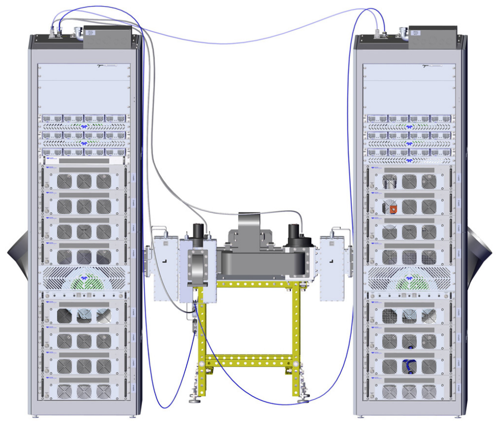
Operations Manual, S-Band Indoor PowerMAX System, Model HPASS800AEZA001G2

Drawing Number: 217022
Revision -
RA 7780



Last Modified: 07 August 2020

THIS PAGE LEFT INTENTIONALLY BLANK

Indoor PowerMAX Systems, General Information

Teledyne Paradise Datacom
Drawing Number: 214579-1 Revision E
ECO 18918
05 May 2020

Introduction

The PowerMAX technology is the preeminent system technology in High Power Amplifier (HPA) redundancy. PowerMAX is the only purely parallel redundant amplifier system. All aspects of the system's active components are parallel redundant including SSPA modules, monitor and control circuitry, power supplies, and fans. In addition to being parallel redundant all of the active components are hot-swap removable from either the front or rear panels. Once installed there is never a need to remove a solid state power amplifier (SSPA) chassis from the cabinet. All active components are easily spared on site making the PowerMAX the easiest amplifier system to maintain.

The PowerMAX system architecture is based on a single SSPA module per chassis. This allows PowerMAX systems to be configured with a large variety of output power levels. For example, C-Band output power levels range from 400W to 10.0kW.

Furthermore, PowerMAX is a scalable amplifier system. For example, a PowerMAX system may be initially configured with four modules and later upgraded to eight or 16 modules in the field. There is never a need to return any part of the system to the factory as the upgrades are easily installed in the field. This provides a tremendous protection of investment in the amplifier system. The system can easily grow with future power and bandwidth demands.

Theory of Operation

PowerMAX is a purely parallel redundant, modular HPA system. It can be populated with any number of modules between three and sixteen. For maximum RF efficiency it is recommended to power combine binary arrays of four, eight, or sixteen modules.

A modular system is used either as an extremely high output power amplifier or as a self-redundant amplifier system. Parallel architecture systems make excellent redundant systems. The PowerMAX system concept is purely parallel throughout all aspects of the design. The failure of a power supply module, fan, or monitor and control card has no effect on the system operation. Full output power capability is maintained as well as remote communications and control of the amplifier system. The system will issue a minor alarm and indicate precisely which component has failed. The maintenance technician can then perform the replacement of the failed component without removing the amplifier from service. This is referred to as hot-swap component replacement. These components can be replaced without the need to remove an amplifier chassis from the equipment cabinet.

Figure 1: Four-Module PowerMAX System with Touchscreen Display

When used as a self-redundant amplifier system, the PowerMAX should be configured such that there is one module's worth of excess output power capacity. In this way a failure of one SSPA module will still allow the system to provide the minimum output power necessary. This type of architecture is referred to as n+1 redundant, meaning that there is one additional RF module then required for normal system operation.

When configuring n+1 redundant system output power with binary array systems the output power guideline shown in Table 1 should be followed.

Table 1: PowerMAX Output Power Reduction

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

Parallel architecture redundant systems have a distinct advantage over traditional systems with their absence of transfer switching. Microwave transfer switches used in traditional redundant systems have an inherent break-before-make characteristic. This means that there is a finite period of time in which the RF output of the system is completely dropped. This time can vary between hundreds of milliseconds to seconds depending on the system design.

Many satellite communication links are adversely affected by a complete loss of carrier even for 100 milliseconds. Because there is no transfer switch used in the PowerMAX system, there is never a complete loss of output power for any period of time. The system will only lose a percentage of its output power as shown in the system configuration tables (Tables 2 through 4). Under normal operation (i.e., when output power levels are a few dB backed off from maximum output power) there is no noticeable change in operation with a failure of an SSPA module. The system gain of the PowerMAX will automatically compensate for the failed module resulting in no change in the operating output power level.

The sophisticated firmware design of the PowerMAX permits the system to operate as if it were a single chassis amplifier. There is no need to communicate directly with each individual amplifier chassis, whether operating the system by remote link or locally via the front panel. The system maintains a hierarchy of control whereby one of the n modules in a system becomes the master control point. If the master amplifier were to fail, control is automatically passed on to the next amplifier in the array. The master amplifier is easily identified in the array by the front panel display.

The firmware design also provides for power savings operation. Any number of the chassis can be placed in mute mode during periods in which full output power is not required. This will make significant savings in electricity costs required to operate the system. Otherwise the system provides 20dB of gain adjustment in 0.5dB increments as well as optional ALC operation.

The system output power is measured with true rms power detection. Unlike peak detection circuits common in many HPA systems, true rms detection gives a very accurate measurement of the system's output power in the presence of multiple carriers and modulation types.

A 4-module system is configured so that the loss of a single SSPA module results in a 2.4 dB reduction in output power. An 8-module system is configured so if one SSPA module fails, the system output power is only reduced by 1.2 dB. A loss of a single SSPA module in a 16-module system results in an output power reduction of only 0.6 dB.

1.1.1 Four-Module Systems

Figure 2 displays a simple block diagram of a Four-Module PowerMAX system. Table 2 shows an example of maximum and redundant output powers at Psat and PLinear for Four-Module PowerMAX systems. Refer to the specification sheet for a full list of available power levels and output powers in the Four-Module configuration.

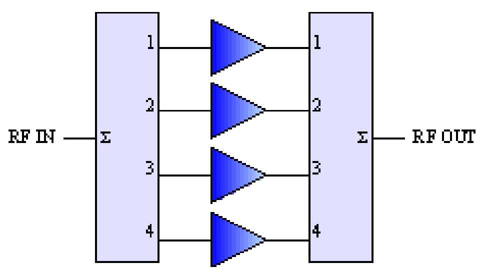


Figure 2: Block Diagram, Four-Module PowerMAX System

Table 2: Four-Module PowerMAX System Output Power Example

SSPA Module Power Level	Typical Maximum Output Power, 4-Modules, Psat	Maximum Output Power, 4-Modules, PLinear	Typical Maximum Output Power, 3-Modules, Psat	Maximum Output Power, 3-Modules, PLinear
400W GaN C-Band	61.5 dBm (1.4kW)	58.5 dBm (700W)	59.1 dBm (800W)	56.1 dBm (400W)

As shown in Table 2, a four-module PowerMAX system which experiences a failure in one module will have a 2.4 dBm reduction in output power. Note that linear power (PLinear) is typically equal to saturated power (Psat) less 3 dBm.

Eight-Module Systems

Figure 3 displays a simple block diagram of a Eight-Module PowerMAX system. Table 3 shows an example of maximum and redundant output powers at Psat and PLinear for Eight-Module PowerMAX systems. Refer to the specification sheet for a full list of available power levels and output powers in the Eight-Module configuration.

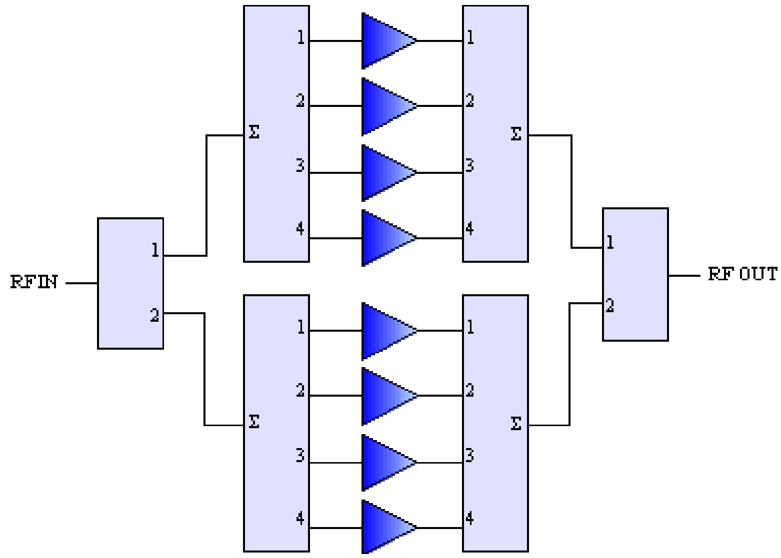


Figure 3: Block Diagram, Eight-Module PowerMAX System

Table 3: Eight-Module PowerMAX System Output Power Example

SSPA Module Power Level	Typical Maximum Output Power, 8-Modules, Psat	Maximum Output Power, 8-Modules, PLinear	Typical Maximum Output Power, 9-Modules, Psat	Maximum Output Power, 9-Modules, PLinear
400W GaN C-Band	64.3 dBm (2.6kW)	63.3 dBm (1.3kW)	63.1 dBm (2.0kW)	60.1 dBm (1.0kW)

As shown in Table 3, an eight-module PowerMAX system which experiences a failure in one module will have a 1.2 dBm reduction in output power. Note that linear power (PLinear) is typically equal to saturated power (Psat) less 3 dBm.

16-Module Systems

Figure 4 displays a simple block diagram of a 16-Module PowerMAX system. Table 4 shows an example of maximum and redundant output powers at Psat and PLinear for 16-Module PowerMAX systems. Refer to the specification sheet for a full list of available power levels and output powers in the 16-Module configuration.

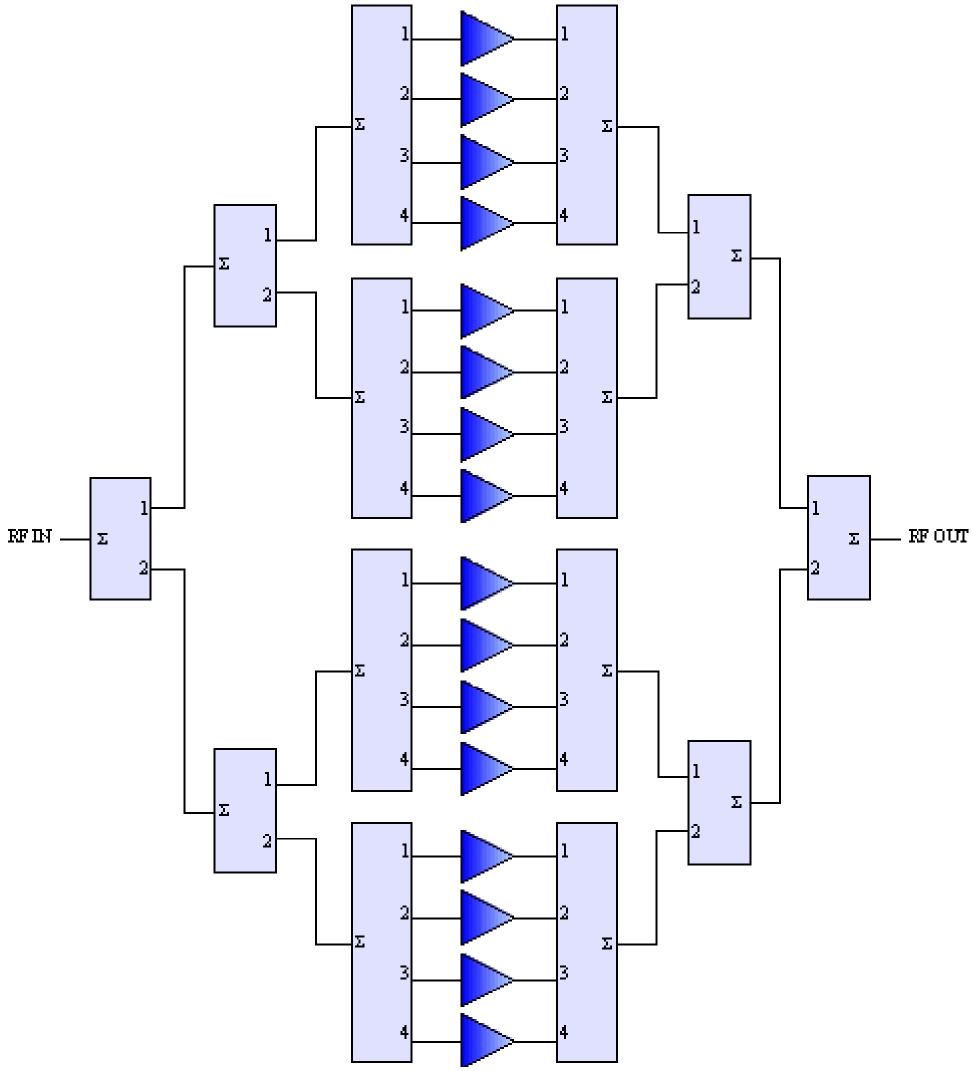


Figure 4: Block Diagram, 16-Module PowerMAX System

Table 4: 16-Module PowerMAX System Output Power Example

SSPA Module Power Level	Typical Maximum Output Power, 16-Modules, Psat	Maximum Output Power, 16-Modules, PLinear	Typical Maximum Output Power, 15-Modules, Psat	Maximum Output Power, 15-Modules, PLinear
400W GaN C-Band	67.0 dBm (5.0kW)	54.0 dBm (2.5kW)	66.4 dBm (4.3kW)	63.4 dBm (2.1kW)

As shown in Table 4, a 16-module PowerMAX system which experiences a failure in one module will have a 0.6 dBm reduction in output power. Note that linear power (PLinear) is typically equal to saturated power (Psat) less 3 dBm.

System Gain, Power vs. Number of Modules

With parallel system architectures the amplifier output power capability and gain will change as the number of active modules vary. The PowerMAX system 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 "Automatic Gain Control" mode.

Figure 5 shows the system gain and maximum output power for a four module PowerMAX system, with one, two, and three modules active in the system.

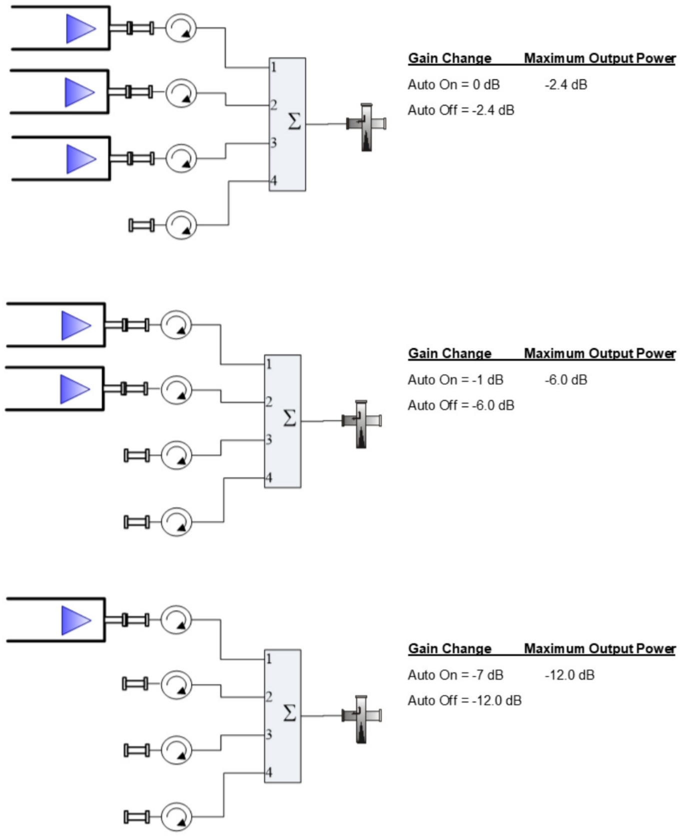


Figure 5: Four Module PowerMAX with 3, 2 and 1 Modules

System gain and output power figures for the eight module PowerMAX system are shown in Figure 6, Figure 7 and Figure 8.

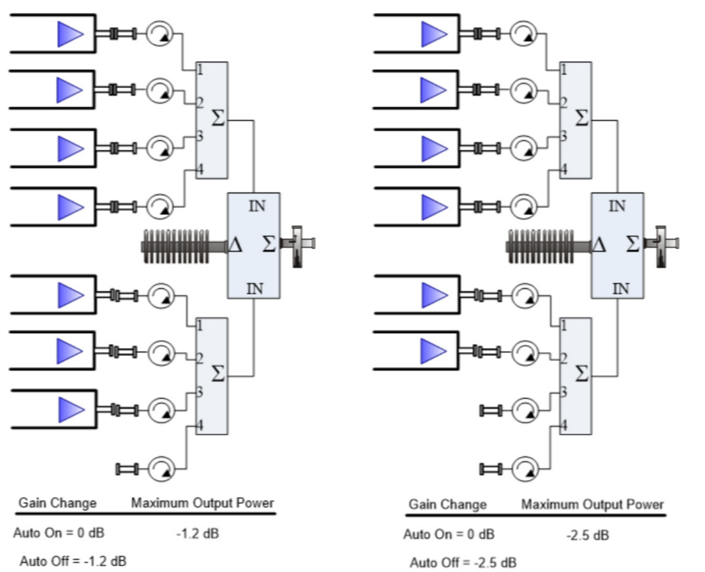


Figure 6: Eight Module PowerMAX Systems with 7 and 6 Modules

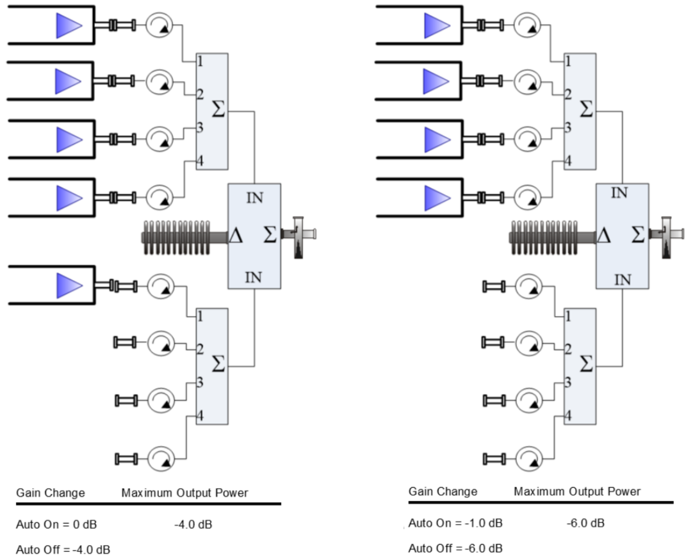


Figure 7: Eight Module PowerMAX Systems with 5 and 4 Modules

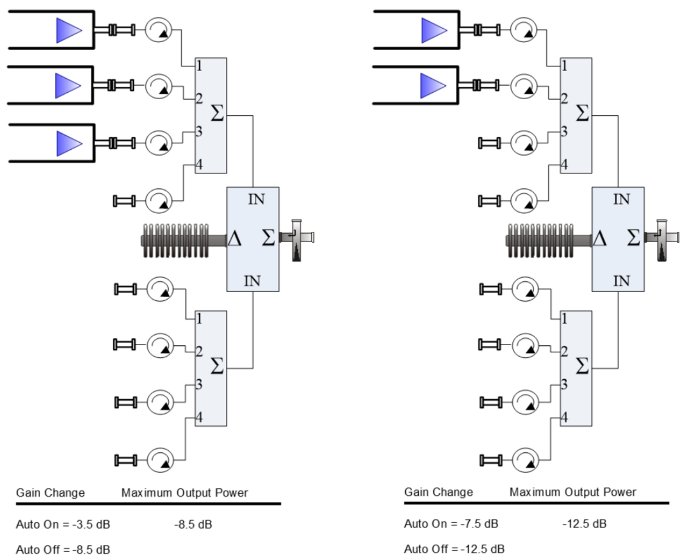


Figure 8: Eight Module PowerMAX Systems with 3 and 2 Modules

System gain and output power figures for the 16 module PowerMAX system are shown in Figure 9, Figure 10, Figure 11 and Figure 12.

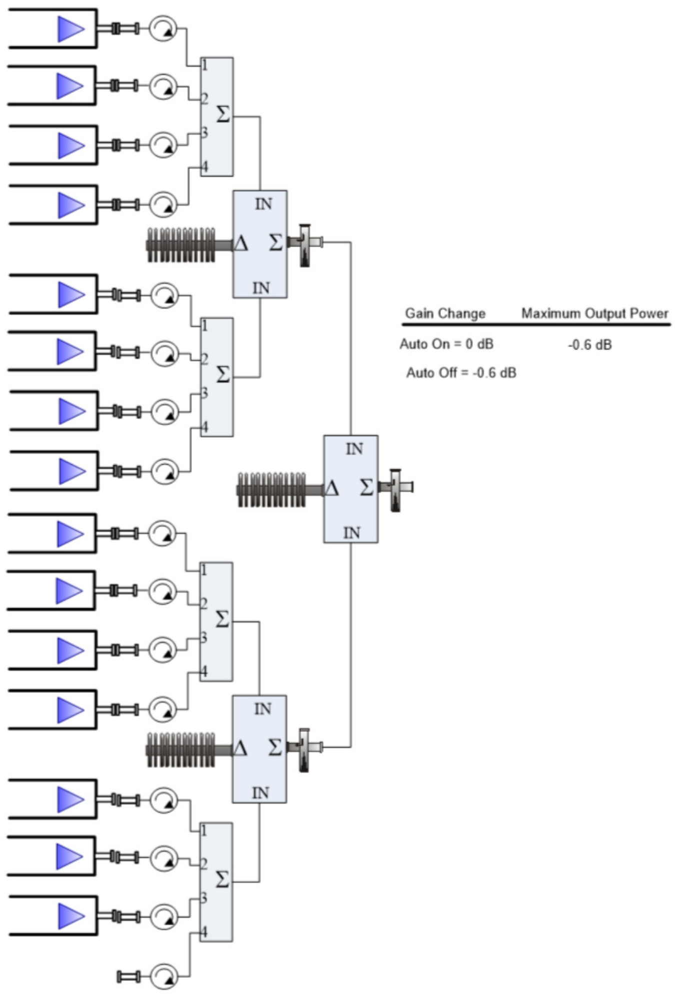
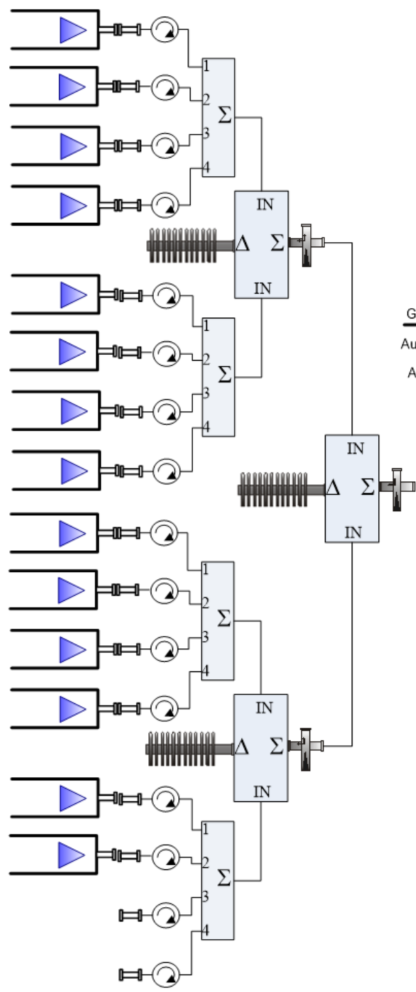


Figure 9: 16 Module PowerMAX Systems with 15 Modules



Gain Change	Maximum Output Power
Auto On = 0 dB	-1.2 dB
Auto Off = -1.2 dB	

Figure 10: 16 Module PowerMAX Systems with 14 Modules

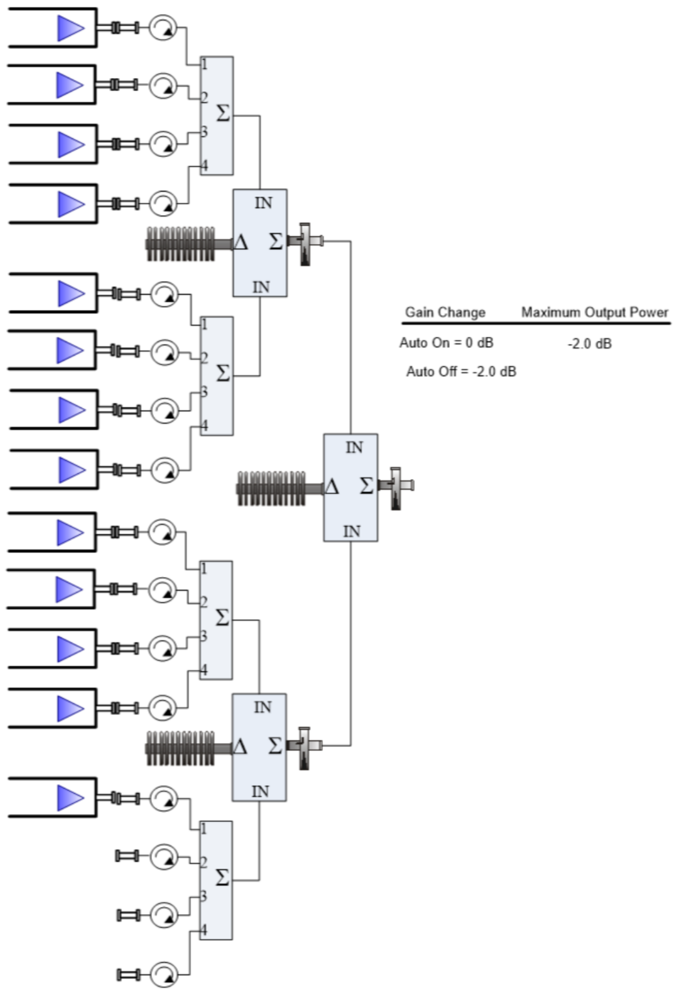


Figure 11: 16 Module PowerMAX Systems with 13 Modules

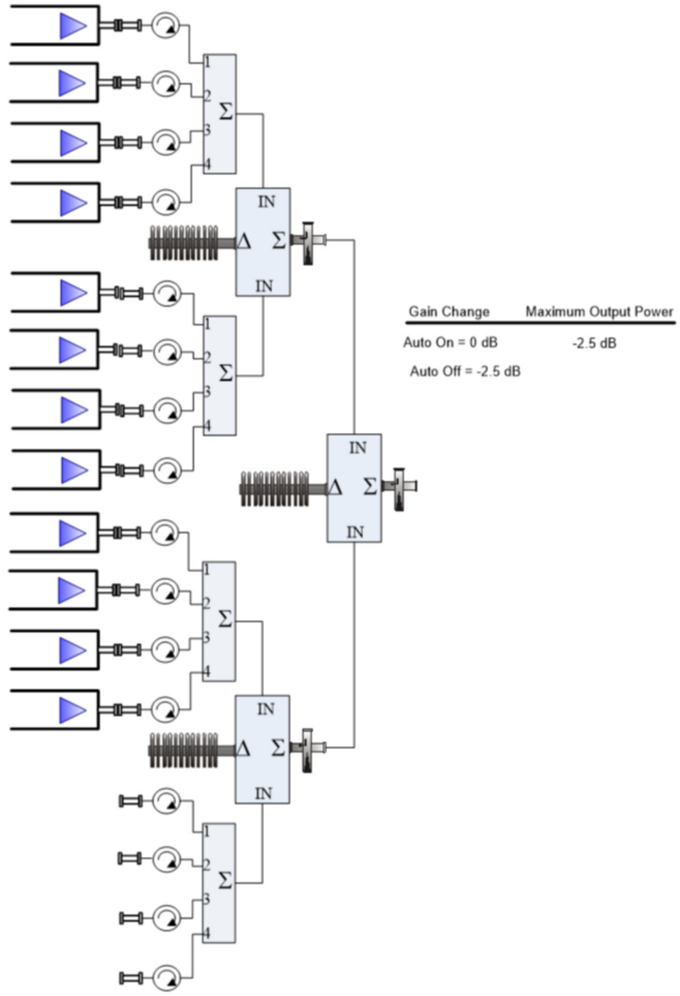


Figure 12: 16 Module PowerMAX Systems with 12 Modules

Specifications

Refer to the Indoor PowerMAX specification sheets for complete specifications. The latest revision of the specification sheets are available on the Teledyne Paradise Datacom web site: www.paradisedata.com.

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
328 Innovation Blvd., Suite 100
State College, PA 16803 USA
Phone: +1 (814) 238-3450
Fax: +1 (814) 238-3829

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.

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.

High Voltage Hazards

High Voltage, for the purpose of this section, is any voltage in excess of 30V. 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.**

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 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.**

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.

High Temperature Hazards

Teledyne Paradise Datacom high power amplifiers are cooled by a combination of thermal conduction and forced air convection. When an amplifier is operating, certain components (combiners, terminations) along the RF path may exhibit temperatures uncomfortable to the touch.

The US Labor Department's Occupational Safety & Health Administration stipulates that surface temperatures exceeding 115°F (46°C) are categorized as having an extremely high risk level of injury. Components which may approach this temperature are marked with the IEC symbol (60417-5041 (DB:2002-10)) and the following or similar wording:

⚠ **WARNING HOT SURFACE DO NOT TOUCH**

RF Transmission Hazards

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

⚠ **Always terminate the RF input and output connector 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.**

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.**

Tipping Hazard

To avoid risk of bodily injury, follow all instructions for maintaining the stability of the equipment during transport, installation and maintenance.

The PowerMAX system is designed to be installed on a level surface. Any attempt to install the cabinet on an uneven surface may cause the cabinet to tip over, which may result in bodily injury.

If the system includes the optional cabinet exhaust fans, do not remove any of the SSPA chassis from the cabinet while the exhaust fan door is open unless the cabinet is secured to the floor.

High Potential for Waveguide Arcing

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

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 5 are pressure tested at the factory to 1.5 psig. As a guide we recommend using the power levels in Table 5 as the threshold levels where special attention be given to dehydration and the overall simplification of waveguide system design.

Table 5: 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	> 1 kW	WR112
Ku Band	13.75 - 14.5 GHz	> 500W	WR75
Ka Band	27 - 31 GHz	> 100 W	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 6 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 6: 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° Twist	0.8 to 0.9
Magic Tee	0.8
E Plane Tee	0.06
H Plane Tee	.8
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 5 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.

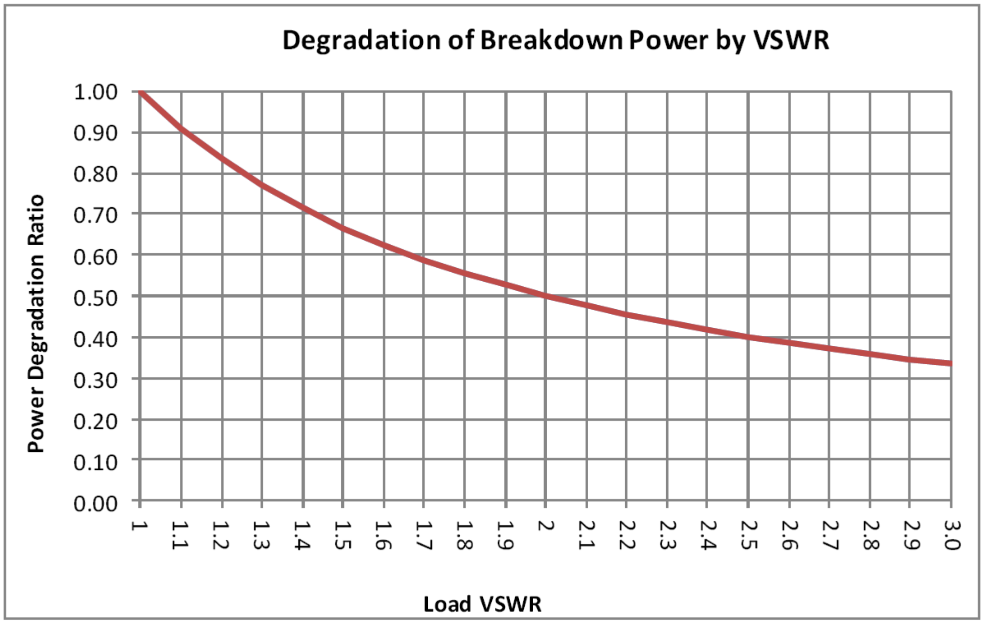


Figure 13: Degradation of Breakdown Power by VSWR

There are many factors to consider with high power amplifier systems in terms of the output waveguide network. Especially when using HPA systems with output power levels of Table 5, 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.

System Components, 1:1 FPC S-Band Indoor PowerMAX System

Teledyne Paradise Datacom
Drawing Number: 217022-1 Revision -
RA 7780
07 August 2020

Introduction

This section contains descriptions of the various components of a PowerMAX SSPA System. These include:

- Equipment Cabinets, Models HPASS800AEZA002G2 and HPASS800AEZA003G2
- Switch Assembly
- Crossguide Assembly
- Termination Assembly
- Waveguide Filter
- System Cables

Figure 1 shows the various assemblies that comprise the 1:1 Fixed Phase Combined S-Band PowerMAX System, as they were disassembled for shipment.

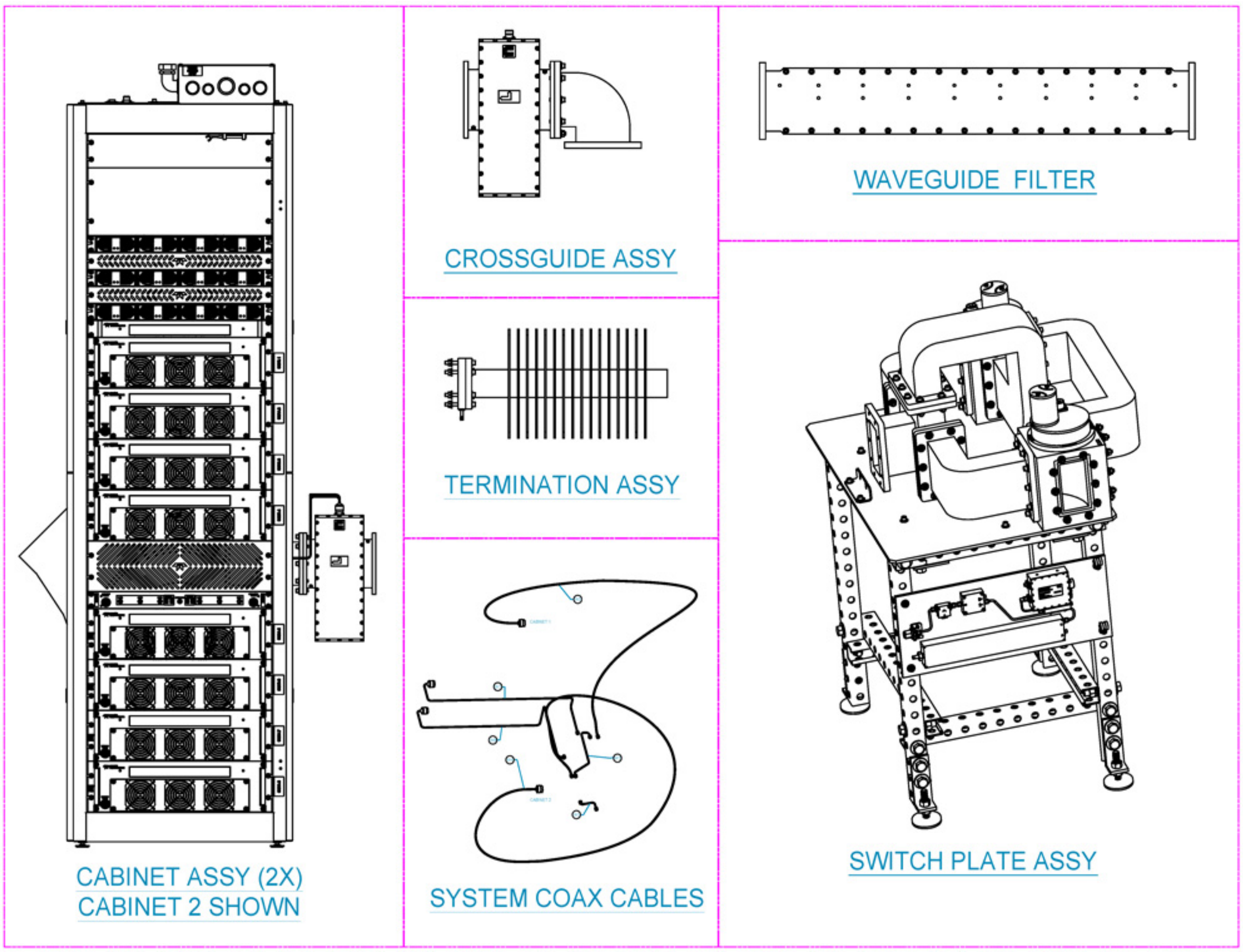


Figure 1: 1:1 FPC S-Band PowerMAX System Components, as Shipped

System Overview

The two PowerMAX cabinets act as individual high power amplifiers that are configured as a 1:1 phase combined system. The RF outputs of each cabinet are directed through the switch assembly and phase combined to the system RF output. The crossguide assembly provides samples of the forward and reflected power, which are directed back to the system.

The operator may control the switch positions so that only the output of a single cabinet is directed to the system RF output, with the output of the other cabinet is directed to the termination.

Control of this phase combined system is handled by a 1RU system controller, installed in cabinet model HPASS800AEZA002G2. See the 1:1 System Setup and Control section for a description of operating the system.

Equipment Cabinets

Refer to the Cabinet level manual (document 217021) for information about installation of the single cabinet (Models HPASS800AEZA002G2 and HPASS800AEZA003G2), and their stand-alone operation.

For purposes of identifying which cabinet is which:

- Cabinet 1 refers to model HPASS800AEZA003G2;
- Cabinet 2 refers to model HPASS800AEZA002G2.

Switch Assembly

The switch assembly consists of a waveguide/switch array mounted to a uni-strut frame, and a plate assembly upon which an RF detector module, phase shifter, signal splitter and system RF input connector are mounted. See Figure 2.

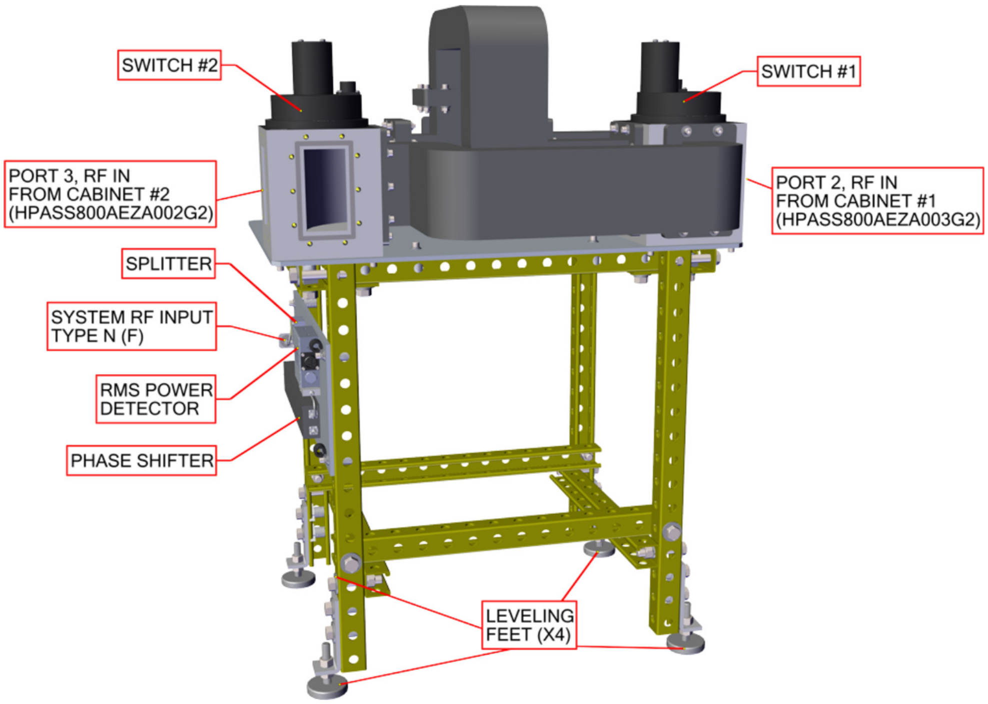


Figure 2: Switch Assembly

Uni-Strut Frame

The uni-strut frame is a Kindorf-type channel system. The frame includes four leveling feet that can be used to raise or lower the entire switch assembly to better align the waveguide/switch array with the system cabinet RF output waveguide flanges.

Waveguide/Switch Array

The waveguide/switch array includes two WR430 waveguide switches, a magic tee, and four connecting waveguide segments.

System Plate Assembly

Figure 3 identifies the components that comprise the system plate assembly.

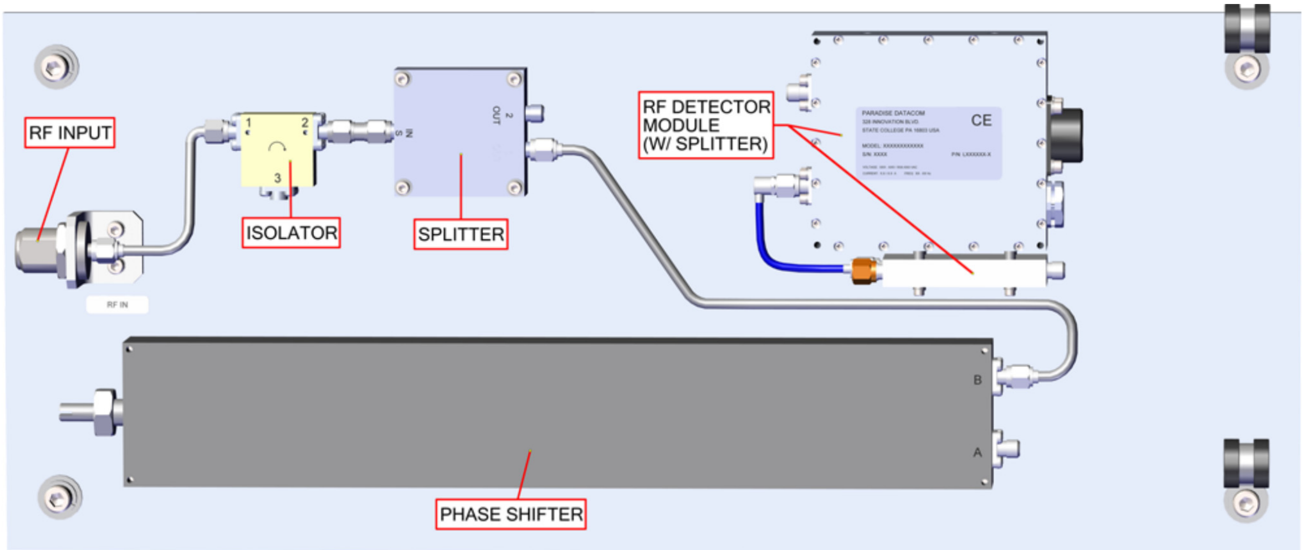


Figure 3: System Plate Assembly

System RF Input Connector [Type N (F)]

This is a Type N (F) connector and is used to introduce an RF signal to the system.

> ⚠ **Warning! Maximum RF Input is +15 dBm.**

Isolator

This is a coaxial isolator used to allow a transfer of signal in one direction, while isolating the reflected signal.

Signal Splitter

The signal splitter accepts an input and divides the signal energy through its two output ports. One output leads to Cabinet 1; the other output leads to the phase adjuster, and ultimately to Cabinet 2.

Phase Shifter

The phase shifter may be used to adjust the phase between two RF inputs when phase combining to a single output.

> ⚠ **Note: The phase adjustment between Cabinet 2 and Cabinet 1 was performed at the factory. There should be no need to adjust the phase.**

RF Detector Module

The RF 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.

For example, a system with 63.1 dBm (2 kW) of maximum forward RF would be capable of reading reflected power levels from 51.1 dBm (130W) to 63.1 dBm (2 kW).

Crossguide Assembly

The crossguide assembly includes the system RF output waveguide and a dual crossguide coupler which provides forward and reflected samples of the RF output. See Figure 4.

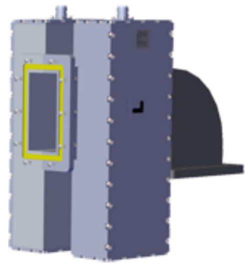


Figure 4: Crossguide Assembly

A label imprinted with calibration data is located adjacent to the N-type (F) sample ports on the crossguide couplers.

Termination Assembly

The termination assembly includes a CPR430G waveguide termination and CPR-430 pressure air inlet. See Figure 5.

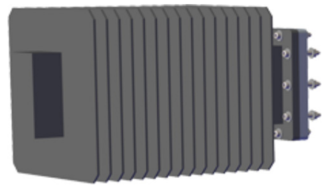


Figure 5: Termination Assembly

The termination has the following characteristics:

Frequency Range: 1.70 - 2.60 GHz
VSWR (max.): 1.15:1
Power (avg.): 6500 W
W/G Size/Flange: WR430 / CPRG

The pressure air inlet is fitted with an 1/8" NPT Schrader valve.

Waveguide Filter

The waveguide filter is a receive band reject filter with part number L205250-S9-TX. This filter can be installed at any point in the waveguide array after the RF output from the crossguide assembly. See Figure 6.

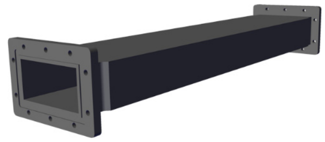


Figure 6: Waveguide Filter

The filter has the following characteristics:

Passband Frequency: 2000 - 2120 MHz
Insertion Loss (max.): 0.35 dB
Return Loss (min.): 19.1 dB
Rejection (min.): 60 dB over 2200 - 2300 MHz
Input Flange: CPRG430
Output Flange: CPRF430
Power Handling: 3200 W

Material: 6061-T6 Aluminum
Finish Outside: Powder coat black
Pressure Test: 5 PSI to 2 PSI > 2 min.
Operating Temp: -40 to +60 °C

System Cables

A series of flexible and semi-rigid coaxial cables provide communication between the various system components. Figure 7 shows the cables.

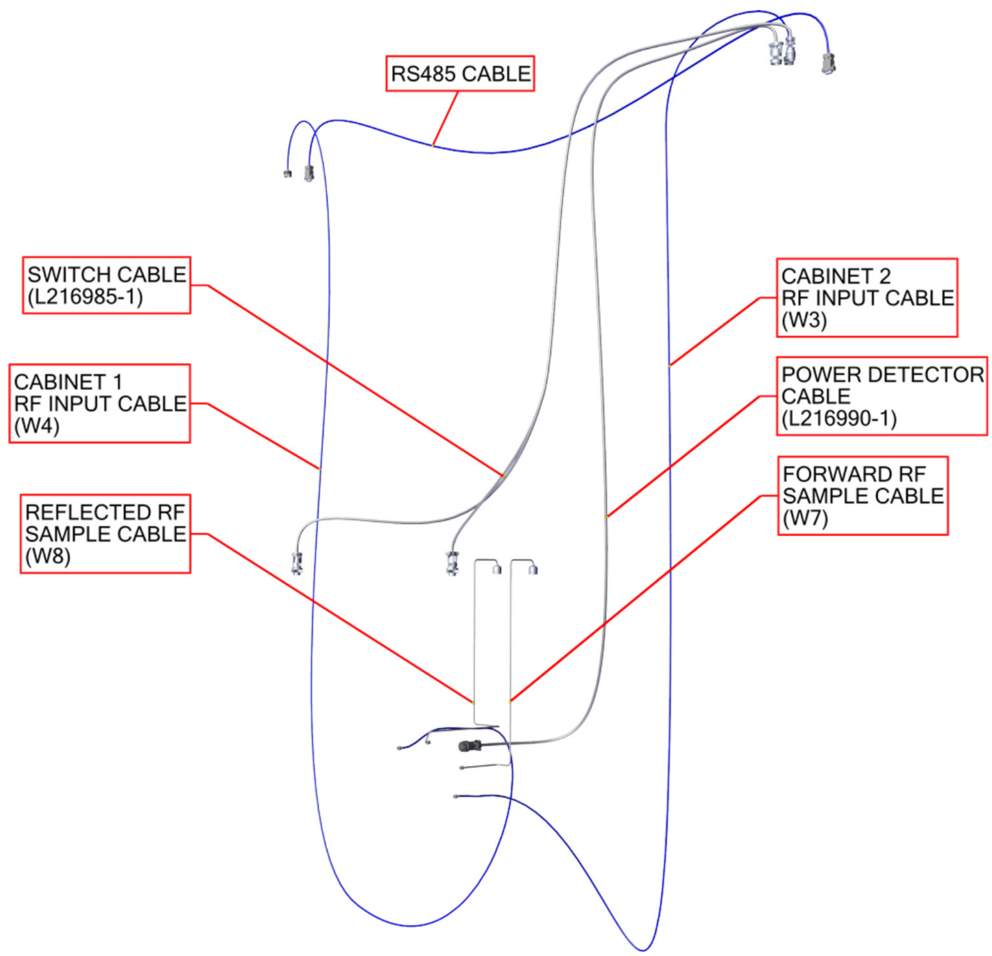


Figure 7: System Coaxial Cables

RS485 Cable

This cable is a 10-foot DB9 Male-Male cable and connects between port J52 (Serial Input from Cabinet 1) at the top of Cabinet 2 and port J22 (Serial Main) at the top of Cabinet 1.

Switch Cable (L216985-1)

This cable is labeled L216985-1 and connects between port J51 (Switch Drive) at the top of Cabinet 2 and the MS connectors on Switch 1 and Switch 2.

Power Detector Cable (L216990-1)

This cable is labeled L216990-1 and connects between port J50 (System Power Detector) at the top of Cabinet 2 and port J1 of the power detector module on the switch assembly plate.

Cabinet 2 RF Input Cable (W3)

This cable is a flexible coaxial cable labeled W3 that will connect between port J23 (RF Input) at the top of Cabinet 2 and port A of the phase shifter on the switch assembly plate.

Cabinet 1 RF Input Cable (W4)

This cable is a flexible coaxial cable labeled W4 that will connect between port J23 (RF Input) at the top of Cabinet 1 and port 2 OUT of the splitter on the switch assembly plate.

Forward RF Sample Cable (W7)

This cable is a semi-rigid coaxial cable labeled W7 that will connect between the Forward RF Sample Port of the crossguide coupler and the splitter at the power detector module on the switch assembly plate.

⚠ **Take care not to bend or otherwise alter the shape of this cable. Doing so may damage the cable.**

Reflected RF Sample Cable (W8)

This cable is a semi-rigid coaxial cable labeled W8 that will connect between the Reflected RF Sample Port of the crossguide coupler and port J3 (Reflected RF Sample In) of the power detector module on the switch assembly plate.

⚠ **Take care not to bend or otherwise alter the shape of this cable. Doing so may damage the cable.**

System Controllers with Touchscreen, Description

Teledyne Paradise Datacom
Drawing Number: 216351-2 Revision A
ECO 18940
01 May 2020

Introduction

This section provides information for the initial inspection, installation, and external connections for the RCP controller.

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
328 Innovation Blvd., Suite 100
State College, PA 16803 USA
Phone: +1 (814) 238-3450
Fax: +1 (814) 238-3829

Mounting

The Teledyne Paradise Datacom RCP controller is designed to be mounted in a standard EIA 19 inch equipment rack. The depth of the chassis, excluding rear panel connectors, is 13.19 inches (335 mm). The height of the chassis is 1.7 inches (44 mm) or 1 rack unit.

Optional 22 inch (559 mm) rack slides with extensions are available.

Storage and Shipment

To protect the controller during storage or shipping, use high quality commercial packing methods. Reliable commercial packing and shipping companies have the facilities and materials to adequately repack the equipment.

Cable Connections

The controller has a wide range of I/O interconnections available at the rear panel. The controller rear panel is shown in Figure 1.

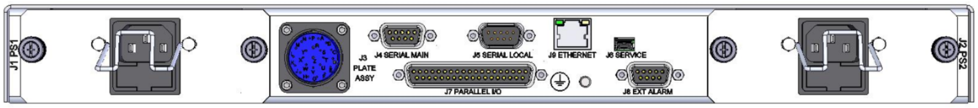


Figure 1: Rear Panel, System Controller

Control Cable Connector (J3) - MS3112E16-23S

The primary connection between the controller and the LNA/LNB (Low Noise Amplifier/Low Noise Block Converter) switch plate or SSPA (Solid State Power Amplifier) switch assembly is through J3. The connector is a 23-pin circular connector, type MS3112E16-23S (See Figure 2 and Table 1). For external waveguide switches, a standard 100 ft. (30m) cable, L201061 should be used.

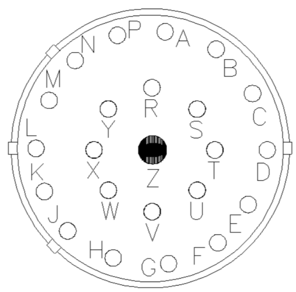


Figure 2: Control Cable Connector (J3)

Table 1: Switch Connector (J3) Pin-Outs

Pin	Description
L	Power Supply #1; +13-17 VDC, 900mA; or, +24V, 1.5A (-HP version only)
J	Power Supply #2 +13-17 VDC, 900mA; or, +24V, 1.5A (-HP version only)
G	Power Supply #3 +13-17 VDC, 900mA; or +24V, 1.5A (-HP version only)
E	Switch Common, +26 VDC, 5A max
B	AMP Support GND
D	Switch Common, +26 VDC, 5A max
W	Switch #1, Position 1 (Tx) (primary)
U	Switch #1, Position 1 (Tx)
P	Switch #1, Position 2 (Tx)
S	Switch #1, Position 2 (Tx) (primary)
F	Switch Common, +26 VDC, 5A max
H	Switch Common, +26 VDC, 5A max
T	Switch #2, Position 1 (Rx)
V	Switch #2, Position 1 (Rx) (primary)
N	Switch #2, Position 2 (Rx)
R	Switch #2, Position 2 (Rx) (primary)
A	AMP Support GND
C	AMP Support GND
K	Switch Common, +26 VDC, 5A max
M	Switch Common, +26 VDC, 5A max

⚠ **Note: The RCP2-1000-CO remote control panel does not require connection to this port.**

Serial Port, Main (J4) - DB9 (F)

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

The pin-out is shown in Table 2. Note that the pin-out is standard DTE; a null modem is not required when connecting to a standard PC serial port.

Table 2: Serial Port, Main (J4) Pin-Outs

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

Serial Port, Local (J5) - DB9 (M)

The local serial port is used to support special transceiver systems and remote control panels. The baud rate of this port is fixed at 9600 Baud and cannot be changed. J5 is permanently configured for RS-485 half duplex communication. Table 3 details the local serial port pin-out. Port features full galvanic isolation from chassis ground.

Table 3: Serial Port, Local (J5) Pin-Outs

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

Service Port (J6) - Mini USB

A 5-contact Mini USB connector is used to provide flash re-programmability for the controller card. In order to reload controller board firmware, connect this port to a standard PC USB port. See the **Fault Analysis and Troubleshooting** section for a description of the firmware upgrade procedure.

Parallel I/O Connector (J7) - DB37 (F)

The controller has a full compliment of parallel monitor and control lines. A 37-pin D sub-style connector is used for the parallel I/O signals, which are detailed in Table 4.

Table 4: Parallel I/O Port (J7) Pin-Outs

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

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

See the External mode description in the **Touchscreen Operation** section for instructions on how to use the Auto/Manual Input (Pin 16) as an External Mute Input.

⚠ **Note: The RCP2-1000-CO remote control panel does not require connection to this port.**

External Alarm Port (J8) - DB9 (F)

An external alarm port is provided to allow maximum flexibility of configurations. This allows the user to interface with the alarm output of other equipment into the controller. Inputs are protected against ESD of ±15 kV using the Human Body model; against ESD of ±8kV using the Contact Discharge method specified in IEC1000-4-2; and against ESD of ±15 kV using the Air Gap method described in IEC1000-4-2. Table 5 shows the external alarm pin-out.

Table 5: External Alarm Port (J8) Pin-Outs

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

⚠ **Note: The RCP2-1000-CO remote control panel does not require connection to this port.**

Ethernet Port (J9) - RJ45 (F)

This is a RJ45 connector with integrated magnetics and LEDs. This port becomes the primary remote control interface when the Interface option is selected to "IPNet" or SNMP interface as described in the Communication > Interface description of the **Touchscreen Operation** section.

This feature allows the user to connect the controller to a 10/100 Base-T office Local Area Network and have full-featured Monitor & Control functions through a web interface. See Table 6.

Table 6: Ethernet Port (J9) Pin-Outs

Pin	Function
1	TX+
2	TX-
3	RX+
6	RX-
4,5,7,8	Ground

⚠ **Note: IP address, Gateway address, Subnet mask, IP port and IP Lock address need to be properly selected prior to first use.**

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

Prime Power Connection (J1, J2)

Two separate removable power supplies are provided for fully redundant operation. Either of the two supplies is capable of operating the system and its associated switches. Two AC power connectors are provided on the rear panel (J1,J2).

Removable Power Supply Modules

The unit has a redundant power supply array consisting of two modules. A failed power supply module may be removed from the chassis by loosening the two captured thumbscrews and sliding the module out of the chassis, then unplugging the quick-disconnect power pole connectors.

24V Power Supply Module

Figure 3 shows an outline drawing of a power supply module.

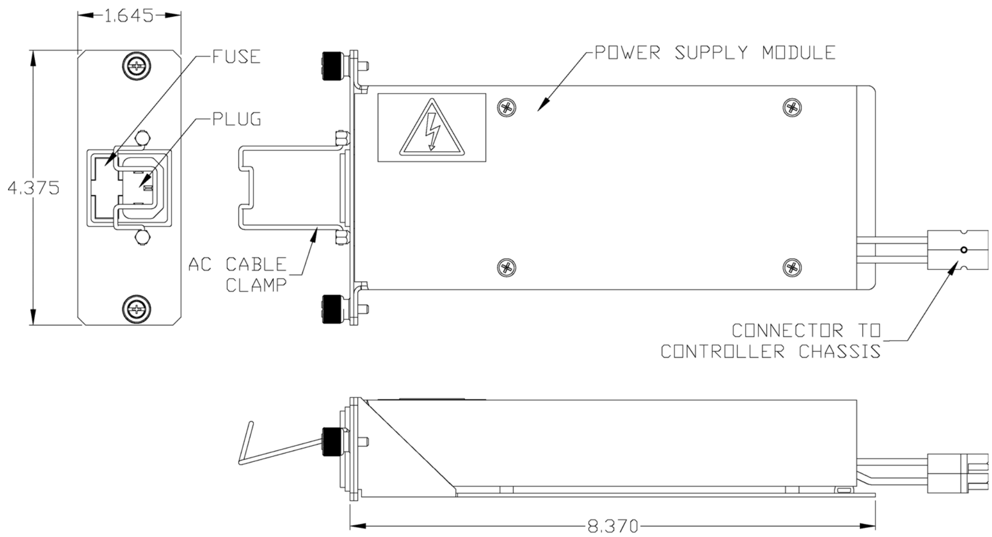


Figure 3: Outline Drawing, 24V Power Supply Module

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

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

See the **Fault Analysis and Troubleshooting** section for directions on identifying and replacing a failed power supply module.

24V Power Supply Module, High Power option

Figure 4 shows an outline drawing of a power supply module for units utilizing the High Power (-HP) option.

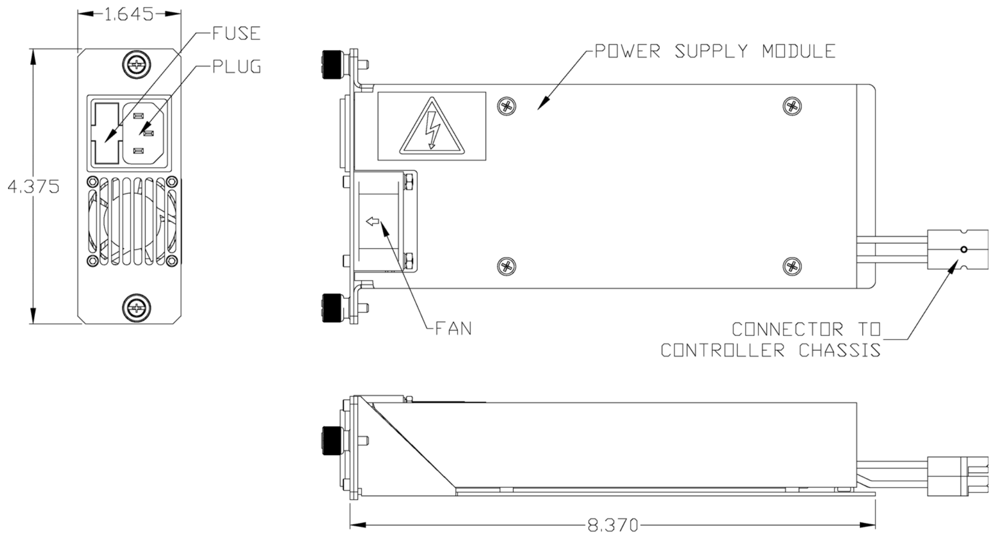


Figure 4: Outline Drawing, -HP Option Power Supply Module

The following list comprises the specifications for the -HP option power supply module:

Plug: IEC, 250V, 10A, Male plug
Fuse: 2 Amp 5x20mm
Power Supply: 85-264 V input, 28V output, 175W
Fan: 40mm, 24V, 4.9 CFM
Connector to chassis: Quick-connect Power pole

See the **Fault Analysis and Troubleshooting** section for directions on identifying and replacing a failed power supply module.

48V Power Supply Module

Figure 5 shows an outline drawing of a 48V power supply module.

