected, it will always come up with default IP settings**). Apply power to the SSPA. Re-plug the Quick Start cable into J4, and check connectivity with the custom IP settings.

If the custom IP settings will be used in normal operation, the user must construct an IP cable or modify the Quick Start cable by disconnecting the interface control pins (pins **j** and **e**, Baud Select 0 and Baud Select 1) from ground. In this configuration, the SSPA will always use the saved communication control settings rather then rolling back to the default configuration.

10.3.1 Connecting to a MIB browser

For a MIB browser application example, we will be using the freeware browser GetIf, version 2.3.1. Other browsers are available for download at http://www.snmplink.org/Tools.html.

1. Copy the provided Teledyne Paradise Datacom MIB file into the Getif Mibs subfolder.
2. Start the GetIf application.
3. Select the unit IP address and community strings in the relevant text boxes on the Parameters tab (**Figure 10-9, Item 1**) and click **Start** (**Figure 10-9, Item 2**).
4. Select the MIBBrowser tab (**Figure 10-9, Item 3**).

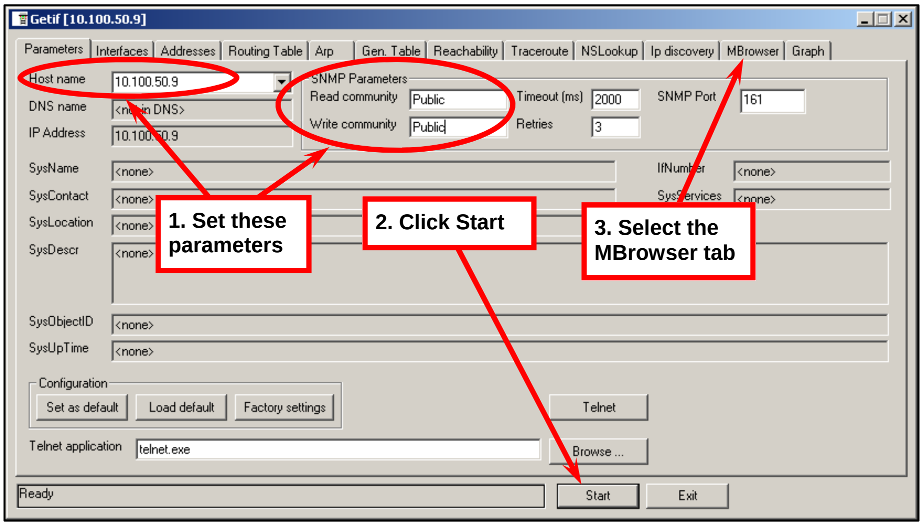


Figure 10-9: GetIF Application Parameters Tab

5. Click on the 'iso' main entity on the MIB tree (**Figure 10-10, Item 1**), and click **Start** (**Figure 10-10, Item 2**).
6. Update data will be displayed in the output data box (**Figure 10-10, Item 3**).

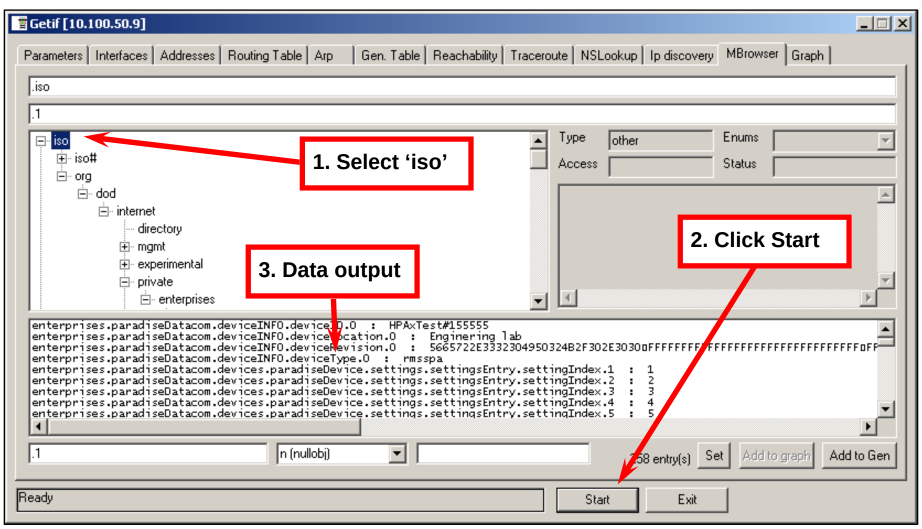


Figure 10-10: Getif MBrowser window, with update data in output data box

10.3.2 SNMP V3 implementation issues in Teledyne Paradise Datacom SSPAs

Simple Network Management Protocol (SNMP) is an interoperable standards-based protocol that allows for external monitoring of the Content Engine through an SNMP agent.

A SNMP-managed network consists of three primary components: managed devices, agents, and management systems. A managed device is a network node that contains a SNMP agent and resides on a managed network. Managed devices collect and store management information and use SNMP to make this information available to management systems that use SNMP. Managed devices include routers, access servers, switches, bridges, hubs, computer hosts, and printers.

An agent is a software module that has local knowledge of management information and translates that information into a form compatible with SNMP: the Management Information Base (MIB). The agent can send traps, or notification of certain events, to the manager.

Essentially, Teledyne Paradise Datacom SSPA is considered a “SNMP agent”.

