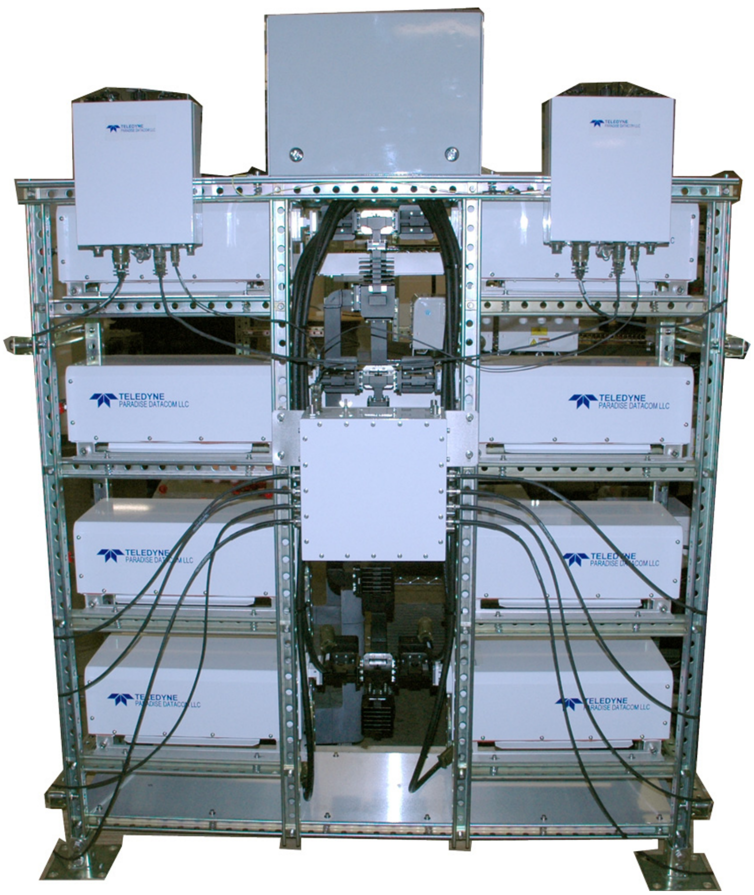
Outdoor PowerMAX Systems
Compact Outdoor SSPA Modules
Operations Manual



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Teledyne Paradise Datacom, a division of Teledyne Defense Electronics 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, Rancho Cordova, CA, USA and Chelmsford, England, Teledyne Paradise Datacom has more than a 20 year history of providing innovative solutions to enable satellite uplinks, battlefield communications, and cellular backhaul.

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1.0 General Information

The PowerMAX technology is the preeminent system technology in High Power Amplifier (HPA) redundancy. PowerMAX is the only purely parallel redundant amplifier system, and has been expanded to include outdoor applications using the popular Compact Outdoor SSPA package.

The Outdoor PowerMAX system maintains complete parallel redundancy down to the embedded control level. Therefore the loss of an entire amplifier will not interrupt remote communications with the system. Remote communications can be either RS-485 or Ethernet. The system will automatically correct its gain level in the event of one or more amplifier failures.

The sophisticated system monitor and control allows the system to be locally or remotely operated as if it were a “single” chassis amplifier. The system control maintains a hierarchical management that allows the operator to interface to a single chassis of the multi-module array.

Another feature unique to Teledyne Paradise Datacom’s Outdoor PowerMAX is the introduction of “true rms” output power measurement. Unlike other amplifier systems that utilize diode detection schemes, the Outdoor PowerMAX reports the true rms output power of the system independent of the number of carriers and modulation schemes.

Proprietary waveguide combining techniques are employed so that maximum power combining efficiency is optimized within the operating frequency band.

The Outdoor PowerMAX system is typically used as a “self-redundant” system. The output power is sized such that the loss of (1) RF module’s power will still allow the system to maintain its minimum required output power. This type of system architecture is described as n+1 redundant. The system can be configured with any number of modules, but best overall efficiency is obtained with the popular binary combinations of 4 or 8 modules.

It is very easy to upgrade the PowerMAX system from 4 modules to 8 modules in the field. It is not necessary to fully populate the system at the time of initial purchase. This provides the user a path to upgrade output power capability as system requirements grow, thus keeping capital investment minimized.

1.1 Theory of Operation

The N+1 PowerMAX architecture provides an improved redundant system topology. The PowerMAX redundant system is a purely parallel array using the single thread Compact Outdoor amplifier modules manufactured by Paradise Datacom.

The PowerMAX system can be configured with 4, 8, or 16 modules phase combined to achieve extremely high output power levels. The system should be sized such that the loss of one module leaves the system with enough output power capacity to meet the system specification. This type of self-redundant system is known as 'N+1' redundancy. Therefore a system with four modules such as shown in **Figure 1-1** should have adequate power with three of four modules operational.

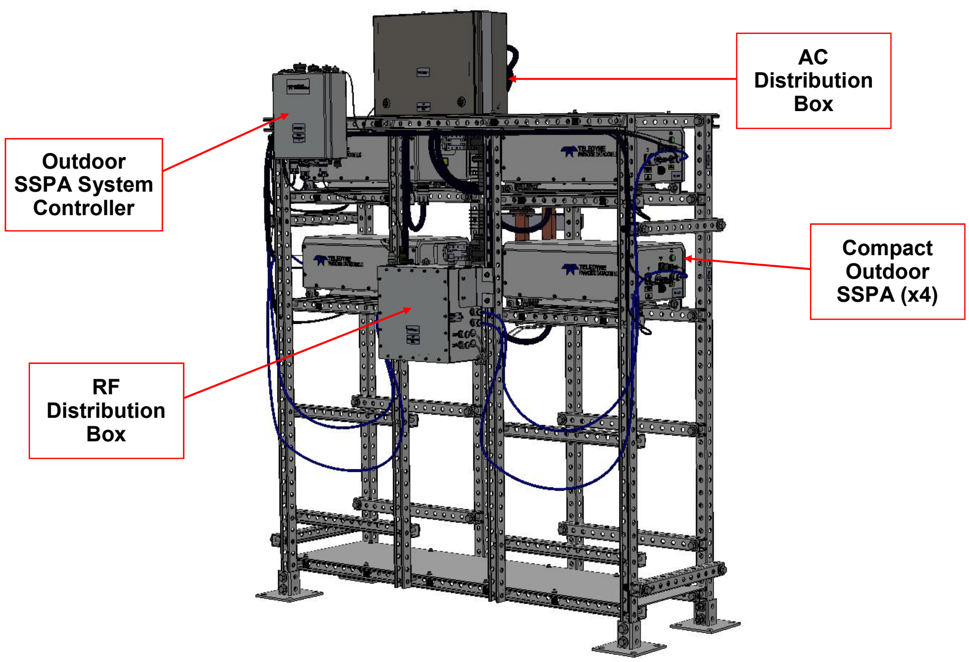


Figure 1-1: Array of Four Compact Outdoor SSPAs in PowerMAX Configuration

In a four-module system, the loss of one module results in a typical reduction of 2.4 dB from the full four-module power. When configuring n+1 redundant system output power with binary array systems the output power guideline shown in **Table 1-1** should be followed.

Table 1-1: PowerMAX Output Power Reduction with Loss of One Module

System Configuration	Loss of One (1) Module	Reduction in Output Power
4-Module System	3 of 4 Modules Operating	-2.4 dB
8-Module System	7 of 8 Modules Operating	-1.2 dB
16-Module System	15 of 16 Modules Operating	-0.6 dB

For example, a system configured with four 250 W modules will typically produce 59.2 dBm (832 W) saturated output power. The redundant output power or 3-of-4 module output power is then typically 56.8 dBm (479 W) saturated output power.

The PowerMAX architecture provides many other benefits including extremely high reliability and availability numbers. A failure of one SSPA results in a seamless reduction of 2.4 dB of maximum output power capability. When operating 4 dB backed off or more, the system can be placed in gain correction mode. This means that the loss of one module does not change the gain of the system and thus it is able to keep the output power constant. Further, there is no redundant switch drop out, so the redundant operation is completely ‘hitless’. The modularity of the system allows the replacement of one SSPA while the system is in operation.

1.1.1 Pure Parallel Redundancy

Unlike some modular based amplifier systems, the PowerMAX architecture is a pure parallel system from the reliability standpoint. Some systems have parallel arrays of RF modules while embedded controllers, fans, and other circuitry are common. This means that these subassemblies are single points of failure. In the PowerMAX architecture, each ‘module’ is essentially a single thread amplifier system. Therefore all of the monitor and control circuitry, fans, and auxiliary control circuits are all parallel redundant. It is virtually impossible to lose communication with the system in the event of a monitor and control circuit card failure.

1.1.2 Simplicity of Operation

At first glance it seems like the Outdoor PowerMAX system would be difficult to operate due to the many SSPA modules.

However, the sophisticated PowerMAX firmware design permits the system to operate as if it were a single amplifier. There is no need to communicate directly with each individual amplifier module. The system maintains a hierarchy of control whereby one of the system controllers becomes the master control point.

In the event of a failure in the master controller, the system will pass control on to the slave controller, thus making it the new master. This makes it very easy to integrate the system into earth station monitor and control systems. Remote communications can be either by RS485 serial or Ethernet.

1.2 System Control

Control of the Outdoor PowerMAX system is provided by the Outdoor SSPA Controllers. See **Figure 1-2** for a map of system control communication paths.

An eight-module PowerMAX system includes two outdoor controllers that are set up in a master/slave configuration. These controllers monitor and control the connected Compact Outdoor SSPAs over a local RS485 serial bus. For troubleshooting purposes, a 10/100 Base-T connection may be made to the Outdoor Controllers, but system control should not be handled at this level.

An optional indoor controller may be used to direct the signal to either the antenna, or to a dummy load for maintenance purposes. This is the Maintenance Switch Controller.

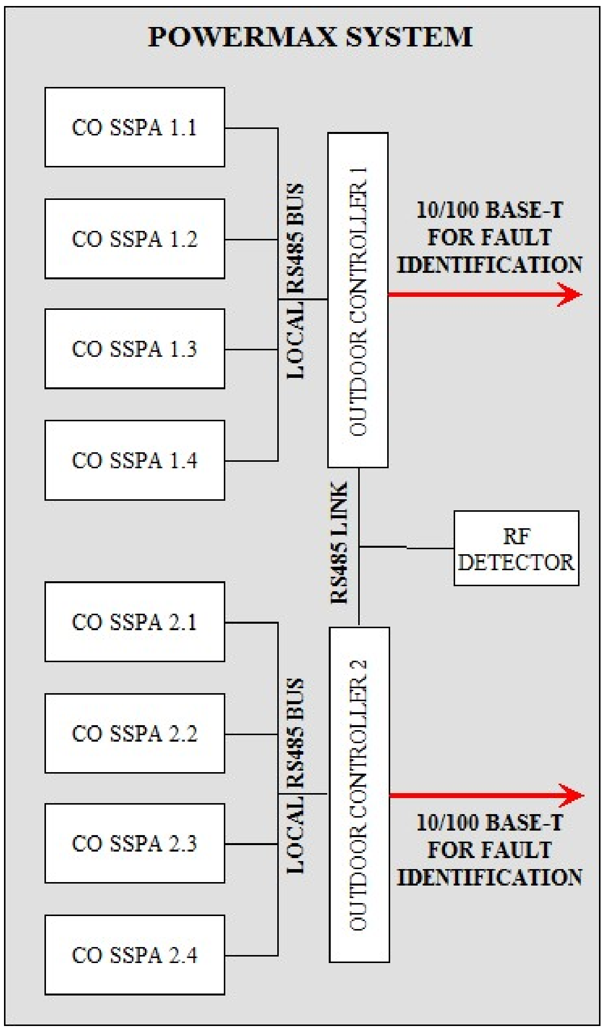


Figure 1-2: System Control Communication Paths, 8-Way System

1.2.1 Maintenance Switch Controller (Optional)

An optional Switch Controller may be used to direct the system RF output signal to a dummy load for maintenance purposes, and back to the antenna output when maintenance is completed.

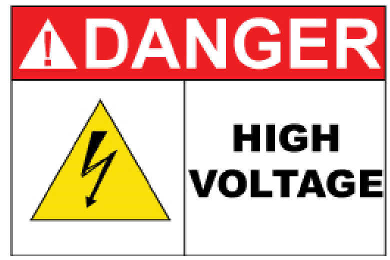
1.3 Safety Considerations

The potential for safety hazards exist unless proper precautions are observed when working with this system. 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 system itself.

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

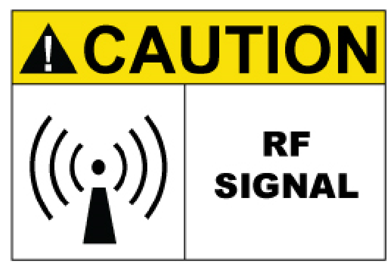
1.3.1 High Voltage Hazards

Only qualified service personnel should service the internal electronic circuitry of the SSPA modules. High DC voltages (300 VDC) are present in the power supply section of the module. 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.



1.3.2 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/cm2. 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.

1.3.3 High Leakage Current Hazards

The SSPA modules may have more than a 3.5 mA leakage current. Make sure a connection to earth ground is present both before applying AC power and after removing AC power.

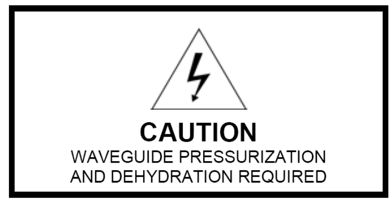
The connections to the SSPA module's earth ground terminal use a 12 AWG cable, UL rated for outdoor use. Connect to the ground stud using the supplied washer and nuts. Make sure to tighten using a wrench.

1.3.4 High Temperature Hazards

When the system is operating, certain surfaces conduct heat and may cause bodily injury if touched. Take appropriate care to avoid touching all surfaces labeled.

- Operators should wear appropriate personal protection equipment when working near hot surfaces.
- The surface thermal conductivity and duration and geometry of contact determine whether dermal injury occurs in scenarios where conduction is the primary mode of heat transfer to the skin. Refer to ASTM C 1055 and ASTM C 1057.

1.3.5 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.

1.4 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 with 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. The amount of pressurization is also difficult to get an accurate calculation 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. The **Table 1-2** shows the power handling capability of some popular waveguide components normalized to the waveguide power rating. From this table we can begin to 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 1-3** 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.

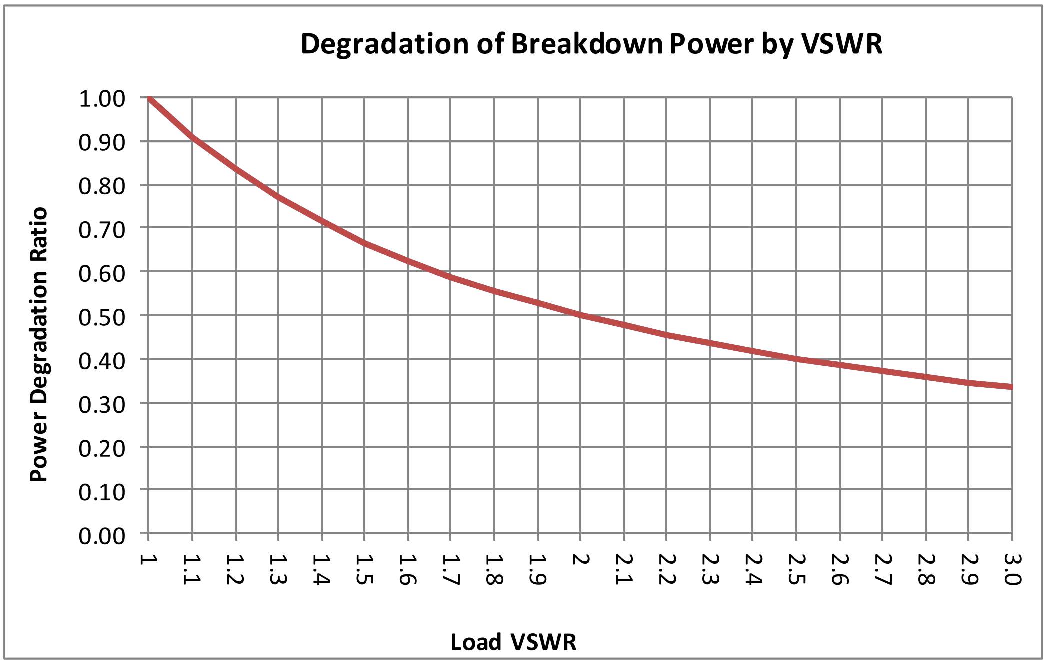


Figure 1-3: Degradation of Breakdown Power by VSWR

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 describes the various components that make up the Outdoor PowerMAX system. These include the Compact Outdoor SSPA enclosure, the RF Distribution Panel (which houses the Power Detector Module), the Outdoor SSPA Controllers, an optional indoor Switch Controller, an optional Ethernet Switch, and an optional AC Distribution Box.

2.1 Compact Outdoor SSPA

Figure 2-1 shows a typical outline drawing of a Compact Outdoor SSPA. The unit enclosure has overall dimensions of 20.9 inches (530.9 mm) by 10 inches (254 mm) by 8 inches (203.2 mm).

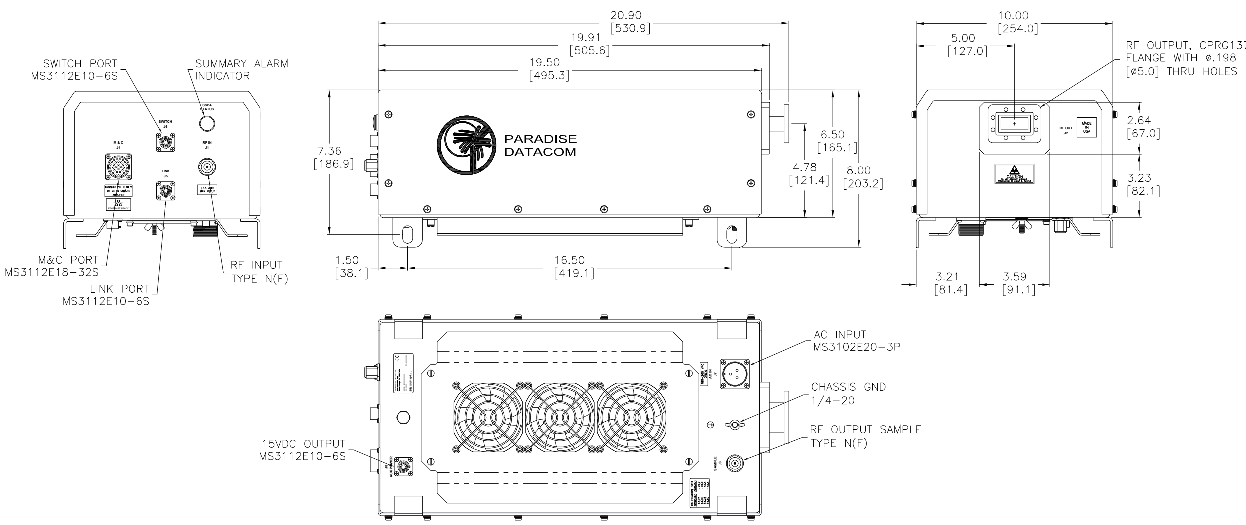


Figure 2-1: Outline Drawing, Typical Compact Outdoor SSPA (C-Band Shown)

The enclosure is sealed to prevent water and debris intrusion, and has an ingress protection rating of IP54. A series of fans provides circulation of ambient air through the enclosure to cool the internal RF module.

A status indicator is located on one end of the unit, opposite the RF output. When the unit is operating normally, the status indicator illuminates green. If the unit enters a fault condition, the status indicator illuminates red. Fault conditions may also be monitored remotely through the Monitor & Control connector (Port J4).

2.1.1 Connector Pin-Outs

The following section details the connector pin-outs for the Compact Outdoor SSPA.

2.1.1.1 RF Input Connector (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:

Input Power = P_{sat} - 75 dB

For example, if a 250 W C-Band unit is used in a system it has a P_{sat} = 54.0 dBm. Therefore the maximum input power should be limited to -21 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.

2.1.1.2 RF Output (J2)

C-Band units use a CPR style grooved waveguide flange (CPRG-137). Ku-Band units use a WR75 grooved flange. X-Band units use a CPRG-112 grooved flange.

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). Never look directly into the RF Output waveguide.

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

The RF Output Sample port, J3, is located on the bottom of the amplifier. This connector provides a sample of the amplifier's output signal. It is a N-type female connector. A sticker is affixed adjacent to the connector which shows the calibration offsets for signals available at this connector.

2.1.1.4 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 **Table 2-1**.

Table 2-1: SSPA Module M&C Connector (J4) Pin-Out

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 5.6**
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	Analog Output	Relative Indication of RF Output Power	R	+4.0 VDC at Psat (RF Power Detector)
Fan Speed Control [1]		Fan Speed Control		No connection (Fan Speed Control)
Fan Alarm [2]		Fan Alarm		
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 Convert-er 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 5.6**
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 **Section 2.1.3**
Baud Select 1	Closure to Gnd	Select Baud Rate & Protocol	e	Refer to **Section 2.1.3**
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.
[2] Ka-Band units only.

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

The interface connector is used to connect between two ore more units when used in a redundant system. It is a 6 pin circular connector, MS3112E10-6S. It requires a mating connector, MS3116F10-6P. See **Table 2-2**.

Table 2-2: SSPA Module 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

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

The switch port (MS3112E10-6S) is used in redundant systems, and is connected via cable to the waveguide switch. See **Table 2-3**. It mates with MS3116F10-6P.

Table 2-3: SSPA Module 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

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

The AC Input connector, J7, is located on the fan side of the unit. 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 2-4**.

Table 2-4: SSPA Module 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 180-265 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. Typical prime power for each 250W C-Band SSPA module is 1500W at 220 vac.

2.1.1.7.1 AC Power Cable

AC power cables connect from the AC Distribution panel, and use a MS3106E20-3S mating connector for J7.

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

2.1.1.8 15 VDC Output Port (J8) [MS3112E10-6S]

The 15 VDC Output, J8, is located on the fan side of the amplifier. This connector provides +15 VDC and up to 1 Amp current to any external equipment. It is a 6-pin MS-type connector (see **Table 2-5** for pin-outs) and mates with MS3116F10-6P.

Table 2-5: SSPA Module +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

2.1.1.9 Chassis Ground Terminal

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

2.1.1.10 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.

2.1.2 Airflow and Removable Fan Tray

The Compact Outdoor SSPA cooling system 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.

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.

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 6.2** for instructions on how to clean the fan assembly and heatsink.

2.1.3 Serial Addressing

The system 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 2-6**).

Table 2-6: SSPA Module Interface Selection on Port J4 (M&C)

Baud0 (Pin j) state	Baud1 (Pin e) state	Selected interface
Open	Open	Interface, Baud Rate and IP Address are all selected by internal SSPA Settings.
Closure to Chassis Ground	Open	
Open	Closure to Chassis Ground	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.
Closure to Chassis Ground	Closure to Chassis Ground	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.

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.

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.

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 2-7**).

Table 2-7: 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 2-6**;
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.

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!

2.1.4 Compact Outdoor SSPA Specifications

Refer to the appropriate specification sheet for the individual Compact Outdoor SSPA module specifications.

The latest version of the specification sheet can be found on the Teledyne Paradise Datacom web site, www.paradisedata.com, under the Outdoor Amplifiers section.

2.2 RF Distribution Panel

Each system of four amplifiers is populated with a RF distribution panel which splits a single RF input signal to each of the amplifiers in the system. The RF Distribution Panel also provides Input and Output sample ports for signal testing purposes. See **Figure 2-2**.

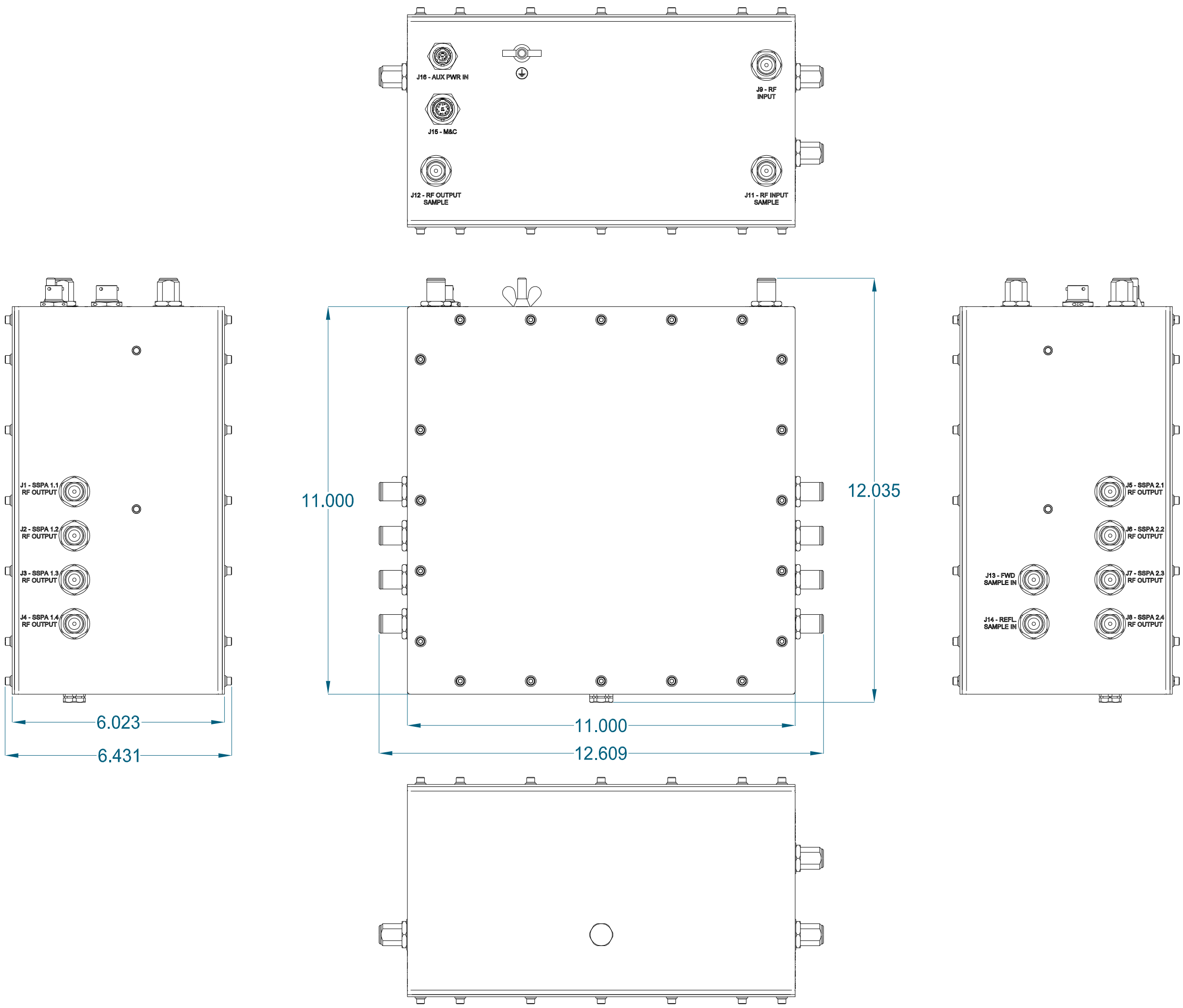


Figure 2-2: RF Distribution Panel

The RF Distribution Panel also houses the Power Detector Module, which is used to monitor the forward and reflected power.

2.2.1 RF Distribution Panel Connections

The RF Distribution Panel is a weather-resistant enclosure that contains 15 connection ports. The enclosure houses the phase adjusters and coaxial cable runs which have been delay matched to provide the signal to each amplifier at the same phase. It also contains the forward and reflected power detector module used to monitor the power from the four-module system.

2.2.1.1 SSPA #.# RF Output (J1 through J8)

These Type N (F) connectors are used to supply the RF signal to each of the amplifiers in the system. A supplied coaxial cable connects between these ports and the RF Input port (J1) of the appropriate amplifier.

2.2.1.2 RF Input (J9)

This is a Type N (F) connector, and is where the RF Input signal is introduced to the system.

2.2.1.3 RF Input Sample (J11)

This is a Type N (F) connector and carries a sample of the RF Input signal. A label with calibration data is affixed near this connector.

2.2.1.4 RF Output Sample (J12)

This is a Type N (F) connector and carries a sample of the RF Output signal. A label with calibration data is affixed near this connector.

2.2.1.5 Forward Sample In (J13)

This Type N (F) connector is used to introduce a sample of the Forward RF signal to the power detector module.

2.2.1.6 Reflected Sample In (J14)

This Type N (F) connector is used to introduce a sample of the Reflected RF signal to the power detector module.

2.2.1.7 M&C Port (J15)

This is a 6-pin circular MIL connector (MS3112E10-6P) which is used for serial communication between the outdoor system controllers and the power detector module. See **Table 2-8** for a pin-out of this connector.

Table 2-8: RF Distribution Panel M&C Port (J15)

Pin #	Connection
A	RS485+
B	RS485-
C	GND

2.2.1.8 Auxiliary Power In (J16)

This is a 3-pin circular MIL connector (MS3112E8-3P) which is used to provide power from the outdoor system controllers to the power detector module. See **Table 2-9** for a pin-out of this connector.

Table 2-9: RF Distribution Panel Auxiliary Power In Port (J16)

Pin #	Connection
A	+15V
B	+15V
C	GND

Power to the device is supplied over a cable connected to the Outdoor SSPA Controller(s) Auxiliary Power Port (J6).

2.2.1.9 Ground Terminal

A ground terminal is provided on the top of the Signal Box. A ¼ - 20 threaded terminal is provided for earth grounding.

2.2.2 Phase Shifters

By removing the front panel of the RF Distribution Box, the operator can access the phase shifters. Each phase shifter is labeled in regard to the SSPA module it affects, and offers mechanical adjustment with a screwdriver. See **Figure 2-3**.

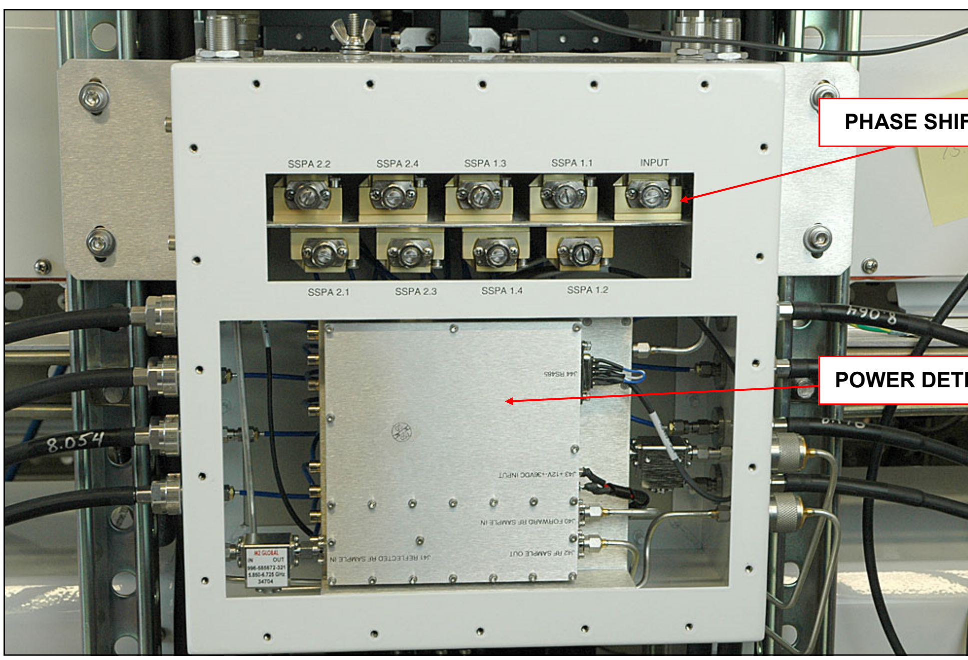


Figure 2-3: Remove Cover to Access Phase Shifters

Note: Phase shifters only required adjustment when a SSPA module is replaced in the field. See **Section 6.5**.

2.2.3 Power Detector Module

The Teledyne Paradise Datacom RMS Power Detector Module is a companion product designed to operate in RF power amplifier systems where an external RF detector is required.

The detector module allows simultaneous monitoring of two independent RF detector channels and reports the monitored RF power over the remote control interface. Channel one (the main channel) is used for monitoring system forward RF power. Channel two is used for reflected power monitoring.

The Detector Module in each RF Distribution Panel monitors the forward and reflected power for the four-module SSPA array to which it is connected. The Detector Modules were pre-configured at the factory and do not need any additional calibration.

2.3 Outdoor SSPA Controllers

This Outdoor SSPA Controller is enclosed in a weather resistant powder-coated aluminum housing. The controller provides a single point of control for up to four (4) connected amplifiers. Multiple controllers can be connected in a master-slave configuration.

2.3.1 Front Panel Interface

Figure 2-4 shows the front panel interface which is located beneath a hinged, weather-resistant door with a locking compression latch that seals the local control panel and sensitive electronics from the environment. The door is sealed against water intrusion by a heavy rubber gasket. Inspect this gasket periodically for tears or signs of leakage, and replace if necessary. **Figure 2-4** also shows the Top Panel and Bottom Panel I/O Connectors.

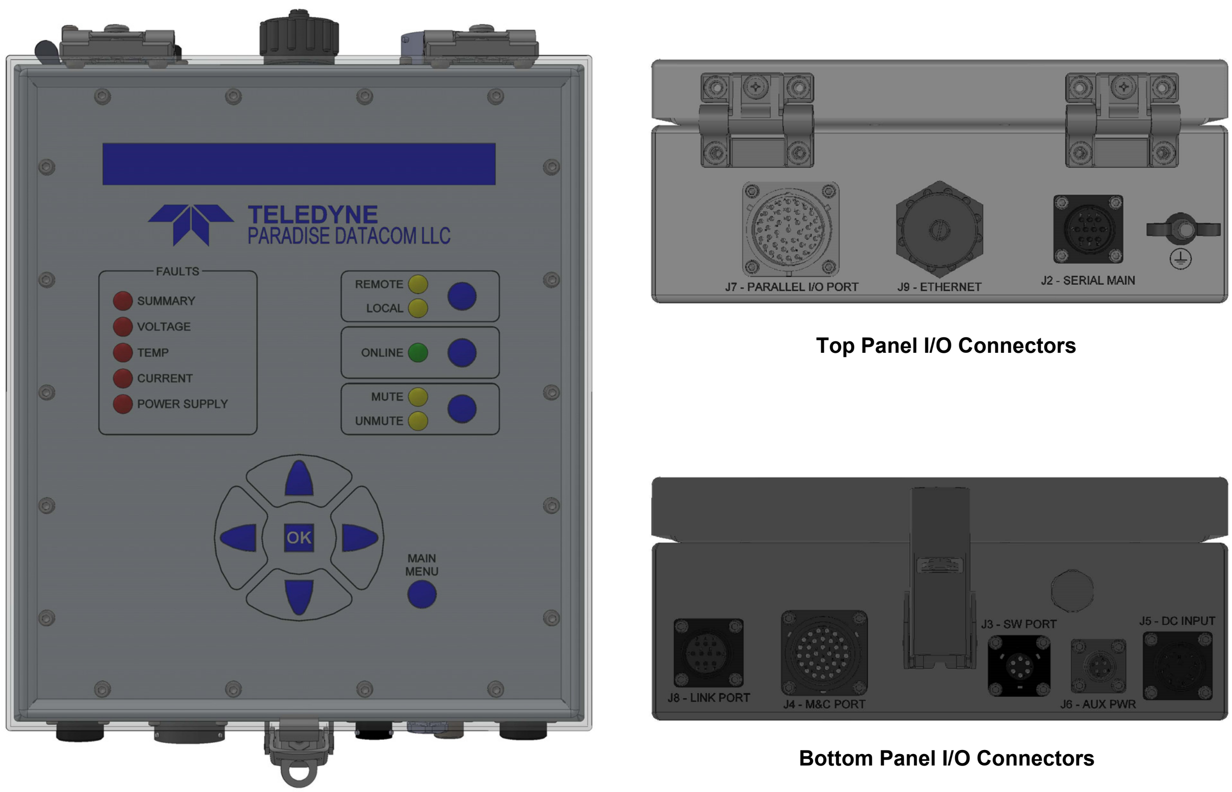


Figure 2-4: Outdoor SSPA Controller Front Panel Interface and I/O Connectors

Lifting the door of the Signal Box/System Controller enclosure reveals the local control panel. The local control panel includes a 40x2 display, ten (10) light emitting diodes, and nine (9) buttons.

The LEDs are used to indicate certain conditions of the system, and the presence of common system faults. Fault LEDs include:

- SUMMARY
- VOLTAGE
- TEMPERATURE
- CURRENT
- POWER SUPPLY

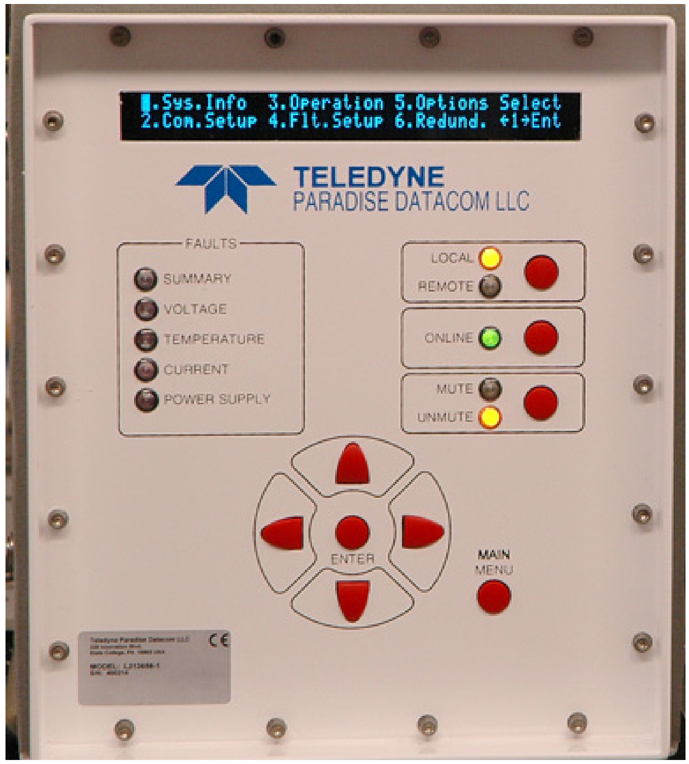


Figure 2-5: Controller Front Panel Interface

If a fault condition exists, the corresponding fault indicator will illuminate red.

