# TELEDYNE
## PARADISE DATACOM
### A Teledyne Technologies Company

# 7 RU Chassis
# Solid State Power Amplifier
# Operations Manual

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

| **Teledyne Paradise Datacom** | **Teledyne Paradise Datacom Ltd.** |
|---|---|
| 328 Innovation Blvd., Suite 100 | 2&3 The Matchyns, London Road, Rivenhall End |
| State College, PA 16803 USA | Witham, Essex CM8 3HA England |
| (814) 238-3450 (switchboard) | +44 (0) 1376 515636 |
| (814) 238-3829 (fax) | +44 (0) 1376 533764 (fax) |

Information in this document is subject to change without notice. The latest revision of this document may be downloaded from the company web site: http://www.paradisedata.com.

**Use and Disclosure of Data**

The items described herein are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

**Proprietary and Confidential**

The information contained in this document is the sole property of Teledyne Paradise Datacom. Any reproduction in part or as a whole without the written permission of Teledyne Paradise Datacom is prohibited.

All other company names and product names in this document are property of the respective companies.

**Figures**

**Tables**

THIS PAGE LEFT INTENTIONALLY BLANK

## 1.0 Introduction

This section provides the general information for the Teledyne Paradise Datacom 7-Rack Unit Solid State Power Amplifier (SSPA) Chassis. This includes a description of the unit and safety precautions.

## 1.1 Description

The Teledyne Paradise Datacom 7RU Rack-Mountable SSPA Chassis employs a modular design, which allows quick and easy replacement in the event of a catastrophic failure of one of the SSPA components. These modular assemblies include: hot-swappable SSPA modules; front and rear fan trays; and a rear panel controller card.

The indoor rack mounted unit contains an internal microprocessor which allows for full monitoring and control from the front panel's 2x40 Vacuum Florescent Display and push-buttons, or via a remote serial (RS-232 or RS-485) or parallel connector, or 10/100 Base-T Ethernet..

The microprocessor monitors various voltages, currents and temperatures within the unit for a full fault analysis. The user also has the ability to select additional faults related to the RF output level, an optional reflected power level and operating temperature.

An internal attenuator allows up to 20.0 dB of attenuation to be applied to the RF signal. Temperature compensation limits the amplifier's output response from varying significantly over the operating temperature. Also, the system contains input and output sample ports.

The power supply for the 7RU SSPA Chassis is a separate N+1 Power Supply Chassis, which houses up to four power supply modules. In the event of a power supply module failure, the amplifier system will not fail.

## 1.2 Specifications

Refer to the specification sheet in **Appendix C** for complete specifications.

## 1.3 Equipment Supplied

The following equipment is supplied with each unit:

- High Power SSPA Chassis RM (7 RU high)
- Power Supply Chassis (3 RU high) (standard)
- Rack Slides
- Interconnecting Cables to Bus Bar
- Operations Manual, High Power SSPA Chassis [208528]

## 1.4 Inspection

When the unit is received, an initial inspection should be completed. First ensure that the shipping container is not damaged.  If it is, have a representative from the shipping company present when the container is opened. Perform a visual inspection of the 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 LLC
>  328 Innovation Blvd., Suite 100
>  State College, PA 16803 USA
>  Phone: +1 (814) 238-3450
>  Fax:    +1 (814) 238-3829

## 1.5 Rack Mounting

The SSPA Chassis is designed to fit in a standard 19" wide EIA rack. The unit is 7 rack units or 10.47 inches (266 mm) high by 33.75 inches (857.3 mm) deep (including connectors and bus bar), and weighs 180 pounds (82 kg). The power supply chassis is 3 rack units or 5.25 inches (133.4 mm) high by 20.42 inches (518.7 mm) deep, and weighs 50 pounds (23 kg) with all three power supply modules installed.

## 1.6 Shipment

To protect the SSPA Chassis during shipment, use high quality commercial packing methods. When possible, use the original shipping container and its materials. Reliable commercial packing and shipping companies have facilities and materials to adequately repack the instrument.

## 1.7 Safety Considerations

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

### 1.7.1 High Voltage Hazards

High Voltage for the purpose of this section is any voltage in excess of 30 volts. Voltages above this value can be hazardous and even lethal under certain circumstances. Care should be taken when working with devices that operate at high voltage.

- All probes and tools that contact the equipment should be properly insulated to prevent the operator from coming in contact with the voltage.
- The work area should be secure and free from non-essential items.
- Operators should never work alone on high voltage devices. There should always be another person present in the same work area to assist in the event of an emergency.

- Operators should be familiar with procedures to employ in the event of an emergency, i.e., remove all power, CPR, etc.

An AC powered unit will have 115 VAC or 230 VAC entering through the AC power connector. Caution is required when working near this connector, the AC circuit breaker, or the internal power supply.

### 1.7.2 High Current Hazards

Many high power devices are capable of producing large surges of current. This is true at all voltages, but needs to be emphasized for low voltage devices. Low voltage devices provide security from high voltage hazards, but also require higher current to provide the same power. High current can cause severe injury from burns and explosion. The following precautions should be taken on devices capable of discharging high current:

- Remove all conductive personal items (rings, watches, medals, etc.)
- The work area should be secure and free of non-essential items.
- Wear safety glasses and protective clothing.
- Operators should never work alone on high risk devices. There should always be another person present in the same work area to assist in the event of an emergency.
- Operators should be familiar with procedures to employ in the event of an emergency, i.e., remove all power, CPR, etc.

**Warning! Large DC currents are generated to operate the RF Module inside of the enclosure. Extreme caution is required when the enclosure is open and the amplifier is operating. DO NOT TOUCH any of the connections on the RF modules when the amplifier is operating. Currents in excess of 60 Amperes may exist on any one connector.**

### 1.7.3 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. 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.

### 1.7.4 Electrical Discharge Hazards

An electric spark can not only create ESD reliability problems, it can also cause serious safety hazards. The following precautions should be followed when there is a risk of electrical discharge:

- Follow all ESD guidelines
- Remove all flammable material and solvents from the area.
- All probes and tools that contact the equipment should be properly insulated to prevent electrical discharge.
- The work area should be secure and free from non-essential items.
- Operators should never work alone on hazardous equipment. There should always be another person present in the same work area to assist in the event of an emergency.
- Operators should be familiar with procedures to employ in the event of an emergency, i.e., remove all power, CPR, etc.

### 1.7.5 Tipping Hazard

Always load equipment into a rack from the bottom up so that it will not become top-heavy and tip over. Deploy your rack's anti-tilt bar to prevent the rack from tipping during equipment installation.

The 7RU SSPA chassis is designed to be installed within a rack cabinet which is placed on a level surface. Any attempt to install the unit into a cabinet on an uneven surface, or to improperly load equipment into the rack cabinet beginning at the top, may cause the cabinet to tip over, which may result in bodily injury.

### 1.7.6 High Potential for Waveguide Arcing

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

## 1.8 Waveguide Pressurization and Dehydration

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

It is extremely difficult to precisely predict the power levels at which the breakdown occurs. It is dependent on a variety of factors but the primary factors are:
- Waveguide temperature and atmospheric pressure
- Components in the Waveguide Transmission System such as: Flanges, Bends, Tees, Combiners, Filters, Isolators, etc.
- Load VSWR presented to the amplifier.

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

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

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

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

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

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

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

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

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

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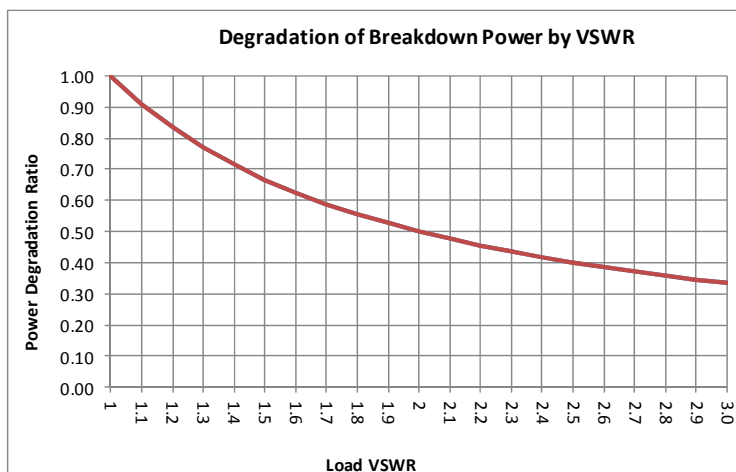


**Figure 1-1: Degradation of Breakdown Power by VSWR**

There are many factors to consider with high power amplifier systems in terms of the output waveguide network. Especially when using HPA systems with output power levels of those shown in **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.

THIS PAGE LEFT INTENTIONALLY BLANK

## 2.0 Introduction

This section contains a description of 7RU SSPA Chassis, including the front panel indicators and controls, and I/O connectors and their functions. The stand-alone 3RU power supply chassis is also described.

## 2.1 Front Panel Features

The 7RU RM SSPA has 10 LEDs to indicate the internal state of the amplifier. Five fault condition LEDs on the left side of the front panel reflect some of the HPA major faults plus the summary fault state. The SSPA on-line LED will turn green when the amplifier is in Online mode (1:1 Mode) or serves as an AC power indicator in standalone mode. Local/Remote and Mute/Unmute LEDs show the current control mode and mute state of the unit. **Figure 2-1** illustrates the front panel.
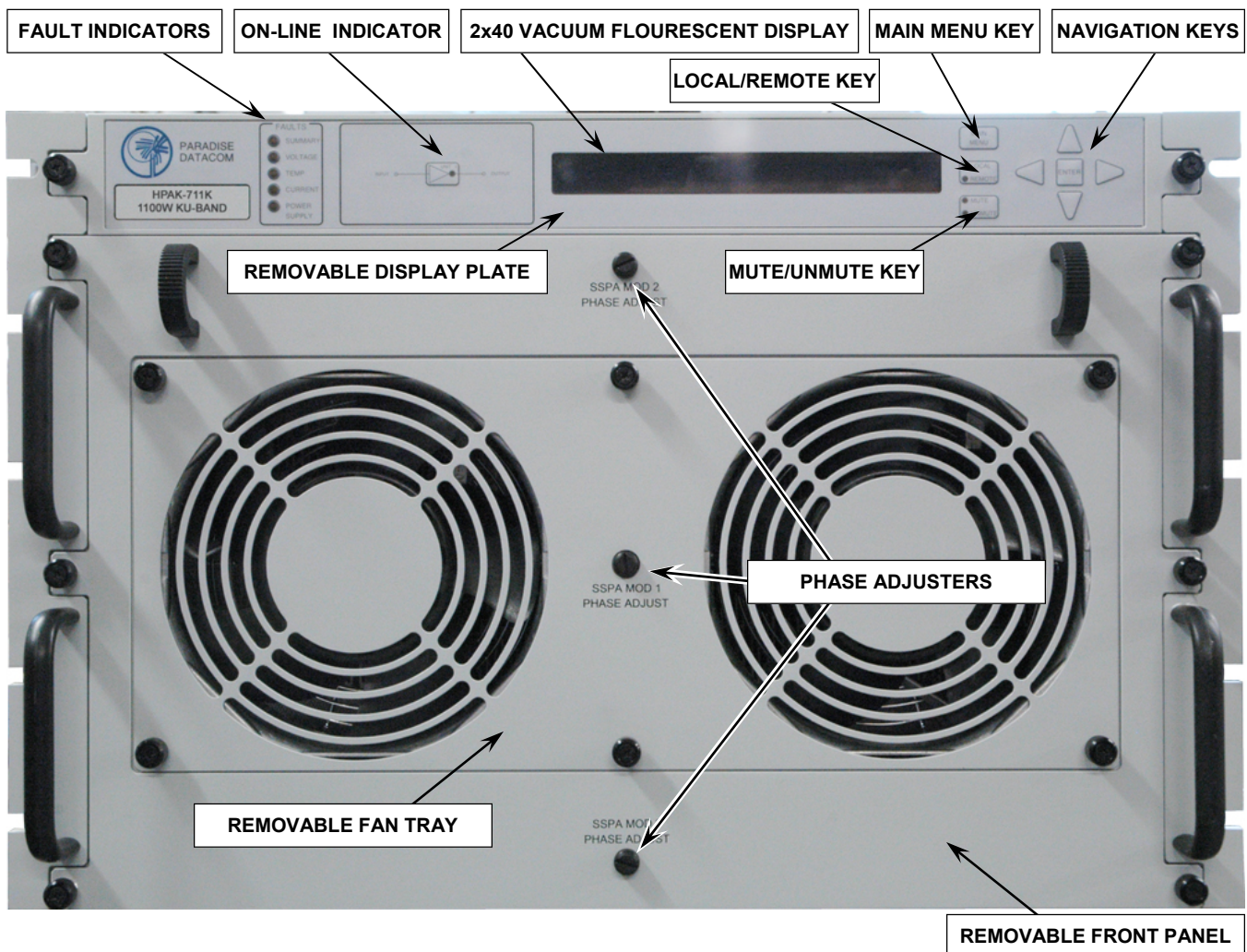


**Figure 2-1: Front Panel, 7RU SSPA Chassis**

### 2.1.1 Removable Display Face Plate

Two captive thumb screws (one on each side) secure the display face plate to the front of the chassis. See **Figure 2-2**.



**Figure 2-2: Removable Display Face Plate**

To remove the display face plate, loosen the captive thumb screws by rotating them counter-clockwise. Gently slide the assembly from its position, taking care not to damage the internal ribbon cable or board assembly.

When the display face plate is removed, a pressure trigger will disengage and disable the SSPA. This function does NOT remove power from the unit. If performing maintenance to the internal components of the unit, completely remove AC power to the unit's power supply to assure no DC voltages are present.

#### 2.1.1.1 Fault Indicator LEDs

The SSPA has five (5) fault indicator LEDs on the left side of the front panel which illuminate RED when a fault condition exists for the following states: Summary, Voltage, Temperature, Current and Power Supply.

#### 2.1.1.2 Online Indicator / Standby Select key

The LED beside this key will turn on when the unit is online. Pressing this key has no effect in Standalone mode. When the SSPA is in 1:1 Redundancy Mode, pressing this key places the amplifier in standby mode. Pressing this key on an amplifier already in standby mode has no effect.

#### 2.1.1.3 Vacuum Florescent Display (VFD)

The front panel 40x2 character VFD allows the user to get detailed information about the state of the unit and provides easy customization of operation through an interactive menu structure.

#### 2.1.1.4 Main Menu Key

Pressing the **Main Menu** key provides a shortcut to the SSPA's operating menu structure in the display. See **Section 3.0** for an overview of the menu selections and operation.

### 2.1.1.5 Local / Remote Key

Pressing the **Local/Remote** key allows the user to disable or enable the local control keypad console. If the SSPA is in "Remote Only" mode, the unit will not react on any keystrokes except the **Local/Remote** key.

### 2.1.1.6 Mute / Unmute Key

Pressing the **Mute/Unmute** key allows the operator to change the Mute status of the SSPA. Muting the amplifier via the front panel requires 100 msec maximum (50 msec typical).

### 2.1.1.7 Navigation Keys

The **Up Arrow** (▲), **Down Arrow** (▼), **Left Arrow** (◄), **Right Arrow** (►) and **Enter** keys on the right side of the front panel allow the operator to navigate through the menu selections displayed on the front panel display.

## 2.1.2 Removable Fan Tray

Six (6) captive thumb screws secure the fan tray to the front of the chassis. Loosen the thumb screws by rotating them counter-clockwise. Gently slide the fan tray assembly out of the enclosure until there is enough clearance to reach the power plug for each fan. Unplug each power connector. See **Figure 2-3** and **Figure 2-4**.



Figure 2-3: Removable Fan Tray

Figure 2-4: Unplug Connector

When the fan tray is removed, a pressure trigger will disengage and disable the fans. This function does NOT remove power from the unit. If performing maintenance to the internal components of the unit, completely remove AC power to the unit's power supply to assure no DC voltages are present.

A replacement fan tray may be ordered from the factory. Order part number L208545-X. Check with the factory to ensure the proper version is ordered.

### 2.1.3 Removable Front Panel

Six (6) captive thumb screws secure the front panel to the front of the chassis. Loosen the thumb screws by rotating them counter-clockwise. The power cable for both fans will need to be disconnected before fully removing the front panel.

#### 2.1.3.1 Phase Adjusters

There are three adjustment screws accessible at the front panel which allow adjustment of the phase of the SSPA modules within the chassis. The phase adjustment of the 7RU chassis is set at the factory for optimum output power across the frequency range. In the event that a module fails and needs to be replaced, the phase of the new module will need to be adjusted for best performance. See **Section 4.4** for directions on adjusting the phase combining.

#### 2.1.3.2 Access to Removable SSPA Modules

The 7RU chassis houses four SSPA module/heatsink assemblies behind the front panel. A system of rack slides allows the module/heatsink assemblies to be removed from the amplifier chassis for maintenance.

A faulted module may be removed from the chassis without taking the amplifier offline. To identify the faulted module, press the **Main Menu** key on the front panel, select **1.SysInfo** and press the **Enter** key. Press the **Down Arrow** (▼) key seven (7) times to view the operation condition of Module1, Module2, Module3 and Module4. **Figure 2-5** shows the location of each module.
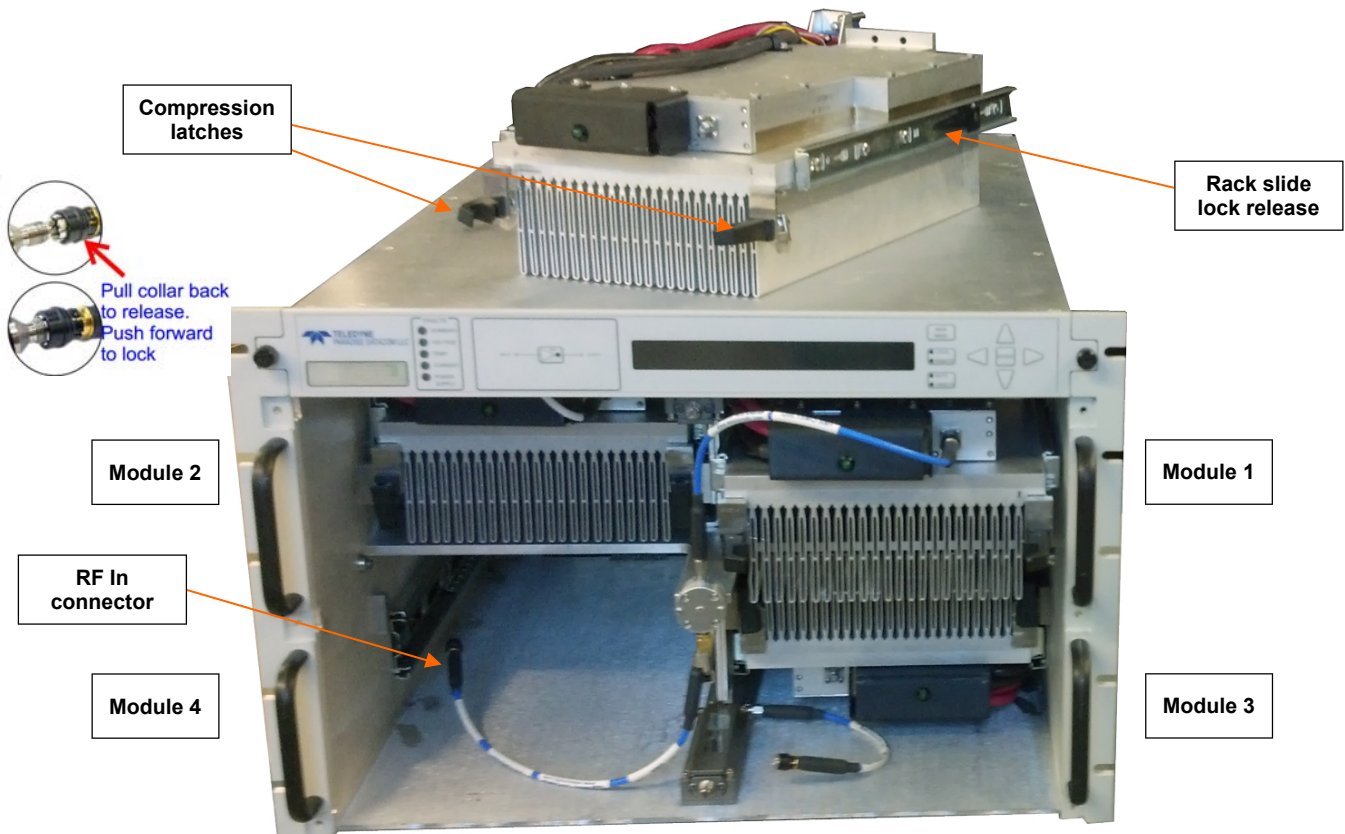


**Figure 2-5: Slide SSPA Module from Chassis Enclosure**

With the front panel removed, uncouple the RF In connector from the faulted module, lift and turn the compression latches on either side of the module assembly, and slide the unit out of the enclosure by releasing the slide locks on either side of the module assembly. See **Figure 2-5**.

> **Note**: See **Section 4.3** for the proper procedure to follow when replacing an RF module, or when removing a fault-free module from the chassis.

A new module/heatsink assembly may be inserted in place of the one removed. Insert the replacement module/heatsink assembly into the rack slide. Carefully slide the assembly back into the enclosure. To ensure the module/heatsink assembly is properly seated, lock the compression latches and gently tug on the handles. The assembly should not slide forward. Re-couple the RF In connector. Some system phase adjustment may be necessary to ensure optimum power output. See **Section 4.4** for a description of proper system phase adjustment.

## 2.2 Rear Panel Features

All cable and waveguide connections are made at the rear panel of the 7RU SSPA Chassis. The chassis rear panel also features a removable controller card assembly, and individual removable fan assemblies.

**Figure 2-6** shows an outline drawing of the rear panel view of a typical C-Band amplifier.
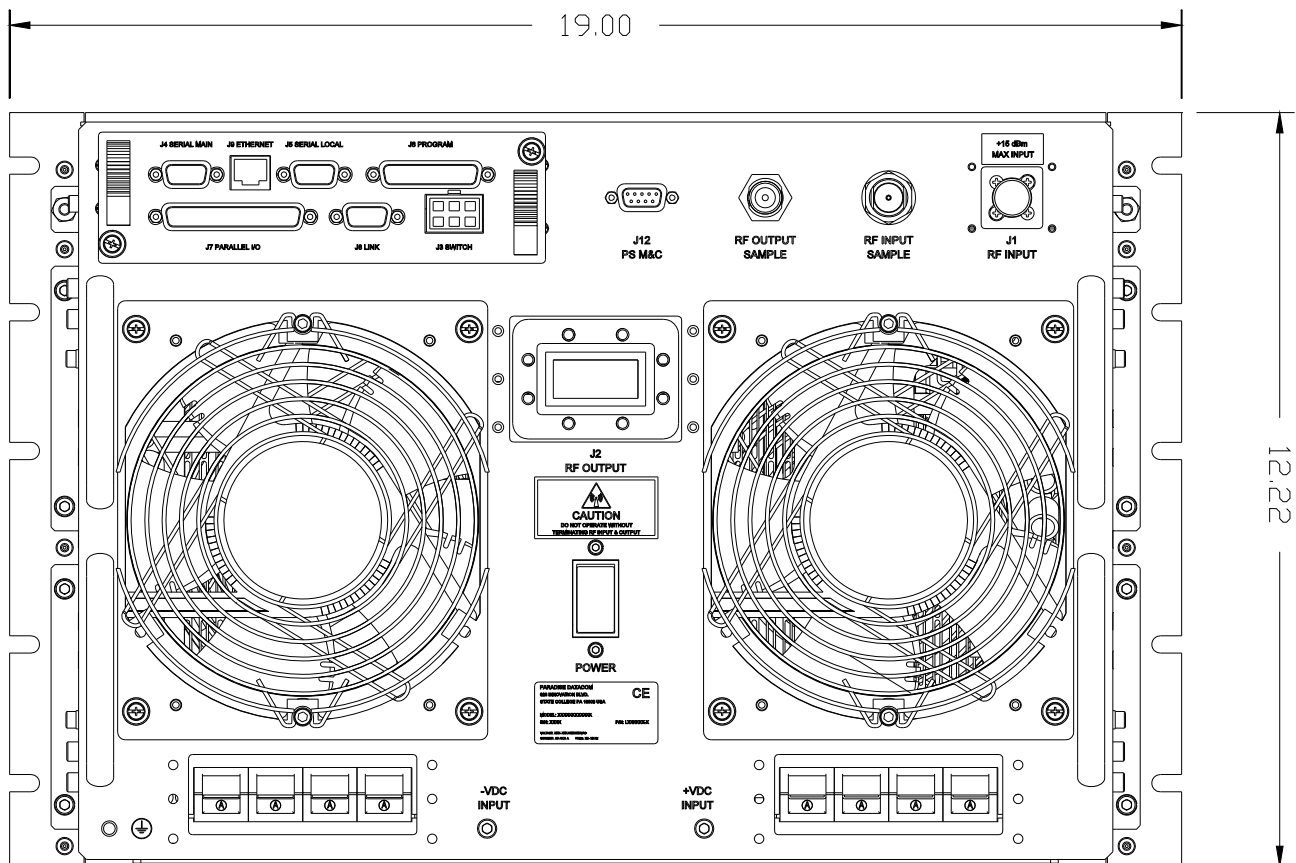


**Figure 2-6: Rear Panel, 7RU SSPA Chassis**

### 2.2.1 RF Input Port (J1) [Type N(F)]

The Type N (F) connector on the top right of the rear panel is used to introduce RF input to the SSPA. Maximum input is +15 dBm.

### 2.2.2 RF Output Port (J2)

The waveguide flange in the middle of the rear panel is used as the RF Output. C-Band amplifiers utilize a WR137 waveguide with CPR 137G flange, while Ku-Band amplifiers use a WR75 waveguide with grooved (PBR-120) flange. X-Band units employ a WR112 rigid wave-guide with a CPRG112 grooved flange with through holes. S-Band amplifiers use a Type N (F) connector for the RF Output port. Do not operate the amplifier without having a mating connection or termination on the RF Output Port. RF Hazard warnings apply.