A manager is a software module that listens to the SNMP notifications sent by SNMP agents. The manager can also send requests to an agent to collect remote information from the Management Information Base (MIB).

The communication between the agent and the manager uses the SNMP protocol, which is an application of the ASN.1 BER (Abstract Syntax Notation 1 with Basic Encoding Rules), typically over UDP (for IP networks).

- Version 1 (SNMPv1, described in RFC 1157) is the initial implementation of SNMP.
- Version 2 (SNMPv2c, described in RFC 1902) is the second release of SNMP. It provides additions to data types, counter size, and protocol operations.
- Version 3 (SNMPv3, described in RFC 2271 through RFC 2275) is the most recent version of SNMP.

SNMP V1

SNMP version 1 (SNMPv1) is the initial implementation of the SNMP protocol. SNMPv1 operates over protocols such as User Datagram Protocol (UDP), Internet Protocol (IP), OSI Connectionless Network Service (CLNS), AppleTalk Datagram-Delivery Protocol (DDP), and Novell Internet Packet Exchange (IPX). SNMPv1 is widely used and is the de-facto network-management protocol in the Internet community.

The Teledyne Paradise Datacom SSPA family of products utilizes the most popular implementation, SNMP V1 over UDP transport layer. Units with serial numbers > 399,999 utilize SNMP V1 with Traps.

SNMP V2

SNMPv2 (RFC 1441–RFC 1452) revises version 1 and includes some improvements in the areas of performance, security, confidentiality, and manager-to-manager communications. It introduced GetBulkRequest, an alternative to iterative GetNextRequests for retrieving large amounts of management data in a single request. However, the new party-based security system in SNMPv2, viewed by many as overly complex, was not widely accepted.

The format of the trap message was also changed in SNMPv2. To avoid these compatibility issues, the trap mechanism was not implemented in the Paradise Datacom SSPA MIB.

SNMP V3

Although SNMPv3 makes no changes to the protocol aside from the addition of cryptographic security, it looks much different due to new textual conventions, concepts, and terminology. SNMPv3 primarily added security and remote configuration enhancements to SNMP.

Problems with implementing SNMP V2 and V3 in Teledyne Paradise Datacom SSPA product family

Many embedded controllers and microprocessors that are used in electronic components such as amplifier modules do not have support for SNMP V2 or V3. This is due to the extensive memory resources required by the computation intensive cryptographic security of SNMP V3.

For this reason V3 has not gained widespread support amongst embedded MCU platform manufacturers. Existing port implementations are limited to very powerful ARM5 or above cores, running under full-scale OS systems (Linux, Android, etc.). At large, these configurations require external bulk RAM/FLASH to operate. This requirement ultimately affects the minimum device startup time (tens of seconds, due to the large boot BIOS) and working temperature range (mostly indoor).

As noted in Cisco's release notes about SNMP V3:

> SNMP notifications can be sent as traps or informs. **Traps are unreliable because the receiver does not send acknowledgments when it receives traps.** The sender cannot determine if the traps were received. However, an SNMP entity that receives an inform request acknowledges the message with an SNMP response PDU. If the sender never receives the response, the inform request can be sent again. Thus, informs are more likely to reach their intended destination.
>
> However, informs consume more resources in the agent and in the network. Unlike a trap, which is discarded as soon as it is sent, an inform request must be held in memory until a response is received or the request times out. Also, a trap is sent only once, while an inform may be retried several times. The retries increase traffic and contribute to a higher overhead on the network.
>
> (http://www.cisco.com/en/US/docs/ios/12_0t/12_0t3/feature/guide/Snmp3.html)

10.4 Terminal Mode Serial Protocol for Paradise Datacom SSPA

Compact Outdoor SSPAs with firmware version 6.60 or later may use Terminal Mode Serial Protocol (TMSP) as a secondary serial protocol for management and control through a remote serial interface.

TMSP allows the user to access internal SSPA functions via a remote ASCII Terminal or its equivalent (such as HyperTerminal for Windows). TMSP is accomplished through either the RS-232 or RS-485, half duplex, serial communication link. US ASCII encoded character strings are used to represent commands and data massages.

A remote terminal or controller initiates a communication session and the SSPA Terminal takes action and returns a report of requested status. The SSPA terminal will not initiate communication and will transmit data only when commanded to do so. Prior to establishing the session with the SSPA Terminal, this mode must be enabled through the SSPA front panel menu.

The remote terminal must be configured with serial settings that match the SSPA's serial port settings. For example, if the SSPA is set at 9600 Baud, the remote terminal must be also configured as ASCII terminal at 9600 Baud, no parity, 8 bit data with 1 stop bit serial connection. The SSPA will not echo back any incoming characters, so local echo must be enabled on the remote terminal.

To establish a remote control session with the SSPA terminal, the user must type **UNIT#XXX** in the terminal window (all letters must be in upper case), where XXX is the SSPA unique network address or the global call address (170).

Press the "Enter" key on the remote terminal keyboard. The SSPA should answer with **Unit#XXX OnLine**, with the first menu screen on the following lines. After a remote session is successfully established, the unit will stay connected as long as needed. The session interface is organized into menu screens.

To assist the user navigate through the menu, the help string with the list of active keys always follows the menu strings. For example, the last transmission string on all informative menu screens will be:

"Active Keys:(U)p+Enter;(D)own+Enter;(C)learFlt; (M)enu+Enter; (E)nd+Enter".