The **Local/Remote** button is adjacent to the LOCAL and REMOTE LEDs. Pressing the **Local/Remote** button toggles between the two choices. The LOCAL LED will illuminate when the system is in Local Mode. The REMOTE LED will illuminate when the system is in Remote Mode.

The **ONLINE** button is adjacent to the ONLINE LED. The ONLINE LED will illuminate green when the system is Online. If the system is in Standby mode, the ONLINE LED will not be illuminated.

The **Mute/Unmute** button is adjacent to the MUTE and UNMUTE LEDs. Pressing the **Mute/Unmute** button toggles between the modes. The MUTE LED will illuminate when the system is Muted. The UNMUTE LED will illuminate when the system is Unmuted.

The **Main Menu** button is adjacent to the navigation buttons. The SSPA operational menu tree is accessed by pressing the **Main Menu** button. Navigation through the menu structure is handled by using the **Up Arrow** [▲], **Down Arrow** [▼], **Left Arrow** [◄], and **Right Arrow** [►] buttons and the **Enter** button to select from the menu items shown in the display.

For menus where an actual numerical value must be entered, the **Up Arrow** [▲] and **Down Arrow** [▼] buttons change the number by factors of 10; the **Left Arrow** [◄] and **Right Arrow** [►] buttons change the number in increments of 1.

> **Note**: If the **Local/Remote** button is toggled so that the Remote LED is illuminated, the **Main Menu** button, **Arrow** buttons and **Enter** button are disabled. Press the **Local/Remote** button so that the Local LED is illuminated to resume local operation.

See **Section 4.5** for a description of the Local Control menu structure.

2.3.2 Outdoor SSPA Controller I/O Connections

Figure 2-3 shows the I/O Connections available on the top and bottom panels of the Outdoor SSPA Controller.

2.3.2.1 Ground Terminal

A 1/4–20 threaded terminal is provided for equipment grounding.

2.3.2.2 Outdoor SSPA Controller Serial Main Port (J2)

The Serial Main Port (J2) is a 10-pin circular MIL type connector (MS3112E12-10P). See **Table 2-10** for the pin-out for this connector.

Table 2-10: Outdoor Controller Serial Main Port (J2) Pin-Outs

Pin #	Connection	Pin #	Connection
A	RS232 OUT / RS485 TX-	F	SERVICE REQUEST 2
B	RS232 IN / RS485 RX-	G	SERVICE REQUEST COMMON
C	RS485 RX+	H	120 OHM TERMINATION
D	RS485 TX+	J	GROUND
E	SERVICE REQUEST 1	K	N/C

2.3.2.3 Outdoor SSPA Controller Switch (SW) Port (J3)

The Switch Port (J3) is a 6-socket circular MIL type connector (MS3112E10-6S). See **Table 2-11** for the pin-out for this connector.

Table 2-11: Outdoor Controller Switch Port (J3) Pin-Outs

Pin #	Connection	Pin #	Connection
A	+28 VDC	D	SW 2 POSITION 1
B	+28 VDC	E	SW 1 POSITION 2
C	SW 1 POSITION 1	F	SW 2 POSITION 2

2.3.2.4 Outdoor SSPA Controller Monitor & Control (M&C) Port (J4)

The Monitor & Control Port (J4) is a circular MIL type connector (PT02E-18-32S). See **Table 2-12** for the pin-out for this connector.

Table 2-12: Outdoor Controller M&C Port (J4) Pin-Outs

Pin #	Connection	Pin #	Connection
T	RS485+	c	SSPA2 FAULT
E	RS485-	g	SSPA3 FAULT
B	MUTE	h	SSPA4 FAULT
V	GROUND	R	FAN FAULT
b	SSPA1 FAULT		

2.3.2.5 Outdoor SSPA Controller DC Input Port (J5)

The DC Input Port (J5) is a 8-pin circular MIL type connector (MS3112E12-8P). See **Table 2-13** for the pin-out for this connector.

Table 2-13: Outdoor Controller DC Input Port (J5) Pin-Outs

Pin #	Connection	Pin #	Connection
A	+28 VDC	E	+15 VDC
B	+28 VDC	F	+15 VDC
C	N/C	G	GROUND
D	N/C	H	GROUND

2.3.2.6 Outdoor SSPA Controller Auxiliary Power (AUX PWR) Port (J6)

The Auxiliary Power Port (J6) is a 4-socket circular MIL type connector (MS3112E8-4S). See **Table 2-14** for the pin-out for this connector.

Table 2-14: Outdoor Controller AUX PWR Port (J6) Pin-Outs

Pin #	Connection	Pin #	Connection
A	+15 VDC	C	GROUND
B	+15 VDC (Ethernet Switch)	D	GROUND

2.3.2.7 Outdoor SSPA Controller Parallel I/O Port (J7)

The Parallel I/O Port (J7) is a 41-socket circular MIL type connector (MS3112E20-41S). See **Table 2-15** for the pin-out for this connector.

Table 2-15: Outdoor Controller Parallel I/O Port (J7) Pin-Outs

Pin #	Connection	Pin #	Connection
A	Power Supply Fault (closed on fault)	W	Current Fault (open on fault)
B	Power Supply Fault (open on fault)	X	Current Fault (common)
C	Power Supply Fault (common)	Y	Low RF Fault (closed on fault)
D	Auxiliary Fault (closed on fault)	Z	Low RF Fault (open on fault)
E	Auxiliary Fault (open on fault)	a	Low RF Fault (common)
F	Auxiliary Fault (common)	b	Mute Input (toggle on falling edge)
G	Mute Status (open on mute)	c	Local/Remote (toggle on falling edge)
H	Mute Status (closed on mute)	d	Auxiliary Fault Input
J	Mute Status (common)	e	Standby Select (falling edge detection)
K	BUC Fault (closed on fault)	f	Latched Fault Clear (falling edge det.)
L	BUC Fault (open on fault)	g	N/C
M	BUC Fault (common)	h	+28V Out
N	Temperature Fault (closed on fault)	i	Chassis Ground
P	Temperature Fault (open on fault)	j	+5 VDC Pull-up
R	Temperature Fault (common)	k	+28V Out
S	Regulator Fault (closed on fault)	m	Chassis Ground
T	Regulator Fault (open on fault)	n	Isolated Ground
U	Regulator Fault (common)	p, q, r, s, t	N/C
V	Current Fault (closed on fault)		

2.3.2.8 Outdoor SSPA Controller Link Port (J8)

The Link Port (J8) is a 10-socket circular MIL type connector (MS3112E12-10S). See **Table 2-16** for the pin-out for this connector.

Table 2-16: Outdoor Controller Link Port (J8) Pin-Outs

Pin #	Connection	Pin #	Connection
A	RS485+	F	SYNC
B	RS485+	G	LINK IN A
C	RS485-	H	LINK IN B
D	RS485-	J	GROUND
E	LINK OUT	K	N/C

2.3.2.9 Outdoor SSPA Controller Ethernet Port (J9)

The Ethernet Port (J9) is a weatherized RJ45 bulkhead connector, with dust cover. See **Table 2-17** for the pin-out for this connector.

Table 2-17: Outdoor Controller Ethernet Port (J9) Pin-Outs

Pin #	Connection	Pin #	Connection
1	TX+	5	GROUND
2	TX-	6	RX-
3	RX+	7	GROUND
4	GROUND	8	GROUND

2.4 Indoor Switch Controller (Optional)

An optional Switch Controller may used to control the position of a maintenance switch placed at the system RF output. Using this controller, the operator can direct the signal to either a dummy load or to the antenna.

2.4.1 Indoor System Controller Cable Connections

This section details the wide range of I/O interconnections available at the rear panel of the controller, shown in **Figure 2-6**.

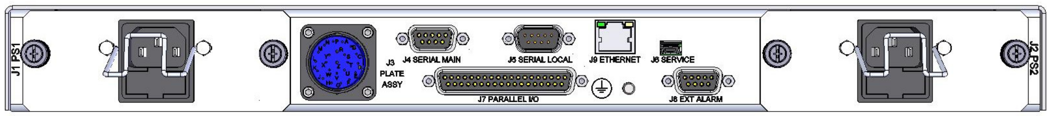


Figure 2-6: Maintenance Switch Controller, Rear Panel (Standard AC Input)

2.4.1.1 Indoor Controller Prime Power Connections (J1, J2)

Two separate removable power supplies are provided for fully redundant operation. Either of the two supplies is capable of operating the system and its associated switches. Two AC power connectors are provided on the rear panel (J1,J2). **Figure 2-7** shows an image of a typical power supply module.

The following list comprises the specifications for the standard power supply module:

- Plug: IEC, 250V, 10A, Male plug with wire-form AC Cable Clamp
- Fuse: 2 Amp 5x20mm
- Power Supply: 85-264 V input, 28V output, 175W
- Connector to RCP chassis: Quick-connect Power pole

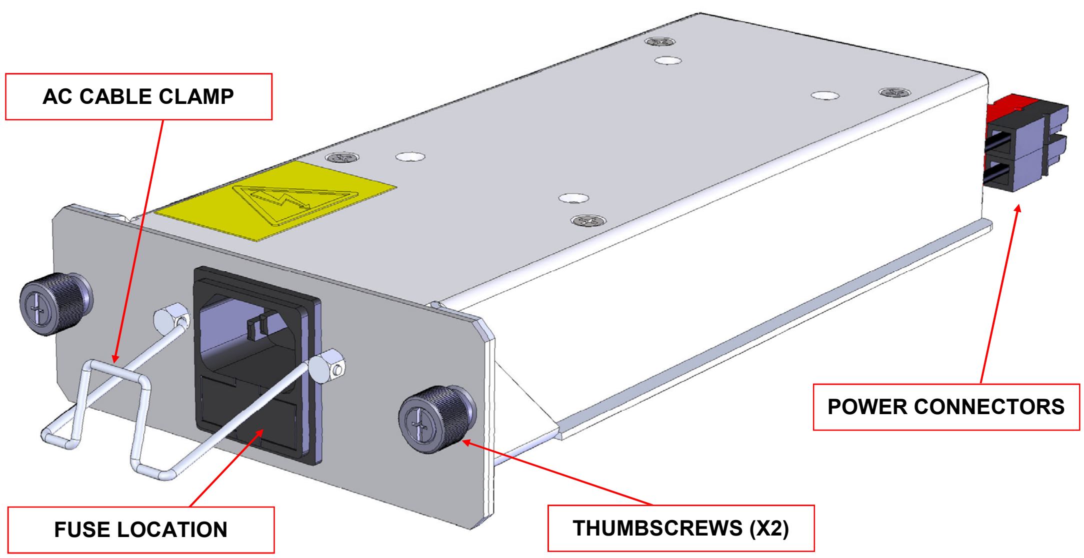


Figure 2-7: Removable Power Supply Module

2.4.1.2 Indoor Controller Control Cable Connector (J3) - MS3112E16-23S

The primary connection between the controller and the LNA/LNB (Low Noise Amplifier/ Low Noise Block Converter) switch plate or SSPA (Solid State Power Amplifier) switch assembly is through J3. The connector is a 23-pin circular connector, type MS3112E16-23S (See **Table 2-18**). For external waveguide switches, a standard 100 ft. (30m) cable, L201061 should be used.

Table 2-18: Indoor Controller J3 Switch Connector, MS3112E16-23S

Pin	Function	Pin	Function
L	Power Supply #1 +13-17 VDC, 900mA or +26V, 1.5A (-HP version only)	F	Switch Common, +26 VDC, 5A max
J	Power Supply #2 +13-17 VDC, 900mA or +26V, 1.5A (-HP version only)	H	Switch Common, +26 VDC, 5A max
G	Power Supply #3 +13-17 VDC, 900mA or +26V, 1.5A (-HP version only)	T	Switch #2, Position 1 (Rx)
E	Switch Common, +26 VDC, 5A max	V	Switch #2, Position 1 (Rx) (primary)
B	AMP Support GND	N	Switch #2, Position 2 (Rx)
D	Switch Common, +26 VDC, 5A max	R	Switch #2, Position 2 (Rx) (primary)
W	Switch #1, Position 1 (Tx) (primary)	A	AMP Support GND
U	Switch #1, Position 1 (Tx)	C	AMP Support GND
P	Switch #1, Position 2 (Tx)	K	Switch Common, +26 VDC, 5A max
S	Switch #1, Position 2 (Tx) (primary)	M	Switch Common, +26 VDC, 5A max

2.4.1.2 Indoor System Controller Serial Port, Main (J4) - DB9 (F)

The main serial port is for connection with any host computer. The pin-out is shown in **Table 2-19**. This port contains both RS-232 and RS-485 communication in half duplex. RS-485 interface is compatible with 2- or 4-wire interface connection. As an additional protection measure, this port features full galvanic isolation from the chassis ground. For convenience, a set of Form C relay contacts are available at this port as a Service Request. The Service Request is essentially a Summary Alarm for any system faults that occur. The baud rate and other communication parameters are selectable via the front panel menu.

Table 2-19: Indoor Controller Main Serial Port (J4) Pin Out

Pin	Function	Notes
1	RS-485 TX+	
2	RS-232 Out or RS-485 TX-	
3	RS-232 In or RS-485 RX-	
4	RS-485 RX+	
5	Signal Ground	
6	Service Request 1	Closed on Fault
8	Service Request 2	Open on Fault
7	Service Request Common	Form C Common
9	Termination (120 Ohm)	Connect to pin 4 to terminate unit on end of bus

Note that the pin-out is standard DTE; a null modem is not required when connecting to a standard PC serial port. A 120 ohm RS-485 termination resistor is provided at pin 9. It should be connected to pin 4 to provide a 120 ohm termination on the RS-485 bus.

2.4.1.3 Indoor System Controller Serial Port, Local (J5) - DB9 (M)

The local serial port is used to support special transceiver systems and remote control panels. The baud rate of this port is fixed at 9600 Baud and cannot be changed. J5 is permanently configured for RS-485 half duplex communication. **Table 2-20** details the local serial port pin-out. Port features full galvanic isolation from chassis ground.

Table 2-20: Indoor Controller Local Serial Port (J5) Pin Out

Function	Pin	Notes
RS-485 RX+	1	
RS-485 RX-	2	
RS-485 TX-	3	
RS-485 TX+	4	
Signal Ground	5	
Termination (120 Ohm)	9	Connect to pin 1 to terminate unit on end of bus

2.4.1.4 Indoor System Controller Service Port (J6) - Mini USB

A 5-contact Mini USB connector is used to provide flash re-programmability for the RCP controller card. In order to reload controller board firmware, connect this port to a standard PC USB port. Make no connection to this port without consulting the factory.

2.4.1.5 Indoor System Controller Parallel I/O Connector (J7) - DB37 (F)

The RCP controller has a full compliment of parallel monitor and control lines. A 37-pin D sub-style connector is used for the parallel I/O signals, which are detailed in **Table 2-21** on the following page.

Ten Form-C relays are used for converter, switch position, and mode control. Each Form-C contact has a rating of 30 VDC @ 0.5 A, 110 VDC @ 0.3 A, and 125 VAC @ 0.5 A. The inputs and ground pins are isolated from the rest of the unit's circuitry. Inputs are activated by pulling it down to the isolated ground pin. In order to fully utilize the built-in inputs protection, it is recommended to keep the input's ground isolated from the chassis ground.

Table 2-21: Indoor Controller Parallel I/O Signals

Identification	Signal	Pin	Function	Notes
Amp 1 Alarm	Output	1	Closed on Fault	Relay Contacts: 30VDC @ 0.5A
		20	Common	
		2	Open on Fault	
Amp 2 Alarm	Output	21	Closed on Fault	Relay Contacts: 30VDC @ 0.5A
		3	Common	
		22	Open on Fault	
Amp 3 Alarm	Output	4	Closed on Fault	
		23	Common	
		5	Open on Fault	
Auto / Manual Mode	Output	24	Closed on Manual	
		6	Common	
		25	Closed on Auto	
Local / Remote Mode	Output	7	Closed on Local	
		26	Common	
		8	Closed on Remote	
Switch #1 Position	Output	27	Switch #1, Position 1	
		9	Common	
		28	Switch #1, Position 2	
Switch #2 Position	Output	10	Switch #2, Position 1	
		29	Common	
		11	Switch #2, Position 2	
Power Supply #1 Alarm	Output	30	Closed on Fault	
		12	Common	
		31	Open on Fault	
Power Supply #2 Alarm	Output	13	Closed on Fault	
		32	Common	
		14	Open on Fault	
Priority Setting	Output	33	Closed on Priority 2	
		15	Common	
		34	Closed on Priority 1	
Fault Clear	Input	37	Ground to Activate	5mA max current on all inputs
Priority Select	Input	17	Ground to Activate	Toggle Function
Auto / Manual	Input	16	Ground to Activate	Toggle Function; Alt Funct.: Ext. Mute Input
Amp 3 Standby	Input	36	Ground to Activate	
Amp 2 Standby	Input	35	Ground to Activate	
Amp 1 Standby	Input	18	Ground to Activate	
Inputs Ground (isolated)	Common	19		

2.4.1.6 Indoor System Controller External Alarm Port (J8) - DB9 (F)

An external alarm port is provided to allow maximum flexibility of configurations. This allows the user to interface with the alarm output of other equipment into the RCP controller. Inputs are protected against ESD of ±15 kV using the Human Body model; against ESD of ±8kV using the Contact Discharge method specified in IEC1000-4-2; and against ESD of ±15 kV using the Air Gap method described in IEC1000-4-2. **Table 2-22** shows the external alarm pin-out.

Table 2-22: Indoor Controller External Alarm Port (J8) Pin Out

Function	Pin	Notes
External Alarm 1	1	Closure to Ground, 5mA max short circuit current, 5 VDC open circuit voltage
External Alarm 2	2	
External Alarm 3	3	
Ground	4,8,9	
Auxiliary Alarm 1	5	Closure to Ground, 5mA max short circuit current, 5 VDC open circuit voltage
Auxiliary Alarm 2	6	
Auxiliary Alarm 3	7	

2.4.1.7 Indoor System Controller Ethernet Port (J9) - RJ45 (F)

This is a RJ45 connector with integrated magnetics and LEDs. This port becomes the primary remote control interface when the Interface option is selected to “IPNet” or SNMP interface as described in **Section 5.6**. This feature allows the user to connect the RCP to a 10/100 Base-T office Local Area Network and have full-featured Monitor & Control functions through a web interface. See **Table 2-23**.

Table 2-23: Indoor Controller Ethernet Port (J9) Pin outs

Pin #	Function / Description
1	TX+
2	TX-
3	RX+
6	RX-
4,5,7,8	GND

Note: IP address, Gateway address, Subnet mask, IP port and IP Lock address need to be properly selected prior to first use (see **Appendix A**).

LED lamps on the connector indicate network status. A steady Green light indicates a valid Ethernet link; a flashing Yellow LED indicates data transfer activity (on either the Transmit and Receive paths). Starting with firmware version 6.00, the controller can support multiple remote control interfaces.

2.4.2 Indoor System Controller Front Panel, Common Functions

The front panel is used to locally control the system. **Figure 2-8** shows the front panel of a 1 RU controller.

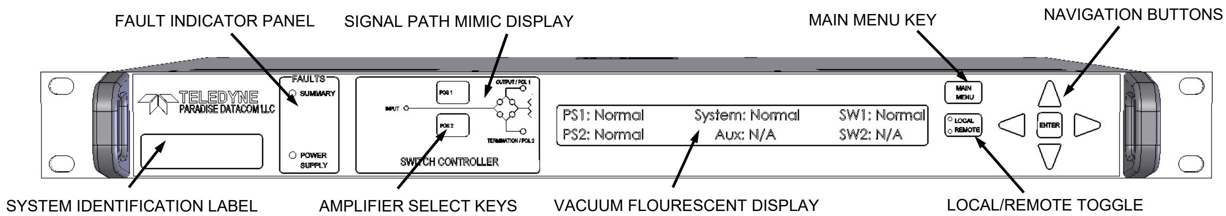


Figure 2-8: Front Panel, System Controller, Typical

2.4.2.1 Indoor System Controller Identification

A label on the lower left hand corner of the controller front panel displays the model number and a brief description of the unit. The serial number is located on the top cover, near the rear panel of the controller.

2.4.2.2 Indoor System Controller Fault Indicators

The fault indicator LEDs illuminate RED when the corresponding fault condition occurs. There are fault lights for Summary and Power Supply faults.

2.4.2.3 Indoor System Controller Signal Path Mimic Display

The front panel mimic display provides a visual representation of the redundant system block diagram. Green LEDs indicate the position of the transfer switches showing the RF signal path from the RF input to the RF output.

The sections for each controller type detail the signal path mimic display for that unit.

2.4.2.4 Indoor System Controller Amplifier Select Keys

The Amplifier Select Keys on the mimic display panel allow the user to manually change the operating mode or switch position. The on-line amplifier or operating mode, is designated by the illuminated green LED.

These keys operate on a “give away” function. The operator must press the active, illuminated key to give away the function to the inactive mode.

2.4.2.5 Indoor System Controller Vacuum Fluorescent Display

The Vacuum Fluorescent Display (VFD) provides a convenient method of selecting various operating parameters of the controller. All internal settings can be achieved via the VFD and menu structure. There is no need to access the interior of the controller to adjust or reconfigure hardware settings. The VFD also provides detailed information about fault conditions.

2.4.2.6 Indoor System Controller Main Menu Key

The **Main Menu** key is a convenient method for instantly returning to the VFD main menu. No matter what menu screen Is currently displayed on the VFD, pressing this key returns the user to the main menu, eliminating the need to scroll backward through several menu levels. See **Section 3.3** for information regarding the menu selections.

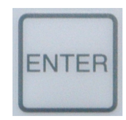
2.4.2.7 Indoor System Controller Local / Remote Key

The **Local/Remote** key selects whether the controller is operational by front panel (local) control or by remote control. Remote control includes the rear panel parallel control signals and serial communication.

2.4.2.8 Indoor System Controller Display Navigation Keys

The display navigation keys allow the operator to move the cursor through the VFD menu structure. **Right**, **Left**, **Up** and **Down** movement is available.

2.4.2.9 Indoor System Controller Enter Key



The **Enter** key is used to select a given menu item. In conjunction with the navigation keys, it is easy to locate and select a desired function.

2.4.3 Front Panel, Optional Switch Controller

An optional Switch Controller is typically connected to the switch drive and to the system's Outdoor SSPA Controllers, so that the output of the amplifiers can be temporarily muted during switchover to prevent arcing in the transmission line.

2.4.3.1 Operation Modes

The optional Switch Controller controls the position of a switch at the output of the connected amplifier or amplifier system. The position of the switch determines whether the output signal of the amplifier or amplifier system is directed to a dummy load (the maintenance position), or to the system output.

2.4.3.1.1 Directing the Output Signal to the System Output

If the output signal is directed to the dummy load, when the operator presses the **POS2** key on the controller front panel, the switch is switched to its primary position. The LED on the **POS1** key will illuminate and the LEDs in the mimic path display will show the signal directed to the system output (antenna). See **Figure 2-9**.

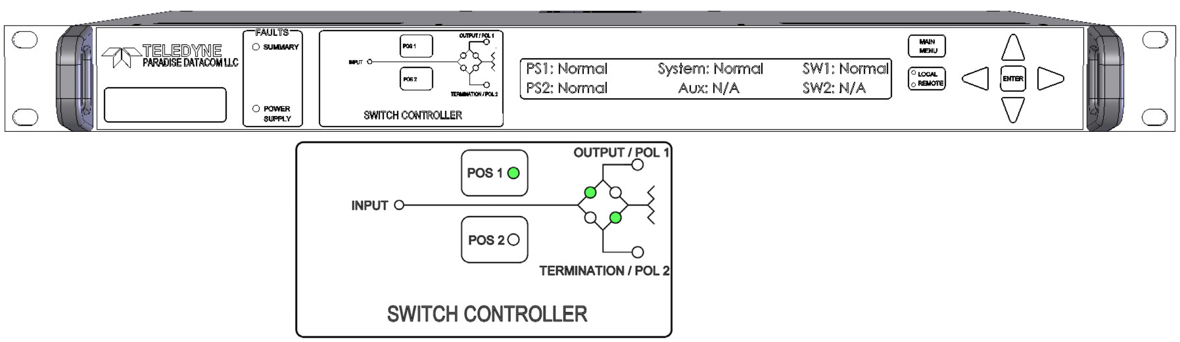


Figure 2-9: Front Panel, Optional Switch Controller, Output Sent to Antenna

2.4.3.1.2 Directing the Output Signal to the Dummy Load

If the output signal is directed to the system output (antenna), when the operator presses the **POS1** key on the controller front panel, the switch is set to its secondary position. The LED on the **POS2** key will illuminate and the LEDs in the mimic path display will show the signal directed to the dummy load (Offline Output on the mimic panel). See **Figure 2-10**.

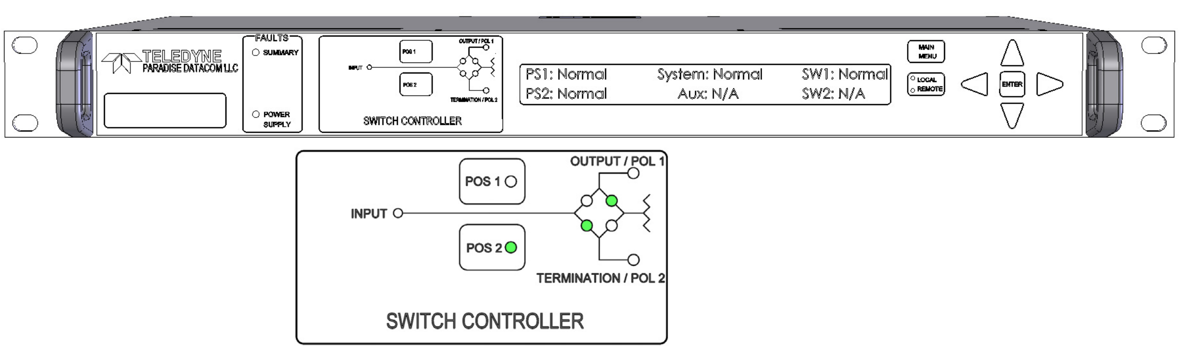


Figure 2-10: Front Panel, Optional Switch Controller, Output Sent to Dummy Load

2.5 Optional Ethernet Switch

Teledyne Paradise Datacom chose the 105M12 Industrial IP65 Rated Ethernet Switch for use with the Outdoor PowerMAX systems. It is designed to meet the most demanding industrial communications requirements while providing high throughput and minimum downtime.

The 105M12 provides five auto sensing 10/100BaseTX ports with M12, D-code, 4 pin (F) style connectors. All ports are full/half duplex capable. The switch auto-negotiates the speed and flow control capabilities of the five TX port connections, and configures itself automatically. Since the switch is auto sensing, there will be no need to make extensive wiring changes if upgrades are made to the host microprocessors or Ethernet I/O modules.

Figure 2-11 shows an outline drawing of the Ethernet Switch.

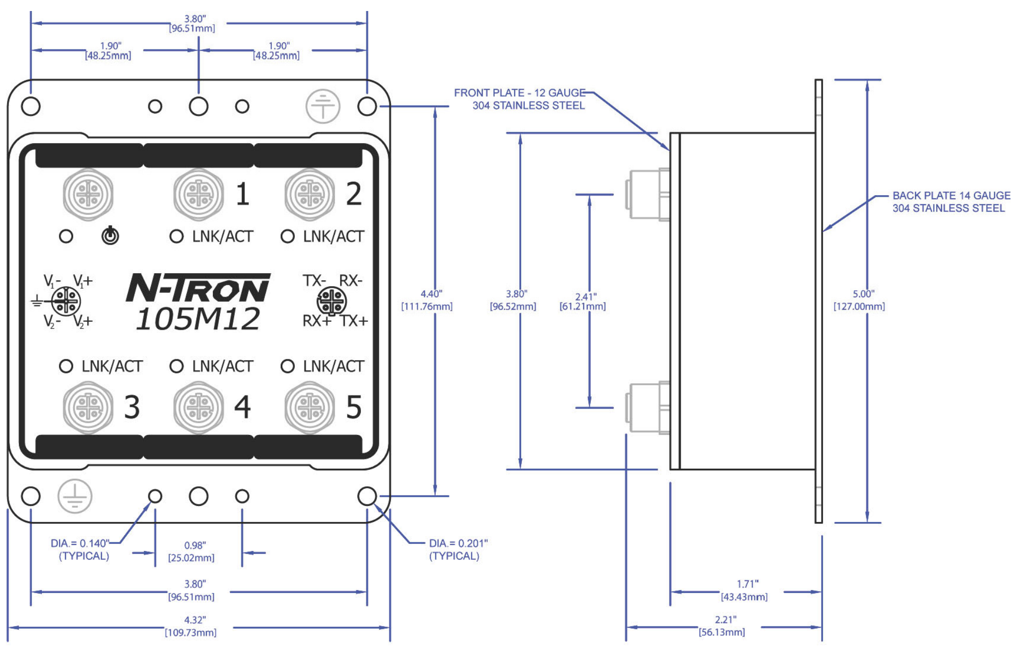


Figure 2-11: Outline Drawing, Optional Ethernet Switch

2.5.1 Ethernet Switch Specifications

Electrical
Input Voltage: 10-30 VDC
Steady Input Current: 250 mA @ 24V
Inrush: 8.1 Amp / 0.7 ms @ 24V

Environmental
Operating Temperature: -40 °C to 80 °C
Storage Temperature: -40 °C to 85 °C
Operating Humidity: 5% to 100%
(Non Condensing)
Operating Altitude: 0 to 10,000 ft.
(3,000 m)

Connectors
10/100BaseTX: Five (5) M12 D-Coded 4-Pin Female Ports
Power: One (1) M12 A-Coded 5-Pin Male Port

Network Media
10BaseT: > Cat3 Cable
100BaseTX: > Cat5 Cable

Reliability
MTBF: > 2 Million Hours

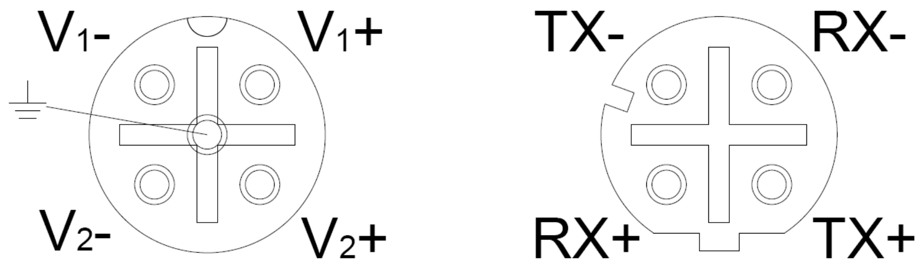


Figure 2-12: Ethernet Switch Power (Left) and COMs (Right) Port Pin-outs

2.5.2 Ethernet Switch Connectors

The switch has an LED at each connector port. The LED adjacent to the Power port will illuminate when power is applied. The LEDs adjacent to the numbered COMs ports are the link/activity indicators. The LED will illuminate when a link is established, but there is no activity on the cable. It will blink when data is being transferred over the cable.

The M12 A-coded, 5-pin (M) power connector is keyed, where the mating connection from the power supply can be made only when the male and female ends are properly aligned. When power is initially connected, all LEDs will illuminate momentarily. See **Figure 2-12**, **left** for the pin-outs of the power connector.

The COMs ports are M12 D-coded, 4-pin (F) connectors and were shipped with IP67 caps installed to protect from dust and moisture ingress. The caps will need to be removed before connecting cables to the COMs port. See **Figure 2-12**, **right** for the pin-outs of the COMs connectors.

Warning: Connecting port-to-port on the Ethernet switch will create a feedback loop. Do not connect port-to-port.

2.5.3 Ethernet Mating Connectors

The Ethernet mating connectors used in the Outdoor PowerMAX system are M12 D-coded, straight, 4-pin (M), shielded plug connectors. If the operator plans to communicate remotely with the system over Ethernet, the cable connection to the Ethernet switch will need to use a M12 D-coded, straight 4-pin (M) shielded plug, such as those manufactured by Phoenix Contact, model SACC-M12MSD-4CON-PG 7-SH.

Note: The Ethernet switch is powered from the RF Distribution Boxes of both System 1 and System 2. See **Section 3.2.10.17** for a description of the Auxiliary Power Cable.

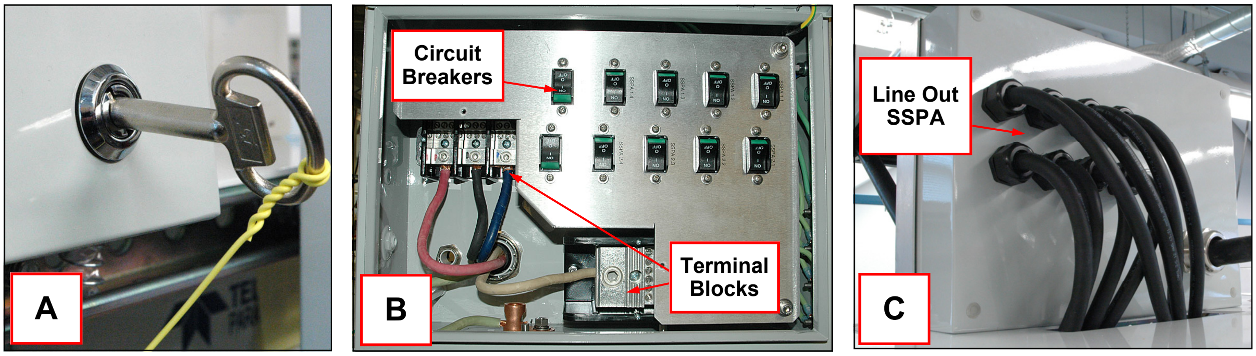


Figure 2-13: Optional AC Distribution Box, External and Interior Views

2.6 Optional AC Distribution Box

An array of up to eight Compact Outdoor SSPAs can be powered through a single AC Distribution Box. This box provides a convenient method of applying power to a single set of terminal blocks, which is then distributed to each of the system amplifiers and auxiliary equipment.

The AC Distribution Box is a weatherized enclosure which houses the terminal blocks and a line out with breaker for each piece of equipment in the system. The hinged front access panel has two quarter-turn keyed latches which can be used to lock the panel closed. See **Figure 2-13-A**.

Opening the front panel reveals a set of circuit breakers, one for each unit in the system. Each breaker is labeled to identify the equipment for which it applies. An access panel is secured by two screws. Removing the panel provides access to the cable conduit and terminal blocks. See **Figure 2-13-B**.

At the rear panel, the Line In cable conduit features a 1.97” (50 mm) dome nut fitting which provides access for cable dimensions of 0.87” to 1.26” OD (22 to 32 mm). A secondary cable conduit may be used for the return line. It is a 0.94” (24 mm) dome nut fitting allowing access for cable dimensions of 0.39” to 0.55” OD (10 to 14 mm).

A Line Out power cable for each unit in the array is connected to each circuit breaker, and run through weatherized access ports at the rear of the box. See **Figure 2-13-C**.

Each power cable terminates in a connector. The power cables for the Compact Outdoor amplifiers have a circular MIL type connector (MS3106E20-3S), which plugs into the AC INPUT port (J7) of the amplifier.

All cables are labeled near the connector.

The AC Distribution Box is pre-wired for 3-phase Y operation (phase to neutral) suitable for a 110/208V or 220/360V circuit, depending on the power requirements of the individual Compact Outdoor SSPA modules. Some Compact Outdoor SSPAs are available with a 110V option. Consult the factory if your system’s power requirements are different than standard.

2.7 Power Detector Module

A dual crossguide coupler at the waveguide output of the system directs a sample of the forward and reflected power to the power detector module. This detector module is housed in the system's RF Distribution Box, as described in **Section 2.2.3**, and is monitored by the system's Master Outdoor SSPA Controller.

The detector module circuitry measures the amount of RF power present in the sample, with a dynamic range of 20 dB starting at the maximum RF output. For example, a system with 64.0 dBm (2.5 kW) of maximum forward RF would be capable of reading reflected power levels from 44.0 dBm (25 W) to 64.0 dBm (2.5 kW).

2.7.1 Reflected Power Measurement

When the system is operating, the forward and reflected power measurements are available from the Master Outdoor SSPA Controller.

1. Press the **Main Menu** button of the Master Outdoor SSPA Controller;
2. Select **1.Sys Info** and press the **Enter** button.

2.7.2 Reflected Power Alarm

All high reflected power and low forward power alarm functions are monitored by the power detector module.

The alarm levels are factory pre-set for the following conditions:

- High reflected power and low forward power alarms are triggered at 54 dBm at the output of the system.

3.0 Introduction

This section describes the unpacking, inspection and installation procedures the user should follow to set up a 4-way or 8-way PowerMAX System.

3.1 Inspection and Unpacking

When the system is received, an initial inspection should be completed. First, ensure that the shipping containers are not damaged. If any damage is discovered, have a representative of the shipping company present when the container is opened.

Perform a visual inspection of the equipment to make sure that all items on the packing list are enclosed. If any damage has occurred or if items are missing, contact:

Teledyne Paradise Datacom
11361 Sunrise Park Drive
Rancho Cordova, CA 95742 USA
Phone: 1 (814) 238-3450

Save all shipping containers and packing materials for future use.

3.2 Installation

The system was shipped from the factory as intact as possible, but some assembly is required to complete the installation. The system includes the following components:

- (1) Uni-Strut SSPA Frame Assembly (per 8-way system);
- (1) Uni-Strut Waveguide Switch/Termination Assembly (per frame);
- (2) Outdoor SSPA Controller Assemblies (per frame);
- (4) or (8) or (16) Compact Outdoor SSPA Modules;
- (1) RF Distribution Box Assembly (per 8-way system);
- (1) Optional Maintenance Switch Controller;
- (1) Optional Maintenance Switch and Termination;
- (1) Optional AC Distribution Box Assembly (per 8-way system);
- (1) Optional Outdoor Ethernet Switch Assembly;
- Coaxial cables and COMS cables.

Installation instructions are available in a separate manual available from the factory.