### 2.2.3 Switch Port (J3) [Molex 43810-0002]

A 6-pin Molex connector header with blind insertion system guides (mates with Molex P/N 39-01-2060) is used in a 1:1 Redundancy System to provide switching for the waveguide transfer switch (RF Switch). **Table 2-1** shows the pin-outs for the Switch Port (J3).

**Table 2-1: Switch Port (J3) pin outs**

| Pin # | Function / Description |
|-------|-----------------------|
| 1 | +28V Switch Drive Output. 3 Amp over current protection. |
| 2 | Switch 1 Position 2 drive |
| 3 | Switch 1 Position 1 drive |
| 4 | +28V Switch Drive Output. 3 Amp over current protection. |
| 5 | Switch 2 Position 2 drive |
| 6 | Switch 2 Position 1 drive |

### 2.2.4 Serial Main (J4) [DB9(F)]

A DB9 female connector serves as primary control interface connector. The interface is re-configurable through the front panel or can be used as a RS-232 or R-485 interface (2 or 4 wires). The RS-485 TX and RX pairs must be twisted for maximum transmission distance. A user-configurable 120-ohm termination resistor is provided on the same connector. **Table 2-2** shows the pin outs for the Serial Main (J4) connector. A form C summary alarm is also present on J4. It is noted as a service request and occupies pins 6, 7 and 8.

**Table 2-2: Serial Main (J4) pin outs**

| Pin # | Function / Description |
|-------|-----------------------|
| 1 | RS485 TX+ (HPA Transmit +) |
| 2 | RS485 TX- (HPA Transmit -)/RS232 TX |
| 3 | RS485 RX- (HPA Receive -)/RS 232 RX |
| 4 | RS485 RX+ (HPA Receive +) |
| 5 | GND |
| 6 | Service Request 1 Form C relay NC contact (Closed on HPA Summary Fault) |
| 7 | Service Request Common Form C relay common contact |
| 8 | Service Request 2 Form C relay NO contact (Opened on HPA Summary Fault) |
| 9 | 120 ohm termination (must be connected to pin 4 to enable termination) |

## 2.2.5 Serial Local (J5) [DB9(M)]

This DB9 male connector is used in advanced system integration and for system debugging purposes. Leave unconnected unless specified otherwise.

## 2.2.6 Service Port (J6) [Mini USB]

A 5-contact Mini USB connector is used to provide field flash re-programmability for the HPA controller card. In order to reload controller board firmware, connect this port to a PC Parallel port through straight through cable. See **Section 4.1.1** for a description of the firmware upgrade procedure.

## 2.2.7 Parallel I/O Port (J7) [DB37(F)]

A DB37 female type connector, the Parallel I/O Port contains a series of contact closures for monitoring SSPA faults as well as opto-isolated inputs for controlling some SSPA functions. Inputs react on the closure to ground. The minimal closure time is 50 mS. See **Table 2-3**.

**Table 2-3: Parallel I/O Port (J7 — 37 socket D connector)**

| Pin # | Function / Description |
|-------|------------------------|
| 1 | Closed on Power Supply Fault Form C relay NC |
| 2 | Open on Power Supply Fault Form C relay NO |
| 20 | Power Supply Fault Common |
| 21 | 1. Standalone mode. Closed on Auxiliary Fault |
| | 2. 1:1 Redundancy Mode. Closed on Automatic switchover mode. Form C relay NC |
| 22 | 1. Standalone Mode. Open on Auxiliary Fault |
| | 2. 1:1 Redundancy Mode. Closed on Manual switchover mode. Form C relay NO |
| 3 | Auxiliary Fault\Auto-Manual Common |
| 4 | Open on Mute. Form C Relay NC |
| 5 | Closed on Mute. Form C Relay NO |
| 23 | Mute Status Common |
| 24 | Closed on BUC Fault. Form C Relay NC |
| 25 | Open on BUC Fault. Form C Relay NO |
| 6 | BUC Fault Common |
| 7 | Closed on High Temperature Fault. Form C Relay NC |
| 8 | Open on High Temperature Fault. Form C Relay NO |
| 26 | High Temperature Fault Common |
| 27 | 1. Standalone mode. Closed on Regulator Low Voltage Fault |
| | 2. 1:1 Redundancy Mode. Closed on HPA Standby. Form C relay NC |
| 28 | 1. Standalone Mode. Open on Regulator Low Voltage Fault. |
| | 2. 1:1 Redundancy Mode. Closed on HPA Online Mode. Form C relay NO |
| 9 | Regulator Low Voltage Fault\Standby-Online Common |
| 10 | Closed on DC Current Low Fault. Form C Relay NC |
| 11 | Open on DC Current Low Fault. Form C Relay NO |
| 29 | DC Current Low Fault Common |
| 30 | Closed on Low Forward RF Fault. Form C Relay NC |
| 31 | Open on Low Forward RF Form C Relay NO |

(continued)

**Table 2-3: Parallel connector (37 socket D connector) (continued)**

| Pin # | Function / Description |
|---|---|
| 12 | Low Forward RF Fault Common |
| 16 | Auto/Manual toggle input. 50mS Closure to isolated ground to activate |
| 17 | Mute/Unmute toggle input. 50mS Closure to isolated ground to activate |
| 18 | Auxiliary Fault input. 50 ms minimum response time |
| 35 | HPA Standby input. 50mS Closure to isolated ground to activate |
| 36 | Local/Remote toggle. 50mS Closure to isolated ground to activate |
| 37 | Fault clear. 50mS Closure to isolated ground to activate |
| 19 | Isolated Signal Ground |
| 15 | +5V Isolated Power 20 mA |
| 13, 32 | +28V Auxiliary Power 1A |
| 14, 33 | Chassis Ground |

### 2.2.7.1 Hardware Mute (TX Enable)

There are three ways to mute the amplifier via hardware input:

1. A 50 ms closure to ground on Port J7, Pin 17 toggles between Mute/Unmute states.
2. Press the **Main Menu** key on the front panel, then select **4.Fault Setup** and press the **Enter** key; select **2.Auxiliary Faults** and press the **Enter** key; select **1.Action** and press the **Enter** key; select **4.Alert+Mute** and press the **Enter** key. Then select **4.Fault Setup** and press the **Enter** key; select **2.Auxiliary Faults** and press the **Enter** key; select **2.Fault Logic** and press the **Enter** key; select **2.Fault on Low** and press the **Enter** key. A continuous closure to ground on Port J7, Pin 18 will then mute the amplifier. See **Section 3.4.2**.
3. Press the **Main Menu** key on the front panel, select **4.Fault Setup** and press the **Enter** key; select **2.Auxiliary Faults** and press the **Enter** key; select **1.Action** and press the **Enter** key; select **4.Alert+Mute** and press the **Enter** key. Select **4.Fault Setup** and press the **Enter** key; select **2.Auxiliary Faults** and press the **Enter** key; select **2.Fault Logic** and press the **Enter** key; select **2.Fault on High**. A continuous open to ground on Port J7, Pin 18 will mute the amplifier. See **Section 3.4.2**.

### 2.2.8 Link Port (J8) [DB9(F)]

The 9-pin male connector J8 Link Port is used to link a SSPA with other units in a redundant system in order to pass online/standby status information between them. Leave unconnected unless specified otherwise.

## 2.2.9 Ethernet Port (J9) [RJ45]

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" as described in **Section 7.6.1.2**. This feature allows the user to connect the SSPA to a 10/100 Base-T Local Area Network and have full-featured Monitor & Control functions through a web interface. See **Table 2-4** for Ethernet port pin outs.

**Table 2-4: 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 needs to be properly selected prior to first use (see **Appendix A** for details).

LED lamps on the connector indicate network status. A steady Green light indicates a valid Ethernet link; a Yellow LED flashes during any data transfer activity (on both Transmit and Receive paths).

## 2.2.10 Power Supply M&C (J12)

See **Section 2.3.1.3**. The Power Supply Alarm Cable is connected between this DB-9 connector and the Alarms Port of the 1RU power supply chassis. The SSPA monitors the status of the power supply chassis and alarms in the event of a power supply module failure. Due to the nature of the N+1 redundant power supply, a failure will not take the amplifier off the air.

## 2.2.11 Input Sample Port (Optional)

An optional RF input sample port is located to the left of the J1 RF Input connector on the rear panel. It is a type N female connector. This port provides a coupled sample of the RF input signal. A calibration tag is located adjacent to the port.

## 2.2.12 Output Sample Port

The Output RF Sample Port, which is a type N female connector, is located to the right of the J12 PS M&C connector on the rear panel. This port provides a coupled sample of the RF output signal. A calibration offset sticker is located beneath the connector.

## 2.2.13 Power Switch

The rocker-type power switch is located near the center of the rear panel, beneath the (J2) RF output.

## 2.2.14 DC Input Quick Connect Ports

Power to the 7RU SSPA Chassis is supplied by a separate power supply chassis (See **Section 2.3**). The power supply's DC output is provided by cables permanently attached to the Power Supply that connect to the SSPA's internal bus-bar via a series of quick-disconnect high current in-line connectors.

Simply connect the mating DC output cable quick-disconnect connectors to the positive and negative power connecters at the rear of the chassis.

## 2.2.15 Removable Fan Assemblies

The exhaust fans on the rear panel are each secured by four (4) captive thumb screws. To remove, loosen the screws and carefully remove the fan assembly from the chassis. Unplug the fan power cord from the connector. Replace with part number L206332-2.

## 2.2.16 Removable Controller Card Assembly

The controller card assembly is located at the rear of the SSPA and includes the Switch (J3), Serial Main (J4), Serial Local (J5), Programming (J6), Parallel I/O (J7), Link (J8) and Ethernet (J9) ports.

To remove this card assembly, loosen the two restraining thumbscrews at the top left and bottom right of the assembly. See **Figure 2-7**. Slide the assembly straight back from the cavity, as shown in **Figure 2-8**. This exposes the SSPA module programming connectors.
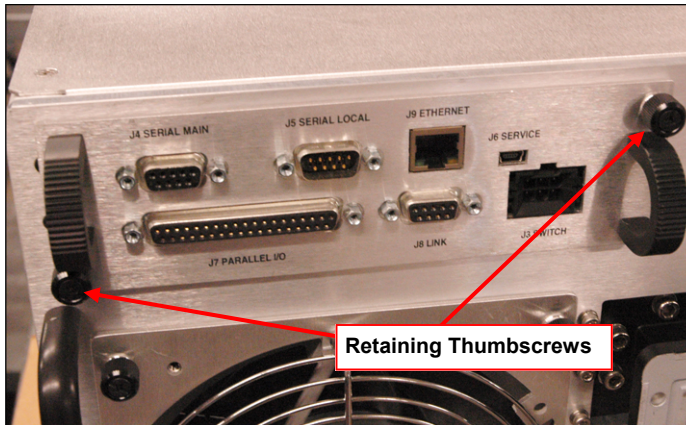


**Figure 2-7: Loosen the Two Retaining Thumbscrews**
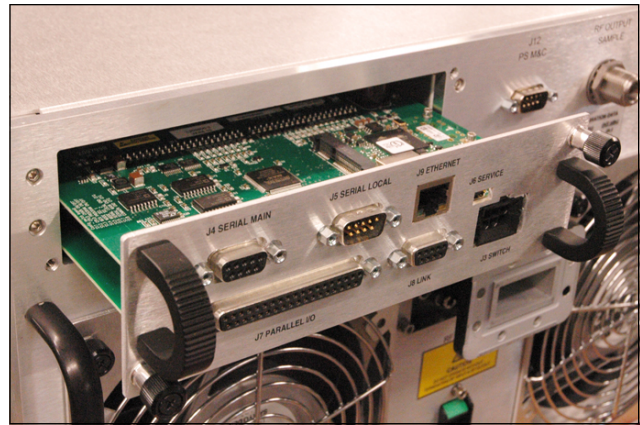
**Figure 2-8: Remove the Card to Access the Programming Connectors**

## 2.3 Redundant Power Supply Chassis

A separate power supply chassis is used to provide redundancy of the power supply to the 7RU SSPA chassis. The power supply is configured with a parallel set of modules. All of the modules are active and share the load current supplied to the amplifier. The power supply module current capacity is chosen such that at least one extra module is included over the amplifier's current requirement. This is to say that the power supply is n+1 redundant. The amplifier will continue to operate normally in the presence of one power supply module failure.

The power supply modules are all hot swappable from the front panel. Therefore, if there ever is a power supply module failure, there is no need to remove the entire power supply chassis. The failed module is simply removed via the front panel. The power supply module removal can be performed with the system powered. This is to say that the modules are "hot swappable".

### 2.3.1 1RU (four-module) N+1 Redundant Power Supply

The 1RU power supply shelf can be mounted directly below and adjacent to the amplifier chassis. The 1RU power supply chassis is configured as an N+1 redundant, hot swappable power source utilizing four 2.5 kW power modules. In the event of a single power module failure, the amplifier system will not fail.

#### 2.3.1.1  AC Mains Connection

In keeping with the redundant architecture of the power supply, there are individual AC inputs for each power supply module.  DC Outputs are in a bus bar configuration. See **Figure 2-9**.
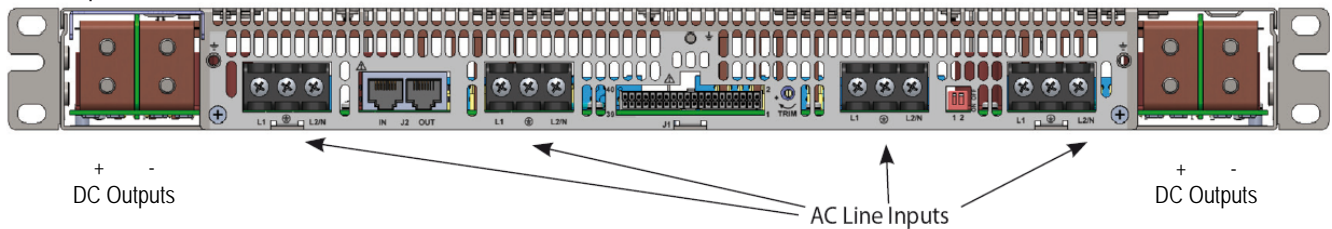


**Figure 2-9: 1RU Power Supply AC Line Inputs/Outputs**

The standard input configuration for the 2.5 kW power supply is 180-265 VAC single phase, 47-63 Hz, 0.99 power factor per module. A separate AC input transformer could feed each AC input.

The wiring identification is as follows:
- L1 - Brown
- Chassis Ground - Green/Yellow
- L2/N - Blue

### 2.3.1.2  DC Output Connection

The DC output is provided by four (4) sets of cables attached to the Power Supply DC output buss bars that connect to the SSPA via a series of quick-disconnect high current in-line connectors.

Connect the mating DC output cable quick-disconnect connectors to the positive and negative power connecters at the rear of the chassis. See **Figure 2-10**.
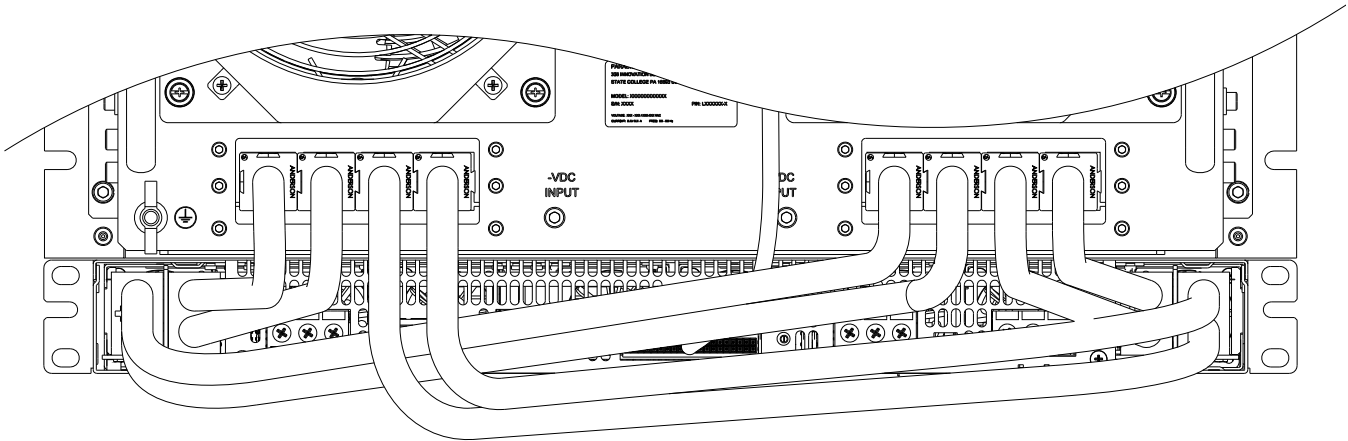


**Figure 2-10: DC Output Cable, Quick-Connect to Rear of Amplifier**

### 2.3.1.3 Power Supply Alarm Connection

Each power supply module has an alarm output. The power supply alarms are monitored by the SSPA's monitor and control system. This provides for local and remote alarm reporting in the event of a power supply module failure. The module alarm outputs are open-collector signals with a low level = fault logic level. Under normal operation the alarm outputs are in a high impedance state.

Using cable L211509-X, connect the Alarms Port of the 1RU Power Supply to Port J12 of the accompanying 7RU SSPA Chassis.

### 2.3.1.4 Alarm Configuration at the SSPA Chassis

The power supply alarms may be monitored via the SSPA Chassis front panel menu. See **Section 3.1.2**.

A failure of one of the power supply modules results in a minor fault, and the Power Supply Fault indicator on the front panel of the SSPA Chassis will light and the System Information screen on Page 2 of the Main menu will indicate a Power Supply Fault. To clear the fault, replace the faulted power supply module.

### *2.3.1.5 Power Supply Module Removal/Replacement*

A failed module can be changed without ever taking the system out of service. Simply lift the release knob and pull the extraction handle until the module slides from the shelf. Slide the replacement module into the empty slot until the module is flush with the front of the shelf. See **Figure 2-11**.
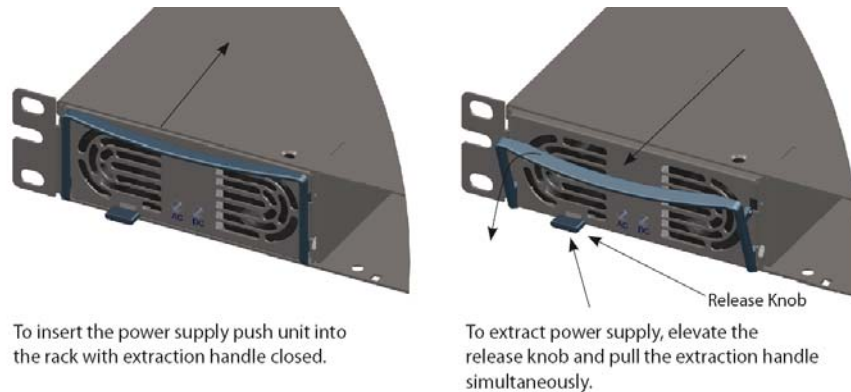


**Figure 2-11: 1RU Power Supply Module Insertion/Extraction**

## 2.3.2  Dual 1RU (four module) Power Supply Option

The 600W Ku-Band 7RU SSPA requires two (2) 1RU power supplies; one 12V supply and one 28V supply. See **Figure 2-12**.
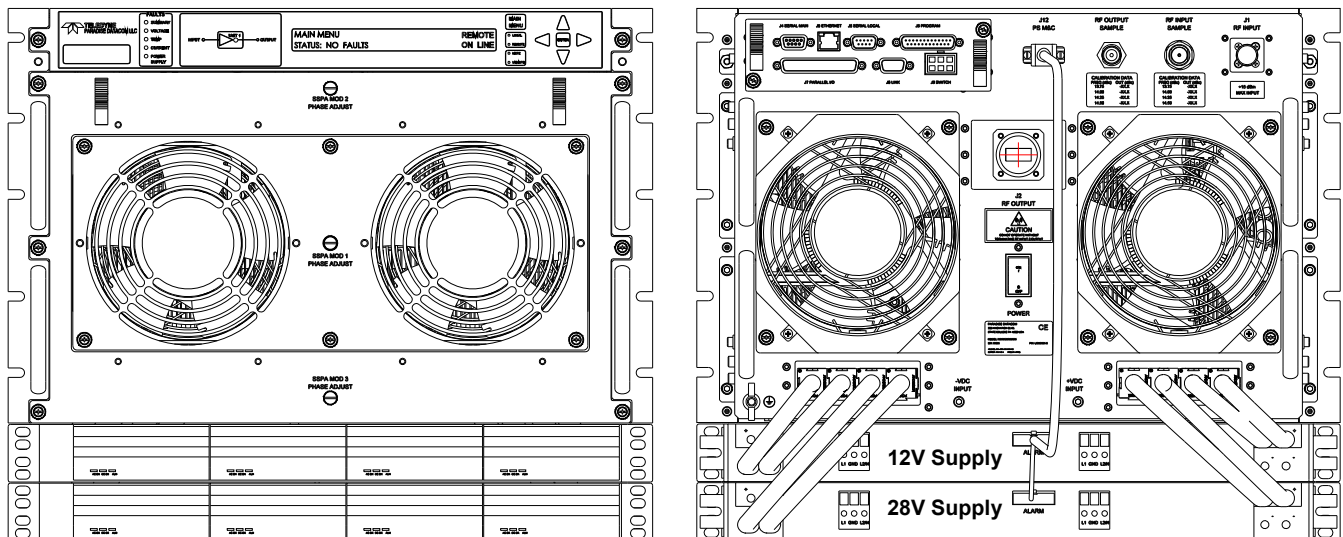


**Figure 2-12: Dual 1RU Power Supply Option**

Each power supply has a single phase, universal AC input ranging from 180-265 VAC, 47-63 Hz and is power factor corrected to 0.99.

### 2.3.2.1  AC Mains Connection

The power supply chassis has a dual feed AC architecture. Power module slots 1 & 2 are supplied via AC Feed 1 and power module slots 3 & 4 are supplied via AC Feed 2. The AC connections on the shelf are made via rear accessed compression style terminal blocks. See **Figure 2-13**.

Connect the first line/hot to L1, the second line or neutral to L2/N and the AC ground to GND. These terminal blocks will accept up to a maximum of 10 AWG wire, and should be torqued to 6 in-lbs



**Figure 2-13: Terminal block**

### 2.3.2.2  DC Output Connection

The DC output is provided by eight (8) sets of cables attached to the Power Supply DC output buss bars that connect to the SSPA via a series of quick-disconnect high current in-line connectors. As shown in **Figure 2-12**, the outputs of the 12V supply plug into the two (2) inputs at the far left and far right of the amplifier.

### 2.3.2.3 Power Supply Alarm Connection

The power supply alarm cable used with the dual 1RU power supply option is L210747-X, and connects between the Alarms Port of each of the power supplies and Port J12 of the 7RU amplifier. The cable connectors are labeled for easy identification.

## 2.4 Power Detector Module

The Power Detector Module allows the user to introduce a sample of both the system Forward RF power and the system Reflected RF power from the waveguide output. The detector box circuitry will measure the amount of RF power present in the sample, with a dynamic range of 12 dB starting at the maximum RF output. See **Figure 2-14**.
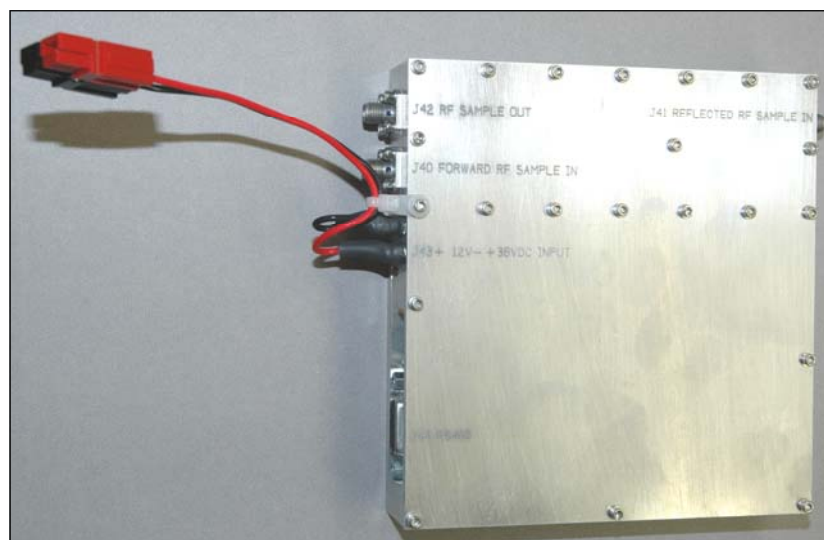


**Figure 2-14: Forward Power Detector Module**

### 2.4.1 J40 Forward RF Sample In [SMA (F)]

A Forward RF Sample may be fed into port J40 of the detector box from a cross-guide coupler on the RF output.

### 2.4.2 J41 Reflected RF Sample In  [SMA (F)]

A Reflected RF Sample may be fed into port J41 of the detector box from a cross-guide coupler on the system RF output.

### 2.4.3 J42 RF Sample Out [SMA (F)]

Port J42 is the detector box's RF Sample Port connector, and provides a coupled sample of the system's RF output signal.

### 2.4.4 J43 +12V Input [Pin]

The Forward Power Detector module is powered via the J7 Parallel Port of the SSPA, when operating a standalone unit. In system configurations, the Forward Power Detector module is powered via a Detector Power Cable that also links to Port J7 between two or more units. A quick-disconnect cable is soldered to the RFI filter at J43 and the adjacent turret terminal, and the connection end is plugged into the mating connector on the line-in for the Auxiliary Power Connector.

### 2.4.5 J44 RS-485 Connector [DB9 (F)]

This DB9 female connector serves as the primary RS-485 (2 or 4 wires) serial remote control interface connector. The detector box is included in the serial chain along with the amplifiers in the system.