Note: All letters must be in upper case!

To refresh the current screen on the remote terminal, press the "Enter" key. To end a session, press "E" and the "Enter" key.

Important! If multiple SSPA units are networked on the same serial link, do not establish a session with more than one SSPA at a time. If you do so you will not get any valid answer from any SSPA!

Figure 10-11 shows an example screen shot of a terminal session.

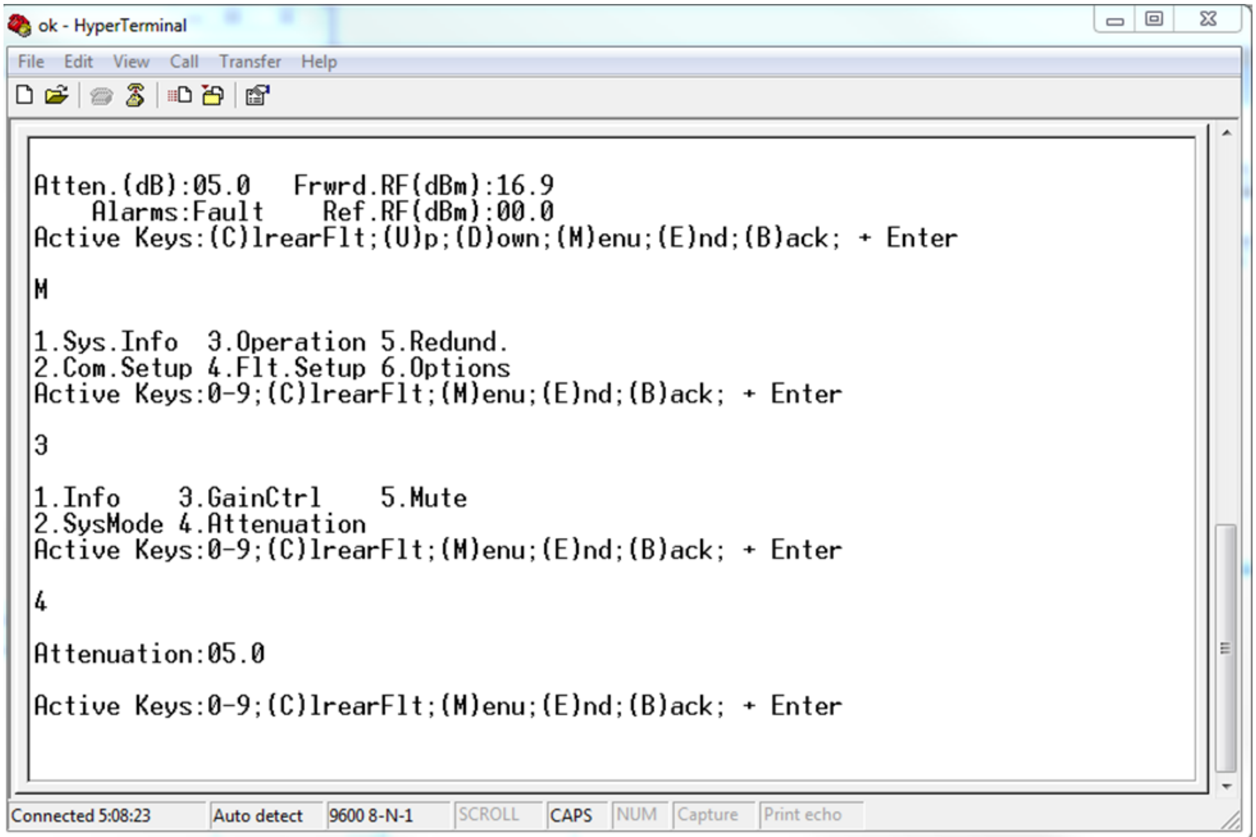


Figure 10-11: Terminal Session Example

10.4.1 Terminal Mode Menu Structure

All Compact Outdoor TMSP menus are organized in logical sublevels: Informative and Main Menu Selection.

At the beginning of the session, the SSPA will prompt the user with the first menu of the Informative sublevel. The user can access the Main menu from any informative sublevel by sequentially selecting the “M” and “Enter” keys on the remote terminal keyboard.

There are five main levels of the menu selection, shown below and in **Figure 10-12**:

1. **Sys. Info** – Shortcut to the Informative menu sublevel;
2. **Com.Setup** – Serial communication related settings;
3. **Operation** – SSPA operation related settings;
4. **Fault Monitoring Setup** – Fault handling settings;
5. **Options** –Optional settings.

```
1.Sys.Info  3.Operation 5.Redund.
2.Com.Setup 4.Flt.Setup 6.Options
Active Keys:0-9;(C)lrearFlt;(M)enu;(E)nd;(B)ack; + Enter
```

Figure 10-12: Terminal Mode, Main Menu

```
Atten.(dB):05.0   Frwrd.RF(dBm):20.9
    Alarms:Fault    Ref.RF(dBm):00.0
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter

D

Voltage:Fault  Temperature:Normal
Current:Fault       Fwd.RF:Normal
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter

D

BUC:Normal Int.Mute:Off State:OnLine
AUX:Normal Ext.Mute:Off  Ctrl:PC Ctr
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter

D

DCCur.(A):00.0 Gate(V):-8.2 RFSW:Normal
Regul.(V):00.0 PS(V):00.0  Temp(C):+33
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter

Prtcl:Terminal Addrs:000  Mode:StdAlone
 Baud:9600   Unit:HPA1  FanSpeed:Auto
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter

D

 BUCLock:Ext         StdbyMode:Hot
SpareFlt:Normal RecordHighT(C):032
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter
```

Figure 10-13: Terminal Mode, System Information Menu

10.4.1.1 System Information Sub-Menu

The informative sublevel of the menu structure contains six pages. See **Figure 10-13**.