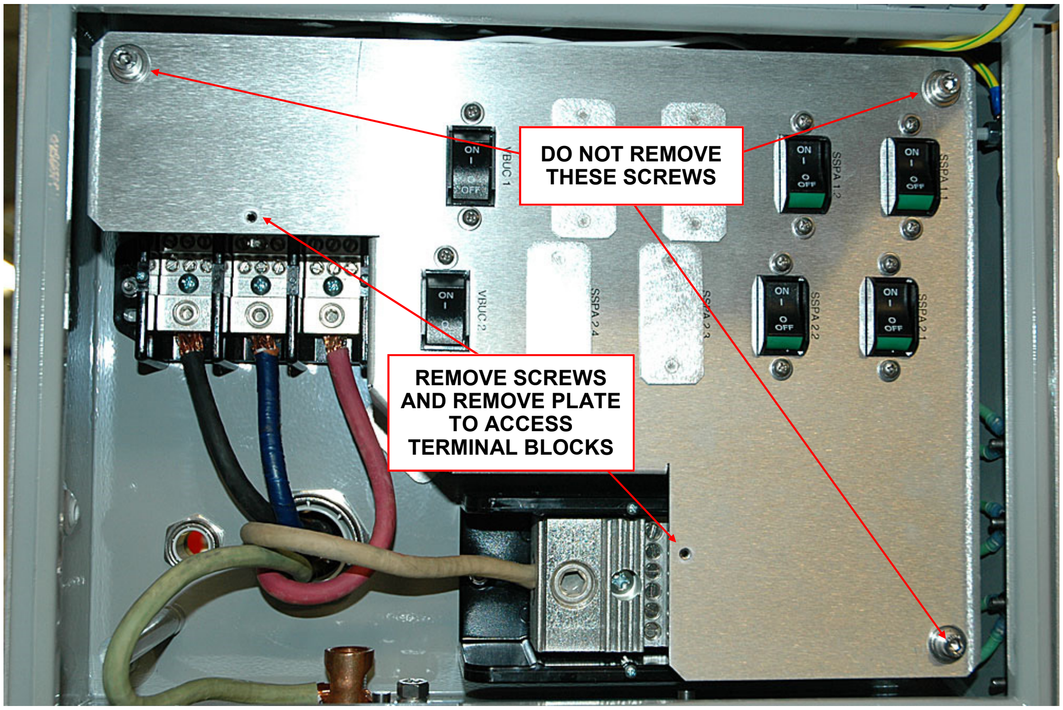


Figure 3-1: Terminal Blocks in AC Distribution Box

3.3 Provide Prime Power

Each system is designed to operate at 220VAC three phase input. Cable access ports with strain relief are available at the rear of the optional AC Distribution Boxes. A separate access port for the return is also available. Use these access ports to introduce prime power cables to the terminal blocks on the inside of the AC Distribution Box.

There is a removable panel inside the box that gives access to the terminal blocks. Remove the two screws securing the L-shaped access panel to the assembly. **Do not remove the three screws in the corners.** The wiring from the terminal blocks to the individual circuit breakers was assembled at the factory, and requires no operator access. See **Figure 3-1**.

Review the system schematic for proper wiring details. Switch off all circuit breakers in each of the AC Distribution Boxes until all wiring is completed.

Use the appropriate wire gauge when connecting between the prime power source and the terminal blocks.

Switch on all circuit breakers to power up the system.

4.0 Introduction

The Outdoor PowerMAX system has been designed to act as if it was a single high power amplifier.

A 4-way HPA system is comprised of an array of four (4) Compact Outdoor amplifiers (HPAs). A RF distribution box provides a single RF input, which is then split to each of the system amplifiers. This weatherproof enclosure also houses the system RF Power Detector module. The output of each Compact Outdoor amplifier in the array is phase combined to a single output. The 4-way system has an outdoor controller which monitors and controls the system amplifiers. This controller is powered by an auxiliary DC output from each of the HPAs in the array.

An 8-way HPA system is comprised of two arrays of four (4) Compact Outdoor amplifiers (HPAs). A RF distribution box provides a single RF input, which is then split to each of the system amplifiers. This weatherproof enclosure also houses the system RF Power Detector module. The output of each Compact Outdoor amplifier in the array is phase combined to a single output. The 8-way system has two outdoor controllers in a master/slave configuration. Each controller is powered by an auxiliary DC output from four (4) of the HPAs. See **Figure 4-1**.

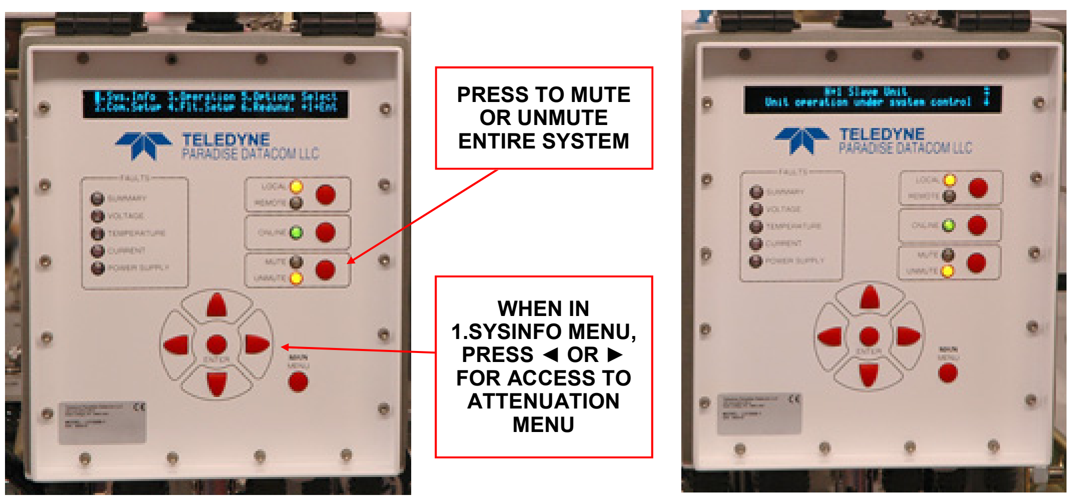


Figure 4-1: Outdoor SSPA Controllers (Master, left, and Slave, right)

A 16-way HPA system is comprised of two 8-way HPA systems as described above, with the outputs of both systems phase combined to a single output.

An optional maintenance switch can be provided at the system output. The position of this switch is monitored and controlled by a separate indoor maintenance switch controller.

4.1 Outdoor SSPA Controller Front Panel Menu Structure

The Outdoor SSPA Controllers are not used for day-to-day operation of the system, but may provide additional system information useful in monitoring the condition of the system SSPA modules and for troubleshooting faults.

Figure 4-2 shows the Outdoor SSPA Controller Menu Structure hierarchy. There are six main levels of menu selections.

- **Sys.Info** - System Information menu sublevel (See **Section 4.1.1**)
- **Com.Setup** - Serial Communication related settings (See **Section 4.1.2**)
- **Operation** - System operation related settings (See **Section 4.1.3**)
- **Fault Monitoring Setup** - Fault handling settings (See **Section 4.1.4**)
- **Options** - Backup/restore and password settings (See **Section 4.1.5**)
- **Redundancy** - Switching and standby settings (See **Section 4.1.6**)

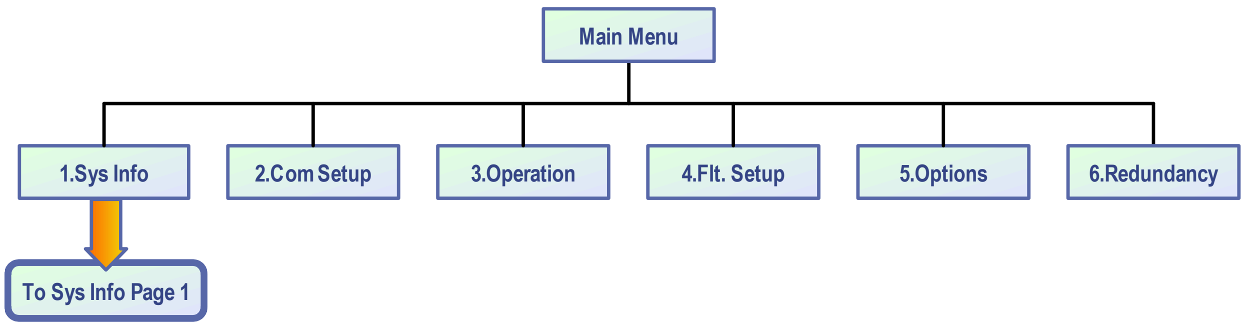


Figure 4-2: Outdoor Controller Front Panel Menu Structure

The menu tree is accessed by pressing the **Main Menu** key on the access panel of the outdoor controller. Navigation through the menu structure is handled by using the **Up Arrow** [▲], **Down Arrow** [▼], **Left Arrow** [◄], and **Right Arrow** [►] keys and the **Enter** key to select from the items shown in the controller display.

For menus where an actual numerical value must be entered, the **Up Arrow** [▲] and **Down Arrow** [▼] keys change the number by factors of 10; the **Left Arrow** [◄] and **Right Arrow** [►] keys change the number in increments of 1.

Note: If the **Local/Remote** key is toggled so that the Remote LED is illuminated, the **Main Menu** key, **Arrow** keys and **Enter** key are disabled. To regain local control, press the **Local/Remote** key so that the Local LED is illuminated.

4.1.1 Outdoor Controller System Information Sub-Menu

The informative sublevel menu contains several pages, shown in **Figure 4-3**.

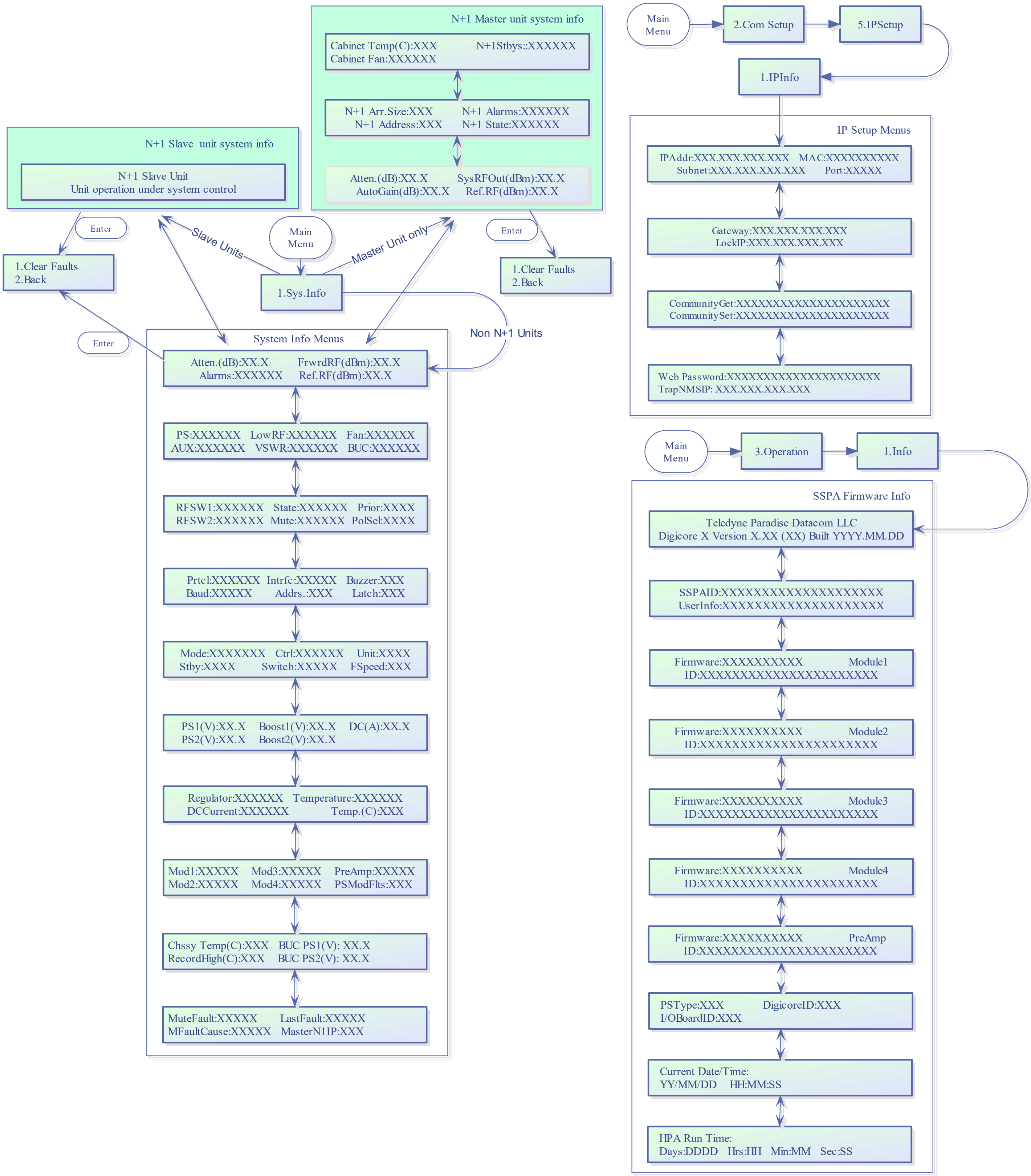


Figure 4-3: Outdoor Controller System Information Sub-Menu

The user can also browse among these pages by navigating the cursor around the menu fields and pressing the Enter button on the keypad. Note that this function will not work if the “Fault Latch” option is selected.

In a N+1 configuration, the Master unit default System Information page is as described in **Section 4.1.1.21**; the default page for Slave units is as described in **Section 4.1.1.22**. In non-N+1 configurations, the default page is as shown in **Section 4.1.1.1**.

4.1.1.1 Sys Info Page 1

This is the HPA main status information page. The page shows:

- **Atten.**(dB) — HPA attenuation measured in dB, with accuracy of 0.1 dB;
- **FrwrdRF**(###) — Forward RF Power, measured in either dBm with resolution of 0.1 dBm, or Watts with a resolution of 0.1 Watts, with a 20 dBm dynamic range from the maximum rated output power;
- **Alarms** — Will display “FAULT!” if a fault is present on the HPA, or “None” if no fault is present.
- **Ref.RF**(###) — Reflected RF Power, measured in either dB with resolution of 0.1 dBm, or Watts with a resolution of 0.1 Watts. Displays “N/A” if unavailable. See **Section 4.X** for further discussion.

When on this page, pressing the Enter key will open the Clear Faults Menu. The Clear Faults Menu is also available from the N+1 Master Page 1 and N+1 Slave Info Page.

4.1.1.1.1 Clear Faults Menu

This page allows clearing latched faults conditions, if the Fault Latch option is enabled.

- **1.Clear Faults** — When selected, all latched fault conditions are cleared. Also Master N+1 unit fault history and SNMP trap history will be cleared when “Clear Faults” function is selected.
- **2.Back** — When selected, navigates back to System Info page without clearing fault state holders.

4.1.1.2 Sys Info Page 2

This page shows a variety of alarm states which may be present within the HPA. Fault values could be “FAULT!”, “Normal” and “N/A”. If the fault condition doesn't apply to the HPA it will display “N/A” for “Not Available”.

- **PS** — Power supply alarm, displays “Normal” if HPA power supplies are normally operational and “FAULT!” if one or more power supplies failed.
- **LowRF** — Low RF fault;
- **Fan** — Cooling system failures;
- **Aux.** — Auxiliary fault condition;
- **VSWR** — High Reflected power fault;
- **BUC** — Block Up converter fault.

4.1.1.3 Sys Info Page 3

This page displays miscellaneous information related to the redundancy operation and the HPA mute status.

- **RFSW1** — Displays the state of RF switch 1, possible values - “Pos1”, “Pos2”, “N/A”, “FAULT!”;
- **RFSW2** — Displays the state of RF switch 2, possible values - “Pos1”, “Pos2”, “N/A”, “FAULT!”;
- **State** — HPA online state, possible values “Online”, “Standby”;
- **Mute** — HPA mute state, possible values “Clear”, “Set”;
- **Prior** — Priority polarization select (1:2 Mode Only);
- **PolSel** — Current Polarization output (1:2 Mode Only)

4.1.1.4 Sys Info Page 4

This page displays various HPA settings:

- **Prtcl.** — Current HPA remote control protocol. Will display “Terminal”, if terminal mode protocol is currently active and “Normal” if string I/O type protocol is used.
- **Baud** — Selected baud rate for remote control serial port. Selection: “2400”, “4800”, “9600”, “19200”, “38400”;
- **Intrfc.** — Selected serial port interface. Selection: “RS232”, “RS485”.
- **Addrs.** — HPA remote control network address. Value could be in range from 0 to 254. Note: address 255 is reserved for global calls and should not be used for an individual unit’s addressing.
- **Buzzer** — Audible alarm. “Dis” for disabled or “Enb” for enabled.
- **Latch** — Fault latch option. “Dis” for disabled or “Enb” for enabled.

4.1.1.5 Sys Info Page 5

Page 5 shows settings related to the HPA 1:1 Redundant System operation.

- **Mode** — Indicates HPA operational mode. See **Section 4.5.3.4**.
- **Stby.** — Shows the HPA standby state selection. “Hot” - Hot standby operation (HPA retains unmuted state during standby); “Cold” - Cold standby (HPA always mutes itself in standby mode and unmutes when switched online).
- **Ctrl.** — Shows HPA control style. “Local” - Both local and remote control are supported; “Remote” - When only remote control provided (keypad locked);
- **Switch** — Indicates switching style. “Auto” - Automatic fault tracking/ switching; “Manual” - If redundancy switching is provided by the operator.
- **Unit** — Redundancy topological factor. “HPA1” - HPA connected to RF switch port 1 or 4 (Online Position 1 of the RF switch); “HPA2” - HPA connected to RF switch port 2 or 3 (Online Position 2 of the RF switch).
- **FSpeed** — Displays the current fan speed setting of “Hi”, “Low” or “Auto”. GaN units only.

4.1.1.6 Sys Info Page 6

This page shows the status of the HPA's internal power supplies.

- **PS1(V)** — Main power supply 1 output voltage with resolution of 0.1V. Normal output voltage for GaAs amplifiers is in the range of 11 to 13 V; Normal output voltage for GaN amplifiers is in the range of 25 to 28 V.
- **PS2(V)** — Main power supply 2 output voltage.
- **Boost1(V)** — Booster power supply 1 output voltage with resolution of 0.1V. Normal range 24 to 30 V (typical 28V);
- **Boost2(V)** — Booster power supply 2 output voltage.
- **DC (A)** — Total DC current draw by RF modules from main power supply. Value varies depending on the power level of the HPA. If the HPA is muted, current normally drops to within the 0 to 5 A range.

4.1.1.7 Sys Info Page 7

This page shows RF module related faults and conditions.

- **Regulator** — RF module regulator low voltage fault. Values: "FAULT!" or "Normal";
- **DC Current** — Low DC current fault. Values: "FAULT!" or "Normal";
- **Temperature** — High temperature fault. Values: "FAULT!" or "Normal".
- **Temp.(C)** — Internal RF module plate temperature in Celsius. In multi-module units, the hottest module baseplate temperature is displayed.

4.1.1.8 Sys Info Page 8

This page shows individual RF module states in multi-module HPAs.

- **Mod#** & **PreAmp** — Mod1 to Mod4 represent the overall state of the relevant RF Power modules. If the amplifier is equipped with a separate pre-amplifier module, the "PreAmp" value will represent the overall state of the pre-amplifier. Under normal operation, the value will read "Normal".

  If a unique module does not exist in the HPA configuration, the value shows "N/A" (not available). Each value represents the summary fault state of an individual RF module, which includes the Voltage, Current and Temperature state as well as the quality of data connection. For a module or pre-amp exhibiting a fault condition, the value will read "FAULT!".

  If the HPA controller card cannot reliably communicate with an SSPA module, that module will be declared faulted. This type of fault will not affect the overall summary fault state, because the controller card has the ability to track RF module faults independently. When an existing module or pre-amp is present in the current HPA configuration, but fails to respond to control board status queries, "ComErr" (Communication Error) will be displayed.
- **PSModFlts** — For amplifiers utilizing an external N+1 power supply, this value indicates the number of detected N+1 PS module faults. For units

with an internal power supply, this value reads “000” and should be ignored. Check PS1 and PS2 Voltage readings to assess the state of an internal power supply.

4.1.1.9 Sys Info Page 9 (version 6.00)

This page shows various miscellaneous operation parameters.

- **Chssy Temp** — Chassis temperature reading measured by the control board. Since the control board is typically located at rear of the chassis, this reading correlates with the exhaust air temperature;
- **RecordHigh** — The highest temperature detected over unit lifetime. This value is updated each time a temperature higher than the current record is detected. Value could be used for SSPAs problem troubleshooting. Record data is factory reset only.
- **BUC PS1(V)** — This value represents the power supply voltage used for biasing an optional BUC unit. Voltage could be used for detecting problems related to BUC operation. The SSPA does not have a specific alarm threshold for this voltage. Normal reading for this parameter should be in range of 15V– 16V.
- **BUC PS2(V)** — This value represents secondary BUC power supply voltages. Units equipped with a single power supply show “N/A”.

4.1.1.10 Sys Info Page 10 (version 6.00)

The page shows advanced fault analysis information and N+1 operation features.

- **MuteFault** – This parameter allows the user to check the SSPA mute condition. Possible values:
  - Clear — No present fault mute condition on SSPA unit. Mute/Unmute function under full user control;
  - Set — One or more mute fault conditions present in the system. The unit is forced to the Mute On condition.
- **MFltCause** — This parameter allows the user to determine the last detected Mute fault condition. Possible values:
  - None — No detected Mute fault conditions;
  - AuxFlt — Mute fault condition triggered by a detected Auxiliary fault;
  - ExtM — Mute condition forced by external signal applied on the parallel port Mute input;
  - BUCFlt — Mute fault condition caused by a detected BUC fault;
  - PSFlt — The unit is forced to mute due to one or more failed N+1 power supply modules;
  - N+1Flt — N+1 configuration forced unit into a mute state due to an internal summary fault condition;
- **LastFault** – This parameter shows information about the last detected fault. The value is latched to the last fault occurrence. Use the Clear Fault function to reset. Possible Values:
  - LowRF – Low RF level fault;
  - AuxFlt – Auxiliary fault;
  - BUCFlt – Block Up converter fault;
  - PSFlt- Power Supply fault;

    - ColdSt – Unit cold start power up detected;
    - N+1Flt – N+1 System Fault;
    - TmpFlt – High temperature fault;
    - RegFlt – Voltage Regulator fault;
    - CurFlt – Low DC Current fault;
    - HiVSWR – High reflected RF level fault;
    - Other – Unknown fault condition;
- **None** – No information about present or past fault conditions (Clear Fault function was implemented by user);

4.1.1.11 IP Info Page 1

This page is available through the Comm. Setup menu, and shows SSPA settings related to the IP interface.

- **IP Address** – IP address of the SSPA. Consult your network administrator to set this address according to your LAN configuration.
- **MAC** – Medium Access Control address of the SSPA Ethernet controller. This address is factory preset.
- **Subnet** – IP subnet mask of the SSPA. Consult your network administrator to set this address.
- **IPPort** – IP port value for the SSPA. This address is valid only when IPNet protocol is selected. The port value should not be selected outside the existing services range to avoid access conflict on the M&C PC end.

4.1.1.12 IP Info Page 2

This page shows SSPA settings related to the IP interface.

- **Gateway** – IP Gateway address. This address is used only if access to the SSPA is provided from an outside LAN. If no such access is required, the address must be set to 0.0.0.0
- **LockIP** – This address is used to increase the security measure for the IPNet protocol. The SSPA will answer a request which comes only from a specified IP address. Set this address value to 255.255.255.255 to disable this feature. See **Section 4.1.2.5.1**.

4.1.1.13 IP Info Page 3

This page shows SSPA settings related to the IP interface.

- **CommunityGet** – Security string used in SNMP protocol for “Get” requests. Set this value to match the value specified in the NMS or MIB browser. Maximum string length is 20 alpha-numeric characters. The string allows read operation for the RM SSPA SNMP agent.
- **CommunitySet** – Security string used in SNMP protocol for “Set” requests. Set this value to match the value specified in the NMS or MIB browser. For security reasons this string must be different than the Community Get string. The maximum string length is 20 alpha-numeric characters. The string allows write operation for the RM SSPA SNMP agent.

Note: Community strings are essentially passwords. The user should use the same rules for selecting them as for any other passwords: no dictionary words, spouse names, etc. An alphanumeric string with mixed upper- and lower-case letters is generally a good idea.

4.1.1.14 IP Info Page 4

This page contains information about the web password and Trap NMSIP.

- **WebPassword** — Indicates the selected password for the web page interface. A blank value indicates that the web interface does not require a password protected login.
- **TrapNMSIP** — Shows the selected IP address for the SNMP trap recipient. (Version 6.00).

4.1.1.15 Firmware Info Page 1

This page is available through the Operation Setup menu, and provides information about the SSPA micro-controller unit firmware revision level and build date.

4.1.1.16 Firmware Info Page 2 (version 4.0)

This page provides additional SSPA information.

- **SSPA ID** – SSPA unique serial and model number.
- **UserInfo** – User information string, which could be set over SNMP protocol (see SNMP MIB info for details)

4.1.1.17 Firmware Info Pages 3, 4, 5 and 6 (version 4.0)

These pages contain information about the firmware revision level and unique ID of each RF module. A unit may contain one to four RF modules. Pages will remain blank if a particular module is not installed.

4.1.1.18 Hardware Info Page 8 (version 6.00)

This page shows the hardware ID markers for the power supply configuration, the type of hardware build of the DigitalCore board and the I/O board. This information is for factory use only.

4.1.1.19 HPA Local Time Page 9 (version 6.00)

This page shows the optional device clock. The device clock is a user selectable parameter. User set time is power dependent. A backup capacitor is used to keep the clock running while the SSPA is powered down. The clock will need to be reset if the unit remains without power longer than 5 hours.

Clock output format is Year/Month/Day Hours:Minutes:Seconds. Only 24-Hour format is supported at this time.

4.1.1.20 HPA Run Time Page 10 (version 6.00)

This page shows the days, hours, minutes and seconds since last power-up.

4.1.1.21 N+1 Master Info Page 1

This page can only be viewed when the SSPA unit is configured as the N+1 Master unit. The page also becomes the default startup page for the Master SSPA .

Several parameters related to N+1 System operational parameters are displayed:

- **Atten.(dB)** — System level attenuation. In the case when the N+1 Auto Gain option is turned on, this attenuation level may differ from an individual SSPA attenuation level;
- **AutoGain(dB)** or **SSPAGain(dB)** — Displays the estimated system wide linear gain. Actual SSPA gain may differ if the unit has reached its saturated power level or malfunctions (see Section 4.0.6.6.3);
- **SysRFOut** — Indicates system forward RF output power detected at the output flange of the final phase combined structure. This value can be displayed in dBm or Watts, depending on the RF Unit setting. If the RF power detector unit is not accessible for any reason, the value shown will be “N/A”.

  Note: If detected power falls below lowest detectable threshold it will read 0.00. In reality, RF output power may differ from the displayed value. Consult the system datasheet on RF detector dynamic range specifications.

- **Ref.RF** — Indicates system reflected RF power. This value can be displayed in dBm or Watts, depending on the RF Unit setting. If the RF power detector unit is not accessible for any reason, the value shown will be “N/A”.

  Note: If reflected power falls below lowest detectable threshold it will read 0.00. In reality, RF output power may differ from the displayed value. Consult the system datasheet on RF detector dynamic range specifications.

When on this page, pressing the Enter key twice will open the Clear Faults Menu. The Clear Faults Menu is also available from Sys Info Page 1 and N+1 Slave Info Page.

4.1.1.21.1 Clear Faults Menu

This page allows user to clear latched faults conditions, if the Fault Latch option is enabled.

- **1.Clear Faults** — When selected, all latched fault conditions are cleared. Also Master N+1 unit fault history and SNMP trap history will be cleared when "Clear Faults" function is selected.
- **2.Back** — When selected, navigates back to System Info page without clearing fault state holders.

4.1.1.22 N+1 Slave Info Page

Figure 4-4 shows the display for all Slave units in the system.

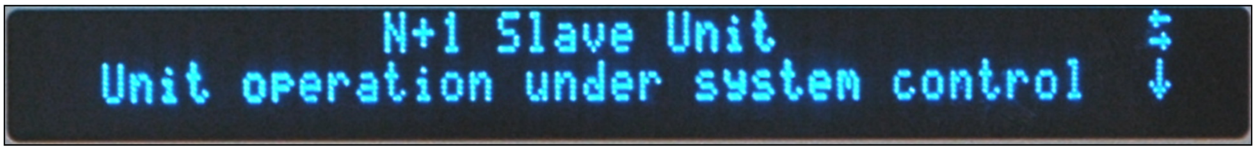


Figure 4-4: Slave Unit Display

This page can only be viewed when a unit is assigned as a N+1 Slave unit. All normal Info pages pertaining to individual SSPA operation parameters are accessible on subsequent menu levels. This page becomes the default page for a N+1 slave unit.

When on this page, pressing the Enter key will open the Clear Faults Menu. The Clear Faults Menu is also available from Sys Info Page 1 and N+1 Master Page 1.

4.1.1.22.1 Clear Faults Menu

This selection allows the user to clear latched faults, when Fault Latching is enabled.

- **1.Clear Faults** — When selected, all latched fault conditions are cleared. Also Master N+1 unit fault history and SNMP trap history will be cleared when "Clear Faults" function is selected.
- **2.Back** — When selected, navigates back to System Info page without clearing fault state holders.

4.1.1.23 N+1 Master Info Page 2

This page displays additional N+1 system operation data, and can be accessed by pressing the **Up Arrow** (▲) key from the N+1 Master Info Page 1. This page is only accessible from the N+1 Master unit.

- **N+1 Arr.Size** — Displays the N+1 array size. Valid sizes: 2, 4, 8 or 16 units.
- **N+1 Address** — Displays the master unit N+1 priority address;
- **N+1 Alarms** — Displays the number of detected SSPA unit alarms present in the system.
- **N+1 State** — Displays the current N+1 fault state. If the Master unit de-

tects no more than one (1) SSPA chassis alarm, the N+1 state will be displayed as “Normal”; otherwise “FAULT!”.

4.1.1.24 N+1 Master Info Page 3

This page displays information related to N+1 system operation, and can be accessed by pressing the **Up Arrow** (▲) key twice from the N+1 Master Info Page 1. This page is only accessible from the N+1 Master unit.

- **Cabinet Temp(C)** — Not applicable in the Outdoor PowerMAX system.
- **Cabinet Fan** — Not applicable in the Outdoor PowerMAX system.

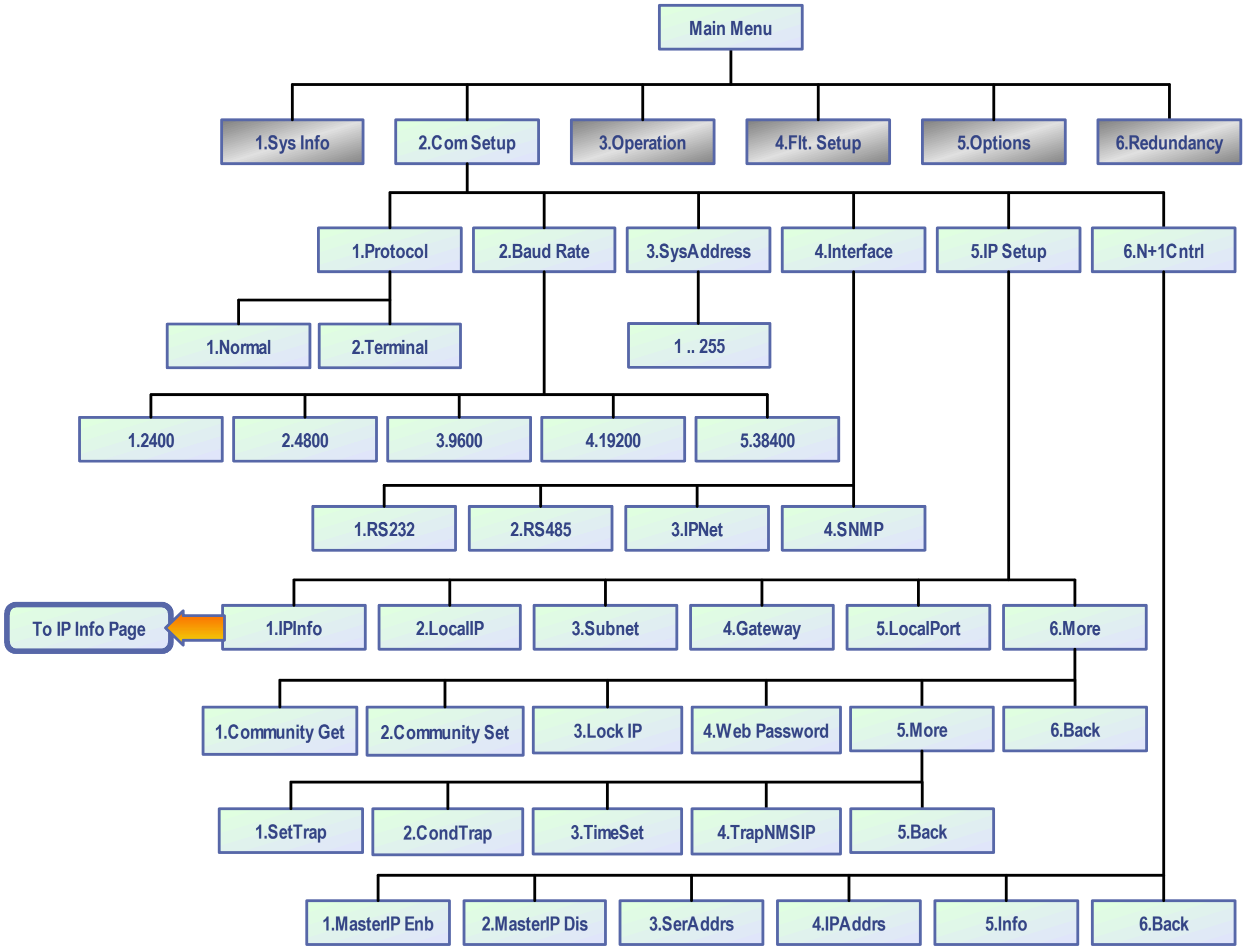


Figure 4-5: Outdoor Controller Communication Setup Sub-Menu

4.1.2 Outdoor Controller Communication Setup Sub-Menu

This menu, shown in **Figure 4-5**, allows the user to select the parameters for communication between the SSPA and any remote monitor and control station.

4.1.2.1 Protocol

Allows the user to select the serial protocol. Available communication protocols include:

- **Normal** — As described in **Section 5.2**.
- **Terminal** — As described in **Section 5.5**.

4.1.2.2 Baud Rate

Selects the desired baud rate for serial communication. Available baud rates include 2400, 4800, 9600, 19200 and 38400. The factory default Baud Rate is 9600.

4.1.2.3 System Address

Sets the network address of the controller if used on a RS-485 network. Choose 1-255. The factory default address is 0.

> **Note**: Changes in serial communication settings from the controller's front panel are effective immediately. Changes to these parameters from serial interface require that the unit be reset in order to take effect. The units can be reset either by cycling power or by issuing a reset command from the controller front panel. See **Section 4.5.5.6**.

4.1.2.4 Interface

User may selected between RS232, RS485, IPNet (Ethernet) or SNMP communication.

4.1.2.5 IP Setup

Select between the following menu items:

- **1.IP Info** — This selection allows the user to review all IPNet Settings as described in **Section 4.1.1.11** through **Section 4.1.1.14**)
- **2.Local IP** — This selection allows the user to set the Local IP Address;
- **3.Subnet Mask** — This selection allows the user to set the Subnet Mask;
- **4.Default Gateway** — This selection allows the user to set the network Default Gateway Address;
- **5.LocalPort** — This selection allows the user to set the Local Port for the unit. The default Local Port address is 1007;
- **6.More** — This selection opens the menu items listed in **Section 4.1.2.5.1**.

4.1.2.5.1 More (SNMP, IP and Web Settings)

This menu allows the user to set the Community String Selection (Set/Get) and assign the Web Password.

Use the **Up Arrow** [▲] and **Down Arrow** [▼] keys to browse through selected characters. Press the **Up Arrow** [▲] and **Down Arrow** [▼] keys simultaneously to erase the selected character. Press the **Left Arrow** [◄] and **Right Arrow** [►] keys to navigate within the string. Maximum length is 20 characters.

- **1.Community Get** — This selection allows user to set the SNMP Community Get String. Default is "public";
- **2.Community Set** — This selection allows user to set the SNMP Community Set String. Default is "private";
- **3.LockIP** — This selection allows user to set the IP address from which requests will be accepted by the amplifier. The LockIP selection gives the user the ability to increase the security measure for the IPNet protocol. The SSPA will answer a request which comes only from the assigned IP address. For firmware prior to version 6.00, set this address value to

0.0.0.0 or 255.255.255.255 to disable this feature.
Starting with version 6.00, the Lock IP address function has been updated 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 completed, 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 first detected IP source; Address 255.255.255.255 accepts all peers, without binding. If Lock IP is a multicast address, then the amplifier will accept queries sent from any IP address of multicast group;

- **4.WebPassword** — This selection allows the user to set the password for the web interface. Default is “paradise”. Erase all characters to disable password protection;
- **5.More** — This selection opens the menu items listed in **Section 4.1.2.5.2**.
- **6.Back** — This selection opens the menu items listed in **Section 4.1.2.5**.

4.1.2.5.2 More (Traps and Time Settings)

This menu allows the user to set SNMP Trap settings, and also set the internal clock.

- **1.SetTrap** — This selection allows the user to set the Settings Trap;
- **2.CondTrap** — This selection allows the user to set the Conditions Trap;
- **3.TimeSet** — This selection allows the user to set the time. Clock output format is YY/MM/DD HH:mm. Only 24-Hour format is supported at this time. Press the **Up Arrow** [▲] key to increment the value highlighted by the cursor. Press the **Down Arrow** [▼] key to decrease the value highlighted by the cursor. Press the **Right Arrow** [►] key to move the cursor to the right; Press the **Left Arrow** [◄] key to move the cursor to the left. Press the **Enter** key to accept the entered values.
- **4.TrapNMSIP** — This selection allows the user to set the Trap NMS IP Address;
- **5.Back** — This selection opens the menu items listed in **Section 4.1.2.5.1**.

4.1.2.6 N+1 Control (Floating Master Mode)

This menu allows the user to set parameters relating to Floating N+1 Master operation.

This feature allows having a single point of control for an N+1 system Master Module. When enabled, this mode will switch the N+1 Master Module serial and IP address to a dedicated floating Master IP and serial address.

Without this function, a faulted Master Module in an N+1 system delegates its control privileges to another unit, which has a different serial and IP address.
With this feature activated, the Master serial and IP address are reassigned to the new Master Module and the former master unit restores its normal communication parameters.

This mode of operation allows having single M&C connection point bonded to a known IP and Serial address, regardless which module in the N+1 system assumes the role of the Master Module. In this mode, the user could maintain a remote connection to a single Master unit. Simultaneous connections to other modules is optional.

If Floating Master mode is disabled, the N+1 Master unit responds to its unique IP and serial address rather than to a dedicated master address. In this mode, simultaneous connection to all N+1 unit in the system is the most desirable method of remote control operation.

Floating Master mode could be used over both RS-485 and IP network. Communication over a RS-485 network requires the assignment of a unique Master serial address. The module currently assigned as the Master Module will also respond to queries on its own serial address.