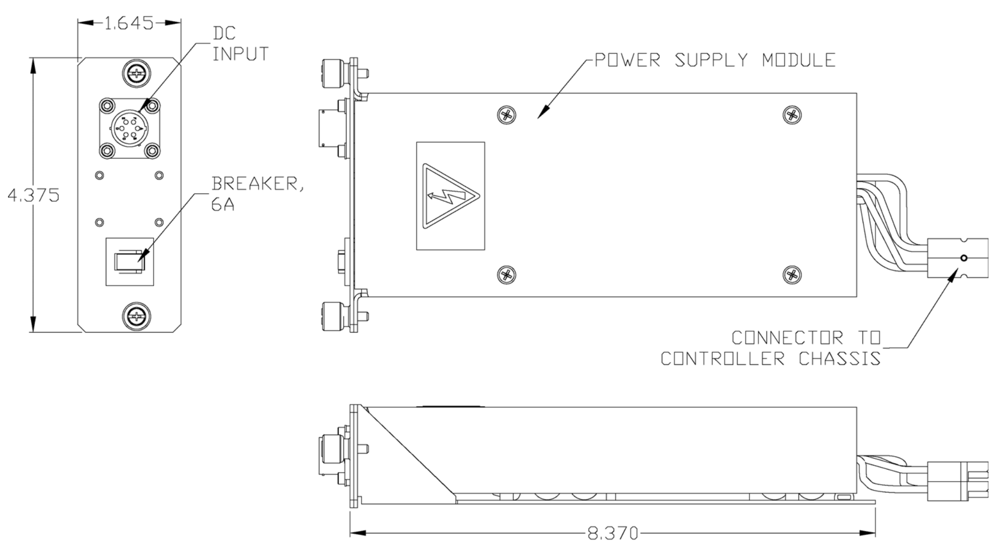


Figure 5: Outline Drawing, 48V Power Supply Module

The following list comprises the specifications for the 48V power supply module:

Plug: MS3112E10-6P Circular MIL connector, 6-pin (MS3116F10-6S mating)
Circuit Breaker: 6 Amp
Power Supply: 48V, 150W
Connector to chassis: Quick-connect Power pole

See the **Fault Analysis and Troubleshooting** section for directions on identifying and replacing a failed power supply module.

Design Philosophy

The redundant controller was designed to achieve a new level in high reliability, maintenance free operation. A tightly integrated modular assembly approach has been used to realize an extremely versatile controller while maintaining its user friendly operator interface. Four basic building blocks are combined in the redundant system controller:

1. Redundant Power Supplies
2. Digital Core Board Assembly
3. I/O Board Assembly
4. Touchscreen Display

Redundant Power Supplies

A block diagram of the controller is shown in Figure 6. Two power supplies are provided in the controller. These supplies can be connected to two independent AC sources for absolute system redundancy. Either supply is capable of operating the controller and its associated transfer switches. Both power supplies have universal input capability operating over an input voltage range of 85 to 265 VAC and line frequencies of 47 to 63 Hz. The power supplies have a power factor of 0.93 ensuring minimum line harmonic products. Each power supply produces +26 VDC.

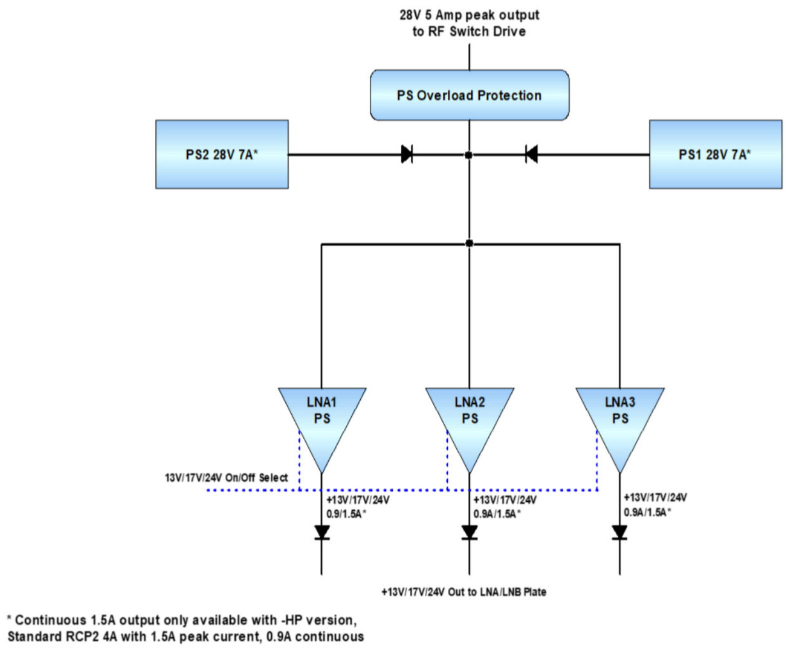


Figure 6: Block Diagram, Power Supply Configuration

The controller provides three channel power outputs for connecting external LNA/LNB units. In standard configuration, each LNA/LNB channel can be selected to supply 13V or 17V with up to 900 mA DC current output. Output voltage is user-selectable either from the front panel menu or over the remote control interface. The -HP model provides an additional 24V 1500 mA output option for use with higher power external equipment.

All channels are protected from overload and will reduce output if the maximum power output capacity is exceeded by an external load.

> ⚠ **Note for 24V 1500 mA channel output: In order to provide an equal load to both internal AC/DC supplies, channels derive their power asymmetrically: Channel 1 from PS2, Channel 3 from PS1; and Channel 2 from either PS2 or PS1. See Figure 6. This configuration allows default standby Channel 2 to power up in case one of the AC/DC power supplies fails. In order to conserve power from the remaining power supply, the LNA/LNB channel will reduce its power output to 13V, 900 mA.**

Digital Core Board

The Digital Core Board is operated by a microcontroller unit. All digital I/O lines feature transient absorbing devices and a ground isolated barrier for extra protection. The power supply lines are protected by current limiting devices. The digital core board also contains a USB port that allows the controller to be firmware upgradeable in the field.

I/O Board Assembly

The I/O Board Assembly contains the primary parallel (hardware) interface circuitry of the controller. It is physically attached to the Digital Core Board by a 40-pin header. The I/O Board provides user selectable output voltage: +13, 17 and 24 VDC supply output for the LNB units.

Each output on a standard unit can supply continuously up to 0.9A and up to 1.5A in peak current. The -HP version can supply 1.5A continuously. All channels are short circuit protected. The 10 Form C relays and opto isolated inputs for the parallel I/O interface are included on this board assembly. A series of rugged N-channel enhancement mode MOSFET devices provide the current sink circuitry to drive either one or two waveguide transfer switches.

Touchscreen Display

Rarely found in redundant controllers, the controller provides a large full-color touchscreen panel. This provides an extremely user friendly interface. The touchscreen is directly interfaced to the microcontroller via the address and data bus. Virtually all of the controller's setup and adjustments are accessible from the touchscreen. There is no need to access the interior of the controller to make any setup changes.

The touchscreen may be configured as a redundant system controller (1:1 or 1:2), as a phase combined controller (1:1 fixed phase combined or 1:2 phase combined), or as a maintenance switch. A great deal of human engineering has gone into the design of this membrane panel. A full complement of alarm indicators are provided along with the mimic display which shows the switch positions of the redundant system. An intuitive menu structure allows the user to easily set the operating parameters, and monitor and control the connected system. Separate Action Buttons have been provided for frequently used functions, further enhancing the controller's ease of use. See the **Touchscreen Operation** section.

Control Cable Considerations

The redundant controller is designed to drive negative 28 VDC latching style transfer switches. Latching means that the switch has a self cutoff and does not require continuous current consumption. Some commonly used waveguide transfer switches used in Teledyne Paradise Datacom Redundant Systems are given in Table 7.

Table 7: Commonly Used Waveguide Transfer Switches

Part Number	Description	Manufacturer	Voltage Range	Current
75SBOS	10.7-14.5 GHz (Waveguide/Coax)	Sector	-20 to -30 VDC	0.80 Amps
3NBGS	5.8-6.4 GHz (Waveguide/Coax)	Sector	-20 to -30 VDC	2 Amps
2SBGS	3.7-4.2 GHz (Waveguide/Coax)	Sector	-20 to -30 VDC	3 Amps
4BF	1.7-2.6 GHz (Waveguide)	Sector	-20 to -30 VDC	4 Amps

As Table 7 shows, the switch drive current is dependent on the frequency band which determines the physical size of the switch motor. Therefore the system designer must consider the resistive cable losses when choosing a control cable length.

Similarly, the system designer must ensure use of the proper cable insulation for the particular installation. Teledyne Paradise Datacom uses both standard service and burial grade for redundant system control cables. Standard service cable has a PVC jacket which is ultra violet ray (UV) stable in outdoor use. However, standard service cable should not be immersed in water or be buried underground for long periods of time. For such applications, burial grade cable should be installed.

The controller sources a maximum +26 VDC @ 5 Amps to the transfer switch. A typical -28 VDC waveguide switch will operate over a range of -20 to -30 volts. Therefore, the minimum voltage required at the waveguide switch is -20 VDC. Using this as a design guideline, the control cable should be sized so that it does not drop more than 6 VDC from the controller to the switch.

Teledyne Paradise Datacom control cables utilize 20 conductors of #18 AWG stranded wire. The control cable schematic is shown in Figure 7. The resistance of #18 AWG stranded wire is 6.5 ohms per 1000 feet. The controller switch connector (J3) allows contacts for two wires per switch connection. Therefore, two conductors can be paralleled for both the source and return lines for the transfer switch. With a maximum allowable voltage drop of 6 volts, this equates to a 3 volt drop in the source wires and 3 volt drop in the return wires. This is shown schematically in Figure 7. Using four (4) parallel #18 AWG conductors gives a resultant cable resistance of 1.6 ohms per 1000 feet, or 0.0016 ohms per foot.

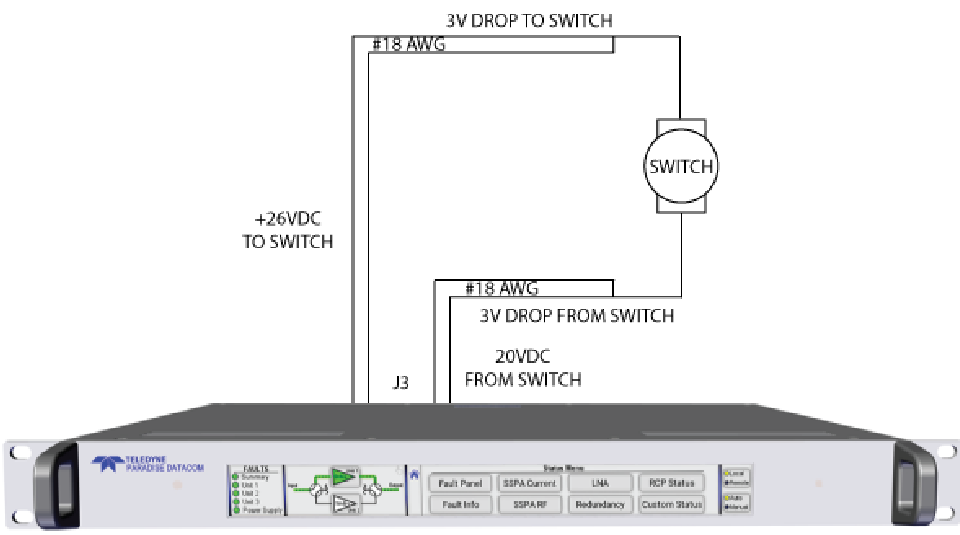


Figure 7: Cable Losses to Transfer Switch

To calculate the maximum cable length that can be accommodated to the transfer switch, first consider the current draw by the switch either from the manufacturer's data or from Table 7. Next divide this current into 6 volts. This gives the maximum cable resistance to and from the switch. Finally, divide this cable resistance by 0.0016 ohms/ft. to find the maximum cable length. This is shown in the following example:

```
Switch Current draw = 3 Amps
6 V / 3 Amps = 2 ohms (maximum cable resistance)
2 ohms/0.0016 ohms/ft. = 1250 ft.;
maximum cable length using (4) #18 AWG connectors
```

Table 8 gives the maximum cable length for some popular switches.

Table 8: Maximum Cable Length for Selected Switches (Single Switch Systems)

Part Number	Description	Manufacturer	Maximum Cable Length
75SBOS	10.7-14.5 GHz (Waveguide/Coax)	Sector	4,690 ft. (1,430 m)
3NBGS	5.8-6.4 GHz (Waveguide/Coax)	Sector	1,880 ft. (572 m)
2SBGS	3.7-4.2 GHz (Waveguide/Coax)	Sector	1,250 ft. (381 m)
4BF	1.7-2.6 GHz (Waveguide)	Sector	938 ft. (286 m)

Teledyne Paradise Datacom
Drawing Number 216351-2 Revision A
ECO 18940
Last Modified: 01 May 2020

Installation, 1:1 FPC S-Band Indoor PowerMAX System

Teledyne Paradise Datacom
Drawing Number: 217022-2 Revision -
RA 7780
07 August 2020

Introduction

The 1:1 Fixed Phase Combined S-Band Indoor PowerMAX System was shipped from the factory as intact as possible. Some assembly will be required to complete the installation.

The major components that will require assembly are as follows:

- Equipment Cabinets, Models HPASS800AEZA002G2 and HPASS800AEZA003G2
- Switch Plate Assembly
- Crossguide Assembly
- Termination Assembly
- Waveguide Filter
- System Cables

Uncrating the Equipment

Remove all equipment from the shipping containers prior to installation. Once the equipment is unpacked, the crates and packing materials should be saved for future use in the event that the equipment needs to be shipped elsewhere.

Inspect System

Before beginning the installation, perform an inspection of each of the components and all cables.

If damage to any equipment is apparent, document the damage and contact the factory:

Teledyne Paradise Datacom
328 Innovation Blvd., Suite 100
State College, PA 16803 USA
814-238-3450
TeledyneParadiseSupport@Teledyne.com

Inspect Components to be Installed

Figure 1 shows the various assemblies that comprise the 1:1 Fixed Phase Combined S-Band PowerMAX System, as they were disassembled for shipment.

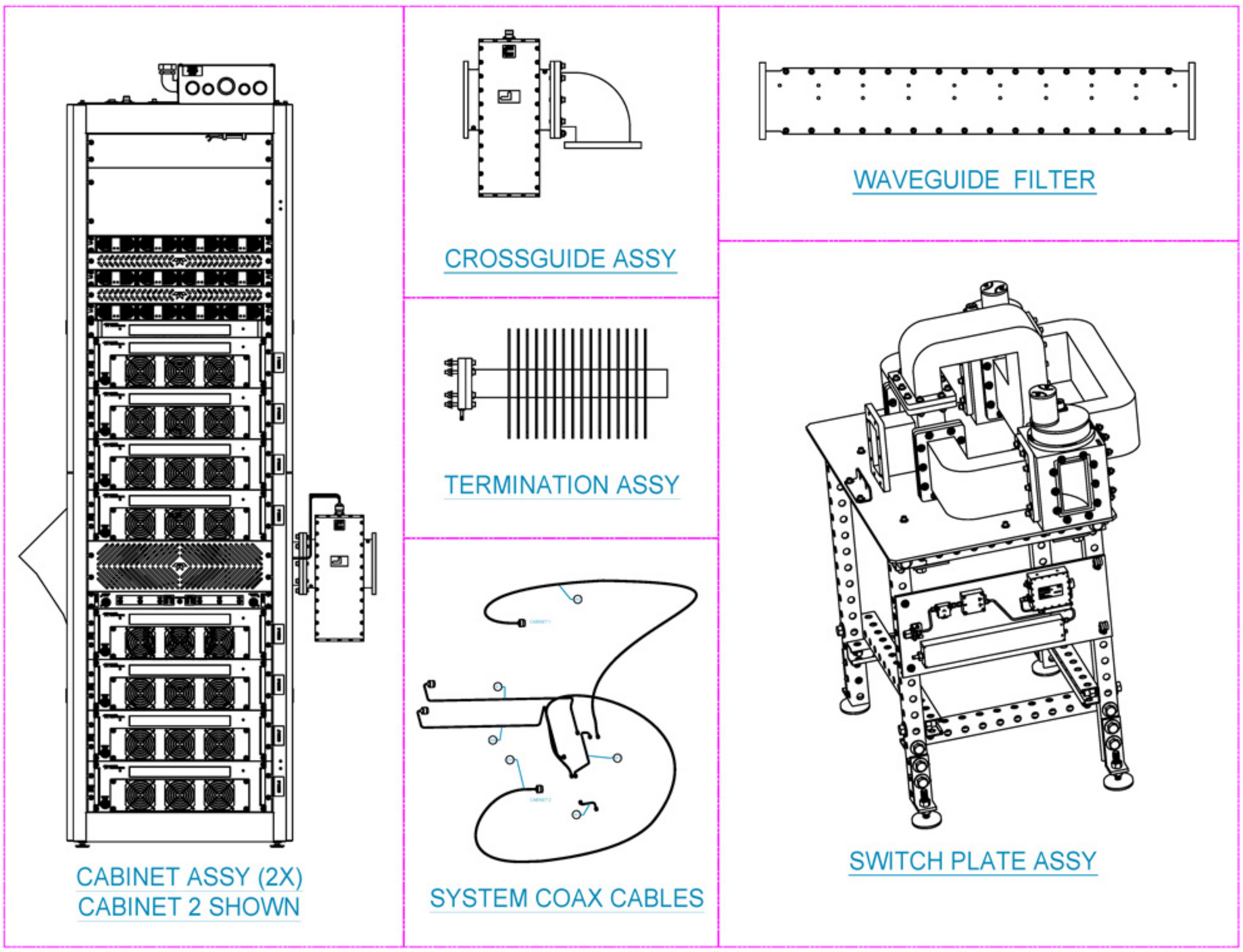


Figure 1: 1:1 FPC S-Band PowerMAX System Components, as Shipped

Install Equipment Cabinets

Refer to the Cabinet level manual (document 217021) for information about installation of the single cabinet (Models HPASS800AEZA002G2 and HPASS800AEZA003G2), and their stand-alone operation.

Position the cabinets so that the cabinet RF outputs face each other. Refer to Figure 2, which shows the dimensions between the cabinets and the cabinet RF output flanges.

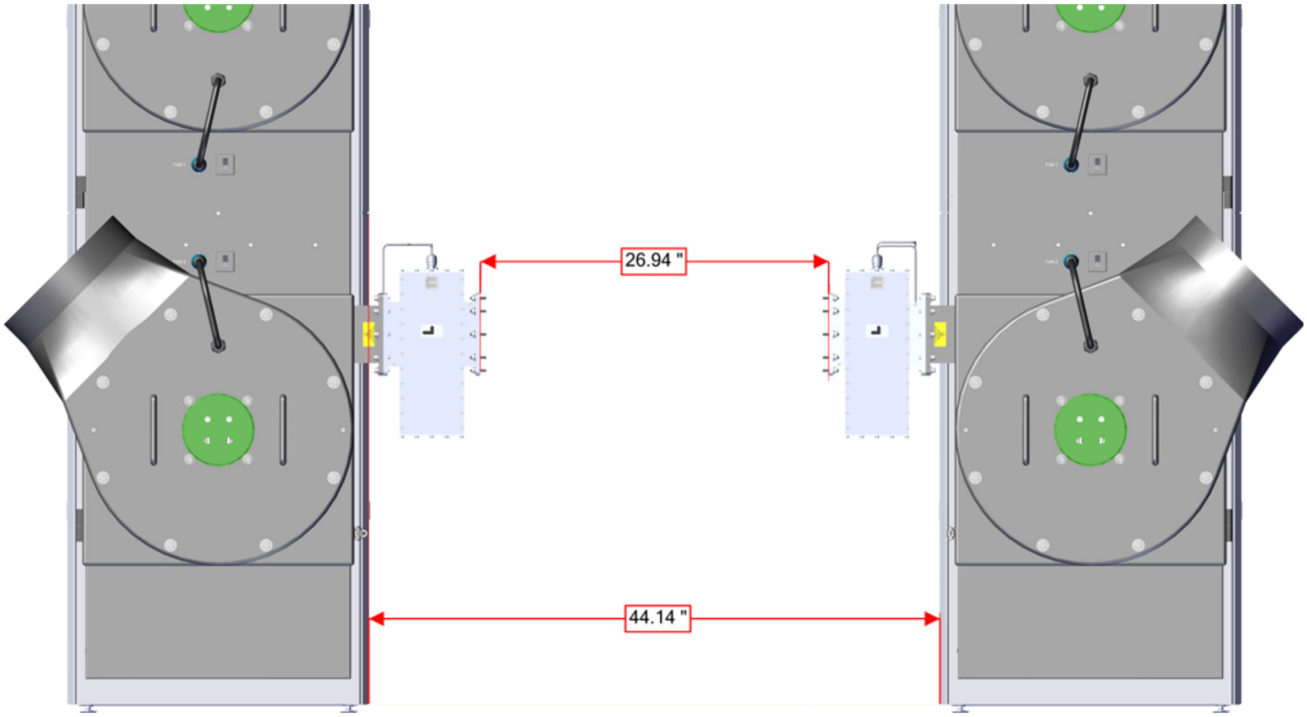


Figure 2: Dimensions, Space Between Cabinets and RF Output Flanges

It may be easier to install one cabinet first, then the switch assembly, and then install the second cabinet.

> ⚠ **Warning! Remove power from the cabinets prior to proceeding with the installation instructions below. Switch off all circuit breakers at each cabinet's AC Distribution Panel.**

For purposes of identifying which cabinet is which:

- Cabinet 1 refers to model HPASS800AEZA003G2;
- Cabinet 2 refers to model HPASS800AEZA002G2.

Install Switch Assembly

The HPASS800AEZA002G2 cabinet RF output waveguide will attach to port 3 of switch 2 (SW2) of the switch assembly. The HPASS800AEZA003G2 cabinet RF output waveguide will attach to port 2 of switch 1 (SW1) of the switch assembly.

Use the leveling feet to align the cabinet RF output waveguide flanges with the switch waveguide ports. See Figure 3. Loosen the top nut and spin the nut up the thread to give sufficient space to adjust the position of the switch assembly. Use the bottom nut to adjust the height of the leveling foot. Once the switch assembly is properly positioned, tighten the top nut to lock the leveling foot position in place.

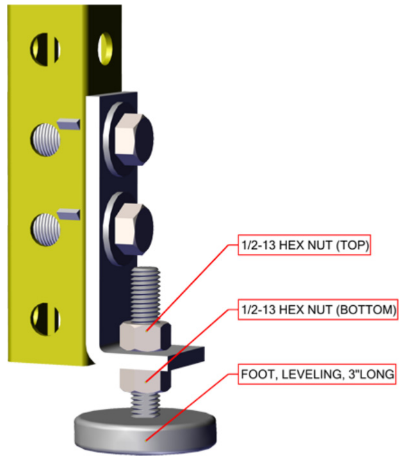


Figure 3: Detail, Leveling Foot

Remove any Kapton tape or waveguide covering from the open ends of the WR430 waveguide on the (HPASS800AEZA002G2) cabinet RF output and on port 3 of switch 2 (SW2).

Insert a CPRG430 half gasket in the crossguide flange with the flat side of the gasket in the grooved channel.

Slide the crossguide assembly onto the 1/4-20 threaded studs at port 3 of switch 2 (SW2). Refer to Figure 4.

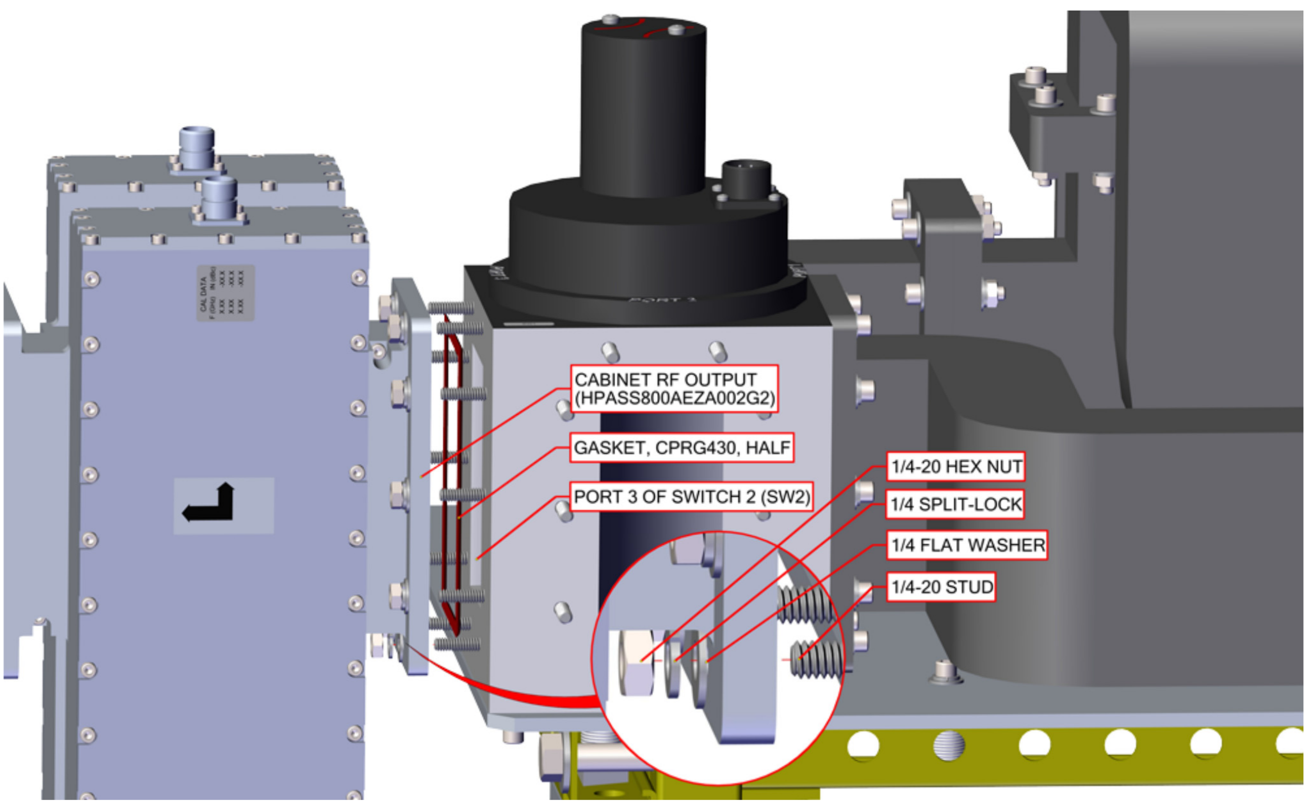


Figure 4: Connect Cabinet 2 (HPASS800AEZA002G2) to Switch Assembly

Remove any Kapton tape or waveguide covering from the open ends of the WR430 waveguide on the (HPASS800AEZA003G2) cabinet RF output and on port 2 of switch 1 (SW1).

Insert a CPRG430 half gasket in the crossguide flange with the flat side of the gasket in the grooved channel.

Slide the crossguide assembly onto the 1/4-20 threaded studs at port 2 of switch 1 (SW1). Refer to Figure 5.

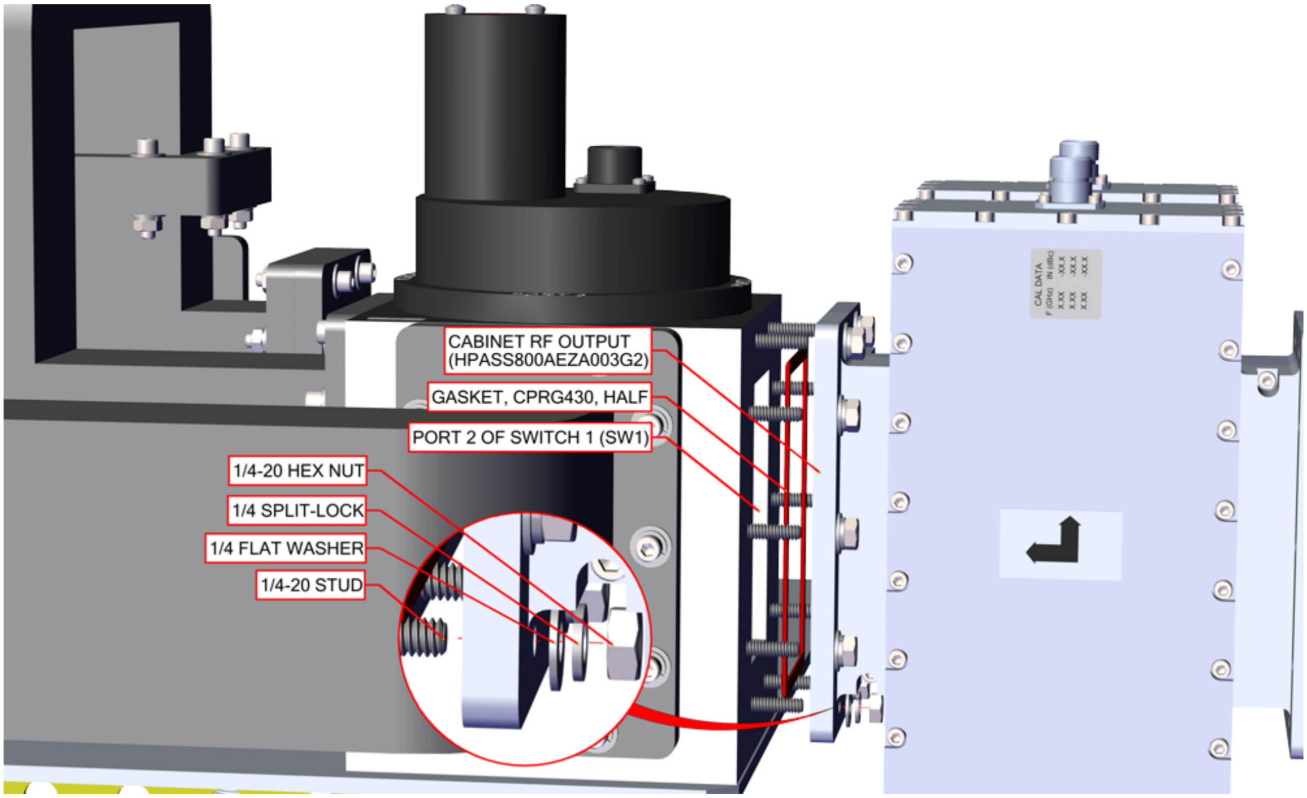


Figure 5: Connect Cabinet 1 (HPASS800AEZA003G2) to Switch Assembly

Tighten the hardware at both waveguide flanges in a star pattern, as shown in Figure 6. Torque to 75.6 lb-in. (8.5 Nm).

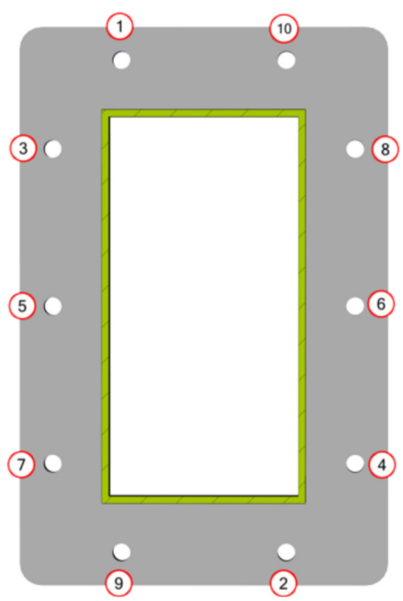


Figure 6: Torque Hardware in Star Pattern

Install Crossguide Assembly

Remove any Kapton tape or waveguide covering from the open ends of the WR430 waveguide on the crossguide assembly and on port 2 of switch 2 (SW2).

Insert a CPRG430 half gasket in the crossguide flange with the flat side of the gasket in the grooved channel.

Slide the crossguide assembly onto the 1/4-20 threaded studs at port 2 of switch 2 (SW2). Make sure the open waveguide flange at the 90-degree H-bend is facing down. Refer to Figure 7.

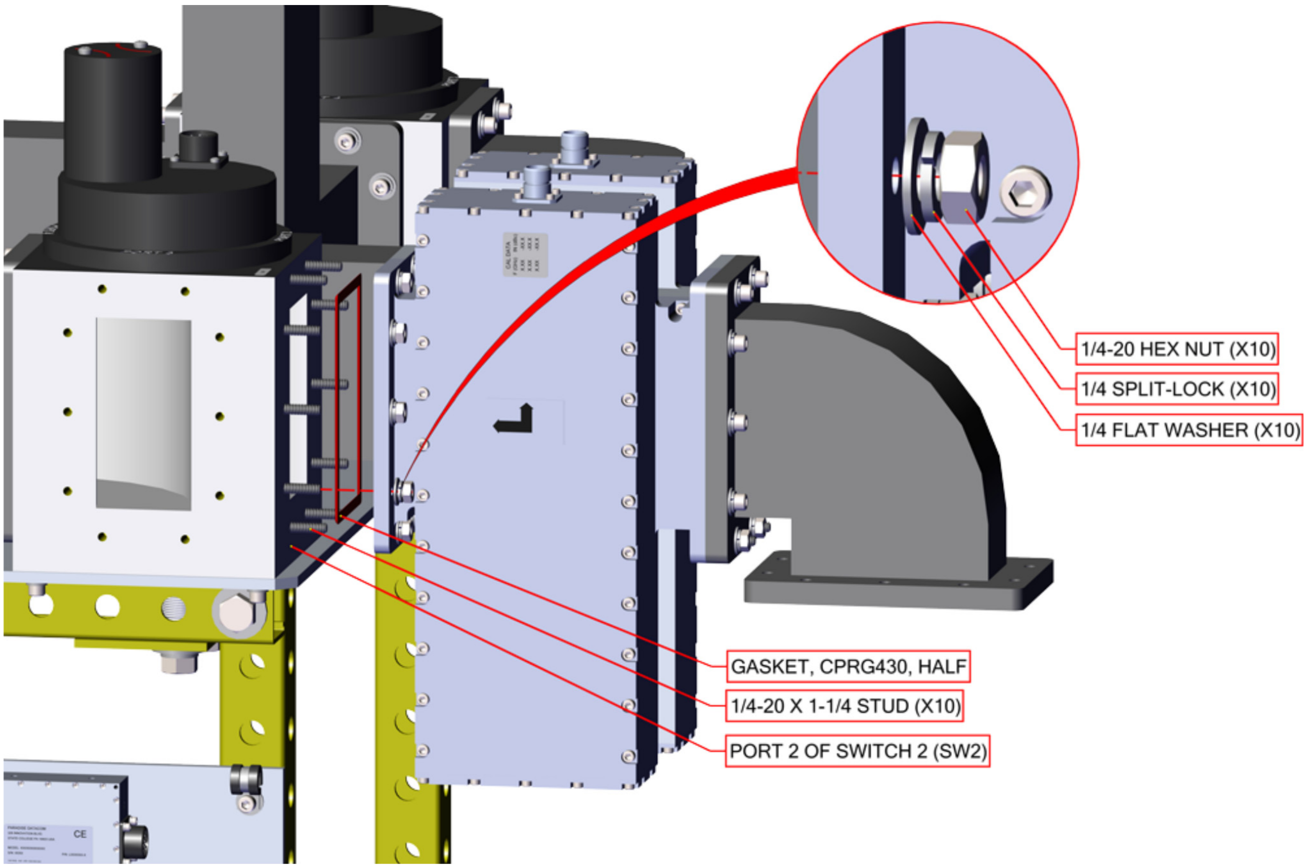


Figure 7: Install Crossguide Assembly

Secure the crossguide assembly to the switch using the hardware provided. Tighten the hardware in a star pattern, as shown in Figure 8. Torque to 75.6 lb-in. (8.5 Nm).

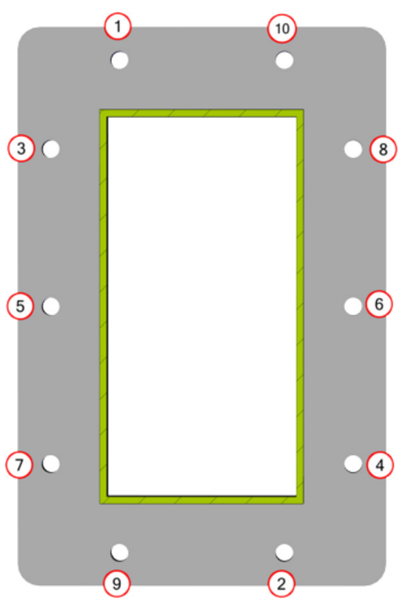


Figure 8: Torque Hardware in Star Pattern

Install Termination Assembly

Remove the shipping support from between the magic tee and the termination support bracket as shown in Figure 9. Save the hardware.

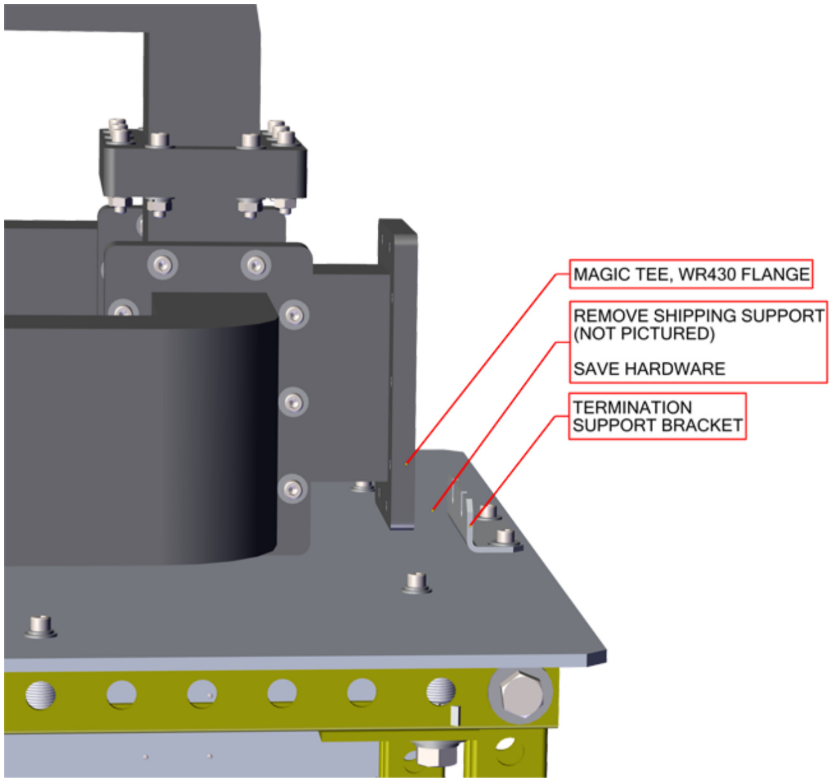


Figure 9: Remove Shipping Support

Remove any Kapton tape or waveguide covering from the open ends of the WR430 waveguide on the termination assembly and from the magic tee waveguide flange.

Loosen the hardware securing the termination support to the switch assembly plate. Slide the termination support as far as possible from the waveguide flange at the magic tee.

Insert a CPRG430 half gasket at the termination assembly waveguide flange with the flat side of the gasket in the grooved channel. See Figure 10.

Slide the termination assembly between the support bracket and the magic tee waveguide flange, taking care not the unseat the gasket.

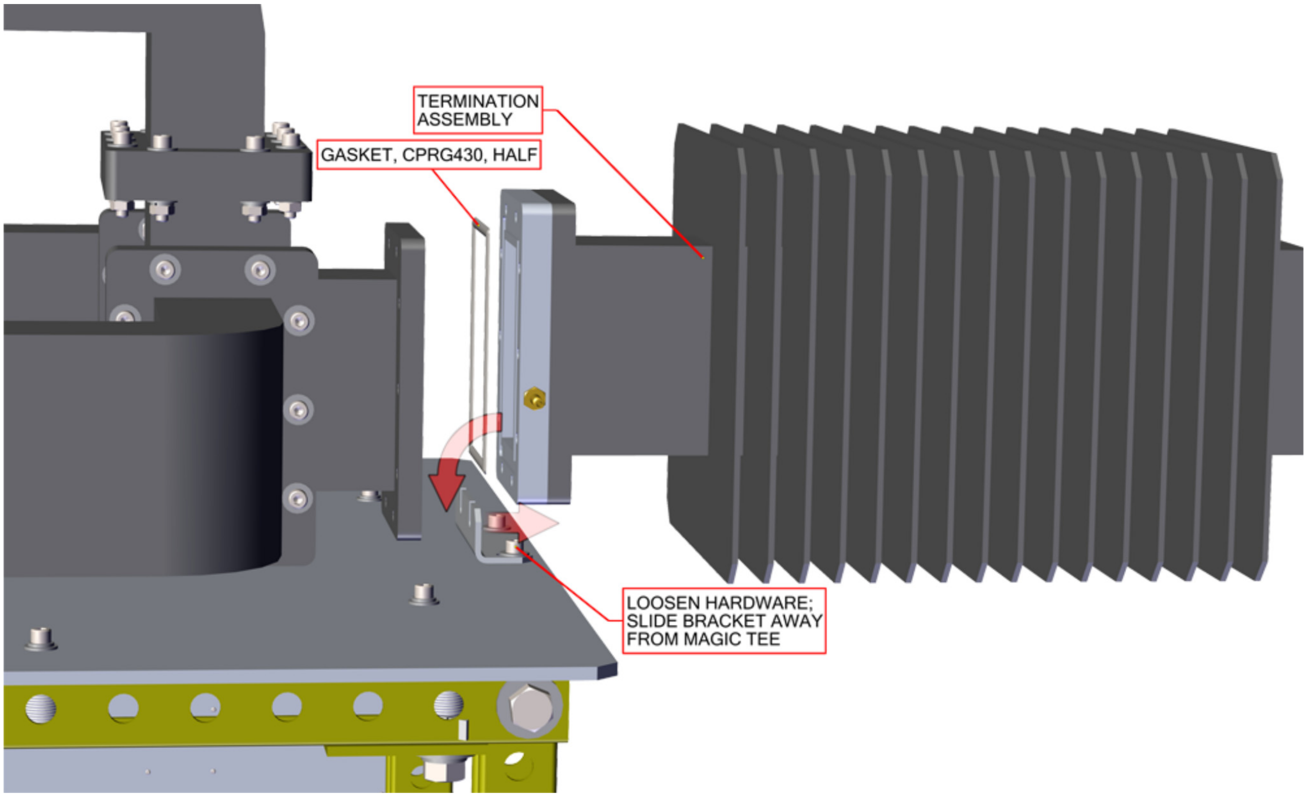


Figure 10: Slide Bracket, Install Gasket

Secure the waveguide flanges together using the provided hardware. Use the hardware saved from removing the shipping support through the termination support bracket. See Figure 11.

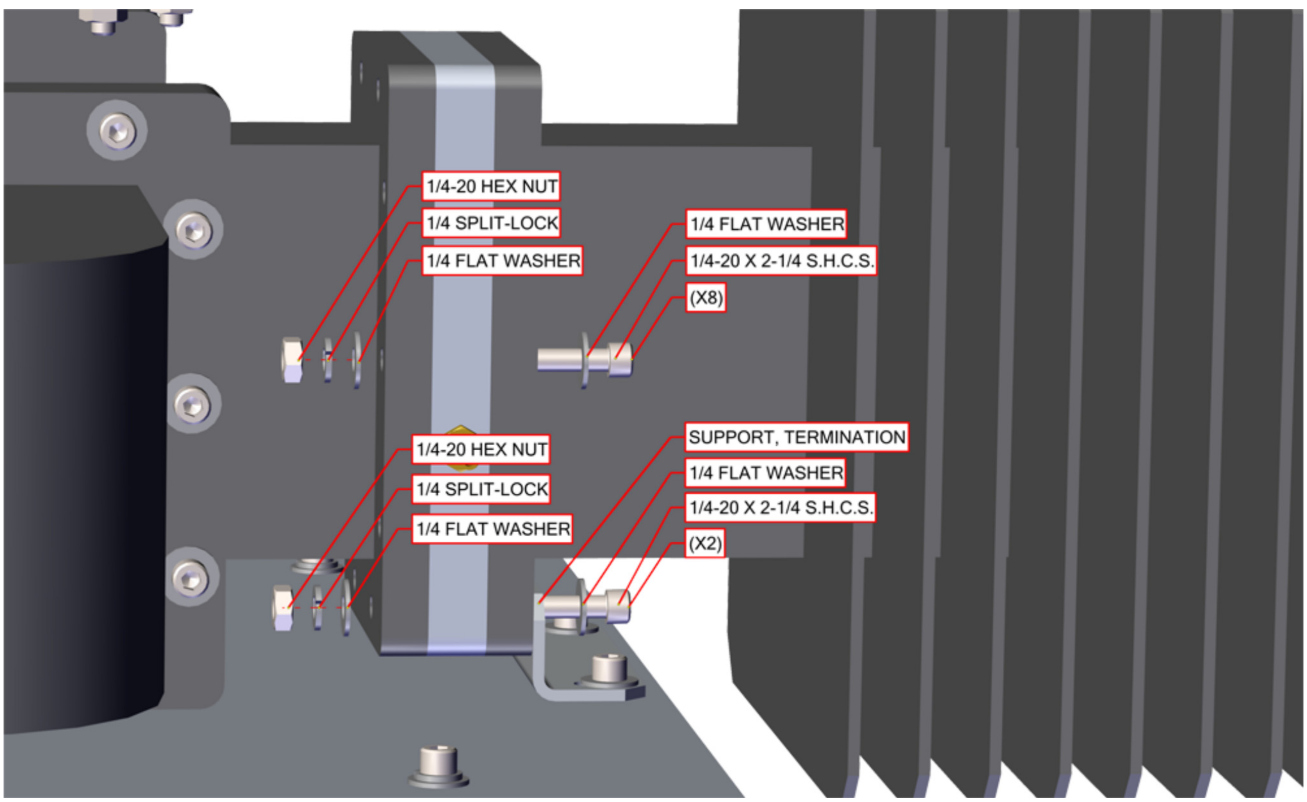


Figure 11: Bolt W/G Flanges Together

Tighten the hardware in a star pattern, as shown in Figure 12. Torque to 75.6 lb-in. (8.5 Nm). Tighten the hardware securing the termination support bracket to the switch assembly plate.

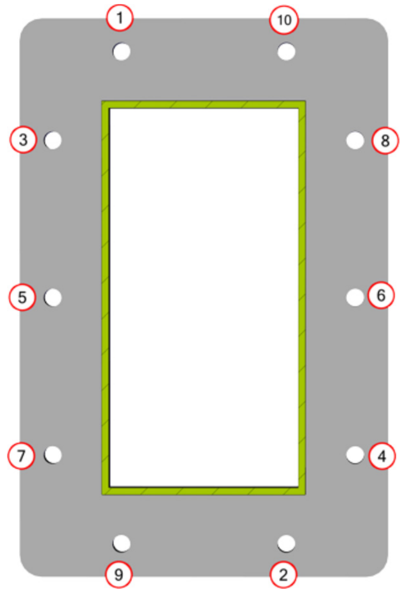


Figure 12: Torque Hardware in Star Pattern

Install Waveguide Filter

The waveguide filter may be installed at any point in the waveguide run after the system RF output. The input flange is a CPRG430 (grooved); the output flange is a CPRF430 (flat). See Figure 13.

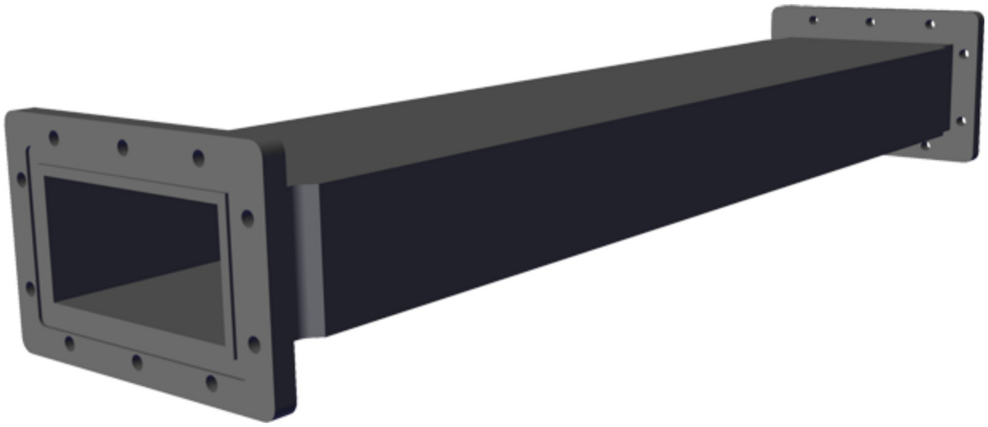


Figure 13: Waveguide Filter

Insert a CPRG430 half gasket with the flat side of the gasket in the grooved channel of the input waveguide flange.

Install System Cables

Refer to Figure 14 for connections to the system I/O panel on the switch assembly.

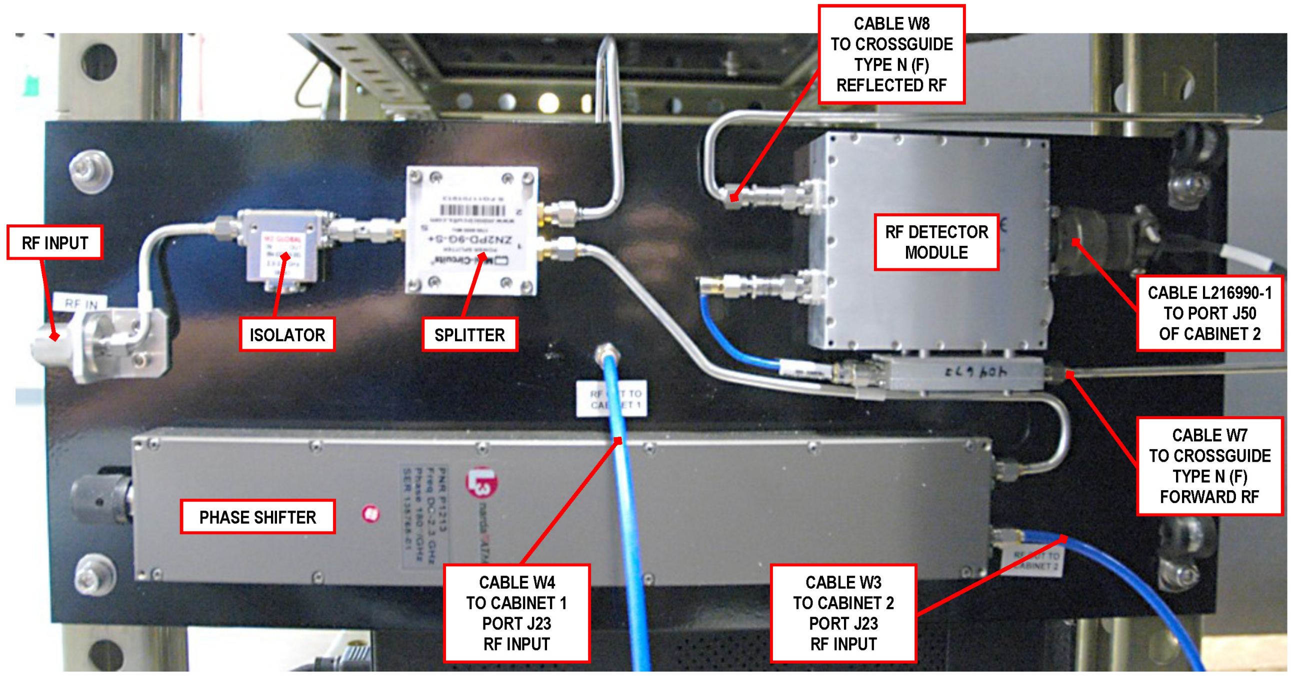


Figure 14: Connections to System Plate Assembly

RS485 Cable

Connect the 10-foot DB9 Male-Male cable between port J52 (Serial Input from Cabinet 1) at the top of Cabinet 2 and port J22 (Serial Main) at the top of Cabinet 1.

Switch Cable (L216985-1)

Connect the cable labeled L216985-1 between port J51 (Switch Drive) at the top of Cabinet 2 and the MS connectors on Switch 1 and Switch 2.

Power Detector Cable (L216990-1)

Connect the cable labeled L216990-1 between port J50 (System Power Detector) at the top of Cabinet 2 and port J1 of the power detector module on the switch assembly plate.

Cabinet 2 RF Input Cable (W3)

Connect the flexible coaxial cable labeled W3 between port J23 (RF Input) at the top of Cabinet 2 and port A of the phase shifter on the switch assembly plate. Use the cable clamp near port A of the phase shifter to support and guide the cable run.

Cabinet 1 RF Input Cable (W4)

Connect the flexible coaxial cable labeled W4 between port J23 (RF Input) at the top of Cabinet 1 and port 2 OUT of the splitter on the switch assembly plate. Use the cable clamp near the RF Detector Module to support and guide the cable run.

Forward RF Sample Cable (W7)

Connect the semi-rigid coaxial cable labeled W7 between the Forward RF Sample Port of the crossguide coupler and the splitter at the power detector module on the switch assembly plate.

> ⚠ **Take care not to bend or otherwise alter the shape of this cable. Doing so may damage the cable.**

Reflected RF Sample Cable (W8)

Connect the semi-rigid coaxial cable labeled W8 between the Reflected RF Sample Port of the crossguide coupler and port J3 (Reflected RF Sample In) of the power detector module on the switch assembly plate.

> ⚠ **Take care not to bend or otherwise alter the shape of this cable. Doing so may damage the cable.**

Connect RF Input/Output

The system RF Output is a CPR430G waveguide flange at the dual crossguide coupler. If not connecting to an antenna, a dummy load of sufficient size to handle system saturated power must be connected to the system RF Output prior to power-up.

If connecting to an antenna, position the waveguide that will be connected to the cabinet such that it aligns with the cabinet RF Output waveguide flange. Install an o-ring gasket (supplied) between the cabinet RF Output and the connecting waveguide. Bolt the waveguide flanges together, tightening the hardware in opposite pairs.

> ⚠ **Warning! Do not operate the system without terminating the RF Output!**

Connect a signal source to the RF Input port on the Switch Assembly.

> ⚠ **Maximum input is +15 dBm.**

Connect Dehydrator to Waveguide Array

⚠ **Teledyne Paradise Datacom recommends that all waveguide transmission systems in high power amplifiers be dehydrated and pressurized to minimize the risk of electrical arcs forming within the waveguide array.**

A pressure air inlet is included on the termination assembly that was installed to the switch assembly. Connect a pressurization/dehydrator unit to that valve before powering up the system.

⚠ **Important! Teledyne Paradise Datacom recommends purging the air from the cabinet waveguide prior to applying power to a standalone cabinet or to a system which includes multiple cabinets.**

Apply Power

Switch on all breakers at the AC Distribution Panel of both cabinets to power up the system.

Teledyne Paradise Datacom
Drawing Number 217022-2 Revision -
RA 7780
Last Modified: 07 August 2020

SSPA Touchscreen Overview

Teledyne Paradise Datacom
Drawing Number: 216512-4 Revision B
ECO 18951
11 June 2020

Introduction

All indoor rack-mountable solid state power amplifiers are available with a front panel touchscreen, from which the user can control the amplifier, and obtain information about the operational status of the amplifier.

There are four main areas on the touchscreen display, as shown in Figure 1:

- (1) Menu
- (2) Fault Indicators
- (3) RF Signal Path Display
- (4) Action Buttons

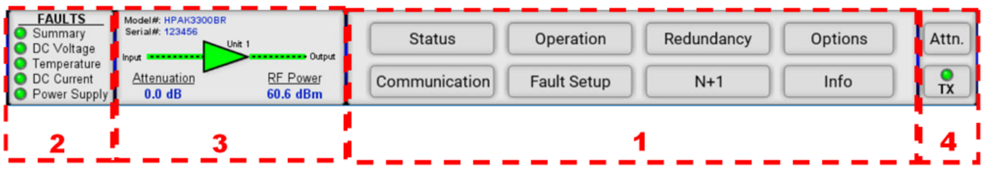


Figure 1: Main Areas of the Touchscreen Front Panel

Menu

This area is where all menu selections are made. See the **Touchscreen Menu Structure** section for a complete description of the menu selections.

Fault Indicators

Up to five fault indicators are shown in the left-most section of the touchscreen display. The Summary fault indicator is always displayed at the top. The user can select up to four other fault indicators to be displayed. See the Config Faults description in the **Touchscreen Menu Structure** section.

By default, in addition to the Summary fault indicator, the following fault indicators are shown:

- DC Voltage
- Temperature
- Forward RF
- Power Supply

If the fault indicator is green, it means there is no fault present for that fault parameter. If the fault indicator is flashing red, a fault exists for that fault parameter. If the fault indicator is yellow, a communication error with the module exists.

Depending on fault settings, the presence of certain types of faults will also trigger a Summary fault.

RF Signal Path Display

To the right of the fault indicators is the RF Signal Path Display. This section of the touchscreen includes the model number and serial number of the unit, the online status of the unit (when in a redundant configuration), the attenuation setting, and the RF output power. See Figure 2.

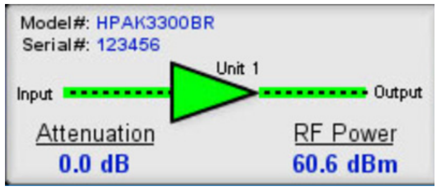


Figure 2: RF Signal Path Display, Standalone Unit

If the unit is configured as part of a system (redundant or phase combined) or configured with a maintenance switch, there is a secondary screen available.

Click on the indicator (as shown in Figure 3) at the top-right of the RF Signal Path Display screen to view the secondary MIMIC panel.

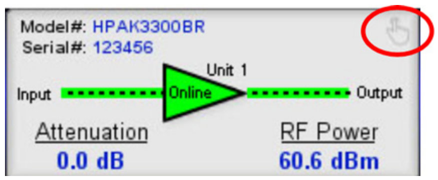


Figure 3: RF Signal Path Display, Unit Configured as Part of a System

The first time this indicator is selected (until a unit reset or power cycle), a warning message will appear: "This MIMIC panel will display the RF path only. It will not indicate Mute/Unmute or Fault State of any amplifier." See Figure 4. Click on the red 'X' in the upper right to close this message.

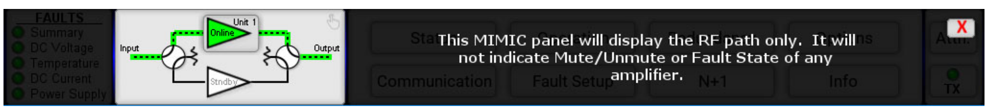


Figure 4: RF Signal Path Display, MIMIC Panel Warning Message

The resulting screen displays the selected system configuration, the RF path and switch positions, and the online state of the amplifier. Touch the indicator at the top-right of the screen to return to the RF Signal Path Display. See Figure 5.

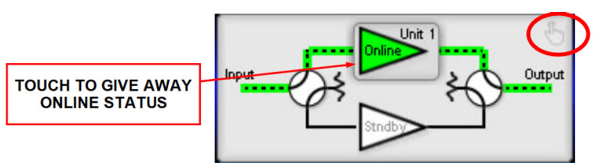


Figure 5: MIMIC Panel Display

The user can touch the outline of the online unit to give away its online status to the standby unit in the system. A confirmation window will appear. Touch the "OK" button to confirm the state change, or the "Cancel" button to cancel the action. See Figure 6.

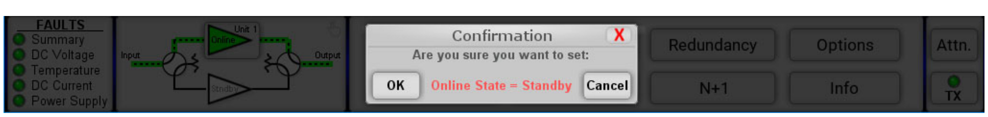


Figure 6: Online State Change Confirmation Window

If the online state change was confirmed, the amplifier will display the "Standby" state, and the RF signal path and switch positions will change to show the RF signal path of the online amplifier. See Figure 7.

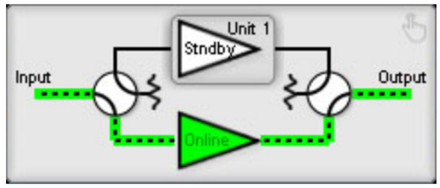


Figure 7: New RF Signal Path Display After Online State Change

Note that touching the outline of an amplifier displaying the "Standby" state will not do anything. Only an amplifier with the "Online" state can give away its online status.

Action Buttons

Up to two action buttons may appear to the far right of the touchscreen. These buttons are typically used to trigger common functions without having to navigate through the menu structure.

By default, the Attenuation button is on top, and the Mute button is on the bottom. See Figure 8. The button selection may be customized by the user. See the Config Buttons description in the **Touchscreen Menu Structure** section.

Figure 8: Action Buttons

Attenuation Button

Tapping the Attenuation button opens the attenuation setting screen. See Figure 9. The current attenuation setting is displayed in the green window. The user may adjust the ones place and the tenths place by touching the up and down arrows on the screen. The attenuation adjustment is immediately applied to the amplifier. Tap the OK button to accept the attenuation setting.

Figure 9: Action Button > Attenuation Setting

Mute (TX) Button

Tapping the Mute (TX) button results in a confirmation window (unless prompts are disabled in the **Options > Front Panel > Confirm Prompt** menu) to change the mute state of the amplifier. Tap the OK button to change the mute state or the Cancel button to keep the current mute state. See Figure 10.

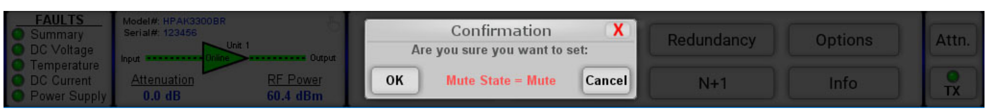


Figure 10: Action Button > Mute Setting

If confirmation prompts are disabled, tapping the Mute button will toggle the mute state of the amplifier between muted and unmuted.

Standby State Button

Tapping the Standby State button results in a confirmation window (unless prompts are disabled in the **Options > Front Panel > Confirm Prompt** menu) to change the Online state of the amplifier to Standby. Tap the OK button to change the mute state to Standby or the Cancel button to keep the unit Online. See Figure 11.