THIS PAGE LEFT INTENTIONALLY BLANK

## 3.0 Front Panel Display Menu Structure

**Figure 3-1** shows the Front Panel Display Menu Structure hierarchy. There are six main levels of menu selections.

- **Sys.Info** - System Information menu sublevel (See **Section 3.1**)
- **Com.Setup** - Serial Communication related settings (See **Section 3.2**)
- **Operation Setup** - System operation related settings (See **Section 3.3**)
- **Fault Monitoring Setup** - Fault handling settings (See **Section 3.4**)
- **Options** - Backup/restore and password settings (See **Section 3.5**)
- **Redundancy** - Switching and standby settings (See **Section 3.6**)
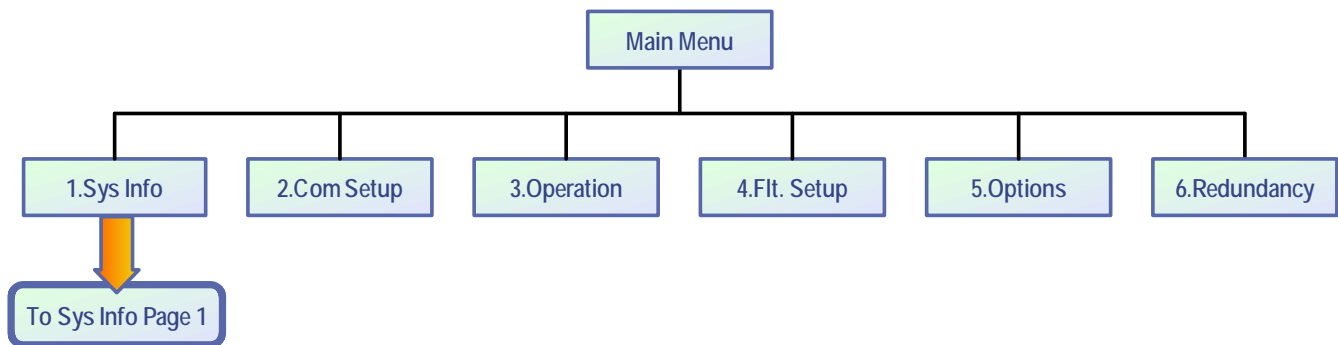


**Figure 3-1: Main Menu, Top Level**

The menu tree is accessed by pressing the Main Menu key on the front panel of the SSPA. 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 front panel 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.

# 3.1 System Information Sub-Menu

The informative sublevel menu structure contains several pages, shown in **Figure 2-5**.
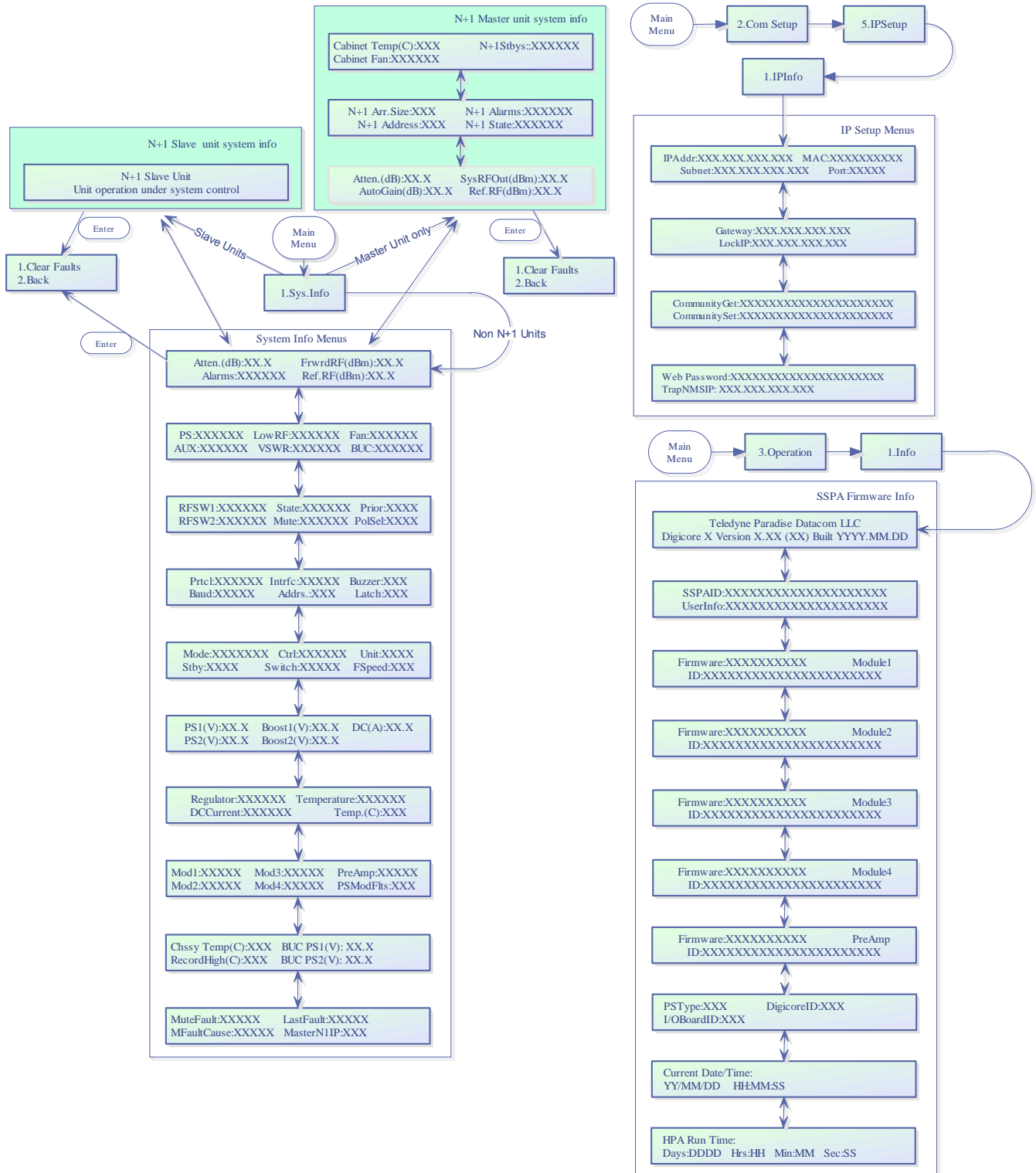


**Figure 3-2: System Information Sub-Menu**

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 3.1.21**; the default page for Slave units is as described in **Section 3.1.22**. In non-N+1 configurations, the default page is as described in **Section 3.1.1**.

### 3.1.1 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 2.4** 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.

#### *3.1.1.1 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.

### 3.1.2 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.

### 3.1.3 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)

### 3.1.4 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 availability. "Dis" for disabled or "Enb" for enabled.
- **Latch** — Fault latch option selection. "Dis" for disabled or "Enb" for enabled.

### 3.1.5 Sys Info Page 5

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

- **Mode** — Indicates HPA operational mode. See **Section 3.3.4**.
- **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".

### 3.1.6 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; The voltage range for GaN amplifiers depends on the frequency band of the unit. Typical GaN SSPA power supply ranges are:
  - L– and S-Band SSPAs: 40 to 50 VDC;
  - C-Band SSPAs: 24 to 28 VDC;
  - X-Band SSPAs: 20 to 26 VDC;
  - Ku-Band SSPAs: 20 to 28 VDC;
  - Ka-Band SSPAs: 20 to 24 VDC.
- **PS2(V)** — Main power supply 2 output voltage. See above.
- **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.

### 3.1.7 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, only the hottest module baseplate temperature is displayed.

### 3.1.8 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 with module. 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.

### 3.1.9 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. For a unit equipped with a single power supply this value shows "N/A" (not available).

### 3.1.10 Sys Info Page 10 (version 6.00)

The page shows advanced fault analysis information and advanced 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** — Parameter allows user to determine 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 re-set. 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);

### 3.1.11 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 pro-tocol is selected. The port value should not be selected outside the existing ser-vices range to avoid access conflict on the M&C PC end.

### 3.1.12 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 ad-dress 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 3.2.5.1**.

### 3.1.13 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.

### 3.1.14 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).

### 3.1.15 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.

### 3.1.16 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)

### 3.1.17 Firmware Info Pages 3, 4, 5, 6 and 7 (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 and one pre-amp. Pages will remain blank if a particular module is not installed.

### 3.1.18 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. For factory use only.

### 3.1.19 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.

### 3.1.20 HPA Run Time Page 10 (version 6.00)

This page shows the days, hours, minutes and seconds since the unit was last powered up.

### 3.1.21 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 3.6.6.3**);
- **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.

### 3.1.21.1 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.

### 3.1.22 N+1 Slave Info Page

**Figure 3-3** shows the display for all Slave units in the system.
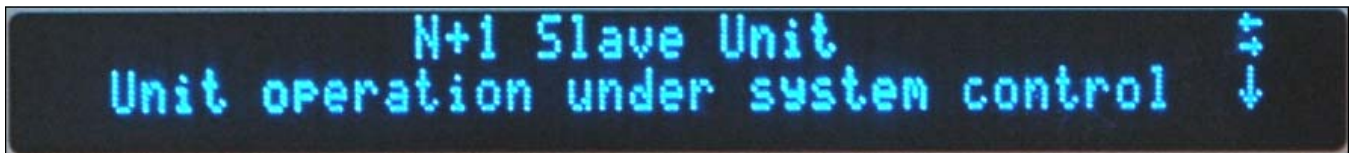


**Figure 3-3: Slave Unit Display**

This page can only be viewed when a SSPA 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 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.

### 3.1.22.1 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.

### 3.1.23 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 detects no more than one (1) SSPA chassis alarm, the N+1 state will be displayed as "Normal"; otherwise "FAULT!".

### 3.1.24 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)** — Displays the temperature within the system cabinet.
- **Cabinet Fan** — Displays the fault state of the cabinet exhaust impellers. Possible states are: "Normal", "FAULT!" or "N/A".
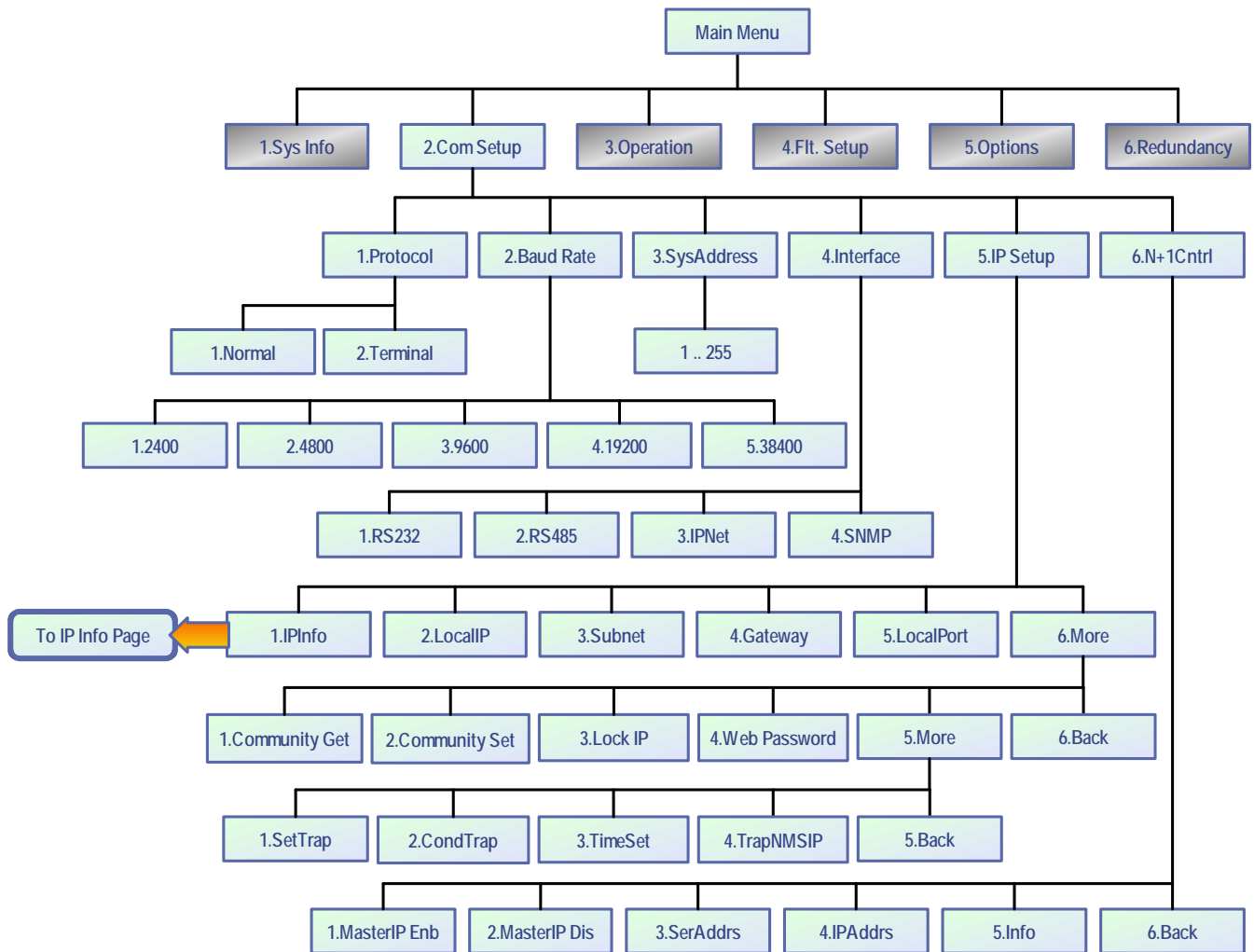
**Figure 3-4: Communication Setup Sub-Menu**

## 3.2 Communication Setup Sub-Menu

This menu, shown in **Figure 3-4**, allows the user to select the parameters for communication between the SSPA and any remote monitor and control station.

### 3.2.1 Protocol

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

- **1.Normal** — As described in **Section 7.2**.
- **2.Terminal** — As described in **Section 7.5**.

### 3.2.2 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.

### 3.2.3 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 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 to the unit or by issuing a reset command from the front panel. See **Section 3.5.6**.

### 3.2.4 Interface

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

### 3.2.5 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 3.1.11** through **Section 3.1.14**)
- **2.Local IP** — This selection allows the user to set the unit's Local IP Address. Factory default for standalone units is **192.168.0.9**;

  ```
  New IP:XXX.XXX.XXX.XXX
  ```

- **3.Subnet Mask** — This selection allows the user to set the Subnet Mask. Factory default is **255.255.255.0**;

  ```
  SubnetMask:XXX.XXX.XXX.XXX
  ```

- **4.Default Gateway** — This selection allows the user to set the network Default Gateway Address. Factory default is **192.168.0.1**;

  ```
  DefGateway:XXX.XXX.XXX.XXX
  ```

- **5.LocalPort** — This selection allows the user to set the Local Port for the unit. The default Local Port address is **1007**;

  ```
  LocalPort:XXXXX
  ```

- **6.More** — This selection opens the menu items listed in **Section 3.2.5.1**.

### 3.2.5.1 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";

  > CommunityGet:public

- **2.Community Set** — This selection allows user to set the SNMP Community Set String. Default is "private";

  > CommunitySet: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;

  > LockIP:255.255.255.255

- **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;

  > WebPassword:paradise

- **5.More** — This selection opens the menu items listed in **Section 3.2.5.2**.
- **6.Back** — This selection opens the menu items listed in **Section 3.2.5**.

### 3.2.5.2 More (Traps and Time Settings)

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

- **1.SetTrap** — This selection allows the user to set the Settings Trap;

  ```
  SettingsSend:XX
  ```

- **2.CondTrap** — This selection allows the user to set the Conditions Trap;

  ```
  ConditionsSend:XX
  ```

- **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.

  ```
  Set New Time (YY/MM/DD HH:mm)
  YY/MM/DD HH:mm
  ```

- **4.TrapNMSIP** — This selection allows the user to set the Trap NMS IP Address;

  ```
  TrapNMSIP:XXX.XXX.XXX.XXX
  ```

- **5.Back** — This selection opens the menu items listed in **Section 3.2.5.1**.

### 3.2.6 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 3.2.6**.
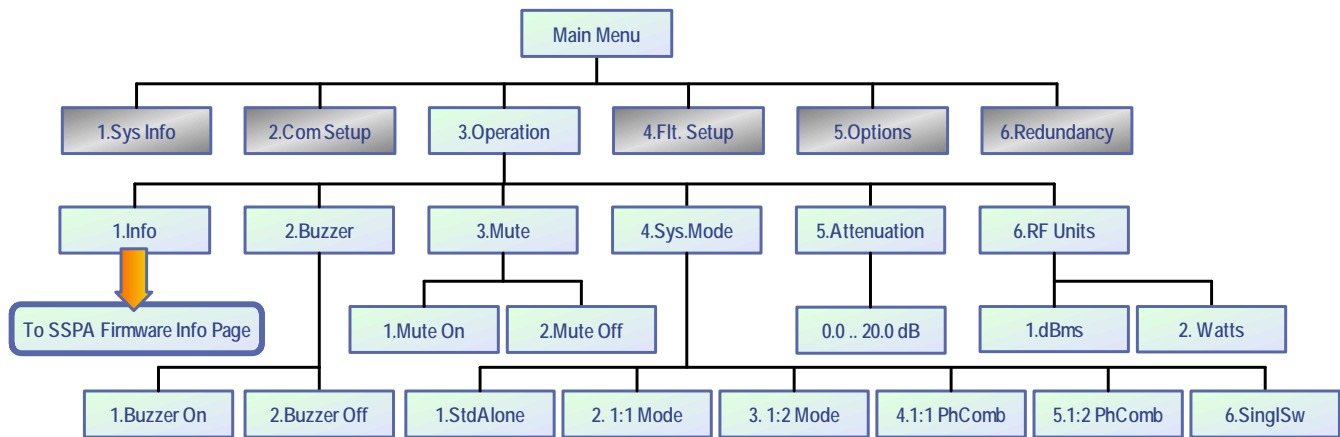
**Figure 3-5: Operation Setup Sub-Menu**

## 3.3 Operation Setup Sub-Menu

This menu, shown in **Figure 3-5**, allows the user to select system-specific options.

### 3.3.1 Info

Shows the current firmware version. See **Figure 2-5** and **Section 3.1.15** through **Section 3.1.17**.

### 3.3.2 Buzzer

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

### 3.3.3 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).

### 3.3.4 Sys. Mode

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

- **Standalone** – Select this option for standalone SSPA application. All RF wave-guide 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 is highly recommended. 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 is highly recommended. 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.

### 3.3.5 Attenuation

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

**Note**: If the Auto Gain function is active (any setting other than Auto Gain Off), the amount of attenuation will be affected. See **Section 3.6.6.3**.

### 3.3.6 RF Units

Allows user to set the unit of power measurement between dBm or Watts.
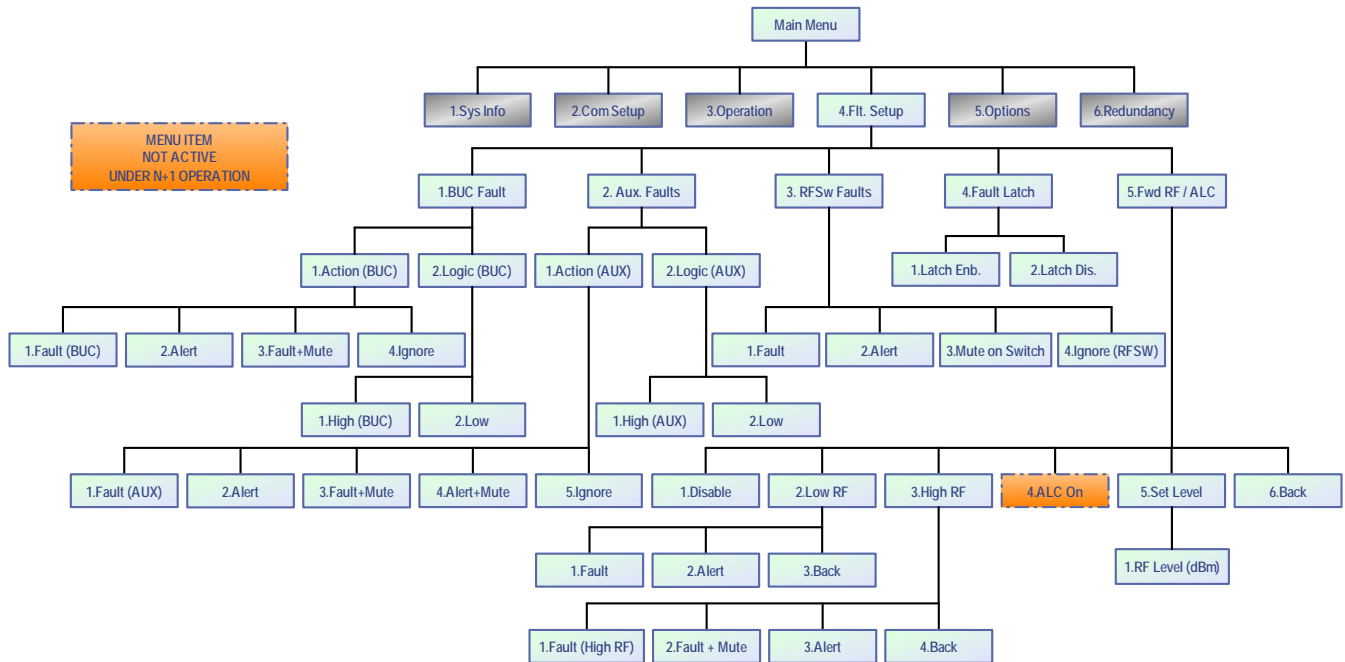
**Figure 3-6: Fault Monitoring Setup Sub-Menu**

## 3.4 Fault Monitoring Setup Sub-Menu

This menu, shown in **Figure 3-6**, allows the user to select how the SSPA will handle fault conditions.

### 3.4.1 BUC Fault

Allows the operator to select the Action and the Fault Logic for fault conditions associated with the unit's Block Up Converter. The operator can select the following Actions: **1.Fault**; **2.Alert**; **3.Fault + Mute**; or **4.Ignore**. The following Fault Logic parameters are available: **1. High(BUC)**; or **2.Low**.

### 3.4.2 Auxiliary Faults

Allows the operator to select the Action and the Fault Logic for fault conditions associated with the Auxiliary connections. The operator can select from the following Actions: **1.Fault (AUX)**; **2.Alert**; **3.Fault + Mute**; **4.Alert + Mute**; or **5.Ignore**. The following Fault Logic parameters are available: **1.High(AUX)**; or **2.Low**.

See **Section 2.1.2.7.1** for a description of how to mute the amplifier using the **4.Alert + Mute** option.

### 3.4.3 RF Switch Faults

Determines whether a switch fault should cause a major alarm and attempt to switch, or simply show an alert on the front panel, 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.

### 3.4.4 Fault Latch

Determines the alarm reporting condition. A latched alarm will remain indicated on the 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.

### 3.4.5 Forward RF / Automatic Level Control

This menu allows the operator to choose whether to enable or disable a Forward RF Fault Alarm, or to set Automatic Level Control.

*3.4.5.1 Disable*

This selection disables the Forward RF Fault Alarm function, as well as the Automatic Level Control function. Selecting this item also unlatches any Forward RF fault conditions.

*3.4.5.2 Low RF*

When this menu item is selected, an alarm is triggered when the RF output power falls below a threshold value, which is adjustable by the operator (see **Section 3.4.5.5**).

The operator may set the fault handling to trigger either a Major Fault (Fault) or Minor Fault (Alarm).

- **1.Fault** — When selected, a Major Fault condition (Summary Alarm) is triggered when RF output power falls below the set threshold value;
- **2.Alarm** — When selected, a Minor Fault condition is triggered when RF output power falls below the set threshold value;
- **3.Back** — This selection displays the menu listed in **Section 3.4.5**.

*3.4.5.3 High RF*

When this menu item is selected, an alarm is triggered when the RF output power rises above a threshold value, which is adjustable by the operator (see **Section 3.4.5.5**). This function is available in units with firmware version 6.14 and above.

The operator may set the fault handling to trigger either a Major Fault (Fault), Major Fault with Mute, or Minor Fault (Alarm).

- **1.Fault (High RF)** — When selected, a Major Fault condition (Summary Alarm) is triggered when RF output power rises above the set threshold value;
- **2.Fault + Mute** — When selected, a Major Fault condition (Summary Alarm) is triggered when RF output power rises above the set threshold value, and the amplifier is placed in a mute state. To avoid output oscillations between the Mute and Unmute states, this fault condition will latch itself and will not self-clear without operator intervention;
- **3.Alarm** — When selected, a Minor Fault condition is triggered when RF output power rises above the set threshold value;
- **4.Back** — This selection displays the menu listed in **Section 3.4.5**.

There are several methods to clear detected High RF Fault Mute:

1. Select "Fault Clear" menu from front panel menu (see **Section 3.1.1.1**);
2. Apply "Fault Clear" signal from Parallel I/O port (see **Table 2-3**, pin 37);
3. Disable Forward RF fault (see **Section 3.4.5.1**).

*3.4.5.4 ALC On (Automatic Level Control)*

The Automatic Level Control function will take control of the amplifier's attenuation settings to maintain the desired RF output power level and will not allow any attenuation adjustments via 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 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;

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

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 amplifier's front panel.

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

*3.4.5.5 Set Level*

The operator may set the detected RF Output value used as the threshold for either a High RF or Low RF fault condition. Valid values are 0 to 80 dBm, adjustable in 1 dBm steps.

When the amplifier is set to detect High RF faults, if the detected RF Output rises above the set value, a fault condition is triggered.

When the amplifier is set to detect Low RF faults, if the detected RF Output falls below the set value, a fault condition is triggered.