When this mode is used over an IP network, certain factors need to be taken in account:

- The Master IP address must be a unique address, not used anywhere else on the network;
- Since Floating Master mode is assumed, the Master Module will stop responding on its individual IP address and start responding on Master IP address. When the Master Module assumes slave mode (and another unit is assigned the Master privileges), the former Master unit responds to its individual IP address;
- The Master address should be selected from same subnet mask and use the same gateway address as the rest of the N+1 units in the system;
- During the switchover process from a unit's normal IP address and Master address and back, the SSPA unit will execute a "gratuitous ARP" request to a network. The operator needs to make sure that the network equipment connected to the system supports dynamic ARP tables which could be updated by "gratuitous ARP". Consult your network administrator for details;
- Floating Master mode needs to be disabled if network switches utilize static ARP tables or if dynamic IP changes are forbidden.

Use of a dedicated serial Master address is optional, but desirable.

Menu selections include:

- **1.MasterIP Enable** — This selection enables Floating Master Control mode;
- **2.MasterIP Disable** — This selection disables Floating Master Control mode;
- **3.Serial Address** — This selection allows the user to assign a unique floating serial control address to the N+1 Master;
- **4.IP Address** — This selection allows the user to assign a unique floating IP address to the N+1 Master;
- **5.Info** — This selection displays a informational menu regarding the Floating N+1 Master mode. Includes the mode state (Enabled/Disabled),

the assigned serial address and assigned IP address.

- **6.Back** — This selection opens the menu items listed in **Section 4.1.2.6**.

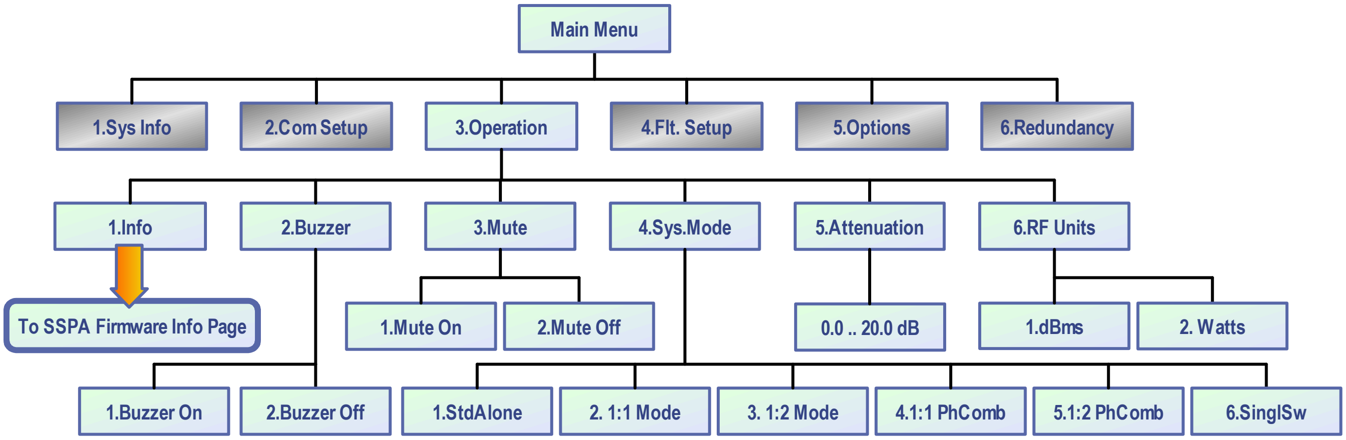


Figure 4-6: Outdoor Controller Operation Setup Sub-Menu

4.1.3 Outdoor Controller Operation Setup Sub-Menu

This menu, shown in **Figure 4-6**, allows the user to select system-specific options.

4.1.3.1 Info

Shows the current firmware version. See **Figure 4-3** and **Section 4.1.1.12** through **Section 4.1.1.15**.

4.1.3.2 Buzzer

Toggles the audible alarm buzzer on/off. Factory default is Enabled.

4.1.3.3 Mute

Allows user to Set or Clear the Mute status for the unit. Muting the amplifier via remote M&C requires 70 msec maximum (30 msec typical).

4.1.3.4 Sys. Mode

Selects the logical state machine used by the controller. Available choices are:

- **Standalone** – Select this option for standalone SSPA application. All RF waveguide switch controls are disabled;
- **1:1 Redundancy** – Select this option for classic internal 1:1 redundancy application. For proper function, a second SSPA is required and also needs to be configured for the same operation mode. Other settings may need to be selected, see internal 1:1 operation section for details;
- **1:2 Mode** – This setting is used for the internal 1:2 redundancy operation schema. See relevant section for operation details;
- **PhComb** – Mode used for hybrid 1:1 phase combined operation. Use of N+1 controls is recommended in conjunction with 1:1 phase combined operation. See 1:1 phase combined operation section for details;
- **1:2PhComb** – This mode is similar to 1:2 mode, but is used to combine two SSPA outputs rather than supplying a signal for two separate polarizations. Use of N+1 controls in conjunction with 1:2 phase combined op-

eration. See 1:2 Phase combined operation section for details.

- **SinglSw** – This SSPA mode allows the control of a maintenance switch connected to the output of single SSPA unit. This is not a redundancy operation mode. The switch is used to redirect the output of an SSPA between an antenna and a dummy load. See Maintenance Switch Operation section for details.

4.1.3.5 Attenuation

Allows user to set the desired attenuation between 0 and 20.0 dB in 0.1 dB steps.

4.1.3.6 RF Units

Allows user to set the unit of power measurement between dBm or Watts.

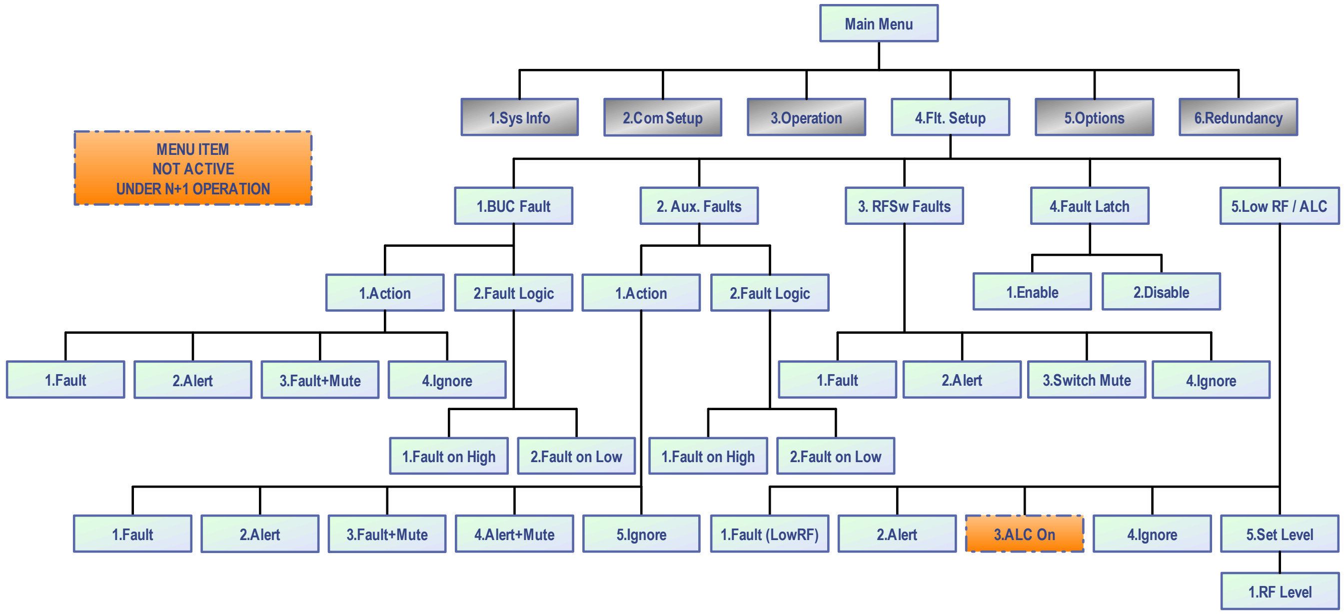


Figure 4-7: Outdoor Controller Fault Monitoring Setup Sub-Menu

4.1.4 Outdoor Controller Fault Monitoring Setup Sub-Menu

This menu, shown in **Figure 4-7**, allows the user to select how the SSPA will deal with fault conditions.

4.1.4.1 BUC Fault

Allows the user to select the Action and the Fault Logic for fault conditions associated with the BUC. User can select the following Actions: Fault + Mute; Fault; Alert; Ignore. User can select the following Fault Logic parameters: Fault on High; Fault on Low.

4.1.4.2 Auxiliary Faults

Allows the user to select the Action and the Fault Logic for fault conditions associated with the Auxiliary connections. User can select the following Actions: Fault; Alert; Fault + Mute; Alert + Mute; Ignore. User can select the following Fault Logic parameters: Fault on High; Fault on Low. See **Section 2.1.2.7.1** for a description of how to mute the amplifier using the Alert + Mute option.

4.1.4.3 RF Switch Faults

Determines whether a switch fault should cause a major alarm and attempt to switch, or simply show an alert on the display menu, the latter case considered a minor alarm.

- **1.Fault** — This is the Major Alarm mode. Summary alarm on fault;
- **2.Alert** — This is the Minor Alarm mode. No summary alarm on fault;
- **3.Switch Mute** — In this mode, when the switch position changes, the amplifier is momentarily muted during switchover to prevent arcing in the waveguide;
- **4.Ignore** — This setting ignores any RF Switch faults.

4.1.4.4 Fault Latch

Determines the alarm reporting condition. A latched alarm will remain indicated on the controller front panel until the operator clears the alarm by pressing the Enter key. Unlatched alarms will allow the summary alarm indicator to stop displaying the alarm condition if the circumstance creating the alarm has been cleared or corrected.

4.1.4.5 Low RF / Automatic Level Control

Alerts the user when the output power falls below the threshold value, which is adjustable by the user with 1 dBm steps by selecting the “Set Level” menu item. Fault handling is adjustable by user, who may choose between Alert Only (Minor Fault), Fault (Major Fault), and Ignore.

In addition, the user may select Automatic Level Control from this menu.

1. Select **3.ALC On** and press the **Enter** key;
2. Select **5.Level**;
3. Use the arrow keys to set the desired output level and press the **Enter** key.

Once activated, the ALC will take control of the amplifier’s attenuation setting to maintain the desired RF output power level and will not allow any attenuation adjustments via the front panel. 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 65 dB.

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

1. Using the controller front panel menu, make sure the amplifier is not in ALC mode;
2. Set the amplifier attenuation level to 10 dB;
3. Apply a CW RF signal to the amplifier;
4. Use a power meter to measure the output power of the amplifier;
5. Adjust the RF input level until the desired output power level is achieved;
6. Follow the steps listed above to activate the ALC control. The ALC will take over the control of the output level and maintain the RF output level set point.

The ALC has the ability to accurately control the RF output power over a 15 dB range from Psat. 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.

If the output power set point is set outside the operational range of the ALC circuit, the ALC will adjust the output power to the lowest possible level and set a minor fault on the controller’s front panel.

Note: Automatic Level Control is inactive when the system is in N+1 operation.

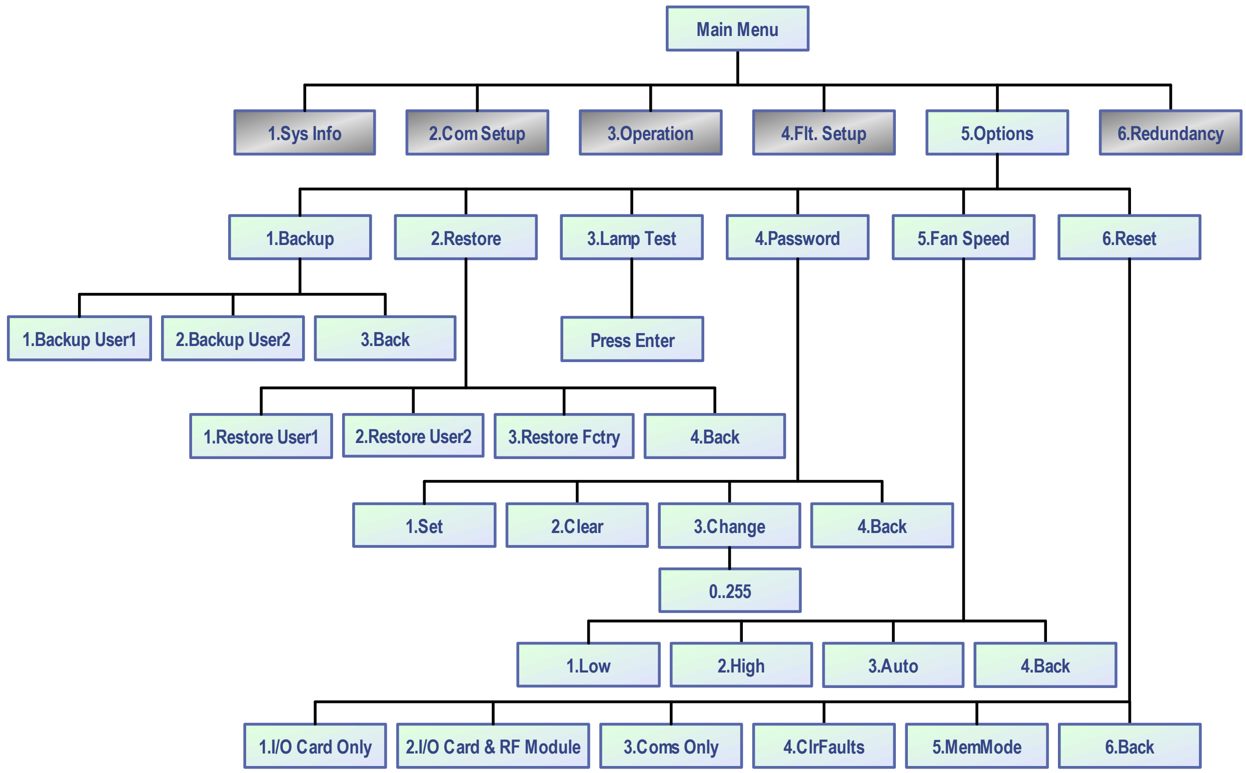


Figure 4-8: Outdoor Controller Options Sub-Menu

4.1.5 Outdoor Controller Options Sub-Menu

This menu, shown in **Figure 4-8**, makes available functions to backup or restore settings, set a password or the speed that the cooling fans spin, and test the LED lamps on the controller.

4.1.5.1 Backup User Settings

Allows the user to backup all settings to nonvolatile memory. There are two repositories for saved settings. Menu selections include:

- **1.Backup User1** — Select to save current settings to User1 repository;
- **2.Backup User2** — Select to save current settings to User2 repository;
- **3.Back** — Select this item to return to Options Sub-Menu (**Section 4.1.5**).

4.1.5.2 Restore

Allows the user to restores saved settings from a previous backup or factory pre-set. Menu selections include:

- **1.Restore User1** — Select to restore settings saved in User1 backup;
- **2.Restore User2** — Select to restore settings saved in User2 backup;
- **3.Restore Fctry** — Select to restore factory default settings;
- **4.Back** — Select to return to Options Sub-Menu (**Section 4.1.5**).

4.1.5.3 Lamp Test

This selection activates all LED indicators on the controller front panel, including the Fault Indicators, Online Indicator, **Local/Remote** key and **Auto/Manual** key. Press the **Enter** key to exit the Lamp Test.

4.1.5.4 Password

Allows the user to set, clear, or change a password that prohibits others from changing controller settings. Menu selections include:

- **1.Set** — Enables password protection. Uses last saved number from 1-255;
- **2.Clear** — Disables password protection;
- **3.Change** — Allows user to define the password. A number from 1-255 can be selected. Use the front panel navigation keys to set the number. The **Up Arrow** (▲) and **Down Arrow** (▼) keys change the number by factors of 10. The **Left Arrow** (◄) and **Right Arrow** (►) keys change the number in increments of 1;
- **4.Back** — Select this item to return to the Options Sub-Menu (**Section 4.1.5**).

4.1.5.5 Fan Speed

Allows the user to set the unit's fan speed. GaN units only. Menu selections include:

- **1.Low** — Select this item to force the fans to spin at the lowest speed.
- **2.High** — Select this item to force the fans to spin at the highest speed.
- **3.Auto** — Select this item to allow the amplifier to monitor the internal module plate temperature and adjust the power to the fans if the temperature rises (fans draw more power) or falls (fans draw less power) outside a pre-set temperature threshold.
- **4.Back** — Select this item to return to the Options Sub-Menu (**Section 4.1.5**).

Warning! Running the fans on the 1.Low setting while the amplifier is transmitting at its saturated power level may cause the internal module plate temperature to increase to dangerous levels. Monitor the temperature from the controller front panel and switch to a faster fan setting if the temperature increases.

4.1.5.6 Reset

Allows the user to reset the SSPA controller hardware to activate certain settings. For example, when the IP Address is modified the SSPA must be reset for it to use the new IP Address. Firmware version 6.00 allows multiple reset levels for the SSPA unit:

- **1.I/O Card** — Resets all hardware on the controller card as well as the embedded cards on all RF modules. The amplifier will be Muted during the reset process. Hence, reset will cause a momentary loss of RF output. All communication links to remote M&C will be dropped until reset process is complete. The amplifier will use currently selected communication parameters (IP address, baud rate, etc);
- **2.I/O Card & RFModule** — Resets only embedded chips in all RF modules. I/O card remains operational and maintains communication link to remote M&C. The RF module will be muted during the reset process. This function is useful for clearing latched fault conditions in SSPA units under N+1 system control;
- **3.Coms only** — Resets only communication parameters. If unmuted, the SSPA maintains an unchanged RF output level during reset. Remote COM links will be dropped and re-enabled with currently selected parameters;
- **4.ClrFaults** — Clears all latched faults and remaining fault history information. SSPA remains fully operational during the process;
- **5.MemMode** — Allows alternate SSPA settings retention function. Two choices are allowed:
  - **RAM Mode** — In this mode SSPA will not backup any settings changes to internal EEPROM. This mode is optional and needs to be set by the user every time when the SSPA undergoes a power cycle or I/O card reset. This mode is beneficial when the SSPA application requires frequent changes to the SSPA state (such as mute/unmute or attenuation changes). Since any EEPROM device has limited write cycles, RAM mode allows the user to execute unlimited settings changes. If the SSPA experiences a power or reset cycle in RAM mode, it will use the last saved settings setup before RAM was engaged;
  - **EEPROM mode** — Default SSPA mode. Without user intervention, the SSPA will retain this mode of operation. All changes to settings setup performed over local or remote interface will be backed up to EEPROM within 3 seconds time interval. If the SSPA experiences a power cycle or reset, the last saved set of settings will be applied to the unit upon each power up or I/O card reset. Any EEPROM device has a limited ability to endure write cycles. Maximum write cycles ability for SSPAs with firmware version prior to 6.00 is 150,000 times. After exciding write cycles limit, the SSPA will operate in RAM mode, utilizing a default set of settings on each power up. Firmware version above 6.00 allows 3,000,000 minimum write cycles before opting out to RAM mode;
- **6.Back** — Select to return to the Options Sub-Menu (**Section 4.1.5**).

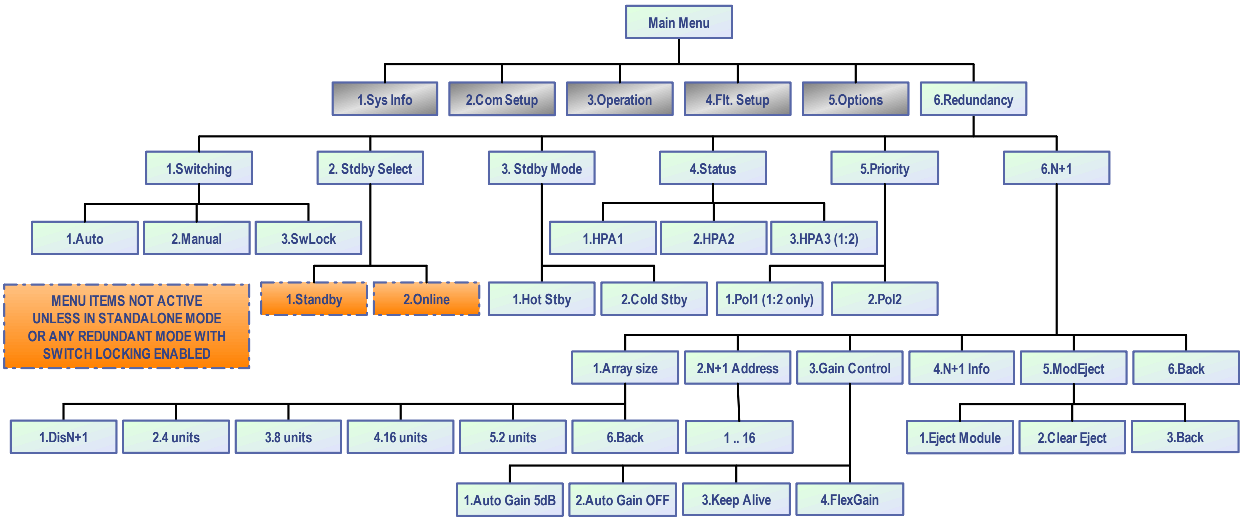


Figure 4-9: Outdoor Controller Redundancy Sub-Menu

4.1.6 Outdoor Controller Redundancy Sub-Menu

Under this menu, shown in **Figure 4-9**, the user may select the redundancy settings for units in a 1:1 redundant mode.

4.1.6.1 Switching

User may select between Auto switching, Manual switching or Switch Lock modes.

4.1.6.2 Standby Select

Allows user to select between Standby and Online states. This selection is not active unless the unit is in Standalone mode, or in any redundancy or phase combined mode (see **Section 4.1.3.4**) with Switch Lock enabled.

4.1.6.3 Standby Mode

User may select either Hot Standby or Cold Standby.

- **1.Hot Standby** — In this mode, when the amplifier is in standby mode, it is transmitting its signal to the dummy load. If the standby amplifier is switched to the online state, full output power is immediately available.
- **2.Cold Standby** — In this mode, when the amplifier is in standby mode, it is muted. If the standby amplifier is switch to the online state, it will un-mute and will take several moments to achieve full output power.

4.1.6.4 Status

Allows user to select between HPA1, HPA2 and HPA3. In 1:1 and 1:2 redundant systems, HPA2 is typically the standby amplifier.

4.1.6.5 Priority

For use in 1:2 redundant systems. Allows the user to select Polarity 1 or Polarity 2. If the online amplifiers for Polarity 1 and Polarity 2 simultaneously enter a faulted state, the standby amplifier will switch to the selected polarity.

4.1.6.6 N+1 System Operation Parameters

Under this set of menus, the user may select or adjust important N+1 options.

4.1.6.6.1 N+1 Array Size

This menu sets the type of N+1 system or disables N+1 operation for this unit.

- **1.Disable** — Disables the N+1 function;
- **2.4 Units** — Sets the system to recognize an array of 4 units;
- **3.8 Units** — Sets the system to recognize an array of 8 units;
- **4.16 Units** — Sets the system to recognize an array of 16 units;
- **5.2 Units** — Sets the system to recognize an array of 2 units;
- **6.Back** — Select this item to return to the N+1 menu (**Section 4.1.6.6**).

Units connected to a N+1 system must have an identical N+1 array selection or have N+1 operation disabled. A unit connected to a N+1 link cable with the N+1 option disabled will not be controlled by a N+1 Master. To the Master unit, it will appear as a faulted chassis.

4.1.6.6.2 N+1 Address

This option allows the selection of the unit's N+1 priority address. All units in a N+1 array must be unique and with a contiguous N+1 address. Due to the architecture of the PowerMAX system, a four-unit array utilizes four (4) addressing units (addresses 1 through 4). An eight-unit array uses eight (8) addressing units (addresses 1 through 8).

The unit with the lowest N+1 address has the highest priority when the system selects a new Master unit in the event of the failure of the assigned Master unit. A unit with Address 1 will be the default Master unit. If Unit 1 fails, Unit 2 will take its place as the Master unit.

4.1.6.6.3 Auto Gain Control

This option allows the user to enable or disable the N+1 Automatic Gain options.

- **1.AutoGain 5dB** — When Auto Gain is enabled, the system will automatically back off from maximum linear gain and reserve 5 dB of attenuator range for gain compensation. When this option is enabled, the N+1 Master unit default System Information page will display: AutoGain(dB):XX.X
- **2.AutoGain Off** — When Auto Gain is disabled, the system can be adjusted as if it was a single SSPA unit, attenuating system gain between 0 and 20 dBm. System gain will not apply automatic gain compensation if any of the units in the N+1 redundancy array fails. When this option is

disabled, the Master unit default System Information page will display: SSPAGain(dB):XX.X.

- **3.Keep Alive** — The Keep Alive setting disables the automatic mute function when a module enters a fault condition. This option may be beneficial in systems where the N+1 option is used only as a convenient single point of control, rather than as a redundancy control measure. Consult the factory on the use of this option.
- **4.Flex Gain** — Flex Gain is a form of automatic gain control for N+1 systems. This control option has the same basic operation principles as the standard Auto Gain option except that the gain reserves and amount of gain compensation differ. This setting is designed to serve the special gain compensation needs of hybrid PowerMAX SSPA systems.
  When FlexGain mode is enabled, the Master unit of the PowerMAX system automatically reserves a predetermined amount of attenuation to each amplifier in the system and reduces overall system gain. In case of one or more amplifier unit failures, the system will return a certain amount of reserved gain in order to compensate system gain degradation from the failed unit(s).
  In the case of hybrid 4- and 2-way modes, the Master unit monitors the amplifiers placed in standby mode and provides the proper amount of gain compensation for these system configurations.

4.1.6.6.4 N+1 Info

When selected, the menu shown in **Figure 4-10** is displayed and used for N+1 system troubleshooting.

Figure 4-10: N+1 Info Menu

Note: The values shown do not indicate the current system state, but instead offer a history of any fault occurrences.

- **Last Fault/Ticks** — Shows different information for Master and Slave units. On the Master unit, it displays the unit address of the last detected fault in the N+1 system. If the display shows “000”, that indicates no fault instances since the unit assumed its Master state. On Slave units, the value displays the amount of system clock tick remaining since the last Master unit call. The Slave unit will assume Master state when the tick count reaches 0.
- **Fault Cause** — Master unit only. Displays the cause for the last detected N+1 unit fault. Possible values include “None,” for no faults; “Timeout,” if a Slave unit fails to respond to a Master request for three (3) consecutive queries; or “Summary,” if a unit exhibited a Summary fault.

4.1.6.6.5 Module Eject

Amplifiers and amplifier systems which are configured in an N+1 array must use the Module Eject function before removing a SSPA module from the array.

- **1.Eject Module** — Select this item to identify the SSPA module that will be removed from the enclosure. Enter the module's N+1 Address. Removing the Master Module from the N+1 array will cause the Master function to be transferred to the next available module.
- **2.Clear Module** — Select this item to identify the SSPA module that has been re-installed in the enclosure. Enter the module's N+1 Address.
- **3.Back** — Select this item to return to the Redundancy Sub-Menu (**Section 1.5.6**).

4.1.6.6.6 Back

Select this item to return to the Redundancy Sub-Menu (**Section 4.1.6**).

5.0 Overview

A system which includes an SSPA can be managed from a remote computer over a variety of remote control interfaces (see **Figure 5-1**).

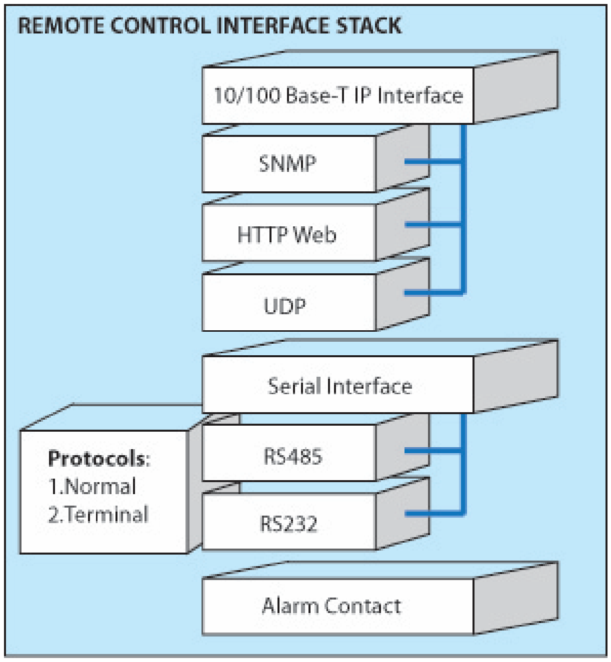


Figure 5-1: Remote Control Interface Stack

The parallel port on SSPA unit provides a simple form of remote control. There are 10 "dry" Form-C relay contacts for remote monitoring and six (6) galvanic isolated inputs for remote control commands. Parallel interface is always enabled, and does not require any special settings to operate.

Serial interface supports both RS232 and RS485 standards. The control protocol supports two formats: Normal serial protocol (as detailed in **Section 5.2**) and ASCII based protocol suitable for HyperTerminal applications (see **Section 5.5**). Serial interface is equipped with overvoltage and overcurrent protection and benefits from full galvanic isolation from the chassis ground for extra protection.

The Ethernet interface supports multiple communication standards which can be used exclusively or simultaneously depending on the selected setting:

- IPNet interface - UDP encapsulated Normal serial protocol (**Section 5.6.10**);
- SNMP V1 with support of SNMP traps (**Section 5.6.2**);
- HTTP web interface (**Section 5.6.1.3**);

Serial protocol format for both RS232 and RS485 interfaces is set at no parity, 8 bit, 1 stop bit, no handshaking.

If using a Terminal mode protocol, the SSPA provides remote menu access through a HyperTerminal program or through an actual hardware terminal.

The Ethernet interface auto-selects between 10 and 100 Mbit/s speeds, with a maximum node length of 100 feet. The use of CAT5E or CAT6 cables is preferred. A CAT5 cable can be used for 10Base-T standard or short runs of 100Base-T.

J4 connector for RS232 utilizes standard DCE 9 pin pin-out (straight through cable requires for connecting to remote PC RS232 port). For this interface maximum cable run of 100 feet can be achieved for 9600 Baud and lower speed rates with quality ground shield cable.

RS485 interface pin out is compatible with most 9 pin RS485 adapters. Interface always works in half-duplex mode and suitable for either 4 or 2 wire RS485 configuration. Maximum achievable node length for this interface is 1500 feet. Proper termination and use of shielded twisted pair cable is required to achieve long cable runs.

Digicor5 digital platform controller allows simulations support of multiple remote control interfaces.

Table 5-1 shows a list of enabled interfaces depending on chosen interfaces setting. Serial protocol is an independent selection and allows support of Normal or Terminal

Table 5-1: Interfaces Enabled Based on Chosen Interface Setting Selection

Interface Selection	Supported Serial Interface	Supported IP Interface
RS232	RS232	IPNet, Web M&C (read/write), SNMP (read/write)
RS485	RS485	IPNet, Web M&C (read/write), SNMP (read/write)
IPNET	RS485	IPNet, Web M&C (read/write), SNMP (read only)
SNMP	RS485	Web M&C (read only), SNMP (read/write)

mode protocols. Operation over IP interface remains unchanged regardless of serial protocol selection.

5.1 Remote Control - Parallel

5.1.1 Control Outputs

The hardware behind the form C relay is a single pole, double throw relay. Under normal operation (no alarms) the relays are in an energized state. When a fault occurs or the controller is powered off, the relays are in a de-energized state. The relay contacts are capable of handling a maximum of 30 VDC @ 1A . The form C relay is shown schematically in **Figure 5-2**. The form C relay contact outputs are listed in **Table 2-2**.

5.1.2 Control Inputs

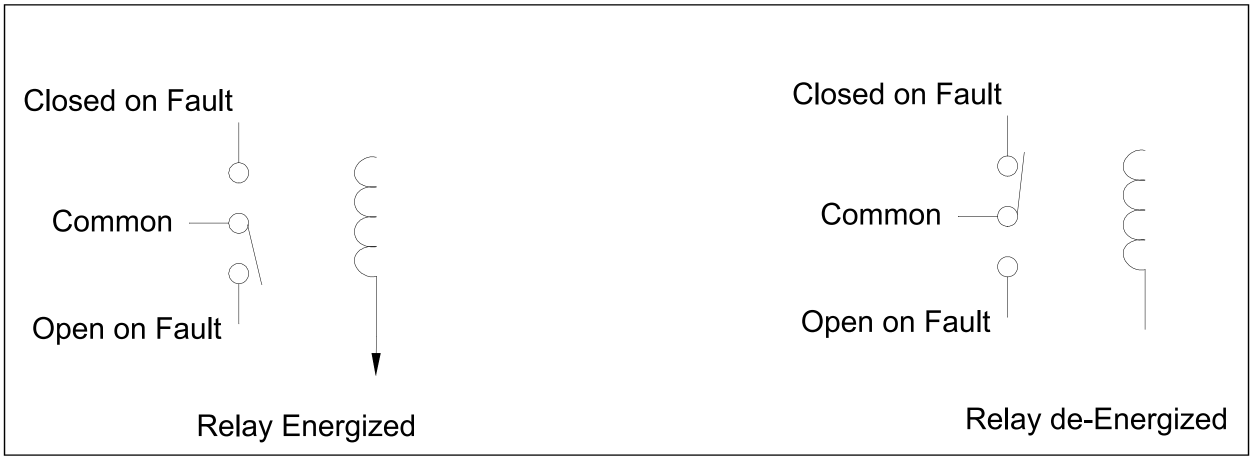


Figure 5-2: Parallel I/O Form C Relay

All parallel control inputs feature galvanic isolation from the chassis ground. Pull up resistors are provided on each input. To trigger a remote input command, the input should be pulled to port signal ground. All inputs except the Auxiliary fault input are pulse activated. Pulse relevant pin to signal ground (J7 pin 19) for at least 20mS for function activation.

For example: To change the current mute state of the SSPA to opposite, provide momentary connection for at least 20 mS between pin 17 (Mute Input) of 37-pin connector J7 to pin 19 (Signal Ground). Subsequent pulses will be ignored until Mute state is changed to opposite. Typical time for command propagation depends on type of SSPA and can vary from 100 to 500 mS. Current Mute state can be monitored by dry Form-C relay contacts 4-23-5.

Auxiliary input is level activated. Auxiliary input function and logic is user selectable through the front panel or over remote interface.

Mute input is set up to be pulse activated by default. However, by special request it could be changed to level activated (Mute on Low or High logic levels). Contact Teledyne Paradise Datacom if you need Mute activation logic different than the default.

5.2 Serial Communication Protocol

This section describes the basic serial communication protocol between the SSPA and host computer. The amplifier will only respond to properly formatted protocol packets. The basic communication packet is shown in **Figure 5-3**. It consists of a Header, Data and Trailer sub-packet.

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

Figure 5-3: Basic Communication Packet

5.2.1 Header Sub-Packet

The Header packet is divided into 3 sub-packets which are the Frame Sync, Destination Address and Source Address packets (See **Figure 5-4**).

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

Frame Sync (2 bytes) 0xAA5	Destination Address (1 byte)	Source Address (1 byte)

Figure 5-4: Header Sub-Packet

5.2.1.1 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 amplifier 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.

5.2.1.2 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. 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 amplifier will reply with its unique address.

5.2.1.3 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.

5.2.2 Data Packet

The data sub-packet is comprised of 6 to 32 bytes of information. It is further divided into seven (7) fields as shown in **Figure 5-5**. The first six (6) fields comprise the command preamble while the last field is the actual data.

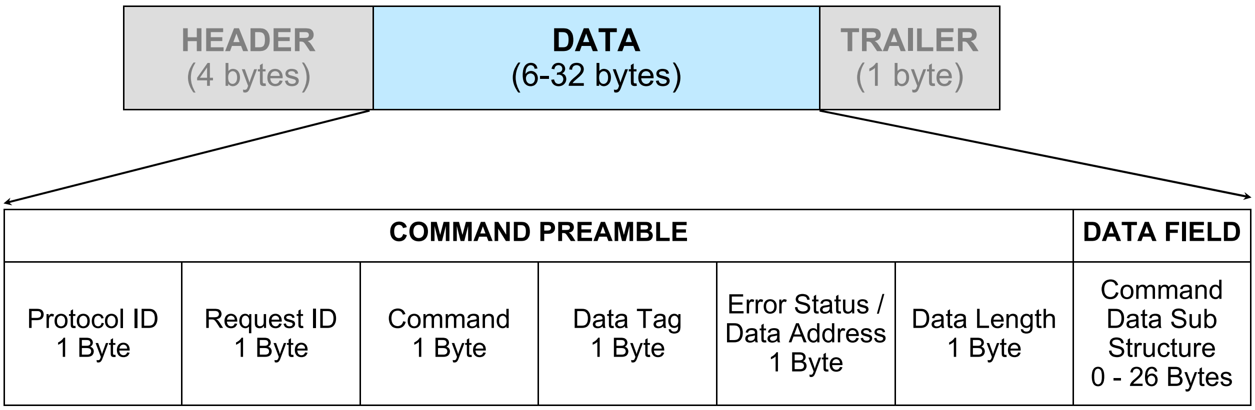


Figure 5-6: Data Sub-Packet

5.2.2.1 Protocol ID

This field provides backward compatibility with older generation equipment protocol. It should normally be set to zero (0). This field allows the amplifier to auto-detect other firmware versions.

5.2.2.2 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.

5.2.2.3 Command

This one byte field tells the receiver how to use the attached data. There are four (4) possible values for this field. The sender and receiver are limited to two commands. For example: if the sender issued “Set Request” command, receiver must answer with “Get Request” and “Get Response” form of the command. The byte value for each command is given in **Table 5-2**.

Table 5-2: Command Byte Values

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

5.2.2.4 Data Tag

The data tag specifies the type of internal resource of information needed to be accessed on the amplifier. The data associated with certain tags is read only. Therefore, only the "Get" command byte would be associated with these data tags. The data tag byte values are given in **Table 5-3**.

Table 5-3: Data Tag Byte Values

Tag Name	Data Tag Byte Value	Minimum valid length of the Data Field	Description
System Settings Tag	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 of the settings may require hardware reset of the remote RCP unit.
System Thresholds Tag	1	2 Bytes	This tag allows access to the critical unit thresholds. Host access status: Tag has read only status.
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 the data can not be set or modified remotely.
ADC Channels Access Tag	4	2 Bytes	ADC legacy access. Don't use for new development
Reserved	6	N/A	This tag is reserved.
Reserved	2	N/A	This tag is reserved.
Reserved	5	N/A	This tag is reserved for factory use only
Special Command Tag (v.6.00)	10	N/A	This tag is reserved for factory use only

5.2.2.5 Error Status / Data Address

This byte is a tag extension byte and specifies the first data 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 requester wants to access the amplifier's unique network address, it should set data tag 0 (Systems settings tag) and data address 8 (see Systems Settings Details table). If the following Data Length field is more than one (1), then all subsequent Settings will be accessed after the Unique Network Address. When the Response Frame Data Address is omitted, this byte position is replaced with the Error Status fields. The various error codes are given in **Table 5-4**. Note that the Request and Response frames are different.