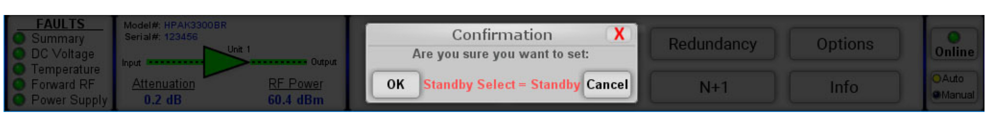


Figure 11: Action Button > Standby Setting Confirmation

Note that only the Online amplifier can give away its online status. Tapping the Online button with the red indicator results in a warning screen. See Figure 12.

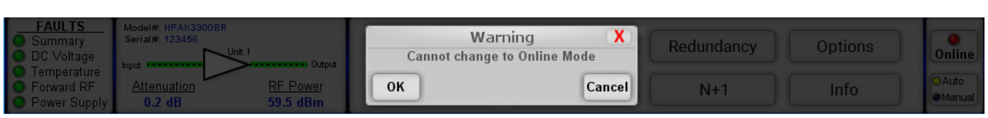


Figure 12: Action Button > Standby Warning

Switch Mode Button

Tapping the Switch Mode button results in a confirmation window (unless prompts are disabled in the **Options > Front Panel > Confirm Prompt** menu) to change the method of switch control to either Auto or Manual mode. A yellow indicator on the button shows which mode is currently active for the unit. Tap the OK button to change the switch control mode or the Cancel button. See Figure 13.

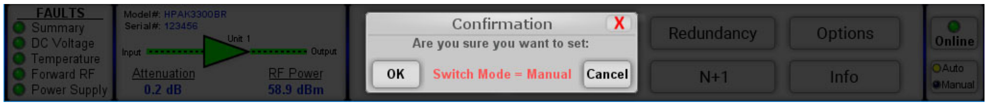


Figure 13: Action Button > Switch Mode Setting Confirmation

If confirmation prompts are disabled, tapping the Control Mode button will toggle the switch control mode between Auto and Manual.

Control Mode Button

Tapping the Control Mode button results in a confirmation window (unless prompts are disabled in the **Options > Front Panel > Confirm Prompt** menu) to change the control mode to either Local or Remote mode. A yellow indicator on the button shows which mode is currently active for the unit. Tap the OK button to change the control mode or the Cancel button. See Figure 14.

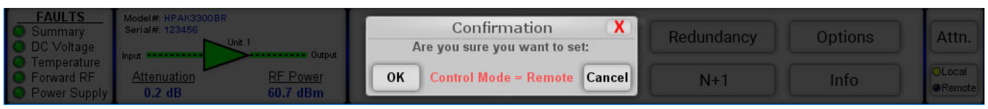


Figure 14: Action Button > Control Mode Setting Confirmation

If confirmation prompts are disabled, tapping the Switch Mode button will toggle the control mode between Local and Remote.

Note that when the unit is in Remote mode, the user will not be able to access any functions from the touchscreen except the Local/Remote Action button. A message on the display will indicate "Unit in Remote Mode". See Figure 15.

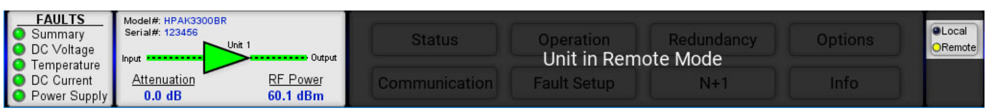


Figure 15: Display When in Remote Mode

Touchscreen Menu Structure

Teledyne Paradise Datacom
Drawing Number: 216512-5 Revision B
ECO 18951
11 June 2020

Menu Structure

Figure 1 shows the front panel menu structure hierarchy.

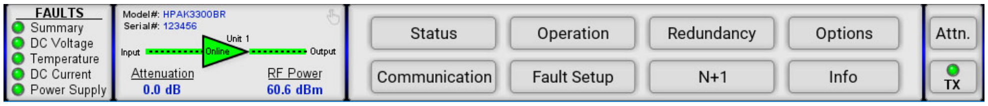


Figure 1: Main Menu

There are eight main levels of menu selections:

- Status
- Communication
- Operation
- Fault Setup
- Redundancy
- N+1
- Options
- Info

The user should touch the button of interest to proceed to the next menu level. When navigating the menu, the user can touch the home icon to go back to the Main Menu at any time. There are also icons that may be used to go back to the previous screen.

Status Menu

Figure 2 shows the Status menu.

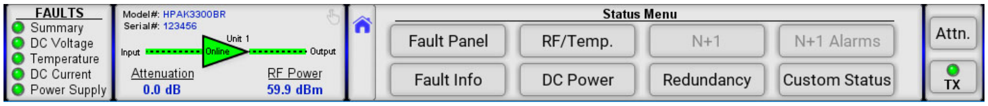


Figure 2: Status Menu

The Status menu includes the following buttons:

- Fault Panel
- Fault Info
- RF/Temp.
- DC Power
- N+1 (not available if unit is not configured for N+1 operation)
- Redundancy
- N+1 Alarms (not available if unit is not configured for N+1 operation)
- Custom Status

Fault Panel

Figure 3 shows the Fault Panel.

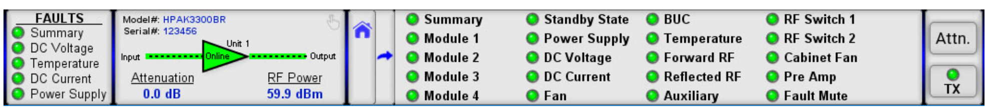


Figure 3: Status > Fault Panel

The Fault Panel displays the fault status for various parameters monitored by the unit's controller. A green icon next to the unit condition title indicates a non-faulted state. A red icon next to the unit condition title indicates a faulted state. A yellow icon indicates a communication error. A black icon designates a condition not applicable to the unit.

Fault states for the following conditions are displayed: Summary fault, Module (1, 2, 3 and 4) faults, Standby state (where a red icon designates the unit in a redundant system is in the Standby state), Power Supply faults, DC Voltage fault, DC Current fault, fan fault, BUC fault, Temperature fault, Forward RF fault, Reflected RF fault, Auxiliary fault, RF switch (1 and 2) faults, Cabinet Fan fault, Pre Amp fault, and Fault Mute.

Fault Info

Figure 4 shows the Fault Info menu. This menu can be used for advanced fault analysis.

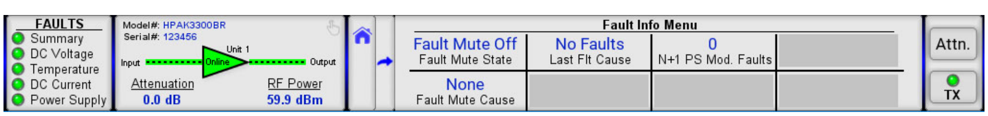


Figure 4: Status > Fault Info Menu

This menu displays the read-only values of the Fault Mute State (On or Off), the Fault Mute Cause, the Last Fault Cause and the number of N+1 PS Mod. Faults.

The Fault Mute State section displays whether the Fault Mute State is on or off. Any Summary Fault will turn on the Fault Mute State, as will any customizable fault set to a Major Fault with Mute state. See the **Fault Setup Menu** section for various fault settings that may affect the Fault Mute State.

The Fault Mute Cause section displays the cause of the last condition that triggered a fault mute state. If no cause exists, it will display None. Other conditions include: 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);

The Last Fault Cause section displays the cause of the last condition that triggered a fault. The value is latched to the last fault occurrence. Use the Clear Fault function to reset. If no cause exists, it will display No Faults. Other values include: 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).

For amplifiers utilizing an external N+1 power supply, The N+1 PS Mod. Faults 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.

RF/Temp. Menu

Figure 5 shows the RF/Temp. menu.

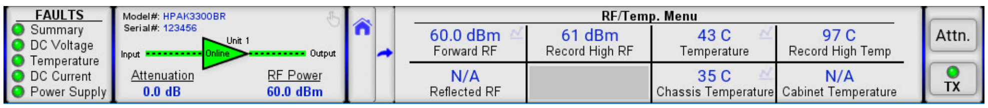


Figure 5: Status > RF Temperature Menu

The read-only information displayed on this screen includes the Forward RF power (in dBm or Watts, depending on user preference), Reflected RF power (in dBm or Watts, depending on user preference, if the unit includes a reflected RF power detector), Record High RF power (in dBm only), Temperature (recorded at the RF module baseplate), Chassis Temperature (recorded at the control board); Record High Temp (recorded at the RF module baseplate), and the Cabinet Temperature (if the unit includes a temperature detector for the cabinet).

Note that each of those parameters, except the Record High RF power and Record High Temp, includes a link to a trendline graph that shows the history of that parameter since unit power-up or reset of the trendlines. Trendlines are turned on by default, but can be turned off. See the **Show Trends** section of the Options Menu.

Trendlines

Figure 6 shows an example of a trendline for Forward RF power.

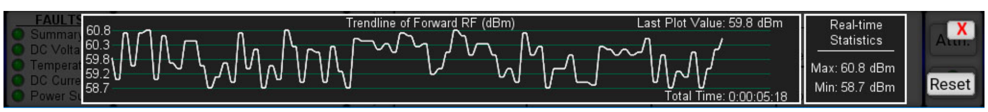


Figure 6: Example, Trendline, Forward RF Power

The Y-axis at the left of the screen shows the range encompassing the maximum (top) and minimum (bottom) values of the currently displayed trendline. The total time of the trendline is displayed at the bottom right of the graph. The last plot value is shown at the top right of the graph.

The trendline shows up to the last approximately 670 points of the parameter being graphed. Any prior measurements are dropped off the graph, but minimum and maximum values are saved in the Real-time Statistics block.

The user may reset all trendlines by clicking on the Reset button at the bottom right of the screen. See the **Reset Trends** section of the Options Menu. To close the trendline, click on the red X at the top right of the screen.

DC Power Menu

Figure 7 shows the DC Power menu.

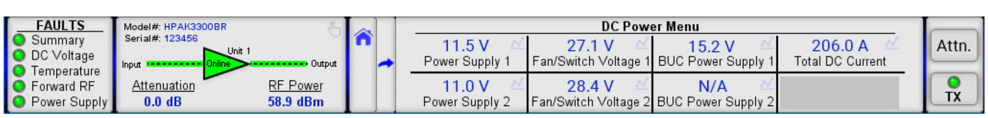


Figure 7: Status > DC Power Menu

This screen shows the read-only values of the power supply voltages, the boost voltages, the BUC power supply voltages and the total DC current consumption.

Power Supply 1 and Power Supply 2 display the output voltages with resolution of 0.1V. Normal output voltage for GaAs amplifiers is in the range of 11 V to 13 V; the voltage range for GaN amplifiers can be between 24 V and 50 V, depending on the particular SSPA module.

Fan/Switch Voltage 1 and Fan/Switch Voltage 2 show the output voltage with resolution of 0.1 V. Normal range is 24 V to 30 V (typical 28 V).

BUC Power Supply 1 and BUC Power Supply 2 represent 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 15 V to 16 V. For a unit equipped with a single power supply, BUC Power Supply 2 shows N/A.

Total DC Current displays the total DC current drawn by the RF modules from the main power supply. This value varies depending on the power level of the HPA. If the HPA is muted, current normally drops to within the 0 A to 5 A range.

Note that each of the parameters on this screen includes a link to a trendline graph that shows the history of that parameter since unit power-up or reset of the trendlines. See the **Trendlines** section of the Status Menu for more information.

N+1 Menu

Figure 8 shows the N+1 menu. This menu is only available in units configured for N+1 operation. Note that in place of Attenuation, the Master/Slave status is shown.

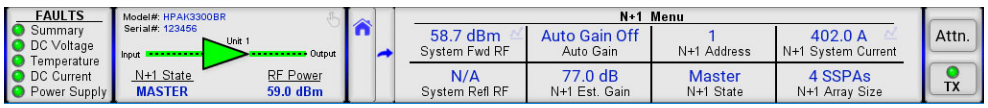


Figure 8: Status > N+1 Menu

This screen shows the read-only values of the System Forward RF power (in dBm or Watts, depending on RF unit selection), System Reflected RF power (in dBm or Watts, depending on RF unit selection, and if the system includes a reflected power detector), Auto Gain status, estimated N+1 System Gain, the unit's N+1 address, the unit's N+1 state, the total N+1 System current draw, and the N+1 System array size.

Note that the System Forward RF and Reflected RF power parameters on this screen includes a link to a trendline graph that shows the history of that parameter since unit power-up or reset of the trendlines. See the **Trendlines** section of the Status Menu for more information.

Redundancy Menu

Figure 9 shows the Redundancy menu.

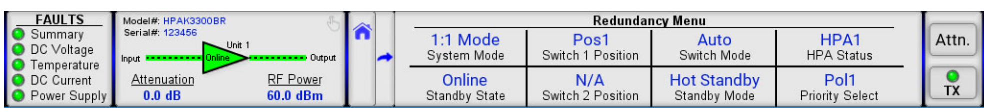


Figure 9: Status > Redundancy Menu

This screen shows the read-only values of the System Mode, the unit Standby State (for units in system configurations), the system Switch Positions (if applicable), the unit's Switch Mode, Standby Mode, HPA Status and Priority Select (for 1:2 redundant systems).

N+1 Alarms Menu

Figure 10 shows the N+1 Alarms menu.

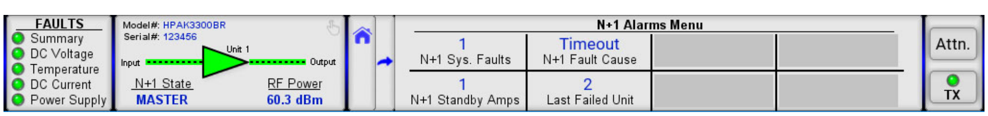


Figure 10: Status > N+1 Alarms Menu

This screen shows the read-only values of the number of N+1 System Faults, the number of Standby Amplifiers in the N+1 System, the N+1 Fault Cause, and the Last Failed Unit in the N+1 System.

Custom Status Menu

Figure 11 shows the default Custom Status menu message, which is displayed until the user selects parameters to be shown in this menu.

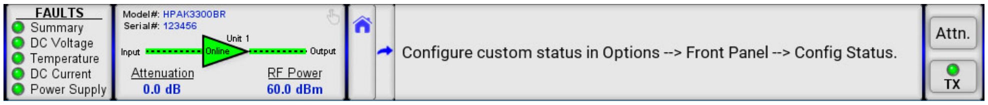


Figure 11: Status > Custom Status Default Menu

Figure 12 shows an example of a Custom Status menu, after the user has selected the parameters to be shown. See the **Config Status** section of the Options Menu for details on how to select up to eight (8) parameters to be displayed on this screen.

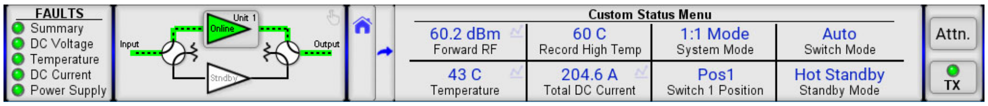


Figure 12: Status > Custom Status Menu (Custom Items Selected)

Note that depending on the parameters selected to be shown in the Custom Status menu, a link to a trendline graph that shows the history of that parameter since unit power-up or reset of the trendlines may be included. See the **Trendlines** section of the Status Menu for more information.

Communication Menu

Figure 13 shows the Communication menu.

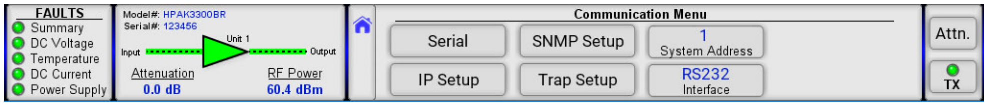


Figure 13: Communication Menu

The Communication menu allows the user to select the parameters for communication between the SSPA and any remote monitor and control station.

These parameters include the following buttons:

- Serial
- IP Setup
- SNMP Setup
- Trap Setup
- System Address
- Interface

Serial Button

Pressing the Serial button opens the Serial menu, from which the user can select the Baud Rate and Serial Protocol used by the amplifier. See Figure 14.

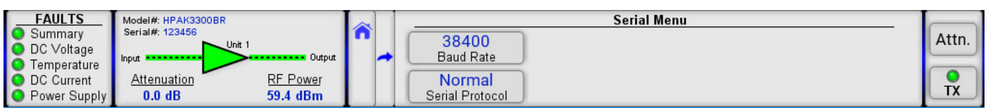


Figure 14: Communication Menu

Baud Rate Menu

Pressing the Baud Rate button opens the Baud Rate menu. The user may select from the available baud rates. Default baud rate is 9600. See Figure 15.

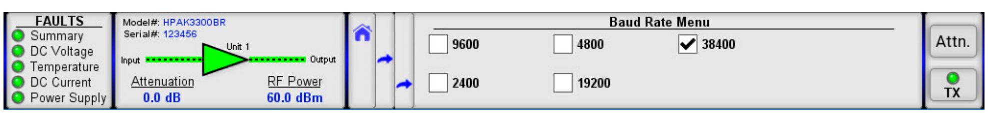


Figure 15: Communication > Baud Rate Menu

Serial Protocol Menu

Pressing the Serial Protocol button opens the Serial Protocol menu. The user may select either Normal or Terminal communication protocol. See Figure 16.

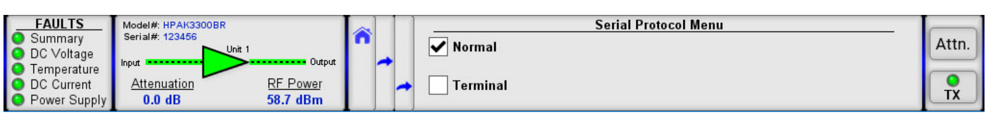


Figure 16: Communication > Serial Protocol Menu

IP Setup Button

Pressing the IP Setup button opens the IP Setup menu, from which the user can select the IP address and parameters used by the amplifier. See Figure 17.

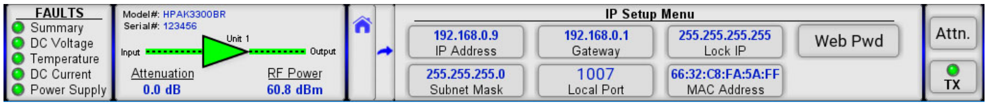


Figure 17: Communication > IP Setup Menu

IP Address

Pressing the IP Address button opens the IP Address menu, from which the user can enter the IP Address for the amplifier. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch each section to enter the values for that octet. Default IP Address is 192.168.0.9. See Figure 18.

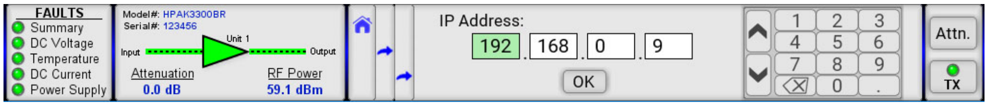


Figure 18: Communication > IP Setup > IP Address Selection

Note: Teledyne Paradise Datacom products use IPv4, Class C addressing.

Subnet Mask

Pressing the Subnet Mask button opens the Subnet Mask menu, from which the user can enter the Subnet Mask for the amplifier. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch each section to enter the values for that octet. Default Subnet Mask is 255.255.255.0. See Figure 19.

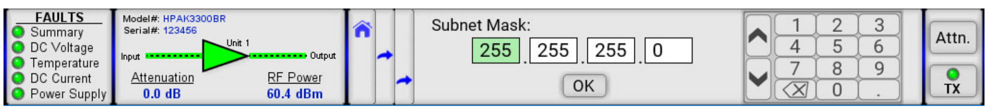


Figure 19: Communication > IP Setup > Subnet Mask Selection

Gateway

Pressing the Gateway button opens the Gateway menu, from which the user can enter the Gateway for the amplifier. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch each section to enter the values for that octet. Default Gateway is 192.168.0.1. See Figure 20.

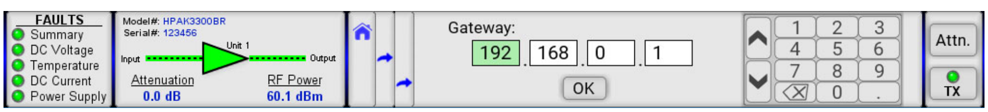


Figure 20: Communication > IP Setup > Gateway Selection

Local Port

Pressing the Local Port button opens the Local Port menu, from which the user can enter the Local Port for the amplifier. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Default Local Port is 1007. See Figure 21.

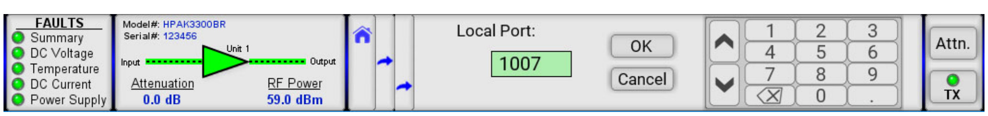


Figure 21: Communication > IP Setup > Local Port Selection

Lock IP

Pressing the Lock IP button opens the Lock IP menu, from which the user can enter the IP address from which requests will be accepted by the amplifier. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch each section to enter the values for that octet. See Figure 22. Default Subnet Mask is 255.255.255.255.

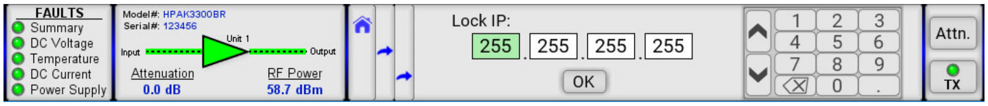


Figure 22: Communication > IP Setup > Lock IP Selection

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.

MAC Address

Pressing the MAC Address button opens the read-only MAC Address display. See Figure 23.

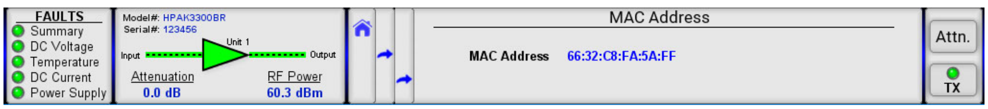


Figure 23: Communication > IP Setup > MAC Address Display

Web Password

Pressing the Web Password button opens the Web Password menu, from which the user can enter the web password which is requested when the user attempts to communicate with the amplifier over IPNet using a web browser. Use the alpha-numeric keypad on the screen to enter the value for the web password. When the alphabetic keypad is displayed, touch the "#" symbol to switch to the numeric keypad. When the numeric keypad is displayed, touch the "A" to switch to the alphabetic keypad. Touch the "OK" button to confirm the entered password and return to the IP Setup Menu. Maximum password length is 20 characters. Erase all characters to disable password protection. Default Web Password is paradise. See Figure 24.

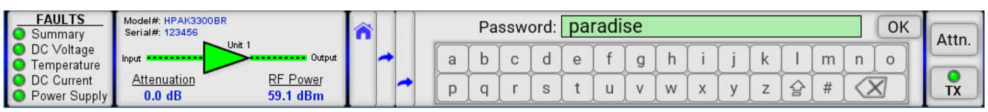


Figure 24: Communication > IP Setup > Web Password Selection

SNMP Setup Button

Pressing the SNMP Setup button opens the SNMP Setup menu, from which the user can select the Community Get and Community Set passwords, and review the User Info. See Figure 25.

Figure 25: Communication > SNMP Setup Menu

Community Get

Pressing the Community Get button opens the Community Get menu, from which the user can enter the Community Get password which is requested when the user attempts to communicate with the amplifier over IPNET using SNMP. Use the alpha-numeric keypad on the screen to enter the value for the web password. When the alphabetic keypad is displayed, touch the "#" symbol to switch to the numeric keypad. When the numeric keypad is displayed, touch the "A" to switch to the alphabetic keypad. Touch the "OK" button to confirm the entered password and return to the IP Setup Menu. Maximum password length is 20 characters. Erase all characters to disable password protection. See Figure 26. Default Community Get password is public.

Figure 26: Communication > SNMP Setuip > Community Get Selection

Community Set

Pressing the Community Set button opens the Community Set menu, from which the user can enter the Community Set password which is requested when the user attempts to communicate with the amplifier over IPNET using SNMP. Use the alpha-numeric keypad on the screen to enter the value for the web password. When the alphabetic keypad is displayed, touch the "#" symbol to switch to the numeric keypad. When the numeric keypad is displayed, touch the "A" to switch to the alphabetic keypad. Touch the "OK" button to confirm the entered password and return to the IP Setup Menu. Maximum password length is 20 characters. Erase all characters to disable password protection. See Figure 27. Default Community Set password is private.

Figure 27: Communication > SNMP Setup > Community Set Selection

User Info

Pressing the User Info button opens the User Info display screen. See Figure 28.

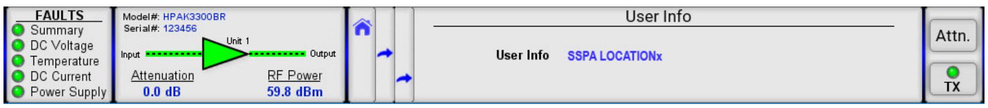


Figure 28: Communication > SNMP Setup > User Info Display

This screen is reserved for future development.

Trap Setup Button

Pressing the Trap Setup button opens the Trap Setup menu, from which the user can set the various SNMP trap parameters, and assign the Network Management System (NMS) IP address which will receive the trap notifications. See Figure 29.

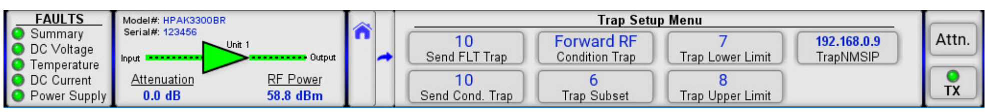


Figure 29: Communication > Trap Setup Menu

Send FLT Trap

Pressing the Send FLT Trap button opens the Send FLT Trap menu, from which the user can set the Send FLT Trap parameter. The value entered equals the number of attempts the unit will make to send all fault information to the assigned NMS IP address. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Entering "0" disables this feature. Touch the "OK" button to set the entered value. See Figure 30.

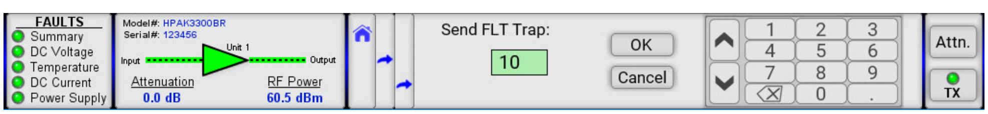


Figure 30: Communication > Trap Setup > Send FLT Trap Selection

Send Cond. Trap

Pressing the Send Cond. Trap button opens the Send Cond. Trap menu, from which the user can set the Send Cond. Trap parameter. The value entered equals the number of attempts the unit will make to send the selected condition information to the assigned NMS IP address. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Entering "0" disables this feature. Touch the "OK" button to set the entered value. See Figure 31.

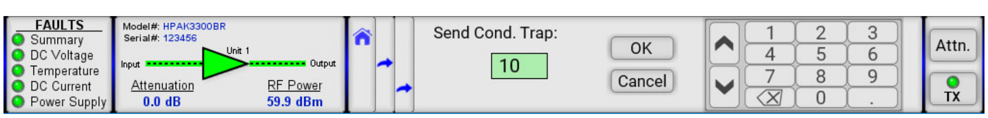


Figure 31: Communication > Trap Setup > Send Condition Trap Selection

Condition Trap

Pressing the Condition Trap button opens the Condition Trap menu, from which the user can select the amplifier condition that will be monitored and trigger a trap notification if it falls outside the upper and lower limits defined by the user. See Figure 32.

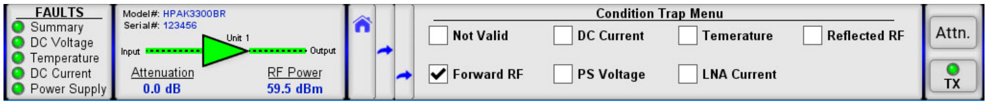


Figure 32: Communication > Trap Setup > Condition Trap Selection

Trap Subset

Pressing the Trap Subset button opens the Trap Subset menu, from which the user can set the Trap Subset parameter. This parameter is required when the trap condition selected has multiple sources, such as multiple power supplies in a unit. The value entered corresponds to the condition source selected. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch the "OK" button to set the selected value. See Figure 33.

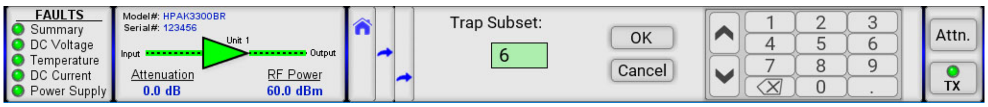


Figure 33: Communication > Trap Setup > Trap Subset Selection

Trap Lower Limit

Pressing the Trap Lower Limit button opens the Trap Lower Limit menu, from which the user can set the lower limit of the selected condition being monitored. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch the "OK" button to set the selected value. See Figure 34.

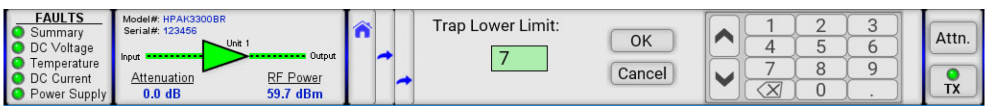


Figure 34: Communication > Trap Setup > Trap Lower Limit Selection

Trap Upper Limit

Pressing the Trap Upper Limit button opens the Trap Upper Limit menu, from which the user can set the upper limit of the defined condition being monitored. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch the "OK" button to set the selected value. See Figure 35.

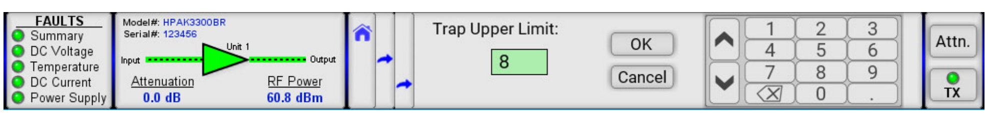


Figure 35: Communication > Trap Setup > Trap Upper Limit Selection

TrapNMSIP

Pressing the Trap Setup button opens the Trap Setup menu, from which the user can assign the Network Management System IP address which will receive the trap notifications. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch each section to enter the values for that octet. Touch the "OK" button to set the selected address. The default address is 192.168.0.9. See Figure 36.

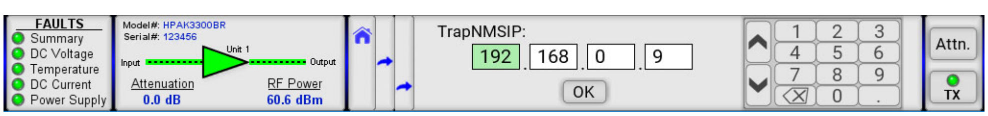


Figure 36: Communication > Trap Setup > Trap NMS IP Selection

System Address Button

Pressing the System Address button opens the System Address menu, from which the user can set the network address of the amplifier if used on a RS-485 network. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Valid values are 1 through 255. The factory default address is 0. Touch the "OK" button to set the selected address. See Figure 37.

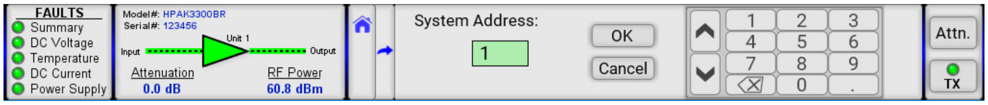


Figure 37: Communication > System Address Selection

⚠ **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.**

Interface Button

Pressing the Interface button opens the Interface Menu. The user may select between RS232, RS485, IPNet (Ethernet) or SNMP communication. See Figure 38.

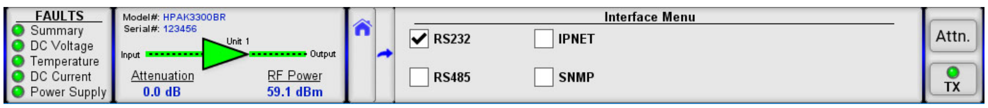


Figure 38: Communication > Interface Menu

Operation Menu

Figure 39 shows the Operation menu.

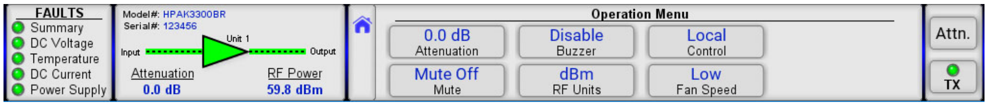


Figure 39: Operation Menu

The Operation menu allows the user to select the operational parameters for the amplifier. These parameters include the following buttons:

- Attenuation
- Mute
- Buzzer
- RF Units
- Control
- Fan Speed

Attenuation Button

Pressing the Attenuation button opens the Attenuation menu, from which the user can select the amount of attenuation (in dB) that should be applied to the gain of the amplifier. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch the "OK" button to set the selected value. See Figure 40.

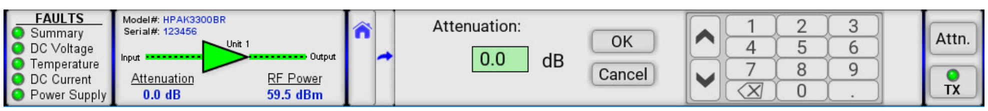


Figure 40: Operation > Attenuation Selection

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.

Mute Button

Pressing the Mute button opens the Mute menu, from which the user can select the Mute state of the amplifier. The current Mute state is checked. See Figure 41.

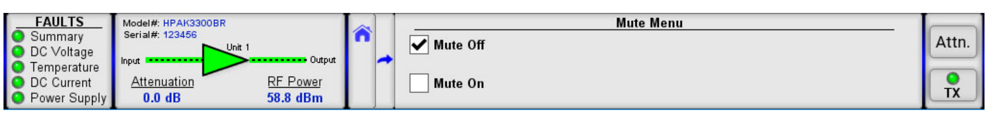


Figure 41: Operation > Mute Menu

Buzzer Button

Pressing the Buzzer button opens the Buzzer menu, from which the user can enable or disable the buzzer alarm that is triggered whenever a fault condition occurs. The current Buzzer state is checked. See Figure 42.

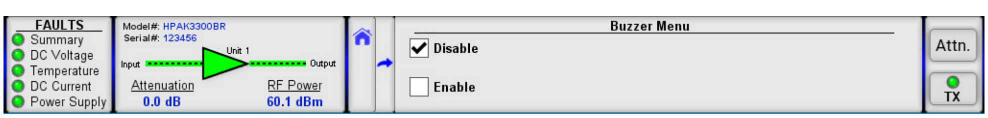


Figure 42: Operation > Buzzer Menu

RF Units Button

Pressing the RF Units button opens the RF Units menu, from which the user can select the type of unit displayed on the touchscreen. Values are dBm and Watt. The current unit type selected is checked. See Figure 43.

Figure 43: Operation > RF Units Menu

Control Button

Pressing the Control button opens the Control menu, from which the user can select either Local or Remote control of the unit. The current selection is checked. See Figure 44.

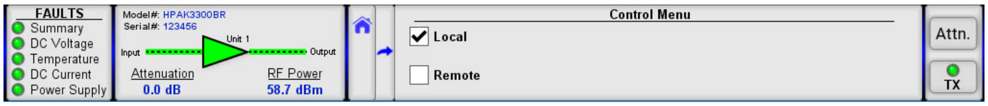


Figure 44: Operation > Control Menu

Note that when the unit is in Remote mode, the user will not be able to access any functions from the touchscreen except the Local/Remote Action button. A message on the display will indicate "Unit in Remote Mode". See Figure 45.

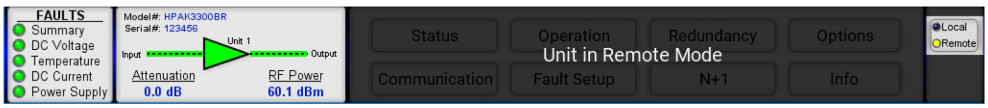


Figure 45: Operation Menu

Fan Speed Button

Pressing the Fan Speed button opens the Fan Speed menu, from which the user can select the speed that the unit's fans spin. The current selection is checked. See Figure 46.

Figure 46: Operation > Fan Speed Menu

Selecting the Low setting forces the fans to spin at the lowest speed. Air velocity will remain at the same level regardless of other operation parameters.

> ⚠ **Warning! Running the fans at the Low setting while the amplifier is operating 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.**

Selecting the High setting forces the fans to spin at the highest speed. Air velocity will remain at the same level regardless of other operation parameters.

Selecting the Auto setting allows 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 preset temperature threshold. If the module plate temperature remains below 50 C, the fan speed will be set to minimum. If the registered module plate temperature is above 50 C, unit will gradually increase the fan speed. Fan speed will reach maximum at a plate temperature of 65 C.

Fault Setup Menu

Figure 47 shows the Fault Setup menu.

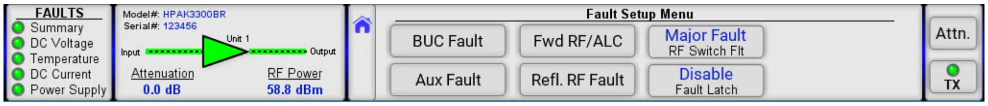


Figure 47: Fault Setup Menu

The Fault Setup menu allows the user to select the operational parameters for the amplifier. These parameters include the following buttons:

- BUC Fault
- Aux (Auxiliary) Fault
- Fwd RF/ALC (Automatic Level Control)
- Refl. RF Fault
- RF Switch Fault
- Fault Latch

BUC Fault Button

Pressing the BUC Fault button opens the BUC Fault menu, from which the user can select the action and logic type that any BUC faults would trigger. See Figure 48.

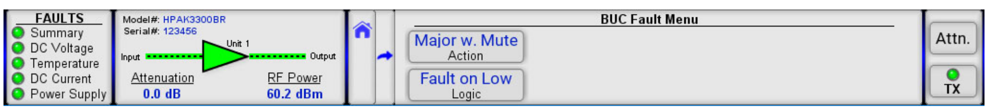


Figure 48: Fault Setup > BUC Fault Menu

Action

Pressing the Action button opens the Action menu, from which the user can select what type of fault action a BUC fault would trigger. The current selection is checked. See Figure 49.

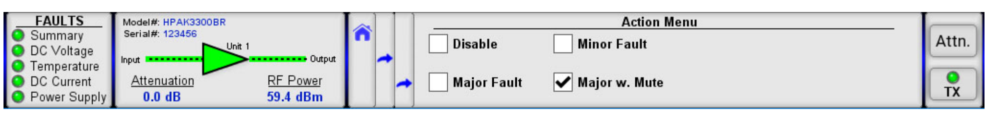


Figure 49: Fault Setup > BUC Fault > Actions Menu

If Disable is selected, no action will be taken by the unit if a BUC fault occurs. This is the default setting for units without an internal BUC.

If Major Fault is selected, in the event of a BUC fault, the unit will exhibit a Summary fault, as well as a BUC fault indicator.

If Minor Fault is selected, in the event of a BUC fault, the unit will only trigger the illumination of the BUC fault indicator.

If Major w. Mute is selected, a BUC fault will trigger a Summary fault, as well as illuminate the BUC fault indicator, and will mute the amplifier. This is the default setting for units which include an internal BUC.

Logic

Pressing the Logic button opens the Logic menu, from which the user can select the logical state necessary to trigger a BUC fault. See Figure 50.

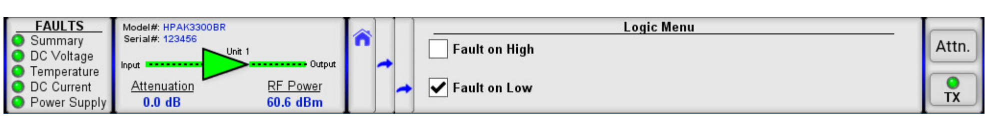


Figure 50: Fault Setup > BUC Fault > Logic Menu

Fault on High is the default setting, where faults are triggered by a high impedance state.

If Fault on Low is selected, faults are triggered by a low impedance state.

Aux Fault Button

Pressing the Aux Fault button opens the Aux Fault menu, from which the user can select the action and logic type that any Auxiliary faults would trigger. See Figure 51.

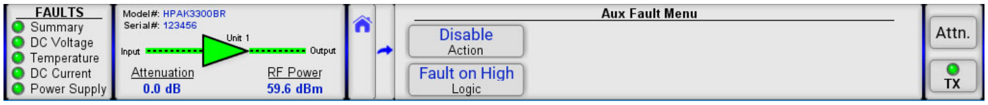


Figure 51: Fault Setup > Auxiliary Fault Menu

Action

Pressing the Action button opens the Action menu, from which the user can select what type of fault action an Auxiliary fault would trigger. The current selection is checked. See Figure 52.

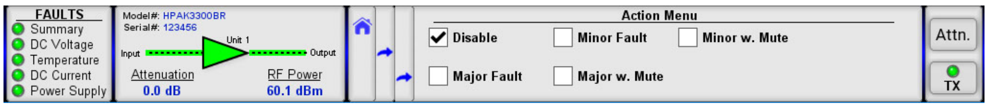


Figure 52: Fault Setup > Auxiliary Fault > Actions Menu

If Disable is selected, no action will be taken by the unit if an Auxiliary fault occurs.

If Major Fault is selected, in the event of an Auxiliary fault, the unit will exhibit a Summary fault, as well as an Auxiliary fault indicator.

If Minor Fault is selected, in the event of an Auxiliary fault, the unit will only trigger the illumination of the Auxiliary fault indicator.

If Major w. Mute is selected, in the event of an Auxiliary fault, the unit will exhibit a Summary fault, as well as an Auxiliary fault indicator, and the amplifier is placed in a mute state.

If Minor w. Mute is selected, in the event of an Auxiliary fault, the unit will only trigger the illumination of the Auxiliary fault indicator, and the amplifier is placed in a mute state.

Logic

Pressing the Logic button opens the Logic menu, from which the user can select the logical state necessary to trigger an Auxiliary fault. See Figure 53.

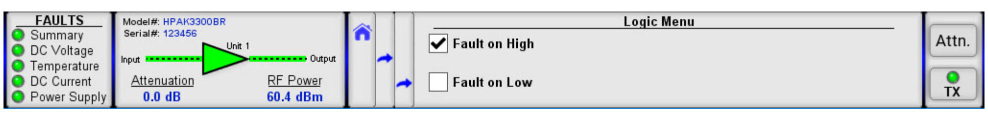


Figure 53: Fault Setup > Auxiliary Fault > Logic Menu

Fault on High is the default setting, where faults are triggered by a high impedance state.

If Fault on Low is selected, faults are triggered by a low impedance state.

Fwd RF/ALC Button

Pressing the Fwd RF/ALC button opens the Fwd RF/ALC menu, from which the user can set the action to be taken for any Forward RF condition that would result in a fault, and set the level at which that action is triggered. See Figure 54.

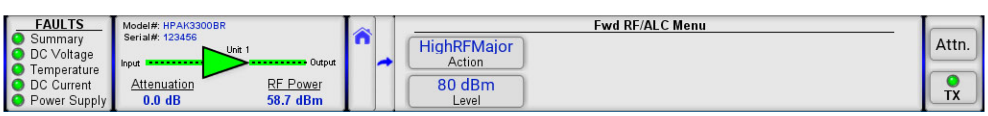


Figure 54: Fault Setup > Fwd RF/ALC Menu

Action

Pressing the Action button opens the Action menu, from which the user can select whether a Low or High Forward RF power condition triggers a fault or, alternately, sets the unit in Automatic Level Control mode. The current selection is checked. See Figure 55.

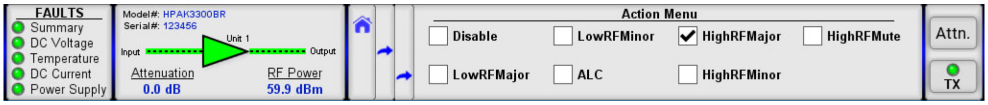


Figure 55: Fault Setup > Fwd RF/ALC > Action Menu

Selecting Disable 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.

If LowRFMajor is selected, in the event that the Forward RF power falls below the defined level, a Summary fault is triggered, as well as a Forward RF fault.

If LowRFMinor is selected, if the Forward RF power falls below the defined level, a Forward RF fault is triggered.

If ALC is selected, 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.

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

When HighRFMajor is selected, if the Forward RF power rises above the defined level, a Summary fault is triggered, as well as a Forward RF fault alarm.

When HighRFMinor is selected, if the Forward RF power rises above the defined level, a Forward RF fault alarm is triggered.

When HighRFMute is selected, in the event that the Forward RF power rises above the defined level, a Summary fault is triggered, as well as a Forward RF fault alarm, 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.

Level

Pressing the Level button opens the Level menu, from which the user can define the threshold that will be used to trigger a High or Low RF fault condition or, in the case of ALC, the desired output power level to be maintained. Use the numbered keypad on the screen to enter the value for the highlighted selection. Touch the "OK" button to set the selected value. See Figure 56.

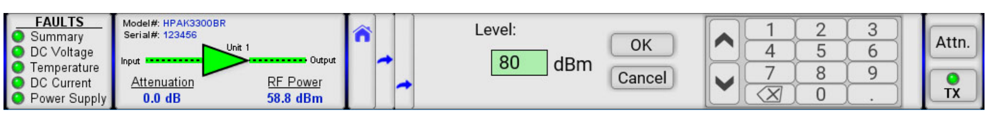


Figure 56: Fault Setup > Fwd RF/ALC > Level Selection

Refl. RF Fault Button

Pressing the Refl. RF Fault button opens the Reflected RF Fault menu, from which the user can set the action to be taken for any Reflected RF condition that would result in a fault, and set the level at which that action is triggered. See Figure 57.

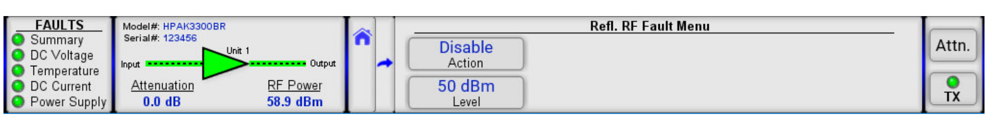


Figure 57: Fault Setup > Refl. RF Fault Menu

Action

Pressing the Action button opens the Action menu, from which the user can select what type of fault action a Reflected RF fault would trigger. The current selection is checked. See Figure 58.

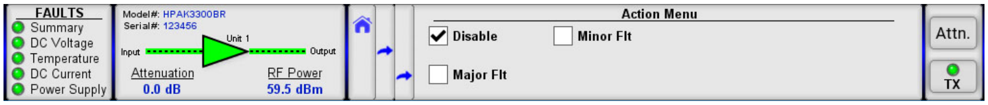


Figure 58: Fault Setup > Refl. RF > Action Menu

Selecting Disable disables the Reflected RF fault alarm function. Selecting this item also unlatches any Reflected RF fault conditions.

If Major Fault is selected, in the event that the Reflected RF power meets or exceeds the defined level, a Summary fault is triggered, as well as a Reflected RF fault.

If Minor Fault is selected, if the Reflected RF power meets or exceeds the defined level, a Reflected RF fault is triggered.

Level

Pressing the Level button opens the Level menu, from which the user can assign the value at which a Reflected RF fault will be triggered. Use the numbered keypad on the screen to enter the value for the highlighted selection. Touch the "OK" button to set the selected value. See Figure 59.

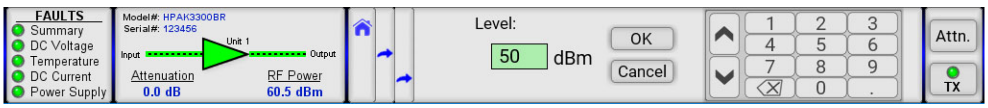


Figure 59: Fault Setup > Refl. RF > Level Selection

RF Switch Fault Button

Pressing the RF Switch Fault button opens the RF Switch Fault menu, from which the user can select the action to be taken in the event of an RF Switch fault. The current selection is checked. See Figure 60.

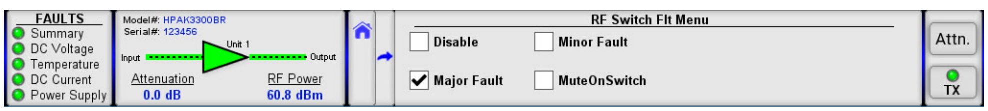


Figure 60: Fault Setup > RF Switch Fault Menu

Selecting Disable disables the RF Switch fault alarm function. Selecting this item also unlatches any RF Switch fault conditions.

If Major Fault is selected, in the event of an RF Switch fault, a Summary fault is triggered, as well as an RF Switch fault alarm.

If Minor Fault is selected, in the event of an RF Switch fault, an RF Switch fault alarm is triggered.

If Mute on Switch is selected, any change in the position of a switch in the RF path of the amplifier will cause the amplifier to be placed in a mute state until the switch position change is completed. This function helps to prevent arcing in the waveguide.

Fault Latch Button

Pressing the Fault Latch button opens the Fault Latch menu, from which the user can enable or disable the Fault Latch function. A latched alarm will remain indicated on the front panel until the operator clears the alarm. 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. The current selection is checked. Default setting is Disable. See Figure 61.

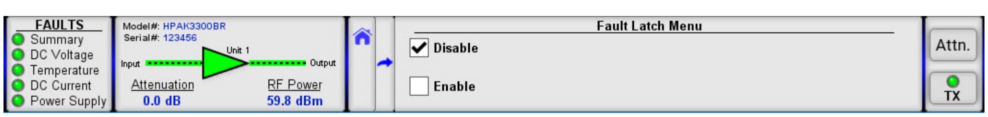


Figure 61: Fault Setup > Fault Latch Menu

⚠ **Note: When the fault latch feature is enabled, a Clear faults button will appear on the Status > Fault Panel screen. See Figure 62. This button performs the same function as described in the Reset section of the Options Menu.**

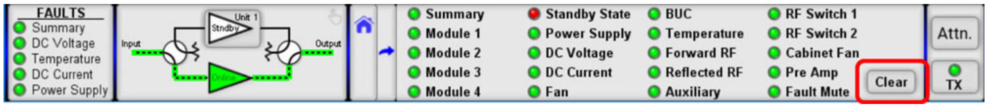


Figure 62: Status > Fault Panel > Clear Faults Button

Redundancy Menu

Figure 63 shows the Redundancy menu.

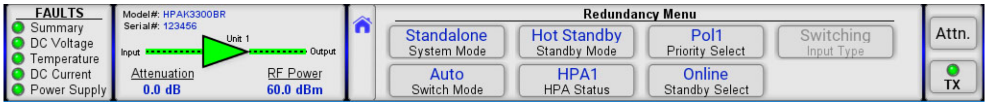


Figure 63: Redundancy Menu

The Redundancy menu allows the user to select the redundancy settings for the amplifier. These parameters include the following buttons:

- System Mode
- Switch Mode
- Standby Mode
- HPA Status
- Priority Select (applies to 1:2 systems only)
- Standby Select
- Input Type (active for 1:1 systems only)

System Mode Button

Pressing the System Mode button opens the System Mode menu, from which the user can select the type of system into which the amplifier will be configured. The current selection is checked. See Figure 64.

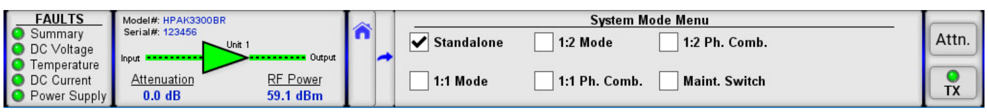


Figure 64: Redundancy > System Mode Menu

Standalone -- Select this option for standalone amplifier applications, or whenever the unit is configured in a system which includes a redundant system controller. All RF waveguide switch controls are disabled in this mode.

1:1 Mode -- Select this option for internal 1:1 redundant configurations. For proper function, a second amplifier is required and also needs to be configured for the same operation mode. Other settings will need to be selected. When this mode is selected, click on the icon in the top right of the RF Signal Path screen to switch to a 1:1 Redundant System Mimic Panel view of the system configuration. See the **Internal 1:1 Redundant System Operation** section.

1:2 Mode -- This setting is used for internal 1:2 redundancy operation. Two additional amplifiers are required, which need to be configured in the same operational mode. When this mode is selected, click on the icon in the top right of the RF Signal Path screen to switch to a 1:2 Redundant System Mimic Panel view of the system configuration. See the **Internal 1:2 Redundant System Operation** section.

1:1 Ph. Comb. -- This setting is used for hybrid 1:1 phase combined system operation. The use of N+1 controls in conjunction with this setting is highly recommended. When this mode is selected, click on the icon in the top right of the RF Signal Path screen to switch to a 1:1 Phase Combined System Mimic Panel view of the system configuration. **Internal 1:1 Phase Combined mode is currently not supported.**

1:2 Ph. Comb. -- This mode is similar to 1:2 mode, but is used to combine two amplifier outputs, rather than supplying a signal for two separate polarizations. The use of N+1 controls in conjunction with this setting is highly recommended. When this mode is selected, click on the icon in the top right of the RF Signal Path screen to switch to a 1:2 Phase Combined System Mimic Panel view of the system configuration. **Internal 1:2 Phase Combined mode is currently not supported.**

Maint. Switch -- This SSPA mode allows the control of a maintenance switch connected to the output of single amplifier. This is not a redundant system operation mode. The switch is used to direct the RF output of the amplifier to either an antenna or a dummy load. When this mode is selected, click on the icon in the top right of the RF Signal Path screen to switch to a Maintenance Switch Mimic Panel view of the system configuration.

Switch Mode Button

Pressing the Switch Mode button opens the Switch Mode menu, from which the user can select how the system's switch functions will be triggered. The current selection is checked. See Figure 65.

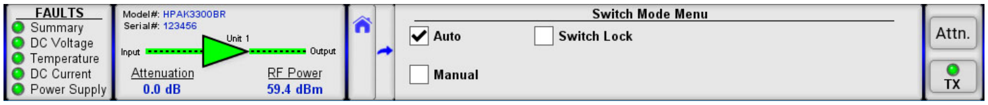


Figure 65: Redundancy > Switch Mode Menu

Auto -- This mode provides automatic detection of an amplifier fault and switchover to the operational amplifier in the system. The system is also protected from operator errors; selecting a faulted SSPA is not allowed.

Manual -- In this mode, the operator can select the online and standby amplifiers by pressing the "Unit#" key in the Mimic Panel screen. Note that only the online amplifier can give away its online status. The system will not provide automatic switchover from a faulted unit, but rather will keep the selected unit online, regardless of its state. In Manual mode, the standby amplifier will always accept the online state regardless of its own fault status.

If Switch Lock is selected, the switches are locked into the position based on the system type. For 1:1 redundant systems, the switch is set to keep Unit 1 online by default. For 1:1 phase combined systems, the switch is set to keep both Unit 1 and Unit 2 phase combined by default. For 1:2 redundant systems, the default is to keep Unit 1 online on Polarity 1 and Unit 3 online on Polarity 2. For 1:2 phase combined systems, the switch is set to keep Unit 1 and Unit 3 phase combined by default.

Standby Mode Button

Pressing the Standby Mode button opens the Standby Mode menu, from which the user can select either Hot or Cold Standby Mode. The current selection is checked. See Figure 66.

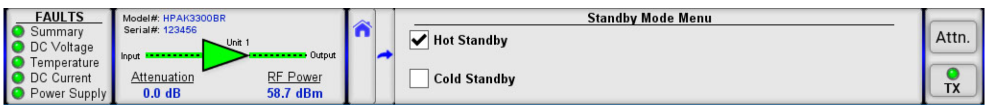


Figure 66: Redundancy > Standby Mode Menu

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.

Cold Standby -- In this mode, when the amplifier is in standby mode, it is muted. If the standby amplifier is switched to the online state, it will unmute and will take several moments to achieve full output power.

> ⚠ **Warning! It is advised that when operating in Hot Standby mode, that the Switch Mute function is enabled. See the RF Switch Fault Button section.**

HPA Status Button

Pressing the HPA Status button opens the HPA Status menu, from which the user can assign the identity of the amplifier in a redundant or phase combined system. In 1:1 and 1:2 redundant systems, HPA2 is typically the standby amplifier. The current selection is checked. See Figure 67.

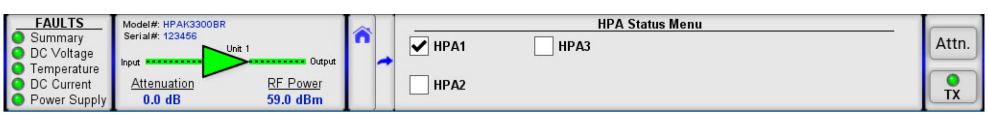


Figure 67: Redundancy > HPA Status Menu

Priority Select Button

Pressing the Priority Select button opens the Priority Select menu. For use in 1:2 redundant systems. The user may select Pol1 (Polarity 1) or Pol2 (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. The current selection is checked. See Figure 68.

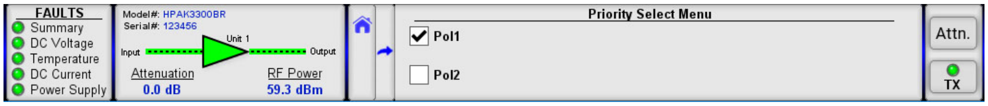


Figure 68: Redundancy > Priority Select Menu

Standby Select Button

Pressing the Standby Select button opens the Standby Select menu, from which the user can assign the online/standby status for the amplifier. The current selection is checked. See Figure 69.

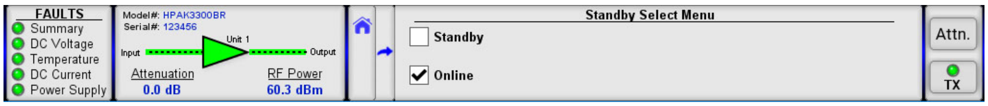


Figure 69: Redundancy > Standby Select Menu

Selecting Standby will place the amplifier in a redundant system configuration in the standby state. If there is another non-faulted amplifier in the redundant system, it will be switched to the online state.

Selecting Online will place the amplifier in a redundant system configuration in the online state. If there is another non-faulted amplifier in the redundant system, it will be switched to the standby state.

Input Type Button

Pressing the Input Type button opens the Input Type menu, from which the user can select either Input Switching or Input Splitting when the amplifier is configured in 1:1 Redundant mode. The current selection is checked. See Figure 70.

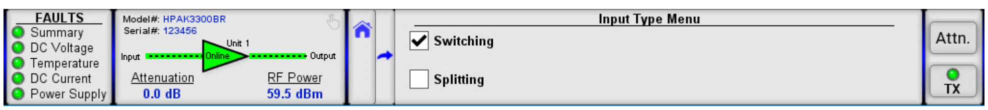


Figure 70: Redundancy > Input Type Menu

Figure 71 shows the Mimic Panel with a 1:1 system using input switching (top) and input splitting (bottom).

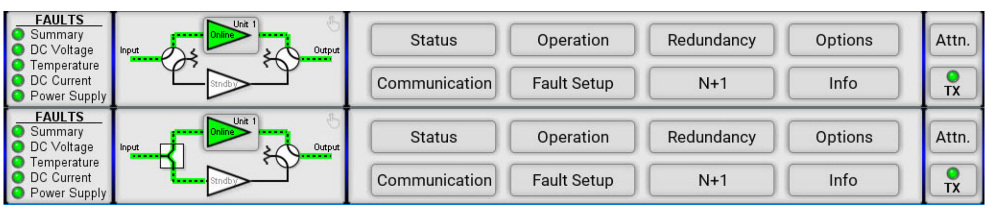


Figure 71: Mimic Panels Showing Input Switching (top) and Input Splitting (bottom)

N+1 Menu

Figure 72 shows the N+1 menu.

Figure 72: N+1 Menu

The N+1 menu allows the user to set the N+1 system array size, addressing, communication settings and Auto Gain settings, as well as select a module in a multi-module amplifier that will be removed or re-installed for maintenance purposes.

- Array Size
- N+1 Address
- Auto Gain
- N+1 Comms
- Mod. Eject

Array Size Button

Pressing the Array Size button opens the Array Size menu, from which the user can select the type of N+1 system into which the amplifier is being configured, or disables N+1 operation for this unit. The current selection is checked. See Figure 73.

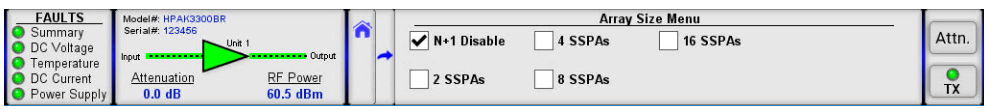


Figure 73: N+1 > Array Size Menu

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.

N+1 Address Button

Pressing the N+1 Address button opens the N+1 Address menu, from which the user may assign the amplifier's N+1 priority address. All amplifiers in a N+1 array must have a unique address, and all addresses must be contiguous. Enter the value in the highlighted field and press the OK button to set that value. See Figure 74.

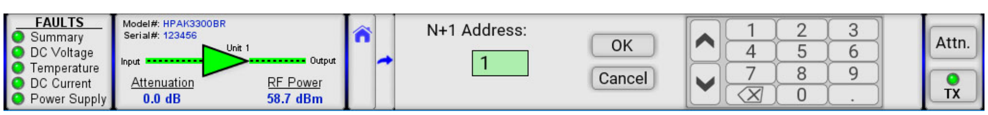


Figure 74: ImageCutline

The non-faulted 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 N+1 Address 1 will be the default Master unit. If the unit with N+1 Address 1 fails, the unit with N+1 Address 2 will take its place as the Master unit.

Auto Gain Button

Pressing the Auto Gain button opens the Auto Gain menu, from which the user can enable or disable the N+1 Automatic Gain adjustment functions. See Figure 75.

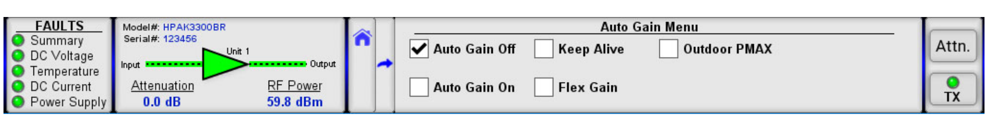


Figure 75: ImageCutline

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 N+1 Master unit default System Information screen will display System Gain. See Figure 76.