*3.4.5.6 Back*

This selection displays the menu listed in **Section 3.4.5**.
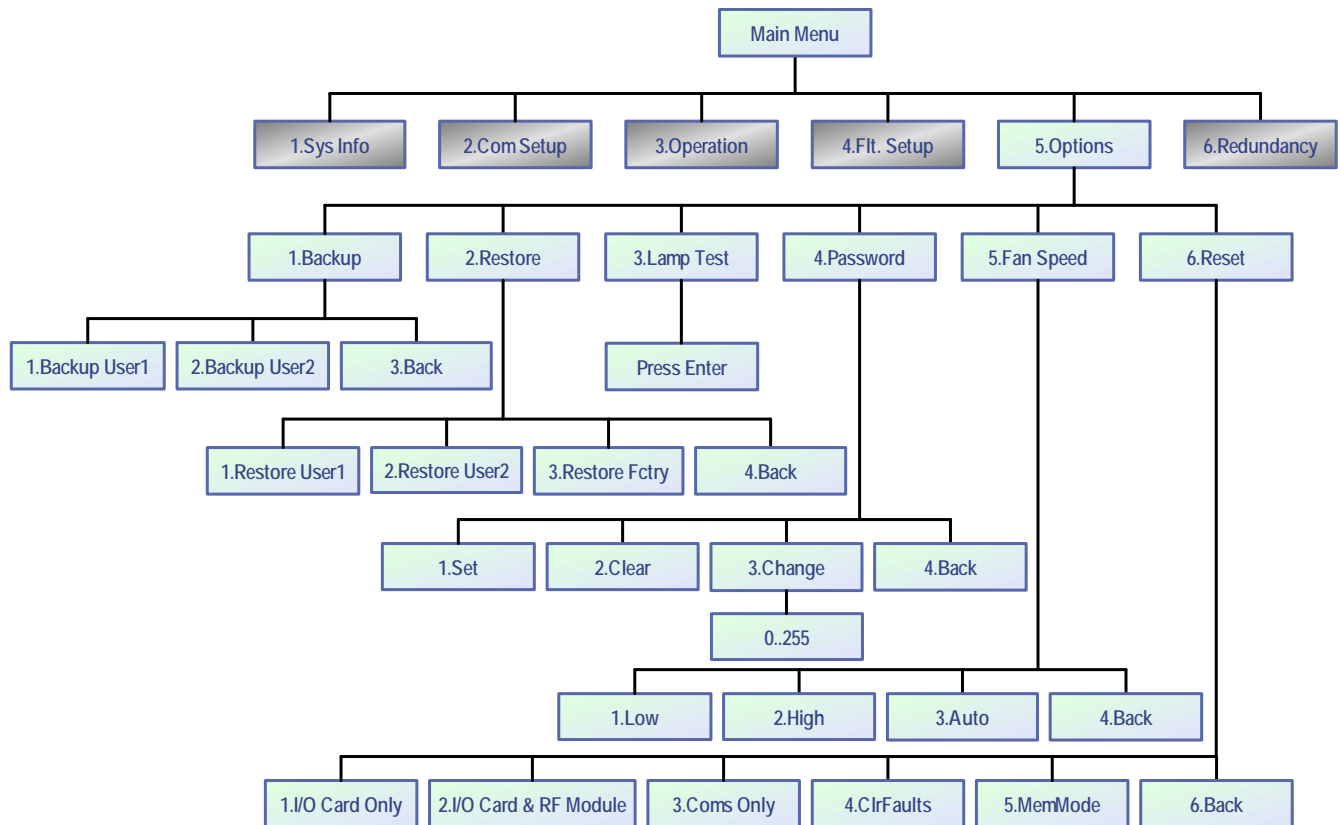
**Figure 3-7: Options Sub-Menu**

## 3.5 Options Sub-Menu

This menu, shown in **Figure 3-7**, 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 front panel.

### 3.5.1 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 this item to save current settings to User1 repository;
- **2.Backup User2** — Select this item to save current settings to User2 repository;
- **3.Back** — Select this item to return to Options Sub-Menu (**Section 3.5**).

### 3.5.2 Restore

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

- **1.Restore User1** — Select this item to restore settings saved in User1 backup;
- **2.Restore User2** — Select this item to restore settings saved in User2 backup;
- **3.Restore Fctry** — Select this item to restore factory default settings;
- **4.Back** — Select this item to return to Options Sub-Menu (**Section 3.5**).

### 3.5.3 Lamp Test

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

### 3.5.4 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; Press the **Enter** key to accept the new password.
- **4.Back** — Select this item to return to the Options Sub-Menu (**Section 3.5**).

### 3.5.5 Fan Speed

Allows the user to set the unit's fan speed. 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 3.5**).

**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 front panel and switch to a faster fan setting if the temperature increases.**

### 3.5.6 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 SSPA unit:

- **1.I/O Card** — Resets all hardware on the removable M&C 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 SSPA endured 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 this item to return to the Options Sub-Menu (**Section 3.5**).
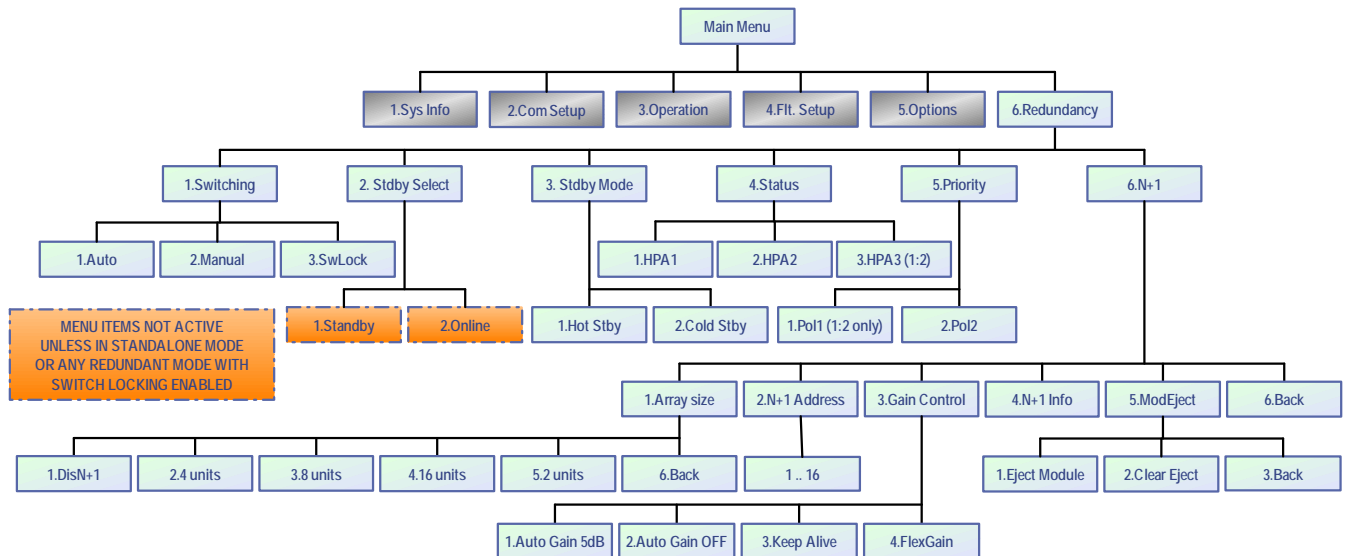
**Figure 3-8: Redundancy Sub-Menu**

## 3.6 Redundancy Sub-Menu

Under this menu, shown in **Figure 3-8**, the user may select the redundancy settings for units in a 1:1 redundant mode.

### 3.6.1 Switching

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

### 3.6.2 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 3.3.4**) with Switch Lock enabled.

### 3.6.3 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 unmute and will take several moments to achieve full output power.

### 3.6.4 Status

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

### 3.6.5 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.

### 3.6.6 N+1 System Operation Parameters

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

#### 3.6.6.1 N+1 Array Size

This menu sets the type of N+1 system or disables N+1 operation for this unit. Choices include the following: Disable N+1; System of 2 units; System of 4 units; System of 8 units; or System of 16 units. A single 5RU chassis in N+1 operation utilizes a system of 2 units.

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.

#### 3.6.6.2 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 7RU chassis, a single chassis utilizes four addressing units (typically addresses 1 through 4). For a system made up of two 7RU chassis, the second chassis utilizes addresses 5 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.

#### 3.6.6.3 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.
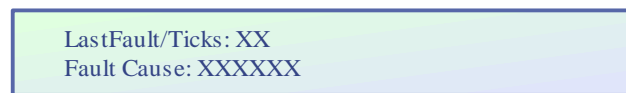
- **4.Flex Gain** — Flex Gain is a form of automatic gain control for N+1 systems. This control option has the same basic operation principles as the standard Auto Gain option except that the gain reserve and amount of gain compensation differ. This setting is designed to serve the special gain compensation needs of hybrid PowerMAX SSPA systems.

  When Flex Gain 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.

### 3.6.6.4 N+1 Info

When selected, the menu shown in **Figure 3-9** is displayed and used for N+1 system troubleshooting.

```
LastFault/Ticks: XX
Fault Cause: XXXXXX
```

**Figure 3-9: 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 displayed is the number of system clock ticks 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.

### 3.6.6.5 Module Eject

When selected, this menu allows the operator to select a module in a multi-module amplifier that will be removed or re-installed for maintenance purposes.

- **1.Eject Module** — Select this menu item to identify the address of the module which will be removed from the amplifier. Enter the module address in the resulting window and press the Enter key.

  Module Address:XXX

- **2.Clear Eject** — Select this menu item to identify the address of the module which will be replaced into the amplifier. Enter the module address in the resulting window and press the Enter key.

  Module Address:XXX

- **3.Back** — Select this item to return to the N+1 System Operation Parameters Sub-Menu (**Section 3.6.6**).

### 3.6.6.6 Back

Select this item to return to the Redundancy Sub-Menu (**Section 3.6**).

## 3.7 N+1 Operational Basics (single unit)

A single SSPA unit may be operated in N+1 mode in order to take advantage of the Auto Gain Control features described in **Section 3.6.6.3**. In this case, each SSPA module within the SSPA chassis is counted as a separate N+1 entity. For example, a four-module 7RU chassis acts like a four-way N+1 array.

N+1 array indexing also accounts this type of functioning. Each 7RU chassis occupies a segment of N+1 addressing equal to the number of modules; i.e., 4 modules = 4 addresses.

The remaining N+1 functions remain the same. When one of the internal modules develops a failure, it will be forced to mute by the internal SSPA controller. The unit will develop a summary alarm, but will remain in N+1 master mode (if it was prior to failure). Multi-module units will delegate a new master mode only when all internal modules develop a failure.

> **Note**: With multi-module RM SSPA chassis configurations, the N+1 system will require fewer chassis to form a N+1 redundancy array.

Examples of 4-way N+1 systems:

> One (1) four-module 5RU, 6RU, or 7RU chassis;
> Two (2) two-module 5RU, 4RU or 3RU chassis;
> Four (4) one-module 4RU or 3RU chassis.

## 3.8 N+1 Operational Basics (two or more units)

A system which utilizes two or more 7RU SSPA chassis in an N+1 configuration may be operated directly from the front panel as if it was a single very high power SSPA. Any 7RU SSPA chassis in the system can serve as the Master Module single point of control.

### 3.8.1 Selecting the Master Module

The selection of the Master Module is fully automatic and shifts from one SSPA to another based on the priority ranking assigned to the modules comprising each SSPA unit. A lower priority index number (referred hereafter as the N+1 Address) means a higher rank in the N+1 hierarchy. The fault-free unit with the lowest N+1 address is selected as the N+1 Master Module. The remainder of the units become N+1 Slave units.

Slave unit settings are under full control of the Master unit. Any system-related setting change made on the Master Module automatically propagates to the Slave units to keep all units under N+1 control in sync.

If the Master Module develops any kind of major fault condition, it delegates its Master privileges to the unit which is next in N+1 ranking and becomes a slave unit. This type of control architecture eliminates a single point of failure and achieves true N+1 system redundancy.

The Master Module is designated with a lit Online indicator and VFD display showing the overall system state. See **Figure 3-10**.
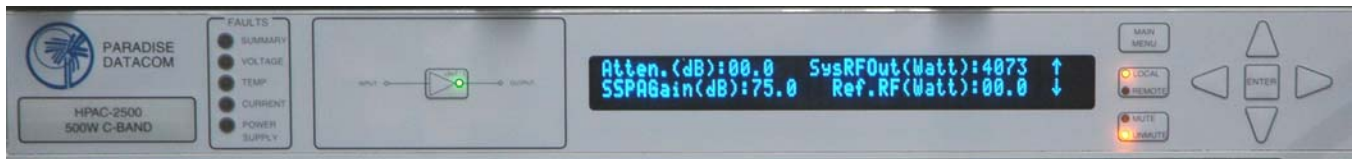
**Figure 3-10: Front Panel Display, Master Module (Online LED Illuminated)**

The Online indicators of the Slave units are always turned off and the VFD displays the message shown in **Figure 3-11**.



**Figure 3-11: Front Panel Display, Slave Unit (Online LED Dark)**

Any unit that develops a major fault condition will be automatically muted to avoid any side effects of the faulted unit on overall system performance.

The Master Module offers two extra informative menu screens for displaying system level information such as: System forward and reflected power levels, system wide gain or attenuation, amount of faulted SSPA chassis in the system, etc.

To avoid control conflicts, slave units are forbidden to gather system-wide information, therefore these system wide information screens always hidden on N+1 Slave units.

### 3.8.2 Controlling System Operation

The N+1 system is under the control of the Master Module at all times. Any system-wide settings changes (local or remote) need to be performed on the Master Module. If a setting is adjusted on a Slave unit, the Master Module will erase and override it with the current system setting.

Some settings are not controlled by the Master Module because they are used for unit identification or required for local adjustment during maintenance. Settings such as the SSPA Network Address, N+1 Address, and IP Address are not enforced by the Master Module and need to be set individually at every SSPA chassis.

The setting for enabling/disabling/sizing the N+1 system is also not controlled by the Master Module. This setting allows the user to virtually remove individual SSPA units from the N+1 control array for maintenance and troubleshooting.

### 3.8.3 N+1 Addressing

During initial system installation, an appropriate N+1 address has to be selected for each unit in the system. Each unit should be assigned a unique N+1 address. The valid addressing range is 1 to 16 for any type of system configuration. Address 0 is reserved for factory debugging and should not be used. Assigning an address higher than the total number of SSPA chassis in the system (i.e., address 10 for a system comprising two 7RU SSPA units) makes the unit thus assigned invisible to the Master Module. The unit will continue to receive commands from the Master Module.

To set the N+1 address of a particular SSPA unit, press the **Main Menu** key; select **6.Redundancy** and press the **Enter** key; select **6.N+1** and press the **Enter** key; select **2.N+1 Addressing** and press the **Enter** key. Enter the desired address by using the **Left Arrow** [◄] and **Right Arrow** [►] keys to increment the ones place and the **Up Arrow** [▲] and **Down Arrow** [▼] keys to increment the tens place. Press the **Enter** key to accept the entered value.

The N+1 address order is not important for system operation. Assign the lowest address to the unit located most conveniently to the user. Subsequent addresses should be assigned while keeping in mind the accessibility of the front panel controls.

See **Section 4.5** for directions on changing the N+1 hierarchy of SSPAs in an active system.

### 3.8.4 Adjust System Gain

Nominal system gain with Auto Gain enabled is 65 dB; nominal system gain with Auto Gain disabled is 70 dB.

To adjust the gain of the system, press the **Main Menu** key; select **3.Operation** and press the **Enter** key; select **5.Attenuation** and press the **Enter** key. Alternately, from any of the System Information menus described in **Section 3.1**, press either the **Left Arrow** [◄] or **Right Arrow** [►] key. Enter a value between 0 and 20.0 dB. If Auto Gain is enabled, the system will reserve 5 dB of attenuator range for gain compensation and attenuation is limited to a value between 0 and 15.0 dB. Press the **Enter** key to accept the entered value.

### 3.8.5 N+1 Automatic Gain Control Option

Any modular hitless SSPA system may exhibit natural gain drift when one or more individual SSPA chassis is removed from the system or malfunctions. The automatic gain control option allows the system to maintain a constant gain level during such events.

This feature is user selectable and can be activated from the SSPA front panel or a remote interface.

To toggle the Automatic Gain Control option, press the **Main Menu** key and select **6.Redundancy** and press the **Enter** key; select **6.N+1** and press the **Enter** key; select **3.Gain Control** and press the **Enter** key. Select either **Auto Gain On** or **Auto Gain Off**. Only utilize other Auto Gain menu selections at the direction of Teledyne Paradise Datacom.

When this option is activated, the SSPA will automatically reserve 5 dB of attenuator range for future gain compensation. This will reduce the maximum SSPA gain by 5 dB. The attenuator range will also be reduced to 15 dB.

Five dB of reserved attenuator range allows the system to fully auto compensate gain when one SSPA module in a single 5RU SSPA unit enters a fault condition.

### 3.8.6 N+1 RF Power Measurements

The N+1 system may be equipped with a dedicated RF power measurement unit. The RF Power Detector provides RMS measurement of Forward and Reflected RF power directly at the output waveguide and this reading is acquired by the N+1 Master unit.

Besides N+1 system level power detection, each individual SSPA unit may be equipped with its own RF power detector. This reading can be viewed at each SSPA unit and may be used for troubleshooting individual SSPA units.

To view the RF power detector reading on the front panel, press the **Main Menu** key, select **1.SysInfo** and press the **Enter** key; press the **Down Arrow** [▼] key to get to Sys Info Page 1.

### 3.8.7 N+1 Fault Detection

The N+1 system carries comprehensive fault detection logic. Each SSPA chassis processes its internal fault conditions as if it was a standalone unit. All N+1 Slave units report any fault state to the Master Module, which is responsible for system wide fault state handling. Failure of any single SSPA unit leads to a minor N+1 alarm on the Master Module. This type of fault condition will not produce a summary system alarm.

The user may view the number of faults in a system from the front panel by pressing the **Main Menu** key of the Master Module; press the **Up Arrow** [▲] key to get to N+1 Master Info Page 2. Any detected SSPA unit alarms present in the system will be displayed at the "N+1 Alarms" screen.

If the Master unit detects two or more failed units, it will report a system-wide Summary alarm (Summary alarm LED on the Master unit will illuminate). The cause of the alarm will not be evaluated by the Master Module. To find cause of the failure, the operator will need to evaluate the local fault conditions of the failed SSPA unit.

## 3.9 Reflected Power Option

When this option is installed, the user may measure the amount of reflected RF power present at the amplifier's output flange, with a dynamic range of 12 dB starting at the maximum RF output.

For example, an amplifier with 50 dBm (100W) of maximum forward RF would be capable of reading reflected power levels from 38 dBm (6W) to 50 dBm (100W). The amount of reflected power can be viewed on the Front Panel Display screen:

1. Press the **Main Menu** key on the front panel;
2. Select **1.SysInfo** and press the **Enter** key.

**Note**: All Teledyne Paradise Datacom SSPAs are protected from short-term 100% reflected power conditions. Teledyne Paradise Datacom does not recommend operating the amplifier under a sustained condition of 100% reflected power. The addition of the reflected power sensor option allows the operator to monitor the amount of reflected power on the amplifier for the purposes of identifying issues with the transmission signal. The user may set up a Major Alarm trigger for High Reflected Power conditions in the Teledyne Paradise Datacom Universal M&C software. This alarm only indicates the presence of the high reflected power condition, and will not alter the amplifier settings to compensate for the condition.

### 3.9.1 Reflected Power Alarm

Because the reflected power circuitry is not a true VSWR measurement, but simply a measure of absolute reflected power, it is possible to set an alarm level. In units with the reflected power monitor option, the alarm level is factory pre-set as a major alarm at 80 percent of the amplifier's rated power.

For example, an amplifier with 50 dBm (100W) of output power would have an alarm level set to 49 dBm (80W).

**Note**: Teledyne Paradise Datacom does not recommend changing this setting from the factory pre-set due to possible frequent false alarms that may be generated if set at a much lower level. However, it is possible to adjust the setting in the Universal M&C software.

## 4.0 Troubleshooting Faults

The 7RU SSPA chassis has five fault condition LEDs on left side of the front panel which reflect a summary fault, and fault states for voltage, temperature, current and the amplifier's power supply. Additional fault reporting is available via the front panel display readout. Figure 4-1 shows a representation of the fault condition indicators.

The following sections describe steps the user should take to determine the cause of a fault state in a stand-alone amplifier.
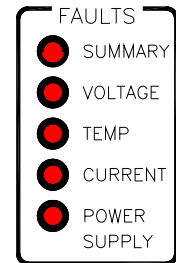
**Figure 4-1:**
Front panel
Fault display

### 4.0.1 Summary Fault

Any of the following four faults (Voltage, Temperature, Current and Power Supply faults) also results in a summary fault state.

### 4.0.2 Voltage Fault

The user should check the voltages displayed on Page 6 of the system information menu of the front panel display. Press the **Main Menu** key, select **1.Sys Info** and press the **Enter** key, then press the **Down Arrow** (▼) key five times (5x).

If the listed voltages are outside of the normal output ranges as described in **Section 3.1.6**, consult the factory.

### 4.0.3 Temperature Fault

If you are experiencing a temperature fault, follow the steps below:

- Check the ambient are temperature of the room where the SSPA is installed. Check the environmental specifications on the specification sheet for your SSPA. If the ambient temperature is beyond these limits, the unit may experience a temperature fault. If this is the case, the operator will need to bring the ambient temperature into the specified range.
- If the ambient temperature is within the specified range and the user still experiences a temperature fault, the user should first perform a visual inspection of the fans to make sure they all appear to be functioning.
- The user should check the front panel read-out out for a fan fault. This can be found under the system information portion of the main menu on the front panel. Press the **Main Menu** key, select **1.Sys Info** and press the **Enter** key, then press the **Down Arrow** (▼) key.
- If a fan fault is present, the operator may need to replace the fan that is not functioning.

- The operator should check the booster board voltages on the front panel display. This information can be found under the system information portion of the main menu on the front panel. Press the **Main Menu** key, select **1.Sys Info** and press the **Enter** key, then press the **Down Arrow** (▼) key five times (5x).
- The voltage should read approximately 28VDC for each of the fans in the SSPA. If the booster voltage is lower than 25VDC, the user should check for a power supply fault and follow the procedures to handle this problem.
- The user should check the baseplate temperature on the front panel display. This data can be found under the system information portion of the Main Menu on the front panel. Press the **Main Menu** key, select **1.Sys Info** and press the **Enter** key, then press the **Down Arrow** (▼) key six times (6x).

## 4.0.4 Current Fault

In the case of a current fault, follow the tips below:

- The operator should check the current displayed on page 6 of the system information menu of the front panel display. Press the **Main Menu** key, select **1.Sys Info** and press the **Enter** key, then press the **Down Arrow** (▼) key five times (5x).

**Note:** If the amplifier is muted, current drops within a range of 0 to 5 A.

## 4.0.5 Power Supply Fault

In the case of a power supply fault, follow the steps below:

- When using an external power supply with the amplifier, verify that all power supply modules are operating normally. Replacement power supply modules are available through technical support.
- Check the power supply readings on the SSPA front panel. Observe any fluctuations and record the level.
- Mute the amplifier. Check the power supply readings on the SSPA front panel. Sometimes muting the amplifier corrects the power supply fault.
- Check the DSUB (alarm) cable that connects between the SSPA and the external power supply. If this cable is pulled or making poor contact, this may cause a false power supply alarm.
- Note that the amplifier M&C logic is designed to mute the amplifier is more than one power supply module faults. If the DSUB power supply alarm cable is removed, the amplifier will continue to operate but will show a persistent power supply fault.

**4.0.6 Fan Fault**

In the case of a fan fault, follow the tips below:

- Inspect the fans.
- The user should check the booster board voltages on the front panel display. This can be found under the system information portion of the main menu. Press the **Main Menu** key, select **1.Sys Info** and press the **Enter** key, then press the **Down Arrow** (▼) key five times (5x).
- The voltage should read approximately 28VDC for each of the fans in the SSPA.
- If necessary, replace the fan (See **Section 2.1.2**).

**4.0.7 Low RF Fault**

In the case of a Low RF alarm, follow the steps below.

- Check the forward RF level on the front panel readout under the system information menu. If the user has access to a power meter or spectrum analyzer, this power level can be verified by means of the output sample port on the front panel.
- Compare this value to the forward RF alarm threshold level in the Fault Set-up menu. If the Threshold level is higher than the actual RF output level, this will produce a low RF alarm, providing that the low RF alarm option is enabled.
- At this point, be sure that the forward RF alarm threshold level is set to a value corresponding to the desired output level for the SSPA in question. The factory pre-set for this value is always 10 dBm below the specified $P_{1dB}$ compression point of the SSPA. However, you may wish to set this level closer to the desired output level in order to catch any minor fluctuations below the set level. If the level is set too high, the low RF alarm may be displayed when there are no legitimate problems. If the RF input signal has been lowered, this will also lower the output of the SSPA and may cause a low RF alarm.
- If the user is certain that the amplifier is in an alarmed state due to problems other than the ones stated above, the user should verify that no other fault conditions are present. If a power supply fault, current fault, or voltage fault is present, this may also cause the low RF alarm to show. If any of these is the case, the user should refer to the sections corresponding to that specific fault.

## 4.1 Removable Controller Card (rear panel)

The Rack Mount SSPA Controller card is a removable assembly located at the rear of the SSPA. The controller card includes connections for the Switch (J3), Serial Main (J4), Serial Local (J5), Programming (J6), Parallel I/O (J7), Link (J8) and Ethernet (J9) ports.

To remove this card assembly, loosen the two restraining thumbscrews at the top left and bottom right of the assembly. See **Figure 4-2**. Slide the assembly straight back from the cavity, as shown in **Figure 4-3**.

A replacement controller card is available from the factory.
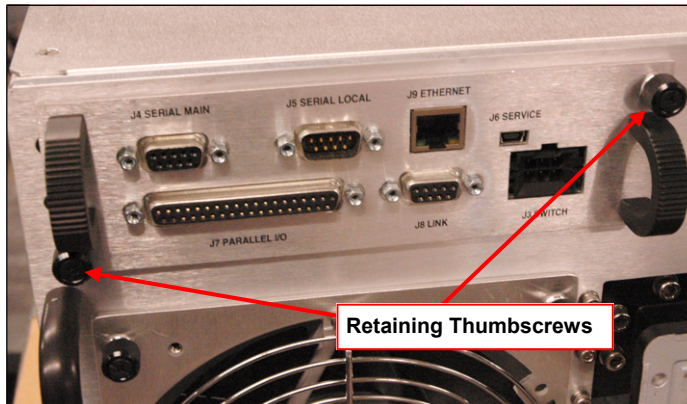


Figure 4-2: Loosen Thumbscrews



Figure 4-3: Slide Out M&C Card

The DigiCore5 controller card is equipped with a configuration DIP switch block, S1. This switch allows the adjustment of certain configuration parameters.