Table 5-4: Error Status Byte Values

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.

5.2.2.6 Data Length

This byte contains different information for Request and Response frames. In a Request frame, it specifies the number of data bytes that are to be accessed starting from the first byte of the value specified in the Data Address byte. That byte must not exceed the maximum data bytes from a particular tag. The maximum data length for the Settings tag is 26 bytes. The maximum data length for the System Threshold tag is six (6) bytes.

5.2.2.7 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. Any “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 amplifier if the word size of the information is 16-bits or 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).

5.2.3 Trailer Packet

The trailer component contains only one (1) byte called the Frame Check Sequence, shown in **Figure 5-7**.

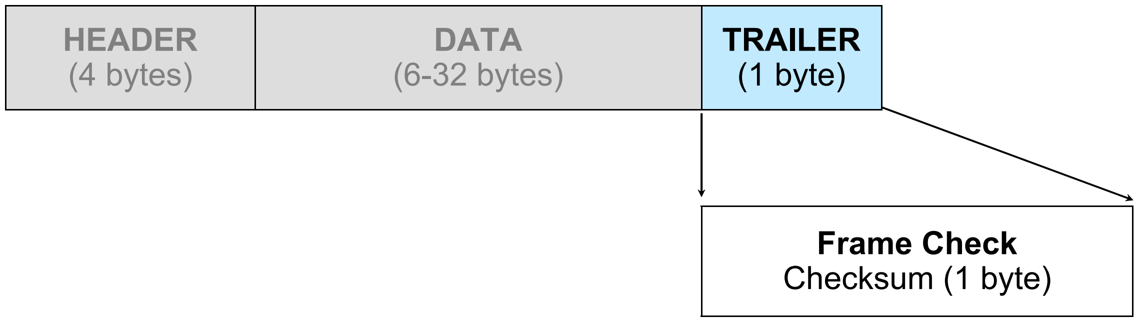


Figure 5-7: Trailer Sub-Packet

5.2.3.1 Frame Check

This field provides a checksum during packet transmission. 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
```

5.2.4 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 unites. 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.

5.2.5 Serial Communications Protocol

Table 5-5 through **Table 5-9** detail the various values of the serial communications protocol.

Table 5-5: Request Frame Structure

Byte	Tag	Description
1	0xAA	Frame Sync 1
2	0x55	Frame Sync 2
3	Destination Address	- // -
4	Source Address	-// -
5	Protocol Version	Protocol Compatibility Byte, must be set 0
6	Request ID	Service Byte
7	Command	0 = Set Request; 1 = Get Request
8	Data Tag	0 = System Settings; 1 = System Thresholds; 2 = Reserved; 3 = Conditions; 4 = ADC Data; 5 = Reserved; 6 = Packet Wrapper
9	Data Address	Setting number, Sensor command, EEPROM address
10	Data Length	Total length of the data, valid values: 1 – 10
11+N	Data	Actual Data
11+N+1	Checksum	Destination Address + Source Address + Protocol Version + Request ID + Command + Data Tag + Data Address + Data Length + Data

Table 5-6: Response Frame Structure

Byte	Tag	Description
1	0xAA	Frame Sync 1
2	0x55	Frame Sync 2
3	Destination Address	- // -
4	Source Address	-// -
5	Protocol Version	Protocol Compatibility Byte, must be set 0
6	Request ID	Service Byte
7	Command	2 = Set Response; 3 = Get Response
8	Data Tag	0 = System Settings; 1 = System Thresholds; 2 = Reserved; 3 = Conditions; 4 = ADC Data; 5 = Reserved; 6 = Packet Wrapper
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 – 10
11+N	Data	Actual Data
11+N+1	Checksum	Destination Address + Source Address + Protocol Version + Request ID + Command + Data Tag + Data Address + Data Length + Data

Table 5-7: System Setting Details

Data Address	Min. Data Length (bytes)	Description	Limits and valid values
0	1	Device Type (read only)	0 = Reserved; **1 = RM SSPA;** 2 = CO SSPA; 3 = RCP2/FPRC; 4 = RCP2-1000-CO; 5 = RCP2-1000-RM; 6 = RCP2-1000-RCP; 7 = VSAT BUC=7 (Version 4.00*)
1	1	System Operational Mode Designator	0 = Standalone Mode; 1 = 1:1 Redundant Mode; 2 = 1:2 Redundant Mode; 3 = 1:1 Phase Combined (v. 4.70); 4 = 1:2 Phase Combined (v. 4.98); 5 = Maintenance Switch (v. 6.00*)
2	1	System Switch Mode	0 = Auto; 1 = Manual; 2 = Switch Lock
3	1	Control Mode	0 = Local; 1 = Remote
4	1	Fan Speed	0 = Low; 1 = High; 2 = Auto (GaN units only)
5	1	Mute	0 = Mute OFF; 1 = Mute ON
6	1	Serial Protocol Select	0 = Normal; 1 = Terminal Mode; 2 = Locus (No longer supported, beginning with v. 4.00)
7	1	Baud Rate	0 = 9600; 1 = 2400; 2 = 4800; 3 = 19200; 4 = 38400
8	1	Network Address	Valid Values: 0 - 255
9	1	Serial Interface	0 = RS232; 1 = RS485; 2 = IPNet (v. 2.50*); 3 = SNMP (v. 4.00*)
10	1	Auxiliary Fault Handling	0 = Disable Fault Checking; 1 = Major Fault; 2 = Minor Fault; 3 = Major Fault + SSPA Mute
11	1	Auxiliary Fault Logic	0 = Fault on Logic High; 1 = Fault on Logic Low
12	1	RF Switch Fault Handling	0 = Disable Fault Checking; 1 = Major Fault; 2 = Minor Fault; 3 = Mute on Switch
13	1	Fault Latch	0 = Disable; 1 = Enable
14	1	BUC Fault Handling	0 = Disable Fault Checking; 1 = Major Fault; 2 = Minor Fault; 3 = Major Fault + SSPA Mute
15	1	BUC Fault Logic	0 = Fault on Logic High; 1 = Fault on Logic Low
16	1	User Password	Valid Values: 0 - 255
17	1	Standby Select	0 = Standby; 1 = Online
18	1	Buzzer	0 = Disable; 1 = Enable
19	1	Menu Password Protection	0 = Disable; 1 = Enable
20	1	RF Units	0 = dBm; 1 = Watts (v. 3.40*)
21	1	Standby Mode	0 = Hot Standby; 1 = Cold Standby
22	1	HPA Status	0 = HPA1; 1 = HPA2; 2 = HPA3 (v. 3.10*; 1:2 mode only)
23	1	Priority Select (1:2 mode)	0 = Pol1; 1 = Pol2 (v. 3.10*)
24	1	Low Fwd. RF Flt Handling	0 = Disable; 1 = Major Fault; 2 = Minor Fault; 3 = ALC
25	1	Hi Refl. RF Flt Handling	0 = Disable; 1 = Major Fault; 2 = Minor Fault
26	1	SSPA Attenuation	Valid values: 0 - 200; 0.1 dBm per 1 value
27	1	Low Fwd RF Threshold	Valid values: 0 - 80; 1 dBm per 1 value
28	1	High Refl. RF Threshold	Valid values: 0 - 80; 1 dBm per 1 value

* Version numbers listed indicate the version in which the listed feature was introduced.
Note that the Outdoor SSPA Controllers use Device Type 1 = RM SSPA.

(Continued)

Table 5-7: System Setting Details (continued from previous page)

Data Address	Min. Data Length (bytes)	Description	Limits and valid values
29	1	IP Address Byte 1 (MSB)	These fields are available only for RM SSPA with Ethernet IP Option (See **Table 8-9**, Field 20 Digital Core Board ID Byte for details) (v. 2.50*)
30	1	IP Address Byte 2	
31	1	IP Address Byte 3	
32	1	IP Address Byte 4	
33	1	IP Gateway Byte 1	
34	1	IP Gateway Byte 2	
35	1	IP Gateway Byte 3	
36	1	IP Gateway Byte 4 (LSB)	
37	1	Subnet Mask Byte 1 (MSB)	
38	1	Subnet Mask Byte 2	
39	1	Subnet Mask Byte 3	
40	1	Subnet Mask Byte 4 (LSB)	
41	1	Receive IP Port Byte 1 (MSB)	
42	1	Receive IP Port Byte 2 (LSB)	
43	1	IP Lock Address Byte 1 (MSB)	
44	1	IP Lock Address Byte 2	
45	1	IP Lock Address Byte 3	
46	1	IP Lock Address Byte 4 (LSB)	
47	1	N+1 Array size	0 = N+1 disabled; 2 = Array of two SSPAs; 4 = Array of four SSPAs; 8 = Array of eight SSPAs; 16 = Array of 16 SSPAs; Any other numeric value is invalid. (v. 4.20*)
48	1	N+1 Priority Address	Valid range (Array of 2): 1 to 2; Valid range (Array of 4): 1 to 4; Valid range (Array of 8): 1 to 8; Valid range (Array of 16): 1 to 16; (v. 4.20*)
49	1	N+1 Auto Gain Option	0 = Auto Gain Off; 1 = Auto Gain On (v. 4.20*); 2 = Keep Alive (v. 4.67*); 3 = FlexGain (v. 4.78)*; 4 = OPMAX Select (v. 6.31)*
50	1	N+1 Attenuation	Valid values: 0 - 200; 0.1 dBm per 1 value
51	1	Master IP Address Byte 1	Valid Values: 0 - 255 (v. 6.00)
52	1	Master IP Address Byte 2	Valid Values: 0 - 255 (v. 6.00)
53	1	Master IP Address Byte 3	Valid Values: 0 - 255 (v. 6.00)
54	1	Master IP Address Byte 4	Valid Values: 0 - 255 (v. 6.00)
55	1	Floating N+1 Master Mode	0 = Disable; 1 = Enable (v. 6.00)
56	1	Floating N+1 Master Serial Address	Valid Values: 0 - 255 (v. 6.00)

* Version numbers listed indicate the version in which the listed feature was introduced.

Table 5-8: System Threshold Addressing Details (Read Only)

Data Address	Min. Data Length (bytes)	Description	Limits and valid values
1	2	Forward RF power	If RF Units (**Table 5-7**, Data Address 20) = 0, then 0.1 dBm per 1 value; If RF Units = 1, then 0.1 Watt per 1 value (v. 3.40*)
2	2	Reflected RF power	If RF Units (**Table 5-7**, Data Address 20) = 0, then 0.1 dBm per 1 value; If RF Units = 1, then 0.1 Watt per 1 value (v. 3.40*)
3	2	SSPA DC Current	0.1 A per 1 value; Value will return (-100) if reading is not available at this time.
4	2	Main Power Supply 1 Output Voltage	0.1 V per 1 value; Value will return (-100) if reading is not available at this time.
5	2	Main Power Supply 2 Output Voltage	0.1 V per 1 value; Value will return (-100) if reading is not available at this time.
6	2	Booster Power Supply 1 Output Voltage	0.1 V per 1 value; Value will return (-100) if reading is not available at this time.
7	2	Booster Power Supply 2 Output Voltage	0.1 V per 1 value; Value will return (-100) if reading is not available at this time.
8	2	SSPA Core Temperature	1 °C per 1 value; Value will return (-100) if reading is not available at this time.
9	2	N+1 System Forward Power (available from Master unit only!)	If RF Units (**Table 5-7**, Data Address 20) = 0, then 0.1 dBm per 1 value; If RF Units = 1, then 1 Watt per 1 Value. Value will return (-100) if reading is not available at this time. v. 4.20*.
10	2	N+1 Estimated System Gain (available from Master only!)	0.1 dB per Value. Estimated N+1 system linear gain. v. 4.20*.
11	2	N+1 System Reflected Power (available from Master unit only!)	If RF Units (**Table 5-7**, Data Address 20) = 0, then 0.1 dBm per 1 value; If RF Units = 1, then 1 Watt per 1 Value. Value will return (-100) if reading is not available at this time. v. 4.20*.
12	2	Cabinet Temperature	1 °C per 1 value; Value will return (-100) if reading is not available at this time. v. 4.40*.
13	2	BUC PS1 Voltage	0.1 V per 1 value; Value will return (-100) if reading is not available at this time. v. 6.00*.
14	2	BUC PS2 Voltage	0.1 V per 1 value; Value will return (-100) if reading is not available at this time. v. 6.00*.
15	2	Chassis Temperature	1 °C per 1 value; Value will return (-100) if reading is not available at this time. v. 6.00*.

* Version numbers listed indicate the version in which the listed feature was introduced.

Note: In general, data length must be at least two (2) bytes to form an integer; the lower byte must come first. If an odd number of bytes arrived, the last data byte in the packet will be saved as the lower part of the integer; the upper part will be 0 by default.

Table 5-9: System Conditions Addressing Details

Data Address	Length (bytes)	Description	Limits and valid values
1	1	Summary Fault State	0 = No Fault; 1 = Fault
2	1	Power Supply Fault	0 = No Fault; 1 = Fault
3	1	High Temperature Fault	0 = No Fault; 1 = Fault
4	1	Low Regulator Voltage Fault	0 = No Fault; 1 = Fault
5	1	Low DC Current Fault	0 = No Fault; 1 = Fault
6	1	Auxiliary Fault	0 = No Fault; 1 = Fault
7	1	BUC Fault	0 = No Fault; 1 = Fault
8	1	Module 1 Fault	0 = No Fault; 1 = Fault; 2 = N/A
9	1	Module 2 Fault	0 = No Fault; 1 = Fault; 2 = N/A
10	1	Module 3 Fault	0 = No Fault; 1 = Fault; 2 = N/A
11	1	Module 4 Fault	0 = No Fault; 1 = Fault; 2 = N/A
12	1	Cooling Fan Fault	0 = No Fault; 1 = Fault; 2 = N/A
13	1	Low Forward RF Fault	0 = No Fault; 1 = Fault; 2 = N/A
14	1	High Reflected RF Fault	0 = No Fault; 1 = Fault; 2 = N/A
15	1	RF Switch 1 Position	1 = Fault; 2 = N/A; 3 = Pos1; 4 = Pos2
16	1	RF Switch 2 Position	1 = Fault; 2 = N/A; 3 = Pos1; 4 = Pos2
17	1	Optional Faults Port Byte 1 (External N+1 Power Supply Module Fault Identification)	Valid Value Range: 0 - 255; If using 3RU Power Supply: 0 = Fault, 1 = Normal for following bits: If using 1RU Power Supply: 0 = Normal, 1 = Fault for following bits: Bit 4 = PS Module 1 Alarm Input Bit 5 = PS Module 2 Alarm Input Bit 6 = PS Module 3 Alarm Input Bit 7 = PS Module 4 Alarm Input
18	1	Optional Faults Port Byte 2	Valid Value Range: 0 - 255
19	1	I/O Board ID Byte	Bit 0 = 0; Bit 1 = 0; 1 Module Rack Bit 0 = 0; Bit 1 = 1; 2 Module Rack Bit 0 = 1; Bit 1 = 1; 4 Module Rack Bit 2 to Bit 6 = Board Hardware Version Bit 7 = 0, Internal Power Supply Bit 7 = 1, External Power Supply
20	1	Digital Core Board ID Byte	0 = No Ethernet Support; 1 = Ethernet Support Version 1 (Ethernet/UDP/Normal protocol only)
21	1	Unit Standby State	0 = Standby; 1 = Online
22	1	Reserved for future use	Valid Value Range: 0 - 255 (v. 4.20*)
23	1	Unit N+1 State	0 = N+1 Slave; 1 = N+1 Master; 2 = N+1 Disabled (v. 4.20*)

(Continued)

Table 5-9: System Conditions Addressing Details (continued)

Data Address	Min. Data Length (bytes)	Description	Limits and valid values
24	1	Cabinet Impeller Fault	No Fault = 0; Fault = 1; N/A = 2 (v. 4.40*)
25	1	N+1 System faults (for N+1 Master unit only)	0 to 15, depending on number of faulted N+1 SSPA units and N+1 array size; Fault detection disabled (Slave unit)=255 (v. 4.20*)
26	1	Selected SSPA attenuation. Shows real SSPA attenuation in ALC or N+1 auto gain mode	0.1 dB per 1 Value
27	1	Reserved for factory use	0 - 255 (v. 4.40*)
28	1	Reserved for factory use	0 - 255 (v. 4.40*)
29	1	PreAmp Fault	0 = No Fault; 1 = Fault; 2 = N/A; 3 = Com Error (v. 4.64*)
30	1	N+1 Total offline units count. Include faulted units and units in standby mode (in case of switched redundancy schema implemented along with N+1 redundancy.	0 to 15, depending on number of faulted and standby units and N+1 array size. Slave unit = 255 (v. 4.70*)
31	1	Fault Mute State	0 = Fault Mute Off; 1 = Fault Mute On
32	1	Fault Mute Cause	0 = None; 1 = Auxiliary Fault; 2 = External Mute Input; 3 = BUC Fault; 4 = PS Fault; 5 = N+1 Fault (v. 6.00*)
33	1	Last Detected Fault Cause	1 = Cold Start; 2 = High Temperature; 3 = Low Regulator Voltage; 4 = Low DC Current; 5 = Aux Fault; 6 = BUC Fault; 7 = Low Forward RF; 8 = High Reflected RF; 11 = N+ 1 Fault; 12 = PS Fault; 14 = Other Fault; 15 = No Faults (v. 6.00*)
34	1	Detected N+1 Module Faults	0 to 6, depending on number of detected faults and type of N+1 power supply. (v. 6.00*)

5.3 Example 1 Check SSPA settings

Assumptions: SSPA unit unique network address: 5;
PC Host unique network address: 10;
Request ID: 111;
Unit attached to the serial line;

PC request string:

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	0	Destination Address of RCP unit
4	A	Source address of Request originating PC Host
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	3	“System Conditions” tag indicates which data from respondent required in response frame
9	1	Data Address field indicates the beginning data address inside of the “System Conditions” data set to 1 (first element)
10	C	Data Length field indicates how many data bytes of the “System conditions” requested from RCP2 (12 is all available data of “System Conditions” type)
11	8A	Arithmetic checksum of bytes 3 through 10

SSPA 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	0	Source address of RCP respondent
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Echo of the Originator's Request ID byte
7	3	Command field for "Get" type response
8	3	"System Conditions" tag indicates which data from respondent included in response frame.
9	0	Data Address field omitted and replaced with Error status code. 0 in this field indicates absence of errors.
10	C	Data Length field indicates how many data bytes of the "System conditions" requested from RCP. "C" indicates the first 12 "System Conditions" data fields.
11	0	Data field 1 contains data element 1 of "System Conditions" data type, which is RCP System Unit1 Fault State. "0" indicates that Unit 1 is not faulted.
12	1	Data field 2 contains data element 2 of "System Conditions" data type, which is RCP System Unit2 Fault State. "1" indicates that Unit 2 is in fault condition.
13	0	Data field 3 contains data element 3 of "System Conditions" data type, which is RCP System Unit3 Fault State. "0" indicates that Unit 3 is not faulted.
14	1	Data field 4 contains data element 4 of "System Conditions" data type, which is RCP System Summary Fault State. "1" indicates presence of faults in the system.
15	0	Data field 5 contains data element 5 of "System Conditions" data type, which is RCP System Power Supply 1 Fault State. "0" indicates that Power supply 1 is not faulted and functioning properly.
16	0	Data field 6 contains data element 6 of "System Conditions" data type, which is RCP System Power Supply 2 Fault State. "0" indicates that Power supply 2 is not faulted and functioning properly.
17	1	Data field 7 contains data element 7 of "System Conditions" data type, which is RCP System Auxiliary Fault State. "1" indicates presence of faults on one of the Auxiliary Inputs.
18	FF	Data field 8 contains data element 8 of the "System Conditions" data type. This data element is reserved for future applications.
19	FF	Data field 9 contains data element 9 of the "System Conditions" data type. This data element is reserved for future applications.
20	FF	Data field 10 contains data element 10 of the "System Conditions" data type. This data element is reserved for future applications.
21	3	Data field 11 contains data element 11 of the "System Conditions" data type, which is RF Switch 1 state. "3" indicates that RF Switch 1 is in Position 1.
22	1	Data field 12 contains data element 12 of the "System Conditions" data type, which is RF Switch 2 state. "1" indicates that RF Switch 2 is has a fault condition or its position can't be reliably determined.
23	8F	Arithmetic checksum of bytes number 3 through 22

5.4 Terminal Mode Serial Protocol for Paradise Datacom SSPA

The Teledyne Paradise Datacom Rack Mount SSPA utilizes 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 RM SSPA unique network address or the global call address (255). Press the "Enter" key on 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 mimics the SSPA's front panel menu. To help 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)lrearFlt; (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 THE SAME TIME. If you do so you will not get any valid answer from the SSPA!

```
UNIT#001
Welcome! Unit#001 Online


Atten.(dB):20.0   Frwrd.RF( dBm):00.0
    Alarms:FAULT!   Ref.RF( dBm):N/A
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter

M

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

3

1.Info   3.Mute     5.Attenuation
2.Buzzer 4.Sys.Mode 6.RF.Units
Active Keys:0-9;(C)lrearFlt;(M)enu;(E)nd;(B)ack; + Enter


_
```

Figure 5-8: Terminal Mode Session Example

Figure 5-8 shows an example screen shot of a terminal session.

5.5 This section has been deprecated.

5.6 Ethernet Interface

The rack mount SSPA Ethernet Port (J9) 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 the Teledyne Paradise Datacom Universal M&C software.
- **SNMPv1 protocol** - This protocol is 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 5.6.1.2** and **Section 5.6.2.4** 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.

5.6.1 IPNet Interface

5.6.1.1 General Concept

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

- Unsurpassed system integration capabilities;
- Widely available and inexpensive set of 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 SSPAs. 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 RM 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. 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 Teledyne Paradise Datacom RM SSPA serial protocol was selected. This protocol is 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 in **Figure 5-9**.

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

Figure 5-9: UDP Redirect Frame Example

A detailed OSI model for the RM SSPA M&C interface is represented in **Table 5-10**.

Table 5-10: OSI Model for RM SSPA Ethernet IP Interface

OSI Layer	Protocol	Notes
Application	Paradise Datacom RM SSPA Serial Protocol	This is the frame structure described in **Section 5.2** through **Section 5.6.**
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 the Teledyne Paradise Datacom Universal M&C software package. The software is supplied on CD with the unit, or can be download from company's web site, http://www.paradisedata.com.

5.6.1.2 Setting IPNet Interface

Before enabling the Ethernet IP interface, the following IP parameters need to be set: IP Port address, Default Gateway, Subnet Mask, Receive IP Port and Lock IP address. All IP related menu items consolidate under the Communication Setup menu. Press the **Main Menu** key, select **2.Com.Setup** and press the **Enter** key, select **5.IP Setup** and press the **Enter** key.

The Lock IP address is a security measure. Setting this parameter either to 255.255.255.255 or 0.0.0.0 will allow any host to control the SSPA. Setting the parameter to the specific address of the remote host will lock SSPA access to this host. Packets received from other hosts will be ignored.

For other parameters (IP address, Gateway, Subnet, IP port) contact your network system administrator for assistance.

> **Important!** If you are planning to access the SSPA RM via the Internet, you must exercise appropriate security measures. It is strongly recommended to put SSPA units behind a protective Firewall or set up a VPN link for remote access.

After selecting the IP parameters, turn on IP interfaces: Press the **Main Menu** key, select **2.Com.Setup** and press the **Enter** key; select **4.Interface** and press the **Enter** key; select **3.IPNet** and press the **Enter** key.

Ethernet Interface is now the primary remote control interface and the RS232/485 Main port is disabled. The user may adjust any IP settings when the IPNet interface is turned on, as needed, without losing IP link. New settings become effective only after a hardware reset (press the **Main Menu** key; select **5.Options** and press the **Enter** key; select **6.Reset** and press the **Enter** key; select **3.Coms Only** and press the **Enter** key; or cycle power to the unit).

To disable the Ethernet port and enable the RS-232/RS-485 Serial Main port, press the **Main Menu** key and select **2.Com.Setup**, press the **Enter** key; select **4.Interface**, press the **Enter** key; select either **1.RS232** or **2.RS485**, and press the **Enter** key.

> **Important!** At the present, the RM SSPA controller supports only one remote control protocol selection through its Ethernet interface port. This protocol is referred to as “Normal” on the front panel display (See **Section 3.1** through **Section 3.6**). If the protocol selection is set differently, the controller will force its protocol selection to “Normal”.

The RM SSPA Ethernet port can be connected to a network hub using straight through network cable or directly to a work station NIC card through a null-modem or cross-over cable (Rx and Tx lines are crossed). As soon as an Ethernet interface has been selected as the primary interface, you should be able to verify the network connection to the unit by using the Ping command from your host workstation.

To do so on a Windows based PC, open a Command Prompt window and type PING and the dot delimited IP address of the RM SSPA, then press the Enter key. If the unit is successfully found on the network, the request statistic will be displayed.

If the unit does not answer on the ping command, check all hardware connections and verify that the IP settings on your host workstation and the RM SSPA match your network parameters. On a Windows-based PC you may also check Address Resolution Protocol (ARP) table entries. The new IP address of the RM SSPA may be set to another PC or network equipment with a different MAC address.

Open a Command Prompt window and type “ARP -a”, the press Enter. The current ARP data will be displayed. If you see the RM SSPA IP address entry in the table, delete it by issuing the command “ARP -d XXX.XXX.XXX.XXX” and press Enter (XXX.XXX.XXX.XXX is the IP address of the RM SSPA unit). Try the PING command again. More information about how to set up a network connection with the RM SSPA can be found in **Appendix B**.

5.6.1.3 Using the Rack Mount Web Interface

Starting with firmware version 6.00, the rack mount web interface no longer needs to have a pre-installed Java application to operate. 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).

To connect to SSPA internal web page, the user must make sure Web/IPNet interface is enabled on the device (See **Section 8.6.1.2**) and that an IP address has been assigned to the unit. Connect the unit to an Ethernet network or directly to a PC 10/100 Base-T adapter and then open a web browser.

Enter IP address of the unit into the address bar of the browser. A security login window will appear.

In the User Name field, enter **admin**, the default User Name. See **Figure 5-10**. The User Name is fixed and cannot be changed by the operator.

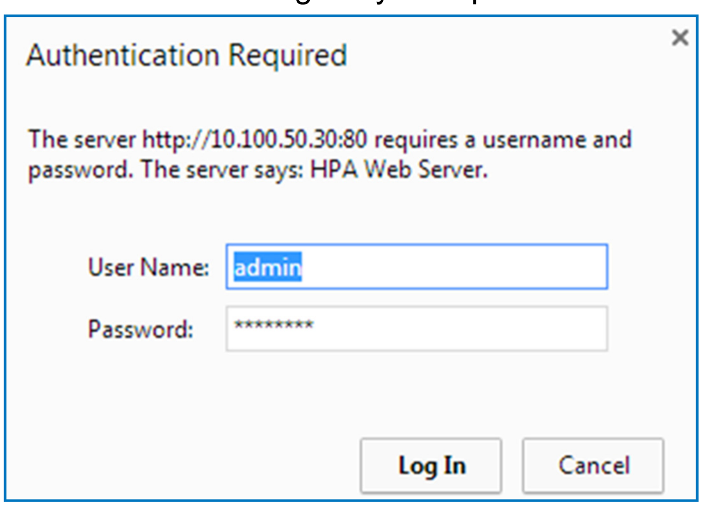


Figure 5-10: Web Interface Login Window

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.

Click on the [Log In] button to open the M&C control in the browser window. See **Figure 5-11**.

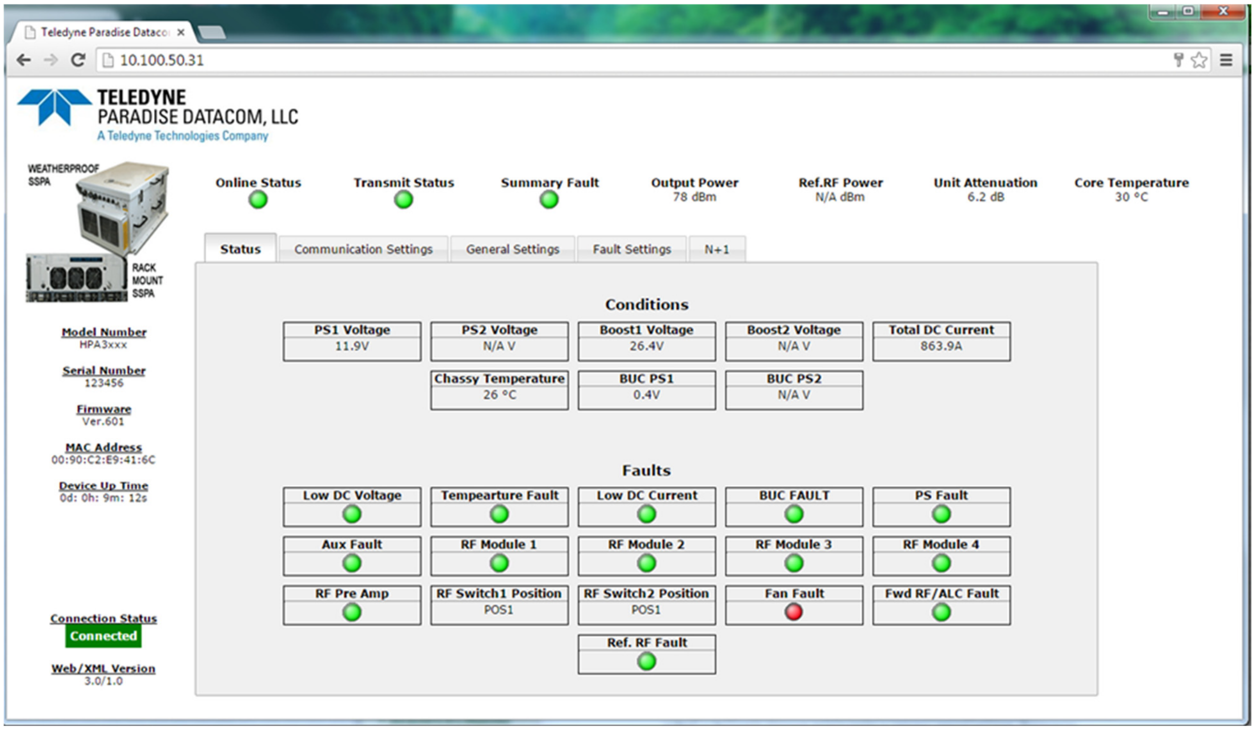


Figure 5-11: RM SSPA Web Interface, Status Tab

The top bar of SSPA Monitor and Control application shows device's online status, transmit status, RF output power, reflected RF power (if available), attenuation and RF module core temperature.

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.

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

- **Status tab**: A view of critical device operation parameters and alarm statuses.
- **Communication Setup 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;
- **N+1 tab**: page shows N+1 system related operation parameters.

The web server has limited hardware resources to support multiple simultaneously connected users. In the case that multiple users are connected to the same amplifier, service quality cannot be assured.

5.6.2 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 on units with serial numbers of 400000 and below.

In order to utilize SNMP protocol, the operator has to enable this feature through the front panel or by remote serial protocol. SNMP uses the UDP fixed port 161.

The definition of managed objects described in the Management Information Base (MIB) file. The MIB file is available for download from the Downloads section of the Teledyne Paradise Datacom web site, http://www.paradisedata.com.

5.6.2.1 Interface

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 **Table 5-11** through **Table 5-13**.

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

As with the serial protocol, the MIB allows access to a remote SSPA (default state) as well as to the RCP unit itself. To switch between those devices' MIBs, the proper Device Type has to be selected (OID -1.3.6.1.4.1.20712.1.4).

5.6.2.2 SNMP V3 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, 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, a 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.

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 Teledyne 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.

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 inform requests. Traps are unreliable because the receiver does not send acknowledgments when this device 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 protocol data unit (PDU). If the sender never receives the response, the inform request can be sent again. Therefore, 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. Traps are sent only once, while an inform can be retried several times. The retries increase traffic and contribute to a higher overhead on the network.
>
> (http://www.cisco.com/c/en/us/support/docs/ip/simple-network-management-protocol-snmp/13506-snmp-traps.html, last visited on 22 January 2015.)

5.6.2.3 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)
```

5.6.2.4 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 only 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 LLC SNMP enabled devices except Modem. See the Evolution Modem manual for specific MIB information. Branches for Devices A, B and C are reserved for future use.

paradiseDevice - Field contains tables that 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 RM SSPA SNMP device see **Table 5-11**. Read/write access for settingsValue column.

thresholds - Table provides information about device internal limits and subsystems info. For detailed table information refer to **Table 5-12**. Read only access.

conditions - Table contents device fault status information. Read only access. For detailed conditions table info see **Table 5-13**.