Figure 76: N+1 > Auto Gain Off > N+1 Master Screen

AutoGain On -- When Auto Gain is enabled, the system will automatically increase its gain to compensate for a failed module. The system will keep 5 dB of gain in reserve, thus allowing only 15 dB of system gain adjustment. When this option (or any of the other options below) is enabled, the N+1 Master unit screen will display Auto Gain. See Figure 77.

Figure 77: N+1 > Auto Gain On > N+1 Master Screen

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.

Flex Gain -- Flex Gain is a form of automatic gain control for N+1 systems. This control option has the same basic operation principles as the standard Auto Gain option except that the gain reserves and amount of gain compensation differ. This setting is designed to serve the special gain compensation needs of hybrid PowerMAX SSPA systems. When 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. Consult the factory on the use of this option.

Outdoor PMAX -- This setting should be used for all 8-module or 16-module Outdoor PowerMAX systems. Under this setting, should the secondary controller fail, the primary controller will handle any attenuation adjustments and mute status changes for the units normally controlled by the secondary controller.

N+1 Comms Button

Pressing the N+1 Comms button opens the N+1 Comms menu, from which the user can assign various communication settings for N+1 operation. See Figure 78.

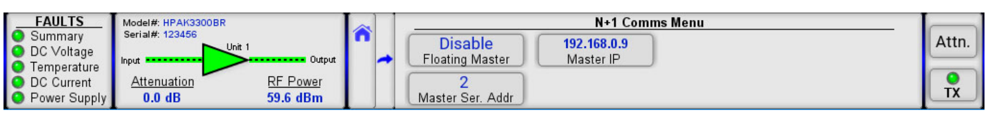


Figure 78: N+1 > N+1 Comms Menu

Floating Master

Pressing the Floating Master button opens the Floating Master menu, from which the user can enable or disable the N+1 Floating Master feature. The current selection is checked. See Figure 79.

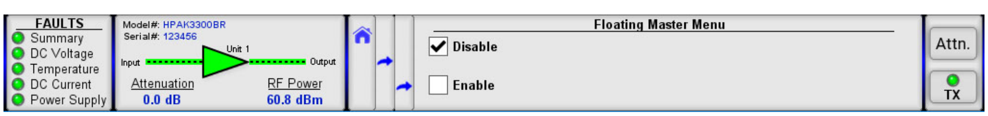


Figure 79: N+1 > N+1 Comms > Floating Master Menu

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.

Master Ser. Addr.

Pressing the Master Ser. Addr. button opens the Master Ser. Addr. menu, from which the user can enter the serial address for the N+1 Master Unit. Enter the value in the highlighted field and press the OK button to set that value. See Figure 80.

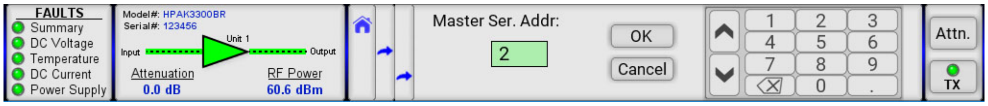


Figure 80: N+1 > N+1 Comms > Master Serial Address Selection

Master IP

Pressing the Master IP button opens the Master IP menu, from which the user can enter the IP address for the N+1 Master Unit. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch each section to enter the values for that octet. Touch the "OK" button to set the selected address. See Figure 81.

Figure 81: N+1 > N+1 Comms > Master IP Selection

Mod. Eject Button

Pressing the Mod. Eject button opens the Module Eject menu, from which the user can eject a module (Eject Module) in a multi-module configuration for removal and replacement, or clear the ejection of a module (Clear Eject). See Figure 82.

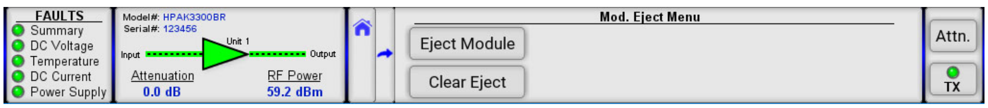


Figure 82: N+1 > N+1 Comms > Module Eject Menu

Eject Module

Pressing the Eject Module button opens the Eject Module menu. Press the button for the module which will be removed (Module 1 through Module 4, or PreAmp). See Figure 83.

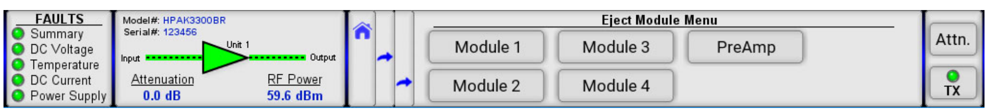


Figure 83: N+1 > N+1 Comms > Eject Module Menu

A confirmation window will appear after a button is selected and pressed. Press the OK button to confirm, or the Cancel button to cancel the action. See Figure 84.

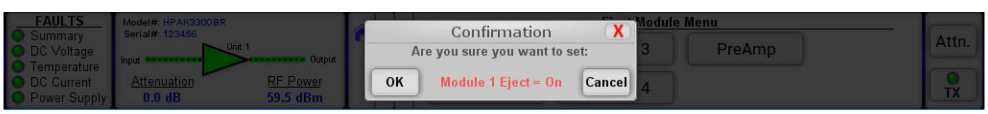


Figure 84: N+1 > N+1 Comms > Eject Module Confirmation

Clear Eject

Pressing the Clear Eject button opens the Clear Eject menu. Press the button for the module (Module 1 through Module 4, or PreAmp) which will resume operation in the unit. See Figure 85.

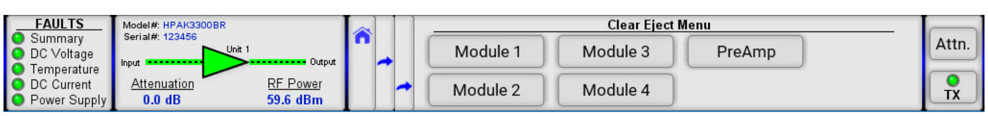


Figure 85: N+1 > N+1 Comms > Clear Eject Menu

A confirmation window will appear after a button is selected and pressed. Press the OK button to confirm, or the Cancel button to cancel the action. See Figure 86.

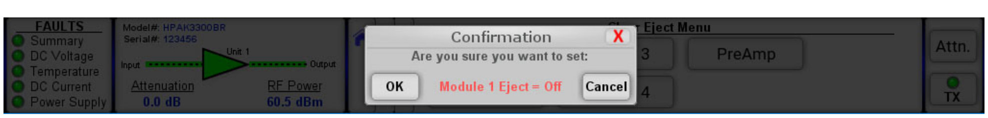


Figure 86: N+1 > N+1 Comms > Clear Eject Confirmation

Options Menu

Figure 87 shows the Options menu.

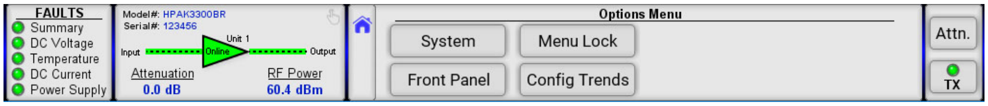


Figure 87: Options Menu

The Options menu allows the user to select the System backup and restore utilities, Front Panel configuration options, Menu Lock options, and Trends configurations.

- System
- Front Panel
- Menu Lock
- Config Trends

System Button

Pressing the System button opens the System menu, from which the user can choose to backup settings, restore settings from a saved backup, reset the unit, or select the memory mode used by the unit's EEPROM. See Figure 88.

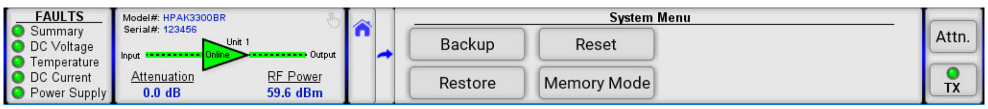


Figure 88: Options > System Menu

Backup

Pressing the Backup button opens the Backup menu, which allows the user to backup all settings to nonvolatile memory. There are two repositories for saved settings, User 1 and User 2. See Figure 89.

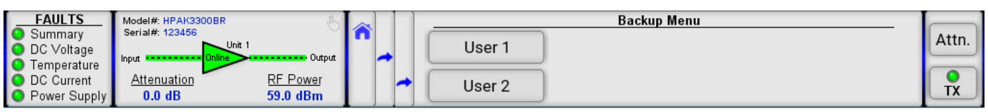


Figure 89: Options > System > Backup Menu

A confirmation window will appear after a button is selected and pressed. Press the OK button to confirm, or the Cancel button to cancel the action. See Figure 90.

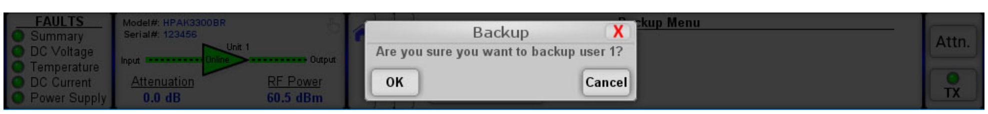


Figure 90: Options > System > Backup Confirmation

Restore

Pressing the Restore button opens the Restore menu, which allows the user to restore settings from nonvolatile memory. There are three repositories for saved settings, User 1, User 2, and Factory. Selecting Factory restores all factory default settings. See Figure 91.

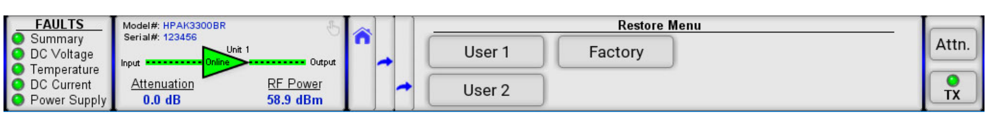


Figure 91: Options > System > Restore Menu

A confirmation window will appear after a button is selected and pressed. Press the OK button to confirm, or the Cancel button to cancel the action. See Figure 92.

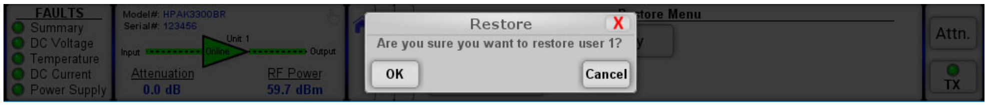


Figure 92: Options > System > Restore Confirmation

Reset

Pressing the Reset button opens the Reset menu, which 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. See Figure 93.

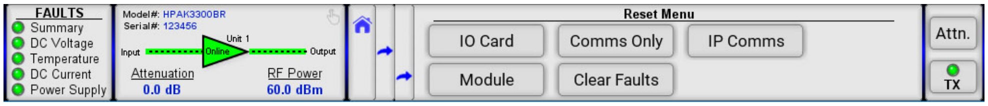


Figure 93: Options > System > Reset Menu

IO 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, therefore the 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 the currently selected communication parameters (IP address, baud rate, etc);

Module -- Resets only the embedded chips in all RF modules. The I/O card remains operational and maintains a 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;

Comms 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 selected parameters;

Clear Faults -- Clears all latched faults and remaining fault history information. SSPA remains fully operational during the process;

IP Comms -- Resets only IP communication parameters. If unmuted, the SSPA maintains an unchanged RF output level during reset. Remote COM links will be dropped and re-enabled with selected IP parameters.

When the user selects and presses one of the buttons described above, a confirmation window will appear. See Figure 94. Press the OK button to continue the reset function, or the Cancel button to cancel the function.

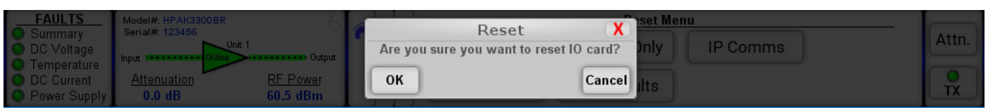


Figure 94: Options > System > Reset Confirmation

In the case of the Clear Faults button, a different confirmation window will appear. See Figure 95. Press the OK button to continue the reset function, or the Cancel button to cancel the function.

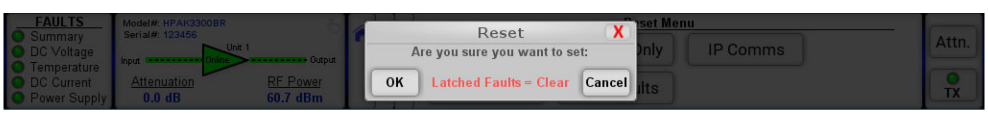


Figure 95: Options > System > Clear Faults Confirmation

Memory Mode

Pressing the Memory Mode button opens the Memory Mode menu, from which the user can select options for how the unit retains settings in memory. See Figure 96.

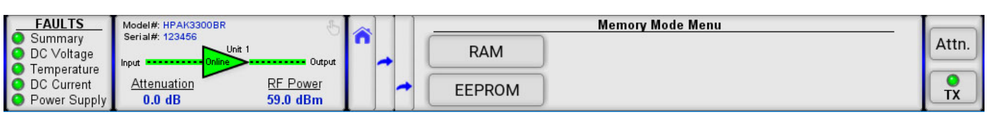


Figure 96: Options > System > Memory Mode Menu

RAM -- In this mode, the unit will not backup any settings changes to internal EEPROM. This mode is optional and needs to be set by the user every time the unit endures a power cycle or I/O card reset. This mode is beneficial when the SSPA application requires frequent changes to the SSPA state (such as mute/unmute or attenuation changes). Since any EEPROM device has limited write cycles, RAM mode allows the user to execute unlimited settings changes. If the SSPA experiences a power or reset cycle in RAM mode, it will use the last saved settings setup before RAM was engaged;

EEPROM -- Default mode. Without user intervention, the unit will retain this mode of operation. All changes to settings setup performed over local or remote interface will be backed up to EEPROM within a 3 second time interval. If the unit 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 units with firmware version prior to 6.00 is 150,000. After exceeding this limit, the unit will operate in RAM mode, utilizing a default set of settings on each power up. Firmware versions above 6.00 allow a minimum of 3,000,000 write cycles before opting out to RAM mode.

After selection one of the choices above, a confirmation window will appear. See Figure 97. Press the OK button to continue the reset function, or the Cancel button to cancel the function.

Figure 97: Options > System > Memory Mode Confirmation

Front Panel Button

Pressing the Front Panel button opens the Front Panel menu, from which the user can select options for the touchscreen, and configure the customizable fault display, action buttons, and status display, or reset the screen. See Figure 98.

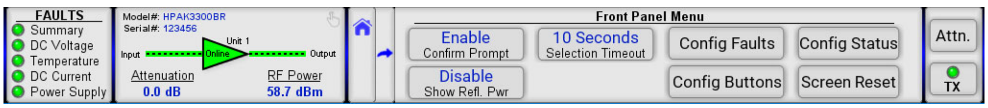


Figure 98: Options > Front Panel Menu

Confirm Prompt

Pressing the Confirm Prompt button opens the Confirm Prompt menu, from which the user can enable or disable the confirmation prompts that are generated when certain actions (such as changing Mute Status or initiating a Backup/Restore) are triggered. The current selection is checked. See Figure 99.

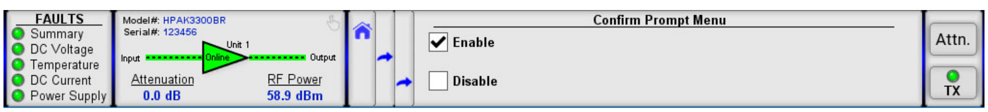


Figure 99: Options > Front Panel > Confirm Prompt Menu

Show Refl. Pwr

Pressing the Show Refl. Pwr button opens the Show Refl. Pwr menu, from which the user can enable or disable the display of the Reflected Power measurement in the RF Signal Path Display. See Figure 100.

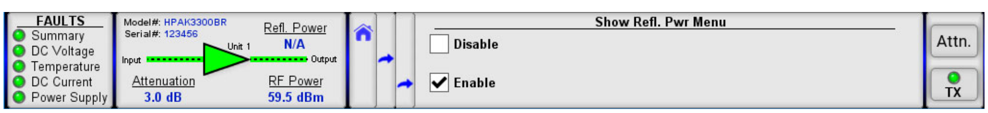


Figure 100: Options > Front Panel > Show Reflected Power Menu

⚠ **Note: If the amplifier or system does not include a Reflected Power Monitor, the display will show N/A.**

Selection Timeout

Pressing the Selection Timeout button opens the Selection Timeout menu, from which the user can select the time interval that must pass (10 Seconds or 30 Seconds) before most menu screens revert to the previous menu screen if a selection is not made, or disable all confirmation screens. Default setting is 10 Seconds. See Figure 101.

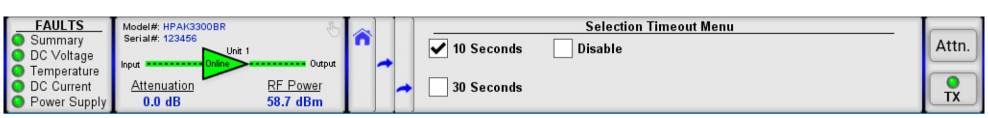


Figure 101: Options > Front Panel > Selection Timeout Menu

Config Faults

Pressing the Config Faults button opens the Config Faults menu, from which the user can select the fault indicators that are shown in the Fault Indicator section at the far left of the touchscreen display. The Summary selection is always selected by default. Other default settings include Power Supply, Temperature, DC Voltage and DC Current. See Figure 102.

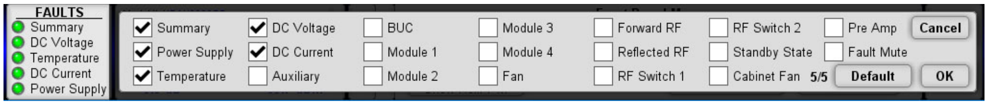


Figure 102: Options > Front Panel > Config Faults Menu

The user may select up to four other options besides the Summary selection to be displayed. Press the OK button to display the selected settings. Press the Cancel button to return to the previous menu. Press the Default button to return to the default settings.

Config Buttons

Pressing the Config Buttons button opens the Config Buttons menu, from which the user can select the Action Buttons that appear on the far right of the touchscreen display. Up to two items may be selected. Attenuation and Mute are selected by default. See Figure 103.

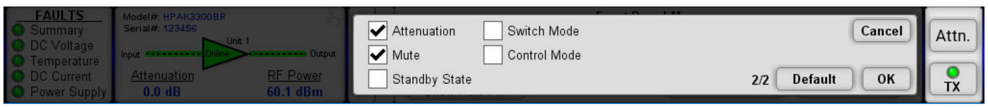


Figure 103: Options > Front Panel > Config Buttons Menu

The first item selected will appear as the top Action Button. The second item selected will appear as the bottom Action Button. Press the Cancel button to return to the previous menu. Press the Default button to return to the default settings.

⚠ **Note: When the unit is set to Remote Only mode, the Control Mode button will appear in the top position of the Action Buttons area, whether or not it was selected by the user. See Figure 104.**

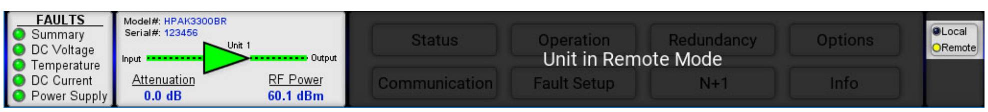


Figure 104: Remote Only Mode

Config Status

Pressing the Config Status button opens the Config Status menu, from which the user can select the items that appear in the Custom Status menu (Status > Custom Status). Up to eight items may be selected between two screens of parameters that may be monitored. See Figure 105 and Figure 106.

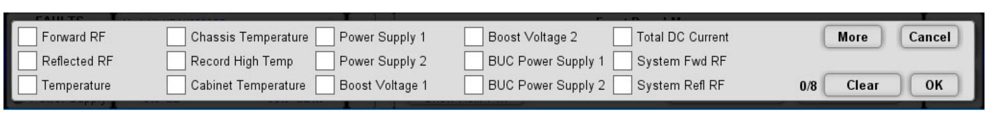


Figure 105: Options > Front Panel > Config Status Menu Page 1

Press the More button to get to page 2.

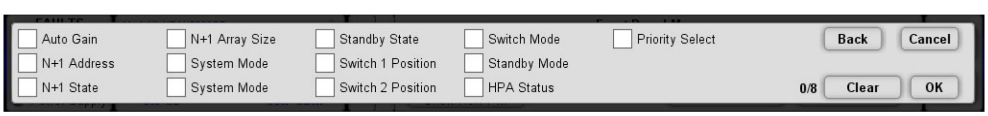


Figure 106: Options > Front Panel > Config Status Menu Page 2

Press the Back button to return to page 1. Touch the Clear button to remove the checks from all items in both page 1 and page 2. Press the Cancel button to return to the previous menu. Press the OK button to accept the selected parameters.

Screen Reset

Pressing the Screen Reset button results in a confirmation window. See Figure 107. Press the OK button to continue the reset function, or the Cancel button to cancel the function.

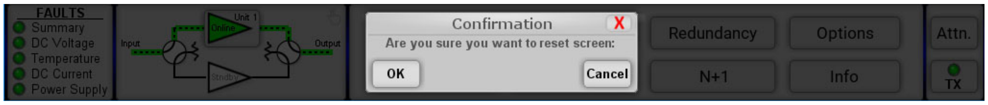


Figure 107: Options > Front Panel > Reset Screen Confirmation

The Screen Reset function reboots the touchscreen's microcontroller card and resets all trendlines.

Menu Lock Button

Pressing the Menu Lock button opens the Menu Lock menu, from which the user can set the parameters for locking the touchscreen menu. See Figure 108.

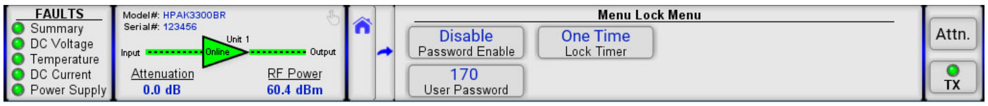


Figure 108: Options > Menu Lock Menu

Password Enable

Pressing the Password Enable button opens the Password Enable menu, from which the user enable or disable password protection for the touchscreen menu. The current selection is checked. See Figure 109.

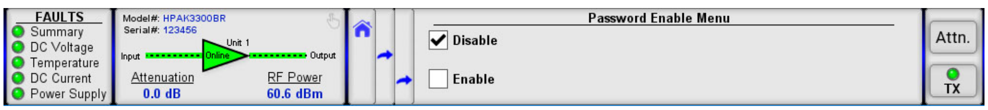


Figure 109: Options > Menu Lock > Password Enable Menu

When this function is enabled, the resulting screen returns to the Main Menu, which will show a red "locked" icon over all buttons that require a password to access. Only the Status and Info menus are not locked. See Figure 110.

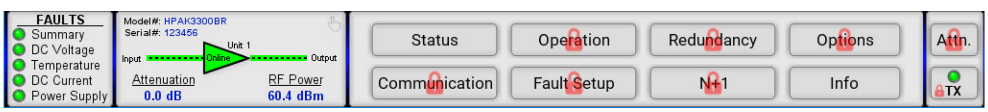


Figure 110: Main Menu With Menu Lock Enabled

If the user selects one of the locked buttons, a password entry screen will appear. See Figure 111. By default, the password is 170.

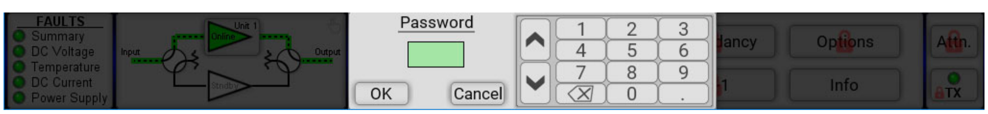


Figure 111: Enter Password to Unlock Menu

If the correct password is entered, the "locked" icons will disappear, and the user can access all buttons normally, until the Lock Timer refreshes (based on its setting).

User Password

Pressing the User Password button opens the User Password menu, from which the user set the password for the touchscreen menu. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch the "OK" button to set the selected value. The default value is 170. See Figure 112.

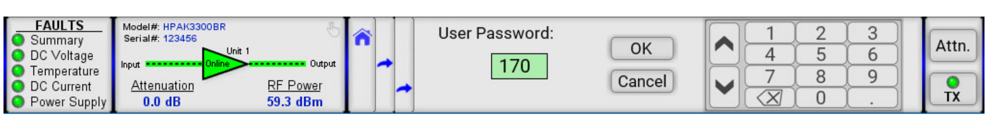


Figure 112: Options > Menu Lock > User Password Selection

Lock Timer

Pressing the Lock Timer button opens the Lock Timer menu, from which the user select how often the screen will be password protected. The current selection is checked. See Figure 113.

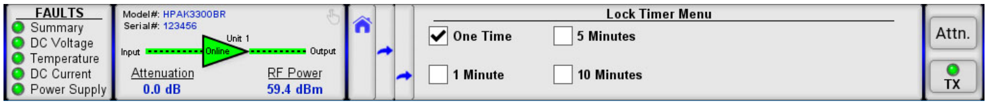


Figure 113: Options > Menu Lock > Lock Timer Menu

If One Time is selected, after the user unlocks the screen for the first time since the menu lock was enabled, the menu lock function will be disabled. Otherwise, the menu lock function will re-establish the touchscreen menu lockdown after the selected time interval passes.

Config Trends Button

Pressing the Config Trends button opens the Config Trends menu, from which the user enable or disable the trendlines, set the time interval between measurements for all trendlines, or reset the trendlines. See Figure 114.

Figure 114: Options > Config Trends Menu

Show Trends

Pressing the Show Trends button opens the Show Trends menu, from which the user may turn on or off all trendlines. The current selection is checked. See Figure 115.

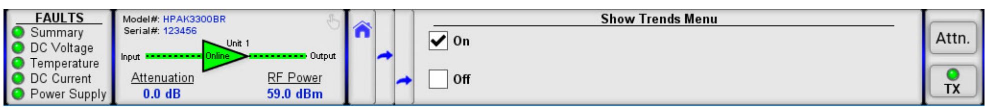


Figure 115: Options > Config Trends > Show Trends Menu

Time Interval

Pressing the Time Interval button opens the Time Interval menu, from which the user may select the time interval between measurements for all trendlines. The current selection is checked. See Figure 116.

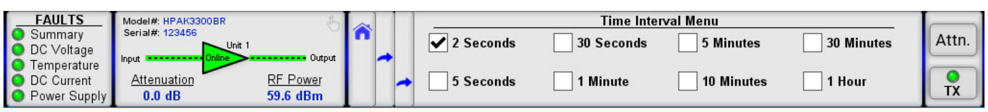


Figure 116: Options > Config Trends > Time Interval Menu

Reset Trends

Pressing the Reset Trends button results in a confirmation window. See Figure 117. Press the OK button to continue the reset function, or the Cancel button to cancel the function.

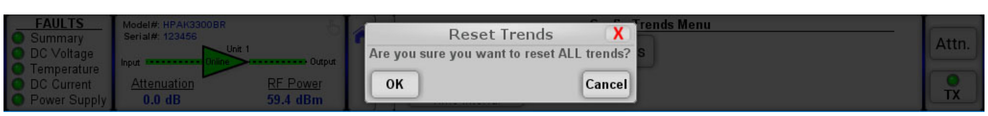


Figure 117: Options > Config Trends > Reset Trends Confirmation

If the user selects OK, all trendlines will begin tracking measurements anew, using the selected time interval.

Info Menu

Figure 118 shows the Info menu.

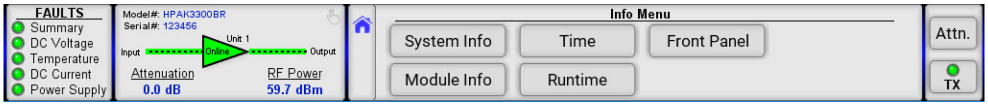


Figure 118: Info Menu

The Info menu allows the user to review the serial number and build level of the amplifier, each RF module used in the amplifier, and the front panel itself; set the date and time; or review how long the amplifier has been running.

- System Info
- Module Info
- Time
- Runtime
- Front Panel

System Info Menu

Pressing the System Info button opens the System Info menu, from which the user can review the unit's serial number, firmware build, pre-amp serial number and firmware build, circuit board IDs, and the user info. See Figure 119.

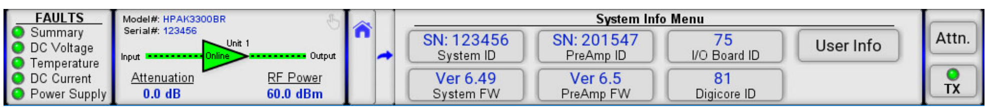


Figure 119: Info > System Info Menu

Pressing any of the buttons on this screen results in a more detailed read-only description. These information screens are not subject to the screen time-out, and will remain open until the user selects the back or home icons. The information contained within these menus are critical when calling technical support.

Module Info Menu

Pressing the Module Info button opens the Module Info menu, from which the user can review the serial number and firmware build for each of the modules contained within the amplifier chassis. See Figure 120.

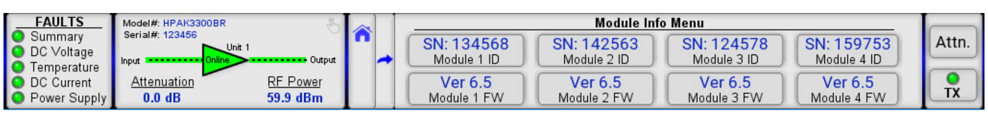


Figure 120: Info > Module Info Menu

Pressing any of the buttons on this screen results in a more detailed read-only description. These information screens are not subject to the screen time-out, and will remain open until the user selects the back or home icons. The information contained within these menus are critical when calling technical support.

Time Menu

Pressing the Time button opens the Time menu, from which the user can review or edit the date and time. See Figure 121.

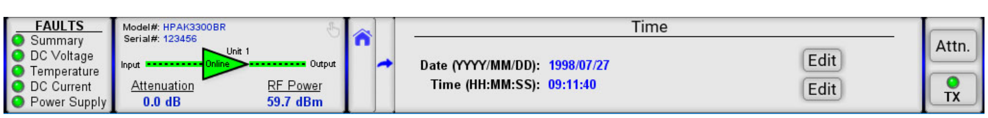


Figure 121: Info > Time Menu

Edit Date

Pressing the Edit button next to the displayed Date opens the Edit Date menu, from which the user can change the date saved to the unit. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch the "OK" button to set the selected value. See Figure 122.

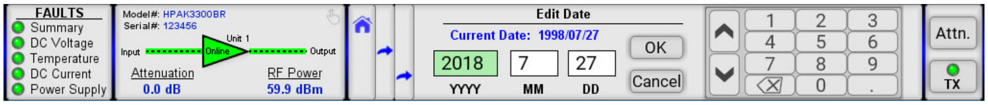


Figure 122: Info > Time > Edit Date Menu

Edit Time

Pressing the Edit button next to the displayed Time opens the Edit Time menu, from which the user can change the time saved to the unit. Use the numbered keypad on the screen to enter the numbers for the highlighted selection. Touch the "OK" button to set the selected value. See Figure 123.

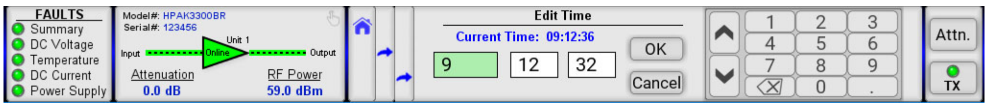


Figure 123: Info > Time > Edit Time Menu

Runtime Menu

Pressing the Runtime button opens the Runtime display, which shows the length of time since the last power-up. This is a read-only screen. See Figure 124.

Figure 124: Info > Runtime Display

Front Panel Menu

Pressing the Front Panel button opens the Front Panel menu, from which the user can review the touchscreen unit's microcontroller (MCU) version, graphic user interface (GUI) type, and serial number. See Figure 125.

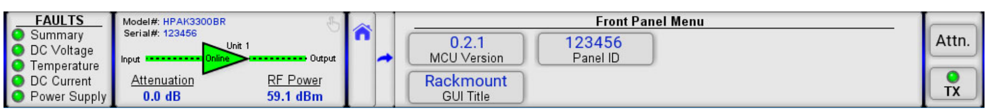


Figure 125: Info > Front Panel Menu

Pressing any of the buttons on this screen results in a more detailed read-only description. These information screens are not subject to the screen time-out, and will remain open until the user selects the back or home icons. The information contained within these menus are critical when calling technical support.

SSPA Touchscreen System Operation

Teledyne Paradise Datacom
Drawing Number: 216512-6 Revision B
ECO 18951
11 June 2020

Introduction

All Teledyne Paradise Datacom rack mountable amplifiers can be placed in redundant system and phase combined system configurations, which can be controlled by the amplifier's controller without the need for an external controller unit.

Possible configurations include:

- 1:1 Redundant Systems (with input switching or splitting)
- 1:2 Redundant Systems
- 1:1 Phase Combined Systems (with an FPRC-1100 controller)
- 1:2 Phase Combined Systems (with an FPRC-1200 controller)
- Maintenance Switch

When an amplifier's operation mode is set to anything other than Standlone, an indicator on the top-right of the RF Signal Path Display can be touched to open the secondary MIMIC panel. See Figure 1.

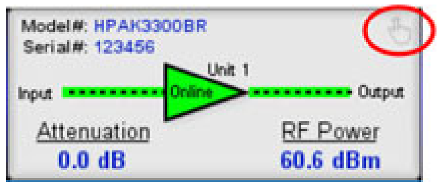


Figure 1: RF Signal Path Display, MIMIC Panel Icon

The resulting screen displays the selected system configuration, the RF path and switch positions, and the online state of the amplifier. See Figure 2.

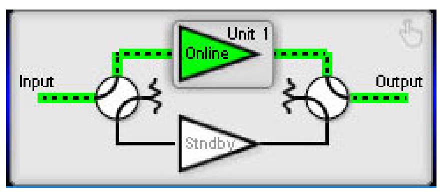


Figure 2: MIMIC Panel, 1:1 Redundant System

⚠ **Note: The MIMIC panel does not indicate the fault status of each amplifier in the system. However, if there is a switch fault, the switches in the MIMIC panel and the RF Switch # indicator in the Fault Panel will turn red, as shown in Figure 3.**

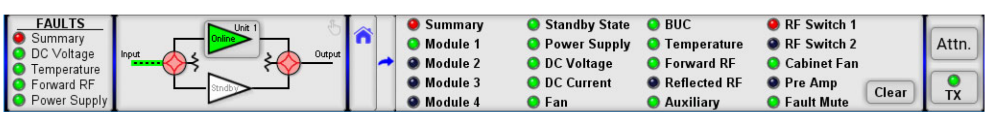


Figure 3: MIMIC Panel Showing Switch Fault

Redundant System Concepts

In order to work in any redundant or phase combined system mode, all connected amplifiers must be properly configured and interconnected. Because each amplifier has a microprocessor unit, an additional controller is not required.

Switch Cable

A switch cable must be connected between each amplifier and the transfer switch(es). The cable is connected to the 6-pin connector at Port J3 on the SSPA rear panel. The switches are controlled by applying +28V to the common of the switch and pulsing either position to the ground. The system then verifies the position of the switch.

See your system schematic for details on the switch cable for your system.

Link Cable

A link cable must be connected between each amplifier's Link Port (J8) in order to pass online/standby status information between them.

See your system schematic for details on the link cable for your system.

> ⚠ **Warning! Do not remove the Link Cable while the system is in operation! The system will not operate properly.**

Switching Modes

The user may configure the system to operate in one of the following switching modes: Auto, Manual or Switch Lock. See Figure 4.

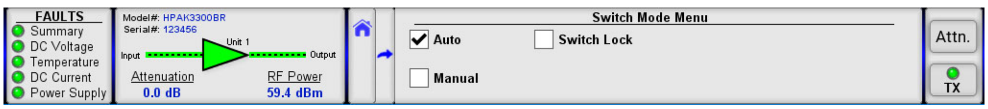


Figure 4: Redundancy > Switch Mode Menu

> ⚠ **Note: Switch Lock mode should only be used in custom systems and at the direction of the factory.**

Normal operational Switch Mode for any system configuration is Auto. This mode provides automatic detection of SSPA faults and switchover to the operational SSPA. The system is also protected from operator errors; selecting a faulted SSPA is not allowed.

In situations when system maintenance must be performed, Manual mode should be used. In Manual mode, the operator can select the on-line and standby SSPA from the touchscreen display. The system will not provide automatic switchover from a faulted SSPA, but will keep the selected SSPA online regardless of its state.

> ⚠ **Note: In order to function normally, both SSPAs in the system must utilize the same switching mode.**

When the system is in Auto mode, if a summary fault develops in the on-line amplifier, its state will be sensed by the standby SSPA through the link cable. If the standby SSPA is in a non-faulted state, it will force the waveguide switch to reposition and put itself into the online state. The process takes no more than 200 ms. See the Switch Mode Button description of the **Touchscreen Menu Structure** section.

Switchover Muting

The system amplifiers may be set so that any change in switch position automatically mutes the amplifiers until the switch position change is completed.

To activate this feature, perform the following steps on each amplifier in the system.

1. From the front panel, tap the Home icon;
2. Tap the Fault Setup button;
3. Tap the RF Switch Flt. button;
4. Tick the MuteOnSwitch checkbox. See Figure 5.

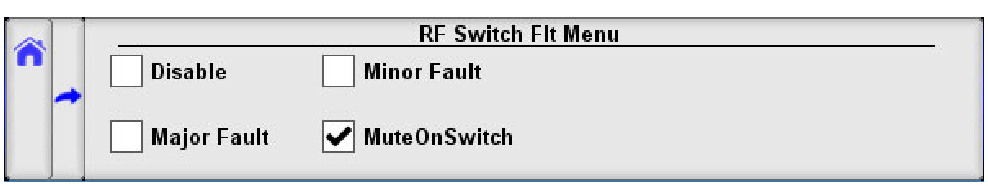


Figure 5: Fault Setup > RF Switch Flt. > MuteOnSwitch Selected

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

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

If this option is turned on, the system ability to output RF power will be bonded to the switch position sensing circuitry. Such circuitry consists of the following components: SSPA electronic switch position detector; wiring harness between SSPA and RF switch; RF switch position sensors. Failure of any of the above components will lead to a break in transmission.

Note that during any switchover, the system will register a minor fault, which will be indicated on the Fault Panel (RF Switch 1 and/or RF Switch 2). Should any of the system switches fail, a minor fault will be triggered and the amplifiers will be muted until the fault condition is cleared. See Figure 3 earlier in this section.

Physically Rotating Transfer Switch

It is possible to physically rotate the shaft on the transfer switch to change the online and standby amplifier positions. This can be done in any Switch Mode. When the switch is physically rotated in automatic mode the online SSPA will attempt to return the switch to its previous position. The SSPA will make two attempts to return the switch before accepting the new position.

If Switchover Muting is enabled, all amplifiers in the system will mute until the switch is completely rotated to a final position.

Hot Versus Cold Standby Mode

Two modes are available for the standby SSPA: Hot or Cold standby.

An SSPA in Hot standby mode (the preferred method) remains fully operational, transmitting its signal to the dummy load. When the standby amplifier is switched to the online state, full output power is immediately available. If switch mute is enabled, the SSPA will be muted during switchover.

An SSPA in Cold standby mode remains muted when off-line. If the standby amplifier is switched to the online state, it will unmute and will take several moments to achieve full output power. This mode is recommended only where prime power conservation is critical. See the Standby Mode Button description in the **Touchscreen Menu Structure** section.

1:1 Redundant Systems

Two amplifiers can be connected in a 1:1 redundant configuration, which can automatically switch to an operating amplifier if the on-line SSPA develops a system fault.

Two amplifiers can be connected to each other and to a waveguide/coaxial switch. One of the amplifiers is designated as "on-line"; the other is designated as "standby". The on-line SSPA receives the input RF signal and transmits an amplified RF signal to the RF load. The output of the standby SSPA is terminated at the dummy load. See the Standby Select Button description in the **Touchscreen Menu Structure** section.

In 1:1 Redundant Systems, the RF input signal can be directed to the online amplifier via a transfer switch (Input Switching), or to both amplifiers by splitting the incoming signal (Input Splitting). Both amplifiers must use the same input setting. See the Input Type Button description in the **Touchscreen Menu Structure** section.

Both SSPAs constantly monitor the waveguide switch position. The proper position for the online SSPA is determined by the Unit Status setting. If the selected SSPA is configured as HPA1, it will drive the RF switch to Position 1 to set itself to the on-line state. Selecting unit status to HPA2 will configure that SSPA to drive the switch to Position 2 for the on-line state. In Auto mode, the online SSPA will make two attempts to force the waveguide switch to take proper position before accepting its new state. See the HPA Status Button description in the **Touchscreen Menu Structure** section.

Configuring Amplifiers for 1:1 Redundant Mode (Internal Control)

The two amplifiers must be connected together with a switch cable and link cable, and the output waveguide directed to a transfer switch.

For convention, the standard position of HPA1 is on top of HPA2. This is represented on the MIMIC panel.

Setting SSPA1 to Work in 1:1 Mode

1. From the front panel of SSPA1, tap the Home icon;
2. Tap the Redundancy button;
3. Tap the System Mode button;
4. Tick the 1:1 Mode box;
5. Tap the HPA Status button;
6. Tick the HPA1 box;
7. Tap the Standby Select button;
8. Tick the Online box;
9. Tap the Input Type button;
10. Tick Switching if the system input passes through a transfer switch, or Splitting if the system input passes through a splitter.

> ⚠ **Note: HPA1 must be set to the same System Mode and Input Type as HPA2.**

Setting SSPA2 to Work in 1:1 Mode

1. From the front panel of SSPA2, tap the Home icon;
2. Tap the Redundancy button;
3. Tap the System Mode button;
4. Tick the 1:1 Mode box;
5. Tap the HPA Status button;
6. Tick the HPA2 box;
7. Tap the Standby Select button;
8. Tick the Standby box;
9. Tap the Input Type button;
10. Tick Switching if the system input passes through a transfer switch, or Splitting if the system input passes through a splitter.

> ⚠ **Note: HPA2 must be set to the same System Mode and Input Type as HPA1.**

Touchscreen Control of 1:1 Redundant System

Once each amplifier in the system is properly configured, the user can use the touchscreen on each of the system SSPAs to monitor and control the system. The user can tap the indicator on the top-right of the RF Signal Path Display to open the secondary MIMIC panel. See Figure 6.

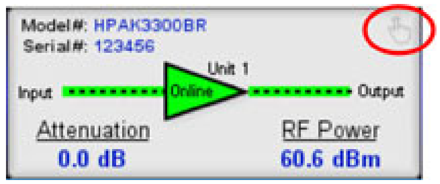


Figure 6: RF Signal Path Display, Tap Icon to Open MIMIC Panel

In normal 1:1 Redundant System operation, HPA1 is set as the online amplifier and HPA2 is the standby unit. Figure 7 shows the MIMIC panel for both amplifiers in a 1:1 Redundant System. The green dotted line indicates the RF path through the input switch, to Unit 1 (HPA1) and then through the output switch. The online amplifier is also green to indicate its online status.

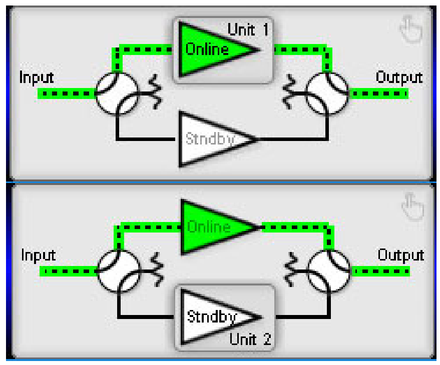


Figure 7: MIMIC Panels, with HPA2 on Standby in 1:1 System

To place HPA2 online, the user may tap the Unit 1 button on the MIMIC Panel of HPA1. See Figure 8.

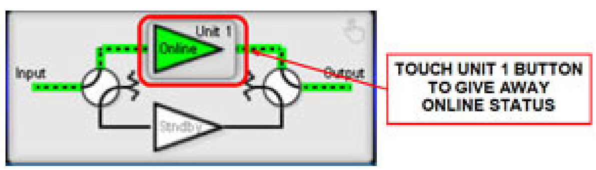


Figure 8: Tap Unit1 Button to Place HPA1 in Standby Mode

⚠ **Note: Only the on-line amplifier can be switched to standby. Attempting to switch the standby SSPA to the on-line state by tapping the Unit # button will not work.**

If the system is in Auto mode, HPA2 will accept the on-line state only if there is no summary alarm on HPA2. The Unit 2 button for HPA2 will turn green, indicting it is on-line, and the system will rotate the transfer switch to the correct position. The green dotted line will change to show the RF path passing through the input switch, to Unit 2 (HPA2) and then through the output switch. See Figure 9. If HPA2 does not accept the online state (due to a fault status), HPA1 will revert to the on-line state after 1 second.

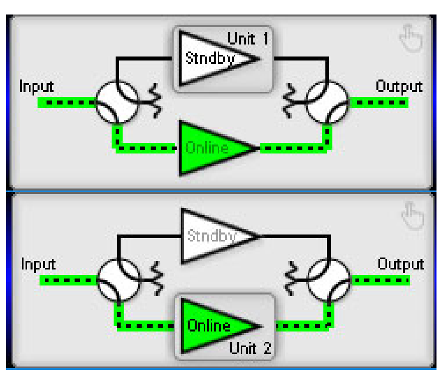


Figure 9: MIMIC Panels, with HPA1 on Standby in 1:1 System

In Manual mode, the standby SSPA will always accept the on-line state regardless of its own fault status.

> ⚠ **Note: The MIMIC Panel will not show if the online amplifier is under a fault condition. The user will need to monitor faults via the Fault Panel or other fault indicators elsewhere on the touchscreen display.**

However, in Auto Switch Mode, if the online amplifier enters a Major fault condition, the system will automatically switch the faulted amplifier to Standby status, and place the standby amplifier on-line.

Redundancy Menu in 1:1 Mode

When the system is placed in 1:1 Mode, the Priority Select button on the Redundancy Menu is disabled and greyed-out. See Figure 10.

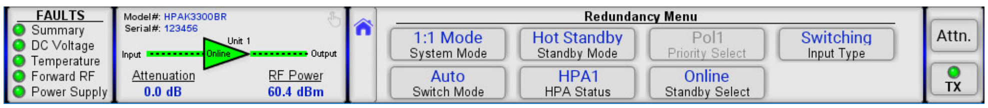


Figure 10: Redundancy Menu in 1:1 Mode

The Input Type button is enabled when the system is placed in 1:1 Mode. The user may select either Input Switching (if the system includes a switch on the RF input path to the amplifier RF IN port J1) or Input Splitting (if the system includes a splitter on the RF input path to the amplifier RF IN port J1). This selection does not affect the operation of the system in any way, but is used only to tell the touchscreen whether to show a switch or splitter on the MIMIC panel. See the Input Type Button description in the **Touchscreen Menu Structure** section.

1:2 Redundant Systems

In 1:2 Redundant Systems, three amplifiers are configured such that two amplifiers receive two distinct inputs and transmit to two outputs (polarization paths), with a third amplifier acting as a standby for either online amplifier.

The system provides automatic switchover of the spare SSPA to either polarization path in case of a primary SSPA malfunction. In the case of two SSPA malfunctions, the backup SSPA can be switched to either polarization path, according to a polarization priority selection setting (POL1 or POL2). See the Priority Select Button in the **Touchscreen Menu Structure** section.

The standard 1:2 configuration has HPA1 online in the polarization 1 path, HPA3 online in the polarization 2 path, and HPA2 acting as spare backup for ether HPA1 or HPA3. In a typical 1:2 redundant system, the state of the system is negotiated between all three HPAs over the link and switch cables. In this system, the link cable is used to pass information regarding the standby/online state between the HPAs. The switch cable is used to drive waveguide switches and determine their current position.

Configuring Amplifiers for 1:2 Redundant Mode (Internal Control)

The three amplifiers must be connected together with a switch cable and link cable, and the output waveguide directed to a transfer switch. For convention, the standard position of HPA1 is on top of HPA2, which is on top of HPA3. This is represented on the MIMIC panel.

Setting SSPA1 to Work in 1:2 Mode

1. From the front panel of SSPA1, tap the Home icon;
2. Tap the Redundancy button;
3. Tap the System Mode button;
4. Tick the 1:2 Mode box;
5. Tap the HPA Status button;
6. Tick the HPA1 box;
7. Tap the Standby Select button;
8. Tick the Online box;

Setting SSPA2 to Work in 1:2 Mode

1. From the front panel of SSPA2, tap the Home icon;
2. Tap the Redundancy button;
3. Tap the System Mode button;
4. Tick the 1:2 Mode box;
5. Tap the HPA Status button;
6. Tick the HPA2 box;
7. Tap the Priority Select button;
8. Tick either the Pol1 or Pol2 box, depending on user preference;
9. Tap the Standby Select button;
10. Tick the Standby box;

Setting SSPA3 to Work in 1:2 Mode

1. 1. From the front panel of SSPA3, tap the Home icon;
2. 2. Tap the Redundancy button;
3. 3. Tap the System Mode button;
4. 4. Tick the 1:2 Mode box;
5. 5. Tap the HPA Status button;
6. 6. Tick the HPA3 box;
7. 7. Tap the Standby Select button;
8. 8. Tick the Online box;

Touchscreen Control of 1:2 Redundant System

Once each amplifier in the system is properly configured, the user can use the touchscreen on each of the system SSPAs to monitor and control the system. The user can tap the indicator on the top-right of the RF Signal Path Display to open the secondary MIMIC panel. See Figure 11.

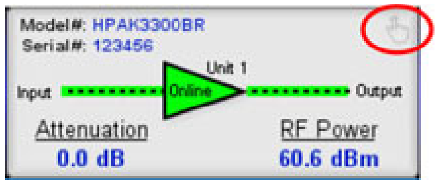


Figure 11: RF Signal Path Display, Tap Icon to Open MIMIC Panel

In normal 1:2 Redundant System operation, HPA1 is set as the online amplifier on POL1, HPA3 is assigned as the online amplifier on POL2, and HPA2 is configured as the standby unit.

Figure 12 shows the MIMIC panel for the three (3) amplifiers in a 1:2 Redundant System. The green dotted lines indicate the RF path through the input switches on POL1 and POL2, to Unit 1 (HPA1) and Unit 3 (HPA3) and then through the output switches. The online amplifiers are also green to indicate their online status.

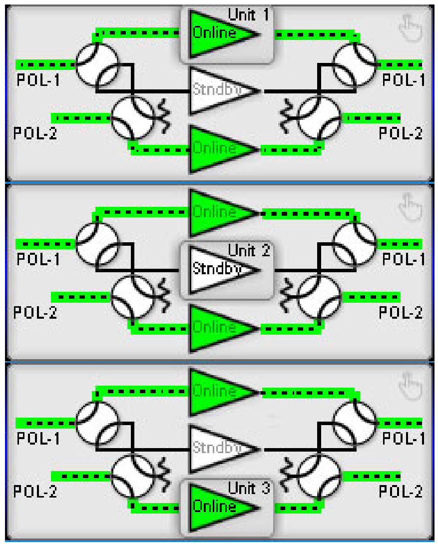


Figure 12: MIMIC Panels, with HPA2 on Standby in 1:2 System

To place HPA2 online on POL1, the user may tap the Unit 1 button on the MIMIC Panel of HPA1. See Figure 13.

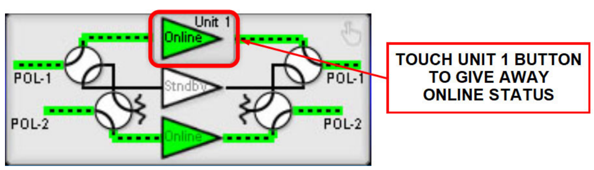


Figure 13: MIMIC Panel, Tap Unit 1 Button to Place Unit 1 in Standby Mode

⚠ **Note: Only the on-line amplifier can be switched to standby. Attempting to switch the standby SSPA to the on-line state by tapping the Unit # button will not work.**

If the system is in "Auto" mode, HPA2 will accept the on-line state only if there is no summary alarm on HPA2. The Unit 2 button for HPA2 will turn green, indicting it is on-line, and the system will rotate the transfer switch to the correct position. The green dotted line will change to show the RF path passing through the POL1 input switch, to Unit 2 (HPA2) and then through the POL2 output switch. See Figure 14. If HPA2 does not accept the online state (due to a fault status), HPA1 will revert to the on-line state after 1 second.

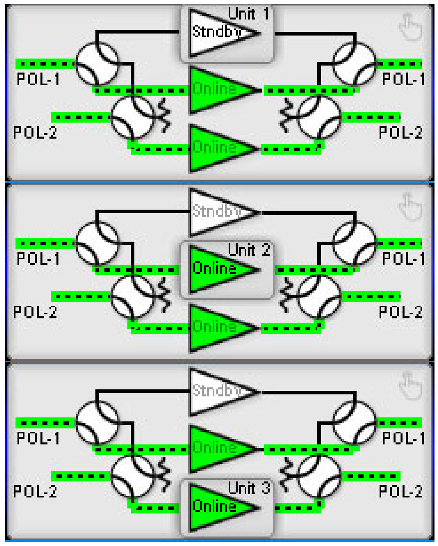


Figure 14: MIMIC Panels, with HPA1 on Standby in 1:2 System

In "Manual" mode, the standby SSPA will always accept the on-line state regardless of its own fault status.

⚠ **Note: The MIMIC Panel will not show if the online amplifier is under a fault condition. The user will need to monitor faults via the Fault Panel or other fault indicators elsewhere on the touchscreen display.**

However, in Auto Switch Mode, if the online amplifier enters a Major fault condition, the system will automatically switch the faulted amplifier to Standby status, and place the standby amplifier on-line.

Redundancy Menu in 1:2 Mode

When the system is placed in 1:2 Mode, the Priority Select button on the Redundancy Menu is enabled. The user may select the polarity path that the standby amplifier will be placed if both online amplifiers fail. Selections are POL1 or POL2. See the Priority Select Button description in the **Touchscreen Menu Structure** section.

The Input Type button is disabled in 1:2 Mode.

See Figure 15.

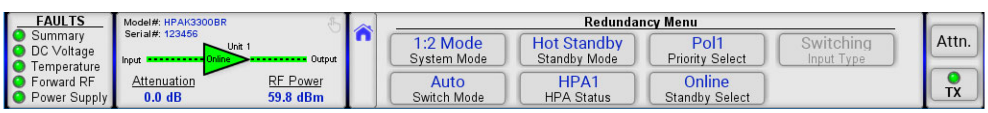


Figure 15: Redundancy Menu in 1:2 Mode

Phase Combined Systems

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

A technique has been developed which accomplishes phase combining and provides redundancy with two waveguide transfer switches. This type of system is sometimes referred to as a "Fixed Phase" combined system to differentiate it from the Variable Phase Combiner (VPC) systems commonly used with TWTAs.

In the 1:1 Fixed Phase Combined system, the waveguide switches allow the amplifier outputs to either be directed into the combiner or bypass the combiner and connect directly to the RF output. The basic system topology is very similar to a 1:1 redundant system. An additional switch is included which allows either amplifier to be individually routed to the antenna or connect both amplifiers to a waveguide combiner. The combined system output power is then routed to the antenna.

In 1:2 Phase Combined mode, three amplifiers, two switches and a waveguide combiner comprise the system. The output power of two of the amplifiers is increased through the combiner. The output of the third amplifier is directed to a dummy load. If one of the two online amplifiers experiences a fault condition, the faulted amplifier is switched to the dummy load, and the standby amplifier is switched online.

Teledyne Paradise Datacom has a system controller which is used in Fixed Phase Combined systems. The controller can be configured to control 1:1 or 1:2 systems.

⚠ **Note: Internal phase combined modes are not currently supported. See the System Controller with Touchscreen manual for information on controlling phase combined systems.**

Maintenance Switch

A maintenance switch may be included at the RF Output of an amplifier. The position of the switch determines whether the output signal of the amplifier or amplifier system is directed to a dummy load (the maintenance position), or to the system output.

Setting the Amplifier for Maint. Switch Mode

The amplifier may be configured to control the maintenance switch, and must be connected to the switch via a single cable. The switch cable connects between port J3 from the amplifier's rear panel to the circular MIL connector on the switch.

1. From the front panel of SSPA2, tap the Home icon;
2. Tap the Redundancy button;
3. Tap the System Mode button;
4. Tick the Maint. Switch box;

See Figure 16.

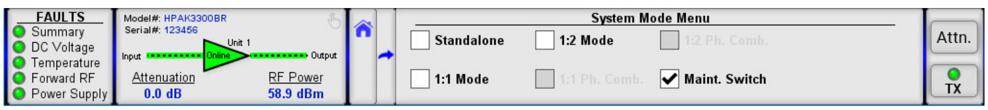


Figure 16: Redundancy > System Mode Menu > Maint. Switch Selected

Direct Signal to Output

Follow the instructions below to direct the RF signal to the system output.

1. From the front panel of SSPA2, tap the Home icon;
2. Tap the Redundancy button;
3. Tap the Standby Select button;
4. Tick the Online box.

The MIMIC panel will show the signal path from the amplifier directed through the switch to the system output. See Figure 17.

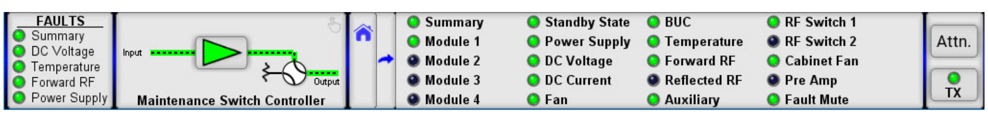


Figure 17: MIMIC Panel, Signal Directed to Output

Direct Signal to Dummy Load

Follow the instructions below to direct the RF signal to the dummy load.

1. From the front panel of SSPA2, tap the Home icon;
2. Tap the Redundancy button;
3. Tap the Standby Select button;
4. Tick the Standby box.

The MIMIC panel will show the signal path from the amplifier directed through the switch to the dummy load. Note that the Standby State indicator in the Fault Panel turns red. See Figure 18.

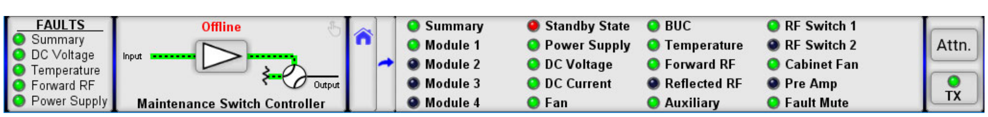


Figure 18: MIMIC Panel, Signal Directed to Dummy Load

Redundancy Menu in Maint. Switch Mode

When the system is placed in Maint. Switch Mode, both the Priority Select button and the Input Type button are disabled. See Figure 19.

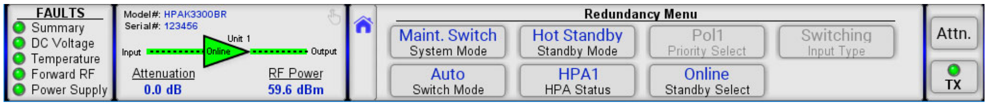


Figure 19: Redundancy Menu in Maintenance Switch Mode

Teledyne Paradise Datacom
Drawing Number 216512-6 Revision B
ECO 18951
Last Modified: 11 June 2020

THIS PAGE LEFT INTENTIONALLY BLANK

Indoor RM SSPAs, Operational Basics

Teledyne Paradise Datacom
Drawing Number: 216512-7 Revision B
ECO 18951
11 June 2020

Introduction

This section provides the instruction on basic amplifier functions, including local/remote control, mute/unmute, setting attenuation, N+1 operation, and the reflected power monitor option.

Applying an RF/IF Signal

The Type N (F) connector (J1) at the rear panel of the amplifier is used as the RF/IF input. An IF (L-Band) signal should be applied only to units which include an optional block up converter.

⚠ **Important: Maximum input is +15 dBm.**

⚠ **Warning: Do not apply RF/IF to the amplifier without first terminating the RF Output (J2) to a load rated for the maximum saturated output power of the unit. Never look into an open waveguide. RF hazards apply.**

Local vs. Remote Control of Amplifier

Control of the amplifier can be handled through front panel operation, or remotely through parallel or serial communication to a computer.

If the amplifier will often switch between local and remote control, the user can choose to assign one of the Action Buttons to the Control Mode button. See the Config Buttons description in the **Touchscreen Menu Structure** section.

For local (front panel) operation of the amplifier, tap the Control Mode action button (Local/Remote) on the front panel touchscreen until the yellow LED indicator is illuminated on Local. See Figure 1.

Figure 1: Action Button > Control Mode (Local Active)

When in Remote mode the front panel buttons are inoperative and a message is shown on the front panel touchscreen, as shown in Figure 2. The fault indicators and RF signal path display will still show the status of the system. Regardless of how the user configures the custom action button display, the Control Mode action button is always active in Remote mode.

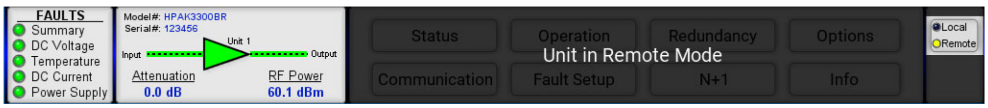


Figure 2: Display When Unit in Remote Mode

See the **Touchscreen Operation** section for information on front panel control.

See the **Remote Control Protocol** section for information on remote control.

If the Control Mode button is not selected as one of the assigned action buttons, the user may place the amplifier in Remote mode by navigating to the Home > Operation > Control menu. Tick the Remote checkbox. See the Control Button description in the **Touchscreen Menu Structure** section.

Mute/Unmute the Amplifier

By default, the SSPA touchscreen is configured with the Mute Action Button at the far right of the screen. It is visible when Remote Mode is not active for the unit. See Figure 3.

Figure 3: Action Button > Mute (TX) Control (Unmute Active)

Tapping the Mute (TX) button results in a confirmation window (unless prompts are disabled in the Options > Front Panel > Confirm Prompt menu) to change the mute state of the amplifier. Tap the OK button to change the mute state or the Cancel button to keep the current mute state. When the unit is in the mute state, the indicator turns red. When unmuted, the indicator turns green.