Sys Info Page 1

The page shows:

- **Attenuation** — SSPA current level of attenuation, measured in dB (Atten. (dB):XX.X) with an accuracy of 0.1 dB;
- **Alarms** — Summary alarm presence, “FAULT!” or “None” will be displayed depending on the state of the SSPA;
- **Forward RF Power** — Displayed in dBm with accuracy of 0.1 dBm;
- **Reflected RF Power** — Displayed in dBm with accuracy of 0.1dBm (if equipped).

Sys Info Page 2

The page shows a variety of alarm states which may be present within the SSPA. Fault values are “Fault” or “Normal”.

- **Voltage** — RF Module voltage regulator low voltage fault;
- **Current** — Low DC current fault;
- **Temperature** — High temperature fault;
- **Fwd.RF** — Forward RF fault (High, Low or Window, depending on the selected fault handling);

Sys Info Page 3

This page reflects various SSPA faults and conditions.

- **BUC** — Displays the block upconverter (BUC) fault (if equipped). Values "Fault" or "Normal";
- **Aux** — Displays the auxiliary fault condition. Values – "Fault" or "Normal";
- **Int.Mute** — Displays the internal mute condition (mute state controlled by internal SSPA hardware, such as serial protocol command or automatic over temperature shutdown). Values – "Off" or "On";
- **Ext.Mute** — Displays the external mute condition (Mute condition controlled by hardware jumper on M&C connector). Values – "On" or "Off";
- **State** — Displays the SSPA online state in a redundant system. Value – "Standby" or "Online";
- **Ctrl** — Displays the type of attenuation control. Values – "Analog" or "PC Ctrl".

Sys Info Page 4

This page shows the detailed information about the state of the SSPA's plate temperature and internal power supply characteristics.

- **DCCur.(A)** — The total DC current draw by the RF module from the main power supply with an accuracy of 0.1A. This value varies depending on the power level of SSPA. If the SSPA is in the mute state, the current drops to a 0 to 5A range.
- **Regul.(V)** — Displays the measured value of the internal RF module voltage regulator. The value in normal mode should be range from 8 to 10.5V. During SSPA mute period, this value drops to near 0V. Measurement is accurate to within 0.1V.
- **Gate (V)** — This value represents the negative GaAsFETs gate drive voltage. Normal value range is 1 to 6 V. The value reading may be affected by SSPA temperature changes and mute state.
- **PS (V)** — Displays the internal power supply voltage output. Normal range is 11 to 13 V, with an accuracy to within 0.1V.
- **Temp(C)** — Current base plate temperature, measured in Centigrade.

Sys Info Page 5

This page displays the SSPA serial communication and redundancy related settings.

- **Prtcl.** — Displays the type of default implemented serial protocol. Values: Normal, Terminal, IPNet or SNMP.
- **Baud** — Displays the default SSPA baud rate. Values: 2400, 4800, 9600, 19200, 38400.
- **Addrs** — Displays the SSPA serial network address. Values: 0 to 255.
- **Unit** — Displays the SSPA 1:1 redundancy topological factor. Values: "HPA1" or "HPA2".
- **Mode** — Displays the implemented redundancy mode. Values: "Standalone", "1:1" or "SinglSw".

Sys Info Page 6

This page displays the SSPA various miscellaneous settings and conditions.

- **BUCLock** — Displays current setting for internal BUC (if equipped) reference locking mechanism. Possible values: Ext for external reference only, Int for internal reference only and Auto for auto switching function between external and internal reference.
- **StdbyMode** — Displays current setting for type of redundancy standby function. Possible values: Cold or Hot.
- **Spare** — spare fault can reflect various fault conditions and events.
- **RecordHighT(C)** — Displays highest recorded baseplate temperature endured by the SSPA unit.

```
1.Protocol 3.Address
2.Baud     4.IPSetup
Active Keys:0-9;(C)lrearFlt;(M)enu;(E)nd;(B)ack; + Enter
```

Figure 10-14: Terminal Mode, Communication Setup Menu

10.4.1.2 Communication Setup Sub-Menu

This menu, shown in **Figure 10-14**, allows the user to select the parameters for communication between the SSPA and the remote monitor and control station. All changes made on this menu will take effect only after a hardware reset of the SSPA controller card. This can be accomplished by either cycling power to the SSPA or by selecting the menu item from Terminal mode “Options” > “Reset” menu item.