- S1.1 - S1.6 — Factory use only; Preset position is ON-ON-ON-OFF-OFF-OFF;
- S1.7 - S1.8 — These settings allow Enable/Disable galvanic isolation of the Main serial port (J4). Factory preset for these ports is OFF – OFF. This configuration disconnects the Serial Main Ground pin from the chassis ground. If, for any reason, the galvanic ground isolation is not desired, this feature could be disabled by changing the position of switches S1.7 - S1.8 to ON – ON.

**Warning! Disabling galvanic ground isolation increases the risk of serial port electrical damage during lightning strike or other ground potential difference issues. If galvanic isolation is disabled, Teledyne Paradise Datacom suggests connecting/disconnecting wire harnesses to this port only with powered down equipment.**

### 4.1.1 Firmware Upgrade Procedure

Teledyne Paradise Datacom's digital engineers continually strive to improve the performance of RM SSPA software and firmware. As this occurs, software and firmware upgrades are made available.

The DigiCore5 controller board allows two methods for upgrading the unit firmware:

- Upgrade over HTTP link by using web browser;
- Over programming USB connector J1;

The web upgrade is performed over the SSPA IP port and does not require any special software. It can be performed through any suitable web browser.

Upgrade over the USB port requires the installation of specific hardware USB drivers and batch scripts.

#### *4.1.1.1 Required hardware*

The following equipment/hardware is necessary to perform the firmware upgrade.

- Depending on type of upgrade: Win7/XP PC with USB port or PC with available 10/100 Base-T port;
- Mini USB cable or Ethernet patch cable;

#### *4.1.1.2 Required Software*

For web upgrade:
- Web browser (IE, Chrome or Firefox);
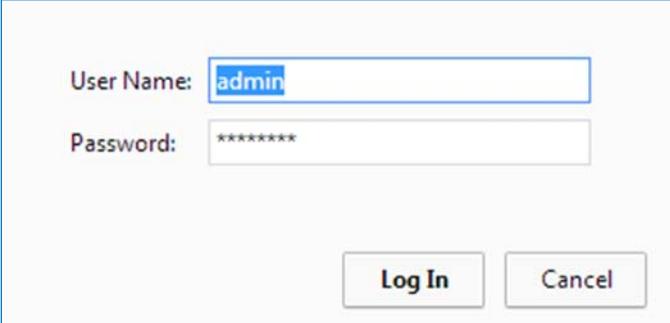
For USB upgrade:
- USB FTDI VCP drivers. Visit the FTDI web page (http://www.ftdichip.com/Drivers/VCP.htm) for the latest set of virtual COM port (VCP) drivers. Drivers need to be installed before making a connection between the PC and the SSPA USB programming port.
- SSPA field programing utility. Contact Teledyne Paradise Datacom technical support to obtain the latest version. The Field Programming utility is typically not required for installation.
- Firmware image upgrade file: code.bin.

### 4.1.1.3 Web Upgrade Procedure

The web upgrade is the preferred method of upgrading the HPA firmware.

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

1. Connect the SSPA to a 10/100 Base-T network or to a PC 10/100 Base-T network adapter. See **Appendix A**.
2. Open a web browser window (Chrome, Firefox or IE are preferred). Enter the following address in the location window of the browser:
XXX.XXX.XXX.XXX/fw/
where XXX.XXX.XXX.XXX is the IPv4 address of the HPA unit. Press Enter.
3. The Upload Form is password protected. An authentication window should come up to ensure authorization. Use "admin" as user name and the HPA web logon password (default password is "paradise"). Click the "Log in" button (see **Figure 4-4**).



**Figure 4-4: Web Upgrade Authentication Window**

4. The firmware upload form will load in the browser window (See **Figure 4-5**). Click the "Choose File" button and select the firmware image code.bin file provided by technical support.



**Figure 4-5: Firmware Upload Form**

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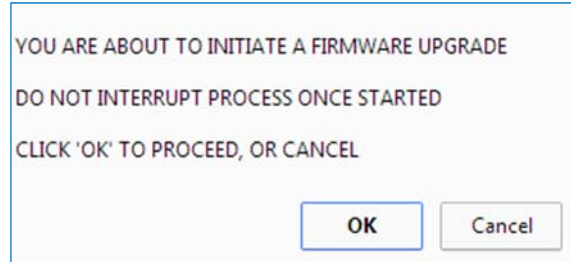


**Figure 4-6: Proceed With Upgrade Prompt**

6. The upload process will begin and the form will be informing about loading process (See **Figure 4-7**). Do not interrupt this process and wait until its completion with positive or negative result. The process may take up to 15 minutes. When completed, the form will notify about end of process. See **Figure 4-8**.
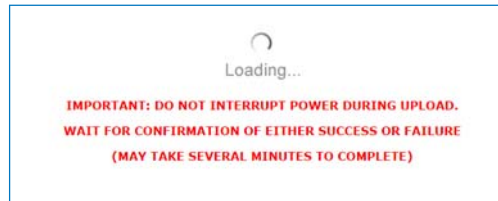


**Figure 4-7: Upload Process Message**



**Figure 4-8: Upload Completed Message**

7. During the upgrade process, the HPA remains fully functional. The new firmware will stay dormant until the next reboot of the HPA control card. Reboot the controller card by selecting the relevant front panel menu or by turning off AC power to the HPA. Browse to the menu firmware information page and verify the version.
8. If the load process was interrupted, for any reason, the HPA may not operate properly after a reboot. It is still possible to recover from the problem by applying firmware upload over USB port. See **Section 4.1.1.4** for details.

### 4.1.1.4 USB Port Upgrade Procedure

1. Contact Teledyne Paradise Datacom support to obtain the latest firmware image and field programing utility. The programming utility package includes an RFU upload utility, a script file and FTDI USB drivers. Use the USB upgrade method only if the web upgrade has failed!
2. Install FTDI VCP driver on the target PC;
3. Connect the USB mini port J1 at the back of HPA unit to an available PC USB port.

**Warning! Connecting J1 to a PC USB will interrupt normal operation of the HPA unit. RF output will be shut down until the USB cable is unplugged!**

4. After connecting the HPA, the target PC should recognize the newly connected hardware and connect to it using the previously installed VCP FTDI drivers. Wait until this process is complete. Check the Windows device manager Ports section and note the newly added USB Serial Port (See **Figure 4-9**). You will need a COM port designator in the next step.
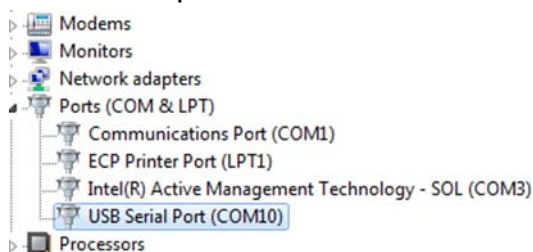


**Figure 4-9: Windows Device Manager > Ports**

5. Locate and run the Upgrade.bat script file which was provided in the upgrade package. The file will open a command prompt window and request the programing serial port designator. Enter the port designator located in previous step and then press **Enter**. The script file will start downloading a new image file to the HPA. The resulting window is shown in **Figure 4-10**;
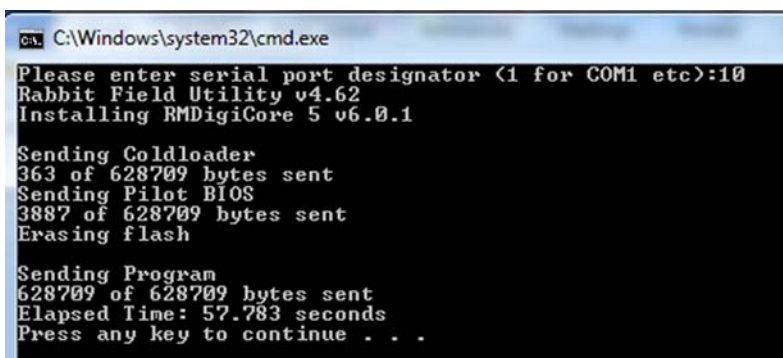


**Figure 4-10: Command Window Showing Program Prompts**

6. Unplug the USB cable from the HPA control card. The HPA unit should restart with the new firmware image.

## 4.2 Fan and Heatsink Maintenance

It is recommended that the cooling system of the SSPA be checked at least once per month. If the environment in the area where the amplifier is being operated produces a large amount of dust and debris, this check should be performed more frequently.

The intake fans of the amplifier can pull airborne debris into the enclosure, and fill the spaces between the heatsink fins. See **Figure 4-11**. As this debris builds up inside the amplifier, the airflow which is important in cooling the amplifier is impinged.



**Figure 4-11: Example of Dust Blocking Heatsink Fins**

Blockage of the heatsink will cause the internal temperature of the amplifier module to rise above what is considered as normal operating conditions. While the amplifiers have thermal protection, long periods of elevated temperatures could reduce amplifier life.

The menu structure available through the front panel can be used to check the amplifier base plate temperature. The base plate temperature should normally not exceed 75 °C. To view the SSPA base plate temperature, press the **Main Menu** key; select **1.SysInfo** and press the **Enter** key; press the **Down Arrow** (▼) key seven times (7x). If the base plate temperature exceeds 75 °C, it is one indicator that the system's airflow requires maintenance.

> **Note:** The amplifier's temperature alarm threshold is set at 85 °C. If the base plate temperature reaches 85 °C, the front panel Temp Fault LED will activate. If the temperature reaches 90 °C, the amplifier will shut down.

The heatsink fins should be visually inspected for excessive dirt and debris build-up. If it appears there is excessive debris in the fans or heatsink; the fan tray can be re-moved for easy cleaning. The front panel intake fan assemblies can be easily replaced with no interruption of service. Replacement fans are available from Teledyne Paradise Datacom.

### 4.2.1 Cleaning Procedure

1. Using a Philips head screw driver, loosen the thumbscrews holding the front fan tray in place.
2. Remove the front panel fan tray. See **Figure 4-12**.



**Figure 4-12: Remove Front Panel Fan Tray**

3. Unplug the fan power cords from the power pole connectors. Each fan has its own power cable. See **Figure 4-13**.
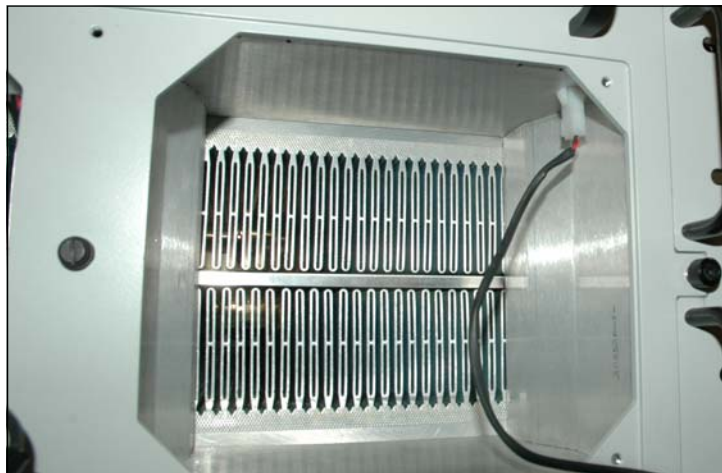


**Figure 4-13: Unplug Fan Power Cords (One for Each Fan)**

4. Use the vacuum to collect all dust and debris.
5. Use a can of compressed air to dislodge any dust or debris lodged within the heatsink fins and the fan assembly. Ensure that the heatsink fins are free from all debris.
6. Plug the fan power cords into the power pole connectors.
7. Re-insert the front panel fan tray.
8. Tighten the thumbscrews which hold the front fan tray in place. Tighten to snug using a Philips head screw driver.

## 4.3 RF Module Removal and Insertion

This section details the procedures that should be followed when removing and replacing a fault-free RF module from the chassis. A failed module will be automatically ready for ejection.

### 4.3.1 Module Ejection Procedure

Before removing fault-free RF module, perform the following procedure. This procedure may also be used as a way of modeling an RF module failure. This procedure can be skipped when removing an RF module which exhibits a true internal fault condition.

1. Press the **Main Menu** key on the front panel;
2. Select **5.Options** and press the **Enter** key;
3. Select **6.Redund**. and press the **Enter** key;
4. Select **6.N+1** and press the **Enter** key;
5. Select **5.ModuleEject** and press the **Enter** key;
6. Select **1.Eject Module** and press the **Enter** key;
7. Select appropriate module to be ejected and press the **Enter** key. Refer to **Figure 4-14** for the location of each RF module in the chassis.
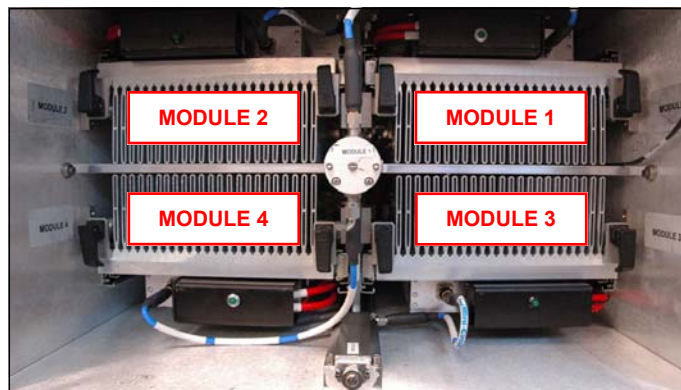


**Figure 4-14: RF Module Locations**

8. Once the module is removed, the amplifier will exhibit a summary alarm and the appropriate module online indicator will turn down.

### 4.3.2 Module Insertion Procedure

When inserting a new module into the chassis, the following procedure should be performed. This procedure prepares the amplifier for the insertion of an RF module, which immediately adjusts the gain to a proper level. This procedure will minimize the gain transition time and allow the operator to make and secure all connections without disturbing amplifier gain.

1. Press the **Main Menu** key on the front panel;
2. Select **5.Options** and press the **Enter** key;
3. Select **3.LampTest**. All front panel LEDs will illuminate;
4. Insert new module and connect RF input;
5. Check all connections and secure the module with side latches;
6. Re-connect the fan power cables and replace the front panel;
7. Press the **Enter** key to exit the Lamp Test.

## 4.4 Phase Adjustment

The phase adjustment of the 7RU SSPA chassis was completed at the factory to ensure optimum output power across the frequency range. In the event an amplifier module should fail and is replaced with another amplifier module with a slightly different phase, the phase of the chassis will need to be adjusted for best performance.

After installing the replacement amplifier module, attach a power meter or spectrum analyzer to the offline coupler and measure the power output of the unit. The phase of amplifier module 4 is used as the baseline for modules 1, 2, and 3.  If no test equipment is available, output power can be monitored from the front panel of the unit by putting the unit in N+1 mode. Press the **Main Menu** key and select **1.Sys Info**. The System RF Output Power (SysRFOut) is shown in the top right of the front panel display. See **Figure 4-15**.

<div align="center">

Atten.(dB):XX.X        SysRFOut(dBm):XX.X
AutoGain(dB):XX.X    Ref.RF(dBm):XX.X

</div>
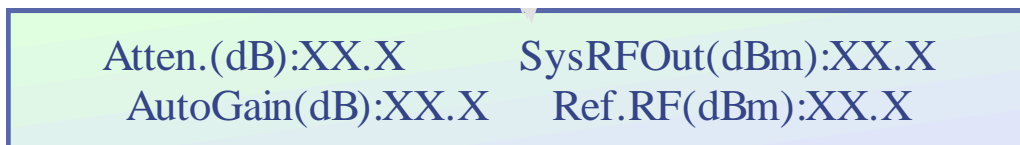
**Figure 4-15: Front Panel Display of System RF Power**

While observing the output power, use a screw driver to rotate the phase adjuster set screw for SSPA 1. Turn the adjuster clockwise or counterclockwise depending on which direction increases the output power; maximize the power at that frequency.  Work through the phase adjustment of SSPA 1, SSPA 2 and SSPA 3 until the total output power is maximized.

## 4.5 Changing N+1 Hierarchy

Normally, the hierarchical structure of the N+1 array must be set during initial system setup. However, the operator may change the N+1 addressing hierarchy at any time. To ensure uninterruptible system operation during such system maintenance, certain procedural steps must be followed.

### 4.5.1 Changing Hierarchical Order of Slave Units

To change the hierarchical order of N+1 slave units without interrupting the system operation:

> **Important!** The Master Module will lose connection to one of the slave units for the duration of this procedure. If the system is in Auto Gain mode, this condition will cause gain overshoot. Temporarily turn off the Auto Gain feature.

1. Turn off Auto Gain setting at the Master Module.
2. Temporarily set the N+1 Address setting of the first slave unit to a value greater than the N+1 array size. For example: A system of 4 units has a N+1 array size of 4, so set the unit to a N+1 Address of 5 or above; a system of 8 units has a N+1 array size of 8, so set the unit to a N+1 Address of 9 or above, etc.
3. Change the N+1 Address of the second slave unit to the former N+1 Address of the first slave unit.
4. Change the N+1 Address of the first slave unit to the former N+1 Address of the second slave unit.

5. The system addressing hierarchy is now exchanged between first and second slave unit.
6. Reset the Auto Gain option to the previous setting, if required for normal system operation.

## 4.5.2 Exchange N+1 Privileges Between Master and Slave Units

To delegate master privileges to a slave unit without interrupting system operation:

1. On the slave unit intended to be set as new Master Module, set the N+1 address value to "0". Assuming the unit is free from internal faults, the unit will instantly change its mode to Master.
2. On former Master Module, set its N+1 address to match the address of the former slave unit.
3. On the new Master Module, change the N+1 address value from "0" to the address value of the former Master Module.

## 4.5.3 Add an SSPA Unit to the System

If one of the SSPA units was removed from the system or it down for maintenance, adding it back to system array may cause an unexpected change to a system state. To provide uninterruptible system operation, follow the procedure below.

1. Locate the current Master Module and change its N+1 address value to "0";
2. If the new unit has an unknown N+1 Address or has not been configured for N+1 operation, turn off the Auto Gain option;
3. If the new unit has a known N+1 Address in conflict with one of the current SSPA slave units, resolve it by changing address of the current slave unit.
4. Add new unit to the system. Make sure the newly added unit assumes N+1 slave mode. Make sure the current Master Module doesn't detect any N+1 faults.
5. Change Master Module  N+1 Address from value "0" to it's previous value.
6. If hierarchical order change is required.

## 4.6 System Gain and Power vs. Number of Modules in System

With parallel system architectures the amplifier output power capability and gain will change as the number of active modules vary. The 7RU SSPA chassis is designed so that the overall system gain will remain constant in the event of a single module failure. This is achieved when the system is operated in "Auto-Gain Control" mode (See **Section 3.8.5**).

**Figure 4-15** shows the system gain and maximum output power for a 7RU SSPA chassis with a failure in one, two, and three SSPA modules.
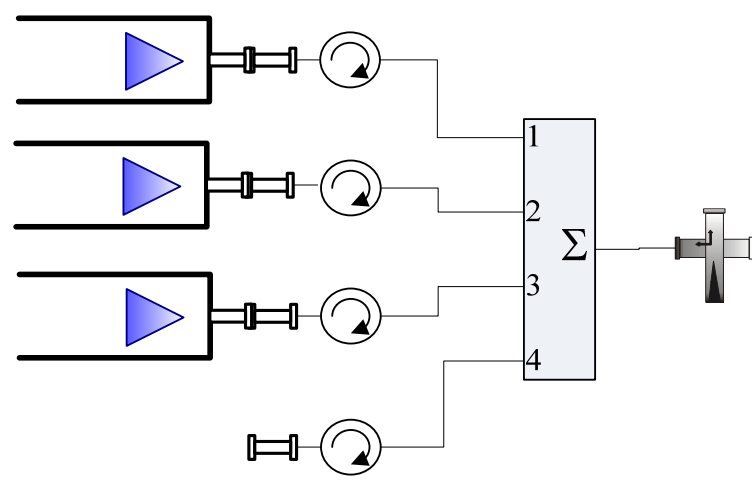
**ONE SSPA MODULE FAILURE**

**Gain Change**　　　　　　**Max. Out-**
**put Power**

**Auto On = 0 dB**　　　　　**-2.5 dB**
**Auto Off = -2.5 dB**
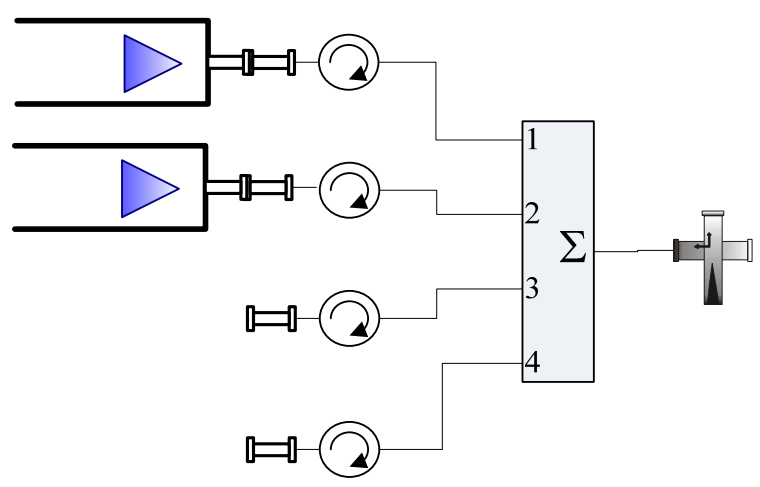
**TWO SSPA MODULE FAILURES**

**Gain Change**　　　　　　**Max. Out-**
**put Power**

**Auto On = -1.0 dB**　　　　**-6.0 dB**
**Auto Off = -6.0 dB**
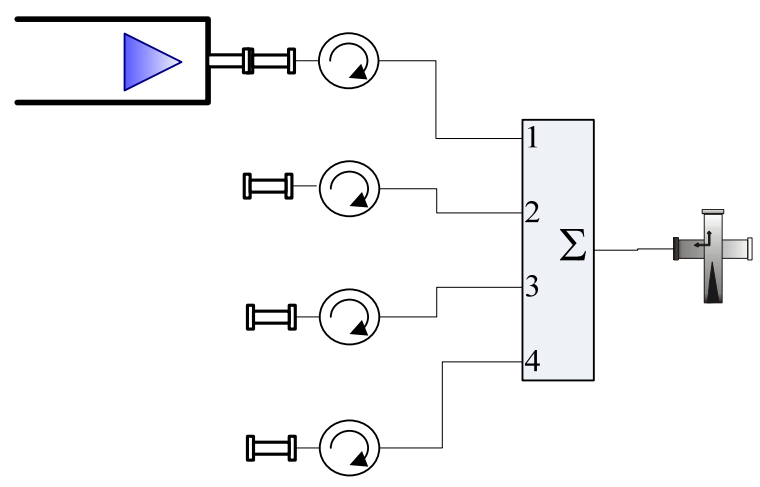
**Figure 4-15: Gain Reduction Due to Failed SSPA Modules**

## 5.0 Block Up Converter Overview

Teledyne Paradise Datacom SSPAs are available with various L-Band up converter options. The primary up converter option is the Zero dBm Block Up Converter, zBUC. The zBUC® block up converter is offered in C-Band, X-Band, and Ku-Band configurations. See **Table 5-1** for specifications on the respective models. The zBUC converter offers ultra low phase noise for applications where phase noise is an overriding factor.

The type of BUC housed within your SSPA is indicated by its model number, as shown in **Figure 5-1**. The example in **Figure 5-1** shows a 800W C-Band 7RU Rack Mount SSPA with Internal Reference zBUC converter. For a full description of this configuration matrix, refer to the 7RU Rack Mount SSPA specification sheet (208114).

HPA C 7 8 0 0 A R M X H X X

Band
Power Level (Watts)
Frequency Sub Band
7RU Rack Mount SSPA

Configuration Modifiers
System Configuration

**Block Up Converter**
M = Internal Reference ZBUC
P = External Reference ZBUC
X = None
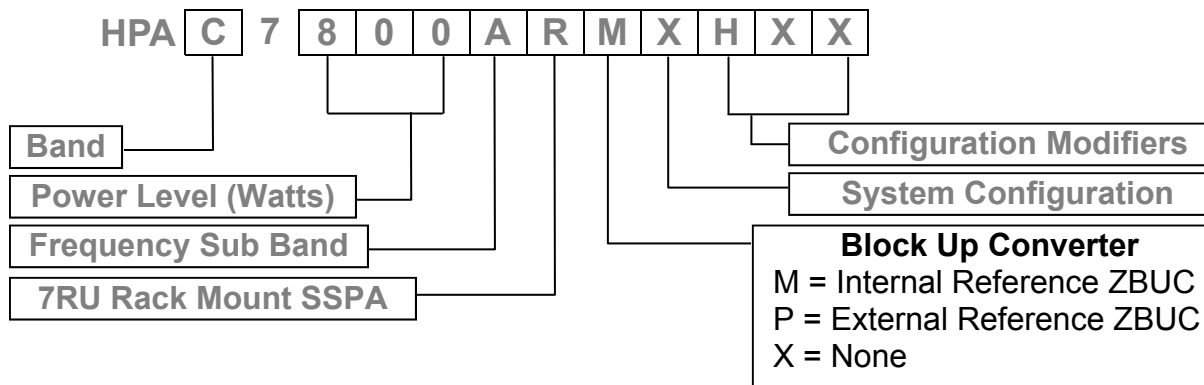
**Figure 5-1: Configurator, 7RU RM SSPA, BUC Options**

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

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

The block up converter is powered from a +15 VDC supply available from the Back Plane Board Assembly of the SSPA. The Block Up Converter is simply cascaded with the SSPA at the input of the amplifier. **Figure 5-2** shows the basic block diagram of the system.
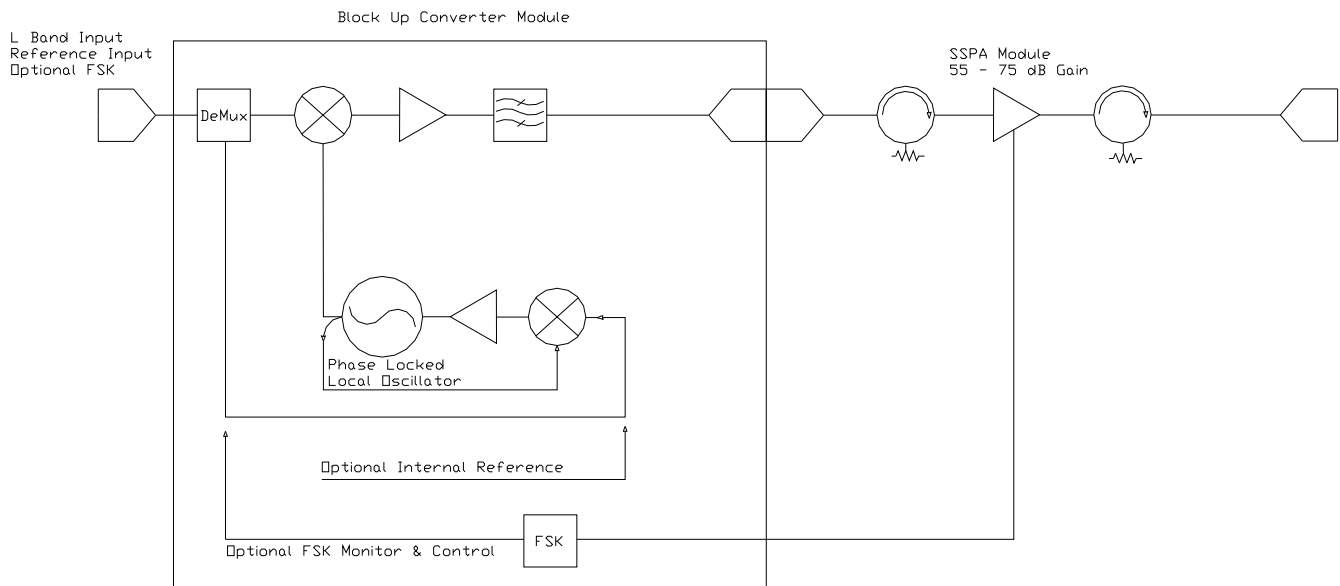


**Figure 5-2: Block Diagram of Block Up Converter / SSPA System**

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

**Note:** Unless the zBUC converter has the built-in internal reference option, with no 10 MHz reference signal present on the IFL input there will be no output signal from the SSPA.