You can also change the mute state of the amplifier by performing the following sequence on the touchscreen:

1. Tap the Home icon;
2. Tap the Operation button;
3. Tap the Mute button;
4. Tick the desired mute state checkbox: Mute Off or Mute On. The active state is selected.

When operating in N+1 mode, changing the mute state of the Master Module also changes the mute state of all Slave units. The mute state of any unit not configured in the N+1 array will not be affected.

Adjust Gain Attenuation

By default, the SSPA touchscreen is configured with the Attenuation action button at the far right of the screen. It is visible when Remote Mode is not active for the unit. See Figure 4.

Figure 4: Action Button > Attenuation Control

Tapping the Attenuation button opens the Attenuation setting screen. The current attenuation setting is displayed in the green window. Use the arrow buttons to adjust the ones and tenths places of the desired attenuation value. The attenuation adjustment is immediately applied to the amplifier. Click the OK button to accept the setting.

You can also change the attenuation setting of the amplifier by performing the following sequence on the touchscreen:

1. Tap the Home icon;
2. Tap the Operation button;
3. Tap the Attenuation button;
4. Use the keypad or arrow keys to adjust the attenuation setting. Tap the OK button to accept the entered attenuation value.

Automatic Level Control

Automatic Level Control (ALC) is an operational option that controls the amplifier's attenuation settings to maintain a desired RF output power level. The ALC function has the ability to accurately control the RF output power over a 15 dB range from saturated power.

Automatic Level Control can be activated via the front panel by following the steps listed below:

1. Tap the Home icon on the front panel touchscreen;
2. Tap the Fault Setup button;
3. Tap the Fwd RF/ALC button;
4. Tap the Action button;
5. Tick the ALC checkbox;
6. Tap the Level button;
7. Enter the desired output level and click the OK button to set.

Once activated, the ALC will take control of the amplifier's attenuation setting to maintain the desired RF output power level and will not allow any attenuation adjustments via the front panel. The ALC circuit will have the greatest ability to adjust for positive and negative RF input level changes when the amplifier's gain level is typically 65 dB. By following the steps below, the optimum ALC RF input level can be set quickly.

1. Tap the Home icon on the front panel touchscreen;
2. Tap the Fault Setup button;
3. Tap the Fwd RF/ALC button;
4. Tap the Action button;
5. Tick the Disable checkbox;
6. Tap the Home icon on the front panel touchscreen;
7. Tap the Operation button;
8. Tap the Attenuation button;
9. Set the attenuation level to 10 dB and click the OK button to set.
10. Apply a CW RF signl to the amplifier;
11. Use a power meter to measure the output power of the amplifier;
12. Adjust the RF input level until the desired output power level is achieved;
13. Follow the steps listed above to activate the ALC control. The ALC will take over the control of the output level and maintain the RF output level set point.

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

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

⚠ **Note: Automatic Level Control is inactive when the system is in N+1 operation. Use the AutoGain control option for units in N+1 configurations.**

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 the **Touchscreen Operation** section. In this case, each SSPA module within the SSPA chassis is counted as a separate N+1 entity. For example, a two-module 5RU chassis acts like a two-way N+1 array.

N+1 array indexing also accounts this type of functioning. Each SSPA chassis occupies a segment of N+1 addressing equal to the number of modules; i.e., 2 modules = 2 addresses.

The remaining N+1 functions remain the same as that of a multi-unit N+1 system. 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 7RU chassis;
- Two (2) two-module 5RU chassis;
- Four (4) one-module 3RU chassis (standard PowerMAX configuration).

N+1 Operational Basics (2+ Units)

A system which utilizes two or more 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 SSPA chassis in the system can serve as the Master Module single point of control.

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 touchscreen of the Master Module shows its status, as well as the attenuation setting, total system gain, system RF power, and (if the system includes a reflected power monitor) the system reflected power. In addition, when the system is operating normally, the background of the N+1 Master information panel is colored green. See Figure 5

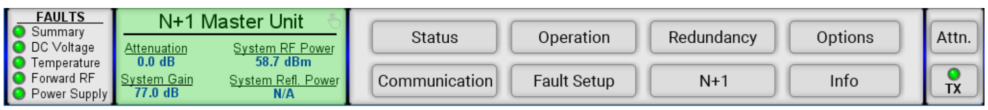


Figure 5: N+1 Master Module Display, Normal Operation

If there is a summary fault in the system, the background is colored red. See Figure 6.

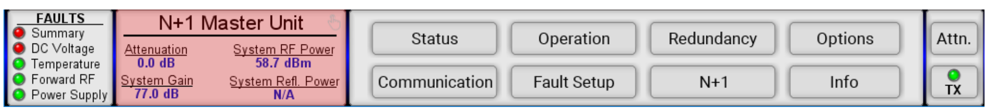


Figure 6: N+1 Master Module Display, Fault Condition

The touchscreen of the Slave units in the system does not display any system information, as shown in Figure 7. The status of the individual Slave unit may be monitored in the Status menus, but any mute or attenuation settings changed at the Slave unit will be overwritten by the Master Module.

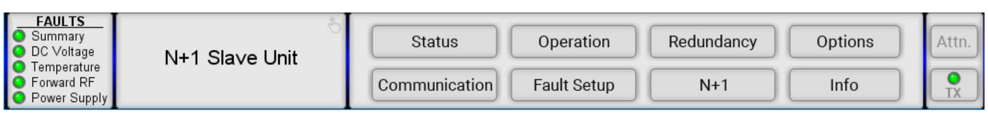


Figure 7: N+1 Slave Module Display

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.

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

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.

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 four 5RU 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:

1. Tap the Home icon;
2. Tap the N+1 button;
3. Tap the N+1 Address button.
4. Enter the desired address and press the OK button to set the value.

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

See the description for **Changing the N+1 Hierarchy** of SSPAs in an active system.

Adjust System Gain

Nominal system gain with Auto Gain enabled is 65 dB; nominal system gain with Auto Gain disabled is 70 dB. Note that Automatic Level Control is inactive in all N+1 configurations.

To adjust the gain of the system:

1. Tap the Home icon;
2. Tap the Operation button;
3. Tap the Attenuation button.
4. Enter the desired attenuation 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.

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:

1. Tap the Home icon on the front panel touchscreen;
2. Tap the N+1 button;
3. Tap the Auto Gain button;
4. Tick the desired Auto Gain option.

See the **Touchscreen Operation** section for information about the Auto Gain options.

When Auto Gain On option is selected, 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 SSPA unit enters a fault condition.

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:

1. Tap the Home icon;
2. Tap the Status button;
3. Tap the RF/Temp. button;
4. The Forward RF value is displayed in the top left.

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.

1. Tap the Home icon of the Master Module in the N+1 system;
2. Tap the Status button;
3. Tap the N+1 Alarms button;
4. The N+1 Alarms menu displays the number of fault in the N+1 system, the number of units in standby; the cause of the last N+1 fault to occur; and the ID of the last failed unit.

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.

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.

Changing Hierarchical Order of Slave Units

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

1. Turn off Auto Gain setting if needed.
2. On the first slave unit, temporarily select a N+1 address setting outside the maximum N+1 address for the current N+1 array. For example, in a system of 4 units, select address 5 or above; for system of 8 units, select address 9 or above.
3. For the second slave unit, change its N+1 address to match the previous N+1 address of the first unit.
4. Change the N+1 address of the first slave unit to match the previous N+1 address of the second unit.
5. System addressing hierarchy is now exchanged between the first and second unit. Turn on Auto Gain option if required.

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 unit, 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 unit, select its N+1 address to match the address of the former slave unit.
3. On the new Master unit, change the N+1 address value from "0" to the address value of the former Master unit.

Add SSPA Unit to the System

If one of the SSPA units was removed from the system or is 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 unit 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 the N+1 address of the current Slave unit.
4. Add new unit to system. Make sure newly added unit assumed N+1 slave mode. Make sure current Master unit doesn't detect any N+1 faults.
5. Change Master unit N+1 address from value "0" to its previous value.
6. Follow Scenario 1 and 2 if hierarchical order change is required.

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, once the option is enabled.

> ⚠ **Note: If the amplifier or system does not include a Reflected Power Monitor, the display will show "N/A".**

For amplifiers or systems which include a reflected power monitor, perform the following sequence on the touchscreen to enable the display:

1. Tap the Home icon;
2. Tap the Options button;
3. Tap the Front Panel button;
4. Tap the Show Refl. Pwr button;
5. Tick the Enable box.

The reflected power will be displayed on the front panel touchscreen:

1. Tap the Home icon;
2. Tap the Status button;
3. Tap the RF/Temp. button;
4. The Reflected RF value should be displayed below the Forward RF measurement.

> ⚠ **You may set the custom status menu to display both the individual amplifier Reflected RF value and the System Reflected RF value (for units configured in a redundant system).**

> ⚠ **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.**

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. To do so, perform the following steps on the front panel touchscreen:

1. Tap the Home icon;
2. Tap the Fault Setup button;
3. Tap the Refl. RF Fault button;
4. Tap the Action button;
5. Tick the checkbox corresponding to the type of fault you wish to be tiggered when a fault condition occurs: Major Flt or Minor Flt.

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.**

Teledyne Paradise Datacom
Drawing Number 216512-7 Revision B
ECO 18951
Last Modified: 11 June 2020

THIS PAGE LEFT INTENTIONALLY BLANK

Operation, 1:1 FPC S-Band Indoor PowerMAX System

Teledyne Paradise Datacom
Drawing Number: 217022-3 Revision -
RA 7780
07 August 2020

Introduction

The HPASS800AEZA001G2 is a traditional 1:1 phase combined amplifier system in which each High Power Amplifier, HPA, is an (8) module PowerMAX System. A traditional 1:1 phase combined system allows each HPA to be connected directly to the system antenna or have both amplifiers phase combined to double the available output power. The simplified block diagram of a 1:1 Phase Combined system is shown in Figure 1.

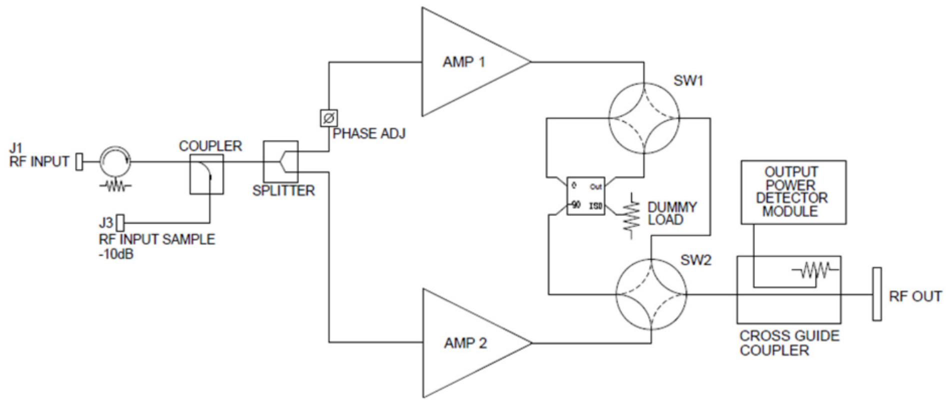


Figure 1: Block Diagram, 1:1 Phase Combined System

The heart of a 1:1 Phase Combined HPA System is the FPRC-1100 System Controller. It is the system controller's responsibility to completely monitor and control the HPAs, waveguide switches, and system output power detector. The FPRC-1100 is shown on Figure 2.

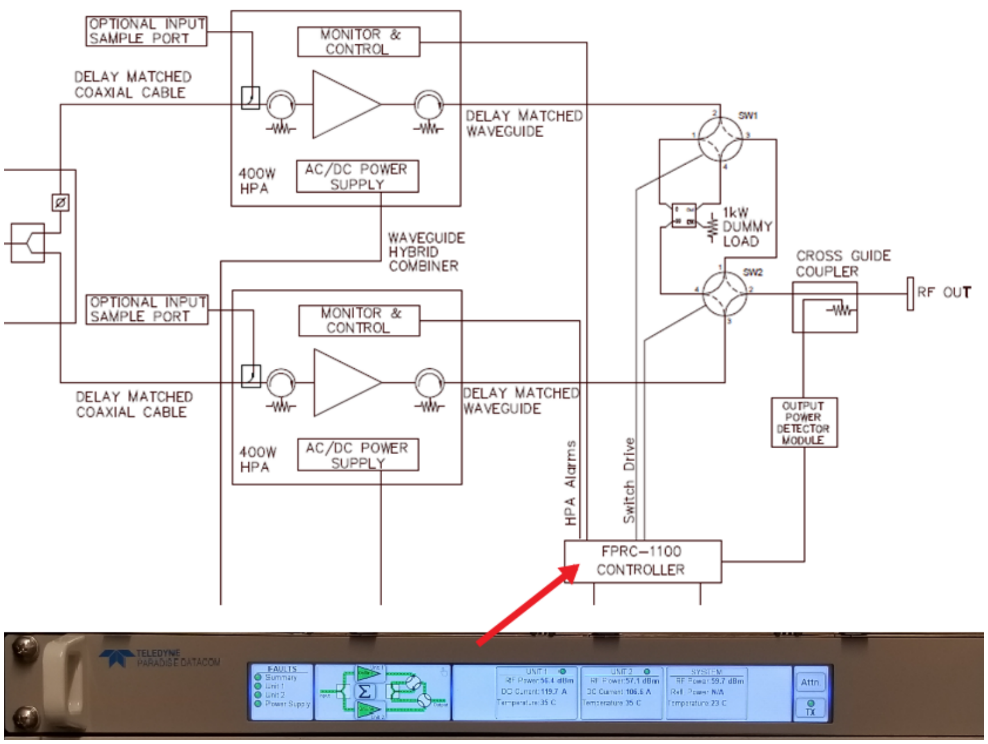


Figure 2: FPRC-1100 Phase Combined System Controller

The FPRC-1100 monitors the health of the amplifier by monitoring the form C relay, Summary Alarm, contacts from each amplifier. The controller also provides the +28 VDC required to engage the WR430 waveguide switches. The FPRC-1100 controller can also adjust the RF gain of the amplifiers as well as the mute (TX enable/disable). There is really no need to have remote M&C connection between the amplifiers themselves and the M&C system. All common operation of the system is provided directly by the FPRC-1100 controller. The FPRC-1100 has an easy to navigate touchscreen display as shown in Figure 2. It can also be controlled by RS485 serial or ethernet control. It is also the responsibility of the FPRC-1100 controller to mute the amplifiers prior to moving the WR430 waveguide switches. It is not recommended to engage the WR430 waveguide switches while the waveguide network is handling full RF power. At power levels near 10kW, waveguide arcing can occur with high VSWR or anomalies in the waveguide system.

The WR430 switch positions can be changed by the FPRC-1100 either at the front panel touchscreen or by remote command. When the FPRC-1100 is instructed to change the WR430 waveguide switch position, it first mutes each amplifier. After the switch position has changed, the FPRC-1100 then un-mutes the amplifiers to ensure that a safe RF switchover takes place.

Finally the FPRC-1100 controller provides a +15 VDC to operate a system level forward and reflected power monitor. A separate (private) RS485 link exists between this power detector and the FPRC-1100 controller.

1:1 Phase Combined System with PowerMAX

Normally a 1:1 Phase Combined System is configured with two single thread amplifiers. To achieve the high RF output power levels required by the HPASS800AEZA001G2 system; the single thread amplifiers are replaced by an (8) module PowerMAX system. Each PowerMAX system is comprised of (8) 800W S-Band amplifier modules. An entire cabinet is capable of producing over 67 dBm (5 kW) of RF power. When combined, the system is capable of nearly 70 dBm (10 kW) of RF power.

> ⚠ **Please exercise extreme caution when working around the amplifier system while producing power levels reaching 10 kW. This level of power can be extremely harmful to the human body. Double check to make sure that the system RF output is always properly terminated. Also use a radiation meter to make sure that there are no significant waveguide joint RF leaks.**

To learn more of the details of each PowerMAX cabinet please reference the S-Band PowerMAX Cabinet operations manual, 217021. In order for each PowerMAX system to properly operate within a 1:1 Phase Combined System, each PowerMAX cabinet is used in 'Floating Master' mode. This means that each cabinet has a single RS485 address and single IP address for all eight amplifiers. This allows the FPRC-1100 to control all eight SSPA modules as if they were a single thread amplifier. It is necessary to operate each cabinet in this mode so that the FPRC-1100 controller can adjust the gain, operate the Mute (TX enable/disable), and most importantly, operating the Mute before waveguide switch operation. It is important to realize that if the PowerMAX cabinet is taken out of 'Floating Master' mode, the switch mute function will not work and any waveguide switching would be done with live RF present.

Each PowerMAX cabinet has its own forward and reflected power detector. The power reported from these detectors is present on the front panel of the top-most (Master) chassis as well as on the FPRC-1100 controller.

The FPRC-1100 controller is located in Cabinet / Unit #2 which is the left most cabinet. The controller is located between the power supply modules and the top SSPA chassis as shown in Figure 3.

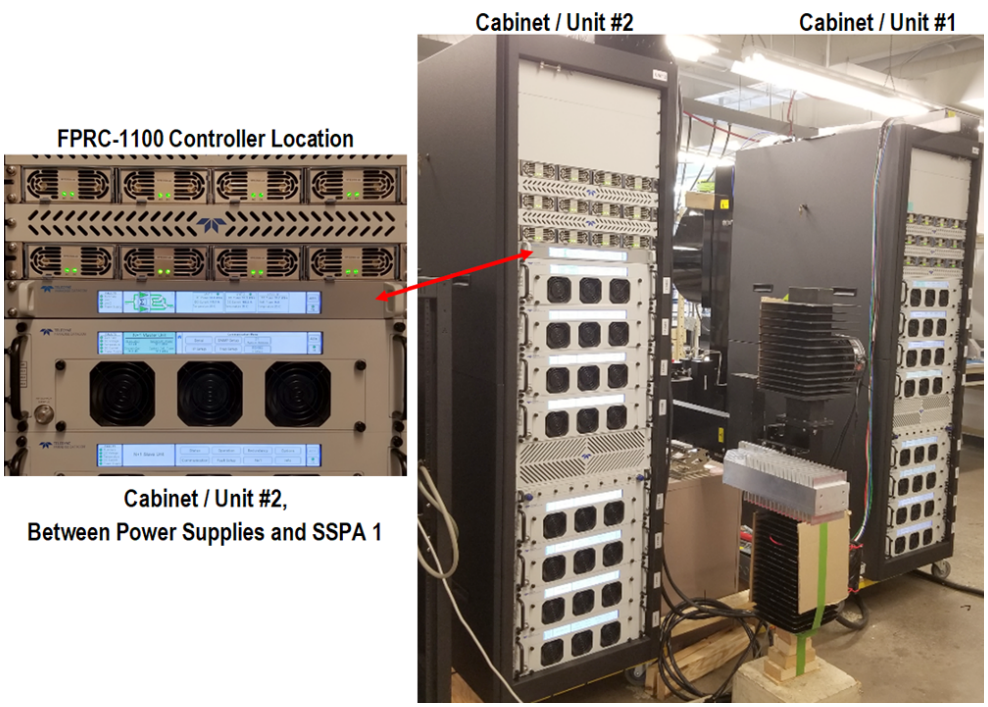


Figure 3: Location of FPRC-1100 Controller, Cabinet #2, Between Power Supplies and SSPA 1

System Operation using the FPRC-1100

This section covers the basic operation of the system using the FPRC-1100 controller. The main default display on the controller is shown in Figure 4. An amplifier is on line when it is illuminated 'green'. Figure 4 shows the system with both amplifiers on line and the system in phase combined mode. The fault panel on the left side of the touchscreen display shows the overall fault status of the system. When the lights are 'green' there are no faults and the system is operating normally. When the lights are 'red' a fault condition exists. The Summary fault can be a significant alarm in any component in the system that requires user intervention. A Summary alarm can be an a fault condition in the FPRC-1100 controller itself or with either PowerMAX amplifier cabinet: Unit 1 or Unit 2. The Power Supply indicator is the status of the redundant power supplies within the FPRC-1100 controller itself. The controller is power by two 48VDC power supplies operating from the cabinet's 48V power bus. These power supplies are redundant. Only one power supply is required to be operational for the FPRC-1100 to operate.

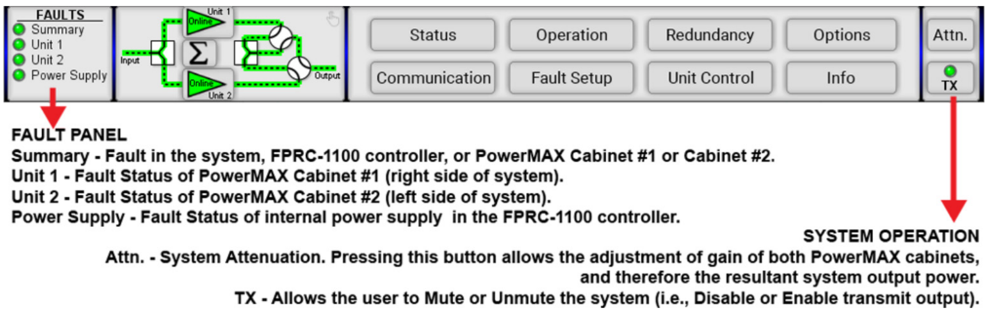


Figure 4: Fault Status and Action Buttons on FPRC-1100 Controller

Pressing the small hand symbol in the upper right side of the system switch position display toggles the main display area between the various sub menu selections and the RF output power display as shown in Figure 5. Each RF detector module includes a temperature sensor. The temperature sensor for Unit 1 and Unit 2 gives a good indication of the ambient temperature inside the cabinet. The temperature sensor for the system gives a good indication of the room ambient temperature.

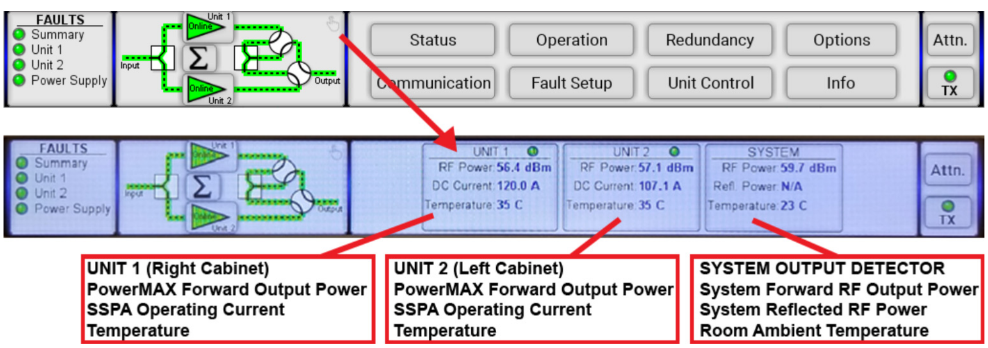


Figure 5: Monitor Status of Cabinets and System from RCP

Changing Switch Positions

Figure 6 shows both amplifiers on line and the system in phase combined mode.

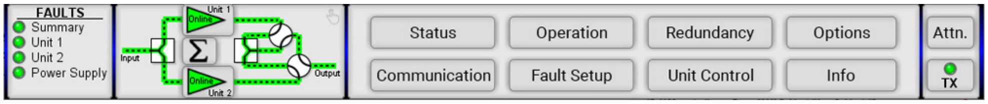


Figure 6: FPRC-1100 Controller, Phase Combined Mode

To place Cabinet / Unit 1 on line and Unit 2 on standby, press the Unit 2 button on the touchscreen display. Confirm that you want to place Unit 2 on standby. See Figure 7.

Figure 7: Tap the OK Button on Confirmation Window

Both PowerMAX cabinets will mute. This can be see by the TX button turning 'red' on each set of PowerMAX chassis.

⚠ **The system is configured to automatically mute any time the switch position changes. This function is used to help prevent arcing within the waveguide for systems operating at high RF.**

The waveguide switches will change position and then the TX button will turn 'green' indicating that the amplifiers are un-muted. The switch position display will now show Unit 2 as a clear 'white' icon. The RF switch positions are changed and the RF path is highlighted in green as shown in Figure 8.

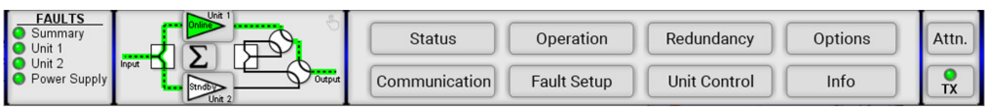


Figure 8: FPRC-1100 Controller, Cabinet #1 Online, Cabinet #2 in Standby

To place the system back in phase combined mode, press the summation (∑) key. Confirm that you want to place the system in phase combined mode.

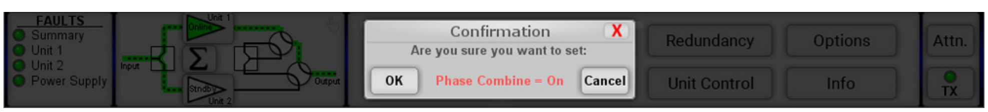


Figure 9: Tap the OK Button on Confirmation Window to Revert to Phase Combined Mode

System Controllers with Touchscreen, System Setup and Control

Teledyne Paradise Datacom
Drawing Number: 216351-4 Revision A
ECO 18940
01 May 2020

Introduction

This section describes various redundant system setups utilizing features available with the Teledyne Paradise Datacom Redundant System Controller.

The controller allows monitor and control of all types of amplifiers, from Low Noise Amplifiers (LNAs), Low Noise Block Converters (LNBs), Solid State Power Amplifiers (SSPA), or Solid State Power Amplifiers with Block Up Converters (SSPBs).

When purchased with a system, the controller is typically pre-set for operation with the system. The user will need to configure any Communication settings to operate the controller remotely over a local area network. See the Communication Menu description in the **Touchscreen Operation** section.

Operation of 1:1 System

Figure 1 shows the basic block diagram of a 1:1 redundant system. In normal operation one of the Amplifiers, 1 or 2, is considered the online amplifier and the other is in standby. If a fault condition occurs in the online amplifier the standby unit can be switched into the circuit by moving the transfer switches on the input and output side of the amplifiers.

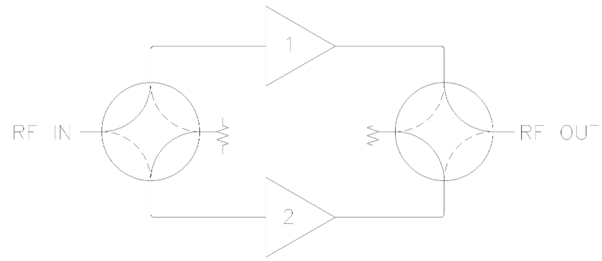


Figure 1: Block Diagram, 1:1 Redundant System

LNA/LNB 1:1 System Operation

This section covers the operation of the system controller with a Teledyne Paradise Datacom LNA or LNB Redundant System. A typical LNA/LNB redundant system consists of an outdoor plate assembly, the indoor controller, and an interconnecting control cable. Figure 2 shows the major components of a typical 1:1 LNA system.

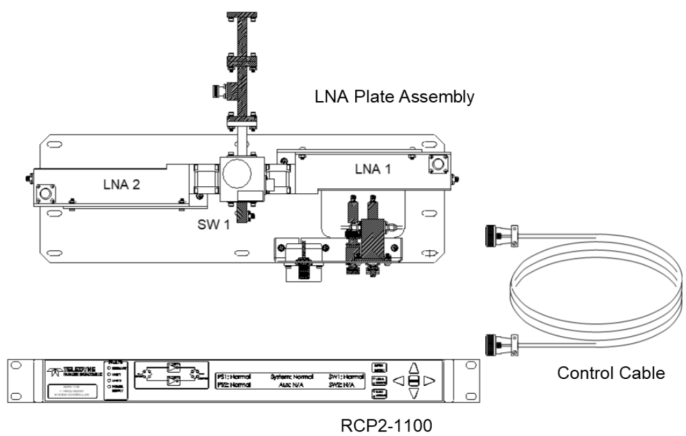


Figure 2: System Components, 1:1 Redundant System

The LNAs or LNBs are powered by the controller via the control cable. Two power supplies are included in the controller for total system redundancy. The power supplies are diode connected so that only one supply can operate the system.

The controller supplies +13/17/26 VDC to power the LNA/LNB and +26 VDC to operate the transfer switch. A failure in an LNA or LNB is typically noted by a change in the DC bias current. The controller has current window comparators that monitor the current drawn by each unit and will report a fault if the current falls outside of the preset current window. The nominal current and window width setting are factory preset to the particular LNA/LNB system, however both are easily adjustable via the front panel control. A typical 1:1 Redundant LNA system is shown in Figure 3.

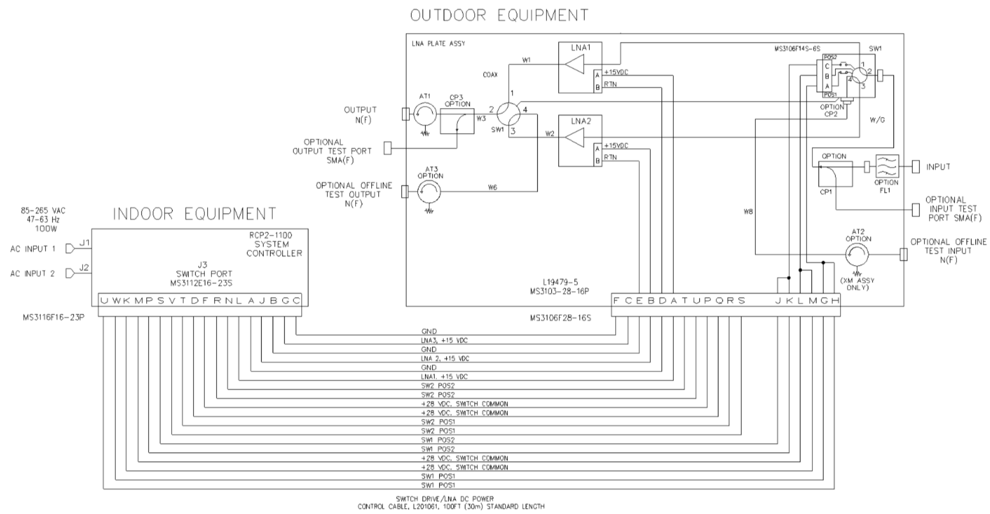


Figure 3: Schematic, Typical, 1:1 Redundant LNA System

LNA/LNB Fault Tracking

To set up the controller for LNA/LNB fault tracking perform the following menu selections.

1. Tap the Home icon on the touchscreen;
2. Tap the Fault Setup button;
3. Tap the Fault Monitor button;
4. Tick either the LNA/LNB Only or Both checkbox. This puts the controller in LNA/LNB current monitor mode.

LNA/LNB Current Calibration

After the controller has been put in the LNA/LNB fault tracking mode, the LNA or LNB nominal current should be calibrated by the controller. To perform the current calibration:

1. Tap the Home icon on the touchscreen;
2. Tap the Unit Control button;
3. Tap the Calibrate LNA button;

Observe the current consupmption displayed in the green boxes for each unit. If the current value displayed is an appropriate value for normal operation, tap the Cal button to set the upper and lower calibration points (based on the selected Fault Window percentage ticked at the right of the screen). This calibrates the normal current consumption of the LNA/LNBs.

The 8% Fault Window setting is the most sensitive and 20% is the least sensitive. The factory default setting is 8%.

> ⚠ **Note: Caution should be used when changing Fault Window settings from the factory preset. Current variations will occur in equipment naturally as a result of changes in operating temperature. Consideration should be given to environmental conditions and, in particular, to operating temperature extremes.**

SSPA 1:1 System Operation

The controller can be configured to accept external fault inputs at connector J8. The external alarm inputs operate with a closure to ground input. The alarm inputs are opto-isolated inputs, exposing +5 VDC (open circuit voltage) at 5 mA maximum short circuit current. The external alarm inputs can be driven with an appropriate open collector device or relay contacts. Solid state power amplifier redundant systems typically use a form C relay summary alarm output to drive the RCP2 external alarm input. A schematic representation of such a system is shown in Figure 4.

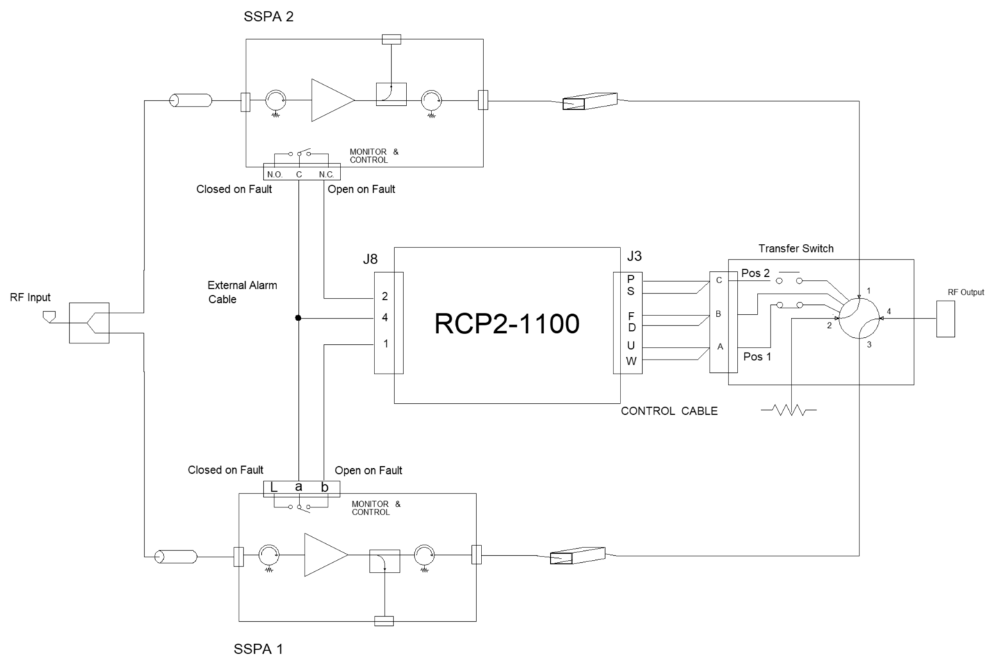


Figure 4: Schematic, Typical, 1:1 Redundant HPA System

The external alarm inputs are not limited to SSPA systems. Any device with the appropriate alarm output circuitry could be connected to the external alarm inputs.

Set External Alarm Tracking

To use the external alarm inputs on the controller, they must first be enabled from the front panel using the following procedure.

1. Tap the Home icon on the touchscreen;
2. Tap the Fault Setup button;
3. Tap the Fault Monitor button;
4. Tick either the SSPA Only or the Both checkbox. Either setting puts the controller in external alarm monitor mode.

Touchscreen Control of 1:1 Redundant System

In normal 1:1 Redundant System operation, HPA1 is set as the online amplifier and HPA2 is the standby unit. Figure 5 shows the RF Signal Path Display on the touchscreen for a 1:1 Redundant System. The green dotted line indicates the RF path through the input switch, to Unit 1 (HPA1) and then through the output switch. The online amplifier is also green to indicate its online status.

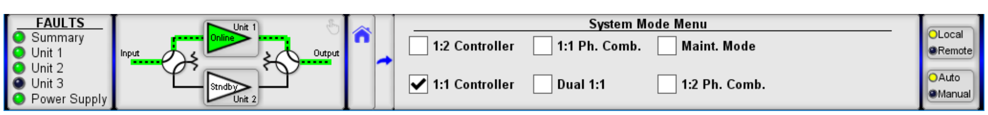


Figure 5: System Mode, 1:1 Controller

To place HPA2 online, the user may touch the Unit 1 button on the RF Signal Path Display. See Figure 6.

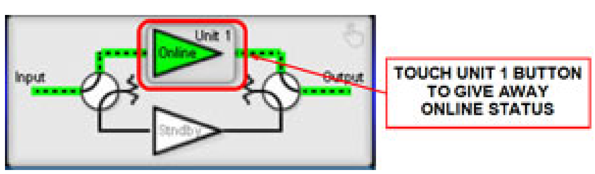


Figure 6: Tap Online Unit Indicator to Give Away Online Status

⚠ **Note: Only the on-line amplifier can be switched to standby. Attempting to switch the standby SSPA to the on-line state by pressing the Unit # button will not work.**

If the system is in Auto mode, HPA2 will accept the on-line state only if there is no summary alarm on HPA2. The Unit 2 button for HPA2 will turn green, indicting it is on-line, and the system will rotate the transfer switch to the correct position. The green dotted line will change to show the RF path passing through the input switch, to Unit 2 (HPA2) and then through the output switch. See Figure 7. If HPA2 does not accept the online state (due to a fault status), HPA1 will revert to the on-line state after 1 second.

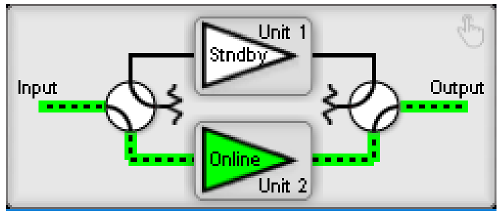


Figure 7: RF Signal Path Display, Unit 2 Online

In Manual mode, the standby SSPA will always accept the on-line state regardless of its own fault status.

However, in Auto Switch Mode, if the online amplifier enters a Major fault condition, the system will automatically switch the faulted amplifier to Standby status, and place the standby amplifier on-line.

System Control of Mute and Attenuation

Navigate to the Unit Control menu (Tap Home icon > Tap Unit Control button) to access system Mute and Attenuation controls. See Figure 8. For more information, see the **Using RCP M&C to Control an SSPA System** section.

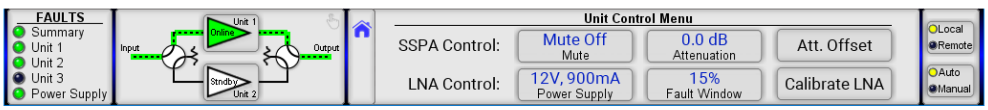


Figure 8: System Mute and Attenuation Control from Unit Control Menu

Operation of 1:2 System

Figure 9 shows the basic block diagram of a 1:2 redundant system. In normal operation amplifiers 1 and 3 are considered the online amplifiers while amplifier 2 is in standby. If a fault conditions occurs in either one of the online amplifiers, the standby unit can be switched into the circuit by moving the transfer switches on the input and output side of the amplifiers. The amplifiers could be Low Noise Amplifiers (LNAs), Low Noise Block Converters (LNBs), Solid State Power Amplifiers (SSPA), or Solid State Power Amplifiers with Block Up Converters (SSPBs).

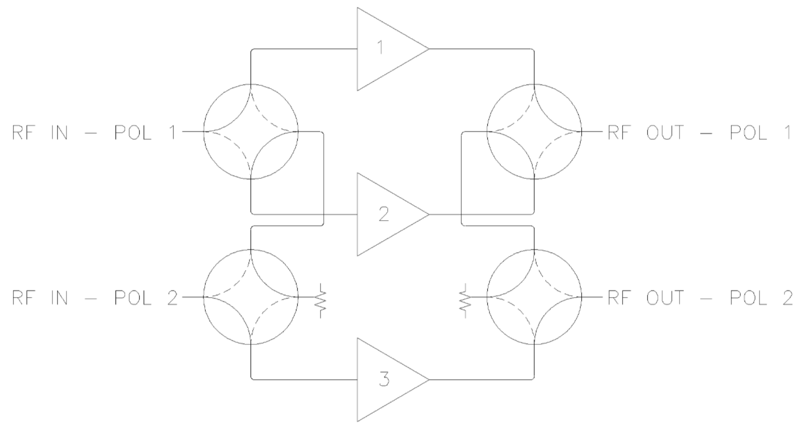


Figure 9: Block Diagram,1:2 Redundant System

A priority can be assigned to either the Polarity 1 or Polarity 2 switch path in the event that both online amplifiers were to fail. See the Priority Select Menu description in the **Touchscreen Operation** section.

LNA/LNB 1:2 System Operation

This section covers the operation of the controller with a Teledyne Paradise Datacom LNA or LNB Redundant System. A typical LNA/LNB redundant system consists of an outdoor plate assembly, the indoor controller, and an interconnecting control cable. Figure 10 shows the major components of a typical 1:2 LNA system.

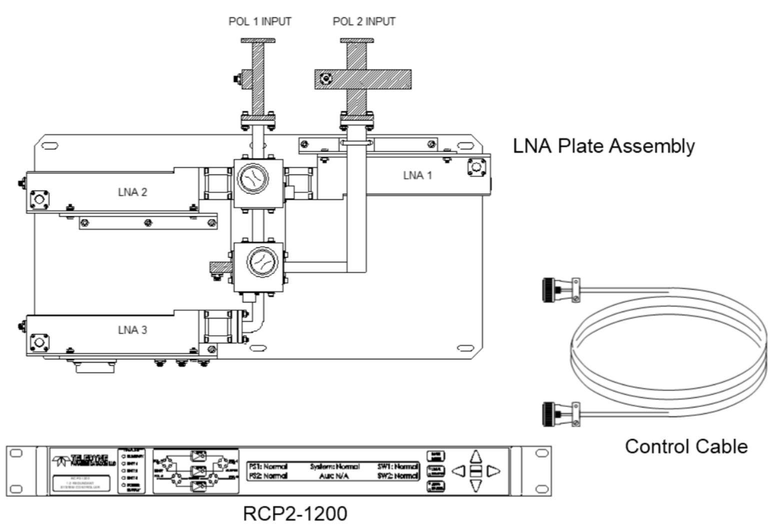


Figure 10: System Components, 1:2 Redundant LNA System

The LNAs or LNBs are powered by the controller via the control cable. Two power supplies are included in the controller for total system redundancy. The power supplies are diode connected so that only one supply can operate the system.

The controller supplies +13/17/26 VDC to power the LNA/LNB and +26 VDC to operate the transfer switches. See the Power Supply Menu description of the **Touchscreen Operation** section.

The controller will keep track of the three independent LNA/LNB systems, keeping the link with the most failures in a given time offline. This is reset each time the user manually overrides the system by selecting one of the units from the front panel.

A failure in an LNA or LNB is typically noted by a change in the DC bias current. The controller has current window comparators that monitor the current drawn by each unit and will report a fault if the current falls outside of the preset current window. The nominal current and window width setting are factory preset to the particular LNA/LNB system, however both are easily adjustable via the front panel control.

A schematic of a typical 1:2 Redundant LNA System is shown in Figure 11.

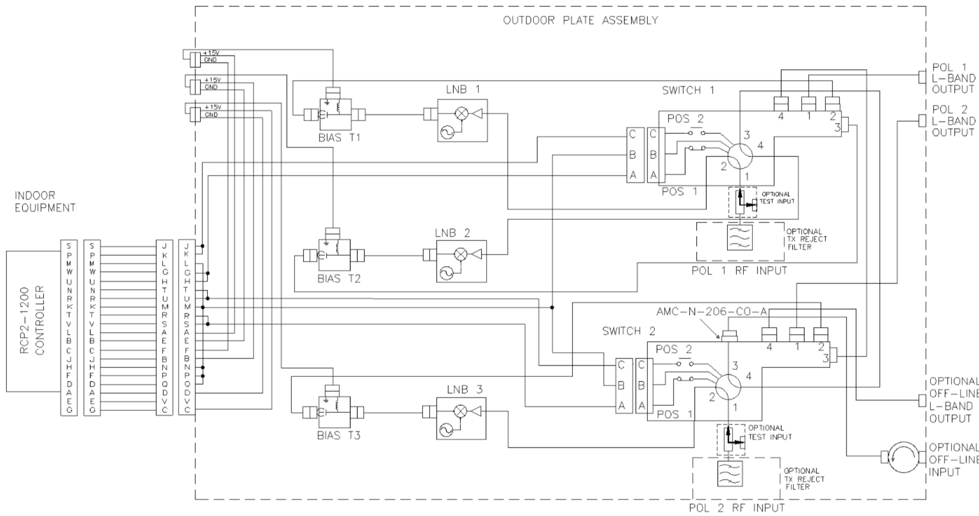


Figure 11: Schematic, Typical, 1:2 Redundant LNA System

LNA/LNB Fault Tracking

To set up the controller for LNA/LNB fault tracking perform the following menu selections:

1. Tap the Home icon on the touchscreen;
2. Tap the Fault Setup button;
3. Tap the Fault Monitor button;
4. Tick either the LNA/LNB Only or Both checkbox. This puts the controller in LNA/LNB current monitor mode

LNA/LNB Current Calibration

After the controller has been put in the LNA/LNB fault tracking mode, the LNA or LNB nominal current should be calibrated by the controller. To perform the current calibration:

1. Tap the Home icon on the touchscreen;
2. Tap the Unit Control button;
3. Tap the Calibrate LNA button;

Observe the current consupmption displayed in the green boxes for each unit. If the current value displayed is an appropriate value for normal operation, tap the Cal button to set the upper and lower calibration points (based on the selected Fault Window percentage ticked at the right of the screen). This calibrates the normal current consumption of the LNA/LNBs.

The 8% Fault Window setting is the most sensitive and 20% is the least sensitive. The factory default setting is 8%.

> ⚠ **Note: Caution should be used when changing Fault Window settings from the factory preset. Current variations will occur in equipment naturally as a result of changes in operating temperature. Consideration should be given to environmental conditions and, in particular, to operating temperature extremes.**

SSPA 1:2 System Operation

The controller can be configured to accept external fault inputs at connector J8. See the External Alarm Port (J8) description in the **Unit Description** section.

The external alarm inputs operate with a closure to ground input. The alarm inputs are opto-isolated inputs that expose +5 VDC, open circuit voltage, at 5 mA maximum short circuit current. The external alarm inputs can be driven by an appropriate open collector device or relay contacts. Redundant systems typically use a form C relay summary alarm output to drive the RCP2 external alarm input. A typical block diagram representation of such a system is shown in Figure 12.

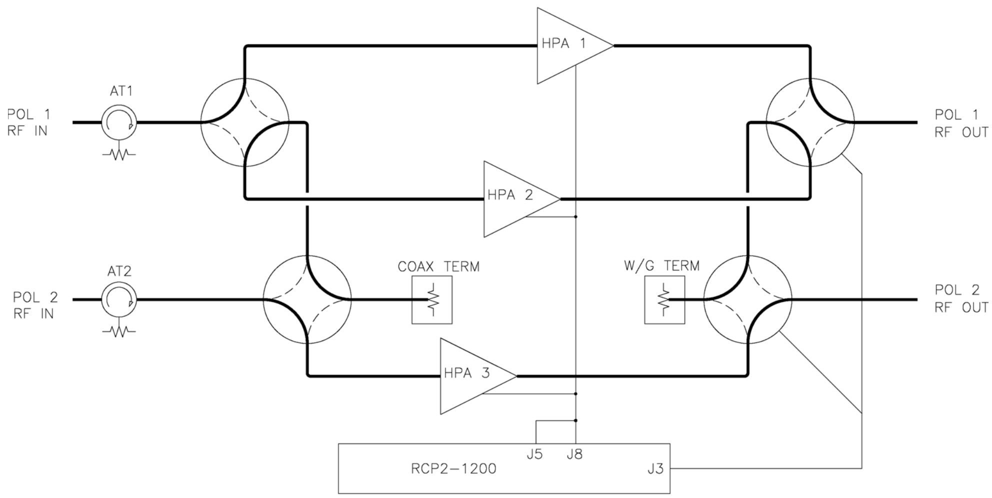


Figure 12: Block Diagram, SSPA 1:2 Redundant System

The external alarm inputs are not limited to SSPA systems. Any device with the appropriate alarm output circuitry could be connected to the external alarm inputs.

External Alarm Tracking

To use the external alarm inputs on the controller they must first be enabled from the front panel using the following procedure.

1. Tap the Home icon on the touchscreen;
2. Tap the Fault Setup button;
3. Tap the Fault Monitor button;
4. Tick either the SSPA Only or Both checkbox. This puts the controller in external alarm monitor mode.

Touchscreen Control of 1:2 Redundant System

In normal 1:2 Redundant System operation, HPA1 is set as the online amplifier on POL1, HPA3 is assigned as the online amplifier on POL2, and HPA2 is configured as the standby unit.

Figure 13 shows the RF Signal Path Display for the three (3) amplifiers in a 1:2 Redundant System. The green dotted lines indicate the RF path through the input switches on POL1 and POL2, to Unit 1 (HPA1) and Unit 3 (HPA3) and then through the output switches. The online amplifiers are also green to indicate their online status.

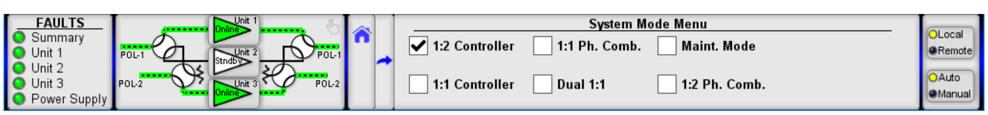


Figure 13: System Mode, 1:2 Controller

To place HPA2 online on POL1, the user may tap the Unit 1 button on the RF Signal Path Display. See Figure 14.

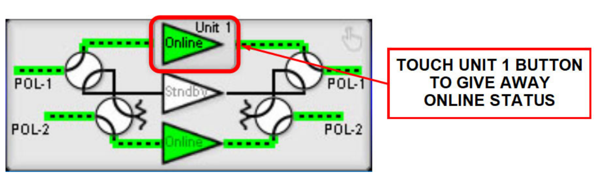


Figure 14: Tap Online Unit Indicator to Give Away Online Status

If the system is in Auto mode, HPA2 will accept the on-line state only if there is no summary alarm on HPA2. The Unit 2 button for HPA2 will turn green, indicting it is on-line, and the system will rotate the transfer switch to the correct position. The green dotted line will change to show the RF path passing through the POL1 input switch, to Unit 2 (HPA2) and then through the POL2 output switch. See Figure 15. If HPA2 does not accept the online state (due to a fault status), HPA1 will revert to the on-line state after 1 second.

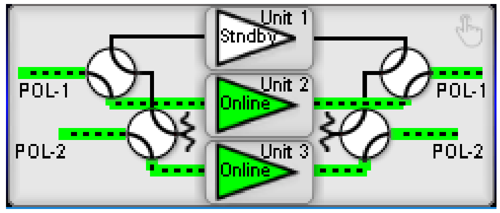


Figure 15: RF Signal Path Display, Unit 1 on Standby

In Manual mode, the standby SSPA will always accept the on-line state regardless of its own fault status.

However, in Auto Switch Mode, if the online amplifier enters a Major fault condition, the system will automatically switch the faulted amplifier to Standby status, and place the standby amplifier on-line.

System Control of Mute and Attenuation

Navigate to the Unit Control menu (Tap Home icon > Tap Unit Control button) to access system Mute and Attenuation controls. See Figure 16. For more information, see the **Using RCP M&C to Control an SSPA System** section.

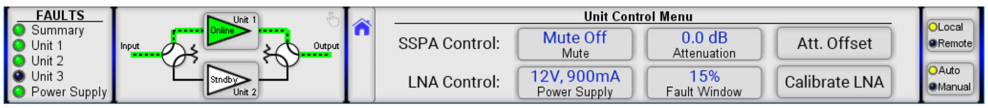


Figure 16: System Mute and Attenuation Control from Unit Control Menu

1:1 Phase Combined System Operation

The 1:1 Fixed Phase Combined Redundant System is a popular system architecture that enables two Solid State Power Amplifiers to operate as a normal 1:1 redundant system or a phase combined system. The basic system topology is very similar to a 1:1 redundant system and is shown in Figure 17.

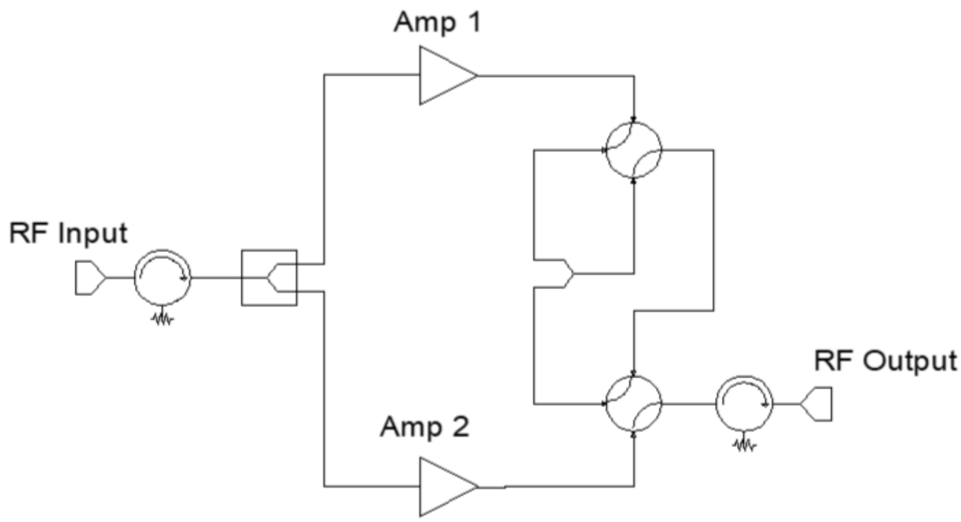


Figure 17: Block Diagram, 1:1 Fixed Phase Combined System

An additional switch is included which allows either amplifier to be individually routed to the antenna or connect both amplifiers to a waveguide combiner. The combined system output power is then routed to the antenna. The operation is very similar to the older generation variable phase ratio combiner (VPRC) techniques.

System designers find that the 1:1 Fixed Phase Combined Amplifier System topology is a cost effective solution to realizing higher power amplifier systems. For slightly more investment over a traditional 1:1 redundant system, the operator can have the capability of doubling the individual amplifier output power when conditions may require additional power. This is helpful when either atmospheric conditions require more power or if additional satellite traffic requires higher power capacity.

The Teledyne Paradise Datacom system controller is specifically designed to handle such an amplifier system. It not only handles all of the traditional fault monitoring and switching duties but also provides an overall system monitor and control facility. The controller can adjust the system gain over a 20 dB range without the need to adjust each of the amplifiers individually. It also provides a convenient display of the overall system output power. Individual amplifier monitor and control can all be achieved through the controller either locally via the front panel or by remote serial communication.

Touchscreen Control of 1:1 Phase Combined System

In normal 1:1 Phase Combined System operation, the outputs of HPA1 and HPA2 are phase combined to a single output.

Figure 18 shows the RF Signal Path Display for the two (2) amplifiers in a 1:1 Phase Combined System. The green dotted lines indicate the RF path through the input switches to Units 1 and 2 and then through the switching/combiner array to the system output. The online amplifiers are also green to indicate their online status.

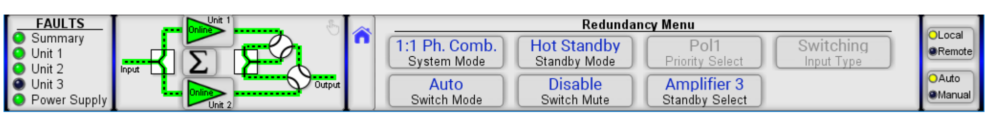


Figure 18: System Mode, 1:1 Ph. Comb. (Phase Combined)

To place HPA2 (Unit 2) on Standby, the user may tap the Unit 2 button on the RF Signal Path Display. See Figure 19. The switch array will change position to bypass the combiner and send only the Unit 1 signal to the system output.

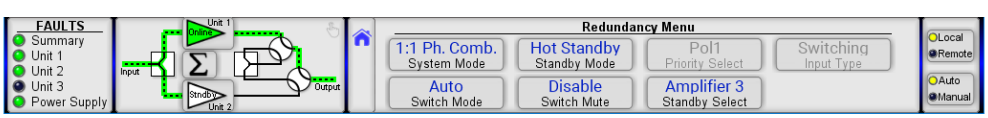


Figure 19: Tap Unit 2 Indicator to Place Unit 2 on Standby (and Out of Phase Combined Mode)

Tap the Summation button [Σ] to place the system back in Phase Combined mode.

See the **Using RCP M&C to Control an SSPA System** section for information about mute and attenuation control of the system amplifiers.

1:2 Phase Combined System Operation

The 1:2 Fixed Phase Combined Redundant System is a popular system architecture that enables Solid State Power Amplifiers to achieve higher output power levels while building in a level of redundancy. The basic system topology is similar to a 1:2 redundant system and is shown in Figure 20.

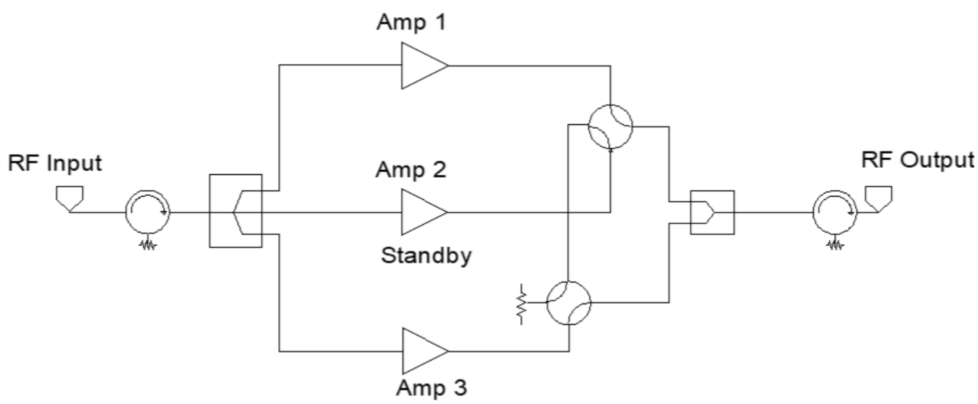


Figure 20: Block Diagram, 1:2 Fixed Phase Combined System

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

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

The FPRC-1200 controller is specifically designed to handle such an amplifier system. It not only handles all traditional fault monitoring and switching duties but also provides an overall system monitor and control facility. The FPRC-1200 can adjust the system gain over a 20 dB range without the need to adjust each of the three amplifiers individually. It also provides a convenient display of the overall system output power. Individual amplifier monitor and control can also be achieved through the FPRC-1200 either locally via the front panel or by remote serial communication.

Touchscreen Control of 1:2 Phase Combined System

In normal 1:2 Phase Combined System operation, the outputs of HPA1 and HPA3 are phase combined to a single output, with HPA2 in standby mode.

Figure 20 shows the RF Signal Path Display for the three (3) amplifiers in a 1:2 Phase Combined System. The green dotted lines indicate the RF path through the input splitter to Units 1 and 3 and then through the switching/combiner array to the system output. Unit 2 is in Standby mode. The online amplifiers are also green to indicate their online status.

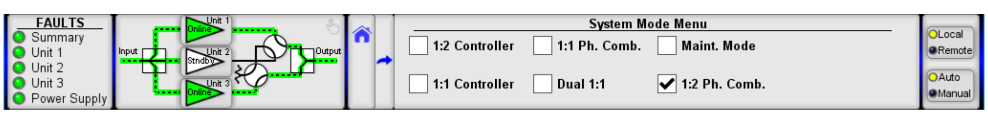


Figure 21: System Mode, 1:2 Ph. Comb. (Phase Combined)

To place HPA2 (Unit 2) on Standby, the user may tap the Unit 2 button on the RF Signal Path Display. See Figure 21. The switch array will change position to bypass the combiner and send only the Unit 1 signal to the system output.

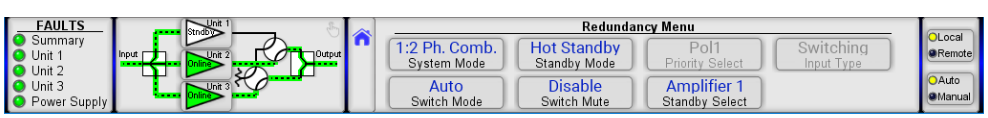


Figure 22: Tap Unit 1 Indicator to Place Unit 1 on Standby

See the **Using RCP M&C to Control an SSPA System** section for information about mute and attenuation control of the system amplifiers.

RCP Remote Control of System SSPAs

RCP units that meet certain conditions are capable of remote control of system SSPAs through the RCP Local Serial Port (J5).

⚠ **Note: The following features are supported only with firmware version 2.2.00 and above. To verify your unit firmware version browse to the SysID screen on the front panel. If the firmware version is below 2.2.00, the unit's firmware can be upgraded to the proper version by the user.**

Systems may contain up to three amplifiers (consisting of the Teledyne Paradise Datacom Compact Outdoor, Rack Mount SSPAs, or vBUC amplifiers) and a remote RF Power Meter. The SSPAs and RF Power Meter must be connected to the RCP Local Serial Port (J5) via RS485 4-wire or 2-wire interface. All connected components must utilize Teledyne Paradise Datacom String Serial Protocol at 9600 Baud.

If properly configured, the RCP will allow the user to remotely change the Mute Status and Attenuation Level of the connected units, and monitor the Output RF Power. Under such control, all connected units are exclusively controlled by the RCP unit and any new unit added to the system will be automatically adjusted to the selected Attenuation Level and Mute State.

Units equipped with firmware version 3.30 or later have extended remote system monitoring features, including the ability to monitor and display individual unit temperature and ambient temperature (if the system is equipped with a Teledyne Paradise Datacom remote RF Power Meter). Moreover, the unit has an additional option to mute a sub-system during the period of switchover. See the Switch Mute Menu description in the **Touchscreen Operation** section.

⚠ **Note: The SSPA fault status is not controlled via the serial line, therefore all controlled SSPA summary alarm lines still have to be connected to the RCP External Alarms Port (J8). A Teledyne Paradise Datacom Remote RF Power Meter can be powered up either from the unit (when remote control mode is enabled, the controller will automatically turn on its LNA/LNB Power supplies) or from an external DC power source with the following characteristics: Output voltage +13/17/26V; Minimum Output Current 300 mA.**

Starting with RCP firmware version 3.40, the controller supports External Reflected Power Monitoring. Monitor unit supports measurement of overall system Reflected Power within 20 dBm range with ±1 dBm accuracy. The current value of the Reflected power can be viewed on the first informative screen of subsystem menus or accessed through the remote control interface. Outside of specified range, the accuracy of measurement is not guaranteed. If the supplied system is not equipped with this feature, the monitor value of reflected power on the front panel VFD will indicated as "N/A".