- **1.Protocol —** Selection allows user to select remote communication protocol. Normal, Terminal, IPNet, SNMP or NDSat protocol selections are available. Refer to protocol description section for details. The factory default protocol is “Normal”.
- **2.Baud —** This item allows the user to select the desired baud rate for serial communication. Available baud rates include 2400, 4800, 9600, 19200 and 38400 Baud. The factory default baud rate is 9600.
- **3.Address —** This selection allows the user to set the network address of the controller if used on a serial network. Choose from 1 to 255. The address 170 should not be selected; it is reserved for factory use.
- **4.IP Setup —** Selection allows user to set up IP network parameters: IP address, Subnet, Gateway. As well as set and review web page password and various SNMP settings.

```
1.Info    3.GainCtrl    5.Mute
2.SysMode 4.Attenuation
Active Keys:0-9;(C)lrearFlt;(M)enu;(E)nd;(B)ack; + Enter
```

Figure 10-15: Terminal Mode, Operation Menu

10.4.1.3 Operation Sub-Menu

This menu, shown in **Figure 10-15**, allows the user to select the parameters for communication between the SSPA and the remote monitor and control station. All changes made on this

- **1.Info —** Displays the unique SSPA ID tag as well as the firmware version of the controller card.
- **2.SysMode (System Mode) —** Allows the user to select the SSPA redundancy mode. Choose Standalone,1:1, Dual 1:1 or Maintenance switch modes.
- **3.GainCtrl (Gain Control) —** Menu selects the style of SSPA attenuation control. User may select between “Analog”, “Serial” and “ALC” types of control. It also allows set ALC RF level when unit setup for ALC control mode.
- **4.Attenuation —** Allows the user to set the SSPA attenuation level between 0 and 20 dB in steps of 0.1dB. In order to take effect, the SSPA must be configured for “Serial” type of attenuation control.
- **5.Mute —** Selects the SSPA mute state. Selection values: “On” or “Off”.

```
1.Aux.Action
2.Aux.Check
Active Keys:0-9;(C)lrearFlt;(M)enu;(E)nd;(B)ack; + Enter
```

Figure 10-16: Terminal Mode, Fault Setup Menu

10.4.1.4 Fault Setup Sub-Menu

This menu, shown in **Figure 10-16**, allows the user to customize the Auxiliary fault setup.

- **1. Aux. Action —** Allows the selection of the final effect of the auxiliary fault on an SSPA operation. Selection: Fault (Major Fault), Fault + Mute, Alert (Minor Fault), or Alert + Mute.
- **2. Aux. Check —** Allows the user to select the fault-triggering event. Logic High – fault occurs on “open” unconnected state of auxiliary input line. Logic Low – fault occurs on “close” shorted to ground state of the auxiliary input line. Ignore – allows user to disable auxiliary fault checking.

```
1.StbySelect 3.Unit
2.StdyMode
Active Keys:0-9;(C)lrearFlt;(M)enu;(E)nd;(B)ack; + Enter
```

Figure 10-17: Terminal Mode, Redundancy Menu

10.4.1.5 Redundancy Sub-Menu

This menu, shown in **Figure 10-17**, allows user to select various settings related to SSPA redundancy operation

- **1.Standby Select —** Allows selecting Standby/Online modes for units operating in redundancy system
- **2.Standby Mode —** Sets Cold or Hot standby operation for SSPA unit
- **3.Unit —** Allows selecting redundancy topological factor: HPA1 or HPA2

```
1.Restore 3.FanSpeed
2.Backup  4.Reset
Active Keys:0-9;(C)lrearFlt;(M)enu;(E)nd;(B)ack; + Enter
```

Figure 10-18: Terminal Mode, Options Menu

10.4.1.6 Options Sub-Menu

This menu, shown in **Figure 10-18**, makes available functions to backup or restore settings.

- **1.Restore —** Restores saved settings from two user backup locations.
- **2.Backup —** Allows the user to create a backup of all settings into two separate nonvolatile memory backup locations.
- **3.Fan Speed —** On units equipped with fans speed control option menu allows user to select desired fan speed. Auto - for temperature proportional fan speed, Low – fixed low speed, High – Fixed high speed, RFCtrl – for output RF level proportional fan speed control.
- **4.Reset —** This menu allows the user to remotely reset the SSPA controller card MCU, which allows the SSPA to apply new communication settings. The aftermath of the action depends on the selection which was made prior reset. If the SSPA is in Terminal mode protocol, communication with the unit may be reestablished after 5 seconds from the reset time. If the SSPA is configured to be part of a 1:1 redundant system, the reset will cause the SSPA to go offline.

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11.0 Overview, RCH-1000

Teledyne Paradise Datacom's Universal Handheld Controller (model RCH-1000) is a versatile device used to interface with a Compact Outdoor SSPA.

The device enclosure features a seal which provides an ingress protection level of IP65. This allows the controller to be used in most outdoor environments. The enclosure's rugged construction provides protection from impact and vibration.

When connected to a Compact Outdoor SSPA, this device allows the operator to adjust the attenuation of the connected unit, control the mute/unmute selection, and monitor the status, conditions and settings of the connected unit via a serial RS-485 connection. Faults and other events are tracked in the controller's internal log.

The front panel of the controller features six light emitting diodes, eight keys and a 2.5 in. x 1.3 in. OLED display. See **Figure 11-1**.

Figure 11-1: Universal Handheld Controller (RCH-1000)

A Quick Start cable (part number L212638-2) is provided with each RCH-1000 Universal Handheld Controller. See **Figure 11-2**.