## 5.1 zBUC Converter Features

This section describes the features available in the new Teledyne Paradise Datacom zBUC[TM] converter. The zBUC converter is available as an option for the SSPA. **Table 5-1** shows the specifications for the respective models.

**Table 5-1: zBUC Converter Frequency Specifications**

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

## 5.2 zBUC Converter Theory of Operation

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

The zBUC converter utilizes single up conversion from L-Band to the desired RF band. The local oscillator circuits are designed to maintain the lowest possible output phase noise. The frequency synthesizer utilizes industry leading technology which allows for phase noise performance previously unattainable in PLL design. The typical phase noise specification is outlined in **Table 5-2**.

**Table 5-2: zBUC Converter RF Output Phase Noise**

| Offset | Guaranteed Max. | C-Band (typical) | X-Band (typical) | Ku-Band (typical) | Units |
|--------|-----------------|------------------|------------------|-------------------|-------|
| 10 Hz | -30 | -60 | -58 | -56 | dBc/Hz |
| 100 Hz | -60 | -74 | -70 | -67 | dBc/Hz |
| 1 kHz | -70 | -84 | -80 | -78 | dBc/Hz |
| 10 kHz | -80 | -100 | -94 | -91 | dBc/Hz |
| 100 kHz | -90 | -105 | -97 | -94 | dBc/Hz |
| 1 MHz | -90 | -125 | -122 | -120 | dBc/Hz |

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

## 5.3 Smart Reference Technology

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

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

> **Note:** The external reference option requires the system operator to provide system reference to the zBUC/SSPB. The system will not lock and will have no output without external reference applied.

> **Note:** Internal reference option allows for either internal or external reference operation.

### 5.3.1 Specifications of Internal Reference Crystal

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

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

## 5.4 Typical System Configuration

This section shows a rack mount SSPB in a common system application. **Figure 5-3** shows the amplifier used with a Teledyne Paradise Datacom PD25 Evolution Series L-Band Modem.



IF: 950 – 1450 MHz (-30 TO -20 dBm) at SSPB
Ref: 10 MHz (-5 dBm to +5 dBm) at SSPB
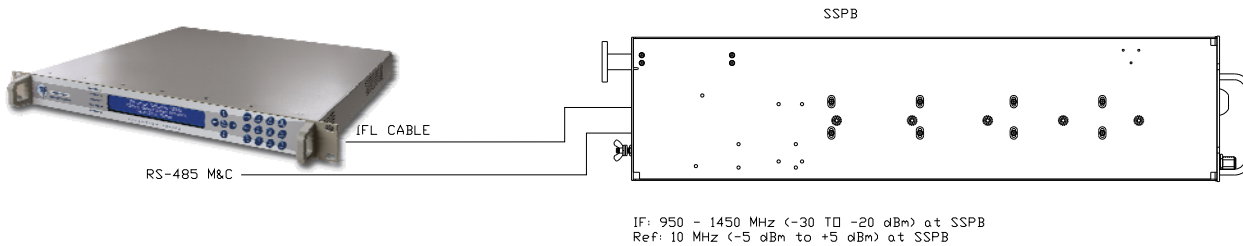
**Figure 5-3: SSPB Chassis with Evolution Series  Modem**

## 5.5 IFL Cable Considerations

Consideration should be given to using a high quality IFL between the indoor and outdoor equipment. The system designer must always consider the total cable loss for a given length and also the implications of the slope of attenuation across the 950 to 1450 MHz bandwidth. **Table 5-3** gives the approximate attenuation vs. frequency for a variety of cable types.

**Table 5-3:  Common Coaxial Cable Characteristics**

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

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

THIS PAGE LEFT INTENTIONALLY BLANK

## 6.0 Download the Universal M&C Application

The Teledyne Paradise Datacom Universal M&C software is available for download from the company website, www.paradisedata.com. Click on the "Downloads" link and click on the link for the Paradise Datacom Universal M&C software; the 7RU SSPA requires version 4.4.8b or later. Install the software on the computer which will be connected to the system and launch the application.

## 6.1 Add Each RM SSPA to the Universal M&C

To add a new unit, choose "Action → Add Unit" from the Main Menu. Then choose "Rackmount SSPA" as shown in **Figure 6-1**. When a unit type is chosen an "Add Rackmount SSPA" dialog will appear for the particular unit you are adding, as shown in **Figure 6-2**.
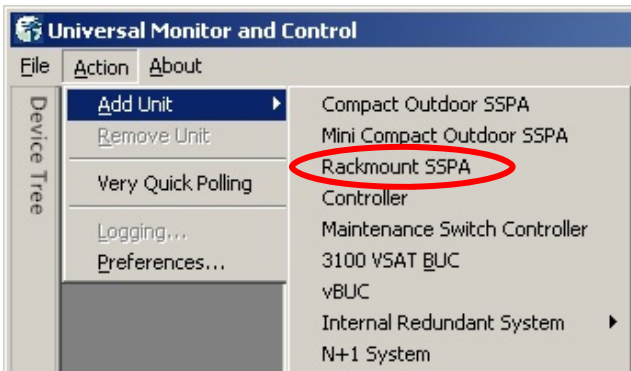
**Figure 6-1: Select Rackmount SSPA**
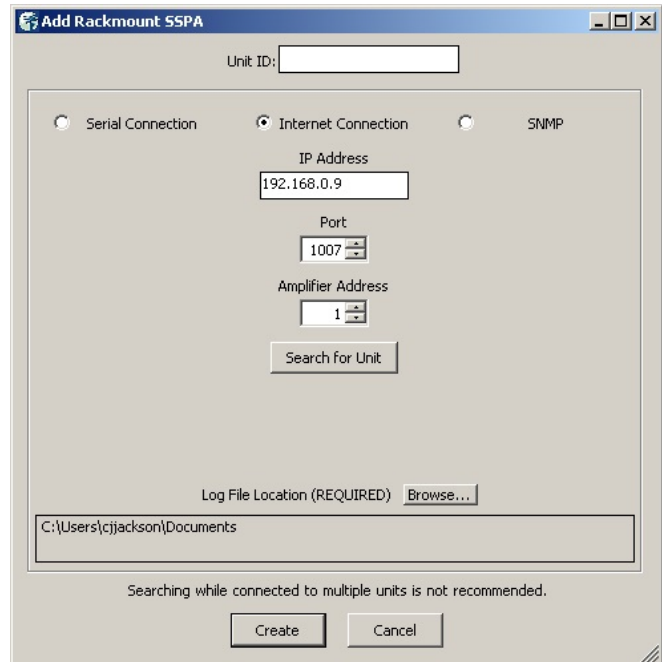
**Figure 6-2: Add Rackmount ►**
**SSPA Dialog Window**

To add a SSPA to the M&C Utility, fill in the appropriate boxes in the "New Rackmount SSPA" dialog window. A Unit ID is not required although it is recommended. If a Unit ID isn't entered the Unit ID will be assigned by the M&C.

To add a unit connected to a serial port you must supply a Port and a Baud Rate. The default baud rate is 9600.

To add a unit connected via UDP (TCP/IP) you must supply either an IP Address or Hostname. Specify the Unit's Unique Address in the Amplifier Address box. If you don't know the address of the unit you may search for it. Be aware that this search feature is only useful when you have only **one** unit connected to your PC at a time.

Choose a log file location by clicking the "Browse" button. The default is the "My Documents" folder. The log file name will be the Unit ID and the extension ".log" appended to it; i.e. "Unit1.log".

Repeat this procedure for each unit in the PowerMAX system.

## 6.2 Add N+1 System to the Universal M&C

If utilizing several 7RU SSPA chassis in a N+1 configuration, the user will need to add N+1 system control to the Universal M&C. Choose "Action → Add Unit" from the Main Menu. Then select "N+1 System" as shown in **Figure 6-3**.
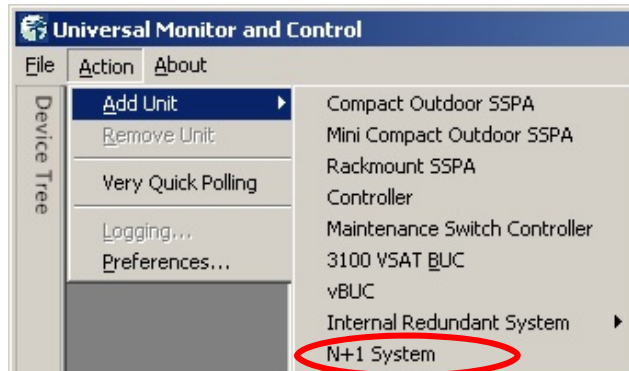


**Figure 6-3: Select 'N+1 System'**

An "Add N+1 System" dialog window will appear, as shown in **Figure 6-4**. Select the Unit Name for each unit in the system and enter a System Name. Click on the [OK] button to initialize the system. The System window may take several moments to load as the software collects and compiles the data from each unit in the system.
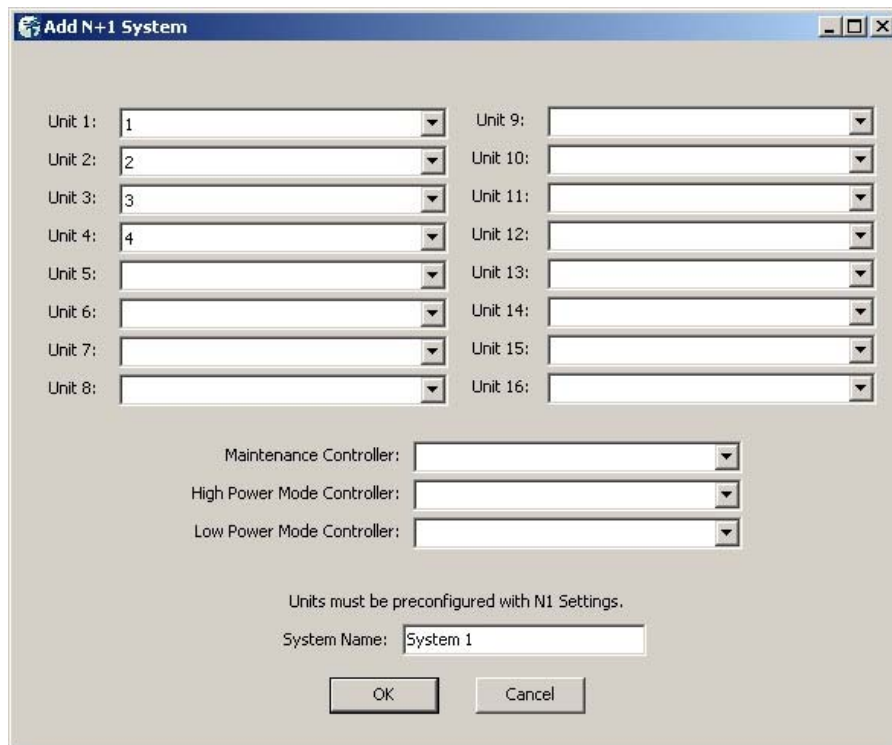


**Figure 6-4: Add N+1 System Dialog Window**

## 6.3 Universal M&C Overview

The Universal M&C software allows the user to monitor the condition of each connected SSPA and the condition of the entire N+1 system. **Figure 6-5** shows a typical Universal M&C screen with four (4) SSPA units (tabs labeled 1, 2, 3, 4) and one (1) system (tab labeled PowerMAX System) being monitored.

The first screen is the "Status" tab shown in **Figure 6-5**. The status screen reflects the current conditions (or state) of the Rack Mount SSPA. In addition, the status screen allows the user to Mute or Unmute the carrier and manually adjust the on-board Attenuator for gain control.
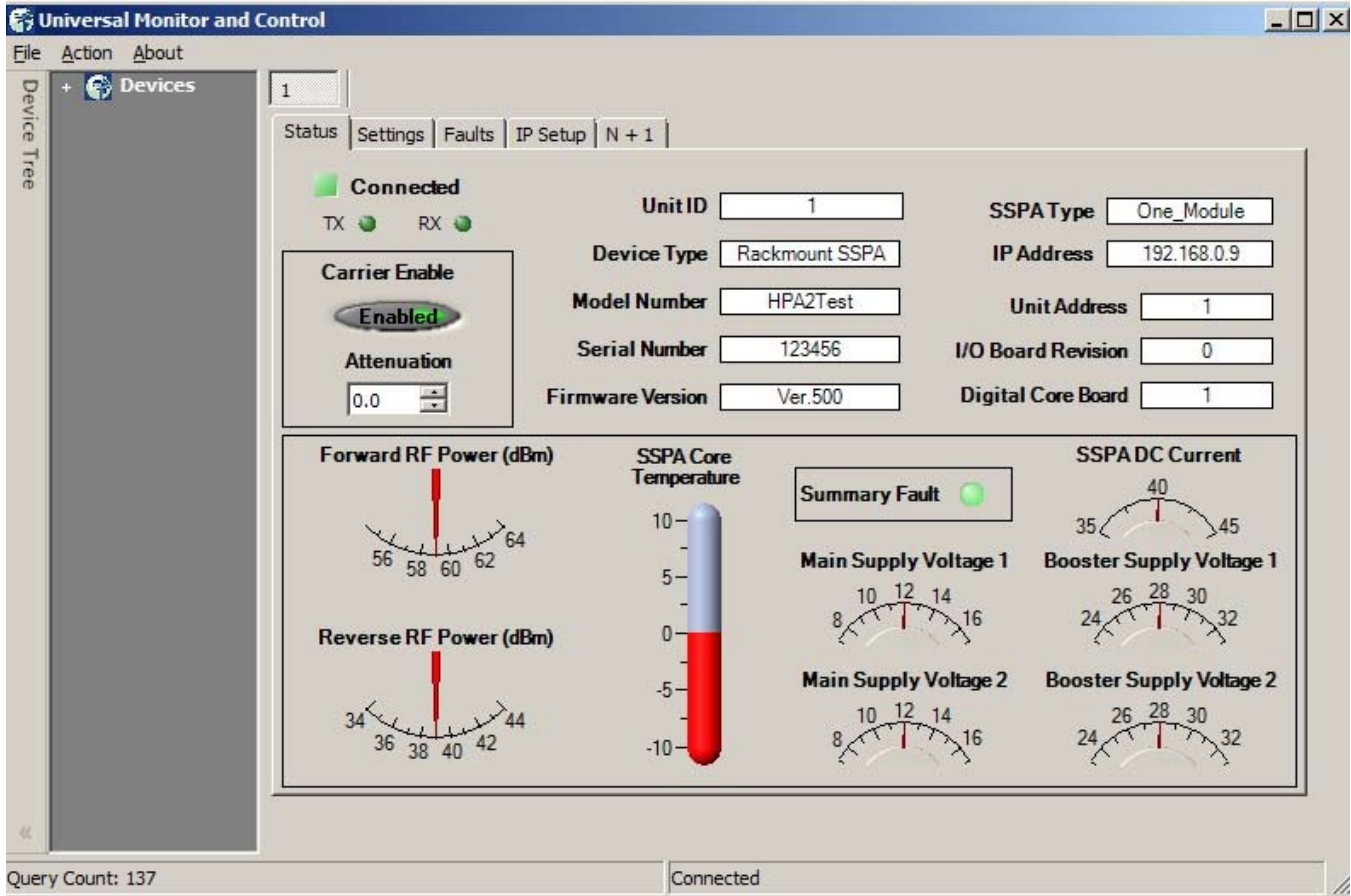


**Figure 6-5: Status Screen**

The Status screen displays the model number, serial number, firmware version and various network information for the connected unit. The core SSPA temperature, forward RF power and voltage and current readings are also displayed.
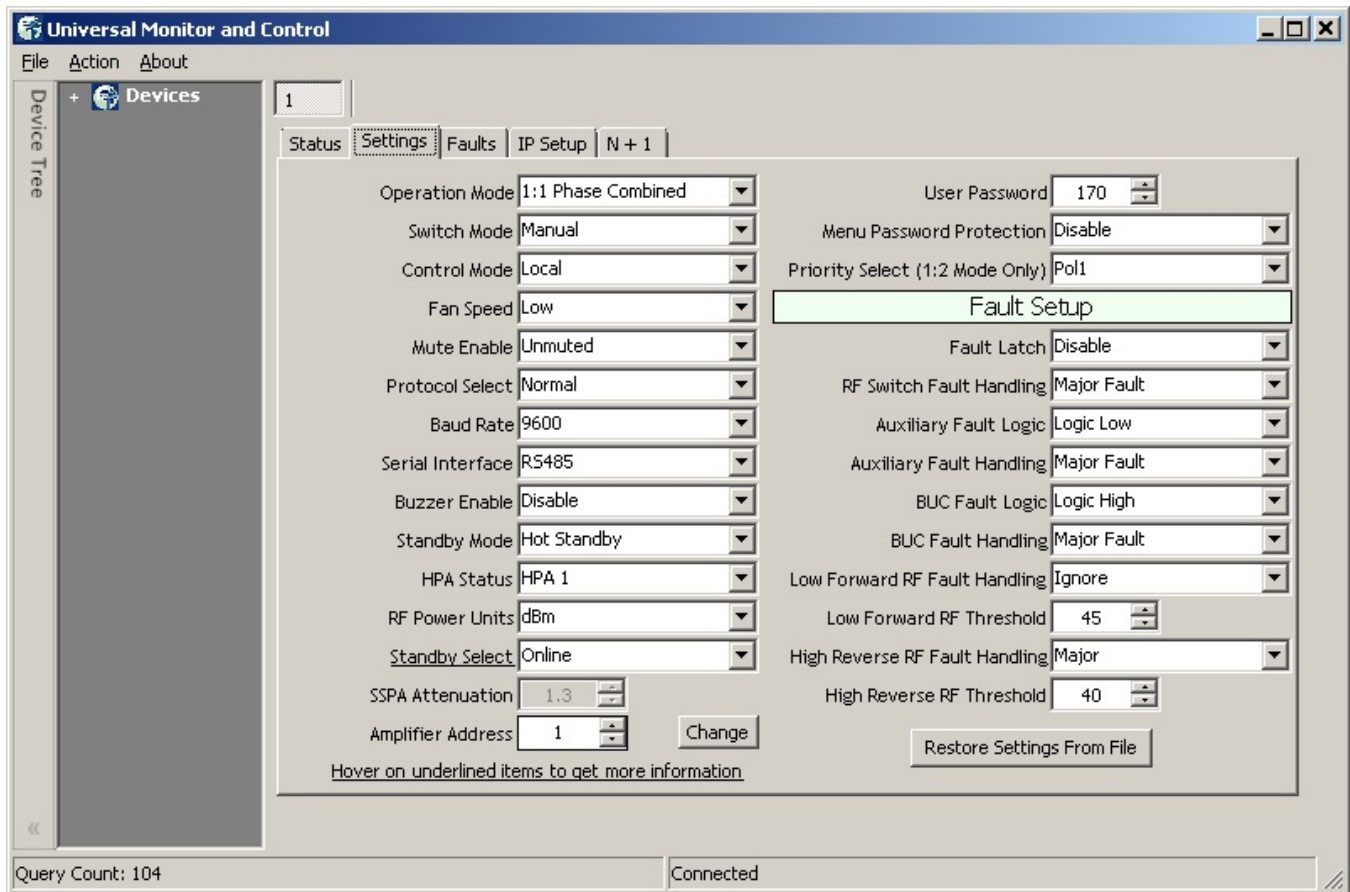
**Figure 6-6: Settings Screen**

The second screen is the "Settings" screen, shown in **Figure 6-6**. It displays the available settings on the selected SSPA.

All user-adjustable settings may be modified to suit the specific needs of the customer. However, it should be noted that the Rack Mount SSPA is configured for the customer at the factory. If any settings need to be modified, please refer to the Rack Mount SSPA Manual.

> **Note:** The Standby Select setting allows the operator to select whether the unit should start up as the on-line amplifier or the standby amplifier. When in a redundant system configuration, if the amplifier Standby Select setting is changed from the Online state to the Standby state, the system will drive the switch so that another amplifier in the system is in the Online state. Only the Online amplifier can give away its Online state. This setting is saved upon unit shut-down, and the unit will start up in the last saved state. The Standby Select setting corresponds to Data Address 17 in **Table 7-6**.

**Figure 6-7: Faults Screen**

The third screen is the "Faults" screen, shown in **Figure 6-7**. It displays the status of all faults affecting the Rack Mount SSPA. In addition to the SSPA as a whole, each of the component RF modules in the SSPA is monitored for faults. If a module is not installed in an SSPA, the notation for that module will show up as "N/A" in the status box.

The software also monitors the fault conditions for the following alarms:

- Summary Fault
- Standby State
- Power Supply
- Low DC Voltage
- Low DC Current
- Fan
- BUC
- High Temperature
- Low Forward RF
- High Reflected RF
- Auxiliary
- RF Switches 1 and 2 (when applicable)
- Optional Faults (Ports 1 and 2)
- Cabinet Impeller (when applicable)
- PreAmp (when applicable)

See **Section 4: Troubleshooting and Maintenance** for tips on clearing faults.
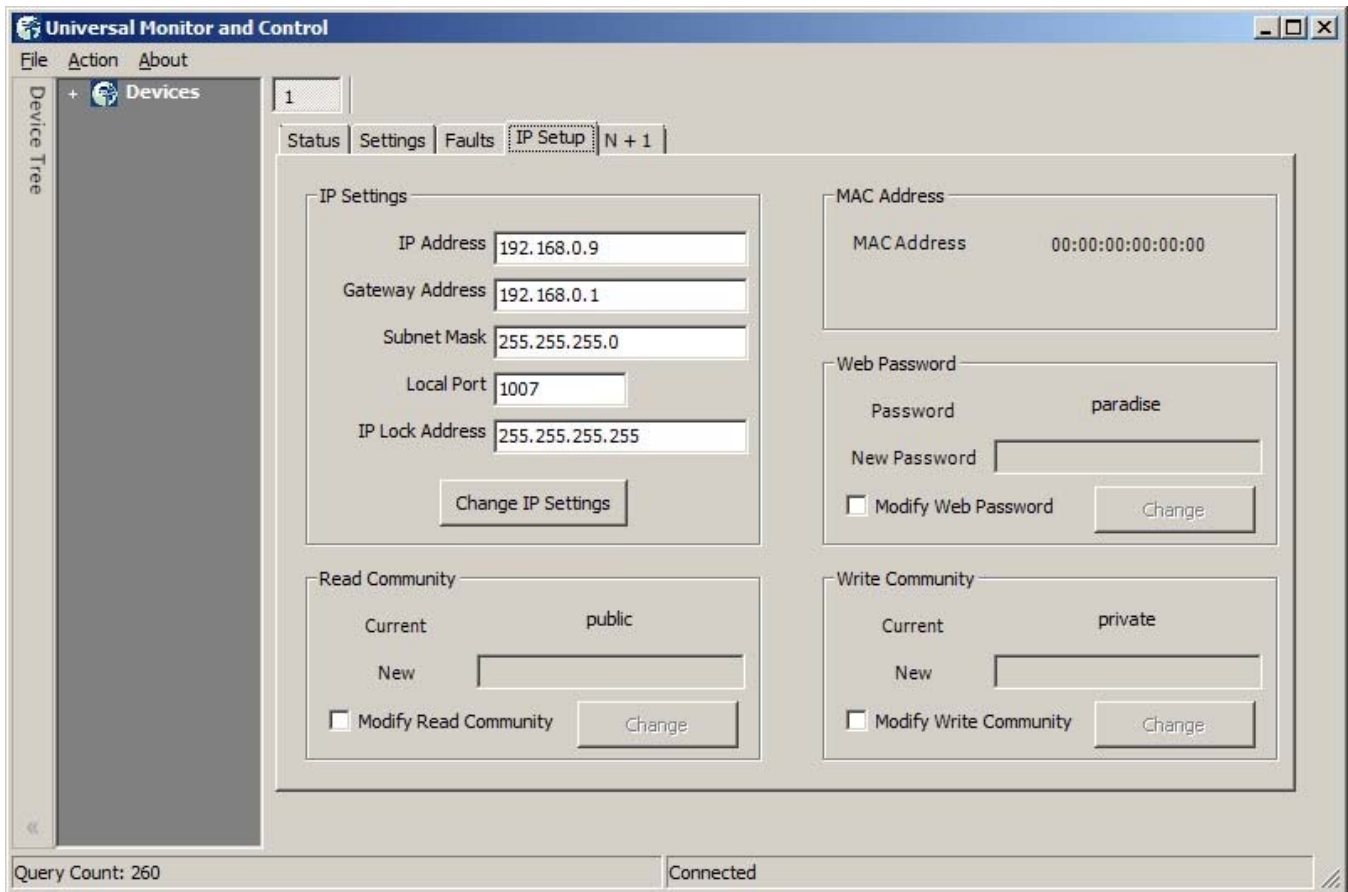
**Figure 6-8: IP Setup Screen**

The fourth screen is the "IP Setup" screen, shown in **Figure 6-8**. It shows the user all of the TCP/IP settings on the Rack Mount SSPA.  When the IP Address is modified the SSPA must be reset for it to use the new IP Address. Until the SSPA is reset it will use the old IP Address.