Configuring the RCP for Remote Control Mode

The controller has to be configured to support remote control of the system. To do so, perform the following steps:

1. Tap the Home icon on the touchscreen;
2. Tap the Operation button;
3. Tap the System Type button;
4. Tick the appropriate checkbox depending on the type of system being controlled.

Tick the CO/HPO checkbox for control of a system of Compact or High Power Outdoor SSPAs.

Tick the Rack Mount checkbox if you want to control a system of Rack Mount SSPAs.

If controlling a system of vBUC amplifiers, tick the vBUC checkbox.

The System X selection is for custom system configurations, and should only be used at the direction of the factory.

Tick the PowerMAX checkbox if controlling a PowerMAX system.

To disable the remote control feature, select None.

After the unit is configured to control a remote system, make sure the system is correctly wired. See Tables 1 through 6 for proper wiring.

Table 1: Wiring RCP2 J5 Serial Local for Compact Outdoor SSPA Systems

RCP2 J5 Serial Local	SSPA1 M&C J4*	SSPA2 M&C J4	SSPA3 M&C J4

1,9 (RX+; 120 Ohm Termination)	T (TX+)	T (TX+)	T (TX+)
2 (RX-)	E (TX-)	E (TX-)	E (TX-)
3 (TX-)	F (RX-)	F (RX-)	F (RX-)
4 (TX+)	U (RX+)	U (RX+)	U (RX+)
5 (Ground)	B,V (Mute In, GND)	B,V (Mute In, GND)	B,V (Mute In, GND)

* If the cable length exceeds 50 ft., a termination resistor of 120 Ohms must be installed between F and U of the SSPA1 M&C J4 connector.

Table 2: Wiring RCP2 J8 External Alarm for Compact Outdoor SSPA Systems

RCP2 J8 Ext. Alarm	SSPA1 M&C J4	SSPA2 M&C J4	SSPA3 M&C J4
1 (Ext. Alarm 1)	b (Summary open on fault)		
2 (Ext. Alarm 2)		b (Summary open on fault)	
3 (Ext. Alarm 3)			b (Summary open on fault)
4 (Ground)	a (Summary Common)	a (Summary Common)	a (Summary Common)

Table 3: Wiring RCP2 J5 Serial Local for Rack Mountable SSPA Systems

RCP2 J5 Serial Local	SSPA1 Serial Main J4	SSPA2 Serial Main J4	SSPA3 Serial Main J4
1,9 (RX+; 120 Ohm Termination)	1 (TX+)	1 (TX+)	1 (TX+)
2 (RX-)	2 (TX-)	2 (TX-)	2 (TX-)
3 (TX-)	3 (RX-)	3 (RX-)	3 (RX-)
4 (TX+)	4,9 (RX+; 120 Ohm Termination)	4,9 (RX+; 120 Ohm Termination)	4,9 (RX+; 120 Ohm Termination)
5 (Ground)	5 (GND)	5 (GND)	5 (GND)

Table 4: Wiring RCP2 J8 External Alarm for Rack Mountable SSPA Systems

RCP2 J8 Ext. Alarm	SSPA1 Serial Main J4	SSPA2 Serial Main J4	SSPA3 Serial Main J4
1 (Ext. Alarm 1)	8 (Summary open on fault)		
2 (Ext. Alarm 2)		8 (Summary open on fault)	
3 (Ext. Alarm 3)			8 (Summary open on fault)
4 (Ground)	7 (Summary Common)	7 (Summary Common)	7 (Summary Common)

Table 5: Wiring RCP2 J5 Serial Local for vBUC Systems

RCP2 J5 Serial Local	vBUC1 Serial Main J4*	vBUC2 Serial Main J4	vBUC3 Serial Main J4
1,9 (RX+; 120 Ohm Termination)	R (TX+)	R (TX+)	R (TX+)
2 (RX-)	U (TX-)	U (TX-)	U (TX-)
3 (TX-)	U (RX-)	U (RX-)	U (RX-)
4 (TX+)	R (RX+)	R (RX+)	R (RX+)
5 (Ground)	L (Isolated GND); J,K (Ext. Mute, GND)	L (Isolated GND); J,K (Ext. Mute, GND)	L (Isolated GND); J,K (Ext. Mute, GND)

* If the cable length exceeds 50 ft., a termination resistor of 120 Ohms must be installed between R and U of the vBUC1 M&C J4 connector.

Table 6: Wiring RCP2 J8 External Alarm for vBUC Systems

RCP2 J8 Ext. Alarm	vBUC1 M&C J4	vBUC2 M&C J4	vBUC3 M&C J4
1 (Ext. Alarm 1)	D (Summary open on fault)		
2 (Ext. Alarm 2)		D (Summary open on fault)	

3 (Ext. Alarm 3)			D (Summary open on fault)
4 (Ground)	F (Summary Common)	F (Summary Common)	F (Summary Common)

All attached units must be properly configured in order to work under RCP Remote Control. The following parameters must be set for each unit:

```
Serial Protocol to "Normal" or "String";
Selected Baud Rate to 9600;
Type of Serial Interface to "RS485";
Unique address selected as follows:
        SSPA1 = 1;
        SSPA2 = 2;
        SSPA3 = 3;
        Remote RF Power Meter = 4.
```

Controlling PowerMAX Systems

Starting with firmware version 6.00, the controller has the capability to remotely control PowerMAX systems. The unit is capable of simultaneous control of three independent PowerMAX systems. Each PowerMAX system must be configured for Floating Master Mode (for details on this mode, see the PowerMAX manual).

As with control over an individual HPA, PowerMAX systems have to be configured for a specific Master response serial address: 1, 2 and 3. Unique HPA chassis in the system must be set outside of the control address range. Recommended addressing for individual chassis are: 11 to 18 for the first system; 21 to 28 for the second; and 31 to 38 for the third.

Each PowerMAX system will be viewed as single HPA unit and top level parameters will be monitored by the controller.

PowerMAX is essentially a N+1 redundancy system where any HPA chassis can perform the master controller functions. In order for the controller to automatically connect to the current master unit, a RS-485 connection to all HPAs in the connected systems must be provided.

Since the total number of connected units may reach 24 units, care must be observed when the RS-485 network is laid out. Racks need to be daisy chained with 4-wire twisted pair cable and line termination enabled only on the farthest RS-485 node.

PowerMAX control mode is different from regular RM SSPA, therefore selection of the appropriate System Type for system remote control is important.

1. Tap the Home icon on the touchscreen;
2. Tap the Operation button;
3. Tap the System Type button;
4. Tick the PowerMAX checkbox.

Using RCP M&C to Control an SSPA System

All SSPA control-related functions are grouped on the same menu, the SSPA control menu. To access the SSPA control menu, tap the Home icon on the touchscreen, then tap the Unit Control button.

SSPA control of the system mute state and attenuation level is available from this menu. See Figure 23.

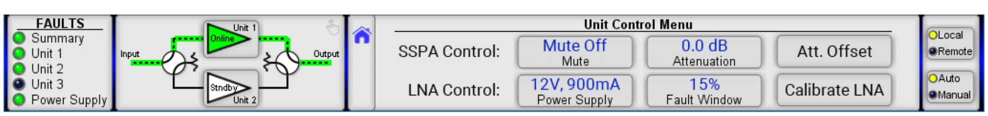


Figure 23: Unit Control Menu

All of the following steps describe RCP remote operation of an SSPA, and assume the user has already selected the SSPA control menu.

Change Mute State

To change the overall mute state of a controlled SSPA system from the RCP, tap the Mute button, then tick either the Mute System or Mute Off checkbox.

Beginning with firmware version 6.15, when the controller's System Mode (Home > Redundancy > System Mode) is set to 1:2 Mode, the following mute selections affect the mute state on each polarity as described below:

• Mute System - mutes both Polarity 1 (POL1) and Polarity 2 (POL2);
• Mute Off - unmutes both POL1 and POL2;
• Mute Pol 1 (1:2 Only) - mutes POL1 in 1:2 mode (firmware v. 6.15);
• Mute Pol 2 (1:2 Only) - mutes POL2 in 1:2 mode (firmware v. 6.15).

When any other system mode is selected, options Mute Pol 1 and Mute Pol 2 should be unavailable (greyed out). If one of these options was selected before the System Mode was changed from 1:2 Redundant, the selection will perform the same function as option Mute System, and will mute both POL1 and POL2.

If mute for the desired polarization is selected, the controller will automatically send a command to the HPA which is currently connected to the relevant RF switch. Depending on a combination of RF switches and polarity preference settings, it could be HPA1 or HPA2 for POL1, or HPA2 or HPA 3 for POL2. The controller will continue to sustain the selected mute state for the chosen polarization even after manual or automatic switchover.

See the Switch Mute Menu description in the **Touchscreen Operation** section for detailed information about the Switch Mute function.

Change Attenuation Level

To change the overall attenuation level of a controlled SSPA system from the controller, tap the Attenuation button. Enter the desired level of attenuation and tap the OK button. The attenuation level will not change until the OK button is tapped.

Note that the user may also configure the Action Buttons to include the **Attenuation** button, from which changes made to the attenuation value are immediately applied to the system.

Change RF Units Displayed

This option allows the user to select the RF Power measurement units (measured in either dBm or Watts) reported on the front panel and remote interface. Both Forward and Reflected RF power sensor measurements will be affected.

1. Tap the Home icon on the touchscreen;
2. Tap the Operation button;
3. Tap the RF Units button;
4. Tick either the dBm or Watt checkbox.

Maintenance Switch Operation

Teledyne Paradise Datacom offers the option of utilizing the redundant system controller as a Maintenance Switch Controller, which controls the position of a single waveguide switch.

A Maintenance Switch Controller is typically connected to the switch drive via a single cable. With systems using amplifiers of certain high power levels, the controller could also be connected to the system SSPAs, so that the output of the amplifiers can be temporarily muted during switchover to prevent arcing in the transmission line.

Operation Modes

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

Directing Output Signal to System Output

When the Amplfier icon is illuminated green, the green dotted line indicates the RF path passing through the amplifier and switch to the system output. See Figure 24.

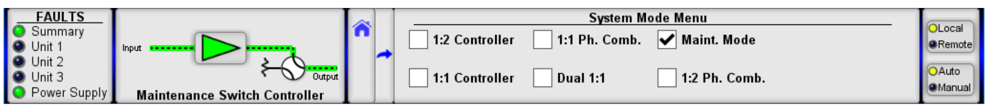


Figure 24: Maintenance Mode, RF Directed to System Output

Directing Output Signal to Dummy Load

Tap the Amplifier icon to signal the controller to change the position of the transfer switch. The Amplifier icon will turn white, and the green dotted line indicating the RF path will pass through the amplifier and switch to the termination. See Figure 25.

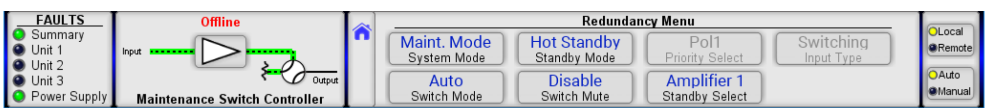


Figure 25: Maintenance Mode, RF Directed to Dummy Load

Application of a Maintenance Switch Controller

Figure 26 shows a typical schematic for a standalone amplifier (HPA 1) utilizing a maintenance switch (SW1) at its output, and a Maintenance Switch Controller.

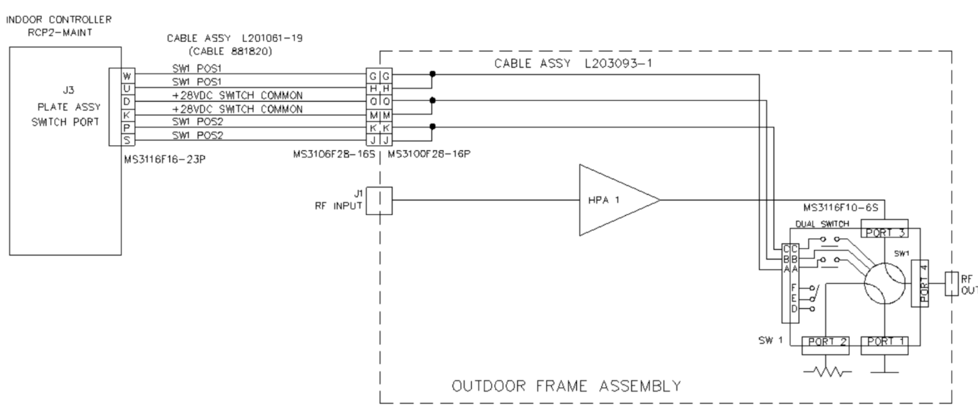


Figure 26: Schematic, SSPA Utilizing Maintenance Switch and Controller

THIS PAGE LEFT INTENTIONALLY BLANK

Indoor RM SSPAs, Maintenance and Troubleshooting

Teledyne Paradise Datacom
Drawing Number: 216512-8 Revision B
ECO 18951
11 June 2020

Required Maintenance

Cooling System

In order to preserve the amplifier's warranty, regular cleaning of the cooling system is required. The amplifier is cooled by forced-air convection through the heatsink fins. Dust and debris can accumulate in the heatsink fins under normal operation, and must be periodically cleaned out.

> ⚠ **Important! Failure to keep the heatsink free of dust and debris will void your warranty.**

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.

Ensure each of the intake fans (and exhaust fans, when included) is operating normally. A fan failure should be remedied by replacing the failed fan. Spare fans are available from the factory.

The intake fans of the amplifier can pull airborne debris into the enclosure, and fill the spaces between the heatsink fins. As this debris builds up inside the amplifier, the airflow which is important in cooling the amplifier is impaired.

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 service life.

The front panel menu 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, perform the following sequence on the front panel touchscreen:

- Tap the Home icon;
- Tap the Status button;
- Tap the RF/Temp. button;
- Review the temperature readings. See Figure 1.

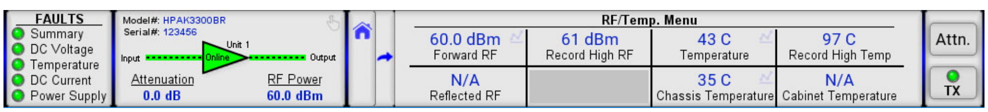


Figure 1: Status & RF/Temp. Menu

Several temperature readings are available in the RF/Temp Menu. The "Temperature" value is the base plate temperature of the RF module inside the chassis. The "Chassis Temperature" value is the temperature at the controller card inside the chassis. The "Record High Temp." value is the highest recorded temperature since the last amplifier power-up or reset. The "Cabinet Temperature" value is the temperature recorded inside the cabinet in systems where this feature is installed.

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 to 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 unit 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 removed for easy cleaning.

Heatsink Cleaning Procedure

Figure 2 shows a heatsink with an accumulation of dust stuck in the heatsink fins.

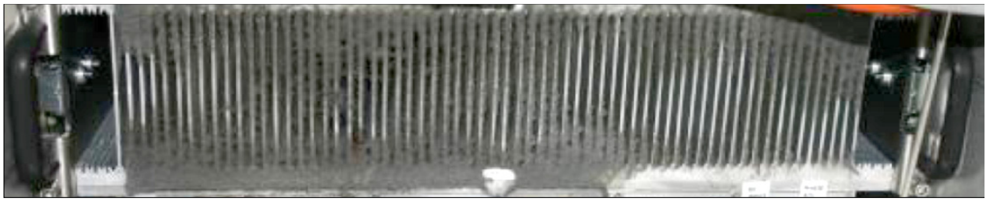


Figure 2: Example, Dust Accumulation in Heatsink

Follow the procedure below to access the heatsink for cleaning.

- Using a Philips head screw driver, loosen the thumbscrews holding the front fan tray in place.
- Remove the front panel fan tray. See Figure 3.

Figure 3: Remove Front Fan Assembly (3RU Chassis shown)

- Unplug the fan power cord from the connector. See Figure 4.

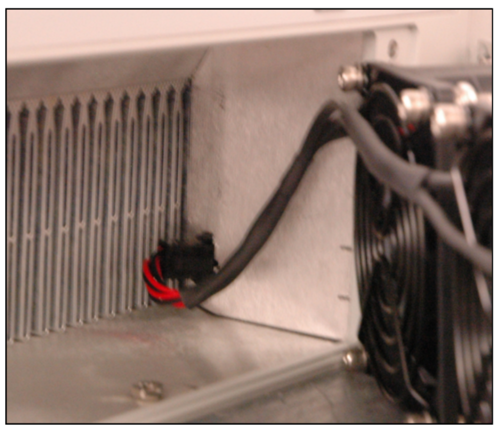


Figure 4: Unplug Fan Power (3RU Chassis shown)

- Use the shop vacuum to collect all dust and debris.
- 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. See Figure 5.

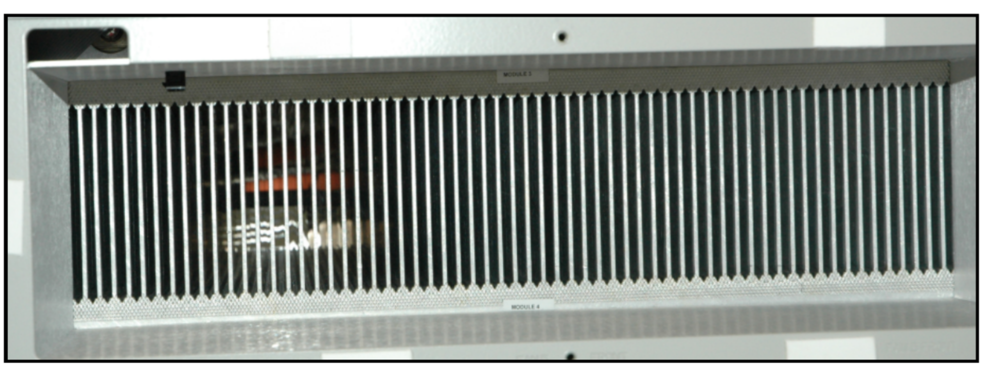


Figure 5: Heatsink Free of Debris

- Plug the fan power cord into the connector.
- Re-insert the front panel fan tray.
- Tighten the thumbscrews which hold the front fan tray in place. Tighten to snug using a Philips head screw driver.

Modular Assemblies

The Teledyne Paradise Datacom SSPA Chassis consists of a modular design, which allows for quick and easy maintenance and replacement of the modular assemblies in the event of a catastrophic failure of one of the SSPA components.

These assemblies include:

- Front Fan Assembly
- Rear Fan Assembly (some units)
- Controller Card
- Removable Power Supply Modules
- Removable RF Module/Heatsink Assemblies (PowerMAX 3RU Chassis only)

Front Fan Assembly

The front panel (intake) fan tray is secured to the front panel by captive thumb screws. To remove, loosen the screws with a Philips screwdriver and carefully remove the fan tray from the chassis. See Figure 6.

Figure 6: Remove Front Fan Assembly (5RU Chassis shown)

Unplug the fan power cord from the connector to fully remove the fan plate assembly. See Figure 7.

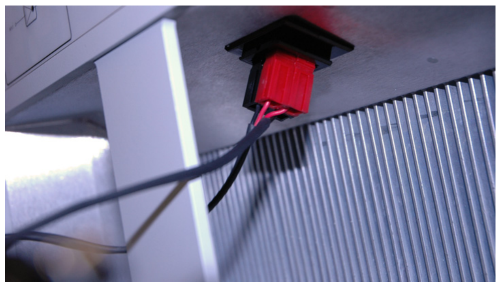


Figure 7: Unplug Fan Power (5RU Chassis shown)

For maintenance purposes, the front fan assembly may be removed for short periods of time while the amplifier is operating.

> ⚠ **While the fan assembly is removed, monitor the temperature of the amplifier and replace the fan assembly if the temperature approaches 80 °C. Operating the amplifier at high temperatures for extended periods of time can damage the microcircuitry in the RF module and reduce its service life.**

Replacement front fan assemblies are available from the factory. Contact Technical Support for details.

Rear Fan Assemblies

Some higher power units require rear exhaust fans to properly cool the amplifier. The exhaust fans on the rear panel are each secured by captive thumb screws. To remove, loosen the screws with a Philips screwdriver and carefully remove the fan assembly from the chassis. Unplug the fan power cord from the connector. See Figure 8 and Figure 9.

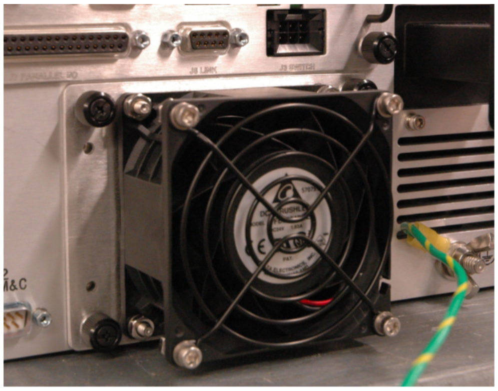


Figure 8: Unscrew Thumbscrews to Remove Rear Fan Assembly (3RU Chassis shown)

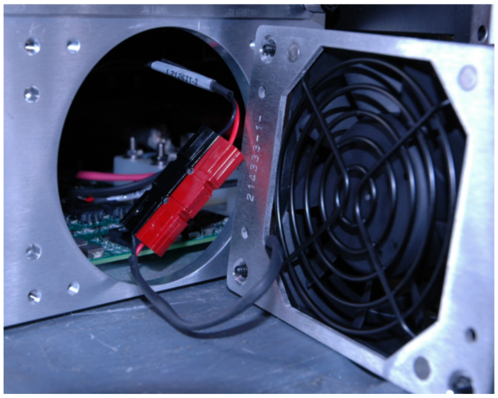


Figure 9: Unplug Fan Power (3RU Chassis shown)

Replacement rear fan assemblies are available from the factory. Contact Technical Support for details.

Removing the Controller Card

The controller card may be removed and replaced in case of a board failure without taking the system offline. To remove the card, disconnect all cables from the card's connection ports. Loosen the two thumbscrews at the top left and bottom right of the assembly. See Figure 10.

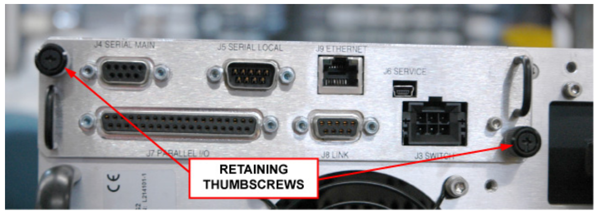


Figure 10: Loosen Thumbscrews to Remove Controller Card

Slide the assembly straight back from the cavity, as shown in Figure 11.

Figure 11: Slide Card from Chassis to Access Programming Connectors

Replacement controller cards are available from the factory. Slide the replacement card along the grooved guides of the chassis enclosure until the card's metal plate is flush with the rear of the chassis. Press the card firmly into place until the captive thumbscrews can be tightened to secure the card to the chassis. Reconnect the cables to the appropriate ports of the card.

See the **Controller Card** section for more information about the controller card.

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 service Mini-USB connector J6;

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 Mini-USB port requires the installation of specific hardware USB drivers and batch scripts.

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;

Required Software

For web upgrade:

- Web browser (IE, Chrome or Firefox);

For USB upgrade:

- USB FTDI 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.

For the latest set of virtual COM port (VCP) drivers, visit the FTDI web page (http://www.ftdichip.com/Drivers/VCP.htm).

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.

Connect the SSPA to a 10/100 Base-T network or to a PC 10/100 Base-T network adapter. See the **Ethernet Interface Set-up and Cabling** section.

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.

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.

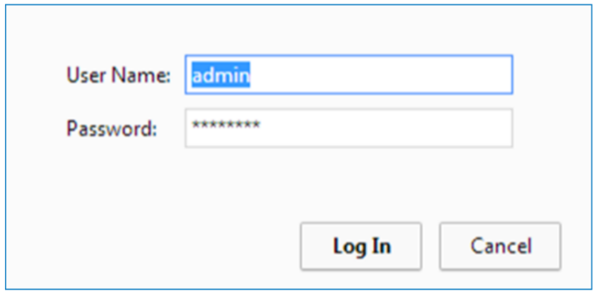


Figure 12: Web Upgrade Authentication Window

The firmware upload form will load in the browser window. Click the "Choose File" button and select the firmware image code.bin file provided by technical support.

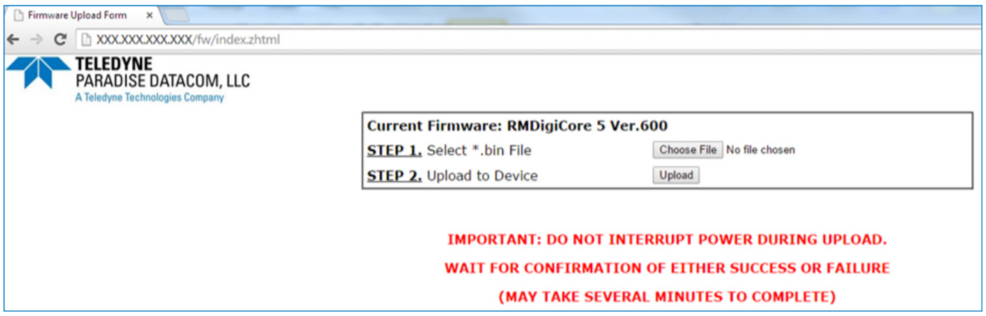


Figure 13: Firmware Upload Form

Click the "Upload" button. A warning message will appear; click the "OK" button.

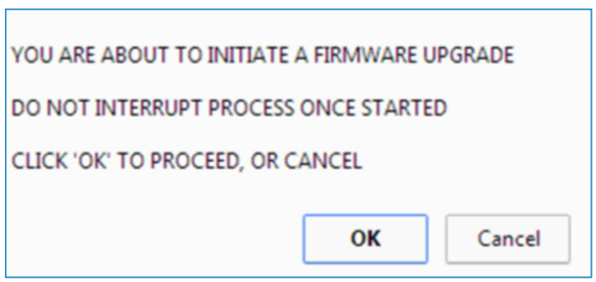


Figure 14: Proceed with Upgrade Prompt

The upload process will begin and the form will be informing about loading process. 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.

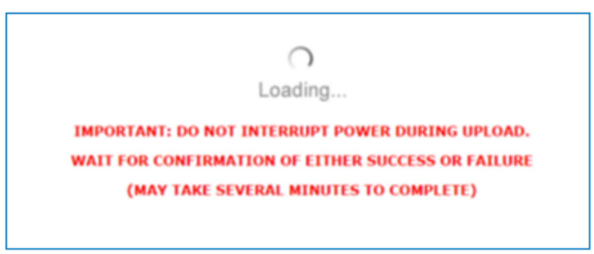


Figure 15: Upload Process Message

Figure 16: Upload Complete Message

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 front panel menu firmware information page and verify the installed version.

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 the **USB Port Upgrade Procedure** for details.

USB Port Upgrade Procedure

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.

> ⚠ **Important! Use the USB upgrade method only if the web upgrade has failed!**

Install FTDI VCP driver on the target PC;

Connect the USB mini port J6 at the back of HPA unit to an available PC USB port.

> ⚠ **Warning! Connecting J6 to a PC USB will interrupt normal operation of the HPA unit. RF output will be shut down until the USB cable is unplugged!**

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. You will need a COM port designator in the next step.

Figure 17: Windows Device Manager > Ports

Locate and run Upgrade.bat script file which was provided in firmware upgrade package. When run, the .bat file will open a command prompt window and request the programming 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 below.

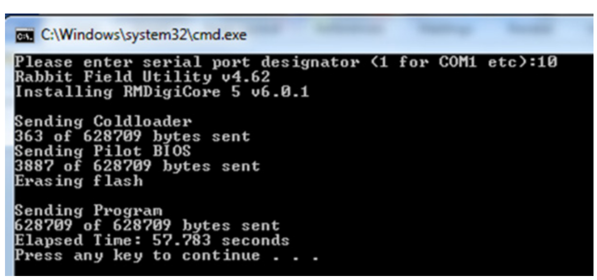


Figure 18: Command Window Showing Program Prompts

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

Removable Power Supply Modules

The Indoor RM SSPA is configured with an external 1RU power supply chassis. Each power supply chassis can house up to four (4) power supply modules, and is fitted with one more power supply module than necessary to power the amplifier.

In some very high power (non-PowerMAX) amplifier configurations, up to two 1RU power supply chassis (up to eight (8) power supply modules) are used to provide the extra power supply module for N+1 operation.

A power supply module can be removed and replaced from the power supply chassis without taking the amplifier offline. See Figure 19.

Figure 19: N+1 Power Supply with Removable Modules

See the External N+1 Power Supply section for detailed information about installing and removing the power supply modules.

Removable RF Module/Heatsink Assemblies

PowerMAX system use a version of the 3RU chassis that is configured to allow the RF module/heatsink assembly to be removed from the front panel.

See the System Components section of the PowerMAX manual that provides a detailed description of the PowerMAX SSPA Chassis.

Troubleshooting Faults

All Teledyne Paradise Datacom amplifiers that use the touchscreen display have up to five fault condition indicators on left side of the front panel. Additional fault reporting is available via the **Status > Fault Panel** and other status screens.

The following sections describe steps the user should take to determine the cause of a fault state in a stand-alone amplifier.

Fault Indicators on the Touchscreen

The touchscreen features a variety of indicators that show normal (green) or faulted (flashing red) status. If an indicator is black, it means that particular parameter does not apply to your unit. A yellow indicator means that there is a communication error with the internal RF module.

These indicators appear on the far left section of the touchscreen display (Fault Indicators), and in the Menu area when the Fault Panel is selected. See Figure 20.

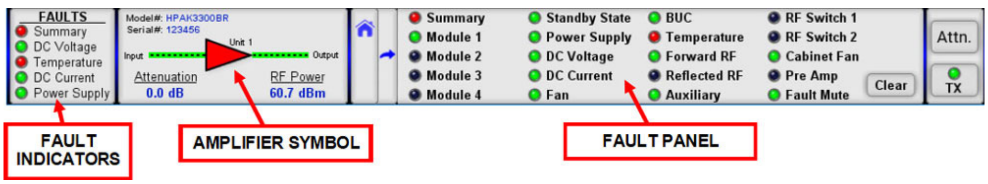


Figure 20: Fault Indicators

In addition, the triangular amplifier symbol in the RF Signal Path Display will turn red when the unit has a major (Summary) fault. The amplifier symbol will turn white when the unit is in Standby mode.

Fault Conditions

The following sections describe various fault conditions that may apply to the amplifier.

Summary Fault

This fault reflects the overall state of the SSPA. Only major faults affect the summary fault state. Some faults may or may not affect the summary fault depending on the SSPA settings.

The Summary fault indicator is always shown at the top of the Fault Indicators panel at the left of the display.

Voltage Fault

If the unit shows a DC Voltage fault, the fault indicators should look like Figure 21. This is a major fault condition.

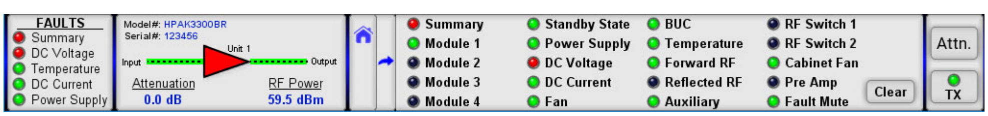


Figure 21: Fault Indicators, DC Voltage Fault

The user should check the voltages displayed on the Status > DC Power menu. See Figure 22. If the voltages are outside of the normal output ranges as described in the DC Power Menu description of the **Touchscreen Menu Structure** section, consult the factory.

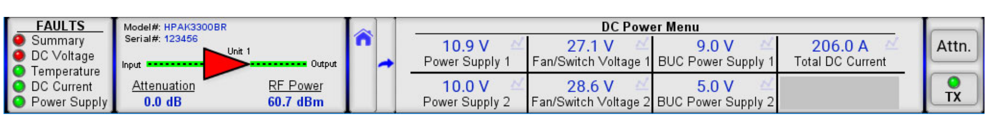


Figure 22: Fault Panel > DC Power Menu

DC Current Fault

If the unit shows a DC Current fault, the fault indicators should look like Figure 23. This is a major fault condition.

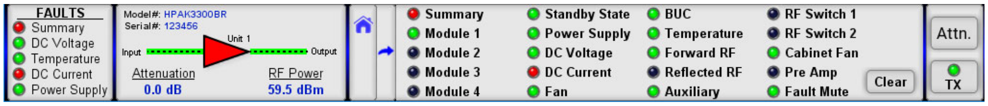


Figure 23: Fault Indicators, DC Current Fault

Check the Total DC Current reading on the **Status > DC Power** menu. See Figure 22. If the amplifier is in the mute state, Total DC Current drops within a range of 0 to 5 A.

Power Supply Fault

If the unit is under a Power Supply fault, the fault indicators should look like Figure 24. This is a major fault condition.

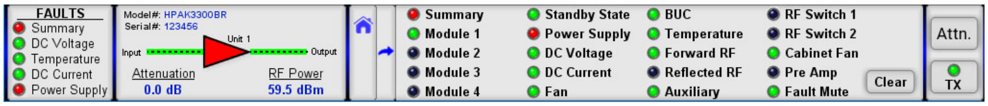


Figure 24: Fault Indicators, Power Supply Fault

Follow the steps below to identify the cause of a power supply fault:

1. When using an external power supply with the amplifier, verify that all power supply modules are operating normally. Replacement power supply modules are available from the factory. Contact technical support.
2. Check the power supply readings on the Status > DC Power menu. See Figure 22. Observe any fluctuations and record the level.
3. Mute the amplifier. Check the power supply readings on the SSPA front panel. Sometimes muting the amplifier corrects the power supply fault.
4. 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 if 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.

Temperature Fault

If the unit shows a Temperature fault, the fault indicators should look like Figure 25. This is a major fault condition.

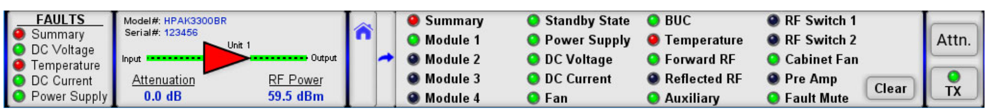


Figure 25: Fault Indicators, Temperature Fault

Follow the steps below to identify the cause of the temperature fault:

1. Check the ambient temperature of the room where the SSPA is installed against the environmental specifications for your amplifier. If the ambient temperature is beyond these limits, the unit may experience a temperature fault. If this is the case, action will need to be taken to bring the ambient temperature into the specified range.
2. If the ambient temperature is within the specified range and the unit still experiences a temperature fault, the operator should perform a visual inspection of the fans to make sure they all appear to be spinning.
3. Make sure the amplifier's heatsink is clean and clear of dust and debris. If not, use a can of compressed air to blow the dust out of the heat sink fins and clear of the plenum.
4. If a Fan fault is present along with a temperature fault, inspect the fans and replace a fan that is not functioning.
5. Check the Fan/Switch voltages on the Status > DC Power menu. The voltage should read approximately 28 VDC for each of the fans in the SSPA. If the voltage is lower than 25 VDC, the operator should check for a power supply fault.

Fan Fault

If the unit shows a Fan fault, the fault indicators should look like Figure 26. This is a minor fault condition that may accompany a major Temperature fault.

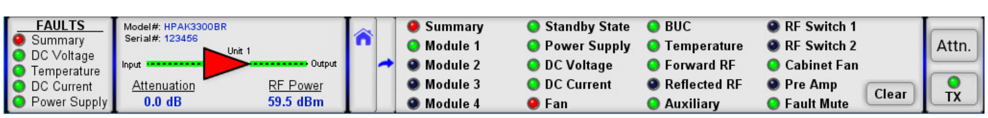


Figure 26: Fault Indicators, Fan Fault

Follow the steps below to attempt to clear the fan fault:

1. Inspect the fans. Replace a fan that is not functioning
2. The user should check the Fan/Switch Voltages on the Status > DC Power menu. The voltage should read approximately 28 VDC for each of the fans in the SSPA.

Forward RF Fault

If the unit shows a Forward RF fault, the fault indicators should look like Figure 27. The user can adjust the severity of this fault condition in the Fault Setup > Fwd RF/ALC menu. In the example below, the Fwd RF/ALC fault setting is set to HighRFMajor, so a Summary fault is also triggered if the forward RF exceeds the selected threshold level. See the Fwd RF/ALC Button description of the **Touchscreen Menu Structure** section.

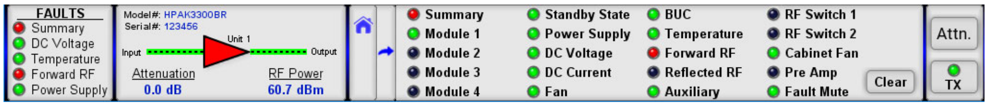


Figure 27: Fault Indicators, Forward RF Fault

In the case of a Forward RF alarm, follow the steps below:

1. Check the forward RF level displayed on the touchscreen. 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.
2. Compare this value to the forward RF alarm threshold level in the Fault Setup > Fwd RF/ALC 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.
3. Ensure 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 P1dB 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.
4. 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.

RF Switch Fault

When the unit is configured as part of a redundant or phase combined system, if a transfer switch in the system does not complete a switch rotation, the switch symbol in the MIMIC display and the RF Switch fault indicator in the Fault Panel will turn red. See Figure 28.

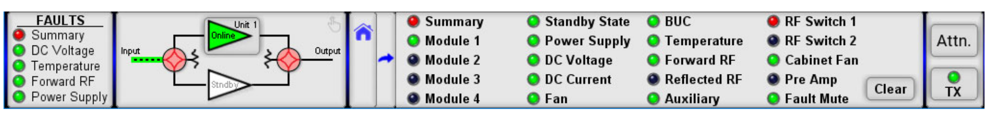


Figure 28: Fault Indicators, RF Switch Fault

The user can adjust the severity of this fault condition in the Fault Setup > RF Switch Flt menu. In the example above, the RF Switch fault setting is set to Major Fault, so a Summary fault is also triggered. See the RF Switch Fault description in the **Touchscreen Menu Structure** section.

A fault condition is also triggered if the amplifier is not connected to the system transfer switch by a control cable. The user should make sure the switch cable is connected between the system amplifiers and switch(es). A faulty cable may also be the cause of an RF Switch fault.

THIS PAGE LEFT INTENTIONALLY BLANK

System Controllers with Touchscreen, Fault Analysis and Troubleshooting

Teledyne Paradise Datacom
Drawing Number: 216351-5 Revision A
ECO 18940
01 May 2020

Introduction

The redundant controller has been designed to be maintenance-free. The only user replaceable parts are the AC input fuses and removable power supplies.

Fuse Replacement

The AC input fuses are 2 Amp Slow Blow style fuses and are accessible at the AC input entry module. Figure 1 shows the location of the input fuses. The fuse part number is Littlefuse 217002, 2 Amp.

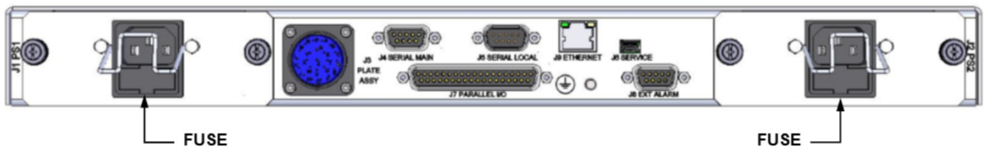


Figure 1: Controller Rear Panel, Fuse Locations

Troubleshoot Power Supply Failures

A power supply fault is always considered a major fault, and will cause the front panel Summary Alarm and Power Supply Alarm indicators to flash red. See Figure 1.

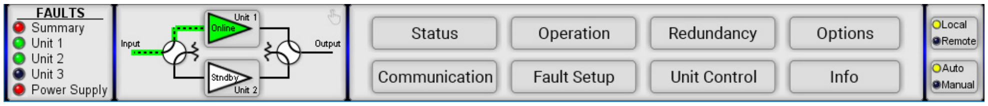


Figure 2: Controller Display Showing Power Supply Fault

To identify which power supply module is faulted, follow these steps:

1. Tap the Home icon on the touchscreen;
2. Tap the Status button;
3. Tap the Fault Panel button.

In the example shown in Figure 3, Power Supply 1 (PS1 Voltage) is showing a fault.

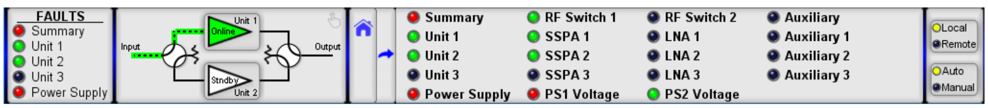


Figure 3: Controller Display Showing Fault Panel

To obtain more information about the state of the power supplies, follow these steps:

1. Tap the Home icon on the touchscreen;
2. Tap the Status button;
3. Tap the RCP Status button.

The resulting screen shows the measured voltages of both power supplies. In the case of the example shown in Figure 4, Power Supply 1 shows a measured voltage of 21.9 V and Power Supply 2 shows 28.3 V.

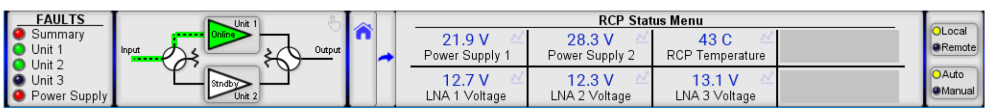


Figure 4: Controller Display Showing RCP Status Info

The controller monitors the output voltage of each power supply module. If the output voltage level for a power supply is above 23V, the fault indicator will illuminate green. If the output voltage drops below 22V, the fault indicator will illuminate red.

When looking at the back panel of the controller, PS1 is on the left and PS2 is on the right. Before removing a power supply, ensure that the power cable to the supply is plugged in to a working outlet, and that the power switch of the supply is turned on.

Remove Power Supply Module

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

1. Unplug the line cord from the failed power supply;
2. Loosen the two captured thumbscrews securing the module to the chassis See Figure 5.;
3. Slide the module out of the chassis;
4. Unplug the quick-disconnect power pole connectors. See Figure 6.

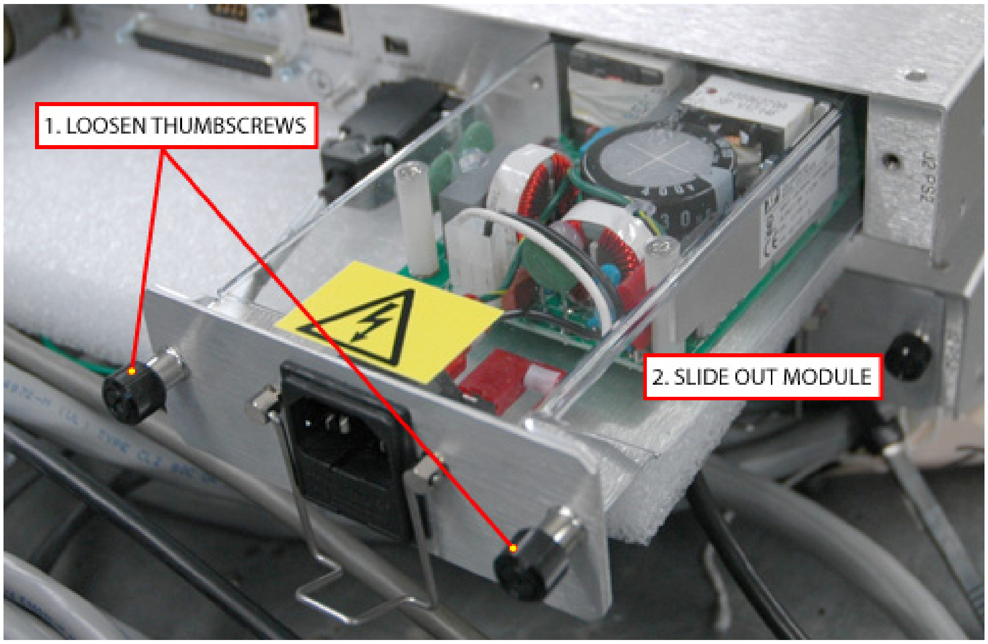


Figure 5: Loosen Thumbscrews and Slide Module from Chassis

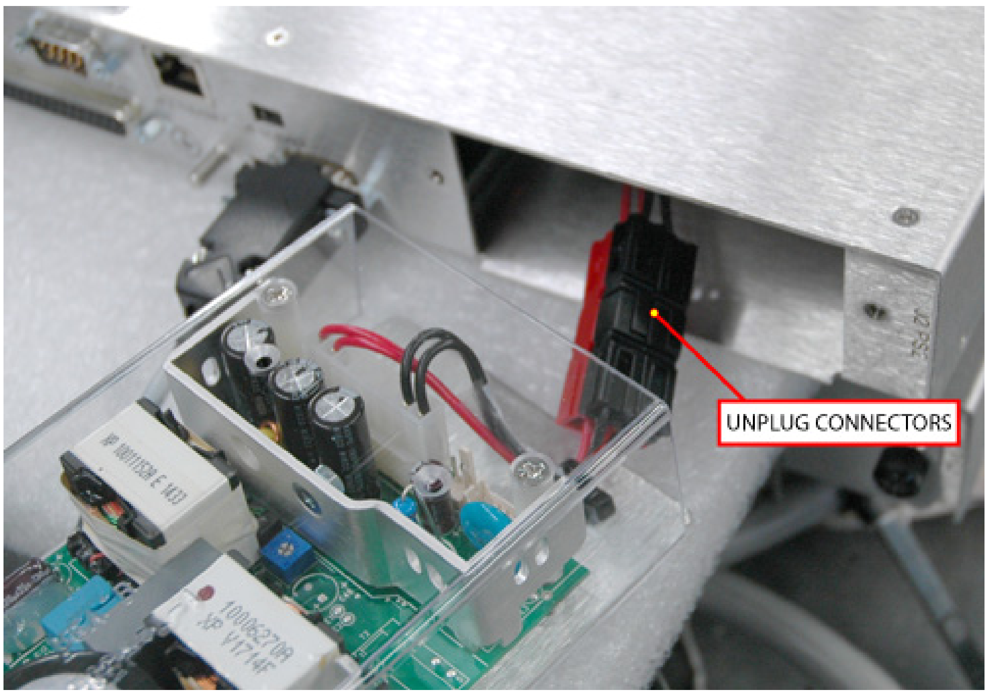


Figure 6: Unplug Power Pole Connectors

Install New Power Supply Module

First, ensure that the new power supply module is the same type as the one being replaced! See the Power Supply description in the **Unit Description** section to review the different power supply module types.

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

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

Restoring Factory Settings

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

> ⚠ **Important: Automatic restoration will restore complete factory setup (including COM settings and miscellaneous fault handling). You will need to reconfigure any custom Communication settings specific to your network.**

See the instructions in the **Touchscreen Operation** section on how to save user settings from which you can restore to the unit. There are two Backup repositories (User 1 and User 2) so you can save different configurations and quickly switch from one to the other using the Restore menu.

Automatic Restore

To restore settings automatically, follow these simple steps:

1. Tap the Home icon on the touchscreen;
2. Tap the Options button;
3. Tap the System button;
4. Tap the Restore button;
5. Tap the Factory button.

Default factory setup is now restored.

Manual Restore

Manual setup restoration is dependent on the makeup of your specific system. To undertake a manual setup restoration, follow these directions:

Set System Mode

1. Tap the Home icon on the touchscreen;
2. Tap the Redundancy button;
3. Tap the System Mode button;
4. Tick the checkbox for the system mode relevant to your system.

Set Fault Monitoring

1. Tap the Home icon on the touchscreen;
2. Tap the Fault Setup button;
3. Tap the Fault Monitor button;
4. Tick the SSPA Only checkbox if the controller is not supplying power to system LNBs; Tick the Both checkbox if the controller must be configured as the primary power source for LNBs.

Set Fault Logic

1. Tap the Home icon on the touchscreen;
2. Tap the Fault Setup button;
3. Tap the Fault Logic button;
4. Tick the Fault on High checkbox.

Skip the following steps if the controller is not configured as a primary power source for the system's LNBs.

Re-calibrate LNBs Fault Window

Make sure the LNBs are reliably connected to the controller and that they are normally operational prior to system calibration;

Make sure the controller is configured for tracking both LNA/LNB and external faults.

1. Tap the Home icon on the touchscreen;

2. Tap the Unit Control button;
3. Tap the Calibration LNBs button;
4. Tick the 8% Fault Window checkbox;
5. Observe the current measurements shown in the green windows on the display. If the current values are all normal, tap the Cal buttons beneath each Unit display.

⚠ **You may need to re-enter all custom Communication settings specific to your network. See the description of the various Communications parameters in the Touchscreen Operation section.**

Firmware Programming

Teledyne Paradise Datacom's digital engineers continually strive to improve the performance of RCP2 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 RCP2 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.

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;

Required Software

For web upgrade:

- Web browser (IE, Chrome or Firefox);

For USB upgrade:

• USB FTDI VCP drivers. Drivers need to be installed before making a connection between the PC and the SSPA USB programming port. Visit the FTDI web page (http://www.ftdichip.com/Drivers/VCP.htm) for the latest set of virtual COM port (VCP) drivers.

• RCP2 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.

Web Upgrade Procedure

The web upgrade is the preferred method of upgrading the 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.

Connect the unit to a 10/100 Base-T network or to a PC 10/100 Base-T network adapter. See the **Ethernet Interface Set-Up and Cabling** section for proper Ethernet cable wiring.

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 unit. Press Enter.

The Upload Form is password protected. An authentication window should come up to ensure authorization. Use "admin" as user name and the web logon password (default password is "paradise"). Click the "Log in" button (see Figure 7).

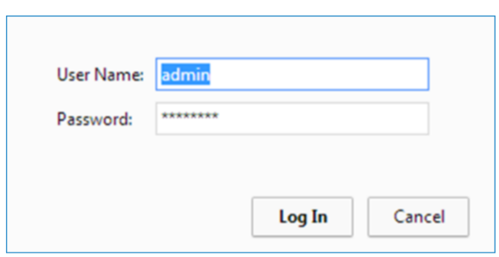


Figure 7: Firmware Upgrade, Upload Form Login Window

The firmware upload form will load in the browser window (See Figure 8). Click the "Choose File" button and browse to location of the firmware image code.bin file provided by technical support.

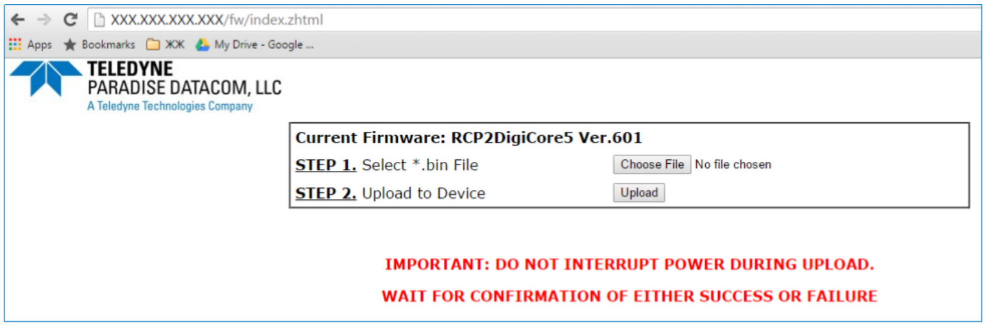


Figure 8: Firmware Upgrade, Upload code.bin File

Click the "Upload" button. A warning message will appear; click the "OK" button (See Figure 9).

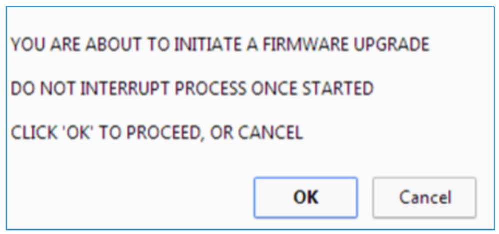


Figure 9: Firmware Upgrade, Click 'OK' at Prompt to Proceed

The upload process will begin and the form will be informing about loading process (See Figure 10).

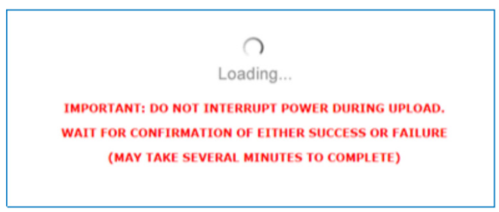


Figure 10: Firmware Upgrade, Upload Process Initiated

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 11.

Figure 11: Firmware Upgrade, Upload Process Complete

During the upgrade process, the unit remains fully functional. The new firmware will stay dormant until the next reboot of the control card. Reboot the controller card by selecting the relevant front panel menu or by cycling power to the unit. Browse to the front panel menu firmware information page and verify the installed version.

If the load process was interrupted, for any reason, the unit may not operate properly after a reboot. It is still possible to recover from the problem by applying firmware upload over USB port. See the **USB Port Upgrade Procedure** for details.

USB Port Upgrade Procedure

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!

Install FTDI VCP driver on the target PC;

Connect the USB mini port J1 at the back of unit to an available PC USB port.

⚠ **Warning! Connecting J1 to a PC USB will interrupt normal operation of the unit.**

After connecting the unit, 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 12). You will need a COM port designator in the next step.

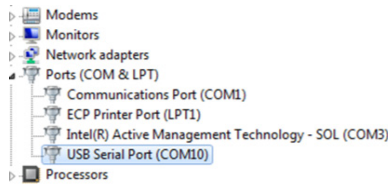


Figure 12: Firmware Upgrade, Check Device Manager for COM Port Designator

Locate and run Upgrade.bat script file which was provided in firmware upgrade package. File will open command prompt window and request the programing serial port designator. Enter the COM port designator located in previous step and then press "Enter". The script file will start downloading a new image file to the unit. The resulting window is shown in Figure 13;

Figure 13: Firmware Upgrade, Command Prompt Window Progress

⚠ **Warning! Do not unplug the USB cable while the script is running.**

When the script is completed, unplug the USB cable from the control card. The unit should restart with the new firmware image.

Advanced System Troubleshooting

The controller offers the ability to control various systems, which can include various subcomponents. In some cases it is important to quickly pinpoint a faulty component without system disintegration. The controller offers such capabilities. The following section describes the troubleshooting procedure for some systems.

Scenario 1

A 1:2 system contains devices connected to the RCP external port (SSPA) as well as an array of LNA devices connected to the Plate assembly port. Major faults are configured to track both types of fault. Fault logic is set to "High". The controller indicates a Unit1 fault.

To determine which component of the controlled setup is failed, tap the Home icon on the touchscreen, tap the Status button, then tap the Fault Info button. Verify the status of the Aux Input State and SSPA Input state items. If the string of numbers includes a "1", that indicates a fault on that Input State. See the Fault Info Menu description of the **Touchscreen Operation** section.

If the faulted element is found in the LNA setup, the user can double-check what caused it. Perform the following steps:

1. Tap the Home icon on the touchscreen;
2. Tap the Unit Control button;
3. Tap the Calibrate LNA button;
4. The calibration points and current consumption for each LNA are displayed. Note whether value in the green fields for each Unit falls between the low and high current values in the white boxes immediately below.

If the faulted element is found in the SSPA setup, double-check the fault causing the problem by tapping the Home icon, then tapping the Fault Info button. Note the information shown in the "Last Flt. Cause" item.

Tap the Touch icon at the top right of the RF Signal Path Display. A new screen should open in the Menu area of the display that shows the RF Power, DC Current and Temperature of each unit in the system. Total system information may also be displayed if the system includes a forward and/or reflected power monitor.

Scenario 2

In a 1:2 SSPA system, three auxiliary devices are connected to the RCP external alarm port (J8). The controller utilizes "fault on high" logic. Auxiliary faults are enabled. An auxiliary fault indicates a fault condition.

To find which auxiliary line indicates the fault, tap the Home icon on the touchscreen, tap the Status button, then tap the Fault Info button. Review the string of numbers in the Aux Input State unit displayed.

If any auxiliary faults are present in the system, this item will show them in format ZYZYX, where X corresponds with Auxiliary Alarm 1 (J8, pin 5), Y with Auxiliary Alarm 2 (J8, pin 6), and Z with Auxiliary Alarm 3 (J8, pin 7). A 0 indicates normal (logic low state) operation and a 1 indicates a fault (logic high state) condition.

For example, a fault on Auxiliary Alarm 2 would display as 01010; faults on Auxiliary Alarms 1 and 3 would display as 10101. A fault on Auxiliary Alarm 1 would display as 00001.

Teledyne Paradise Datacom
Drawing Number 216351-5 Revision A
ECO 18940
Last Modified: 01 May 2020

THIS PAGE LEFT INTENTIONALLY BLANK

Phase Adjustment and System Upsizing

Teledyne Paradise Datacom
Drawing Number: 214579-4 Revision E
ECO 18918
05 May 2020

Phase Adjustment

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

The PowerMAX system utilizes an RF Distribution Box which houses three sets of phase adjusters: one for the first set of four PowerMAX modules, one for the second set of four PowerMAX modules, and one to adjust the phase between the two sets of four PowerMAX modules.

After installing the replacement amplifier module, attach a power meter or spectrum analyzer to the system Forward RF Sample Port and measure the power output. If no test equipment is available, output power can be monitored from the front panel of the Master Module (with the system running in N+1 mode). The System RF Power is shown in the main N+1 display on the touchscreen. See Figure 1.

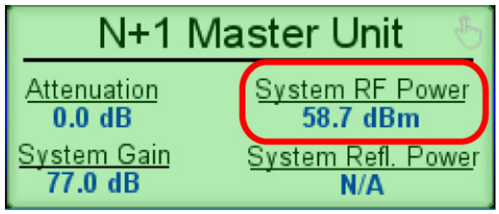


Figure 1: System RF Power Displayed on Touchscreen

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

Adjusting Phase After Replacing SSPA 1, 2, 3 or 4

If SSPA 1, SSPA 2, SSPA 3 or SSPA 4 failed and was replaced, follow this procedure.

The phase of the path of SSPA 1 is fixed and is not adjustable, so any phase adjustments to the system are done using the adjusters for SSPA 2, SSPA 3 and SSPA 4. See Figure 2.

Figure 2: Phase Adjusters for SSPA 2, SSPA 3 and SSPA 4

Remove the black plastic caps from the front of the 1RU RF Distribution Panel associated with SSPA 2, SSPA 3 and SSPA 4 to gain access to the phase adjuster knobs.

While observing the output power, use a flat blade screwdriver to rotate the phase trimmer screws, starting with the one associated with the replaced SSPA (if SSPA 2, SSPA 3 or SSPA 4). Turn the trimmer screw either clockwise or counterclockwise, depending on which direction increases the output power, until the output power is peaked. Repeat the adjustment for each of the remaining phase trimmers (SSPA 2, SSPA 3 and SSPA 4), making sure to peak the power with each adjustment.

After one pass has been completed, repeat the adjustment sequence, peaking the power with each phase trimmer until no further increase in output power is achieved.

Once each of the 4 amplifiers (1,2,3,4) has been phase matched to one another, the bottom half (SSPA 5,6,7,8) needs to be phase matched to the top half (SSPA 1,2,3,4). This is done by adjusting the 8-way phase trimmer while operating in Phase Combined mode.

Remove the black plastic cap for the 8-way trimmer to gain access to the phase adjuster. See Figure 3.

Figure 3: Adjust 8-Way Phase Trimmer

Use a flat blade screwdriver to rotate the trimmer clockwise or counter-clockwise, depending on which direction increases the output power. Adjust until the power has been peaked.

Replace the black plastic caps on the front of the distribution panel.

Adjusting Phase After Replacing SSPA 5, 6, 7 or 8

If SSPA 5, SSPA 6, SSPA 7 or SSPA 8 failed and has been replaced, follow these steps for phase alignment.

The phase of the path of SSPA 5 is fixed and is not adjustable, so any phase adjustment to the system is done using the adjusters for SSPA 6, SSPA 7 and SSPA 8.

Remove the black plastic caps from the RF distribution panel associated with SSPA 6, SSPA 7 and SSPA 8 to gain access to the phase adjusters.

While observing the output power, use a flat blade screwdriver to rotate the phase trimmer, starting with the one associated with the replaced SSPA (if SSPA 6, SSPA 7 or SSPA 8). Turn the trimmer screw either clockwise or counterclockwise, depending on which direction increases the output power, until the output power is peaked. See Figure 4. Adjust until the power is peaked.

Figure 4: Adjusting Phase of SSPA 6, SSPA 7 and SSPA 8

Move to the adjacent phase trimmer and repeat the process of maximizing the output power and continue the process until all phase trimmers (SSPA 6, SSPA 7 and SSPA 8) have been adjusted one time. Repeat the adjustment process a second time, again peaking the output power with each adjustment of the trimmer.

Once each of the 4 amplifiers (5,6,7,8) has been phase matched to one another, the bottom half (SSPA 5,6,7,8) needs to be phase matched to the top half (SSPA 1,2,3,4). This is done by adjusting the 8-way phase trimmer while operating in Phase Combined mode.

Remove the black plastic cap for the 8-way trimmer to gain access to the phase adjuster. See Figure 5.

Figure 5: Adjust 8-Way Phase Trimmer

Use a flat blade screwdriver to rotate the trimmer clockwise or counter-clockwise, depending on which direction increases the output power. Adjust until the power has been peaked.

Replace the black plastic caps on the front of the distribution panel.

PowerMAX Upsizing

There are two primary configurations in which a four-module PowerMAX system can be configured and upgraded to an eight-way PowerMAX system. These are classified as: Maximum Output Power and Hitless Operation options. As the block diagram of Figure 6 shows, a 4-way PowerMAX system contains a 4-way combiner that connects to a waveguide cross-guide directional coupler and rms output detector assembly.

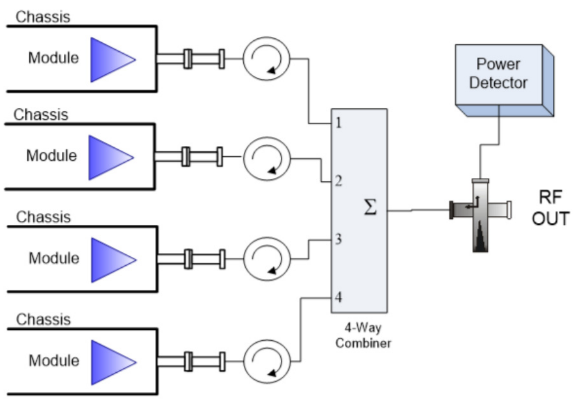


Figure 6: Block Diagram, Four-way PowerMAX System

Upgrading a four-module PowerMAX system to an eight-module system basically involves adding an additional four-module system. This is accomplished by using a two way hybrid microwave combiner attached to each output of the four-way systems. The eight-way configuration is shown in Figure 7.