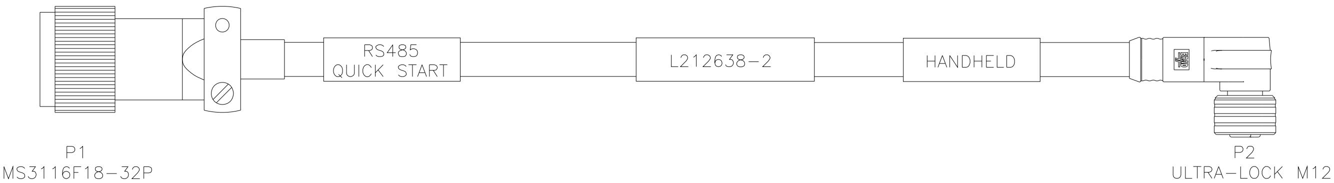

Figure 11-2: Quick Start Cable (L212638-2) for Compact Outdoor SSPAs

See the RCH-1000 Operations Manual (**211668**) for details on remote operation of a Compact Outdoor SSPA using the Universal Handheld Controller.

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A.1 Ethernet Quick Start Cable

The Compact Outdoor SSPA with Ethernet is supplied with a cable that allows the user to quickly setup the amplifier and verify its operation. The "Quick-Start" cable is shown in **Figure A-1**, and the Wiring Chart is shown in **Table A-1**.

The MS-type connector at P1 plugs into Port J4 of the SSPA. The RJ-45 connector at P2 mates with most Ethernet ports on notebook and desktop personal computers. See **Table 3-1** for a full pin-out of the M&C Connector port J4.

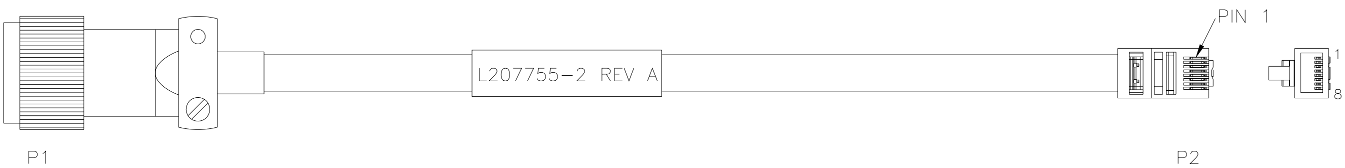

Figure A-1: Ethernet Quick Start Cable

Table A-1: Wiring Chart, Ethernet Quick Start Cable

FROM		TO		COLOR	AWG	LENGTH
CONNECTOR	TERMINAL	CONNECTOR	TERMINAL			
P1	H	P2	2	GRN	24	10 FT.
P1	J	P2	1	WHT/GRN	24	10 FT.
P1	X	P2	3	WHT/ORG	24	10 FT.
P1	W	P2	6	ORG	24	10 FT.
P1	e	P1	V	BLK	24	3 IN.
P1	V	P1	B	BLK	24	3 IN.

Important! If the Compact Outdoor SSPA is powered up with the Quick Start cable attached to J4, the user may change the IP settings used to communicate with the unit. If the SSPA is powered up before the cable is attached to J4, it will use the default IP settings as configured at the factory.

Important! To communicate with a Compact Outdoor SSPA with Ethernet via RS-232 while using Quick Start cable P/N L202151 (used with previous generations of Compact Outdoor SSPAs), the old Quick Start cable harness will need to be modified. To do so, open the MS connector shell and connect the chassis and communication ground pins together (Pins V and d).

A.2 RS-232 Quick Start Cable

Alternately, the Compact Outdoor SSPA can be supplied with a cable that allows the user to quickly setup the amplifier for RS-232 communication and verify its operation.

The RS-232 Quick-Start cable is shown in **Figure A-2**, and the Wiring Chart is shown in **Table A-2**.

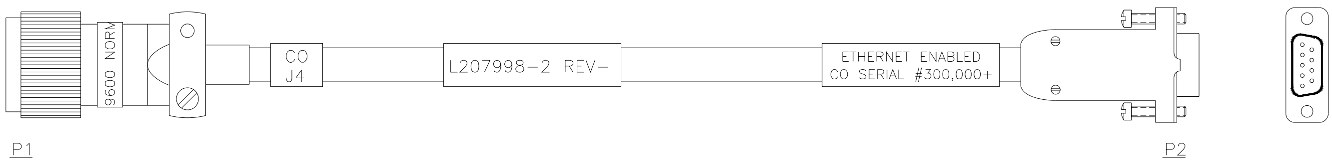

Figure A-2: RS-232 Quick Start Cable, 207998

Table A-2: Wiring Chart, RS-232 Quick Start Cable

FROM		TO		COLOR	AWG	LENGTH
CONNECTOR	TERMINAL	CONNECTOR	TERMINAL			
P1	d	P1	V	BLK	24	3 IN.
P1	j	P1	d	BLK	24	3 IN.
P1	e	P1	j	BLK	24	3 IN.
P1	V	P2	5	BLK	24	10 FT.
P1	F	P2	3	GRN	24	10 FT.
P1	E	P2	2	RED	24	10 FT.
P1	D	P1	V	BLK	24	3 IN.
P1	B	P1	D	BLK	24	3 IN.

Note: Different manufacturers of the MS3116F18-32P circular connector use different labeling conventions, and pin “j” may appear to be pin “I”. This manual uses the convention of pin “j”.

Mixing New Generation Compact Outdoor Amplifiers with Units Manufactured Prior to 2003

Configuring redundant systems with older model Compact Outdoor amplifiers with new generation models will require a different switch cable configuration than those shown in **Section 9**. Older generation amplifiers are generally those manufactured prior to year 2003. This switch cable can be ordered from the factory as part number **201608**.