The Amplifier Local Port is the port that the SSPA listens to for UDP requests. The SSPA also answers requests using the same port. If the Amplifier Local Port is changed, the SSPA must be reset.

The Gateway Address and Subnet Mask are standard settings for TCPI/IP communications. If either of these settings is changed the SSPA must be reset for the new settings to take effect.

The IP Lock Address is used for security. If it is set to something besides 0.0.0.0 or 255.255.255.255 it will only answer the address it is set to. For example, if the IP Lock Address is 192.168.0.50 then a request from 192.168.0.100 will not be accepted. The IP Lock Address may be changed without resetting the SSPA.

The fifth screen is the "N+1" screen, used for systems utilizing N+1 operation. Each module in an N+1 array is assigned a priority address and array size. Depending on whether the unit is assigned Master status or Slave status (the lowest priority address in the N+1 array assumes the Master status), the N+1 screen will show slightly different information. **Figure 6-9** shows the display for the Master unit.
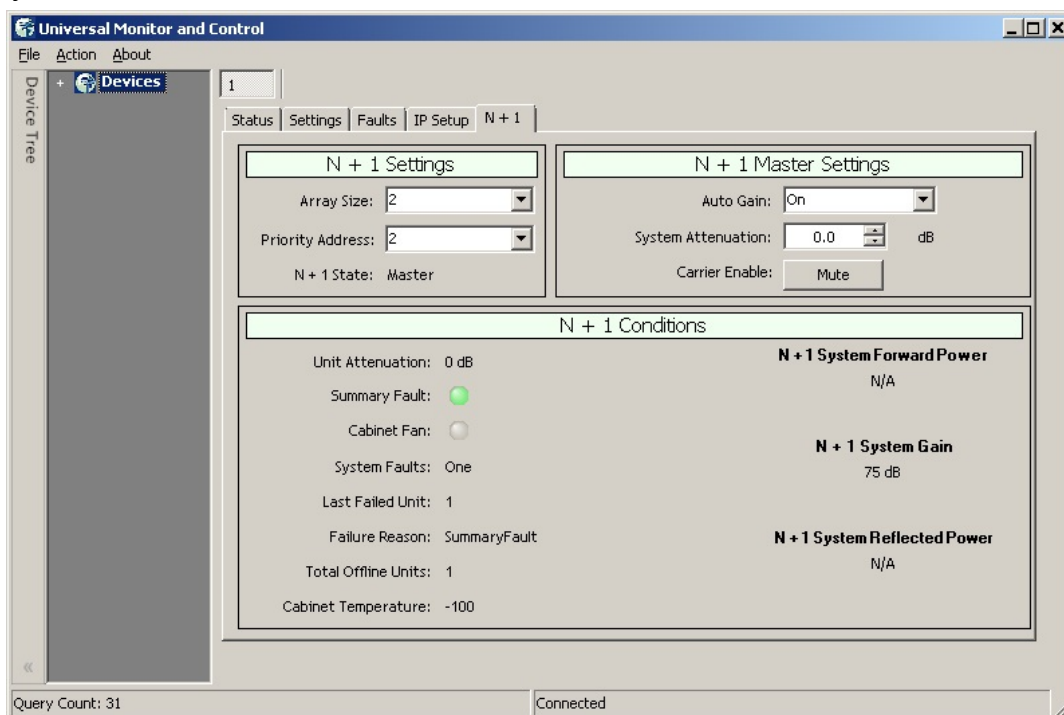


**Figure 6-9: N+1 Screen (Master)**

**Figure 6-10** shows the display for the Slave units.
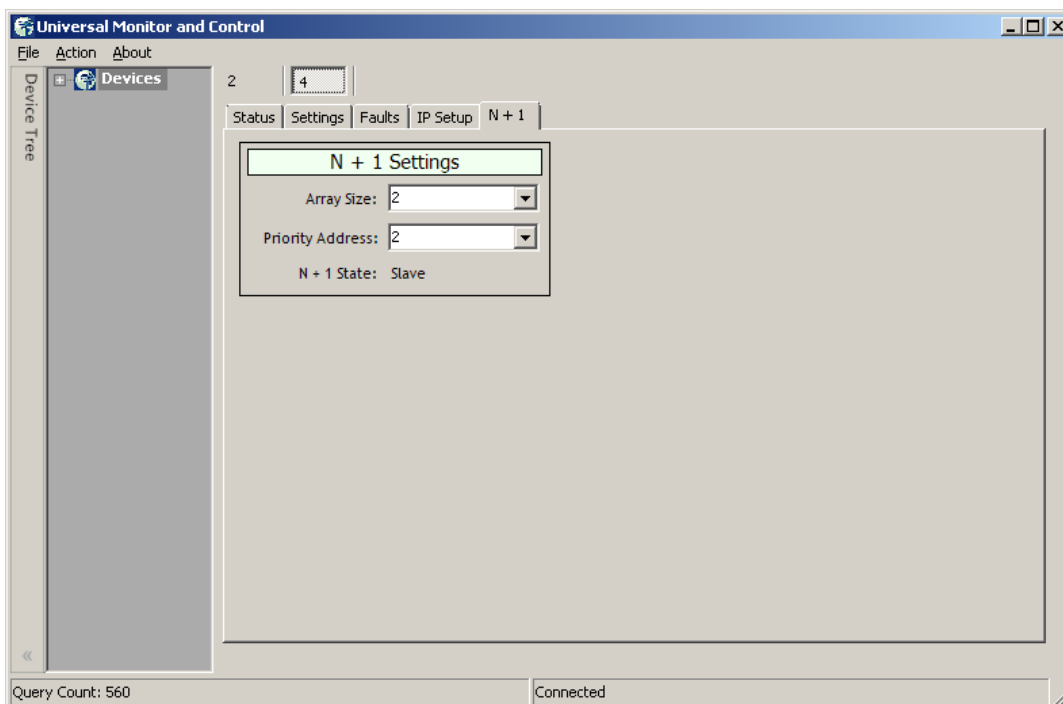


**Figure 6-10: N+1 Screen (Slave)**

The N+1 System Overview screen is available for units in an N+1 array. Each of the units in the array has its own individual Status, Settings, Faults, IP Settings and N+1 tabs. These
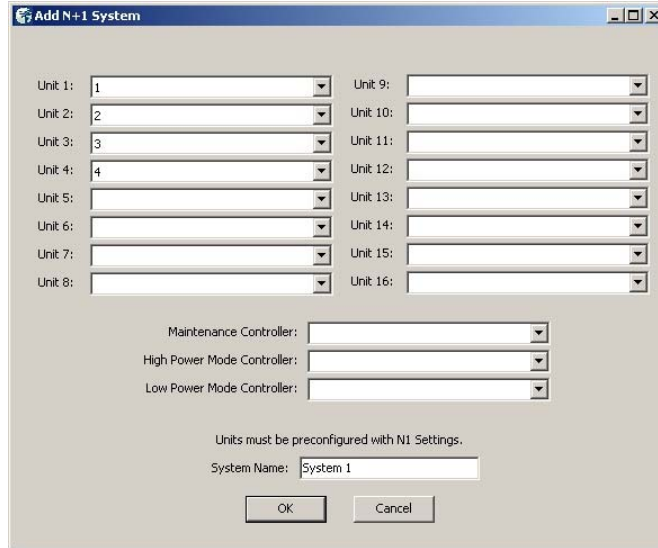


**Figure 6-11: Add N+1 System Window**

units can be combined into a system by selecting Action > Add Unit > N+1 System from the pull-down menu. See **Figure 6-11**.

As shown in Figure 6-12, the resulting System tab shows an overview of each unit in the system, and overall system performance. See **Figure 6-12**.
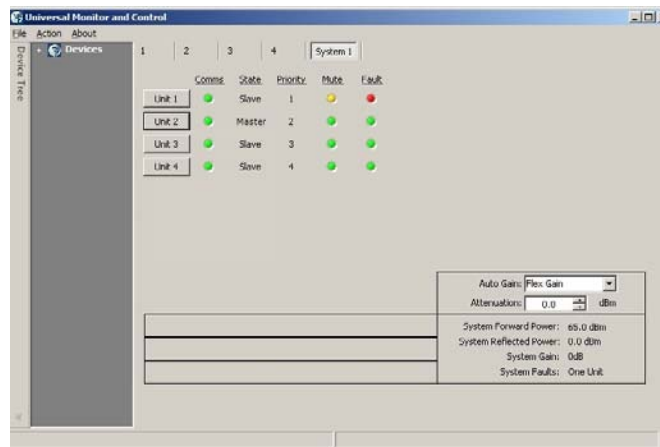


**Figure 6-12: N+1 System Overview**

For each unit in the system, the PowerMAX System tab displays the unit's serial number, comms status, master/slave state, N+1 priority in the system, mute state and fault state.

Also shown are the entire system forward power, reflected power, gain and faults. A checkbox at the lower right of the window allows the user to quickly enable or disable the Auto Gain function.
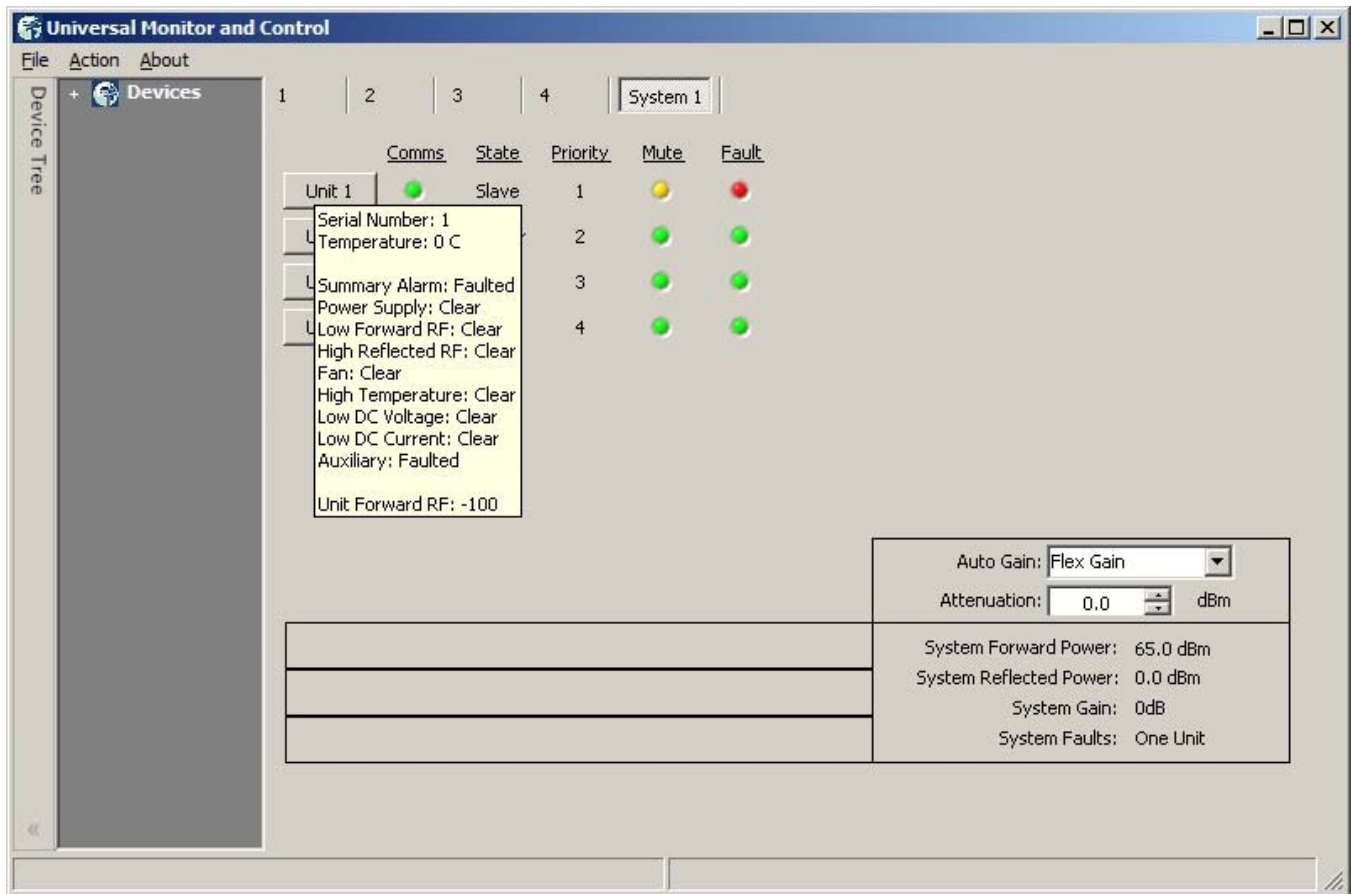
**Figure 6-13: Mouse-over Unit # for Condition Synopsis**

By hovering the mouse over the individual unit buttons, as shown in **Figure 6-13**, the unit's conditions are detailed.

Click on the button to switch to the status tab for that unit.

THIS PAGE LEFT INTENTIONALLY BLANK

## 7.0 Overview

A system which includes an SSPA can be managed from a remote computer over a variety of remote control interfaces (see **Figure 7-1**).
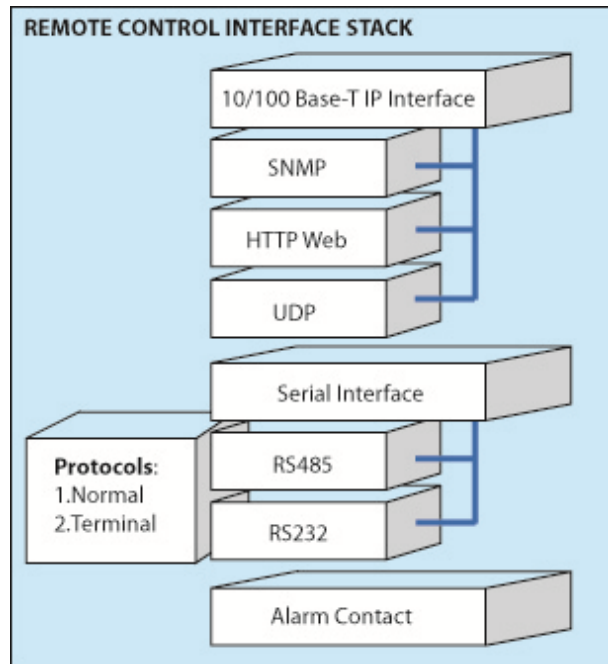


**Figure 7-1: Remote Control Interface Stack**

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 7.2**) and ASCII based protocol suitable for HyperTerminal applications (see **Section 7.5**). 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 7.6.1**);
- SNMP V1 with support of SNMP traps (**Section 7.6.2**);
- HTTP web interface (**Section 7.6.1.3**);

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 Hyper-Terminal program or through an actual hardware terminal.

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

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

The RS485 interface pin-out is compatible with most 9-pin RS485 adapters. The interface always works in half-duplex mode and is suitable for either 4- or 2- wire RS485 configurations. A 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.

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

**Table 7-1** shows a list of enabled interfaces depending on the chosen interface setting.

**Table 7-1: 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) |

Serial protocol is an independent selection and allows support of Normal or Terminal mode protocols. Operation over IP interface remains unchanged regardless of serial protocol selection.

## 7.1 Remote Control - Parallel

### 7.1.1 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 7-2**. The form C relay contact outputs are listed in **Table 2-2**.
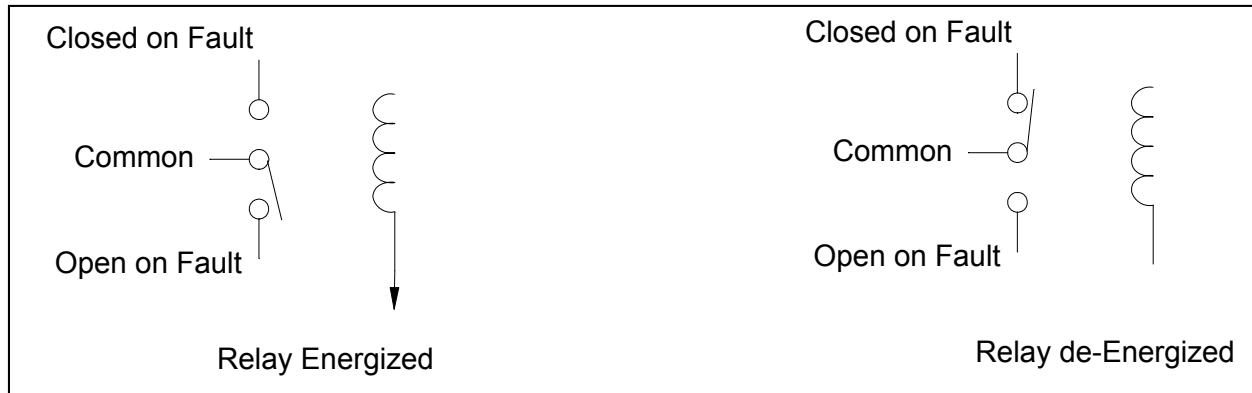


**Figure 7-2: Parallel I/O Form C Relay**

### 7.1.2 Control Inputs

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.

## 7.2 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 7-3**. It consists of a Header, Data and Trailer sub-packet.

| HEADER<br>(4 bytes) | DATA<br>(6-32 bytes) | TRAILER<br>(1 byte) |
|---|---|---|
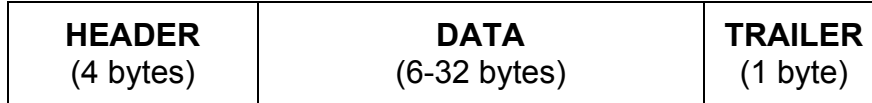
**Figure 7-3: Basic Communication Packet**

### 7.2.1 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 7-4**).

| HEADER<br>(4 bytes) | DATA<br>(6-32 bytes) | TRAILER<br>(1 byte) |
|---|---|---|

| Frame Sync (2 bytes)<br>0xAA5 | Destination Address<br>(1 byte) | Source Address<br>(1 byte) |
|---|---|---|
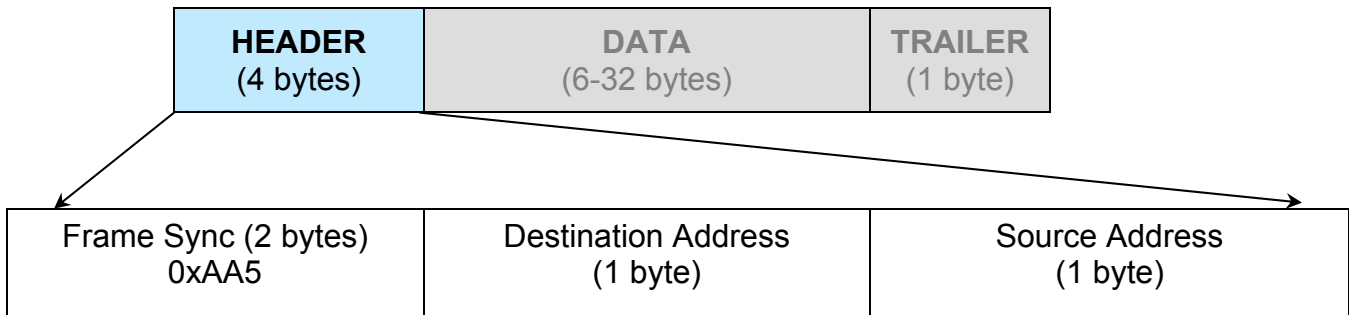
**Figure 7-4: Header Sub-Packet**

#### 7.2.1.1 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.

#### 7.2.1.2 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.

#### 7.2.1.3 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.

### 7.2.2 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 7-5**. The first six (6) fields comprise the command preamble while the last field is the actual data.

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

| COMMAND PREAMBLE | | | | | | DATA FIELD |
| --- | --- | --- | --- | --- | --- | --- |
| Protocol ID 1 Byte | Request ID 1 Byte | Command 1 Byte | Data Tag 1 Byte | Error Status / Data Address 1 Byte | Data Length 1 Byte | Command Data Sub Structure 0 - 26 Bytes |
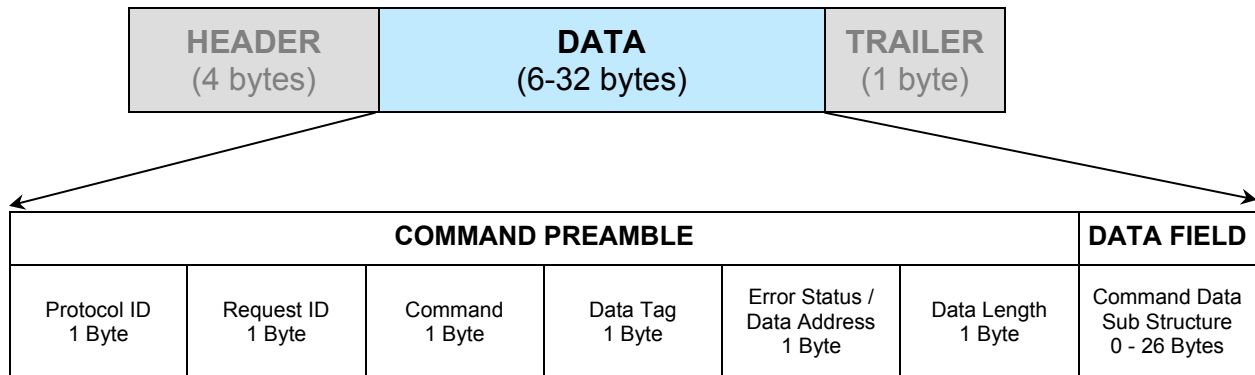
**Figure 7-5: Data Sub-Packet**

### 7.2.2.1 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.

### 7.2.2.2 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.

### 7.2.2.3 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 7-2**.

**Table 7-2: Command Byte Values**

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

### 7.2.2.4 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 7-3**.

**Table 7-3: Data Tag Byte Values**

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

### 7.2.2.5 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 7-4**. Note that the Request and Response frames are different.

## Table 7-4: 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 too big for amplifier buffer to accept |
| No Such Data | 2 | Specified Data Address is out of 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 incoming framed, but SSPA failed to recognize it. All data aborted |

### 7.2.2.6 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.

### 7.2.2.7 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).

### 7.2.3 Trailer Packet

#### 7.2.3.1 Frame Check

The trailer component contains only one (1) byte called the Frame Check Sequence, shown in **Figure 7-6**.