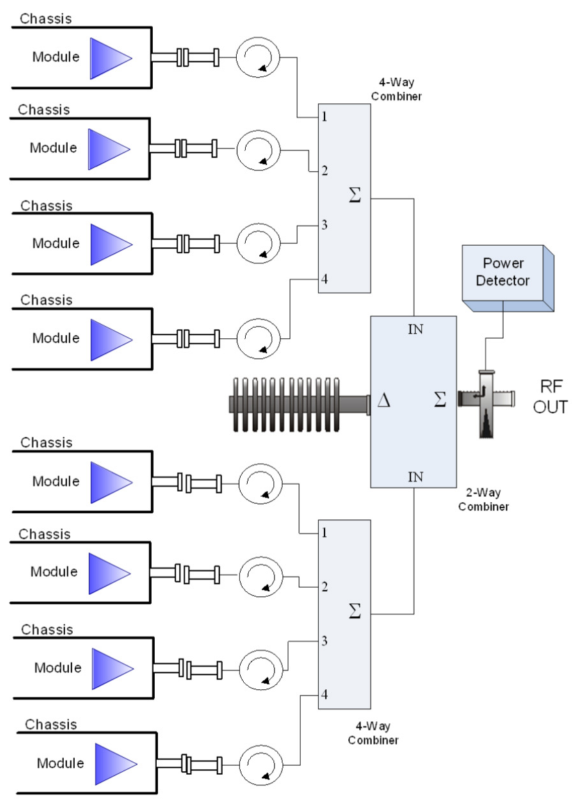


Figure 7: Eight-module PowerMAX System

4- to 8-module Upgrade, Maximum Output Power

To upgrade from a 4-module PowerMAX system to an 8-module system, while operating the 4-module system at maximum output power, an additional complete 4-module PowerMAX system will need to be installed, along with a hybrid 2-way combiner to combine the outputs of both 4-module systems.

The upgrade process is fairly simple to perform in the field by following system installation procedures below. The installation of the hybrid coupler at the system output will require a scheduled service outage so that the PowerMAX system can be powered off. This upgrade process should take no longer than 30 minutes.

> ⚠ **Upgrade procedure requires system power-down!**

1. Install the second 4-way combiner into the cabinet (refer to assembly drawing for placement measurements).
2. Install four (4) additional PowerMAX RM Chassis into cabinet, typically below the existing RF Distribution Box. DO NOT PLUG POWER CORDS INTO BUS BAR!
3. Ensure that all waveguide between the SSPAs and the 4-way combiner align properly. DO NOT FORCE-FIT THE WAVEGUIDE! If necessary, adjust the combiner assembly supports to align the waveguide with the installed HPA Chassis.
4. If required, install a second Power Supply Chassis.
5. Insert additional Power Supply modules as required to sufficiently power the upgraded system.
6. Attach RF input semi-rigid coax from each Chassis to RF Distribution Box.
7. REMOVE POWER FROM CABINET
8. Detach 90-degree waveguide bend from the terminus of the waveguide combiner.
9. Install 2-way hybrid microwave combiner and connect to the new 4-way combiner.
10. Disconnect J13, J14, J15 and J16 coaxial cables (4-module configuration) from the rear of the RF Distribution Box.
11. Reconnect J13, J14, J15 and J16 coaxial cables in the 8-module configuration at the rear of the RF Distribution Box (J13 to J15 and J14 to J16).
12. If required, attach second exhaust impeller to rear door of cabinet.
13. Connect all serial cables and power cables; plug the power cables for each SSPA into the power rail.
14. APPLY POWER TO CABINET
15. Adjust phase combining.
16. Configure the system as an 8-module cabinet.
17. Set Array Size: On each new SSPA in the system, tap the home button on the touchscreen; tap the N+1 button; tap the Array Size button; tick the 8 SSPAs checkbox.
18. Set N+1 Addresses: On each new SSPA in the system, tap the home icon on the touchscreen; tap the N+1 button; tap the N+1 Address button; enter the next highest number in the system array (5, 6, 7 and 8 if upgrading from a 4-unit to an 8-unit system) and click the OK button.

4- to 8-module Upgrade, Hitless Operation

For mission critical systems in which no power outage can be tolerated, an eight-module PowerMAX system can be operated with only four modules installed. In this way the additional four modules can be installed at a later time without requiring the system to be powered off.

The disadvantage of operating the eight-module PowerMAX system with four modules is the additional 3 dB loss that the four-module (half-system) system experiences by going through the final hybrid combiner, as shown in Figure 8.

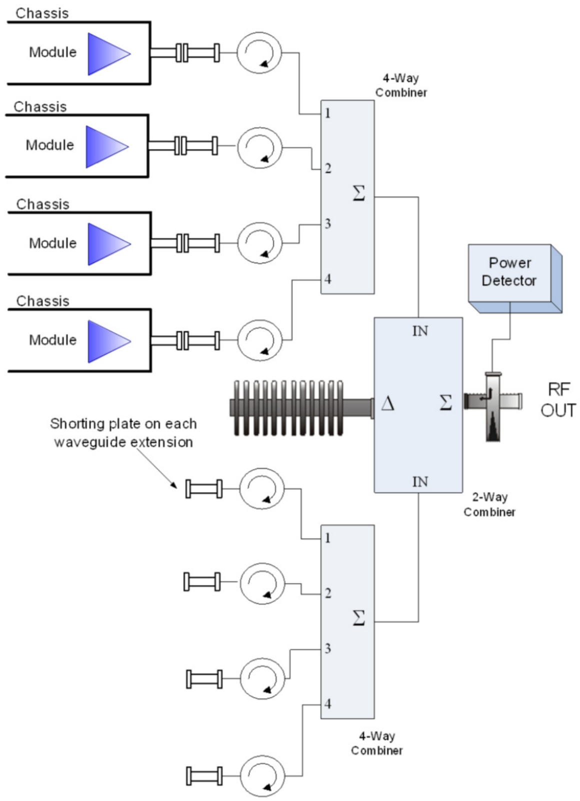


Figure 8: Eight-module PowerMAX System, Less 4 Modules

Therefore the overall output power is actually 6 dB below what it would be with all eight modules present in the system. If, however, the module output power is sized such that this reduction in output power can be tolerated, the system of Figure 8 is an effective means of scaling the system from four modules to eight modules and maintaining true hitless operation. The system never has to be powered down and there are no mechanical switches involved that would create an interruption to the service.

> ⚠ **Caution! Since the 6 dB reduction in power is dissipated as heat in the termination, caution should be observed when performing maintenance or upgrades to the system due to the extreme temperatures at the termination.**

The additional chassis and/or modules can be installed while the system is powered on and carrying service.

> ⚠ **No system power-down required during upgrade procedure!**

1. Remove the shorting plate on each waveguide extension and install four (4) additional PowerMAX RM Chassis into cabinet. DO NOT PLUG POWER CORDS INTO BUS BAR!
2. Ensure that all waveguide between the SSPAs and the 4-way combiner align properly. DO NOT FORCE-FIT THE WAVEGUIDE! If necessary, adjust the combiner assembly supports to align the waveguide with the installed HPA Chassis.
3. If required, install second Power Supply Chassis.
4. Insert additional Power Supply modules as required to sufficiently power the upgraded system.
5. Attach RF input semi-rigid coax from each Chassis to RF Distribution Box.
6. Disconnect J13, J14, J15 and J16 coaxial cables (4-module configuration) from the rear of the RF Distribution Box.
7. Reconnect J13, J14, J15 and J16 coaxial cables in the 8-module configuration at the rear of the RF Distribution Box (J13 to J15 and J14 to J16).
8. If required, attach second exhaust impeller to rear door of cabinet.
9. Connect all serial cables and power cables; plug the power cables for each SSPA into the power rail.
10. Adjust phase combining.
11. Configure system as an 8-module cabinet.
12. Set Array Size: On each new SSPA in the system, tap the home button on the touchscreen; tap the N+1 button; tap the Array Size button; tick the 8 SSPAs checkbox.

13. Set N+1 Addresses: On each new SSPA in the system, tap the home icon on the touchscreen; tap the N+1 button; tap the N+1 Address button; enter the next highest number in the system array (5, 6, 7 and 8 if upgrading from a 4-unit to an 8-unit system) and click the OK button.

Teledyne Paradise Datacom
Drawing Number 214579-4 Revision E
ECO 18918
Last Modified: 05 May 2020

TELEDYNE PARADISE DATACOM
Everywhereyoulook

Indoor RM SSPAs, Remote Control Protocol

Teledyne Paradise Datacom
Drawing Number: 216512-11 Revision B
ECO 18951
11 June 2020

Overview

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

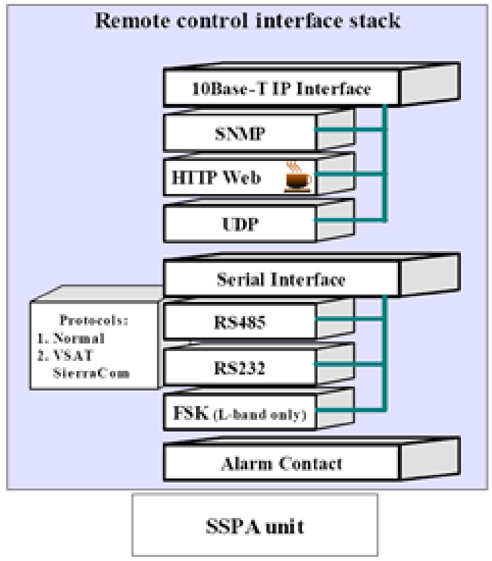


Figure 1: Remote Control Interface Stack

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 and ASCII based protocol suitable for HyperTerminal applications. 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 - UDP encapsulated Normal serial protocol;
- SNMP V1 with support of SNMP traps;
- HTTP web interface

Serial protocol format for both RS232 and RS485 interfaces is set at no parity, 8 bit, 1 stop bit, no handshaking. If using a Terminal mode protocol, the SSPA provides remote menu access through a HyperTerminal program or through an actual hardware terminal.

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. The 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 1 shows a list of enabled interfaces depending on the chosen interface setting.

Table 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.

Remote Control - Parallel

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 2.

Figure 2: Parallel I/O Form-C Relay

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.

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 3. It consists of a Header, Data and Trailer sub-packet.

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

Figure 3: Basic Communication Packet

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 4).

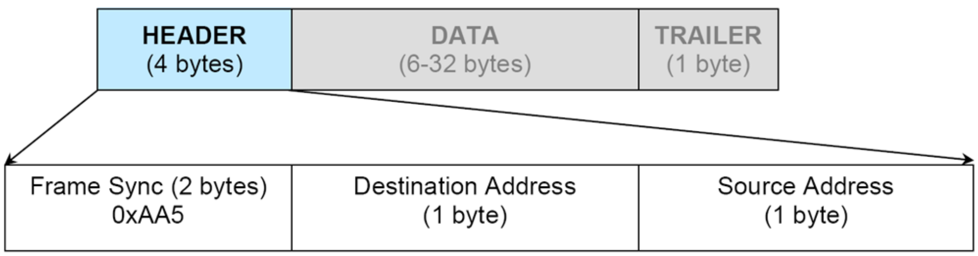


Figure 4: Header Sub-Packet

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.

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.

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.

Data Packet

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

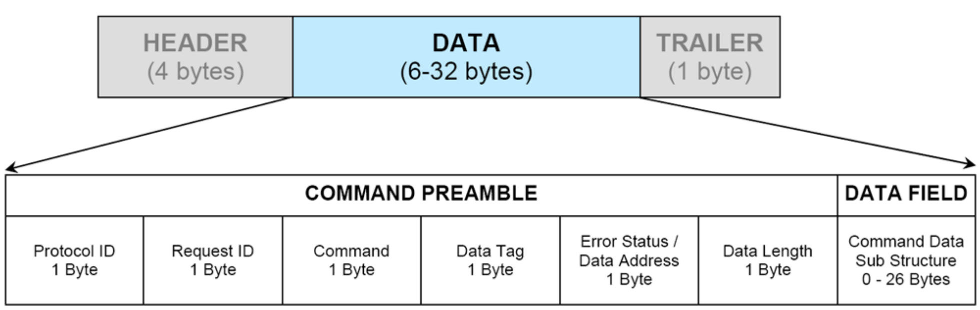


Figure 5: Data Sub-Packet

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.

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.

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 a "Set Request" command, the receiver must answer with a "Get Request" or "Get Response" form of the command. The byte value for each command is given in Table 2;.

Table 2: Command Byte Values

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

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 3.

Table 3: Data Tag Byte Values

Tag Name	Byte Value	Field Length	Description
System Settings Tag	0	1 byte	This tag allows accessing various system settings on remote unit. Host access status: Full Read/Write access. Settings can be modified at any time. Some settings may require hardware reset of the remote SSPA unit.
System Threshold Tag	1	2 bytes	This tag allows access to the critical unit thresholds. Host access status: Read Only.
System Conditions Tag	3	1 byte	This tag allows access to the unit's internal conditions flags, such as fault status or current system status. Host access status: Read only. This type of data cannot be set or modified remotely.
ADC Channel Access Tag	4	2 bytes	This tag allows access to the unit's internal Analog to Digital converter. Host access status: Read only. This type of data cannot be set or modified remotely.
Packet Wrapper	6	1 byte	This tag is used to send requests to a remote SSPA subsystem redirected through a remote systems controller (RCP). All Packet Wrapper requests frames are "Data Set" command requests. Maximum length of the data fields in both directions is 32 bytes.
Reserved	2,5	N/A	These tags are reserved for factory use only.

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 4. Note that the Request and Response frames are different.

Table 4: Error Status Byte

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 respondent 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 originator frame, but respondent failed to recognize it. All data aborted.

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.

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).

Trailer Packet

Frame Check

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

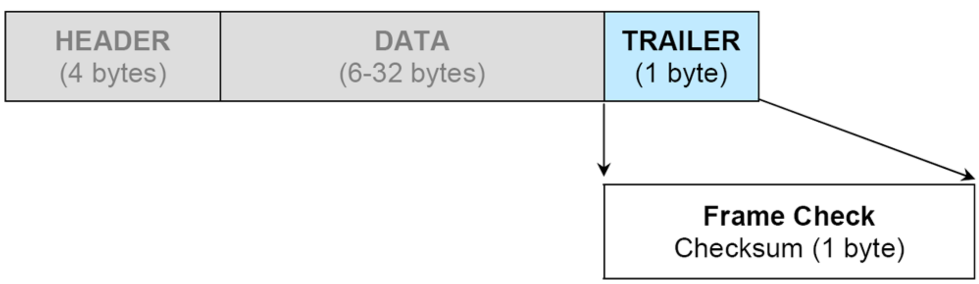


Figure 6: Trailer Sub-Packet

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
```

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.

Request/Response Frame Structure

Table 5 outlines the request frame structure for the system amplifiers. Table 6 outlines the response frame structure for the system amplifiers.

Table 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	Destination address + Source address + Protocol Version + Request ID + Command + Data Tag + Data Address + Data Length + Data

Table 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	Destination address + Source address + Protocol Version + Request ID + Command + Data Tag + Data Address + Data Length + Data

Settings, Conditions and Thresholds

Table 7 outlines the amplifier settings data values. Table 8 shows the amplifier condition data values. Table 9 describes the amplifier threshold data values.

* Indicates firmware version where this feature was first available.

Table 7: System Settings Details

Data Address	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 (v. 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 (Not supported starting 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	Forward RF Fault 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 Reflected RF Fault 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 Forward RF Threshold	Valid values: 0 - 80; 1 dBm per 1 value

28	1	High Reflected RF Threshold	Valid values: 0 - 80; 1 dBm per 1 value
29	1	IP Address Byte 1 (MSB)	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
30	1	IP Address Byte 2	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
31	1	IP Address Byte 3	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
32	1	IP Address Byte 4	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
33	1	IP Gateway Byte 1	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
34	1	IP Gateway Byte 2	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
35	1	IP Gateway Byte 3	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
36	1	IP Gateway Byte 4 (LSB)	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
37	1	Subnet Mask Byte 1 (MSB)	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
38	1	Subnet Mask Byte 2	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
39	1	Subnet Mask Byte 3	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
40	1	Subnet Mask Byte 4 (LSB)	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
41	1	Receive IP Port Byte 1 (MSB)	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
42	1	Receive IP Port Byte 2 (LSB)	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
43	1	IP Lock Address Byte 1 (MSB)	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
44	1	IP Lock Address Byte 2	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
45	1	IP Lock Address Byte 3	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
46	1	IP Lock Address Byte 4 (LSB)	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 20)
47	1	N+1 Array size	Available for SSPA with Ethernet IP Option (See Conditions Table, Field 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)

Table 8: System Conditions 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*)
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*)

Table 9: System Thresholds Details

Data Address	Length (Bytes)	Description	Limits and Valid Values
1	2	Forward RF Power	If RF Units (See Settings Table, 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 (See Settings Table, 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 ℃ per 1 value; Value will return (-100) if reading is not available at this time.
9	2	N+1 System Forward Power (available from Master unit only!)	If RF Units (See Settings Table, 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 unit only!)	0.1 dB per Value. Estimated N+1 system linear gain. v. 4.20*.
11	2	N+1 System Reflected Power (available from Master unit only!)	If RF Units (See Settings Table, 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 ℃ 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 ℃ per 1 value; Value will return (-100) if reading is not available at this time. v. 6.00*.

⚠ **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.**

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 8-7). Packet wrapper requests are associated with longer response times, which must be accounted for 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, Request frame A is the Packet Wrapper frame. It contains Request frame B, intended to be redirected to the remote SSPA.

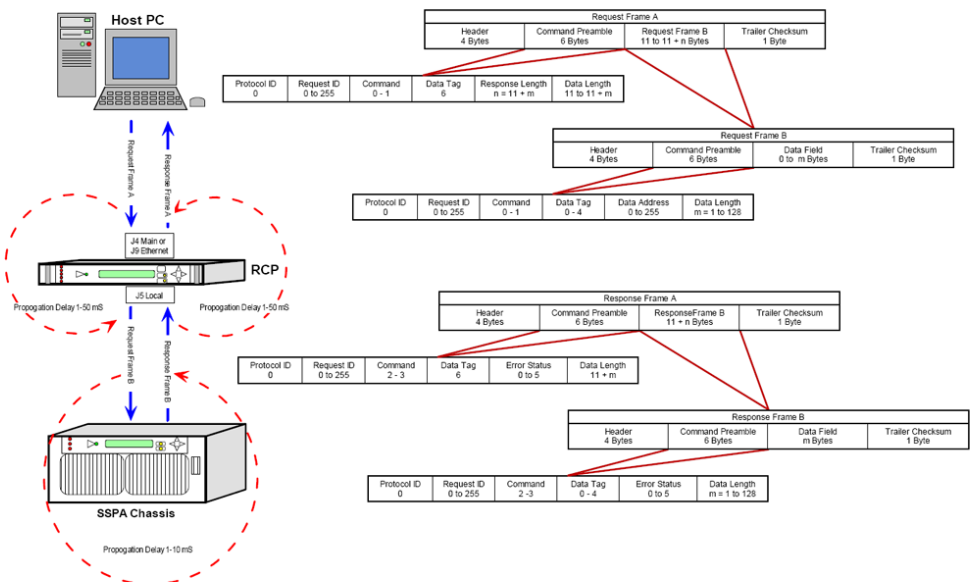


Figure 7: Packet Wrapper Technique

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;
```

Table 10: PC Request String

Byte Count	Value	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.

Table 11: SSPA Response String

Byte Count	Value	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, replaced with Error status code. 0 in this field indicates absence 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

Terminal Mode Serial Protocol

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 a time. If you do so you will not get any valid answer from any SSPA!**

Figure 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 8: Terminal Mode Session Example

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.

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.

IPNet Interface

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

General Concept

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 the SSPA unit and waits for a 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 9.

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

Figure 9: UDP Redirect Frame Example

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

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.

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.

1. At the front panel touchscreen, tap the Home icon to return to the Main Menu;
2. Tap the Communication button;
3. Tap the IP Setup button.

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 the SSPA RM will be accessible over the Internet, exercise appropriate security measures. Teledyne Paradise Datacom strongly recommends placing amplifiers behind a protective Firewall or setting up a VPN link for remote access.**

After selecting the IP parameters, turn on IP interfaces through front panel:

1. Tap the Home icon on the front panel touchscreen to return to the Main Menu;
2. Tap the Communication button;
3. Tap the Interface button;
4. Tick the IPNET checkbox.

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.

1. Either cycle power to the unit, or:
2. Tap the Home icon to return to the Main Menu;
3. Tap the Options button;
4. Tap the System button;
5. Tap the Reset button;
6. Tap the Comms Only button. At the prompt, confirm you want to reset the I/O card.

To disable the Ethernet port and enable the RS-232/RS-485 Serial Main port:

1. Tap the Home icon to return to the Main Menu;
2. Tap the Communications button;
3. Tap the Interface button;
4. Tick either the RS232 or the RS485 checkbox (depending on the desired method of serial communication).

> ⚠ **Important! At 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. 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.

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 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 10. The User Name is fixed and cannot be changed by the operator.

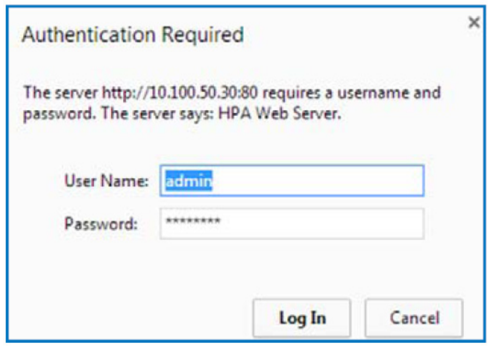


Figure 10: Web Interface Login Window

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 web browser (Figure 11).

Figure 11: Web Interface, Status Tab

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

The left side of the window displays unit model and serial number, firmware build, device MAC address and device up time since last I/O card power up or reboot.

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: This 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.

SNMP Interface

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

Teledyne Paradise Datacom devices with Ethernet interface support the most popular SNMPv1 format (SMIv1, RFC1155), SNMP Get, SNMP GetNext and SNMP Set commands. SNMP Traps are currently unsupported on units with serial numbers below 400000.

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.

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 11 through Table 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: ControlMode'Local=0,Remote=1
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 the MIBs of those devices, the proper Device Type has to be selected (OID -1.3.6.1.4.1.20712.1.4).

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 15 March 2019.)

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)
```

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; field allows 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. 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.

A value of "1" in the validation column of the thresholds table indicates the parameter is valid; a value of "2" indicates the 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 contains current device configuration and provides device management. See Table 12. Read/write access for settingsValue column.

thresholds - Table provides information about device internal limits and subsystems info. Refer to Table 13. Read only.

conditions - Table details device fault status information. See Table 14. Read only.

Table 12: SNMP Settings Values

settingIndex /settingValue	settingTextValue	Value OID 1.3.6.1.4.1.20712...	Description
1/INTEGER	SysMode'StandAlone=0,1:1Mode=1, 1:2Mode=2	2.1.1.1.2.1	System Operation mode
2/INTEGER	SwitchMode'Auto=0,Manual=1, SWLock=2	2.1.1.1.2.2	Redundancy switching mode
3/INTEGER	ControlMode'Local=0,Remote=1	2.1.1.1.2.3	Unit control mode
4/INTEGER	FanSpeed'Low=0,High=1,Auto=2	2.1.1.1.2.4	Fan Speed
5/INTEGER	Mute'Off=0,On=1	2.1.1.1.2.5	Unit mute status
6/INTEGER	Protocol'Normal=0,Terminal=1, Locus=2	2.1.1.1.2.6	Unit remote control protocol
7/INTEGER	Baud'9600=0,2400=1,4800=2, 19200=3,38400=4	2.1.1.1.2.7	Serial Interface speed
8/INTEGER	NetworkAddress'0..255	2.1.1.1.2.8	Serial interface address
9/INTEGER	Interface'RS232=0,RS485=1, IPNet=2,SNMP=3	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	2.1.1.1.2.10	Auxiliary fault handling
11/INTEGER	AuxFltLofic'FaultOnHigh=0, FaultOnLow=1	2.1.1.1.2.11	Auxiliary fault logic
12/INTEGER	RFSWFltHandle'Ignore=0,Major=1, Minor=2,SwMute=3	2.1.1.1.2.12	RF switch fault handling
13/INTEGER	FaultLatch'Disable=0,Enable=1	2.1.1.1.2.13	Fault latch state
14/INTEGER	BUCFltHandle'Ignore=0,Major=1, Minor=2,Major+Mute=3	2.1.1.1.2.14	Internal BUC fault handling
15/INTEGER	BUCFltLofic'FaultOnHigh=0, FaultOnLow=1	2.1.1.1.2.15	Internal BUC fault logic
16/INTEGER	UserPassword'0..255	2.1.1.1.2.16	Numeric menu password
17/INTEGER	StartUpState'Standby=0,Online=1	2.1.1.1.2.17	Redundancy online/standby selection
18/INTEGER	Buzzer'Off=0,On=1	2.1.1.1.2.18	Audible alarm state
19/INTEGER	MenuPassword'Off=0,On=1	2.1.1.1.2.19	Menu password protection
20/INTEGER	Reserved'0..255	2.1.1.1.2.20	Reserved for future use
21/INTEGER	StandbyMode'HotStandby=0, ColdStandby=1	2.1.1.1.2.21	Redundancy standby mode
22/INTEGER	HPAStatus'HPA1=0,HPA2=1,HPA3=2	2.1.1.1.2.22	Redundancy HPA status
23/INTEGER	Priority'Pol1=0,Pol2=1	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	2.1.1.1.2.24	Forward RF fault handling
25/INTEGER	HighRefRFFltHandle'Ignore=0,Major=1, Minor=2	2.1.1.1.2.25	High reflected RF fault handling
26/INTEGER	SSPAAttenuation(dBx10)'0..200	2.1.1.1.2.26	Unit attenuation level
27/INTEGER	LowForwardRFthreshold(dBm)'0..80	2.1.1.1.2.27	Low forward RF threshold
28/INTEGER	HighRefRFThreshold(dBm)'0..80	2.1.1.1.2.28	High reflected RF threshold
29/INTEGER	IPAddressByte1'0..255	2.1.1.1.2.29	Device IP address byte1 (MSB)

30/INTEGER	IPAddressByte2'0..255	2.1.1.1.2.30	Device IP address byte2
31/INTEGER	IPAddressByte3'0..255	2.1.1.1.2.31	Device IP address byte3
32/INTEGER	IPAddressByte4'0..255	2.1.1.1.2.32	Device IP address byte4 (LSB)
33/INTEGER	IPGateWayByte1'0..255	2.1.1.1.2.33	Device Gateway address byte1 (MSB)
34/INTEGER	IPGateWayByte2'0..255	2.1.1.1.2.34	Device Gateway address byte2
35/INTEGER	IPGateWayByte3'0..255	2.1.1.1.2.35	Device Gateway address byte3
36/INTEGER	IPGateWayByte4'0..255	2.1.1.1.2.36	Device Gateway address byte4 (LSB)
37/INTEGER	IPSubnetByte1'0..255	2.1.1.1.2.37	Device Subnet Mask byte1 (MSB)
38/INTEGER	IPSubnetByte2'0..255	2.1.1.1.2.38	Device Subnet Mask byte2
39/INTEGER	IPSubnetByte3'0..255	2.1.1.1.2.39	Device Subnet Mask byte3
40/INTEGER	IPSubnetByte4'0..255	2.1.1.1.2.40	Device Subnet Mask byte4 (LSB)
41/INTEGER	IPPortByte1'0..255	2.1.1.1.2.41	Device Port address byte1 (MSB) (required only for IPNet Interface)
42/INTEGER	IPPortByte2'0..255	2.1.1.1.2.42	Device Port address byte2 (LSB) (required only for IPNet Interface)
43/INTEGER	IPLockByte1'0..255	2.1.1.1.2.43	Device IP lock address byte1 (MSB) (required only for IPNet Interface)
44/INTEGER	IPLockByte2'0..255	2.1.1.1.2.44	Device IP lock address byte2 (required only for IPNet Interface)
45/INTEGER	IPLockByte3'0..255	2.1.1.1.2.45	Device IP lock address byte3 (required only for IPNet Interface)
46/INTEGER	IPLockByte4'0..255	2.1.1.1.2.46	Device IP lock address byte4 (LSB) (required only for IPNet Interface)
47/INTEGER	N1Size'N1Off=0,Size2=2,Size4=4, Size8=8,Size16=16	2.1.1.1.2.47	N+1 Array Size
48/INTEGER	N1Address'1..16	2.1.1.1.2.48	N+1 Priority Address
49/INTEGER	N1AutoGain'Off=0,On=1	2.1.1.1.2.49	N+1 Auto Gain Option
50/INTEGER	Reserved	2.1.1.1.2.50	Reserved

Table 13: SNMP Threshold Values

thresholdIndex /thresholdValue	thresholdTextValue	Value OID 1.3.6.1.4.1.20712...	Description
1/INTEGER	ForwardRFPower(dBmx10)'0..800	2.1.2.1.2.1	Current value of forward RF power
2/INTEGER	ReflectedRFPower(dBmx10)'0..800	2.1.2.1.2.2	Current value of reflected RF power
3/INTEGER	SSPADCCurrent(Ampx10)'0..10000	2.1.2.1.2.3	SSPA DC current consumption
4/INTEGER	PS1Voltage(Voltx10)'0..200	2.1.2.1.2.4	Power Supply 1 output voltage
5/INTEGER	PS2Voltage(Voltx10)'0..200	2.1.2.1.2.5	Power Supply 2 output voltage

6/INTEGER	Booster1Voltage(Voltx10)'0..320	2.1.2.1.2.6	Booster 1 output voltage
7/INTEGER	Booster2Voltage(Voltx10)'0..320	2.1.2.1.2.7	Booster 2 output voltage
8/INTEGER	SSPACoreTemperature(C)'-100..100	2.1.2.1.2.8	SSPA core temperature
9/INTEGER	N1FwdRFPower(RFunitsx1)'0..10000	2.1.2.1.2.9	N+1 System Forward Power
10/INTEGER	N1SystemGain(dBx10)'500..900	2.1.2.1.2.10	N+1 System Linear Gain
11/INTEGER	N1RefRFPower(RFunitsx1)'0..10000	2.1.2.1.2.11	N+1 System Reflected Power
12/INTEGER	N1CabinetTemp(C)'-100..100	2.1.2.1.2.12	N+1 Cabinet Temperature

Table 14: SNMP Condition Values

conditionIndex /conditionValue	conditionTextValue	Value OID 1.3.6.1.4.1.20712...	Description
1/INTEGER	SummaryFault'NoFault=0,Fault=1	2.1.3.1.2.1	Summary fault state
2/INTEGER	PowerSupplyFault'NoFault=0,Fault=1	2.1.3.1.2.2	Power supply fault state
3/INTEGER	HighTemperatureFault'NoFault=0, Fault=1	2.1.3.1.2.3	High Temperature fault state
4/INTEGER	LowRegulatorVoltageFault'NoFault=0, Fault=1	2.1.3.1.2.4	Low Regulator voltage state
5/INTEGER	LowDCCurrentFault'NoFault=0 ,Fault=1	2.1.3.1.2.5	Low DC Current fault state
6/INTEGER	AuxiliaryFault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.6	Auxiliary fault state
7/INTEGER	BUCFault'NoFault=0,Fault=1,N/A=2	2.1.3.1.2.7	BUC fault state
8/INTEGER	Module1Fault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.8	Module1 summary fault state
9/INTEGER	Module2Fault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.9	Module2 summary fault state
10/INTEGER	Module3Fault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.10	Module3 summary fault state
11/INTEGER	Module4Fault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.11	Module4 summary fault state
12/INTEGER	CoolingFanFault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.12	Cooling fan fault state
13/INTEGER	LowForwardRFFault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.13	Low forward RF fault state
14/INTEGER	HighReflectedRFFault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.14	High reflected RF fault state
15/INTEGER	RFSwitch1Position'Fault=1, N/A=2,Pos1=3,Pos2=4	2.1.3.1.2.15	RF switch 1 position /fault state
16/INTEGER	RFSwitch2Position'Fault=1, N/A=2,Pos1=3,Pos2=4	2.1.3.1.2.16	RF switch 2 position /fault state
17/INTEGER	FaultsPortbyte1'0..255	2.1.3.1.2.17	Faults on logic port 1 raw data
18/INTEGER	FaultsPortbyte2'0..255	2.1.3.1.2.18	Faults on logic port 2 raw data
19/INTEGER	IOBoardHardwareID'0..255	2.1.3.1.2.19	I/O Board hardware revision
20/INTEGER	DigitalCoreBoardID'0..255	2.1.3.1.2.20	Digital Core board hardware revision
21/INTEGER	UnitStandbyState'Online=0, Standby=1	2.1.3.1.2.21	Current unit redundancy state
22/INTEGER	Reserved'0..255	2.1.3.1.2.22	Reserved for factory use only
23/INTEGER	N1UnitState'Slave=0, Master=1,N1Off=2	2.1.3.1.2.23	Unit N+1 state

24/INTEGER	ExtFanFault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.24	N+1 Cabinet Impeller Fault
25/INTEGER	N1SysFaults'0..16	2.1.3.1.2.25	Number of SSPA faults in N+1 system
26/INTEGER	SelectedAtten(dBx10)'0,,200	2.1.3.1.2.26	Actual SSPA attenuator value
27/INTEGER	Reserved'0..255	2.1.3.1.2.27	Reserved for factory use only
28/INTEGER	Reserved'0..255	2.1.3.1.2.28	Reserved for factory use only
29/INTEGER	PreAmpFault'NoFault=0, Fault=1,N/A=2	2.1.3.1.2.29	Pre-Amplifier Fault

Configuring SSPA to Work with SNMP Protocol

Set up the unit IP Address. Select the following sequence from the SSPA Front Panel:

1. Tap the Home icon to return to the Main Menu;
2. Tap the Communication button;
3. Tap the IP Setup button;
4. Tap the IP Address button;
5. Input the unit IP address. Tap the OK button when complete.

Set up the unit Gateway Address. Select the following sequence from the touchscreen:

1. Tap the Home icon to return to the Main Menu;
2. Tap the Communication button;
3. Tap the IP Setup button;
4. Tap the Gateway button;
5. Input the unit Gateway address. If no gateway is needed, set the address to 0.0.0.0. Tap the OK button when complete.

Set up the unit Subnet Mask. Select the following sequence from the touchscreen:

1. Tap the Home icon to return to the Main Menu;
2. Tap the Communication button;
3. Tap the IP Setup button;
4. Tap the Subnet button;
5. Input the Subnet Mask address. Tap the OK button when complete.

Set up the unit Community Set and Community Get strings. Select the following sequence from the touchscreen:

1. Tap the Home icon to return to the Main Menu;
2. Tap the Communication button;
3. Tap the SNMP Setup button;
4. Tap the Community Get or Community Set button;
5. Enter the unit community strings information. Tap the OK button when complete.

Set up the unit interface to SNMP. Select the following sequence from the touchscreen:

1. Tap the Home icon to return to the Main Menu;
2. Tap the Interface button;
3. Tick the SNMP checkbox;
4. Restart the unit by cycling power or by selecting the Reset option from the front panel menu.

SNMP protocol now is set and ready to be used.

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/software/forenduser/#7.

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 12) and then click the Start button.
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 13).
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 14.

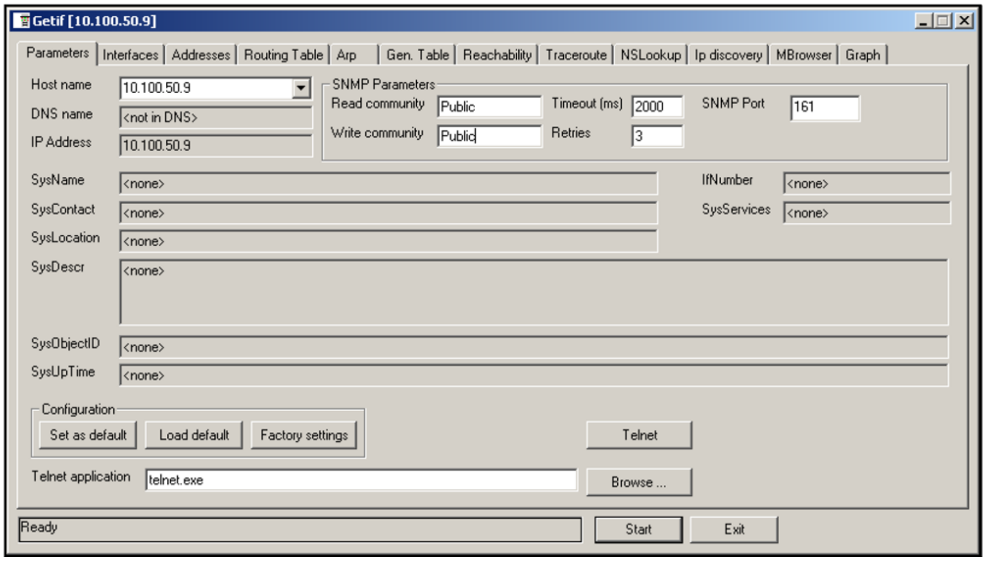


Figure 12: GetIF Application Parameters Tab

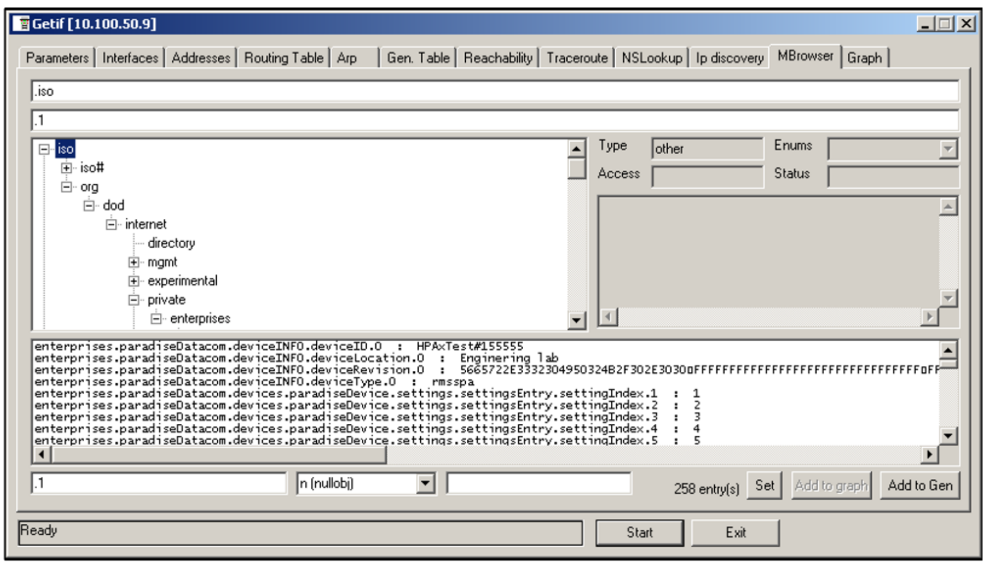


Figure 13: GetIf MBrowser Window

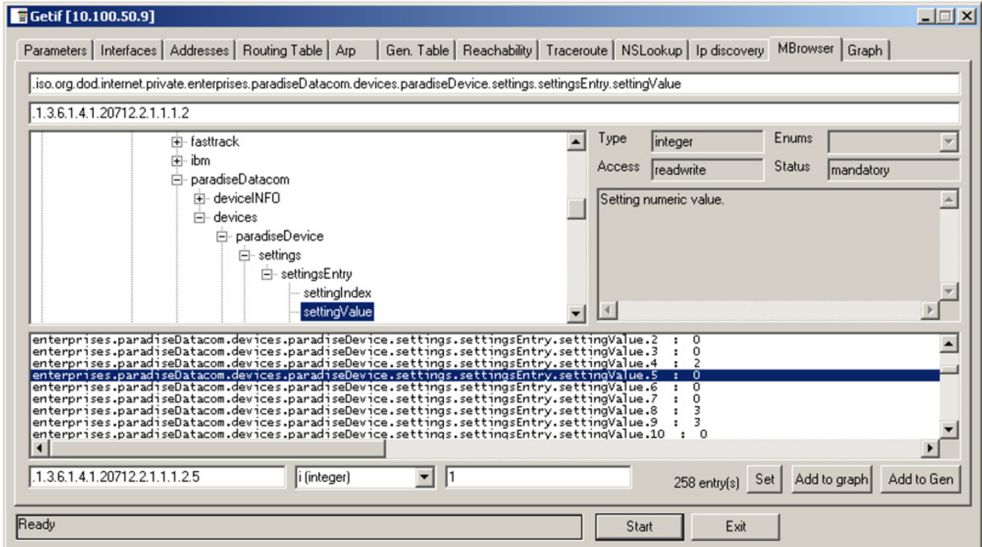


Figure 14: GetIf MBrowser Window, Assign settingValue.5 to a Value of '1'

Extended SNMP Operation

The SSPA 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.

Extended SNMP MIB Tree

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

```
+--paradiseDeviceB(3)
|
+--paradiseDeviceC(4)
|
+--modem(5)
```

Extended SNMP MIB Tree Elements in Detail

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

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

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

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

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

deviceTrappedConditionValue -- Condition value trapped by deviceConditionTrap;

deviceManagerIP -- Trap recipient IP address;

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

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

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

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

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

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

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

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

Teledyne Paradise Datacom
Drawing Number 216512-11 Revision B
ECO 18951
Last Modified: 11 June 2020

THIS PAGE LEFT INTENTIONALLY BLANK

System Controllers with Touchscreen, Remote Control Interface

Teledyne Paradise Datacom
Drawing Number: 216351-6 Revision A
ECO 18940
01 May 2020

Overview

A system which includes a system controller can be managed from a remote computer over a variety of remote control interfaces (see Figure 1).

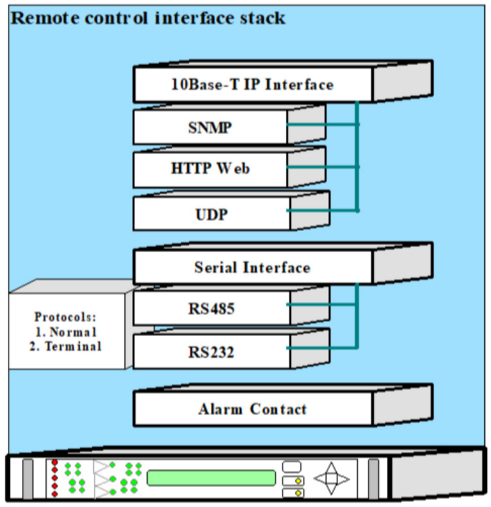


Figure 1: Remote Control Interface Stack

The parallel port on the unit provides a simple form of remote control. There are 10 Form C relay contacts for remote monitoring. There are six opto-isolated inputs for remote control commands. To enable the remote parallel interface, select Remote on the front panel Local/Remote key. When in Remote mode, all front panel commands are disabled with the exception of the Local/Remote key. See the **Remote Control - Parallel** section.

The serial interface supports both RS-232 and RS-485 standards. The control protocol supports two formats:

• Normal serial protocol, as detailed in the **Serial Communication** section;

• ASCII-based protocol, suitable for HyperTerminal applications (see the **Terminal Mode Serial Protocol** section).

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 - UDP encapsulated Normal serial protocol;
- SNMP V1 with support of SNMP traps;
- HTTP web interface

Serial protocol format is set at no parity, 8 bit with 1 stop bit. Baud rate is selectable through the front panel.

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

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

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

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

Table 1 shows a list of enabled interfaces depending on chosen interfaces setting.

Table 1: Interfaces Enabled Based on Chosen Interface Setting Selection

Interface Selection	Supported Serial Interface	Supported IP Interfaces
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.

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

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.

Remote Control - Parallel

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 2. The form C relay contact outputs are listed in Table 2.

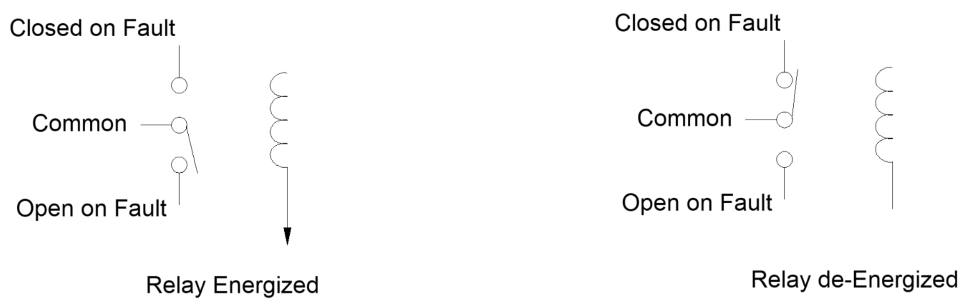


Figure 2: Parallel I/O Form C Relay

Control Inputs

The parallel control inputs are opto-isolated inputs with pull up resistors. To trigger a remote input command, the input should be pulled to ground. The input does not need to be held to ground continuously but it is acceptable to do so. The input only need be pulled low for a minimum of 20 msec. For example, to make amplifier #2 the standby amplifier, pulse pin 36 to ground for 20 msec. If the operator then chooses to make amplifier #1 the standby amplifier, simply pulse pin 37 to ground for 20 msec. The schematic representation of the control input is shown in Figure 3.

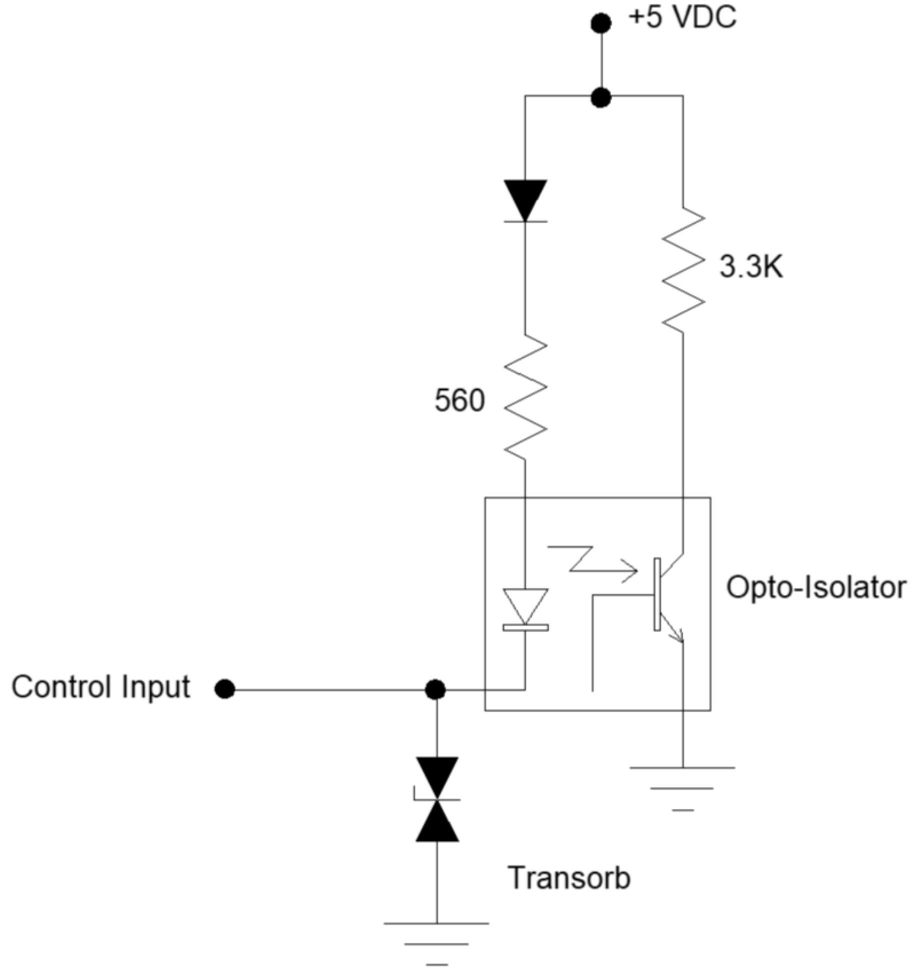


Figure 3: Opto-isolated Parallel I/O Input

The external alarm and auxiliary alarm inputs use the same opto-isolated input circuitry shown in Figure 3.

Serial Communication

This section describes the normal communication protocol between the controller and a host computer over RS232/RS485 serial interface. Serial port settings on host computer must be configured for 8-bit data at no parity, with 1 stop bit. Baud rate should match selected baud rate parameter on unit.

The unit will only respond to properly formatted protocol packets. Figure 4 shows the basic communication packet. It consists of a Header, Data, and Trailer sub-packet.

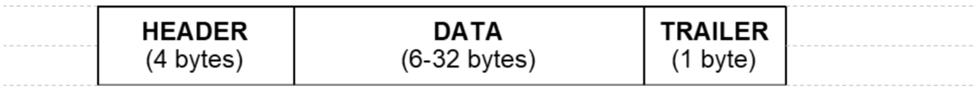


Figure 4: Basic Serial Communication Packet

Header Packet

The Header packet is divided into three sub-packets which are the Frame Sync, Destination Address, and Source Address packets, as shown in Figure 5.

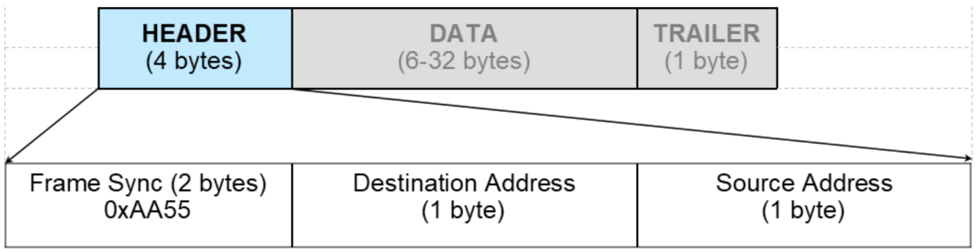


Figure 5: Header Sub-Packet

Frame Sync Word

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

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 or 0xAA. 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 unit will reply with its unique address.

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.

Data Packet

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

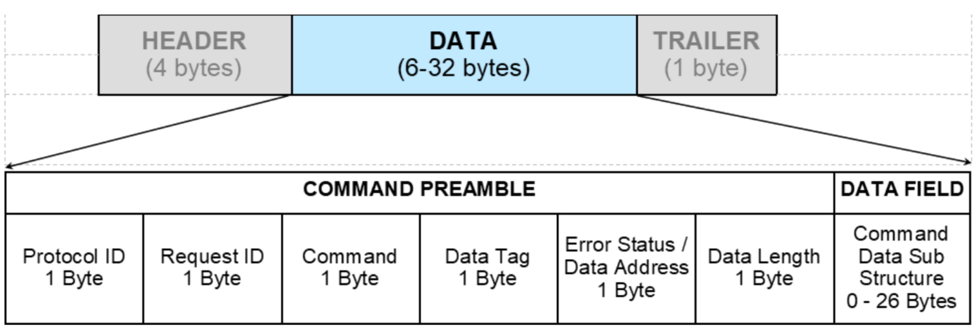


Figure 6: Data Sub-Packet

Protocol ID

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

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.

Command

The RCP2 protocol is a table based protocol. It allows the user to view and modify data tables located on the controlled device. Throughout the remainder of this description, "sender" will refer to the host PC, and "receiver" will refer to the unit.

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

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

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

The byte value for each command is given in Table 2.

Table 2: Command Byte Values

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

Data Tag

The controller internal structure is organized in several tables, all of which share similar functionality and internal resources. To access the various tables, the data tag must be specified in the request frame. The data associated with certain tags is read only. Therefore only the "Get" command request would be allowed to access these data tags. The controller will return an error on attempts to issue a "Set" request to a read-only table tag. Various tables may contain values formatted either in 1 or 2 bytes format. The data tag byte values are given in Table 3.

Table 3: Data Tag Byte Values

Tag Name	Data Tag Byte Value	Min. Valid Length of Data Field	Description
Systems Settings Tag	0	1 Byte	This tag allows accessing various system settings on remote unit. Host access status: Full Read/Write access. Settings can be modified at any time. Some of the settings may require hardware reset of the remote unit.
System Thresholds Tag	1	2 Bytes	This tag allows access to the critical unit thresholds. Host access status: Tag have read only status.
System Conditions Tag	3	1 Byte	This tag allows access to the unit's internal conditions flags, such as fault status or current system status. Host access status: Read only. This type of the data can not be set or modified remotely.
ADC Channels Access Tag	4	2 Bytes	ADC legacy access. Don't use for new development
Reserved	6	N/A	This tag is reserved.
Reserved	2	N/A	This tag is reserved.
Reserved	5	N/A	This tag is reserved for factory use only.

Special Command Tag (v.6.00)	10	N/A	This tag is reserved for factory use only.

Data Address / Error Status / Local Port Frame Length

This field is a tag extension byte and specifies the first table element of the tagged data. If the Data Length is more than 1 byte, then all subsequent data fields must be accessed starting from the specified address. For example, if the requestor wants to access the amplifier's unique network address, it should set data tag 0 (System settings tag) and data address 8 (see Table 7, System Settings Details table). If the following Data Length field is more than 1, then all subsequent Settings will be accessed after the Unique Network Address.

⚠ **Important! In any response frame, the Data Address field is replaced with the Error Status information. The various error codes are given in Table 4.**

Table 4: Error Status Byte Values

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

Data Length

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

Data Field

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

Trailer Packet

The trailer component contains only one byte called the Frame Check Sequence. This field provides a checksum during packet transmission. See Figure 7.

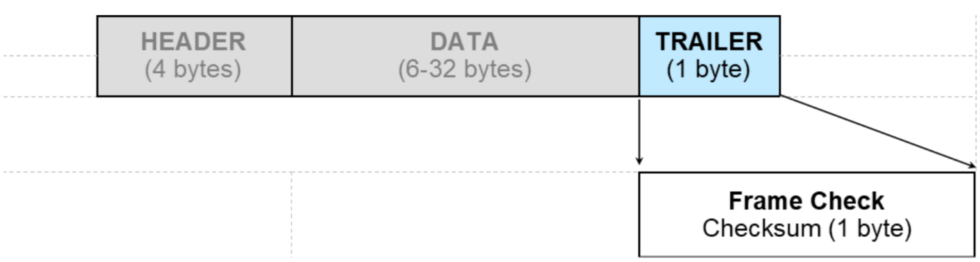


Figure 7: Trailer Sub-Packet

Frame Check Sequence

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
```

Timing Issues

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

Serial Communications Protocol

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

Table 5: Request Frame Structure

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

Table 6: Response Frame Structure

Byte	Tag	Description
1	0xAA	Frame Sync 1
2	0x55	Frame Sync 2
3	Destination Address	-// -
4	Source Address	-// -
5	Protocol Version	Protocol Compatibility Byte, must be set 0
6	Request ID	Service Byte
7	Command	2 = Set Response; 3 = Get Response
8	Data Tag	0 = System Settings; 1 = System Thresholds; 2 = Reserved; 3 = Conditions; 4 = ADC Data; 5 = Reserved
9	Error Status	0 = No Errors, 1 = Too Big, 2 = No Such Data, 3 = Bad Value, 4 = Read Only, 5 = Bad Checksum; 6 = Unrecognized Error
10	Data Length	Total length of the data, valid values: 1 - 10
11+N	Data	Actual Data
11+N+1	Checksum	Destination Address + Source Address + Protocol Version + Request ID + Command + Data Tag + Data Address + Data Length + Data

Table 7: System Settings Data Values

Data Address	# Bytes	Description	Limits and Byte Values
1	1	System Configuration	0 = 1:2 Controller; 1 = 1:1 Controller; 2 = 1:1 Phase combine; 3 = Dual 1:1 Controller; 4 = Maintenance Mode; 5 = 1:2 Phase combine (v. 6.00)
2	1	Switching Mode	0 = Auto Mode; 1 = Manual Mode; 2 = Lock Mode (v. 6.00)
3	1	Control Mode	0 = Local; 1 = Remote

4	1	Reserved	N/A
5	1	Priority Select	0 = Pol1; 1 = Pol2
6	1	Communication Protocol *	0 = Normal; 1 = Terminal (v. 4.00)
7	1	Baud Rate *	0 = 9600; 1 = 2400; 2 = 4800; 3 = 19200; 4 = 38400
8	1	Unique network address	Valid values: 0 - 255
9	1	Type of Serial Interface *	0 = RS232; 1 = RS485; 2 = IPnet; 3 = SNMP (v. 4.00)
10	1	Type of Fault Monitoring	0 = SSPA only; 1 = LNA only; 2 = Both; 3 = SSPA Com Faults (v. 6.00)
11	1	Auxiliary Fault Monitoring	0 = Enable non-switching faults; 1 = Ignore; 2 = Enable non-switching faults, inverted logic; 3 = Enable switching faults (v. 6.00); 4 = Enable switching faults, inverted logic (v. 6.00)
12	1	RF Switch Monitoring	0 = Major Fault; 1 = Alert Only; 2 = Alternate (v. 3.30)
13	1	Fault Latching	0 = Latch Enable; 1 = Latch Disable
14	1	Fault Window	0 = 20%; 1 = 8%; 2 = 12%, 3 = 15%
15	1	Fault Logic	0 = Fault on Low; 1 = Fault on High
16	1	User Password	Valid Values=0 to 255
17	1	Amplifier Standby Configuration	0 = Amplifier 2 on Standby (default); 1 = Amplifier 1 on Standby; 2 = Amplifier 2 on Standby; 3 = Amplifier 3 on Standby
18	1	Buzzer	0 = Enable Buzzer; 1 = Disable Buzzer
19	1	Password Protection	0 = Protection Off; 1 = Protection On
20	1	System Type	0 = None; 1 = Compact Outdoor; 2 = Rack Mount; 4 = vBUC; 5 = SystemX; 6 = PowerMAX (v. 6.00)
21	1	RF Power Units	0 = Measure RF in dBm; 1 = Measure RF in Watts (v. 3.50)
22	1	Reserved	N/A
23	1	LNA/LNB PS Output Voltage	0 = Low range 13V, 900 mA; 1 = High range 17V, 900 mA; 2 = High Power Range 24V, 0.9A/1.5A (Standard/HP version only)
24	1	Standby Mode	0 = Hot Standby; 1 = Cold Standby (v. 6.00)
25	1	Mute State	0 = Mute On; 1 = Mute Pol1 (1:2 only) (v. 6.15); 2 = Mute Pol2 (1:2 only) (v 6.15); 255 = Mute Off
26	1	Remote SSPA Attenuation	Valid Values= 0 to 255 (v. 3.10 dBx10 value)
27	1	Switch Mute	0 = Off; 1 = Internal; 2 = External; 3 = All on (v. 3.30)
28	1	Fault Tolerance	0 = Disabled; 1 = One Fault; 2 = Two Faults (v. 3.70)
29-32	4	IP Address (MSB - LSB) *	Settings required for normal operation of IP interface. Consult network administrator for a proper setup. All settings physically located on the RCP unit. Changes to these settings effective only after controller restart. (v. 4.00)
33-35	4	IP Gateway (MSB - LSB) *	Settings required for normal operation of IP interface. Consult network administrator for a proper setup. All settings physically located on the RCP unit. Changes to these settings effective only after controller restart. (v. 4.00)
36-40	4	IP Subnet Mask (MSB - LSB) *	Settings required for normal operation of IP interface. Consult network administrator for a proper setup. All settings physically located on the RCP unit. Changes to these settings effective only after controller restart. (v. 4.00)
41-42	2	Receive IP Port (MSB - LSB) *	Settings required for normal operation of IP interface. Consult network administrator for a proper setup. All settings physically located on the RCP unit. Changes to these settings effective only after controller restart. (v. 4.00)
43-46	4	IP Lock Address (MSB - LSB) *	Settings required for normal operation of IP interface. Consult network administrator for a proper setup. All settings physically located on the RCP unit. Changes to these settings effective only after controller restart. (v. 4.00)

47-49	3	Individual SSPA Unit Attenuation Offset. Sum of Offset value and Remote SSPA Attenuation value (Data Address 26) must be ≤ 20	Valid Values= 0 to 255 (v. 4.20)
		* Requires hardware reset	

Table 8: System Condition Data Values

Data Address	# Bytes	Description	Limits and Byte Values
1	1	Unit 1 Fault State	0 = No Fault; 1 = Fault; 2 = Ignored
2	1	Unit 2 Fault State	0 = No Fault; 1 = Fault; 2 = Ignored
3	1	Unit 3 Fault State	0 = No Fault; 1 = Fault; 2 = Ignored
4	1	Summary Fault	0 = No Fault; 1 = Fault
5	1	Power Supply 1 Fault State	0 = No Fault; 1 = Fault
6	1	Power Supply 2 Fault State	0 = No Fault; 1 = Fault
7	1	Auxiliary Input Fault State	0 = No Fault; 1 = Fault; 2 = Ignored
8	1	External Port State	Bit 0-2 = SSPA Input lines; Bit 3-8 = Auxiliary Input lines
9	1	LNA Faults	Bit 0 = 1, Faults enabled; Bit 0 = 0, Faults disabled; Bit 1 = 1, Unit 1 Fault; Bit 2 = 1, Unit 2 Fault; Bit 3 = 1, Unit 3 Fault; Bits 1-3 = 0, No Fault
10	1	SSPA Faults	Bit 0 = 1, Faults enabled; Bit 0 = 0, Faults disabled; Bit 1 = 1, Unit 1 Fault; Bit 2 = 1, Unit 2 Fault; Bit 3 = 1, Unit 3 Fault; Bits 1-3 = 0, No Fault
11	1	RF Switch 1 Position	1= Switch Fault; 2 = Switch Ignore; 3 = Position 1; 4 = Position 2
12	1	RF Switch 1 Position	1= Switch Fault; 2 = Switch Ignore; 3 = Position 1; 4 = Position 2
13-14	2	Forward RF Power (available only with systems equipped with Forward RF power meter)	If Setting RF Power Units = 0, Value x 10dBm; If Setting RF Power Units = 1, Value x 10 W; (See Table 7, Data Address 21 for details) (-100 for N/A (0xFF9C)); Low Byte First (v. 3.10)
15-16	2	Ambient Temperature (in °C) (available only with systems equipped with Forward RF power meter)	Value x 1 °C; N/A=0xFF9C (if parameter is not available at present time); Low Byte First (v. 3.10)
17-18	2	Core Temperature of SSPA Unit 1 (available only with systems with remote SSPA control enabled)	Value x 1 °C; N/A=0xFF9C (if parameter is not available at present time); Low Byte First (v. 3.10)
19-20	2	Core Temperature of SSPA Unit 2 (available only with systems with remote SSPA control enabled)	Value x 1 °C; N/A=0xFF9C (if parameter is not available at present time); Low Byte First (v. 3.10)
21-22	2	Core Temperature of SSPA Unit 3 (available only with systems with remote SSPA control enabled)	Value x 1 °C; N/A=0xFF9C (if parameter is not available at present time); Low Byte First (v. 3.10)
23-24	2	Reflected RF Power (available only with systems equipped with Reflected RF power meter)	If Setting RF Power Units = 0, Value x 10dBm; If Setting RF Power Units = 1, Value x 10 W; (See Table 7, Data Address 21 for details) (-100 for N/A (0xFF9C)); Low Byte First (version 3.30)
25-26	2	DC Current (Unit 1 in Amps)	Value x 10 Amp; N/A=0XFF9C; Low Byte First (v. 3.60)
27-28	2	DC Current (Unit 2 in Amps)	Value x 10 Amp; N/A=0XFF9C; Low Byte First (v. 3.60)
29-30	2	DC Current (Unit 3 in Amps)	Value x 10 Amp; N/A=0XFF9C; Low Byte First (v. 3.60)
31-32	2	Forward RF Power (Unit 1 in dBm)	Value x 10 dBm; N/A=0XFF9C; Low Byte First (v. 3.60)
33-34	2	Forward RF Power (Unit 2 in dBm)	Value x 10 dBm; N/A=0XFF9C; Low Byte First (v. 3.60)
35-36	2	Forward RF Power (Unit 3 in dBm)	Value x 10 dBm; N/A=0XFF9C; Low Byte First (v. 3.60)

Table 9: System Threshold Data Values

Data Address	# Bytes	Description	Limits and Byte Values
1	2	LNA Unit 1 Calibration Data	Point conversion: 0.57 mA per 1 value increment, maximum value =4095 (2.3A) (read/write)
2	2	LNA Unit 2 Calibration Data	Point conversion: 0.57 mA per 1 value increment, maximum value =4095 (2.3A) (read/write)
3	2	LNA Unit 3 Calibration Data	Point conversion: 0.57 mA per 1 value increment, maximum value =4095 (2.3A) (read/write)
4	2	LNA Unit 1 DC Current	Point conversion: 0.57 mA per 1 value increment, maximum value =4095 (2.3A) (v6.00) (read only)
5	2	LNA Unit 2 DC Current	Point conversion: 0.57 mA per 1 value increment, maximum value =4095 (2.3A) (v6.00) (read only)
6	2	LNA Unit 3 DC Current	Point conversion: 0.57 mA per 1 value increment, maximum value =4095 (2.3A) (v6.00) (read only)
7	2	LNA Unit 1 DC Voltage	Point conversion: 0.1 V per 1 value increment, maximum value =1023 (v6.00) (read only)
8	2	LNA Unit 2 DC Voltage	Point conversion: 0.1 V per 1 value increment, maximum value =1023 (v6.00) (read only)
9	2	LNA Unit 3 DC Voltage	Point conversion: 0.1 V per 1 value increment, maximum value =1023 (v6.00) (read only)
10	2	PS1 DC Voltage	Point conversion: 0.1 V per 1 value increment, maximum value =1023 (v6.00) (read only)
11	2	PS2 DC Voltage	Point conversion: 0.1 V per 1 value increment, maximum value =1023 (v6.00) (read only)
12	2	RCP Chassis Temperature	Value x 1 °C (v6.00) (read only)

Examples

This section contains several examples of serial data exchange between a host computer and an RCP 1:2 Redundant Controller. All byte values are given in hexadecimal format. The following controller and system switch positions are used throughout all examples.

```
RCP2-1200 Network Address = 0
Host Computer Network Address = 0xA
Request ID = 0x6F


Amplifier Status
  Amplifier #1= OK
  Amplifier #2= Faulted
  Amplifier #3= OK


Power Supply Status
  Power Supply #1=OK
  Power Supply #2=OK


Auxiliary Fault Inputs = Faulted


RF Switch Status
  Switch #1 Position = Position 1
  Switch #2 Position = Undetermined or Faulted
```

Example 1

The host computer requests the RCP system conditions. The RCP detects no errors in the request frame and issues a response. The PC request string is listed below.