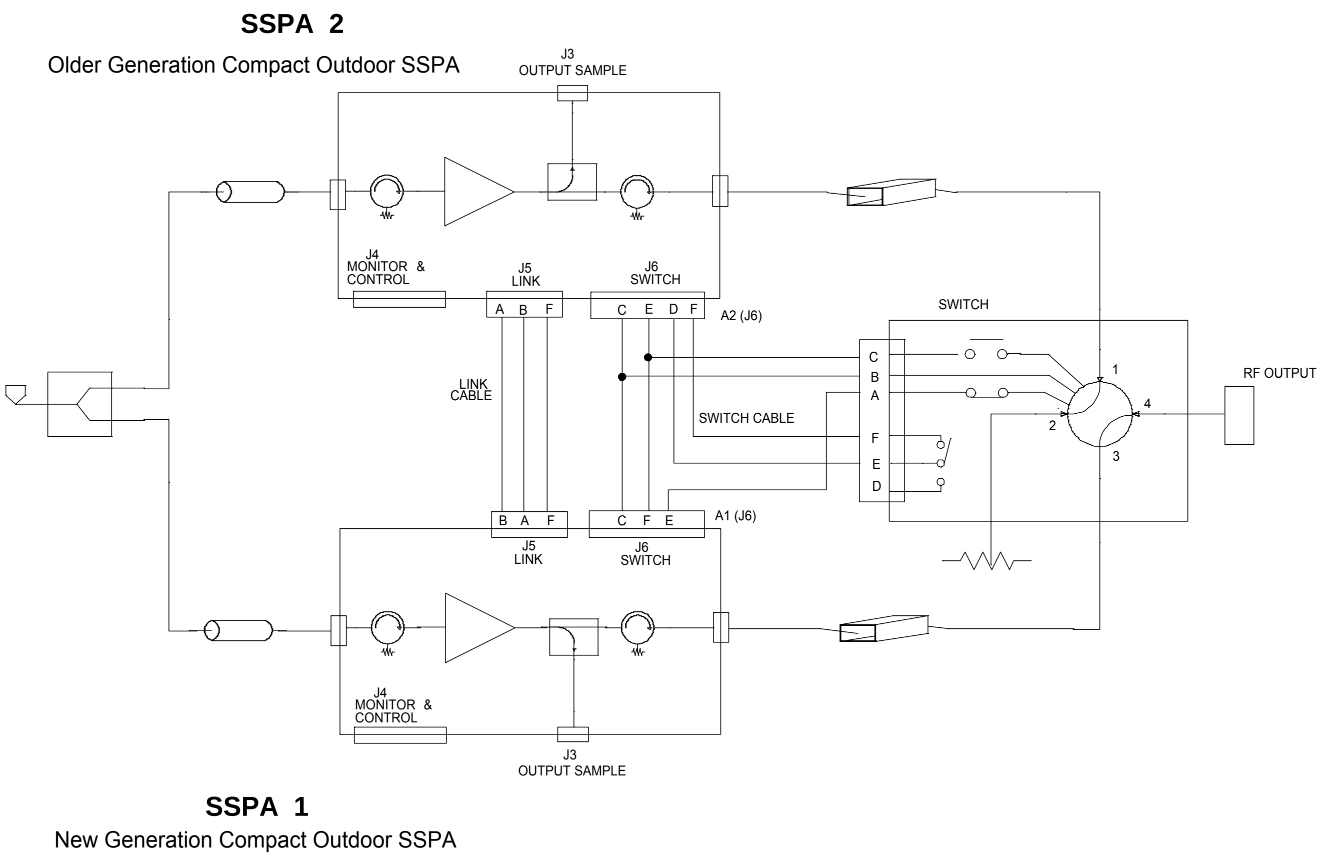

Figure B-1: Mixed Redundant System using New Generation and Original Compact Outdoor Amplifiers

Alternate Redundant System Configurations

Mixing Compact Outdoor SSPA with other manufacturer Amplifier

Configuring redundant systems with other manufacturers amplifiers can be achieved by using an external controller such as the Teledyne Paradise Datacom RCP2-1100. The external controller is required because the internal controller in the Compact Outdoor Amplifier is specifically designed to operate with other Compact Outdoor SSPAs.

The RCP2-1100 controller will control the 1:1 redundant system provided that the other manufacturer's amplifier is equipped with a form A or form C summary alarm relay contact. Such a configuration is shown in the schematic below. The RCP2-1100 is a 1RU remote controller capable of driving a waveguide switch that is located several hundred feet from the controller.