Table 5-11: Outdoor Controller Detailed SNMP Settings

settingIndex/ settingValue	settingTextValue	Value OID	Description
1/INTEGER	SysMode'StdAln=0,1:1=1,1:2=2,1:1PhC=3,1:2PhC=4, SinglSw=5	1.3.6.1.4.1.20712.2.1.1.1.2.1	System Operation mode
2/INTEGER	SwitchMode'Auto=0,Manual=1,SWLock=2	1.3.6.1.4.1.20712.2.1.1.1.2.2	Redundancy switching mode
3/INTEGER	ControlMode'Local=0,Remote=1	1.3.6.1.4.1.20712.2.1.1.1.2.3	Unit control mode
4/INTEGER	FanSpeed'Low=0,High=1,Auto=2 (GaN units only)	1.3.6.1.4.1.20712.2.1.1.1.2.4	Fan Speed
5/INTEGER	Mute'Off=0,On=1	1.3.6.1.4.1.20712.2.1.1.1.2.5	Unit mute status
6/INTEGER	Protocol'Normal=0,Terminal=1	1.3.6.1.4.1.20712.2.1.1.1.2.6	Unit remote control protocol
7/INTEGER	Baud'9600=0,2400=1,4800=2,19200=3,38400=4	1.3.6.1.4.1.20712.2.1.1.1.2.7	Serial Interface speed
8/INTEGER	NetworkAddress'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.8	Serial interface address
9/INTEGER	Interface'RS232=0,RS485=1,IPNet=2,SNMP=3	1.3.6.1.4.1.20712.2.1.1.1.2.9	Unit remote control interface
10/INTEGER	AuxFltHandle'Ignore=0,Major=1,Minor=2,Major+Mute=3, Minor+Mute=4	1.3.6.1.4.1.20712.2.1.1.1.2.10	Auxiliary fault handling
11/INTEGER	AuxFltLofic'FaultOnHigh=0,FaultOnLow=1	1.3.6.1.4.1.20712.2.1.1.1.2.11	Auxiliary fault logic
12/INTEGER	RFSWFltHandle'Ignore=0,Major=1,Minor=2,SwMute=3	1.3.6.1.4.1.20712.2.1.1.1.2.12	RF switch fault handling
13/INTEGER	FaultLatch'Disable=0,Enable=1	1.3.6.1.4.1.20712.2.1.1.1.2.13	Fault latch state
14/INTEGER	BUCFltHandle'Ignore=0,Major=1,Minor=2,Major+Mute=3	1.3.6.1.4.1.20712.2.1.1.1.2.14	Internal BUC fault handling
15/INTEGER	BUCFltLofic'FaultOnHigh=0,FaultOnLow=1	1.3.6.1.4.1.20712.2.1.1.1.2.15	Internal BUC fault logic
16/INTEGER	UserPassword'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.16	Numeric menu password
17/INTEGER	StartUpState'Standby=0,Online=1	1.3.6.1.4.1.20712.2.1.1.1.2.17	Redundancy online/standby selection
18/INTEGER	Buzzer'Off=0,On=1	1.3.6.1.4.1.20712.2.1.1.1.2.18	Audible alarm state
19/INTEGER	MenuPassword'Off=0,On=1	1.3.6.1.4.1.20712.2.1.1.1.2.19	Menu password protection
20/INTEGER	RFUNITS'dBm=0,watts=1	1.3.6.1.4.1.20712.2.1.1.1.2.20	Unit measurement select (dBm or Watts)
21/INTEGER	StandbyMode'HotStandby=0,ColdStandby=1	1.3.6.1.4.1.20712.2.1.1.1.2.21	Redundancy standby mode
22/INTEGER	HPAStatus'HPA1=0,HPA2=1,HPA3=2	1.3.6.1.4.1.20712.2.1.1.1.2.22	Redundancy HPA status
23/INTEGER	Priority'Pol1=0,Pol2=1	1.3.6.1.4.1.20712.2.1.1.1.2.23	1:2 Mode priority select
24/INTEGER	LowFrwrdRFFltHandle'Ignore=0,Major=1,Minor=2,ALC=3	1.3.6.1.4.1.20712.2.1.1.1.2.24	Low forward RF fault handling
25/INTEGER	HighRefRFFltHandle'Ignore=0,Major=1,Minor=2	1.3.6.1.4.1.20712.2.1.1.1.2.25	High reflected RF fault handling

Table 5-11: Outdoor Controller Detailed SNMP Settings (continued from previous page)

settingIndex/ settingValue	settingTextValue	Value OID	Description
26/INTEGER	SSPAAttenuation(dBx10)'0..200	1.3.6.1.4.1.20712.2.1.1.1.2.26	Unit attenuation level
27/INTEGER	LowForwardRFthreshold(dBm)'0..80	1.3.6.1.4.1.20712.2.1.1.1.2.27	Low forward RF threshold
28/INTEGER	HighRefRFThreshold(dBm)'0..80	1.3.6.1.4.1.20712.2.1.1.1.2.28	High reflected RF threshold
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)
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)
47/INTEGER	N+1Size'N1Off=0,Size2=2,Size4=4,Size8=8,Size16=16	1.3.6.1.4.1.20712.2.1.1.1.2.47	N+1 Array Size
48/INTEGER	N+1Address'1..16	1.3.6.1.4.1.20712.2.1.1.1.2.48	N+1 Priority Address
49/INTEGER	N1GainControl'Off=0,5dBOn=1,KeepAlive=2, FlexGain=3	1.3.6.1.4.1.20712.2.1.1.1.2.49	N+1 Auto Gain Option
50/INTEGER	N1Attenuation(dBx10)'0..200	1.3.6.1.4.1.20712.2.1.1.1.2.50	N+1 Attenuation

Table 5-12: Outdoor Controller Detailed SNMP Thresholds

thresholdIndex/ thresholdValue	thresholdTextValue	Value OID	Description
1/INTEGER	ForwardRFPower(RFunitsx10)'0..10000	1.3.6.1.4.1.20712.2.1.2.1.2.1	Current value of forward RF power
2/INTEGER	ReflectedRFPower(RFunitsx10)'0..10000	1.3.6.1.4.1.20712.2.1.2.1.2.2	Current value of reflected RF power
3/INTEGER	SSPADCCurrent(Ampx10)'0..10000	1.3.6.1.4.1.20712.2.1.2.1.2.3	SSPA DC current consump-tion
4/INTEGER	PS1Voltage(Voltx10)'0..200	1.3.6.1.4.1.20712.2.1.2.1.2.4	Power Supply 1 output volt-age
5/INTEGER	PS2Voltage(Voltx10)'0..200	1.3.6.1.4.1.20712.2.1.2.1.2.5	Power Supply 2 output volt-age
6/INTEGER	Booster1Voltage(Voltx10)'0..320	1.3.6.1.4.1.20712.2.1.2.1.2.6	Booster 1 output voltage
7/INTEGER	Booster2Voltage(Voltx10)'0..320	1.3.6.1.4.1.20712.2.1.2.1.2.7	Booster 2 output voltage
8/INTEGER	SSPACoreTemperature(C)'-100..100	1.3.6.1.4.1.20712.2.1.2.1.2.8	SSPA core temperature
9/INTEGER	N1FwdRFPower(RFunitsx1)'0..10000	1.3.6.1.4.1.20712.2.1.2.1.2.9	N+1 System Forward Power
10/INTEGER	N1SystemGain(dBx10)'500..900	1.3.6.1.4.1.20712.2.1.2.1.2.10	N+1 System Linear Gain
11/INTEGER	N1RefRFPower(RFunitsx1)'0..10000	1.3.6.1.4.1.20712.2.1.2.1.2.11	N+1 System Reflected Power
12/INTEGER	N1CabinetTemp(C)’-100..100	1.3.6.1.4.1.20712.2.1.2.1.2.12	N+1 Cabinet Temperature
13/INTEGER	BUCPS1Voltage(Voltx10)'0..200	1.3.6.1.4.1.20712.2.1.2.1.2.13	BUC PS 1 output voltage
14/INTEGER	BUCPS2Voltage(Voltx10)'0..200	1.3.6.1.4.1.20712.2.1.2.1.2.14	BUC PS 2 output voltage
15/INTEGER	ChassisTemperature(C)'-100..100	1.3.6.1.4.1.20712.2.1.2.1.2.15	Chassis Temperature

Table 5-13: Outdoor Controller Detailed SNMP Conditions

conditionIndex/ conditionValue	conditionTextValue	Value OID	Description
1/INTEGER	SummaryFault'NoFault=0,Fault=1	1.3.6.1.4.1.20712.2.1.3.1.2.1	Summary fault state
2/INTEGER	PowerSupplyFault'NoFault=0,Fault=1	1.3.6.1.4.1.20712.2.1.3.1.2.2	Power supply fault state
3/INTEGER	HighTemperatureFault'NoFault=0,Fault=1	1.3.6.1.4.1.20712.2.1.3.1.2.3	High Temperature fault state
4/INTEGER	LowRegulatorVoltageFault'NoFault=0, Fault=1	1.3.6.1.4.1.20712.2.1.3.1.2.4	Low Regulator voltage state
5/INTEGER	LowDCCurrentFault'NoFault=0,Fault=1	1.3.6.1.4.1.20712.2.1.3.1.2.5	Low DC Current fault state
6/INTEGER	AuxiliaryFault'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.6	Auxiliary fault state
7/INTEGER	BUCFault'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.7	BUC fault state
8/INTEGER	Module1Fault'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.8	Module1 summary fault state
9/INTEGER	Module2Fault'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.9	Module2 summary fault state
10/INTEGER	Module3Fault'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.10	Module3 summary fault state
11/INTEGER	Module4Fault'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.11	Module4 summary fault state
12/INTEGER	CollingFanFault'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.12	Cooling fan fault state
13/INTEGER	LowForwardRFFault'NoFault=0,Fault=1, N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.13	Low forward RF fault state
14/INTEGER	HighReflectedRFFault'NoFault=0,Fault=1, N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.14	High reflected RF fault state
15/INTEGER	RFSwitch1Position'Fault=1,N/A=2,Pos1=3, Pos2=4	1.3.6.1.4.1.20712.2.1.3.1.2.15	PF switch position1 /fault state
16/INTEGER	RFSwitch2Position'Fault=1,N/A=2,Pos1=3, Pos2=4	1.3.6.1.4.1.20712.2.1.3.1.2.16	PF switch position1 /fault state
17/INTEGER	FaultsPortbyte1'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.17	Faults on logic port 1 raw data
18/INTEGER	FaultsPortbyte2'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.18	Faults on logic port2 raw data
19/INTEGER	IOBoardHardwareID'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.19	I/O Board hardware revision
20/INTEGER	DigitalCoreBoardID'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.20	DigiCore board hardware revision
21/INTEGER	UnitStandbyState'Online=1,Standby=0	1.3.6.1.4.1.20712.2.1.3.1.2.21	Current unit redundancy state
22/INTEGER	Reserved’0..255	1.3.6.1.4.1.20712.2.1.3.1.2.22	Reserved for factory use only
23/INTEGER	N1UnitState’Slave=0,Master=1,N1Off=2	1.3.6.1.4.1.20712.2.1.3.1.2.23	Unit N+1 state
24/INTEGER	ExtFanFault’NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.24	N+1 Cabinet Impeller Fault
25/INTEGER	N1SysFaults’0..16	1.3.6.1.4.1.20712.2.1.3.1.2.25	# of SSPA faults in N+1 system
26/INTEGER	SelectedAtten(dBx10)’0,,200	1.3.6.1.4.1.20712.2.1.3.1.2.26	Actual SSPA attenuator value
27/INTEGER	Reserved’0..255	1.3.6.1.4.1.20712.2.1.3.1.2.27	Reserved for factory use only
28/INTEGER	Reserved’0..255	1.3.6.1.4.1.20712.2.1.3.1.2.28	Reserved for factory use only
29/INTEGER	PreAmpFault'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.29	PreAmp Fault

5.6.2.5 Configuring RM SSPA Unit to Work With SNMP Protocol

1. Set up the unit IP Address. Select the following sequence from the SSPA Front Panel: Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IP Setup** and press the **Enter** key; select **2.LocalIP** and press the **Enter** key. Use the navigation keys to input the unit IP address. Press the **Enter** key when complete;
2. Set up the unit Gateway Address. Select the following sequence from the SSPA Main Menu: Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IP Setup** and press the **Enter** key; select **4.Gateway** and press the **Enter** key. Then by using the navigation keys, adjust the unit gateway address. If no gateway is needed, set the address to 0.0.0.0. Press the **Enter** key when complete;
3. Set up the unit Subnet Mask. Select the following sequence from the SSPA Front Panel: Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IP Setup** and press the **Enter** key; select **3.Subnet** and press the **Enter** key. Then by using the navigation keys adjust the unit subnet mask. Press the **Enter** key when complete;
4. Set up the unit Community Set and Get strings. Select the following sequence from the SSPA Front Panel: Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IP Setup** and press the **Enter** key; select **6.More** and press the **Enter** key; select **1.CommunitySet** (or **2.CommunityGet**) and press the **Enter** key. Then by using the navigation keys, adjust the unit community strings information. Press and hold the key for alphanumeric selections. Press the **Enter** key when complete. Press and hold the **Down Arrow** [▼] key and then press the **Up Arrow** [▲] key to erase unwanted characters;
5. Set up the unit interface to SNMP. Select the following sequence from the SSPA Front Panel: Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **4.Interface** and press the **Enter** key; select **4.SNMP** and press the **Enter** key. Restart the unit by cycling power or by selecting the Reset option from the front panel menu.
6. SNMP protocol now is set and ready to be used.

5.6.2.6 Connecting to a MIB Browser

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

1. Copy the provided Paradise Datacom LLC MIB file into the Getif Mibs sub-folder.
2. Start the GetIf application.
3. Select the unit IP address and community strings in the relevant text boxes on the Parameters tab (see **Figure 5-12**) and then click the Start button.

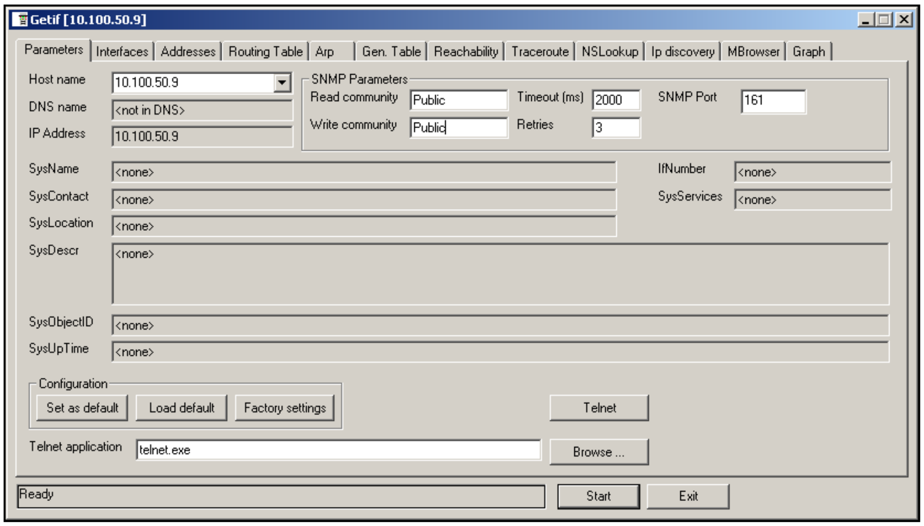


Figure 5-12: GetIF Application Parameters Tab

4. Select the MIBBrowser tab.
5. Click on 'iso main entity' on the MIB tree, then click the Start button.
6. See update data in output data box (**Figure 5-13**).

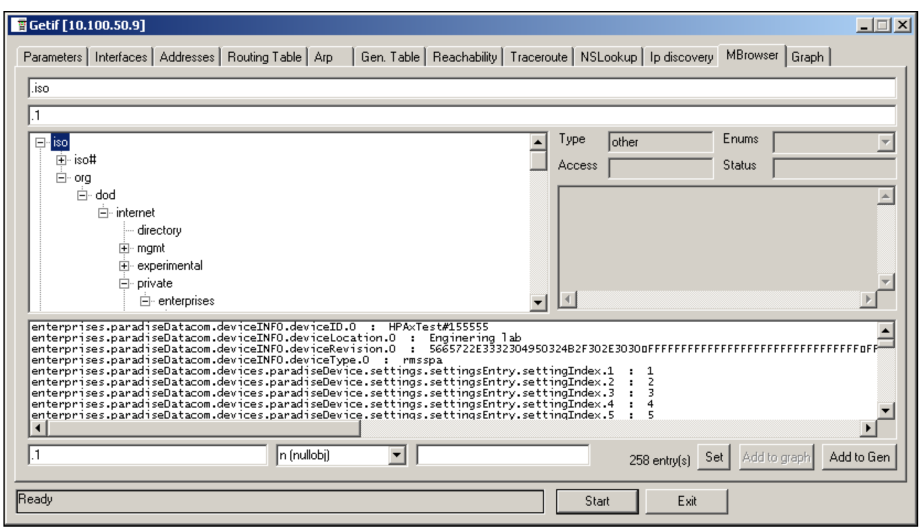


Figure 5-13: Getif MBrowser Window, with Update Data in Output Data Box

7. Select settingValue.5 entity (SSPA Mute), set the value to 1 and click the Set button.
8. Observe the Mute state on the SSPA change to a “Mute On” state. See **Figure 5-14.**

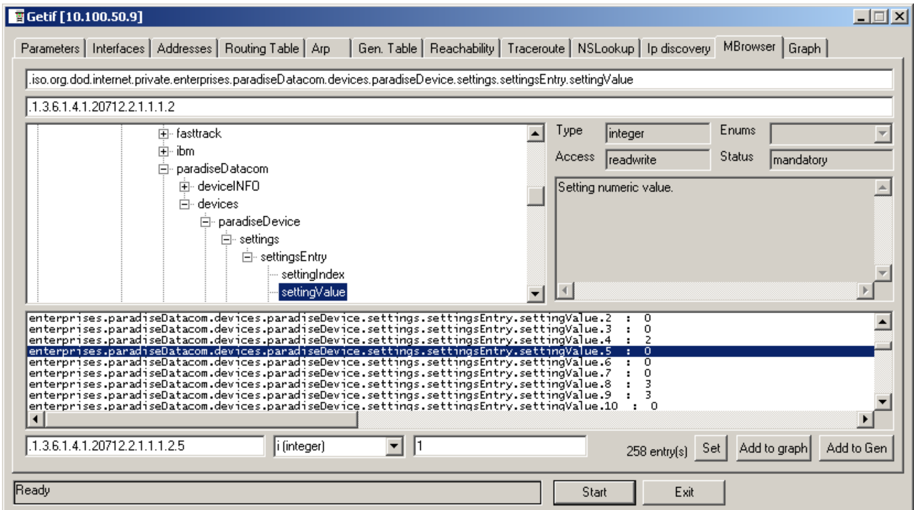


Figure 5-14: Getif MBrowser Window, Setting settingValue.5 to a Value of ‘1’

5.6.3 Extended SNMP Operation

The 5RU SSPA Chassis is equipped with a DigitalCore5 control board and utilizes firmware version 6.00 and above. These units feature an extended SNMP MIB and support 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 operator. The operator 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 operator. 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.