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

**Frame Check**
Checksum (1 byte)
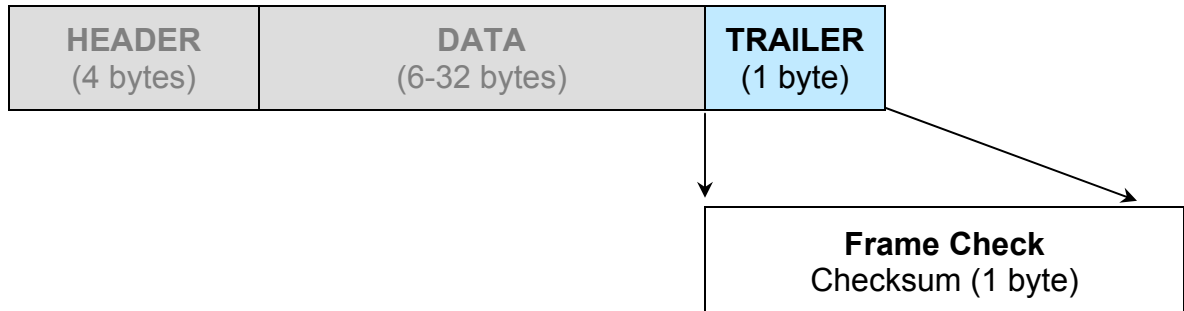
**Figure 7-6: Trailer Sub-Packet**

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
```

### 7.2.4 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.

### 7.2.5 Serial Communications Protocol

**Table 7-5** through **Table 7-9** detail the various values of the serial communications protocol.

#### Table 7-5: Request Frame Structure

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

#### Table 7-6: Response Frame Structure

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

## Table 7-7: 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 |
| 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 | Fwd. RF Flt Handling | 0 = Disable; 1 = Low RF Major Fault; 2 = Low RF Minor Fault; 3 = ALC; 4 = High RF Major Fault (v. 6.14); 5 = High RF Minor Fault (v. 6.14); 6 = High RF Fault + Mute (v. 6.14) |
| 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.

(Continued)

**Table 7-7: 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 7-9**, 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 7-8: 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 7-7**, 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 7-7**, 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 only!) | If RF Units (**Table 7-7**, 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 only!) | If RF Units (**Table 7-7**, 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.

**Table 7-9: 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 7-9: 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*) |

## 7.3 Access SSPA Subsystem through Packet Wrapper Technique

Features introduced in firmware version 4.03 allow send requests directly to a remote SSPA subsystem. In this mode, an RCP unit redirects requests from its Serial Main or Ethernet port to its Local serial port, connected to the SSPA (see **Figure 7-7**). Packet wrapper requests are associated with longer response times, which have to be accounted in the host M&C software. This mode can be useful for advanced remote diagnostic of the attached SSPA subsystem.

All Packet Wrapper request frames must be "Data Set" command requests. Each frame intended for redirection must be included in request packet Data Fields. Packet Wrapping frame M&C should follow the same rules as for any other request frames with one exclusion — the Data Address field will represent the number of bytes expected back from the remote SSPA. These bytes will be redirected back to the Host M&C in the Data Field response packet. The response packet will not be sent until the specified number of bytes is collected in the RCP unit buffer.

Maximum length of the data fields in both directions should not exceed 32 bytes. In the diagram represented in **Figure 7-7**, Request frame A is the Packet Wrapper frame. It contains Request frame B, intended to be redirected to the remote SSPA.

**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.
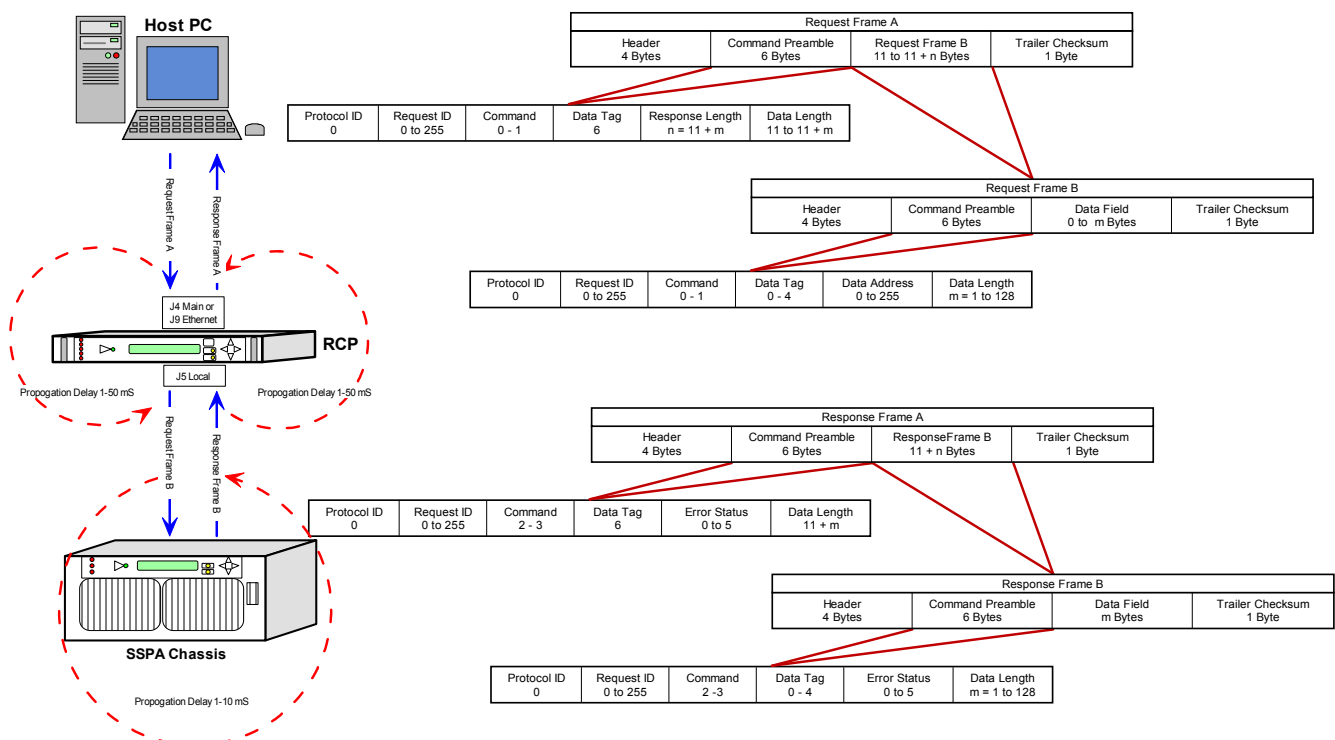


**Figure 7-7: Packet Wrapper technique**

## 7.4 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 Count | Bytes | Description |
|---|---|---|
| 1 | 170 | Frame Sync Byte 1 |
| 2 | 85 | Frame Sync Byte 2 |
| 3 | 5 | Destination Address of Unit |
| 4 | 10 | Source Address of Request Originating PC Host |
| 5 | 0 | Protocol Version Compatibility. Field must always be "0". |
| 6 | 111 | Request ID byte is set by originator, will be echoed back by respondent. |
| 7 | 1 | Command field for "Get" type of the request |
| 8 | 0 | "System Settings" tag indicates which data from respondent required in response frame |
| 9 | 1 | Data Address field indicates the beginning data address inside of the "System Settings" data set to 1 (first element) |
| 10 | 28 | Data Length field indicates how many data bytes of the "System Settings" requested from the unit |
| 11 | 156 | Arithmetic checksum of bytes number 3 through 10 |

SSPA response string:

| Byte Count | Bytes | Description |
|---|---|---|
| 1 | 170 | Frame Sync Byte 1 |
| 2 | 85 | Frame Sync Byte 2 |
| 3 | 10 | Destination Address of PC request originator |
| 4 | 5 | Source address of the respondent |
| 5 | 0 | Protocol Version Compatibility Field must be always 0 |
| 6 | 111 | Echo of the Originator's Request ID byte |
| 7 | 3 | Command field for "Get" type of the response |
| 8 | 0 | System Settings 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 absense of errors |
| 10 | 28 | Data Length field indicates how many data bytes of the "System  Settings"  requested from SSPA |
| 11 | 1 | Data field 1 contains data element 1 of the "System Settings" |
| 12 | 0 | Data field 2 contains data element 2 of the "System Settings" |
| 13 | 0 | Data field 3 contains data element 3 of the "System Settings" |
| 14 | 3 | Data field 4 contains data element 4 of the "System Settings" |
| 15 | 0 | Data field 5 contains data element 5 of the "System Settings" |
| 16 | 0 | Data field 6 contains data element 6 of the "System Settings" |
| 17 | 0 | Data field 7 contains data element 7 of the "System Settings" |
| 18 | 5 | Data field 8 contains data element 8 of the "System Settings" |
| 19 | 0 | Data field 9 contains data element 9 of the "System Settings" |
| 20 | 0 | Data field 10 contains data element 10 of the "System Settings" |
| 21 | 0 | Data field 11 contains data element 11 of the "System Settings" |
| 22 | 0 | Data field 12 contains data element 12 of the "System Settings" |
| 23 | 0 | Data field 13 contains data element 13 of the "System Settings" |
| 24 | 0 | Data field 14 contains data element 14 of the "System Settings" |
| 25 | 0 | Data field 15 contains data element 15 of the "System Settings" |
| 26 | 0 | Data field 16 contains data element 16 of the "System Settings" |
| 27 | 1 | Data field 17 contains data element 17 of the "System Settings" |
| 28 | 0 | Data field 18 contains data element 18 of the "System Settings" |
| 29 | 0 | Data field 19 contains data element 19 of the "System Settings" |
| 30 | 0 | Data field 20 contains data element 20 of the "System Settings" |
| 31 | 0 | Data field 21 contains data element 21 of the "System Settings" |
| 32 | 0 | Data field 22 contains data element 22 of the "System Settings" |
| 33 | 0 | Data field 23 contains data element 23 of the "System Settings" |
| 34 | 0 | Data field 24 contains data element 24 of the "System Settings" |
| 35 | 0 | Data field 25 contains data element 25 of the "System Settings" |
| 36 | 0 | Data field 26 contains data element 26 of the "System Settings" |
| 37 | 0 | Data field 27 contains data element 27 of the "System Settings" |
| 38 | 40 | Data field 28 contains data element 28 of the "System Settings" |
| 39 | 207 | Arithmetic checksum of bytes number 3 through 38 |

## 7.5 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!**

**Figure 7-8** shows an example screen shot of a terminal session.

```
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 7-8: Terminal Mode Session Example**

## 7.6 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 7.6.1.2** and **Section 7.6.2.5** 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.

### 7.6.1 IPNet Interface

#### 7.6.1.1 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 7-9**.

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

**Figure 7-9: UDP Redirect Frame Example**

A detailed OSI model for the RM SSPA M&C interface is represented in **Table 7-10**.

**Table 7-10: OSI Model for RM SSPA Ethernet IP Interface**

| OSI Layer | Protocol | Notes |
|---|---|---|
| Application | Paradise Datacom RM SSPA Serial Protocol | Frame structure described in **Section 7.2** |
| 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.

### *7.6.1.2 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 through front panel: Press the **Main Menu** key, select **2.Com.Setup**, press the **Enter** key; select **4.Interface**, 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 (Terminal), 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 A**.

### 7.6.1.3 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 7.6.1.2**) 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 7-10**. The User Name is fixed and cannot be changed by the operator.
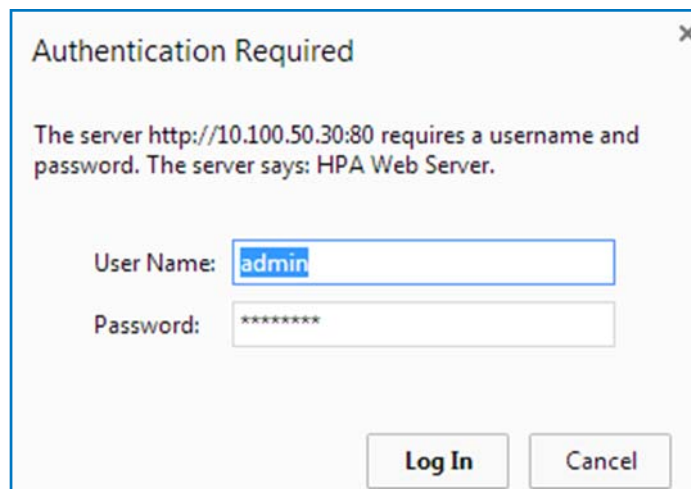


**Figure 7-10: Web Interface Login Window**

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 7-11**.



**Figure 7-11: 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.

### 7.6.2 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.

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.

#### 7.6.2.1 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 7-11** through **Table 7-13**.

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).

#### 7.6.2.2 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.)

### 7.6.2.3 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)
```

### *7.6.2.4 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 7-11**. Read/write access for settingsValue column.

**thresholds** - Table provides information about device internal limits and subsystems info. For detailed table information refer to **Table 7-12**. Read only access.

**conditions** - Table contents device fault status information. Read only access. For detailed conditions table info see **Table 7-13**.

---

# Table 7-11: SNMP Detailed Settings

| settingIndex/ settingValue | settingTextValue | Value OID | Description |
|---|---|---|---|
| 1/INTEGER | SysMode'StdAIn=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 | 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 | FwdRFFlt'Dis=0,LoRF1=1,LoRF2=2,ALC=3,HiRF1=4, HiRF2=5,HiRF3=6 | 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 | Reflected RF fault handling |

**Table 7-11: SNMP Detailed 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 | Reserved | 1.3.6.1.4.1.20712.2.1.1.1.2.50 | Reserved |

## Table 7-12: SNMP Detailed 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 consumption |
| 4/INTEGER | PS1Voltage(Voltx10)'0..200 | 1.3.6.1.4.1.20712.2.1.2.1.2.4 | Power Supply 1 output voltage |
| 5/INTEGER | PS2Voltage(Voltx10)'0..200 | 1.3.6.1.4.1.20712.2.1.2.1.2.5 | Power Supply 2 output voltage |
| 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 7-13: SNMP Detailed 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 |

### *7.6.2.5 Configuring RM SSPA 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.

### 7.6.2.6 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 subfolder.
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 7-12**) and then click the Start button.
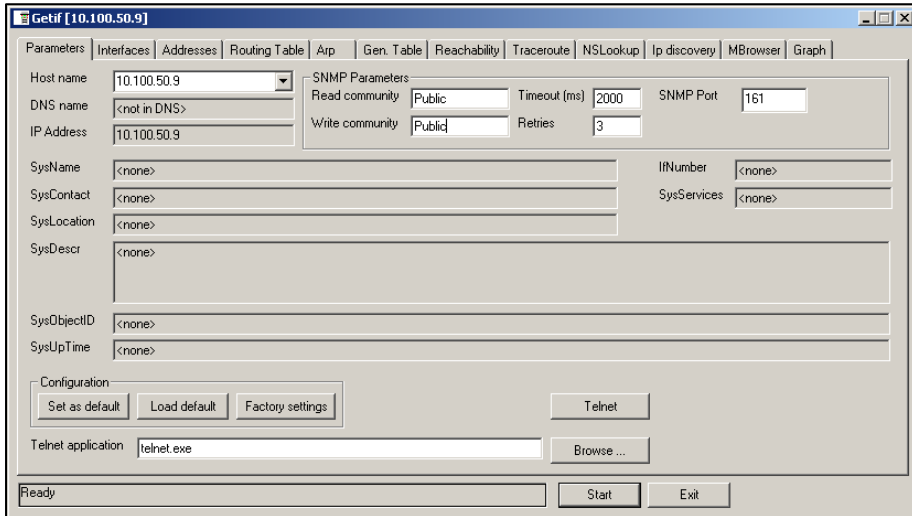


**Figure 7-12: GetIF Application Parameters Tab**

4. Select the MIBBrowser tab.
5. Click on 'iso main entity' on the MIB tree, then click the Start button.
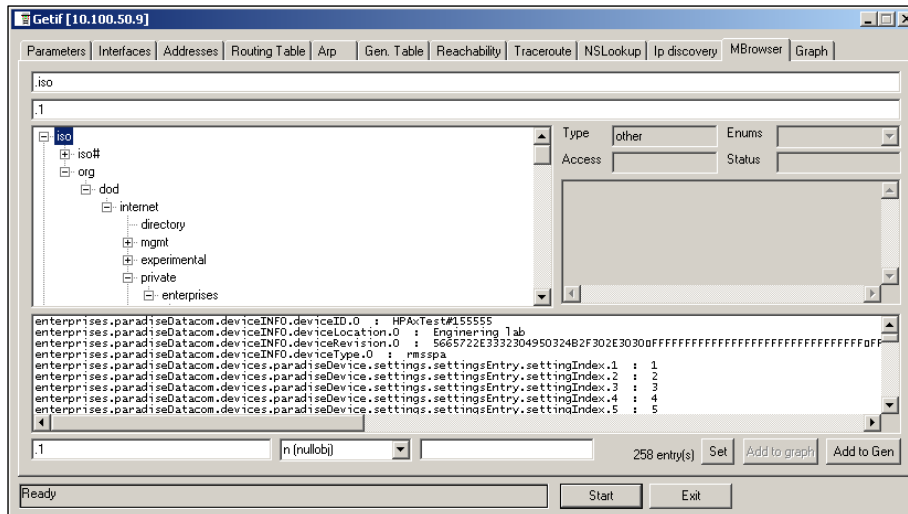6. See update data in output data box (**Figure 7-13**).



**Figure 7-13: 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 7-14.**
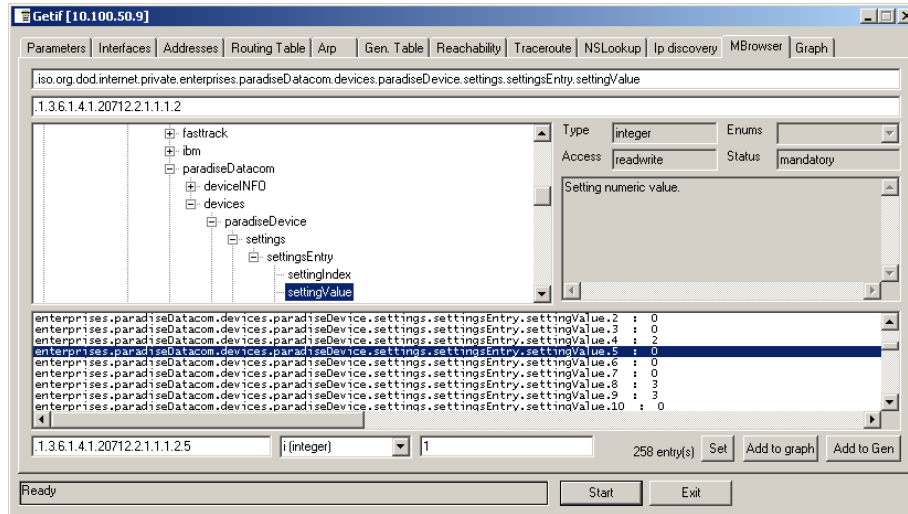


**Figure 7-14: Getif MBrowser window, setting settingValue.5 to a value of '1'**

### 7.6.3 Extended SNMP Operation

The 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.

### 7.6.3.1 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)
```

### *7.6.3.2 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 the 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.

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

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

1. Connect J6 Ethernet Port of the RM SSPA 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.
3. From Windows Control Panel select Network icon;
4. Select TCP/IP properties of your LAN card. The window shown in **Figure A-1** will appear.
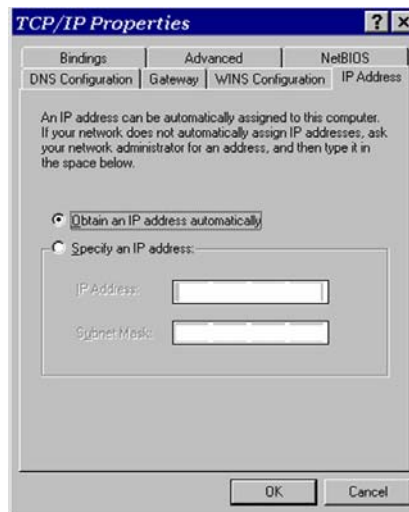


**Figure A-1: TCP/IP Properties Window**

5. 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
```

1. After you press "OK", depending on the operating system, you may need to reboot the workstation.
2. 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:
```

8. 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 I milli-seconds:
              Minimum=0ms, Maximum=0ms, Average=0ms
```

Your network LAN card is now set up.

9. Set up the IP settings on the rackmount SSPA unit.

    a.  From the unit's front panel, 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; use the navigation keys to enter address **192.168.0.0**. Press the **Enter** key.

    b.  Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IPSetup** and press the **Enter** key; select **3.Subnet** and press the **Enter** key; use the navigation keys to enter address **255.255.255.0**. Press the **Enter** key.

    c.  Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IPSetup** and press the **Enter** key; select **4.Gateway** and press the **Enter** key; use the navigation keys to enter address **0.0.0.0**. Press the **Enter** key.

    d.  Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IPSetup** and press the **Enter** key; select **5.LocalPort** and press the **Enter** key; use the navigation keys to enter port **1038**. Press the **Enter** key.

    e.  Press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IPSetup** and press the **Enter** key; select **6.More** and press the **Enter** key; select 3.LockIP and press the Enter key; use the navigation keys to enter address **255.255.255.255**. Press the **Enter** key.

    f.  To verify the selected parameters press the **Main Menu** key; select **2.Com.Setup** and press the **Enter** key; select **5.IPSetup** and press the **Enter** key; select **1.IPInfo** and press the **Enter** key.

10. Set the RM SSPA unit to communicate over IPNet.

   a. From the unit's 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 **3.IPNet** and press the **Enter** key.

The RM SSPA is now set up to work with Ethernet Interface.

11. Ping the SSPA unit from 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 I milli-seconds:
          Minimum=0ms, Maximum=0ms, Average=0ms
```

12. Run the Paradise Datacom Universal M&C package on the host PC to check all M&C functions. Refer to **Appendix C** for details on the unit specifications. 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.

13. The SSPA now connected to your host workstation for remote M&C.

THIS PAGE LEFT INTENTIONALLY BLANK

This section briefly describes the basic theory related to the physical layer of 10/100Bas-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**.
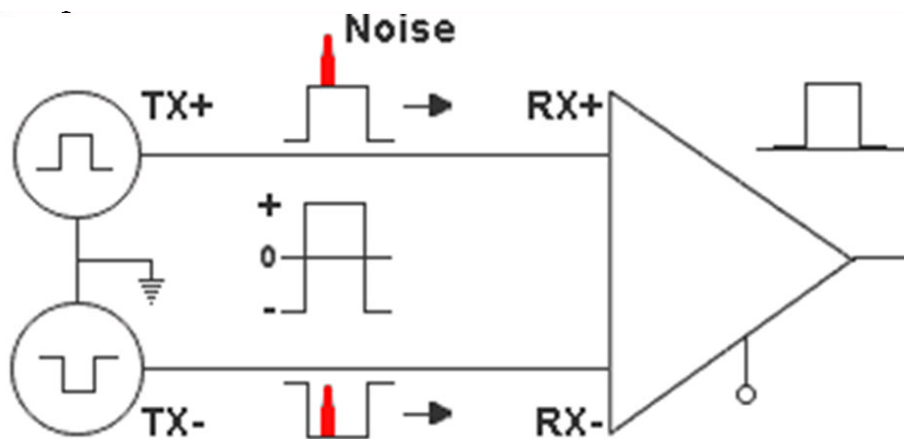


**Figure B-2: Transmission Line**

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.

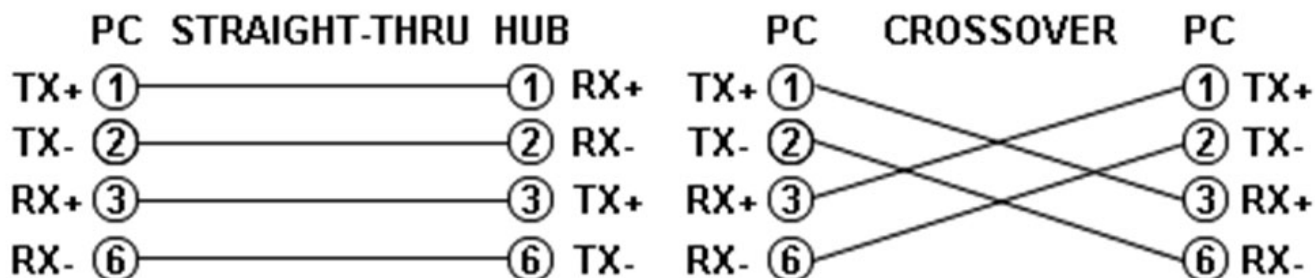Pin-out diagrams of the two types of UTP Ethernet cables are shown in **Figure B-3**.



**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.
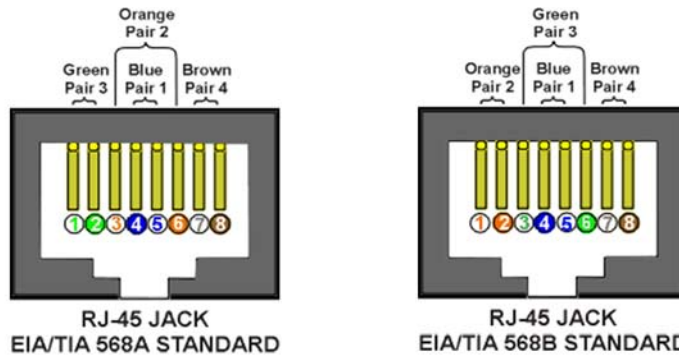
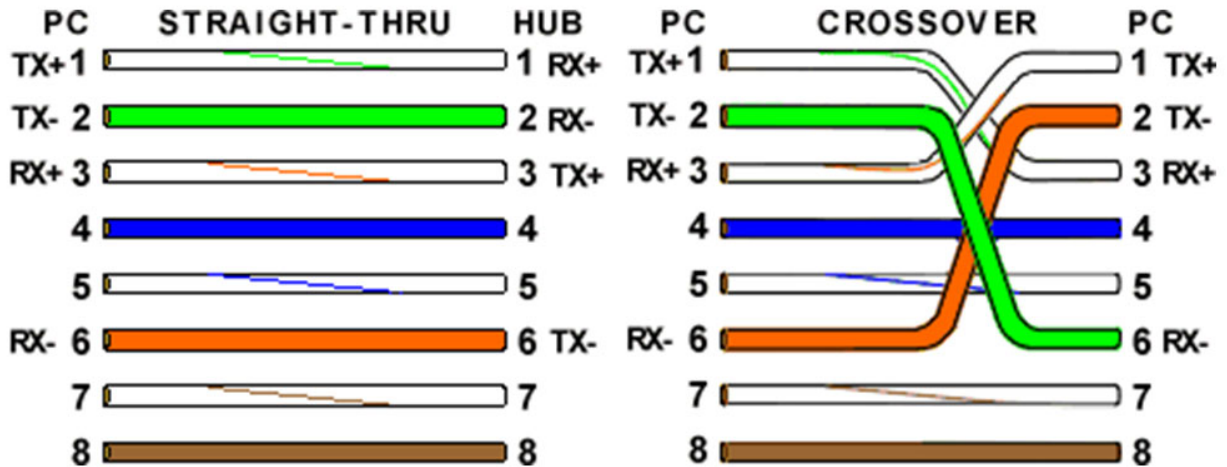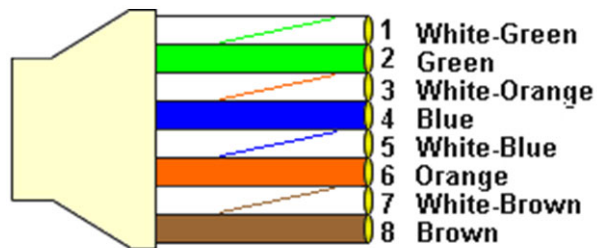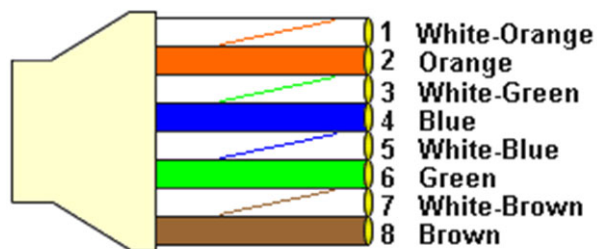**Figure B-4: Ethernet Wire Color Code Standards**



**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. 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.

The following pages comprise the documentation package for the Teledyne Paradise Datacom 7RU Solid State Power Amplifier.

Specification Sheet: **208114** (check our web site http://www.paradisedata.com for the most recent version of this document);

Outline Drawing, specific to your unit;

Block Diagram, specific to your unit;

and Schematic, specific to your unit.

THIS PAGE LEFT INTENTIONALLY BLANK