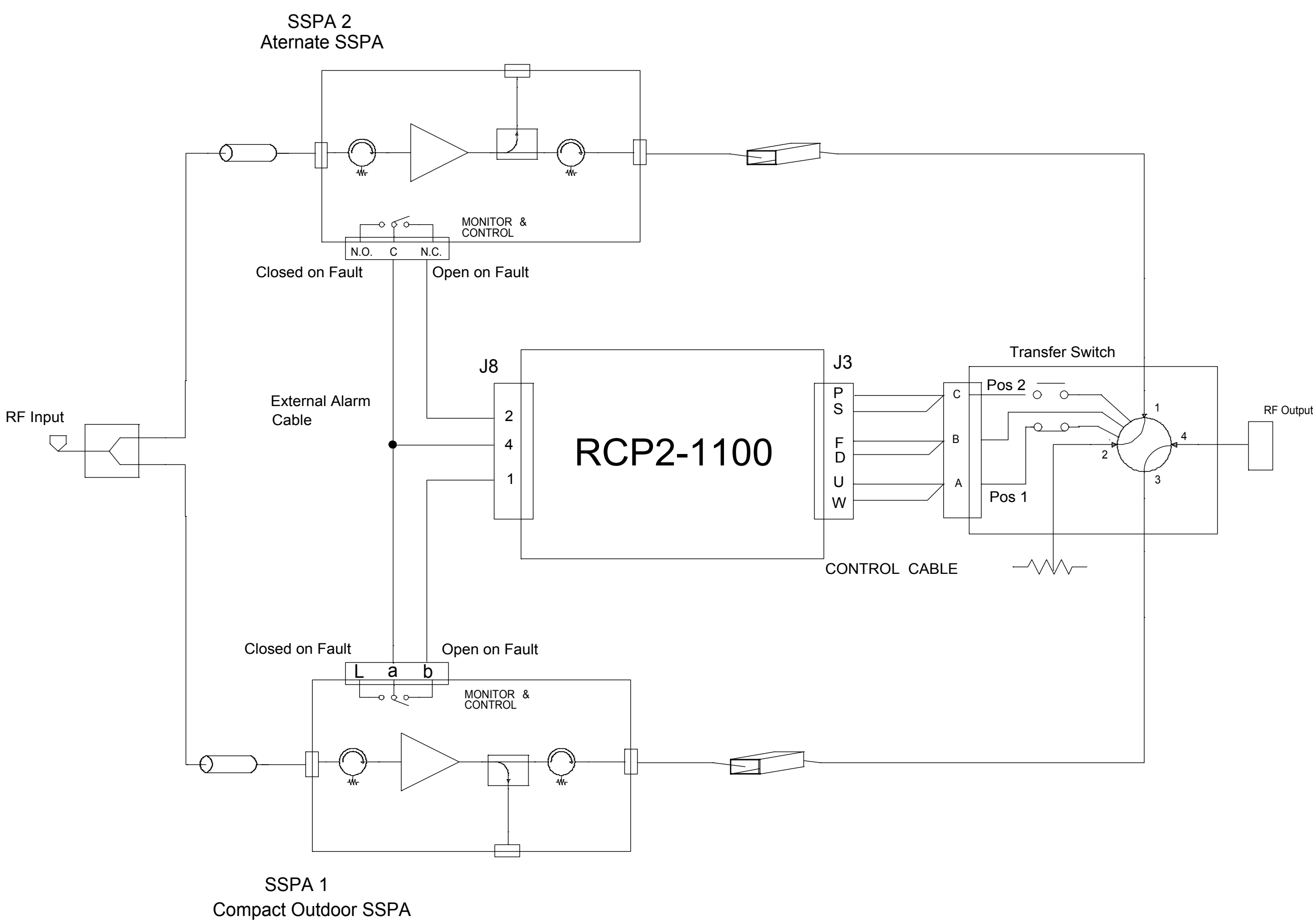

Figure B-2: Redundant System using RCP2-1100 Controller

A Compact Outdoor unit with firmware version 5.05 or beyond may be set up to use the switch control connector (Port J6) to control a single external maintenance waveguide switch (for example, to switch the output between an antenna and a dummy load).

Table C-1 shows the pin-out of the Switch Port (J6).

Table C-1 Switch Port (J6) Pin-Outs

Pin # on J6	Connection	Pin # on J6	Connection
A	N/C	D	N/C
B	N/C	E	POS 2
C	+28 VDC	F	POS 1

In Maintenance Switch Mode (see **Table 10-9**, Data Address 1), a maintenance switch can be placed in Position 1 or Position 2 by toggling the unit's Redundant Startup State setting between the Online and Standby values. The actual state of the SSPA will be determined according to the currently selected hierarchical address.

If hierarchical address "HPA1" is selected, the SSPA will drive the switch to Position 1 when the Redundant Startup State is selected to the "Online" value. The switch will be driven to Position 2 when the Redundant Startup State is selected to "Standby".

For "HPA2", the "Online" and "Standby" selection position for the waveguide switch will be inverted: Position 2 = "Online" state; Position 1 = "Standby" state.

Hardware Switch Position Control

Alternately, the Link In signal on Link Port (J5) can be used for hardware switch position control. **Table C-2** shows the pin-out for Link Port (J5).

Table 2-1: Link Port (J5) Pin-Outs

Pin # on J5	Connection	Pin # on J5	Connection
A	LINK OUT	D	N/C
B	LINK IN	E	N/C
C	N/C	F	GND

In order to use an external line control, the Redundant Startup State must be selected to the "Online" value. In this case, when the Link In signal is left unconnected, the SSPA will drive the waveguide switch to its "Online" state; when the Link In line is connected to a chassis ground, the switch will be driven to the "Standby" position.

"Online" and "Standby" switch positions still will be determined by the hierarchical address selection.

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Appendix D: Documentation

The following pages comprise the specification sheet for the Teledyne Paradise Datacom Compact Outdoor Solid State Power Amplifiers (Drawing Number **205485** for GaAs units; **209555** for GaN units).

See the Teledyne Paradise Datacom web site at http://www.paradisedata.com for the latest revision of these documents.

The block diagram, schematic and outline drawing specific to the ordered unit/system is also appended to this section.

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