5.6.3.1 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]
|
(continued)
```

```
+--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)
```

5.6.3.2 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.

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6.0 Introduction

This section describes some of the standard maintenance practices that should be performed on the system and tips to troubleshoot common customer issues.

6.1 SSPA Cooling System Maintenance

It is recommended that the cooling system be checked at least once per month. If the operating environment is especially dirty, and debris accumulates more regularly, this inspection should be performed more frequently.

Visually inspect the fan intakes and exhaust to make sure that there are no obstructions. See **Figure 6-1**.

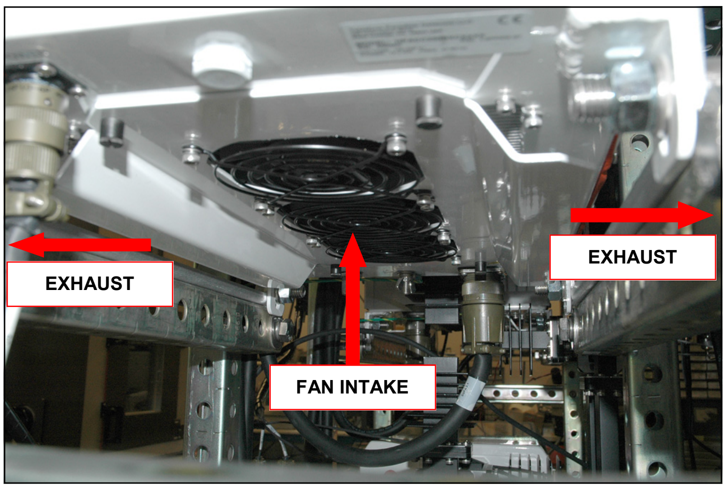

Figure 6-1: Clear Debris from Fan Intake and Exhaust

Note: The Windows-based Universal M&C software can be used to check the amplifier base plate temperature. The base plate temperature normally should not exceed a 35 °C rise above ambient temperature. If the base plate temperature exceeds this temperature rise, it is one indicator that the system's airflow requires maintenance.

Visually inspect the heatsink fins in the exhaust path 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.

Warning! Failure to keep the fans and heatsink clear of debris will void your warranty.

6.2 SSPA Fan Removal and Heatsink Cleaning

It is recommended to remove prime AC power from the amplifier when the fan tray is 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. Loosen the four captive thumbscrews that secure the fan tray to the enclosure. Remove the fan assembly from the bottom of the enclosure. See **Figure 6-2**.

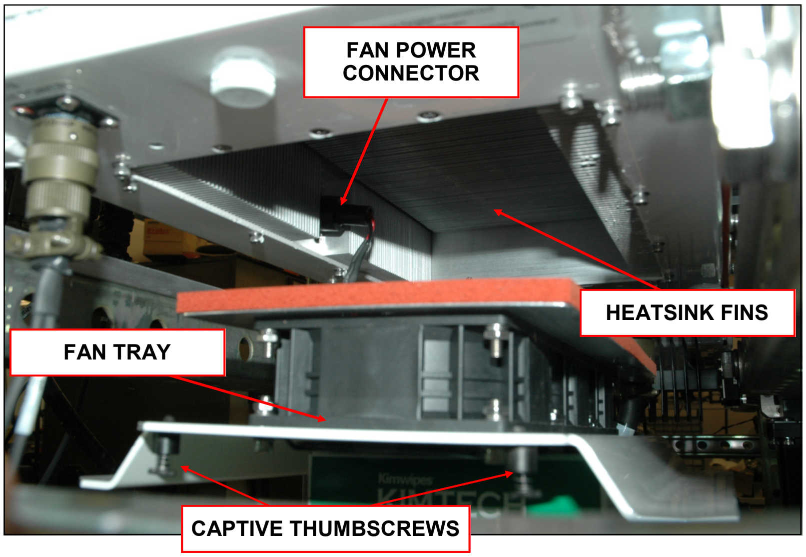

Figure 6-2: Fan Removal

The fans are connected to their power source by a weatherized in-line circular connector. A replacement fan assembly 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. All debris should be removed from the enclosure before reinstalling the fan tray.

6.2.1 SSPA Fan Replacement

The Compact Outdoor SSPA Modules in this system are fitted with a three-fan cooling fan assembly.

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).

6.3 Optional Switch Controller Fuse Replacement

The optional Switch Controller includes fuses on the removable AC power supplies, accessible at the rear panel.

The AC input fuses are 2 Amp Slow Blow style fuses and are accessible at the AC input entry module. **Figure 6-3** shows the location of the input fuses. The fuse part number is Littlefuse 217002, 2 Amp.

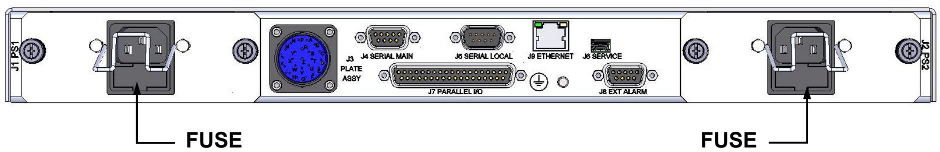

Figure 6-3: Optional Switch Controller Rear Panel Fuse Location

6.4 Identifying and Replacing a Failed RCP Power Supply

In the optional Maintenance Switch Controller, a power supply fault is always considered a major fault, and will cause the front panel Summary Alarm and Power Supply Alarm LEDs to illuminate. To identify which power supply module is faulted, follow these steps:

1. On the front panel keypad, press the **Main Menu** key.
2. Select menu item **1.Sys Info** and press the **Enter** key.
3. The resulting screen shows the status of both power supplies **PS1** and **PS2** on the left side of the display. The controller monitors the output voltage of each power supply module. If the output voltage level for a power supply is above 23V, the display will read **Normal**. If the output voltage drops below 22V, the display will read **Fault**.

When looking at the back panel of the controller, PS1 is on the left and PS2 is on the right.

6.4.1 Removing a Faulted RCP Power Supply Module

To remove a faulted power supply module from the RCP chassis, perform the following steps:

1. Loosen the two captured thumbscrews securing the module to the chassis;
2. Slide the module out of the chassis;
3. Unplug the quick-connect power pole connectors.

6.4.2 Installing a New RCP Power Supply Module

To install a new power supply module into the RCP chassis, perform the following steps:

1. Plug together the quick-connect power pole connectors;
2. Slide the module into the chassis, taking care not to pinch the power cables;
3. Tighten the two captured thumbscrews to secure the module to the chassis.

6.5 Identifying and Replacing a Failed SSPA Module

The system's Outdoor SSPA Controllers monitor the operational status of each of the four (4) Compact Outdoor SSPA Modules to which they are connected. Each Compact Outdoor SSPA Module has a status indicator LED which illuminates red when a unit exhibits a fault condition.

To view the operational status of each SSPA module, perform the following steps:

1. To display the status of SSPA 1.1 through 1.4, press the **Main Menu** button on Outdoor SSPA Controller 1; to see the status of SSPA 2.1 through 2.4, press the **Main Menu** button on Outdoor SSPA Controller 2;
2. With the cursor on **1.SysInfo**, press the **Enter** button;
3. Press the **Down Arrow** [▼] button eight (8) times;
4. Review the status of the four Compact Outdoor SSPA modules;
5. Note the module number indicating a fault and compare with **Table 6-1**;

Table 6-1: Module/SSPA Identification, 8-Way System

Controller 1		Controller 2	
Module 1	SSPA 1.1	Module 1	SSPA 2.1
Module 2	SSPA 1.2	Module 2	SSPA 2.2
Module 3	SSPA 1.3	Module 3	SSPA 2.3
Module 4	SSPA 1.4	Module 4	SSPA 2.4

6. Press the **Down Arrow** [▼] button two (2) times;
7. Review the Fault Conditions listed. Refer to **Section 4.1.1.10** for fault cause notations;
8. If the fault condition cannot be cleared, replacement of the failed amplifier may be necessary. See **Section 6.5.2**.

6.5.1 Remote Identification of Failed SSPA Module

A connection to the Outdoor SSPA Controllers is necessary in order to identify a failed SSPA module from a remote terminal.

The Outdoor SSPA Controllers are connected to the system's Ethernet Hub and remote communication is possible as long as the IP Addresses of the Outdoor SSPA Controllers are known.

Table 6-2 shows the default IP Addresses for each Outdoor SSPA Controller as set at the factory. The operator should note any changes to the controller's IP Addresses that may be necessary to fit with the network to which the system is attached.

Table 6-2: Default IP Addresses, Outdoor SSPA Controllers, 8-Way System

Controller ID	Default IP Address
Outdoor SSPA Controller 1	192.168.0.11
Outdoor SSPA Controller 2	192.168.0.12

See **Section 5.2** for details on the remote serial protocol structure.

Each Outdoor SSPA Controller in the system monitors the fault condition for the four Compact Outdoor SSPA modules to which it is connected. The operator may poll the system conditions for data addresses 8 through 11 to verify the operating status of the SSPA modules.

The Master Outdoor SSPA Controller (typically Controller 1) also tracks the number of N+1 faults in the system. See **Table 5-9**, data address 25.

If a paired set of SSPAs monitored by an Outdoor Controller both lose power, the Outdoor Controller will exhibit a Power Supply fault, in addition to a Summary fault.

- SSPAs 1.1 and 1.2 provide power to Controller 1 as Power Supply 1
- SSPAs 1.3 and 1.4 provide power to Controller 1 as Power Supply 2
- SSPAs 2.1 and 2.2 provide power to Controller 2 as Power Supply 1
- SSPAs 2.3 and 2.4 provide power to Controller 2 as Power Supply 2

6.5.1.1 Example 1 — One SSPA Fault on System 1

In this example, SSPA 1.2 enters a fault condition and automatically mutes. See **Figure 6-4**.

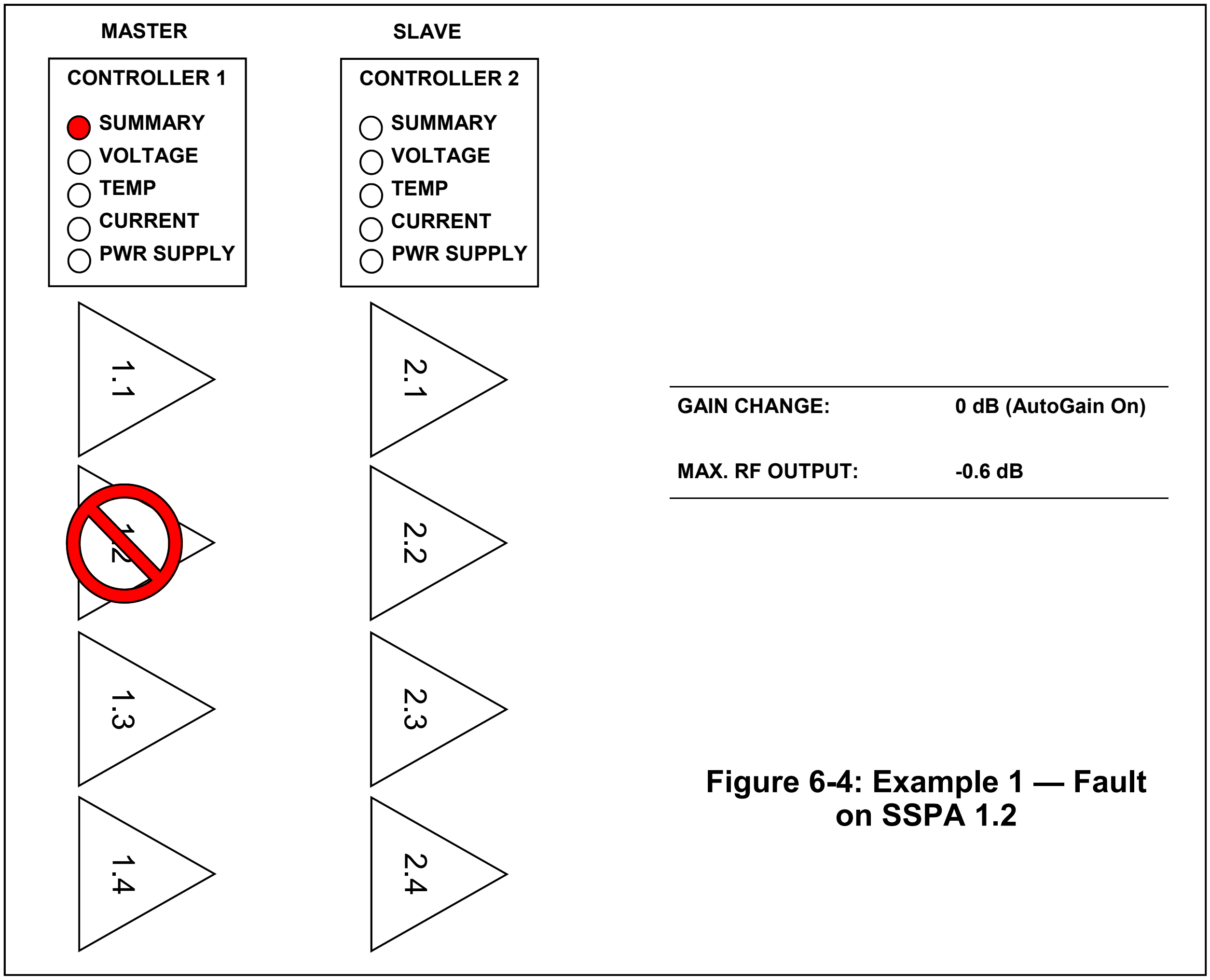

Figure 6-4: Example 1 — Fault on SSPA 1.2

Outdoor SSPA Controller 1 displays a Summary fault.

With the system operating in AutoGain mode, the gain is automatically adjusted to maintain the nominal gain level. If operating below saturated output power, the system will automatically adjust output RF power along with gain.

Maximum total system output power will be reduced by 0.6 dBm.

6.5.1.2 Example 2 — Two SSPA Faults on System 1

In this example, SSPA 1.2 and SSPA 1.3 enter a fault condition and automatically mute. See **Figure 6-5**.

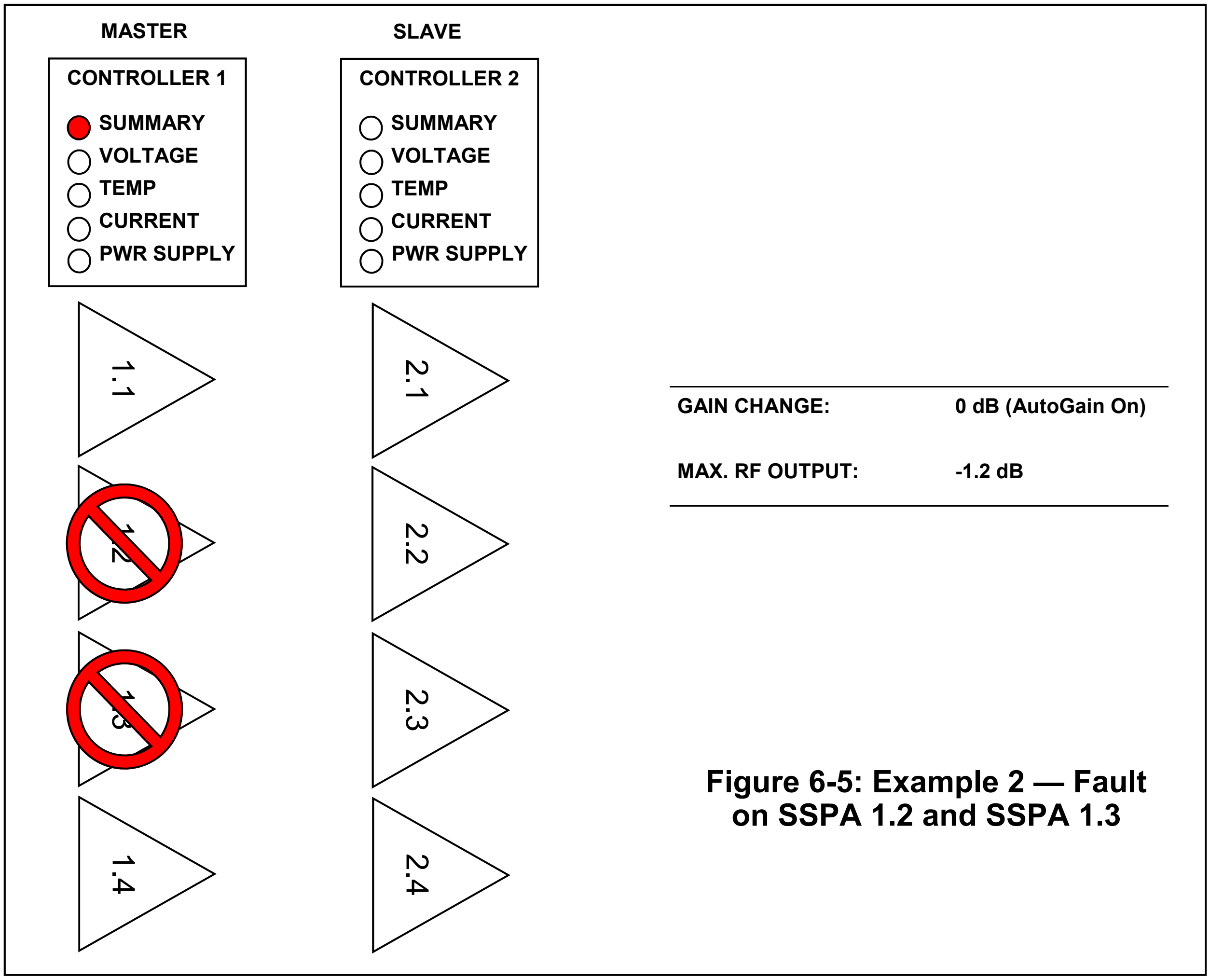

Figure 6-5: Example 2 — Fault on SSPA 1.2 and SSPA 1.3

Outdoor SSPA Controller 1 displays a Summary fault.

With the system operating in AutoGain mode, the gain is automatically adjusted to maintain the nominal gain level. If operating below saturated output power, the system will automatically adjust output RF power along with gain.

Maximum total system output power will be reduced by 1.2 dBm.

6.5.1.3 Example 3 — Two Paired SSPAs Lose Power

In this example, SSPA 1.1 and SSPA 1.2 on the Master side of System 1 lose power. See **Figure 6-6**.

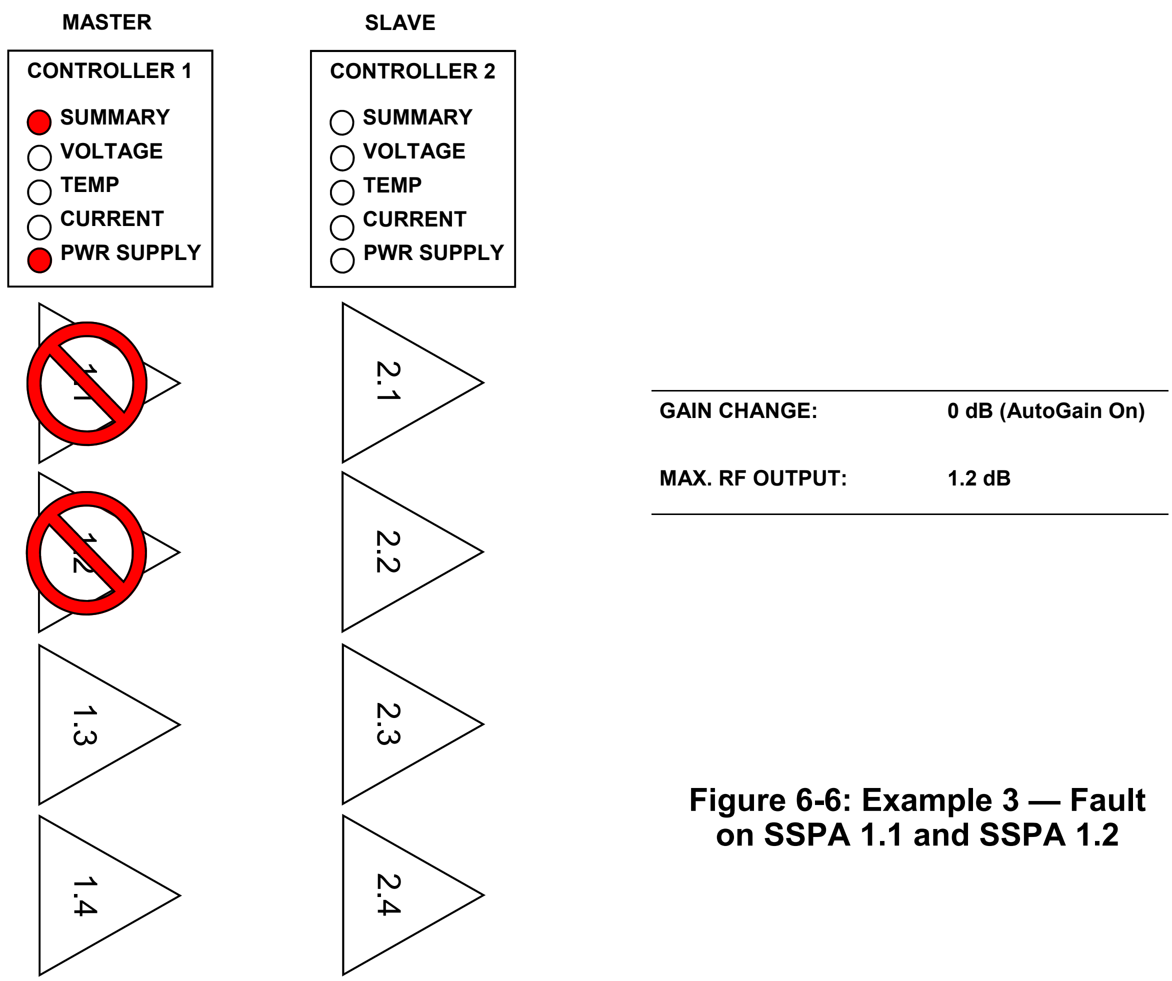

Figure 6-6: Example 3 — Fault on SSPA 1.1 and SSPA 1.2

Outdoor SSPA Controller 1 displays a Summary fault and a Power Supply fault.

> **Note**: Power to the Outdoor SSPA Controller is provided by the SSPA Modules. SSPA Module 1 and 2 are paired (diode ORed) to provide power as Power Supply 1. SSPA Module 3 and 4 are paired (diode ORed) to provide power as Power Supply 2.

With the system operating in AutoGain mode, the gain is automatically adjusted to maintain the nominal gain level. If operating below saturated output power, the system will automatically adjust output RF power along with gain.

Maximum total system output power will be reduced by 1.2 dBm.

6.5.1.4 Example 4 — Fault on Four SSPAs, All on Master Side

In this example, four SSPA modules on what is usually the Master side (under Controller 1) of the system enter a fault condition and automatically mute. See **Figure 6-7**.

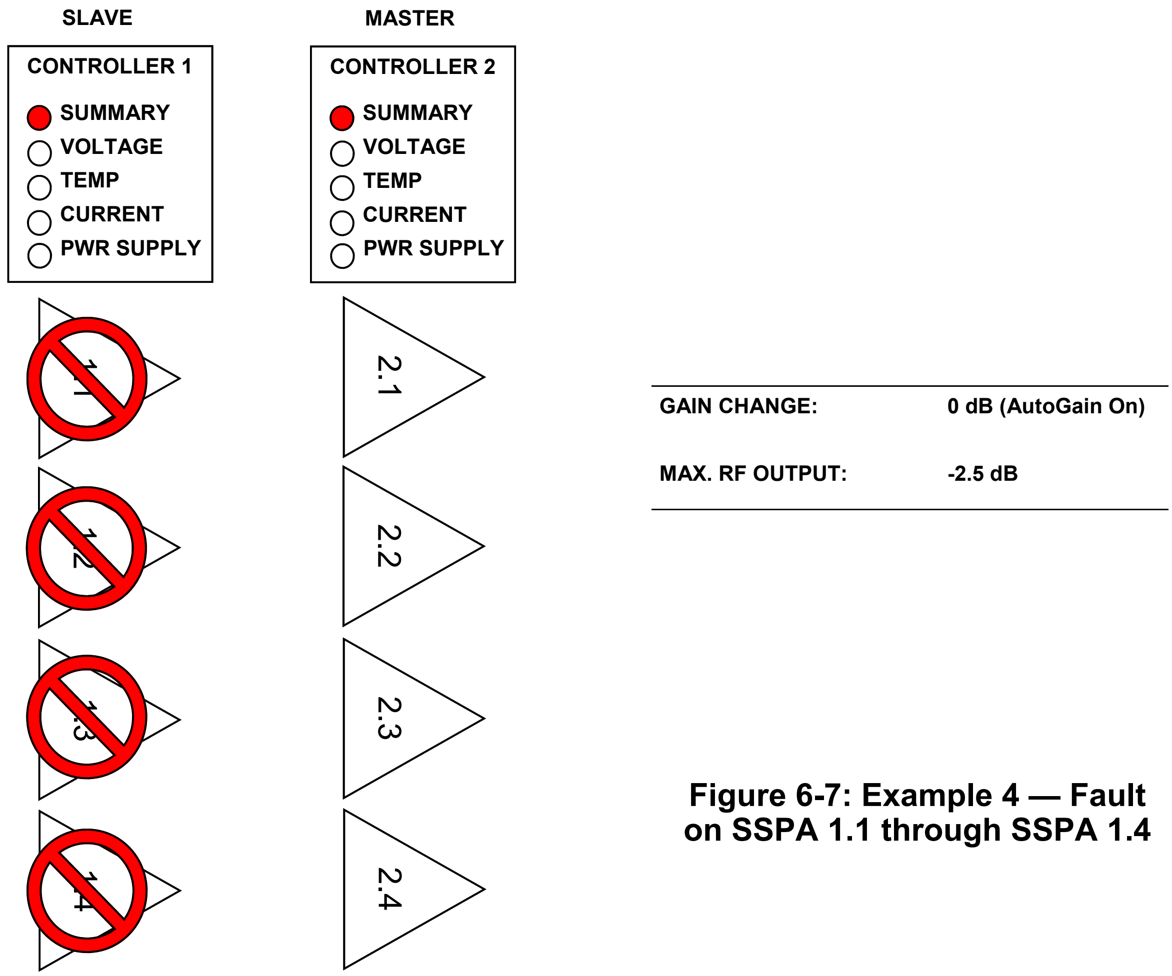

Figure 6-7: Example 4 — Fault on SSPA 1.1 through SSPA 1.4

Outdoor SSPA Controller 1 and Controller 2 display a Summary fault and Master control of the system is switched to Controller 2. Controller 1 becomes the Slave.

With the system operating in AutoGain mode, the gain is automatically adjusted to maintain the nominal gain level. If operating below saturated output power, the system will automatically adjust output RF power along with gain.

Maximum total system output power will be reduced by approximately 2.5 dBm.

6.5.1.5 Example 5 — Four SSPAs on Master Side Lose Power

In this example, four SSPA modules on what is usually the Master side of the system (under Controller 1) lose power. See **Figure 6-8**.

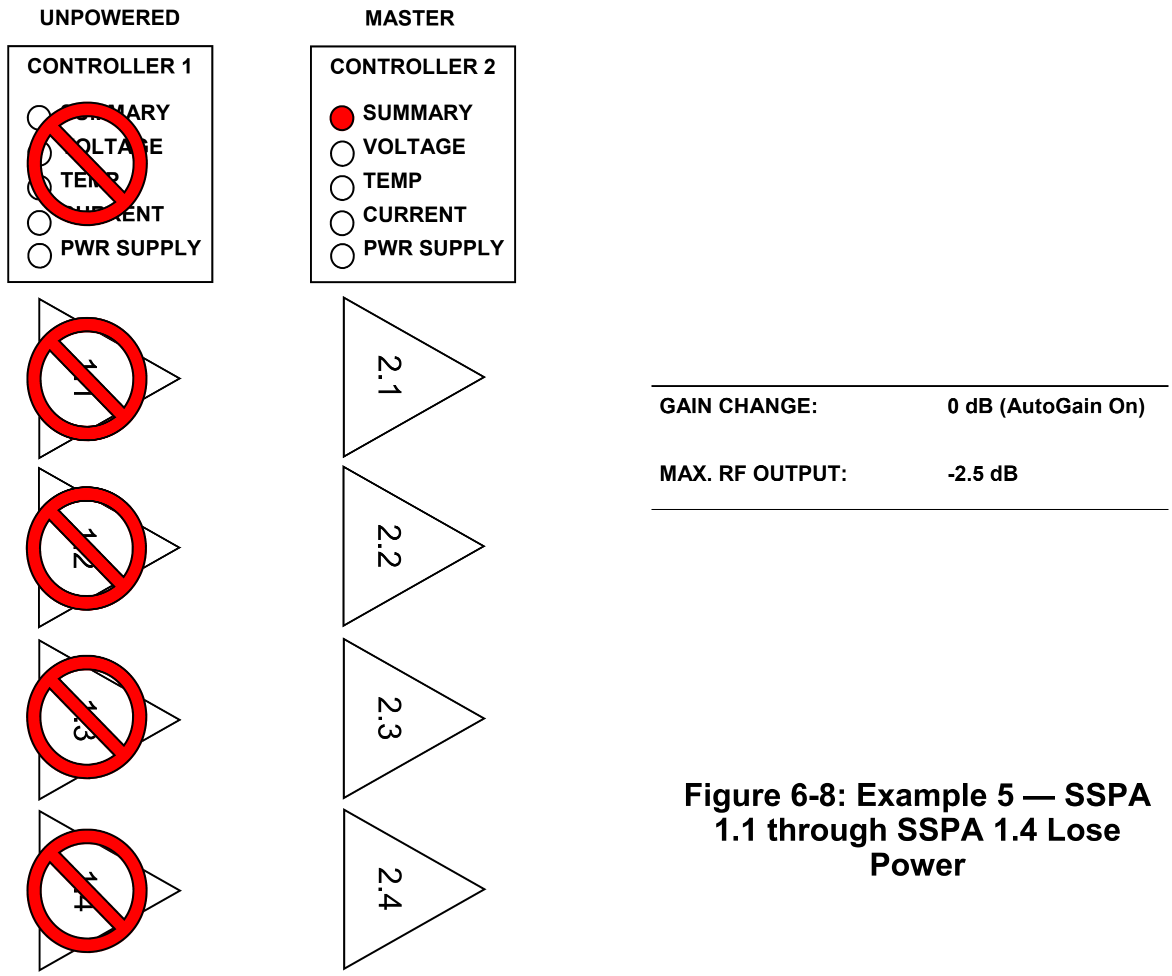

Figure 6-8: Example 5 — SSPA 1.1 through SSPA 1.4 Lose Power

Controller 1 loses power. Controller 2 becomes the Master controller and displays a Summary fault.

With the system operating in AutoGain mode, the gain is automatically adjusted to maintain the nominal gain level. If operating below saturated output power, the system will automatically adjust output RF power along with gain.

Maximum total system output power will be reduced by approximately 2.5 dBm.

6.5.2 Removing a Failed SSPA Module

Once a failed SSPA module has been identified, perform the following procedure to remove the failed module.

Note: The system does not need to be powered down while removing a failed SSPA module.

1. Turn off the breaker for the failed SSPA module in the AC Distribution Box.
2. Disconnect the comms cables from ports J4, J6 and J8.
3. Disconnect the AC Power connector from port J7.
4. Disconnect the RF Input cable from port J1.
5. Remove the hardware securing the SSPA module to the uni-strut. Save all hardware.
6. Disconnect the ground wire.
7. Remove the hardware securing the RF Output flange to the Isolator. Save all hardware.
8. Carefully slide the SSPA module out of the uni-strut frame.
9. Remove the aluminum supports attached to the mounting tabs of the amplifier. Save all hardware.

The failed SSPA module can be shipped to the factory for repair. Contact Teledyne Paradise Datacom support for information on how to issue an RMA order for the repair.

6.5.2.1 Removing an Operating SSPA Module

Follow this procedure if removing an SSPA module that is operating normally.

1. Access the front panel controls of the Outdoor SSPA Controller for the unit to be removed;
2. Press the **Main Menu** button;
3. Select **6.Redundancy** and press the **Enter** button;
4. Select **6.N+1** and press the **Enter** button;
5. Select **5.ModEject** and press the **Enter** button;
6. Select **1.Eject Module** and press the **Enter** button;
7. Enter the address for the module to be removed.
   001 is SSPA module S# - #.1;
   002 is SSPA module S# - #.2.
8. Press the **Enter** button.

The SSPA module may be removed without affecting the performance of the system.

1. Turn off the breaker for the SSPA module in the AC Distribution Box.
2. Disconnect the comms cables from ports J4, J6 and J8.
3. Disconnect the AC Power connector from port J7.
4. Disconnect the RF Input cable from port J1.
5. Remove the hardware securing the SSPA module to the uni-strut. Save all hardware.
6. Disconnect the ground wire.
7. Remove the hardware securing the RF Output flange to the Isolator. Save all hardware.
8. Carefully slide the SSPA module out of the uni-strut frame.

6.5.2.2 Replacing an Operating SSPA Module After Removal

Follow this procedure before replacing an operating SSPA module after its removal.

1. Access the front panel controls of the Outdoor SSPA Controller for the unit to be replaced;
2. Press the **Main Menu** button;
3. Select **6.Redundancy** and press the **Enter** button;
4. Select **6.N+1** and press the **Enter** button;
5. Select **5.**ModEject and press the **Enter** button;
6. Select **2.Clear Module** and press the **Enter** button;

The SSPA module may be replaced as described in **Section 6.5.4**, beginning with Step 2.

6.5.3 Installing a Replacement SSPA Module

Perform the following procedure to install a replacement SSPA module in place of a failed module.

Note: The system does not need to be powered down while installing a replacement SSPA module.

Important: Before installing the replacement SSPA module, the serial address of the module should be set to 170. This setting allows the system to recognize the amplifier serial address based on its position in the M&C cable chain.

1. Set the replacement amplifier “fans up” and attach the aluminum supports (removed in Step 9 of **Section 6.5.3**) to the mounting tabs of the module. Make sure the supports are set at the bottom of the holes in each mounting tab. Hand tighten hardware to snug to allow for later adjustment.
2. Carefully slide the SSPA module into the uni-strut frame.
3. Align the RF Output flange with the threaded studs on the isolator. If necessary, adjust the position of the module by loosening the hardware on the mounting tabs. Once properly aligned, securely tighten the hardware at the mounting tabs.
4. Use the hardware removed in Step 7 of **Section 6.5.3** to secure the RF Output flange to the Isolator.
5. Insert the hardware that secures the SSPA module to the uni-strut frame (removed in Step 5 of **Section 6.5.3**). Use one of the screws to connect the yellow/green striped ground wire to the uni-strut frame.
6. Connect the comms cables to ports J4, J6 and J8.
7. Connect the RF Input cable to port J1.
8. Connect the AC Power connector to port J7.
9. Turn on the breaker for the replacement SSPA module in the AC Distribution Box.

Important: Always connect the M&C cable before connecting the AC Power connector, or otherwise applying power to the amplifier. Failure to do so may cause communication problems with the system.

6.5.4 Phase Adjustment After Replacing an SSPA Module

This procedure details the phase adjustment of an Outdoor PowerMAX system. If a SSPA module fails and is replaced with another SSPA module with a slightly different phase, the system should be adjusted for best performance.

After installing the replacement amplifier module, attach a power meter or spectrum analyzer to the RF Output Sample Port J12 of the RF Distribution Box and measure the power output of the system. If system output power is within specification, then no phase adjustment is necessary.

If no test equipment is available, output power can be monitored from the front panel of the master controller by pressing the **Main Menu** key, selecting **1.SysInfo** and pressing the **Enter** key. System RF Power is shown in the top right of the display.

The PowerMAX system utilizes an RF Distribution Box which houses a series of phase shifters behind the front cover: one for each of the eight SSPA modules, and one to adjust the phase of the input. See **Figure 6-9**.

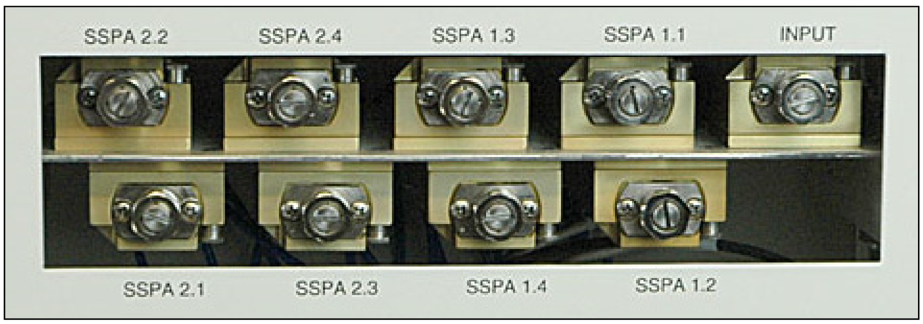

Figure 6-9: Phase Shifters

To access the phase adjusters, remove the (20) 6-32 x 0.375 socket head cap screws, lock washers and flat washers that secure the front panel to the RF Distribution Box. Save all hardware.

If phase adjustment is necessary, it can be performed while the system is carrying multiple modulated carriers or by applying a CW signal to the input. If a CW carrier is used be sure to check RF power at the low, mid and high frequencies after adjustment is made to be sure the power output is close to equal across the band. When using multiple carriers spread across the band, simply peak the RF power read by the test equipment or RF power detector read out from the system.

While observing the output power, use a flat blade screwdriver to rotate the phase trimmer screw that corresponds with the replaced SSPA module. If module 1.3 was replaced, adjust the phase trimmer screw marked SSPA 1.3. Turn the trimmer screw either clockwise or counterclockwise, depending on which direction increases the output power, until the output power is peaked.

After phase adjustment is completed, replace the front panel to the RF Distribution Box using the hardware removed above.

6.6 Troubleshooting Guide for Compact Outdoor SSPA Modules

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

6.6.1 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: Ensure power connector is properly plugged in to port J7. Verify breaker in AC Distribution Box is turned on. Re-check continuity between unit’s chassis ground and earth ground. Earth ground connection is required for normal SSPA operation!

6.6.2 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 unit using 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.

6.6.3 Unit powers up, LED lamp glows green, 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. 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.

6.7 Restoring Factory Settings

Teledyne Paradise Datacom equipment comes with factory-preset settings specific to the default system specifications. This factory setup can be restored at any time either automatically or manually.

Important: Automatic restoration will restore the complete factory setup (including default COM settings and miscellaneous fault handling). COM settings will need to be re-set to the operator's network preferences. Manual restoration must be done one controller at a time, and only settings critical to system operation will be restored.

6.7.1 Automatic Restoration of Controller Settings

This procedure should be used to re-set the factory default settings for the Indoor and Outdoor Controllers.

1. Press the **Main Menu** key on the Indoor Controller;
2. Select **5.Options** and press the **Enter** key;
3. Select **2.Restore** and press the **Enter** key;
4. Select **3.Restore Fctry** and press the **Enter** key.

Reset COM settings to the operator's network preferences. Repeat for each controller in the system.

Note: The operator may use one of the two available user settings back-up repositories if the saved backup restores the unit to the factory default settings and operator-defined COM settings.

6.7.2 Manual Restoration of Controller Settings

The following list of settings shows the values of the equipment settings required for proper system operation. Alteration of any kind is not recommended and may lead to system non-compliance.

Settings not listed in the following tables can be changed by the customer without major impact on the system performance.

If a setting is accidentally changed, the operator should follow the supplied front panel menu path to restore the setting or the operator can restore the factory defaults as listed in **Section 6.7.1**.

Table 6-3: Required Settings, 8-Way System, Outdoor Controller (Controller 1)

Data Address	Min. Data Length (bytes)	Description	Limits and valid values	System 1 Controller 1
0	1	Device Type (read only)	**1 = RM SSPA (Outdoor SSPA Controller)**	1
1	1	System Operational Mode Designator	0 = Standalone Mode; 1 = 1:1 Redundant Mode; 2 = 1:2 Redundant Mode; 3 = 1:1 Phase Combined; 4 = 1:2 Phase Combined; 5 = Maintenance Switch	0
2	1	System Switch Mode	0 = Auto; 1 = Manual; 2 = Switch Lock	0
4	1	Fan Speed	0 = Low; 1 = High; 2 = Auto (GaN units only)	2
6	1	Serial Protocol Select	0 = Normal; 1 = Terminal Mode	0
7	1	Baud Rate	0 = 9600; 1 = 2400; 2 = 4800; 3 = 19200; 4 = 38400	0
8	1	Network Address	Valid Values: 0 - 255	11
9	1	Serial Interface	0 = RS232; 1 = RS485; 2 = IPNet; 3 = SNMP	1
10	1	Auxiliary Fault Handling	0 = Disable Fault Checking; 1 = Major Fault; 2 = Minor Fault; 3 = Major Fault + SSPA Mute	3
11	1	Auxiliary Fault Logic	0 = Fault on Logic High; 1 = Fault on Logic Low	0
12	1	RF Switch Fault Handling	0 = Disable Fault Checking; 1 = Major Fault; 2 = Minor Fault; 3 = Mute on Switch	0
13	1	Fault Latch	0 = Disable; 1 = Enable	0
14	1	BUC Fault Handling	0 = Disable Fault Checking; 1 = Major Fault; 2 = Minor Fault; 3 = Major Fault + SSPA Mute	0
15	1	BUC Fault Logic	0 = Fault on Logic High; 1 = Fault on Logic Low	0
17	1	Standby Select	0 = Standby; 1 = Online	0
21	1	Standby Mode	0 = Hot Standby; 1 = Cold Standby	0
22	1	HPA Status	0 = HPA1; 1 = HPA2; 2 = HPA3	0
23	1	Priority Select (1:2 mode)	0 = Pol1; 1 = Pol2	0
28	1	High Refl. RF Threshold	Valid values: 0-80; 1 dBm per 1 value	54
47	1	N+1 Array size	0 = N+1 disabled; 2 = Array of two SSPAs; 4 = Array of four SSPAs; 8 = Array of eight SSPAs; 16 = Array of 16 SSPAs; Any other numeric value is invalid.	8
48	1	N+1 Priority Address	Valid range (Array of 2): 1 to 2; Valid range (Array of 4): 1 to 4; Valid range (Array of 8): 1 to 8; Valid range (Array of 16): 1 to 16;	1
49	1	N+1 Auto Gain Option	0 = Auto Gain Off; 1 = Auto Gain On; 2 = Keep Alive; 3 = FlexGain; 4 = OPMAX Select	4
56	1	Floating N+1 Master Serial Address	Valid Values: 0 - 255 (v. 6.00)	1

Settings for all data addresses not listed above are subject to operator preference.

Table 6-4: Required Settings, 8-Way System, Outdoor Controller (Controller 2)

Data Address	Min. Data Length (bytes)	Description	Limits and valid values	System 1 Controller 2
0	1	Device Type (read only)	**1 = RM SSPA (Outdoor SSPA Controller)**	1
1	1	System Operational Mode Designator	0 = Standalone Mode; 1 = 1:1 Redundant Mode; 2 = 1:2 Redundant Mode; 3 = 1:1 Phase Combined; 4 = 1:2 Phase Combined; 5 = Maintenance Switch	0
2	1	System Switch Mode	0 = Auto; 1 = Manual; 2 = Switch Lock	0
4	1	Fan Speed	0 = Low; 1 = High; 2 = Auto (GaN units only)	2
6	1	Serial Protocol Select	0 = Normal; 1 = Terminal Mode	0
7	1	Baud Rate	0 = 9600; 1 = 2400; 2 = 4800; 3 = 19200; 4 = 38400	0
8	1	Network Address	Valid Values: 0 - 255	12
9	1	Serial Interface	0 = RS232; 1 = RS485; 2 = IPNet; 3 = SNMP	1
10	1	Auxiliary Fault Handling	0 = Disable Fault Checking; 1 = Major Fault; 2 = Minor Fault; 3 = Major Fault + SSPA Mute	3
11	1	Auxiliary Fault Logic	0 = Fault on Logic High; 1 = Fault on Logic Low	0
12	1	RF Switch Fault Handling	0 = Disable Fault Checking; 1 = Major Fault; 2 = Minor Fault; 3 = Mute on Switch	0
13	1	Fault Latch	0 = Disable; 1 = Enable	0
14	1	BUC Fault Handling	0 = Disable Fault Checking; 1 = Major Fault; 2 = Minor Fault; 3 = Major Fault + SSPA Mute	0
15	1	BUC Fault Logic	0 = Fault on Logic High; 1 = Fault on Logic Low	0
17	1	Standby Select	0 = Standby; 1 = Online	0
21	1	Standby Mode	0 = Hot Standby; 1 = Cold Standby	0
22	1	HPA Status	0 = HPA1; 1 = HPA2; 2 = HPA3	0
23	1	Priority Select (1:2 mode)	0 = Pol1; 1 = Pol2	0
28	1	High Refl. RF Threshold	Valid values: 0-80; 1 dBm per 1 value	54
47	1	N+1 Array size	0 = N+1 disabled; 2 = Array of two SSPAs; 4 = Array of four SSPAs; 8 = Array of eight SSPAs; 16 = Array of 16 SSPAs; Any other numeric value is invalid.	8
48	1	N+1 Priority Address	Valid range (Array of 2): 1 to 2; Valid range (Array of 4): 1 to 4; Valid range (Array of 8): 1 to 8; Valid range (Array of 16): 1 to 16;	5
49	1	N+1 Auto Gain Option	0 = Auto Gain Off; 1 = Auto Gain On; 2 = Keep Alive; 3 = FlexGain; 4 = OPMAX Select	4
56	1	Floating N+1 Master Serial Address	Valid Values: 0 - 255 (v. 6.00)	2

Settings for all data addresses not listed above are subject to operator preference.

Table 6-5: Required Settings, Maintenance Switch Controller (Optional)

Data Address	# Bytes	Description	Limits and Byte Values	Maintenance Switch Controllers
1	1	System Configuration	0 = 1:2 Controller; 1 = 1:1 Controller; 2 = 1:1 Phase combine; 3 = Dual 1:1 Controller; 4 = Maintenance Mode; 5 = 1:2 Phase combine	4
2	1	Switching Mode	0 = Auto Mode; 1 = Manual Mode; 2 = Lock Mode	1
3	1	Control Mode	0 = Local; 1 = Remote	0
4	1	Reserved	N/A	N/A
5	1	Priority Select	0 = Pol1; 1 = Pol2	0
6	1	Communication Protocol	0 = Normal; 1 = Terminal	0
7	1	Baud Rate	0 = 9600; 1 = 2400; 2 = 4800; 3 = 19200; 4 = 38400	*
8	1	Unique Network Address	Valid values: 0 – 255	13
9	1	Type of Serial Interface	0 = RS232; 1 = RS485; 2 = IPNet; 3 = SNMP (v. 4.00)	*
10	1	Type of Fault Monitoring	0 = SSPA only; 1 = LNA only; 2 = Both; 3 = SSPA Com Faults	0
11	1	Auxiliary Fault Monitoring	0 = Enable non-switching faults; 1 = Ignore; 2 = Enable non-switching faults, inverted logic; 3 = Enable switching faults; 4 = Enable switching faults, inverted logic	1
12	1	RF Switch Monitoring	0 = Major Fault; 1 = Alert Only; 2 = Alternate	2
13	1	Fault Latching	0 = Latch Enable; 1 = Latch Disable	0
14	1	Fault Window	0 = 20%; 1 = 8%; 2 = 12%, 3 = 15%	0
15	1	Fault Logic	0 = Fault on Low; 1 = Fault on High	1
16	1	User Password	Valid Values=0 to 255	*
17	1	Amplifier Standby Configuration	0 = Amplifier 2 on Standby (default); 1 = Amplifier 1 on Standby; 2 = Amplifier 2 on Standby; 3 = Amplifier 3 on Standby	*
18	1	Buzzer	0 = Enable Buzzer; 1 = Disable Buzzer	*
19	1	Password Protection	0 = Protection Off; 1 = Protection On	*
20	1	System Type	0 = None; 1 = Compact Outdoor; 2 = Rack Mount; 4 = vBUC; 5 = SystemX; 6 = PowerMAX	0
21	1	RF Power Units	0 = Measure RF in dBm; 1 = Measure RF in Watts	*
22	1	Reserved	N/A	N/A
23	1	LNA/LNB PS Output Voltage	0 = Low range 13V, 900 mA; 1 = High range 17V, 900 mA; 2 = High Power Range 24V, 0.9A	0
24	1	Standby Mode	0 = Hot Standby; 1 = Cold Standby	0
25	1	Mute State	0 = Mute On; 255 = Mute Off	255
26	1	Remote SSPA Attenuation	Valid Values= 0 to 255 (dBx10 value)	0
27	1	Switch Mute	0 = Off; 1 = Internal; 2 = External; 3 = All on	0

Settings with a * are determined by user. Data address 28 is reserved; addresses 29-46 are used for IPNet settings and are user defined; addresses 47-49 are used for individual SSPA unit attenuation offsets and are all set to 0.

7.0 Introduction

Teledyne Paradise Datacom offers a free Universal Monitor and Control software utility that provides M&C functionality for the Teledyne Paradise Datacom line of Satcom Earth Station products.

The software utility is available for download from the Teledyne Paradise Datacom web site, http://www.paradisedata.com.

This software utility may be used to monitor the Outdoor PowerMAX system.

7.1 Load Indoor Controllers to M&C Application

Load each of the Indoor Controllers individually. Refer to **Table 7-1** for the default IP addresses to use.

Table 7-1: Indoor Controllers, IP Addresses for Universal M&C

Controller ID	IP Address for Universal M&C
Maintenance Switch Controller 1	192.168.0.9

1. With the system operating, select the Action pull-down menu, select Add Unit, and select Controller. See **Figure 7-1**.

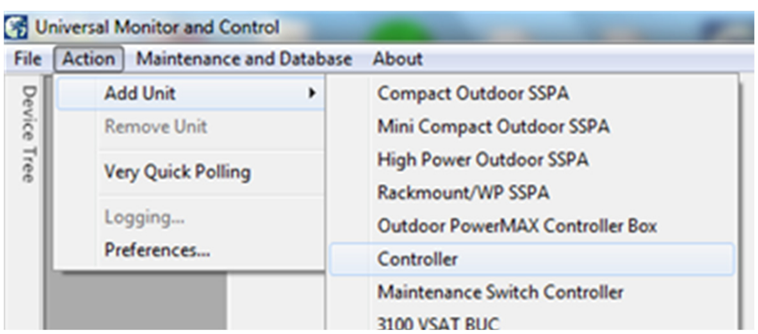

Figure 7-1: Select Action > Add Unit > Controller

2. A new dialog window will open. See **Figure 7-2**.

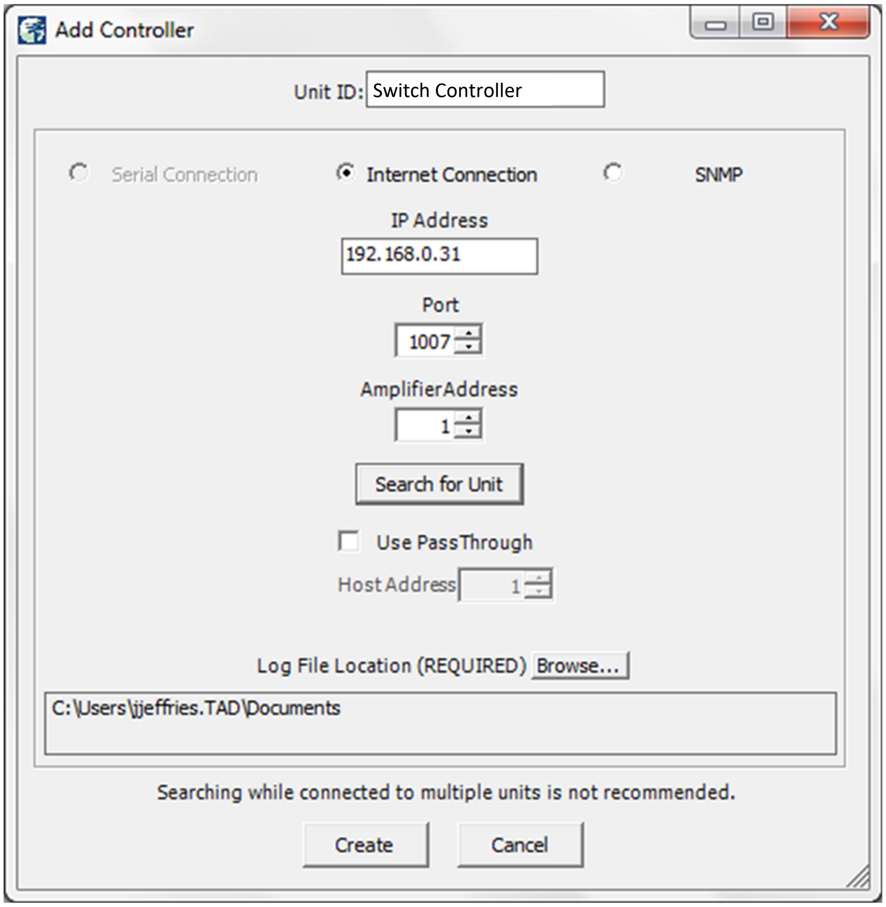

Figure 7-2: Dialog Window, Add Controller

3. Enter the Unit ID text that will be used to identify the unit in the M&C application. For example, “Switch Controller” for Maintenance Switch Controller.
4. Select **Internet Connection**, and enter the IP address of the unit. Refer to **Table 7-1**.
5. Use the default port 1007, or change to reflect the local network.
6. Click on the [Search for Unit] button. The utility will locate the unit on the network. See **Figure 7-3**. Click on the [OK] button.

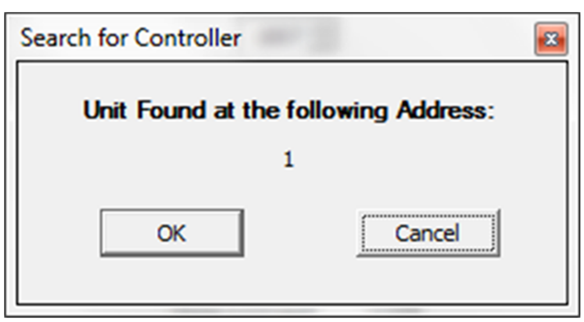

Figure 7-3: Dialog Window, Search for Controller

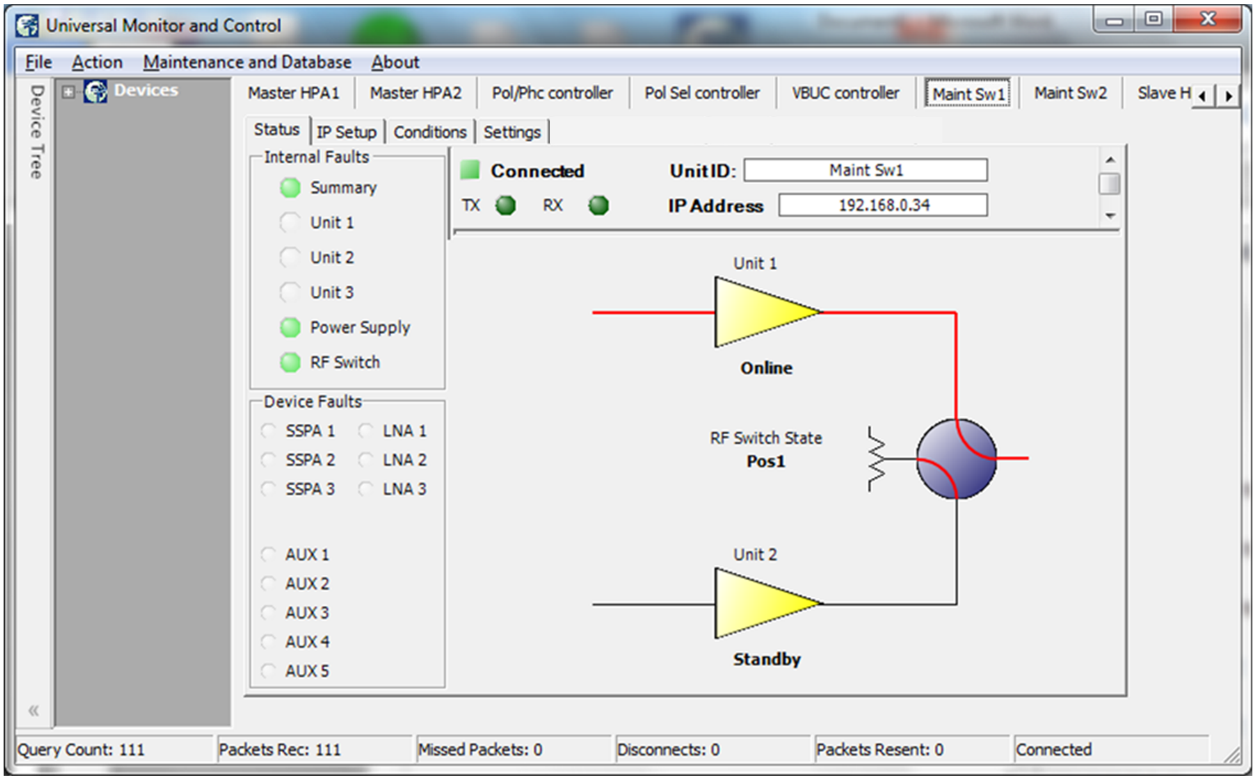

Figure 7-4: Status Window, Maintenance Switch Controllers

7. Click on the [Create] button. The Status window for the newly added unit will appear. See **Figure 7-4**.
8. Repeat for each Indoor Controller.

7.2 Universal M&C Windows for Indoor Controllers

This section describes the information available in each of the Universal M&C screens for the Maintenance Switch Controller

7.2.1 Status Window for Maintenance Switch Controllers

The Status Window for the Maintenance Switch Controller shows the fault states for the controller's internal power supplies and the system's switch positions. See **Figure 7-4**.

The mimic display panel in the Status Window shows the RF switch state for the maintenance switch that direct the RF signal to either the antenna or to the dummy load.

If the RF Switch State is in Pos1 (position 1), then the RF signal is directed to the antenna. If the RF Switch State is in Pos2 (position 2), then the RF signal is directed to the dummy load.

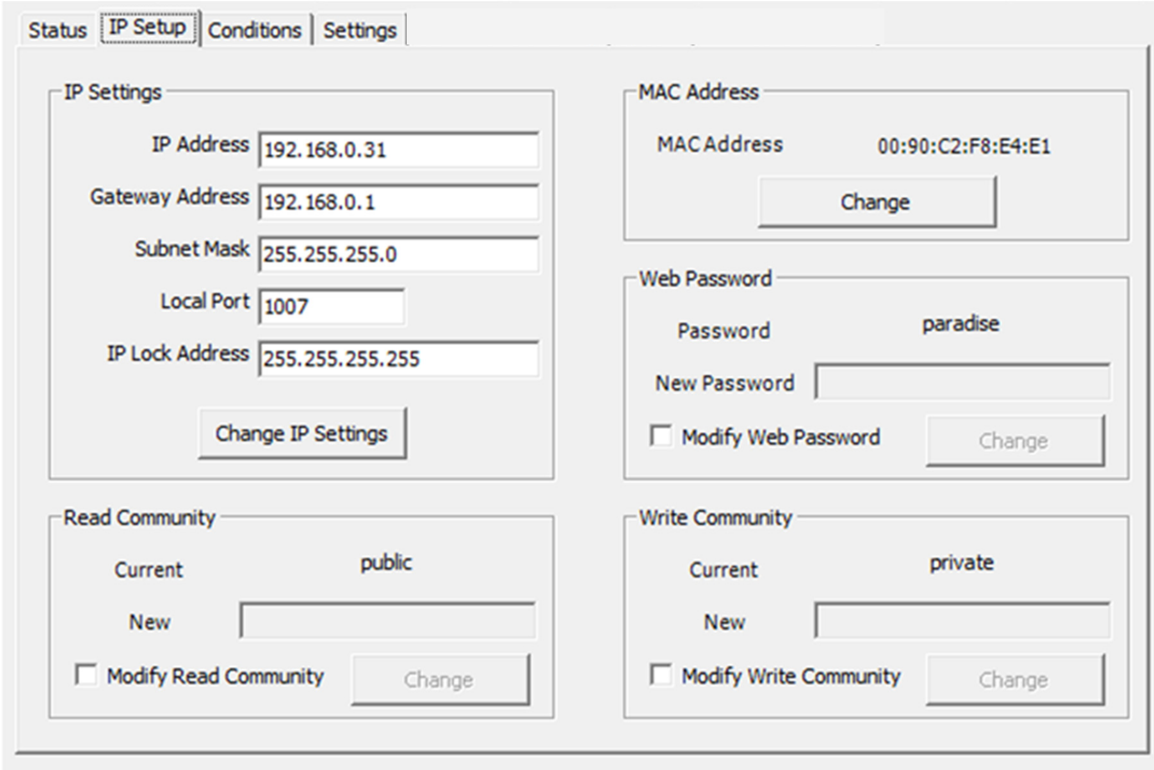

Figure 7-5: IP Setup Window, Indoor Controllers

7.2.2 IP Setup Window

The IP Setup Window is common for all controllers, and is used to adjust the IP settings for the connected unit. The IP Address, Gateway Address, Subnet Mask, Local Port and IP Lock Address may all be modified. See **Figure 7-5**. Changes to these settings require a unit restart before they are applied.

In addition, the operator may modify the read/write community and web passwords. The operator must check the box to unlock the field for the new password, then click on the [Change] button to implement the change.

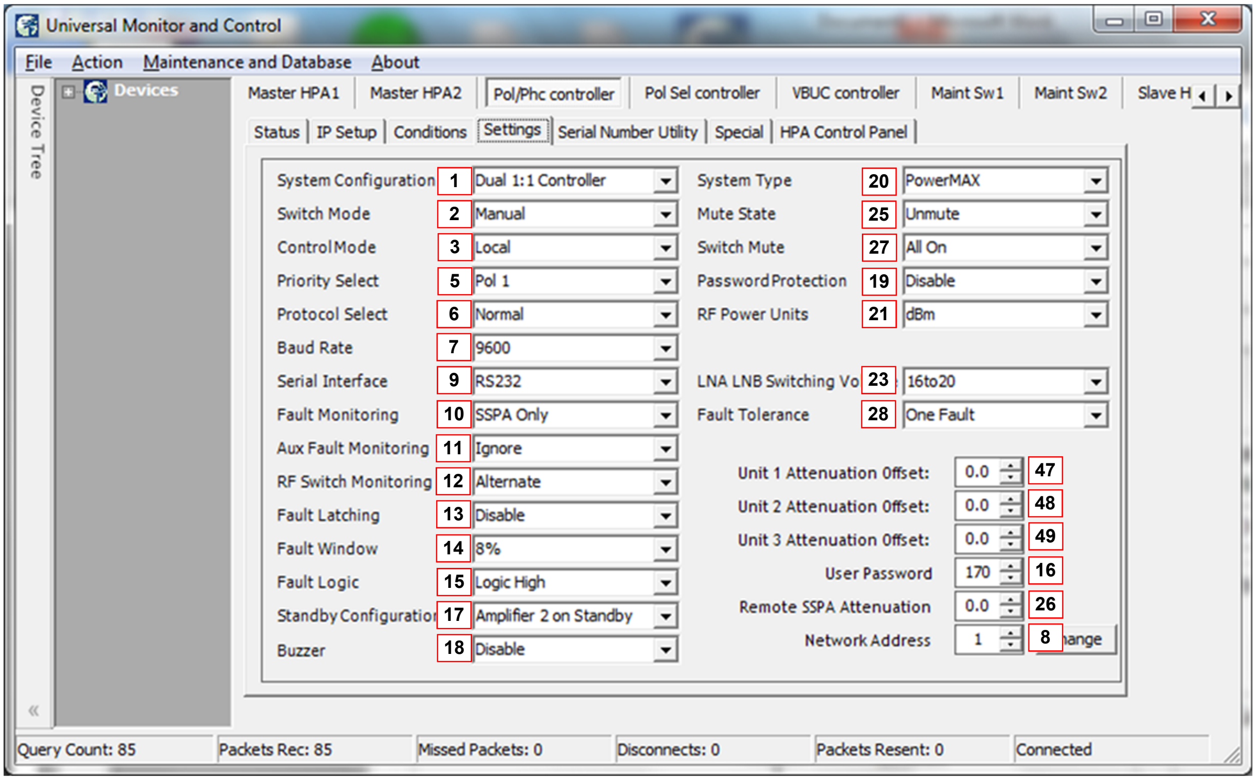

Figure 7-6: Settings Window, All Indoor Controllers

7.2.3 Settings Window for All Indoor Controllers

The Settings Window is common for all indoor controllers, and is used to select the operation settings for the unit.

Figure 7-6 shows the System Settings Data Address that applies for each pull-down menu. See **Section 6.8** for the required settings for each controller.

7.3 Load Outdoor SSPA Controllers to M&C Application

The Outdoor SSPA Controllers can be monitored by the Universal M&C Application. All information is read-only.

The operator must load each of the Outdoor SSPA Controllers individually. Refer to **Table 7-2** for the default IP addresses to use.

Table 7-2: Outdoor SSPA Controllers, IP Addresses for Universal M&C

Controller ID	IP Address for Universal M&C
Outdoor SSPA Controller 1 (Master)	192.168.0.11
Outdoor SSPA Controller 2 (Slave)	192.168.0.12

1. With the system operating, select the Action pull-down menu, select Add Unit, and select Rackmount/WP SSPA. See **Figure 7-7**.

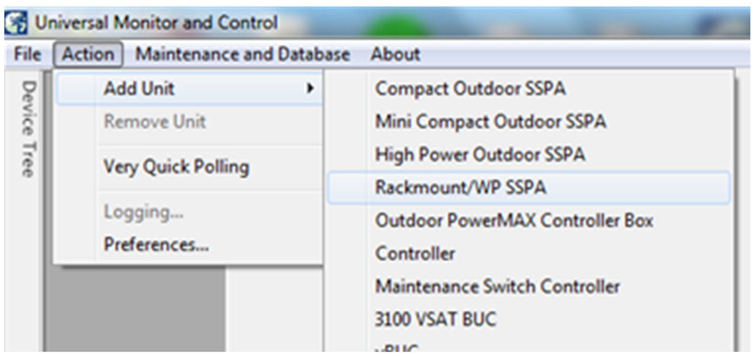

Figure 7-7: Select Rackmount/WP SSPA to Load Outdoor SSPA Controllers

2. A new dialog window will open. See **Figure 7-8**.

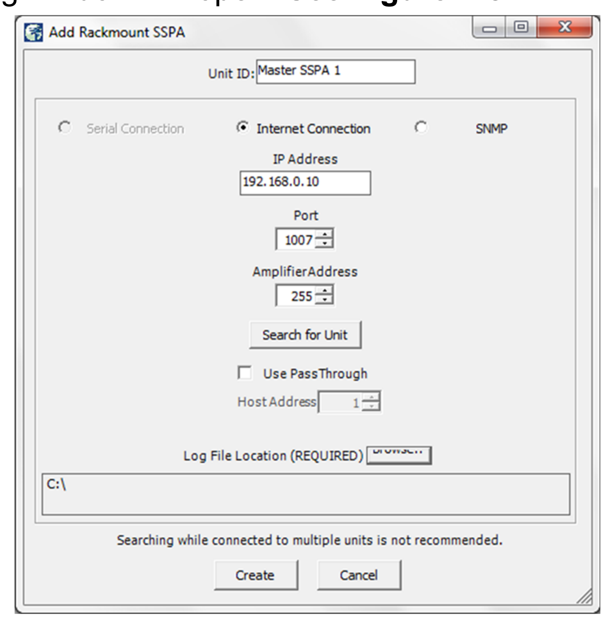

Figure 7-8: Dialog Window, Add Rackmount SSPA (Outdoor SSPA Controllers)

3. Enter the Unit ID text that will be used to identify the unit in the M&C application. For example, “Master SSPA 1” for Controller 1.
4. Select **Internet Connection**, and enter the IP address of the Master or Slave unit . Refer to **Table 7-2**.
5. Use the default port 1007, or change to reflect the local network.
6. Enter the global address (255) in the Amplifier Address field, and click on the [Search for Unit] button. The utility will locate the unit on the network. See **Figure 7-9**. Click on the [OK] button.

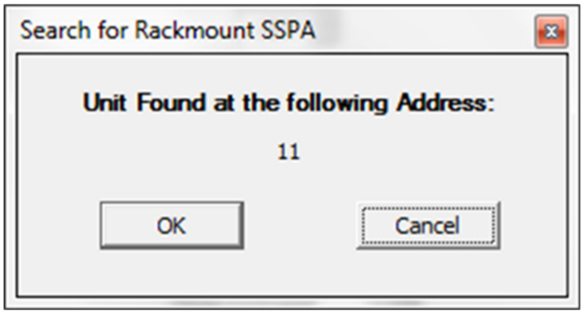

Figure 7-9: Dialog Window, Search for Rackmount SSPA

7. Click on the [Create] button. The Status window for the newly added unit will appear. See **Figure 7-10**.

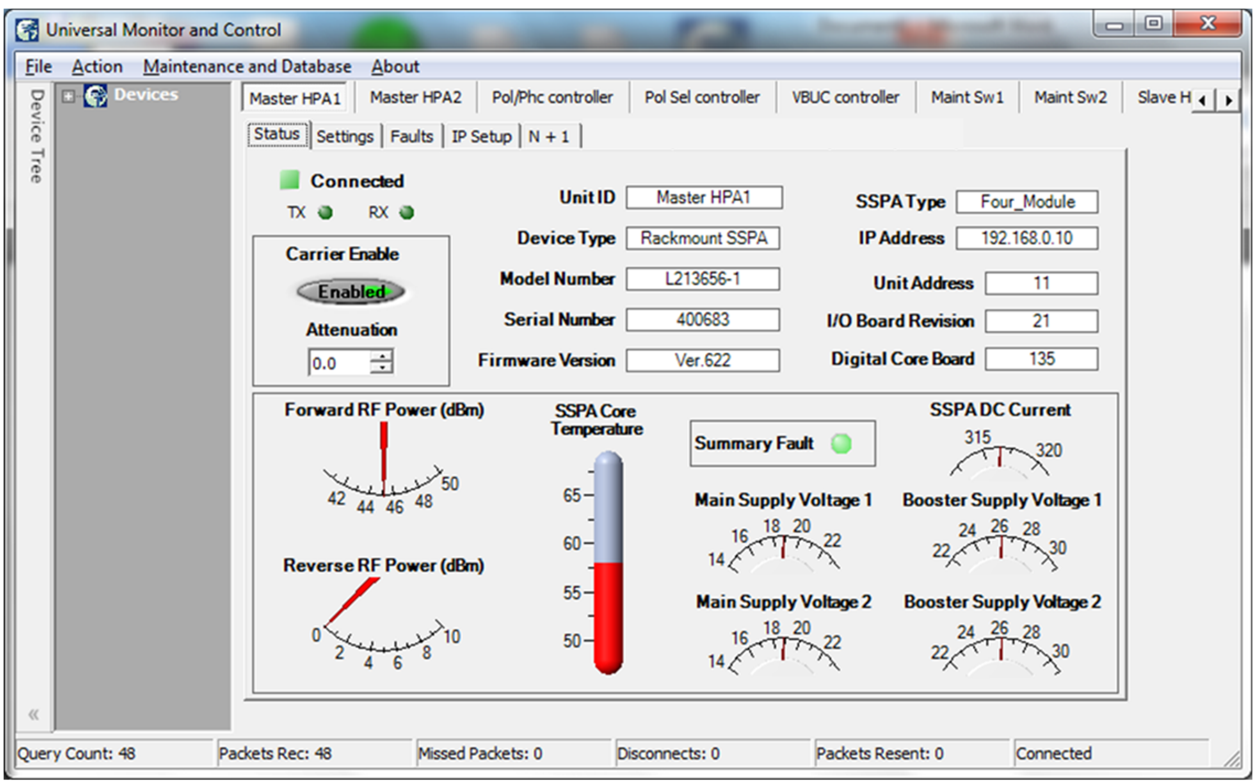

Figure 7-10: Status Window, Outdoor SSPA Controllers

8. Repeat for each Outdoor SSPA Controller.

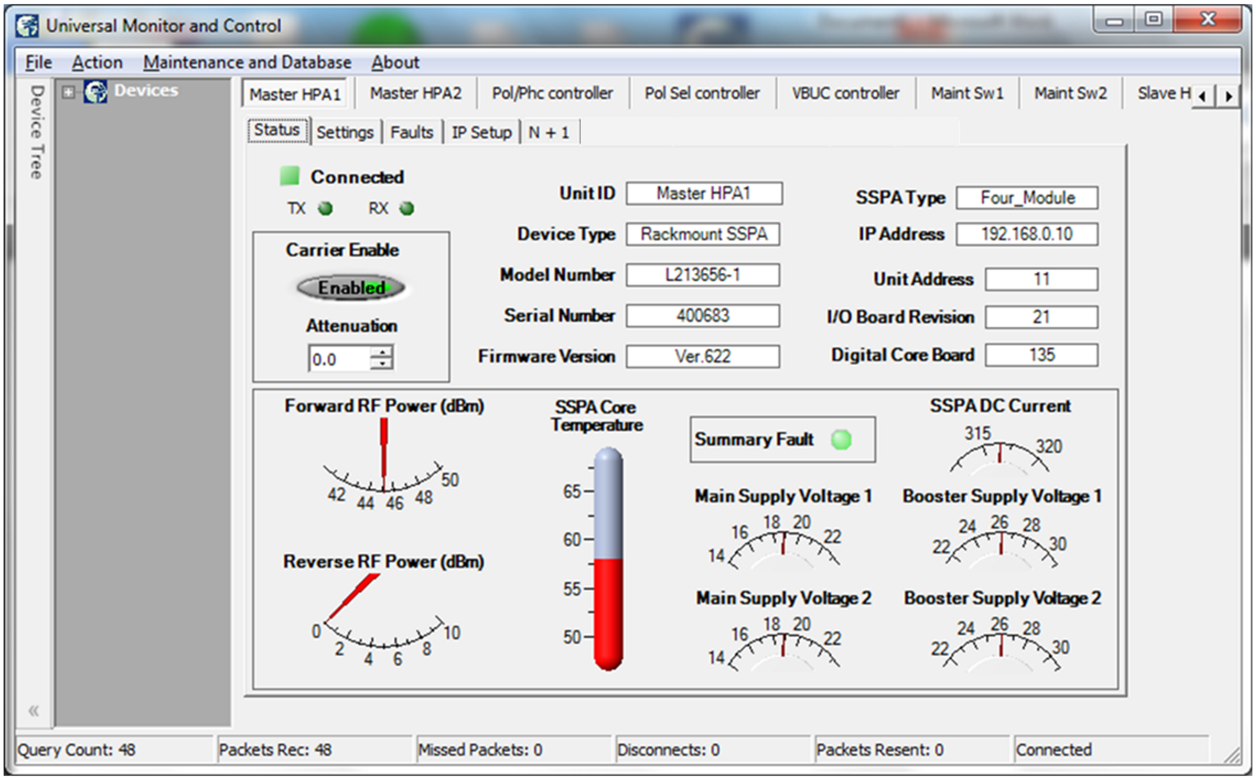

Figure 7-11: Status Window, Outdoor SSPA Controllers

7.4 Universal M&C Windows for Outdoor SSPA Controllers

This section describes the information available in each of the Universal M&C screens for the Outdoor SSPA Controllers.

7.4.1 Status Window for Outdoor SSPA Controllers

The Status Window for the Outdoor SSPA Controllers (Controller 1, typically the Master controller) shows the operational status of the array of four (4) SSPA modules for that system. See **Figure 7-11**.

This window displays the Mute status (Carrier Enable, indicated by "Enabled", if unmuted, or "Muted"), Attenuation and Summary Fault status LED. Also included is information about the System Forward RF Power, Reverse RF Power, SSPA Core Temperature, Main Supply Voltages, DC Current and Booster Supply Voltages.

Note: Changes to Mute Status and Attenuation made in this window will be overwritten by the system.

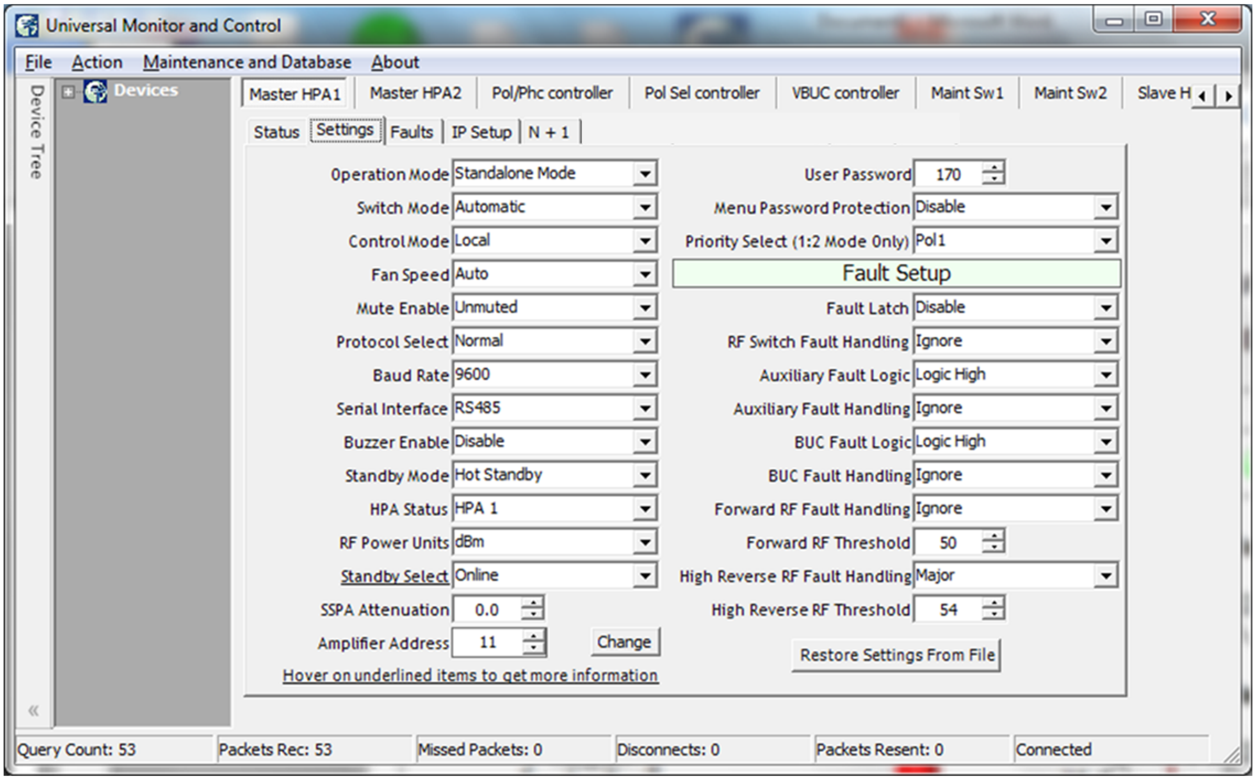

Figure 7-12: Settings Window, Outdoor SSPA Controllers

7.4.2 Settings Window for Outdoor SSPA Controllers

The Settings Window, shown in **Figure 7-12**, is common for all controllers, and is used to select the operation settings for the unit.

See **Section 6.8** for the required settings for each controller.

> **Note**: All settings are read-only. Changes made to settings in this window will be overwritten by the system.

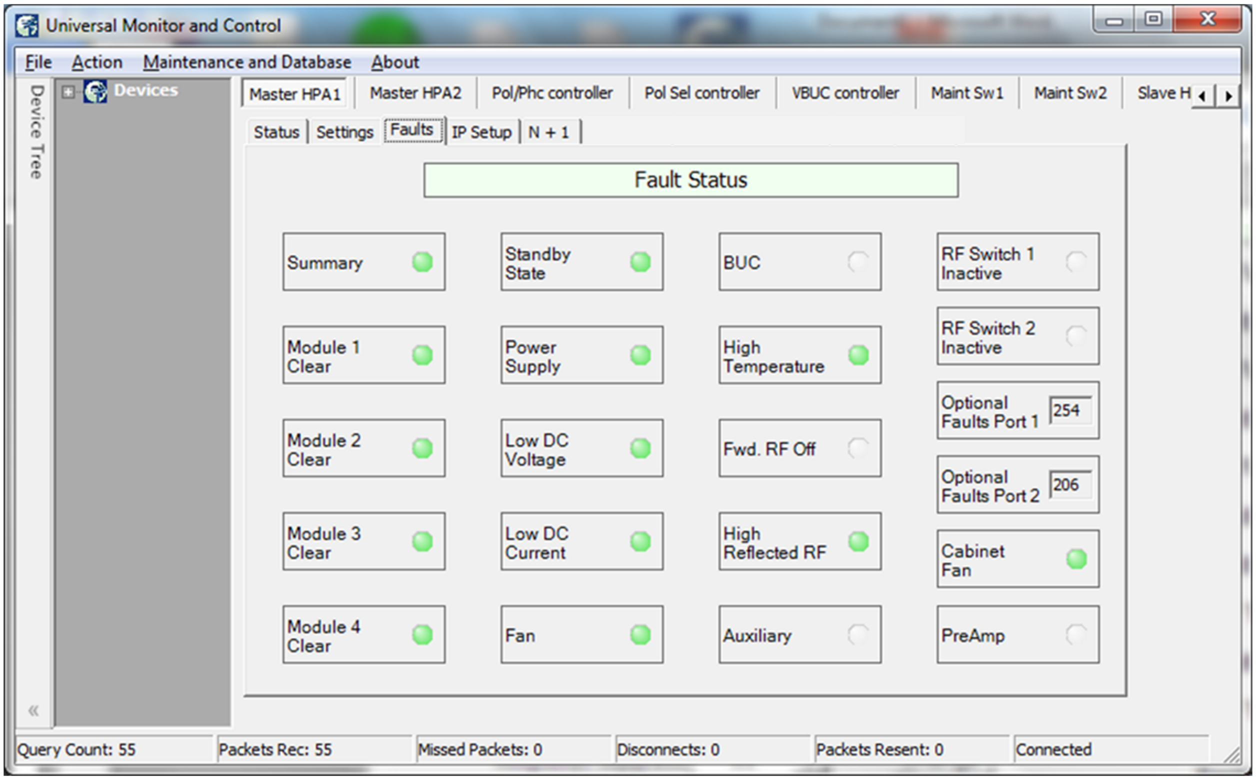

Figure 7-13: Faults Window, Outdoor SSPA Controllers

7.4.3 Faults Window for Outdoor SSPA Controllers

The Faults Window, shown in **Figure 7-13**, is common for all controllers, and is used to monitor the various fault conditions for the SSPA Modules connected to the unit.

Table 7-3 shows how the fault LEDs in this window correspond with the SSPA Modules for the indicated Outdoor Controller.

Table 7-3: Identifying SSPA Module Faults in Universal M&C Faults Window

Module # Fault LED	SSPA Module
Module 1 for the Faults Window of Controller 1	SSPA 1.1
Module 2 for the Faults Window of Controller 1	SSPA 1.2
Module 3 for the Faults Window of Controller 1	SSPA 1.3
Module 4 for the Faults Window of Controller 1	SSPA 1.4
Module 1 for the Faults Window of Controller 2	SSPA 1.5
Module 2 for the Faults Window of Controller 2	SSPA 1.6
Module 3 for the Faults Window of Controller 2	SSPA 1.7
Module 4 for the Faults Window of Controller 2	SSPA 1.8

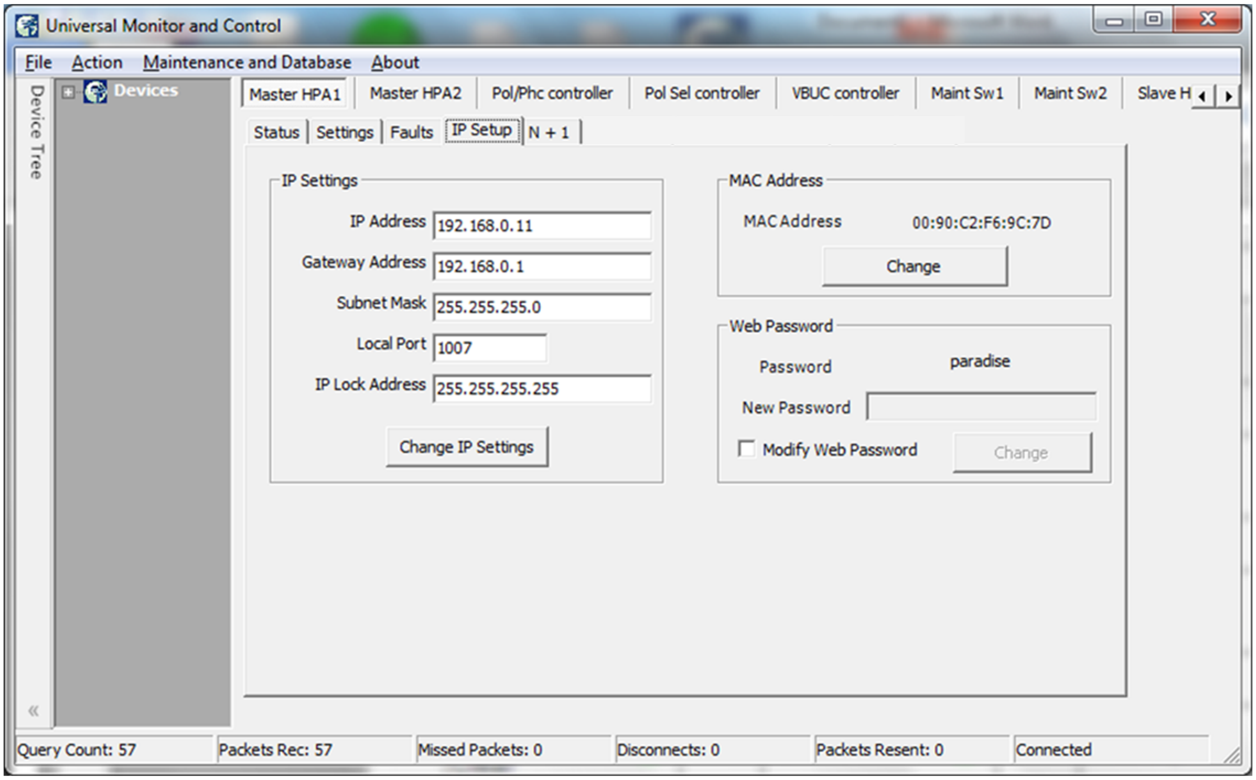

Figure 7-14: IP Setup Window, Outdoor SSPA Controllers

7.4.4 IP Setup Window for Outdoor SSPA Controllers

The IP Setup Window is common for all controllers, and is used to adjust the IP settings for the connected unit. The IP Address, Gateway Address, Subnet Mask, Local Port and IP Lock Address may all be modified. See **Figure 7-14**. Changes to these settings require a unit restart before they are applied.

In addition, the operator may modify the read/write community and web passwords. The operator must check the box to unlock the field for the new password, then click on the [Change] button to implement the change.

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Appendix A: Ethernet Interface Quick Set-Up

This section describes the procedure for setting up the Ethernet IP interface through the Indoor Controller front panel interface. It also describes basic network setup of a Windows based host PC for a peer-to-peer network connection with the RCP unit.

Important! Do not use a crossover cable to connect to the network hub, use crossover only for direct PC-to-RCP connection!

1. Connect J6 Ethernet Port of the RCP controller to a host PC through a crossover null-modem network cable. See **Appendix B** for wiring details.

2. If the PC NIC card has not previously been set, do so now using the following procedure, otherwise skip to Step 3.

2.1 From Windows Control Panel select Network icon;

2.2 Select TCP/IP properties of your LAN card. The window shown in **Figure A-1** will appear:

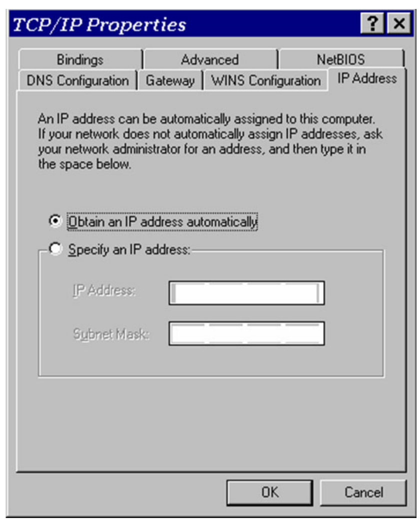

Figure A-1: TCP/IP Properties Window

2.3 Select "Specify an IP Address" and enter the following parameters in the IP address and Subnet fields:

```
IP Address:        192.168.0.3
Subnet Mask:       255.255.255.0
```

After you press "OK", depending on the operating system, you may need to reboot the workstation.

2.4 After optional reboot, open the Command Prompt console window and enter:

```
C:\>IPCONFIG
```

This will display the IP settings:

```
0 Ethernet Adapter:
IP Address:       192.168.0.3
Subnet Mask:      255.255.255.0
Default Gateway:
```

2.5 You can now try to Ping your PC:

In Command Prompt window enter the following:

```
C:\>ping 192.168.0.3
```

This will display:

```
Pinging 192.168.0.3 with 32 bytes of data:
Reply from 192.168.0.3: bytes=32 time<10ms TTL=128
Reply from 192.168.0.3: bytes=32 time<10ms TTL=128
Reply from 192.168.0.3: bytes=32 time<10ms TTL=128
Reply from 192.168.0.3: bytes=32 time<10ms TTL=128
Ping statistics for 192.168.0.3:
                  Packets: Sent=4, Received=4, Lost=0 (0%loss),
                  Approximate round trip times in milli-seconds:
                  Minimum=0ms, Maximum=0ms, Average=0ms
```

Your network LAN card is now set up.

3. On the RCP unit front panel, perform the following sequence:

Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IPSetup** and press the **Enter** key; select **2.LocalIP** and press the **Enter** key. Enter the address **192.168.0.0** by using the navigation keys. Press the **Enter** key to accept the entered value.

Use the same menu pattern above to set the following parameters:

```
Subnet:     255.255.255.0;
Gateway:    0.0.0.0;
IPLock:     255.255.255.255;
IPPort:     1038.
```

Verify the selected parameters by navigating to the **1.IPInfo** screen.

4. On the RCP unit front panel select sequentially:

Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **4.Interface** and press the **Enter** key; select **3.IPNet** and press the **Enter** key.

The RCP unit is now set up to work with Ethernet Interface. You may now ping the RCP unit from the host PC:

```
C:\>ping 192.168.0.0
```

This will display:

```
Pinging 192.168.0.0 with 32 bytes of data:
Reply from 192.168.0.0: bytes=32 time<10ms TTL=128
Reply from 192.168.0.0: bytes=32 time<10ms TTL=128
Reply from 192.168.0.0: bytes=32 time<10ms TTL=128
Reply from 192.168.0.0: bytes=32 time<10ms TTL=128
Ping statistics for 192.168.0.3:
            Packets: Sent=4, Received=4, Lost=0 (0%loss),
            Approximate round trip times in milli-seconds:
            Minimum=0ms, Maximum=0ms, Average=0ms
```

5. Run the Teledyne Paradise Datacom Universal M&C package on the host PC to check all M&C functions. When prompted, select an Internet connection to the unit using IP Address **192.168.0.0**, local port address to **1039** and remote port address to **1038**.

The RCP is now connected to your host workstation for remote M&C.

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Appendix B: Proper 10/100 Base-T Ethernet Cable Wiring

This section briefly describes the basic theory related to the physical layer of 10/100 Base-T networking, as well as proper wiring techniques.

There are several classifications of cable used for twisted-pair networks. Recommended cable for all new installations is Category 5 (or CAT 5). CAT 5 cable has four twisted pairs of wire for a total of eight individually insulated wires. Each pair is color coded with one wire having a solid color (blue, orange, green, or brown) twisted around a second wire with a white background and a stripe of the same color. The solid colors may have a white stripe in some cables. Cable colors are commonly described using the background color followed by the color of the stripe; e.g., white-orange is a cable with a white background and an orange stripe.

The straight through and crossover patch cables are terminated with CAT 5 RJ-45 modular plugs. RJ-45 plugs are similar to those you'll see on the end of your telephone cable except they have eight versus four or six contacts on the end of the plug and they are about twice as big. Make sure they are rated for CAT 5 wiring. (RJ means "Registered Jack"). A special Modular Plug Crimping Tool (such as that shown in **Figure B-1**) is needed for proper wiring.

Figure B-1: Modular Plug Crimping Tool

The 10BASE-T and 100BASE-TX Ethernets consist of two transmission lines. Each transmission line is a pair of twisted wires. One pair receives data signals and the other pair transmits data signals. A balanced line driver or transmitter is at one end of one of these lines and a line receiver is at the other end. A simplified schematic for one of these lines and its transmitter and receiver is shown in **Figure B-2**.

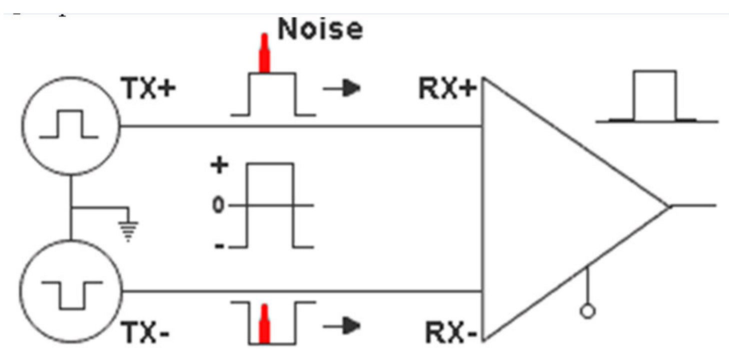


Figure B-2: Transmission Line

The main concern is the transient magnetic fields which surrounds the wires and the magnetic fields generated externally by the other transmission lines in the cable, other network cables, electric motors, fluorescent lights, telephone and electric lines, lightning, etc. This is known as noise. Magnetic fields induce their own pulses in a transmission line, which may literally bury the Ethernet pulses.

The twisted-pair Ethernet employs two principle means for combating noise. The first is the use of balanced transmitters and receivers. A signal pulse actually consists of two simultaneous pulses relative to ground: a negative pulse on one line and a positive pulse on the other. The receiver detects the total difference between these two pulses. Since a pulse of noise (shown in red in the diagram) usually produces pulses of the same polarity on both lines one pulse is essentially canceled by out the other at the receiver. In addition, the magnetic field surrounding one wire from a signal pulse is a mirror of the one on the other wire. At a very short distance from the two wires, the magnetic fields are opposite and have a tendency to cancel the effect of each other. This reduces the line's impact on the other pair of wires and the rest of the world.

The second and the primary means of reducing cross-talk between the pairs in the cable, is the double helix configuration produced by twisting the wires together. This configuration produces symmetrical (identical) noise signals in each wire. Ideally, their difference, as detected at the receiver, is zero. In actuality, it is much reduced.

Pin-out diagrams of the two types of UTP Ethernet cables are shown in **Figure B-3**.

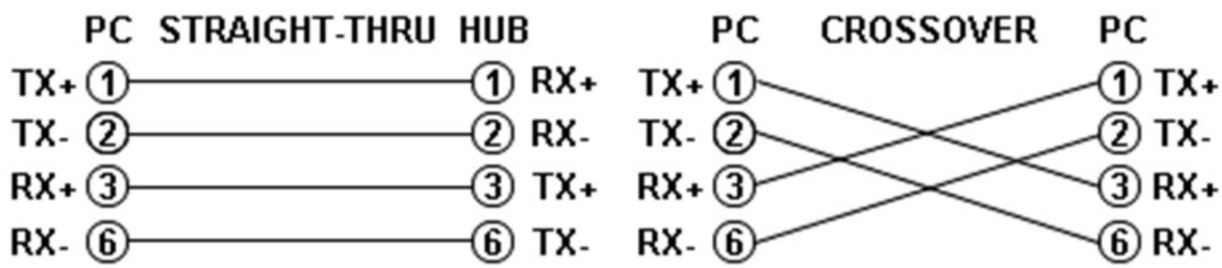


Figure B-3: Ethernet Cable Pin-Outs

Note that the TX (transmitter) pins are connected to corresponding RX (receiver) pins, plus to plus and minus to minus. Use a crossover cable to connect units with identical interfaces. If you use a straight-through cable, one of the two units must, in effect, perform the crossover function.

Two wire color-code standards apply: EIA/TIA 568A and EIA/TIA 568B. The codes are commonly depicted with RJ-45 jacks as shown in **Figure B-4**. If we apply the 568A color code and show all eight wires, our pin-out looks like **Figure B-5**.

Note that pins 4, 5, 7, and 8 and the blue and brown pairs are not used in either standard. Quite contrary to what you may read elsewhere, these pins and wires are not used or required to implement 100BASE-TX duplexing.

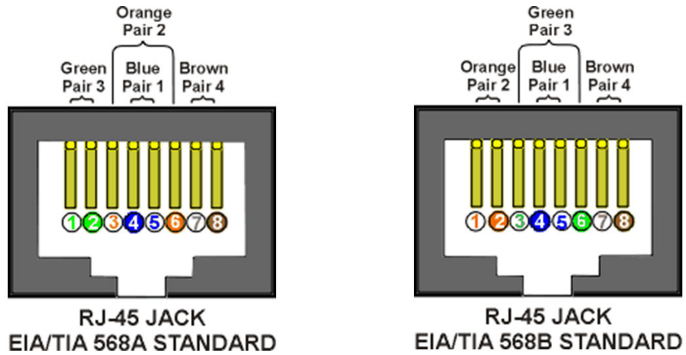


Figure B-4: Ethernet Wire Color Code Standards

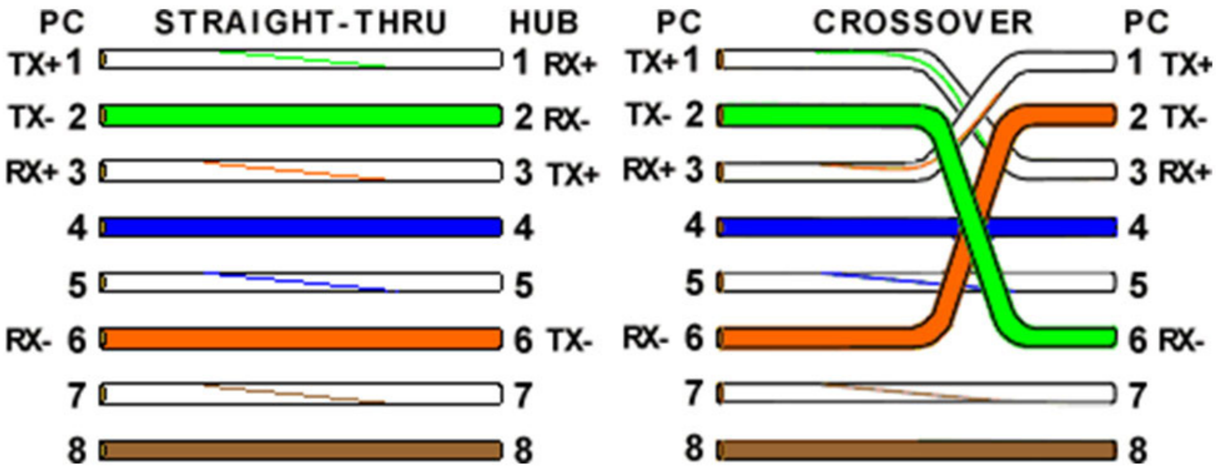
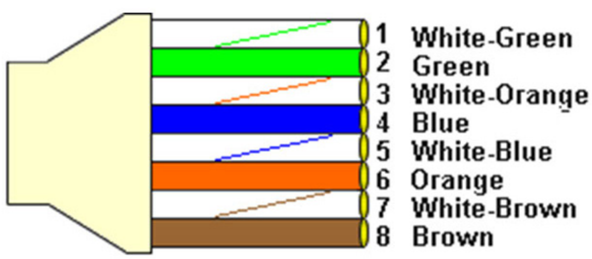
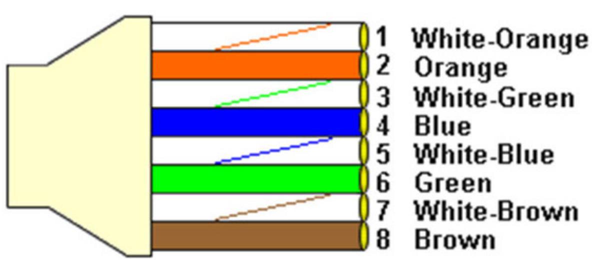


Figure B-5: Wiring Using 568A Color Codes

There are only two unique cable ends in the preceding diagrams, they correspond to the 568A and 568B RJ-45 jacks and are shown in **Figure B-6**.



568A CABLE



568B CABLE

Figure B-6: Wiring Using 568A and 568B Color Codes

Again, the wires with colored backgrounds may have white stripes and may be denoted that way in diagrams found elsewhere. For example, the green wire may be labeled Green-White. The background color is always specified first.

Now, all you need to remember, to properly configure the cables, are the diagrams for the two cable ends and the following rules:

- A straight-thru cable has identical ends.
- A crossover cable has different ends.

It makes no functional difference which standard you use for a straight-thru cable. You can start a crossover cable with either standard as long as the other end is the other standard. It makes no functional difference which end is which. 568A patch cable will work in a network with 568B wiring and 568B patch cable will work in a 568A network

Here are some essential cabling rules:

1. Try to avoid running cables parallel to power cables.
2. Do not bend cables to less than four times the diameter of the cable.
3. If you bundle a group of cables together with cable ties (zip ties), do not over -cinch them. It's okay to snug them together firmly; but don't tighten them so much that you deform the cables.
4. Keep cables away from devices which can introduce noise into them. Here's a short list: copy machines, electric heaters, speakers, printers, TV sets, fluorescent lights, copiers, welding machines, microwave ovens, telephones, fans, elevators, motors, electric ovens, dryers, washing machines, and shop equipment.
5. Avoid stretching UTP cables (tension when pulling cables should not exceed 25 LBS).
6. Do not run UTP cable outside of a building. It presents a very dangerous lightning hazard!
7. Do not use a stapler to secure UTP cables. Use telephone wire/RG-6 coaxial wire hangers, which are available at most hardware stores.

Appendix C: Documentation

The following pages comprise the documentation package for the Compact Outdoor PowerMAX System.

This package consists of:

214334, SPEC SHEET, POWERMAX SYSTEM, CO, GAN;
214335, SPEC SHEET, POWERMAX SYSTEM, CO, GAAS;
(check our web site http://www.paradisedata.com for the most recent version of these documents).

Outline drawing, specific to your system;
Block diagram, specific to your system;
And schematic, specific to your system.

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