Table 10: Example 1: PC Requests RCP System Conditions

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	0	Destination Address of RCP unit
4	A	Source address of Request originating PC Host
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Request ID byte is set by originator, will be echoed back by respondent
7	1	Command field for "Get" type request
8	3	"System Conditions" tag indicates which data from respondent required in response frame
9	1	Data Address field indicates the beginning data address inside of the "System Conditions" data set to 1 (first element)
10	C	Data Length field indicates how many data bytes of the "System Conditions" requested from RCP2 (12 (C) is all available data of "System Conditions" type)
11	8A	Arithmetic checksum of bytes number 3 through 10

The RCP replies with the following response string.

Table 11: Example 1: RCP Response (System Conditions)

Byte Position	Byte Value (Hex)	Description

1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	A	Destination Address of PC request originator
4	0	Source address of RCP respondent
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Echo of the Originator's Request ID byte
7	3	Command field for "Get" type response
8	3	"System Conditions" tag indicates which data from respondent included in response frame.
9	0	Data Address field omitted and replaced with Error status code. 0 in this field indicates absence of errors.
10	C	Data Length field indicates how many data bytes of the "System conditions" requested from RCP (12 (C) is all available data of "System Conditions" type).
11	0	Data field 1 contains data element 1 of "System Conditions" data type, which is RCP System Unit1 Fault State. 0 Indicates that Unit 1 is not faulted.
12	1	Data field 2 contains data element 2 of "System Conditions" data type, which is RCP System Unit2 Fault State. 1 Indicates that Unit 2 is in fault condition.
13	0	Data field 3 contains data element 3 of "System Conditions" data type, which is RCP System Unit3 Fault State. 0 Indicates that Unit 3 is not faulted.
14	1	Data field 4 contains data element 4 of "System Conditions" data type, which is RCP System Summary Fault State. 1 Indicates presence of faults in the system.
15	0	Data field 5 contains data element 5 of "System Conditions" data type, which is RCP System Power Supply 1 Fault State. 0 Indicates that Power supply 1 is not faulted and functioning properly.
16	0	Data field 6 contains data element 6 of "System Conditions" data type, which is RCP System Power Supply 2 Fault State. 0 Indicates that Power supply 2 is not faulted and functioning properly.
17	1	Data field 7 contains data element 7 of "System Conditions" data type, which is RCP System Auxiliary Fault State. 1 Indicates presence of faults on one of the Auxiliary Inputs.
18	FF	Data field 8 contains data element 8 of the "System Conditions" data type. This data element is reserved for future applications.
19	FF	Data field 9 contains data element 9 of the "System Conditions" data type. This data element is reserved for future applications.
20	FF	Data field 10 contains data element 10 of the "System Conditions" data type. This data element is reserved for future applications.
21	3	Data field 11 contains data element 11 of the "System Conditions" data type, which is RF Switch 1 state. 3 Indicates that RF Switch 1 is in Position 1.
22	1	Data field 12 contains data element 12 of the "System Conditions" data type, which is RF Switch 2 state. 1 Indicates that RF Switch 2 is has a fault condition or its position can't be reliably determined.
23	8F	Arithmetic checksum of bytes number 3 through 22

Example 2

The host computer requests the RCP system thresholds. The request string is:

Table 12: Example 2: PC Requests RCP System Thresholds

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	0	Destination Address of RCP unit
4	A	Source address of Request originating PC Host

5	0	Protocol Version Compatibility Field must always be 0
6	6F	Request ID byte is set by originator, will be echoed back by respondent
7	1	Command field for "Get" type request
8	1	"System Thresholds" tag indicates which data from respondent required in response frame
9	1	Data Address field indicates the beginning data address inside of the "System Conditions" data set to 1 (first element)
10	6	Data Length field indicates how many data bytes of the "System Thresholds" requested from RCP2 (6 is all available data of "System Thresholds" type)
11	82	Arithmetic checksum of bytes number 3 through 10

The RCP replies with the following response string:

Table 13: Example 2: RCP Response (System Thresholds)

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	A	Destination Address of PC request originator
4	0	Source address of RCP respondent
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Echo of the Originator's Request ID byte
7	3	Command field for "Get" type response
8	1	"System Thresholds" indicates which data from respondent is included in response frame
9	0	Data Address field omitted and replaced with Error status code. 0 = no errors.
10	6	Data Length field indicates how many data bytes "System Thresholds" requested from RCP (6 is all available data of "System Thresholds" type)
11	D1	Data field 1 contains least significant byte of data element 1 of "System Thresholds" data type, which is LNA 1 cal. point
12	0	Data field 2 contains most significant byte of data element 1 of "System Thresholds" data type, which is LNA 1 cal. point. Data can be normalized to LNA current as follows: Lna1calpoint * 0.57mA/point = 209*0.57 = 119.13 mA
13	F	Data field 3 contains least significant byte of data element 2 of "System Thresholds" data type, which is LNA 2 cal. point
14	0	Data field 4 contains most significant byte of data element 2 of "System Thresholds" data type, which is LNA 2 cal. point. Data can be normalized to LNA current as follows: Lna1 cal point * 0.57mA/point = 216*0.57 = 123.12 mA
15	DC	Data field 5 contains least significant byte of data element 3 of "System Thresholds" data type, which is LNA3 cal. point.
16	0	Data field 6 contains most significant byte of data element 2 of "System Thresholds" data type, which is LNA 3 cal. Point. Data can be normalized to LNA current as follows: Lna1 cal point * 0.57mA/point = 220*0.57 = 125.4 mA
17	8	Arithmetic checksum of bytes number 3 through 16

Example 3

The host computer requests the RCP network address. The PC request string is listed below.

Table 14: Example 3: PC Requests RCP Network Address

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1

2	55	Frame Sync Byte 2
3	FF	Destination Address is broadcast network address
4	A	Source address of Request originating PC Host
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Request ID byte is set by originator, will be echoed back by respondent
7	1	Command field for "Get" type request
8	0	"System Settings" tag indicates which data from respondent required in response frame
9	8	Data Address field indicates the address of the RCP2's network address inside "System Settings" data set to 8
10	1	Data Length field indicates how many data bytes "System Settings" requested from RCP (1 byte requested)
11	82	Arithmetic checksum of bytes number 3 through 10

The RCP replies with the following response string.

Table 15: Example 3: RCP Response (Network Address)

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	A	Destination Address of PC request originator
4	0	Source address of RCP respondent
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Request ID byte is set by originator, will be echoed back by respondent
7	3	Command field for "Get" type of the response
8	0	"System Settings" indicates which data from respondent is included in response frame
9	0	Data Address field omitted and replaced with Error status code. 0 in this field indicates absence of errors
10	1	Data Length field indicates how many data bytes "System Settings" requested from RCP
11	0	Data field 1 contains data element 8 of "System Settings" data type. "Unique Network Address"=0
12	7D	Arithmetic checksum of bytes number 3 through 11

Example 4

The host computer requests the Priority be set to Polarity #2. The PC request string is listed below.

Table 16: Example 4: PC Requests RCP Priority Set to Polarity #2

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	0	Destination Address of RCP unit
4	A	Source address of Request originating PC Host
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Request ID byte is set by originator, will be echoed back by respondent
7	0	Command field for "Set" type request
8	0	"System Settings" indicates which data from respondent is required in response frame

9	5	Data Address field indicates the address of the RCP's Priority Select data element inside "System Settings" (data element 5)
10	1	Data Length field indicates how many data bytes of the "System Conditions" requested from RCP2 (1 byte requested)
11	1	Data Field 1. 1 Indicates that priority must be set to Pol2
12	7F	Arithmetic checksum of bytes number 3 through 11

The RCP replies with the following response string.

Table 17: Example 4: RCP Response (Priority Set Failed)

Byte Position	Byte Value (Hex)	Description
1	AA	Frame Sync Byte 1
2	55	Frame Sync Byte 2
3	A	Destination Address of PC request originator
4	0	Source address of RCP respondent
5	0	Protocol Version Compatibility Field must always be 0
6	6F	Echo of the Originator's Request ID byte
7	2	Command field for "Set" type response
8	0	"System Settings" indicates which data from respondent is included in response frame
9	2	Data Address field omitted and replaced with Error status code. 2 indicates "No such data" error
10	1	Data Length field indicates how many data bytes "System Settings" requested from RCP
11	0	Data field 1 contains rejected data
12	7E	Arithmetic checksum of bytes number 3 through 11

Terminal Mode Serial Protocol

The Teledyne Paradise Datacom RCP Redundant System Controller 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 RCP 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.

U.S. ASCII encoded character strings are used to represent commands and data messages. A remote terminal or controller initiates a communication session and the RCP takes action and returns a report of requested status. The controller will not initiate communication and will transmit data only when commanded to do so. Prior to establishing the session with the unit, this mode must be enabled through the front panel menu.

The remote terminal must be configured with serial settings that match the unit's serial port settings. For example, if the unit 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 unit 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 unit, the user must type "UNIT#XXX" in the terminal window (all letters must be in upper case), where XXX is the unit's unique network address or the global call address (255). Press the "Enter" key on Remote Terminal keyboard.

The unit should answer with words "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 unit'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: "Active Keys:(U)p+Enter;(D)own+Enter;(C)lrearFlt; (M)enu+Enter; (E)nd+Enter" will be the last transmission string on all informative menu screens. NOTE: All letters must be in upper case!

To refresh current screen on the Remote Terminal simply press "Enter" key. To end a session, press "E" and then the "Enter" key.

⚠ **Important! If multiple units are networked on the same serial link, DO NOT ESTABLISH A SESSION WITH MORE THAN ONE UNIT A TIME. If you do so you will not get a valid response!**

The following procedure will guide the user through the remote terminal setup, using the Windows 95/98 HyperTerminal software. The unit must be connected to a PC com port and configured to use TMSP with 9600 Baud rate prior to setting up the PC configurations.

Start the Windows HyperTerminal Program (default Windows location at Programs - Accessories - HyperTerminal).

Enter the name of your serial connection ("Compact Outdoor SSPA" for example), and then click "Ok" button. See Figure 8.

Figure 8: HyperTerminal Connection Description

Select direct connection to the PC communication port (Com1 for example), which meant to be used for communication with unit, and then click "OK" Button. See Figure 9.

Figure 9: HyperTerminal Communication Port Selection

In the next window, select the following as shown in Figure 10:

1. Set Bits per Second to 9600;
2. Set Data bits to 8;
3. Set Parity to None;
4. Set Stop bits to 1;
5. Set Flow control to none.
6. Click the "OK" button.

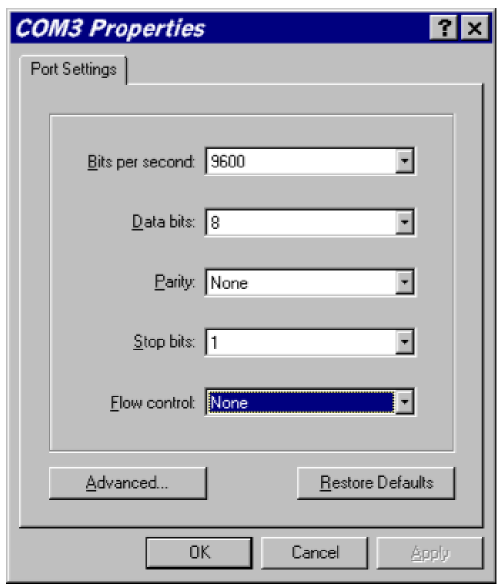


Figure 10: HyperTerminal Communication Properties

Normally, the unit will not echo back characters typed by the user in a Terminal window. For added security and convenience, turn on Local Echo in the HyperTerminal application. To do so, select the following from the HyperTerminal menu: File ? Properties ? Settings ? ASCII setup. This will bring up a window similar to that shown in Figure 11. In this window, check the box marked "Echo typed characters locally" and click "OK".

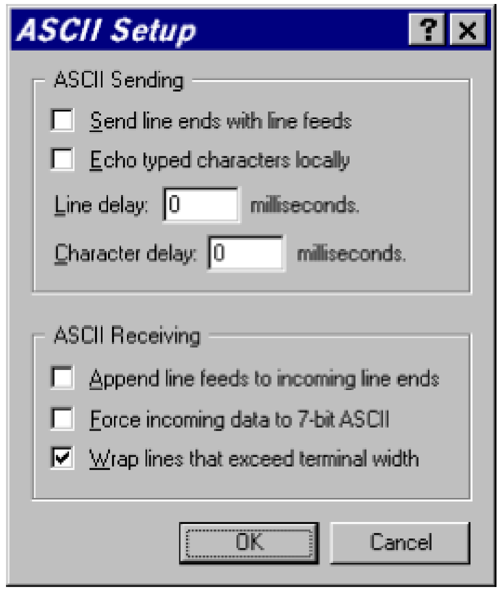


Figure 11: HyperTerminal ASCII Setup

⚠ **NOTE: Due to a software bug on some versions, this feature may not work. Do not use versions prior to 6.3. Download the latest version of HyperTerminal at http://www.hilgraeve.com.**

Your PC is now configured to work with the controller in Terminal mode. To establish a session with the controller, type "UNIT#170"

⚠ **Note: When using a RS-485 connection, avoid using the global address (170). Instead, use the unique RCP address.**

An example of a terminal mode session shown on Figure 12.

```
UNIT#101
Welcome! Unit#101 Online


PS1:Fault  System:Fault  SW1:Fault
PS2:Normal    Aux:Normal SW2:Fault
(B)ack; + EnterlrearFlt;(U)p;(D)own;(M)enu;(E)nd;D



Prtcl:Terminal Intrfc:RS232 Logic:Lo
 Baud:9600    SysAddr:101   Latch:Dis
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter

D

Track:Ext.   Ctrl:Local  Window(%):8%
Prior:Pol1   Mode:Manual    Buzzer:Dis
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter

D

LNA/LNB Faults:N/A   PS1Out(V):00.0
   SSPA Faults:None  PS2Out(V):28.4
Active Keys:(C)lrearFlt;(U)p;(D)own;(M)enu;(E)nd;(B)ack; + Enter
```

Figure 12: Terminal Mode Example

Ethernet Interface

Overview

The RCP2 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 Teledyne Paradise Datacom's Universal M&C software.
- SNMPv1 protocol - This protocol intended for integration into large corporate NMS architectures.
- HTTP Web interface - This interface is designed to allow platform independent remote control function for a single RCP2 unit.

In order to utilize either of the protocols listed above, the relevant interface option has to be turned on. Refer to the following sections:

- IPNET Interface
- SNMP Interface
- Web Interface

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

IPNet Interface

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 unit and controlling workstation when datagrams (packets) are exchanged.

Teledyne Paradise Datacom provides a Windows ®-based control application to establish UDP-based Ethernet communication with the unit. 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 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 RCP2 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. It is up to the user to select an appropriate pair of ports that are not conflicting with standard IP services. Teledyne Paradise Datacom recommends usage of ports 1007, 1038 and 1039. These ports are not assigned to any known application.

As an application layer protocol (which actually carries meaningful data), the standard RCP2 serial protocol was selected. This protocol proves to be extremely flexible and efficient. It is also media independent and can be easily wrapped into another protocol data frame. An example of the UDP frame with encapsulated Teledyne Paradise Datacom protocol frame is shown on Figure 13.

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

Figure 13: UDP Frame

This set of Ethernet IP protocols is currently supported by Teledyne Paradise Datacom Universal M&C package (RCP2/FPRC/RCPD selection). The software is available for download from the web site, http://www.paradisedata.com.

Setting IPNet Interface

All IP-related menu items are consolidated under the following menu: Tap the Home icon to return to the main menu screen; tap the Communication button; tap the IP Setup button.

Prior to enabling the Ethernet IP interface, the following IP parameters need to be set: IP Address, Gateway, Subnet Mask, Local Port and Lock IP Address. The Lock IP address is a security measure. Setting this parameter either to 0.0.0.0 or 255.255.255.255 will allow any host to control the unit. Setting the parameter to the specific address of the remote host will lock RCP2 access to this host. Packets received from other hosts will be ignored. For other parameters (IP Address, Gateway, Subnet Mask, Local Port) contact your network system administrator.

> ⚠ **Important! If you are planning to access the unit through the Internet, you must exercise the appropriate security measures. It is strongly recommended to put RCP2 units behind a protective Firewall or set up a VPN link for remote access.**

After selecting the IP parameters, you may turn on IP interfaces through front panel. Tap the Home icon to get to the main menu; tap the Communication button; tap the Interface button; tick the IPNET checkbox.

Once the Ethernet Interface is selected, the RS232/485 Main port is disabled. IP settings may be adjusted when the IPNet interface is turned on as needed without losing IP link. New settings will become effective only after a controller hardware reset or power cycle (Tap "Home" > "Options" > "System" > "Reset" > "Comms Only" > "OK" to confirm reset).

To disable the Ethernet port and enable the RS232/485 port, tap the Home icon to access the main menu; tap the Communication button; tap the Interface button; tick either the RS232 or RS485 checkbox.

> ⚠ **Important! At present, the controller supports one remote control protocol selection through its Ethernet interface port. This protocol is referred to as "Normal" on the front panel display. If the protocol selection is set to "Terminal", the controller will force its protocol selection to "Normal".**

The Ethernet port can be connected to a network hub through 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 controller, then press the Enter key. If the unit is successfully found on the network, the request statistic will be displayed.

```
PING XXX.XXX.XXX.XXX
```

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 controller match your network parameters. On a Windows-based PC you may also check ARP table entries. The new IP address of the unit 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 table will be displayed. If you see the unit 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 unit). Now try the PING command again. More information about how to set up a network connection with the unit can be found in the **Ethernet Interface Set-Up and Cabling** section.

Using the RCP2 Web Interface

Starting with firmware version 6.00, the RCP web interface no longer needs to have a pre-installed Java application to operate. The web interface uses 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 the controller internal web page, the user must make sure Web/IPNet interface is enabled on the device 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. Refer to the Setting IPNet Interface procedure of the **Remote Control Interface** section.

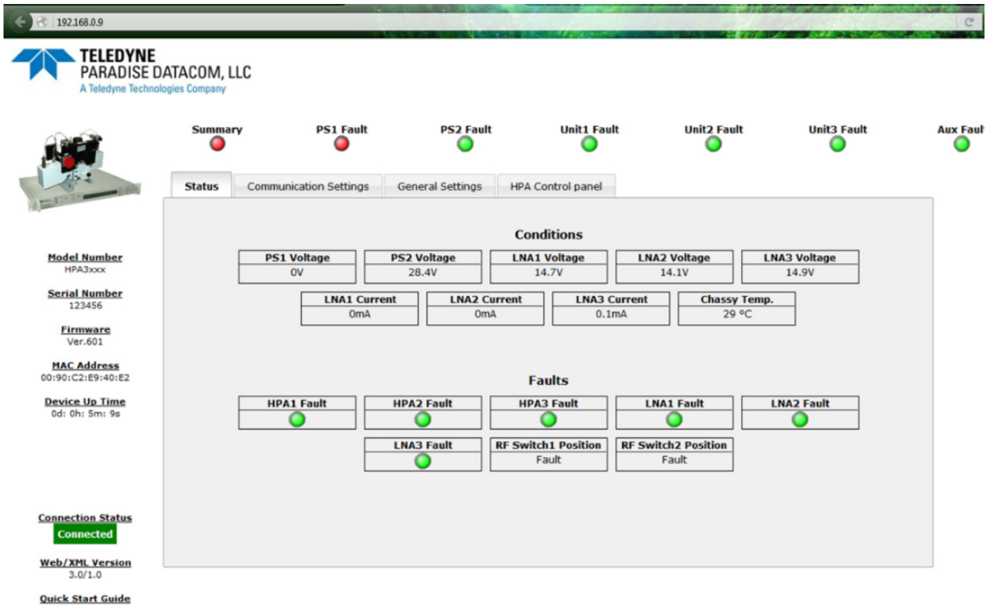


Figure 14: Web Interface Screen

Enter the 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 15. The User Name is fixed and cannot be changed by the operator.

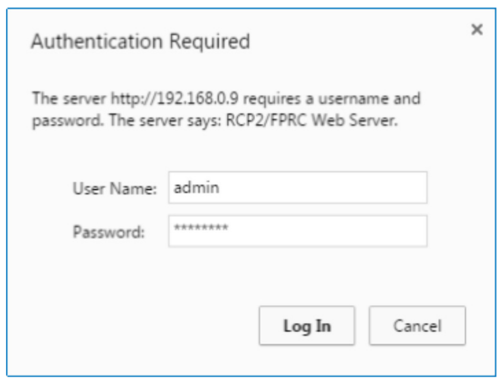


Figure 15: Web Interface Login Window

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 web browser (Figure 15).

To select another password, enter the following selection on the touchscreen: Tap the Home icon to return to the Main Menu; tap the Communication button; tap the Interface button; tick the IPNet checkbox; tap the IP Setup button; tap the Web Pwd button. Enter the new password using the keypad on the touchscreen. Tap the OK button to accept the entered password.

The top bar of RCP2 Monitor and Control application shows top level fault conditions: Power supply and unit faults as well as Auxiliary fault status.

The left side of the window displays unit model and serial number, firmware build, device MAC address and device up time since last I/O card power up or reboot. Additional information is displayed in multipage insert in the middle of the screen:

- Status: A view of all faults and operational parameters.
- Communication Settings: This tab provides access to all communication related settings. From here, the user can change the IP settings, Interface, Protocol, Baud Rate, Password and SNMP settings.
- General Settings: Read/Write listing of most adjustable RCP parameters. All options are selectable. To set a parameter, select the new value and click the "Confirm" button with the mouse pointer.
- HPA Control panel: All information and controls related to remotely control HPA system (if available)

⚠ **Note: 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.**

SNMP Interface

Introduction

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 units with serial numbers of 400000 and below.

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

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

As with the serial protocol, the RCP2 MIB allows access to a remote SSPA (default state) as well as to the 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).

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 11 through Table 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: ControlMode'Local=0,Remote=1

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

SNMP V3 Issues in Teledyne Paradise Datacom RCP2 Controller

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 RCP2 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 19 March 2019.)

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)
```

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), rcp21000rm(4), rcp21000co(5), rcp21000rcp(6), buc(7), rbc(8), minicosspa(9); read/write access. Setting the ID to any other value will default type to cosspa. OID -1.3.6.1.4.1.20712.1.4

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

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

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

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

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

settings - Table contains current device configuration and provides device management. For detailed settings table info for SNMP device see Table 18 . Read/write access for settingsValue column.

thresholds - Table provides information about device internal limits and subsystems info. For detailed table information refer to Table 19. Read only access.

conditions - Table contents device fault status information. Read only access. For detailed conditions table info see Table 20.

Table 18: SNMP Detailed Settings

settingIndex/ settingValue	settingTextValue	Value OID	Description
1/INTEGER	SysMode'1:2=0,1:1=1, 1:1PhC1:1=2,Dual1:1=3, SnglSw=4,PhC1:2=5	1.3.6.1.4.1.20712.2.1.1.1.2.1	System Operation Mode
2/INTEGER	SwitchMode'Auto=0, Manual=1	1.3.6.1.4.1.20712.2.1.1.1.2.2	System Switching Mode
3/INTEGER	ControlMode'Local=0, Remote=1	1.3.6.1.4.1.20712.2.1.1.1.2.3	System Control Mode
4/INTEGER	Reserved'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.4	Field reserved for factory use
5/INTEGER	Priority'Pol1=0,Pol2=1	1.3.6.1.4.1.20712.2.1.1.1.2.5	Switching Priority
6/INTEGER	Protocol'Normal=0, Terminal=1	1.3.6.1.4.1.20712.2.1.1.1.2.6	Remote Serial 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	Baud Rate of Serial Interface
8/INTEGER	NetworkAddress'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.8	Unique Network 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	Type of Remote Control Interface
10/INTEGER	FaultMonitor'SSPA=0, LNA/LNB=1,Both=2, SerCom=3	1.3.6.1.4.1.20712.2.1.1.1.2.10	Type of Fault Monitoring
11/INTEGER	AuxFaultMonitoring'Off=0, NonSw=1,NoSwInv=2, Sw=3,SwInv=4	1.3.6.1.4.1.20712.2.1.1.1.2.11	Auxiliary Fault Monitoring
12/INTEGER	RFSwitchFault'Major=0, Alert Only=1,Alternate=2	1.3.6.1.4.1.20712.2.1.1.1.2.12	RF Switch Fault Monitoring
13/INTEGER	FaultLatch'Enable=0, Disable=1	1.3.6.1.4.1.20712.2.1.1.1.2.13	Fault Latch
14/INTEGER	FaultWindow'20%=0, 8%=1,12%=2,15%=3	1.3.6.1.4.1.20712.2.1.1.1.2.14	LNB/LNA Current Fault Monitoring Window
15/INTEGER	FaultLogic'FaultOnLow=0, FaultOnHigh=1	1.3.6.1.4.1.20712.2.1.1.1.2.15	SSPA and Aux Fault Logic
16/INTEGER	UserPassword'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.16	User Password
17/INTEGER	StandbyUnit'Default=0, Unit1=1,Unit2=2, Unit3/combine=3	1.3.6.1.4.1.20712.2.1.1.1.2.17	Unit Standby Select
18/INTEGER	Buzzer'On=0,Off=1	1.3.6.1.4.1.20712.2.1.1.1.2.18	Audible Alarm
19/INTEGER	MenuPassword'On=0, Off=1	1.3.6.1.4.1.20712.2.1.1.1.2.19	Menu Password State
20/INTEGER	HPASysType'Off=0,CO=1, RM=2,Path=3,VBUC=4, SysX=5,PMAX=6	1.3.6.1.4.1.20712.2.1.1.1.2.20	Type of Optional SSPA Subsystem
21/INTEGER	RFPowerUnits'dBm=0, Watts=1	1.3.6.1.4.1.20712.2.1.1.1.2.21	Frwd/Reflected Power Measurement Units
22/INTEGER	Reserved'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.22	Field reserved for factory use
23/INTEGER	LNAPSRange'Low=0, High=1,Max=2	1.3.6.1.4.1.20712.2.1.1.1.2.23	LNA PS Output Voltage Range
24/INTEGER	StdbyMode'Hot=0,Cold=1	1.3.6.1.4.1.20712.2.1.1.1.2.24	HPA Subsystem Standby Mode Select

25/INTEGER	SubsystemMute'On=0, Pol1=1,Pol2=2,Off=255	1.3.6.1.4.1.20712.2.1.1.1.2.25	SSPA Subsystem Mute Control
26/INTEGER	SubsystemAttenuation (dBx10)'0..200	1.3.6.1.4.1.20712.2.1.1.1.2.26	SSPA Subsystem Attenuation Control
27/INTEGER	SwitchMute'Off=0, Internal=1,External=2, All On=3	1.3.6.1.4.1.20712.2.1.1.1.2.27	Switch Muting State
28/INTEGER	Reserved'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.28	Field reserved for factory use
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)
47/INTEGER	Unit_Offset1'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.47	SSPA Unit 1 Attenuation Offset
48/INTEGER	Unit_Offset2'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.48	SSPA Unit 2 Attenuation Offset
49/INTEGER	Unit_Offset3'0..255	1.3.6.1.4.1.20712.2.1.1.1.2.49	SSPA Unit 3 Attenuation Offset

Table 19: SNMP Detailed Thresholds

thresholdIndex/ thresholdValue	thresholdTextValue	Value OID	Description
1/INTEGER	LNA1CalibrationPoint (x0.57mA)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.1	LNA1 Current Fault Threshold
2/INTEGER	LNA2CalibrationPoint (x0.57mA)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.2	LNA2 Current Fault Threshold

3/INTEGER	LNA3CalibrationPoint (x0.57mA)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.3	LNA3 Current Fault Threshold
4/INTEGER	LNA1DCCurrent (x0.57mA)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.4	LNA1 PS Output Current
5/INTEGER	LNA2DCCurrent (x0.57mA)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.5	LNA2 PS Output Current
6/INTEGER	LNA3DCCurrent (x0.57mA)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.6	LNA3 PS Output Current
7/INTEGER	LNA1PSVoltage (x0.1V)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.7	LNA1 PS Output Voltage
8/INTEGER	LNA2PSVoltage (x0.1V)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.8	LNA2 PS Output Voltage
9/INTEGER	LNA3PSVoltage (x0.1V)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.9	LNA3 PS Output Voltage
10/INTEGER	PS1Voltage (x0.1V)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.10	PS1 Output Voltage
11/INTEGER	PS2Voltage (x0.1V)'0..4095	1.3.6.1.4.1.20712.2.1.2.1.2.11	PS2 Output Voltage
12/INTEGER	ChassyTemperature (C)'-99..99	1.3.6.1.4.1.20712.2.1.2.1.2.12	Chassis Temperature

Table 20: SNMP Detailed Conditions

conditionIndex/ conditionValue	conditionTextValue	Value OID
1/INTEGER	Unit1FaultState'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.1
2/INTEGER	Unit2FaultState'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.2
3/INTEGER	Unit3FaultState'NoFault=0,Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.3
4/INTEGER	SummaryFaultState'NoFault=0,Fault=1	1.3.6.1.4.1.20712.2.1.3.1.2.4
5/INTEGER	PS1FaultState'NoFault=0,Fault=1	1.3.6.1.4.1.20712.2.1.3.1.2.5
6/INTEGER	PS2FaultState'NoFault=0,Fault=1	1.3.6.1.4.1.20712.2.1.3.1.2.6
7/INTEGER	AuxiliaryFaultState'NoFault=0, Fault=1,N/A=2	1.3.6.1.4.1.20712.2.1.3.1.2.7
8/INTEGER	ExternalPortState'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.8
9/INTEGER	LNAFaults'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.9
10/INTEGER	SSPAFaults'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.10
11/INTEGER	RFSwitch1State'NoFault=0, Fault=1,N/A=2,Pos1=3,Pos2=4	1.3.6.1.4.1.20712.2.1.3.1.2.11
12/INTEGER	RFSwitch2State'NoFault=0, Fault=1,N/A=2,Pos1=3,Pos2=4	1.3.6.1.4.1.20712.2.1.3.1.2.12
13/INTEGER	ForwardRFLowByte(0xHLx0. 1RFPowerUnits)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.13
14/INTEGER	ForwardRFHighByte(0xHLx0. 1RFPowerUnits)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.14
15/INTEGER	AmbientTemperatureLowByte(0xHL C)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.15
16/INTEGER	AmbientTemperatureHighByte(0xHL C)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.16
17/INTEGER	Unit1TemperatureLowByte(0xHL C)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.17
18/INTEGER	Unit1TemperatureHighByte(0xHL C)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.18
19/INTEGER	Unit2TemperatureLowByte(0xHL C)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.19
20/INTEGER	Unit2TemperatureHighByte(0xHL C)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.20
21/INTEGER	Unit3TemperatureLowByte(0xHL C)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.21
22/INTEGER	Unit3TemperatureHighByte(0xHL C)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.22
23/INTEGER	ReflectedRFLowByte(0xHLx 0.1EFPowerUnits)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.23
24/INTEGER	ReflectedRFHighByte(0xHLx 0.1EFPowerUnits)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.24
25/INTEGER	Unit1DCCurrentLowByte(0xHLx 0.1Amper)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.25
26/INTEGER	Unit1DCCurrentHighByte(0xHLx 0.1Amper)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.26
27/INTEGER	Unit2DCCurrentLowByte(0xHLx 0.1Amper)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.27

28/INTEGER	Unit2DCCurrentHighByte(0xHLx 0.1Amper)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.28
29/INTEGER	Unit3DCCurrentLowByte(0xHLx 0.1Amper)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.29
30/INTEGER	Unit3DCCurrentHighByte(0xHLx 0.1Amper)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.30
31/INTEGER	Unit1RFOutputLowByte(0xHLx 0.1dBm)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.31
32/INTEGER	Unit1RFOutputLowByte(0xHLx 0.1dBm)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.32
33/INTEGER	Unit2RFOutputLowByte(0xHLx 0.1dBm)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.33
34/INTEGER	Unit2RFOutputLowByte(0xHLx 0.1dBm)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.34
35/INTEGER	Unit3RFOutputLowByte(0xHLx 0.1dBm)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.35
36/INTEGER	Unit3RFOutputLowByte(0xHLx 0.1dBm)'0..255	1.3.6.1.4.1.20712.2.1.3.1.2.36

Configuring RCP2 Unit to Work With SNMP Protocol

Set up the unit IP address. Tap the Home icon to access the main menu; tap the Communication button; tap the IP Setup button; tap the IP Address button. Enter the desired IP address. The default address of a single controller in a system is **192.168.0.9**. Tap the OK button to accept the entered value.

Set up the unit gateway address. Tap the Gateway button; Enter the desitred IP address of the gateway. The default gateway address of a single controller in a system is 192.168.0.1. If no gateway is needed, set the address to **0.0.0.0**. Tap the OK button to accept the entered value.

Set up the unit subnet mask. Tap the Subnet Mask button; Enter the desired Subnet Mask address. The default subnet mask address of a single controller in a system is **255.255.255.0**. Tap the OK button to accept the entered value.

Set up the unit Community Get string. Tap the Home icon to return to the main menu; tap the Communication button; tap the SNMP Setup button. Tap the Community Get button; use the keypad to enter the desired Community Get string. The default string is **public**. Tap the OK button to accept the entered value.

Set up the unit Community Set string. Tap the Community Set button; use the keypad to entered the desired Community Set string. The default string is **private**. Tap the OK button to accept the entered value.

Set up the unit interface to communicate over SNMP. Tap the Home icon to return to the main menu; tap the Communication button; tap the Interface button; tick the SNMP checkbox.

SNMP protocol now is set and ready to be used.

Connecting to a MIB Browser

For a MIB browser application example, we will use the freeware browser GetIf, version 2.3.1. Other browsers are available for download from http://www.snmplink.org.

Copy the provided Paradise Datacom LLC MIB file into the Getif Mibs subfolder. The MIB is available for download at http://www.paradisedata.com.

Start the GetIf application.

Select the unit IP address and community strings in the relevant text boxes on the Parameters tab (see Figure 16) and then click the Start button.

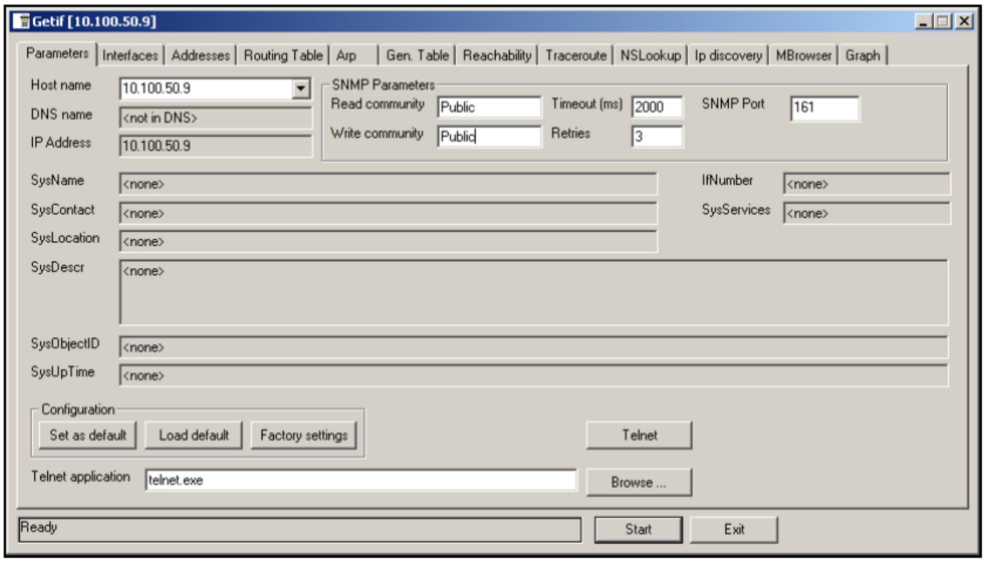


Figure 16: Enter Parameters into GetIF

Select the MIBBrowser tab.

Click on 'iso main entity' on the MIB tree, then click the Start button.

See update data in output data box (Figure 17).

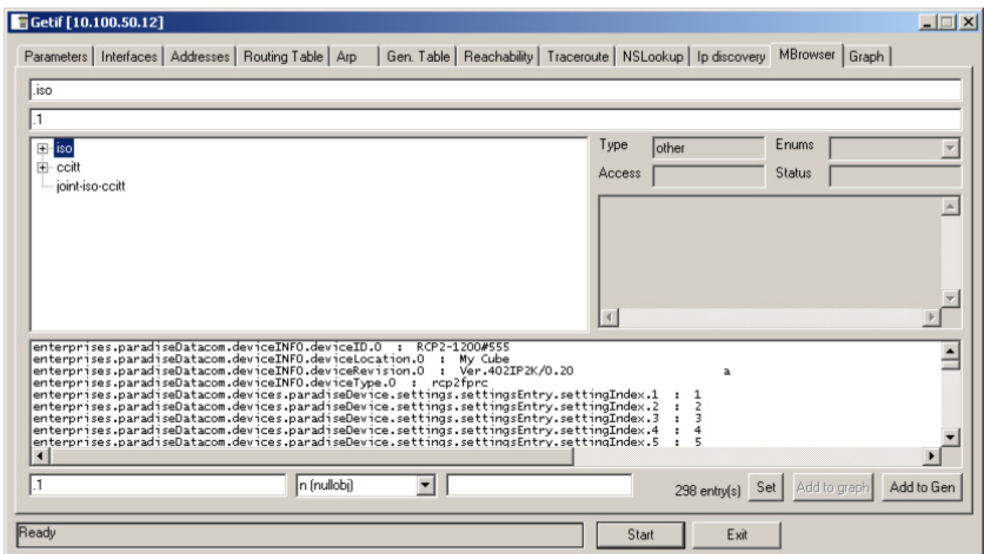


Figure 17: Update Data in MBrowser

The controller 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.

Fault Trap

The Fault trap allows asynchronous notification of the RCP2 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.

Condition Trap

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 (each remotely controlled HPA or System RF level can be selected), Reflected RF Level (for systems equipped with a Reflected RF sensor), DC Current level (each remotely controlled HPA can be selected), PS Voltage level (both internal PS units can be selected), Temperature (each remotely control HPA can be selected or Ambient temperature sensor, if equipped), or LNA/LNB current.

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 controller 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.

Extended SNMP MIB Tree

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

```
+--paradiseDeviceC(4)
|
+--modem(5)
```

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; OID - 1.3.6.1.4.1.20712.1.5.1

deviceFaultTime - Time elapsed since last state change of deviceLastFault parameter in hundredths of second; OID - 1.3.6.1.4.1.20712.1.5.2

deviceSFaultCounter - Counts number of Summary alarms since device power up; OID - 1.3.6.1.4.1.20712.1.6.1

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). OID - 1.3.6.1.4.1.20712.1.7.1

deviceTrappedConditionValue - Condition value trapped by deviceConditionTrap; OID - 1.3.6.1.4.1.20712.1.8.1

deviceManagerIP - Trap recipient IP address; OID - 1.3.6.1.4.1.20712.1.9.1

deviceFaultsTrapResend - Defines how many times deviceFaultsTrap will repeat the message. 0 - Disables trap triggering; OID - 1.3.6.1.4.1.20712.1.9.2

deviceConditionTrapResend - Defines how many times condition trap will repeat the message. 0 - Disables trap triggering; OID - 1.3.6.1.4.1.20712.1.9.3

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); OID - 1.3.6.1.4.1.20712.1.9.4

deviceConditionULimit - Conditions upper trap limit. Trap will be sent when the condition exceeds this limit. OID - 1.3.6.1.4.1.20712.1.9.5

deviceConditionLLimit - Conditions lower trap limit. Trap will be sent when condition falls below this limit. OID - 1.3.6.1.4.1.20712.1.9.6

deviceConditionLocation - Parameter specifying condition measuring location in device containing multiple location of the same type (multiple PS, HPAs, 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", for system wide parameters (System RF power, Ambient temperature etc. select 4). OID - 1.3.6.1.4.1.20712.1.9.7

deviceFaultsTrap - Trap fires deviceFaultsTrapResend times when deviceLastFault or deviceSummaryFault state changes. OID - 1.3.6.1.4.1.20712.1.10.0.11

Ethernet Interface Set-Up and Cabling

Teledyne Paradise Datacom
Drawing Number: 216512-12 Revision B
ECO 18951
11 June 2020

Ethernet Interface Quick Set-Up

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!**

Using a crossover null-modem network cable, connect the Ethernet Port (J9) of the RM SSPA to a host PC. See the **10/100 Base-T Ethernet Cable Wiring** section for wiring details.

If the PC NIC card has not previously been set, do so now using the following procedure; otherwise skip to the **Configure Unit to Use IPNET Protocol** section.

> ⚠ **Note: For PCs running earlier versions of Windows, go to the Control panel and open the Network settings and open the TCP/IP properties of your LAN card. Pick up the procedure with Step 8.**

1. On a PC running Windows 10, click on the Start icon.
2. Type "Settings" and open the Settings window.
3. Click on the Network & Internet icon.
4. Click Ethernet.
5. Click Change Adapter Options.
6. Right-click on the connection that you want to configure and select Properties from the menu.
7. Select Internet Protocol Version 4 (TCP/IPv4) and click on the Properties button.
8. Select "Use the following IP Address" and enter the parameters shown in Figure 1 in the IP Address and Subnet Mask fields.

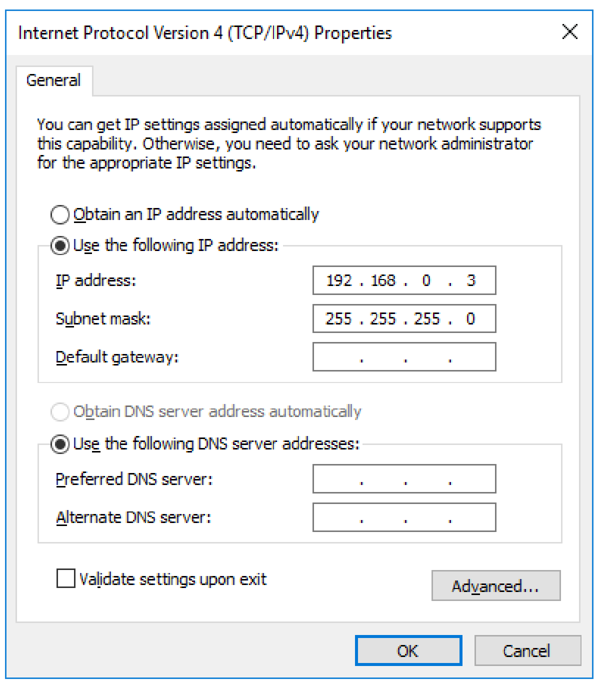


Figure 1: TCP/IPv4 Properties Window

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

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

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:
```

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.

Configure Unit to Use IPNET Protocol

Use the following procedure to configure your unit to operate using the IPNET protocol.

1. On the RM SSPA unit front panel, tap the Home icon to return to the Main Menu;
2. Tap the Communications button;
3. Tap the IP Setup button;
4. Tap the IP Address button;
5. Enter IP address 192.168.0.0;
6. Tap the OK button to accept the entered values.

Follow the same menu route to select the Subnet, Gateway, IP Port and IP Lock items, and set those parameters to:

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

Verify that the values entered above are displayed in the Communications > IP Setup menu.

1. On the RM SSPA unit front panel, tap the Home icon to return to the Main Menu;
2. Tap the Communications button;
3. Tap the Interface button;
4. Tick the IPNET checkbox.

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

Run the Paradise Datacom Universal M&C software on a host PC to check all M&C functions. When prompted, select an Internet connection to the unit using IP Address 192.168.0.0, local port address to 1039 and remote port address to 1038. The SSPA now connected to your host workstation for remote M&C.

10/100 Base-T Ethernet Cable Wiring

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 2) is needed for proper wiring.

Figure 2: 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 3.

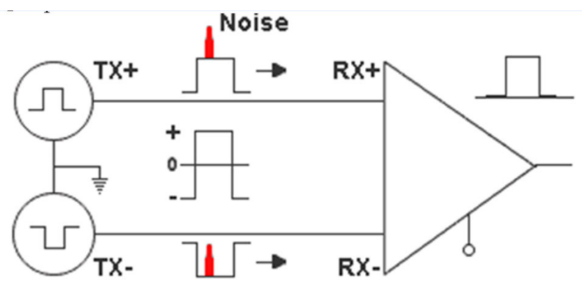


Figure 3: Transmission Line

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 4.

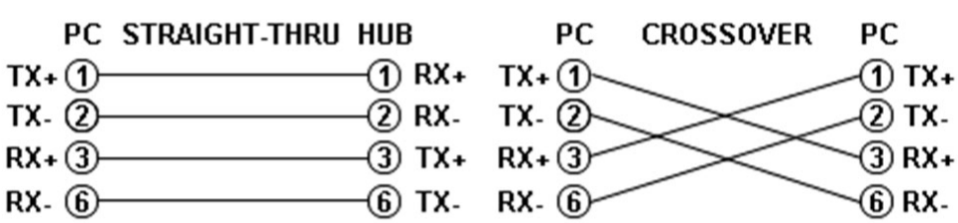


Figure 4: Ethernet Cable Pin-outs

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 5.

If we apply the 568A color code and show all eight wires, our pin-out looks like Figure 6.

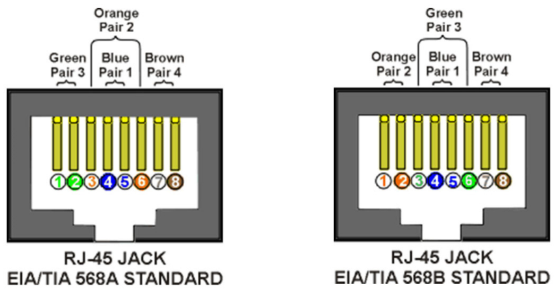


Figure 5: Ethernet Wire Color Code Standards

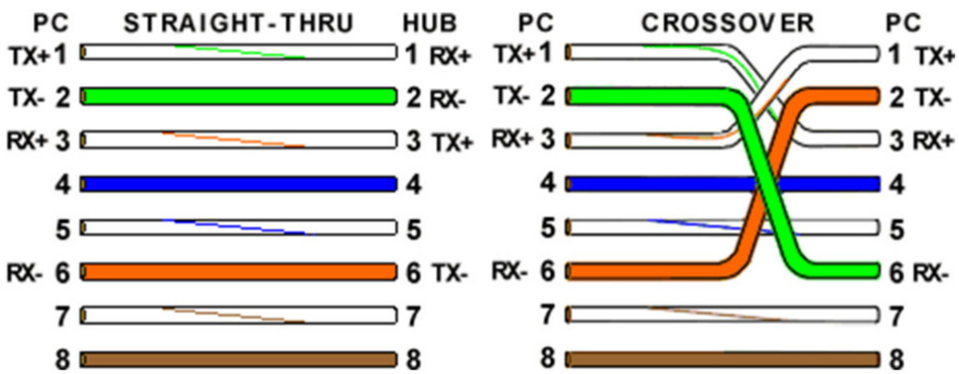


Figure 6: Wiring Using 568A Color Codes

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.

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 7.

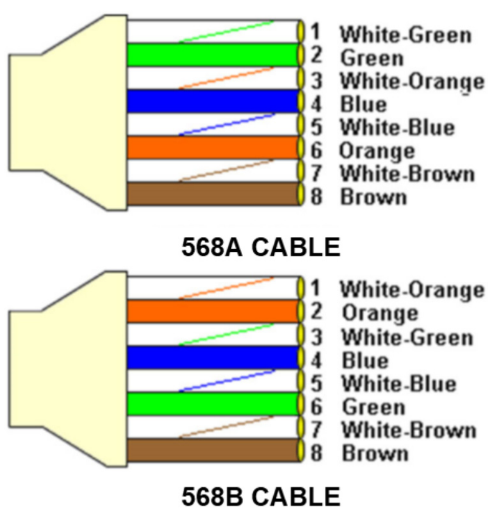


Figure 7: Wiring Using 568A and 568B Color Codes

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.

To properly configure the cables, all you need to remember 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. A 568A patch cable will work in a network with 568B wiring and a 568B patch cable will work in a 568A network.

Here are some essential cabling rules:

- Try to avoid running cables parallel to power cables.
- Do not bend cables to less than four times the diameter of the cable.
- 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.
- Keep cables away from devices which can introduce noise into them, such as: 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.
- Avoid stretching UTP cables (tension when pulling cables should not exceed 25 lbs.).
- Do not run UTP cable outside of a building. It presents a very dangerous lightning hazard!
- Do not use a stapler to secure UTP cables. Use telephone wire/RG-6 coaxial wire hangers, which are available at most hardware stores.

Teledyne Paradise Datacom
Drawing Number 216512-12 Revision B
ECO 18951
Last Modified: 11 June 2020

THIS PAGE LEFT INTENTIONALLY BLANK

Unit Control with Universal M&C Software

Teledyne Paradise Datacom
Drawing Number: 216594-2 Revision A
ECO 18855
11 October 2019

Introduction

This section describes the control of a remote unit using Teledyne Paradise Datacom's free Windows-based Universal Monitor and Control software.

Download/Install Software

Teledyne Paradise Datacom provides a free version of its Universal Monitor and Control (M&C) Software available for download from its web site. Install the software on a PC running Windows 7 or later.

Navigate to the Support > Downloads page and click on the latest version of the sofware to download the zip file.

Unzip the package and run the setup.exe file. This launches the Universal M&C Software installer. Follow the prompts and agree to the license agreement to install the application. When complete, close the installer.

⚠ **By default the installer saves the software to C:\Program Files (x86)\Paradise Datacom. When running the installer, you can change the destination of the installation.**

The software may be used to remotely monitor and control any of the following Teledyne Paradise Datacom products:

- Rack mountable (RM) Amplifiers (3RU, 5RU, 7RU)
- Compact Outdoor (CO) Amplifiers
- High Power Outdoor (HPO) Amplifiers
- Indoor PowerMAX Amplifier Systems
- Outdoor PowerMAX Amplifier Systems
- System Controllers

Add RM Unit to Universal M&C

Launch the Teledyne Paradise Datacom Universal M&C software from the Programs Menu of your PC. During installation, a shortcut to the software may have been added to your desktop.

To add a new rack mountable amplifier, click the 'Action' menu and select 'Add Unit' from the pull-down menu. Select 'Rackmount' from the menu choices. See Figure 1.

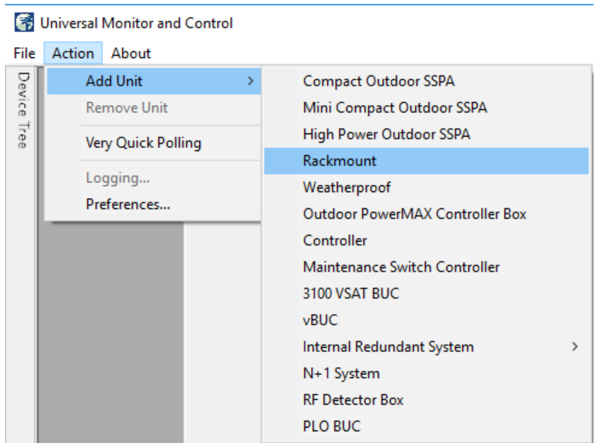


Figure 1: Universal M&C > Action > Add Unit > Rackmount

An 'Add Rackmount SSPA' dialog window will appear.

Enter a Unit ID (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. See Figure 2.

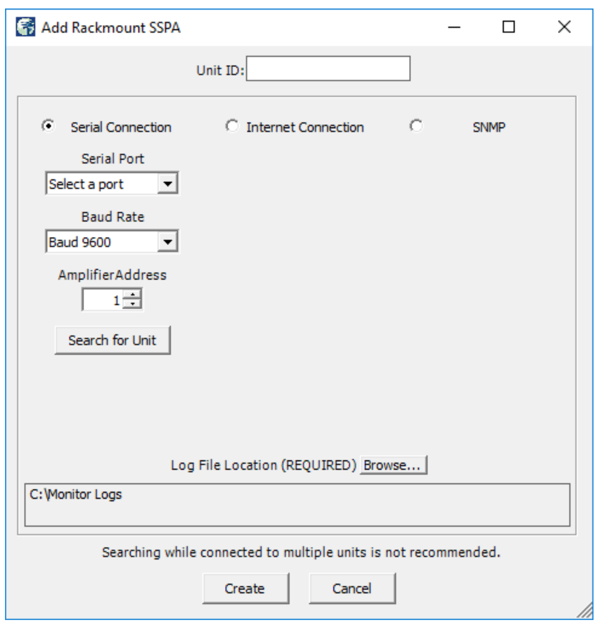


Figure 2: Select a COM Port and Baud Rate for Serial COMs

To add a unit connected via UDP (TCP/IP) you must supply either a Hostname or an IP Address. See Figure 3.

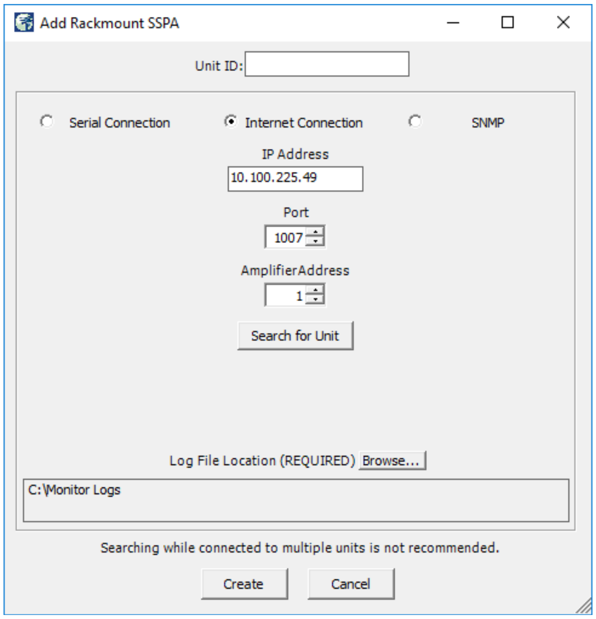


Figure 3: Enter IP Address and Port Address for UDP COMs

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 UnitID and the extension ".log" appended to it. i.e. "Unit1.log".

Click on the 'Create' button to connect to the unit. The Universal M&C software will open a new window from which you can control and review the status of the connected unit.

Overview of RM SSPA M&C

Each SSPA in the Rackmount M&C has six screens:

- Status Tab
- Settings Tab
- Faults Tab
- IP Setup Tab
- N+1 Settings Tab
- SNMP Tab

Status Tab

The first screen is the "Status" tab, shown in Figure 4. The Status tab shows the current conditions (or state) of the connected SSPA. In addition, the Status tab allows the operator to change the Mute state of the carrier and allows adjustment of the on-board attenuator for gain control.

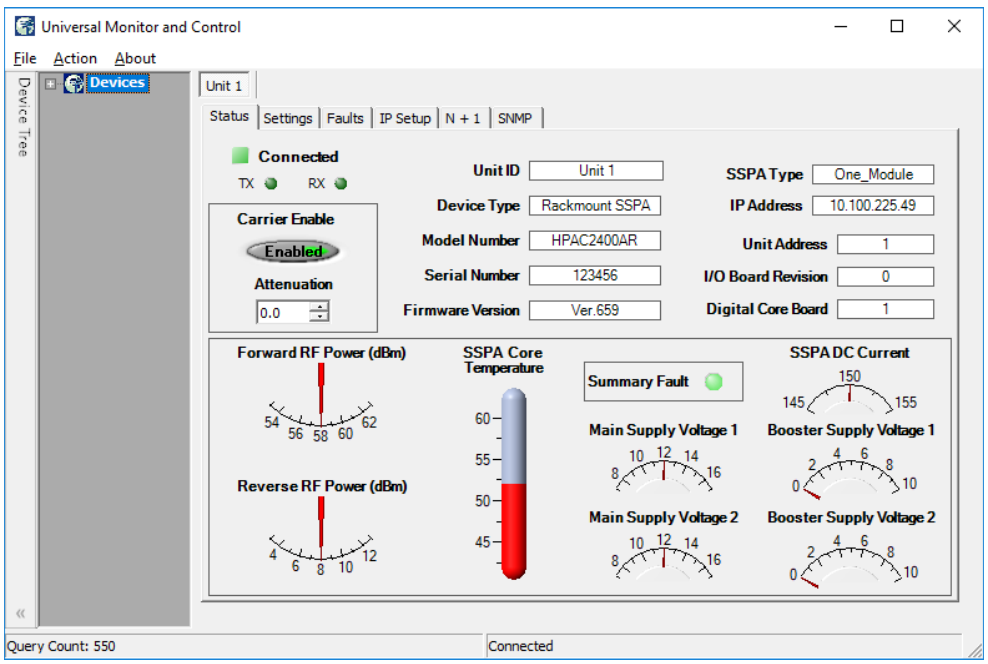


Figure 4: Universal M&C Software > Status Tab

Settings Tab

The second screen is the "Settings" tab, shown in Figure 5. It shows the user all available settings on the SSPA. All user-adjustable settings are allowed to be modified to suit the specific needs of the customer. However, it should be noted that the SSPA is configured for the customer at the factory.

If modification of any settings is necessary, details of each setting, condition and threshold are available in the Settings, Conditions and Thresholds description of the **Remote Control Protocol** section of any rack mountable amplifier manual.

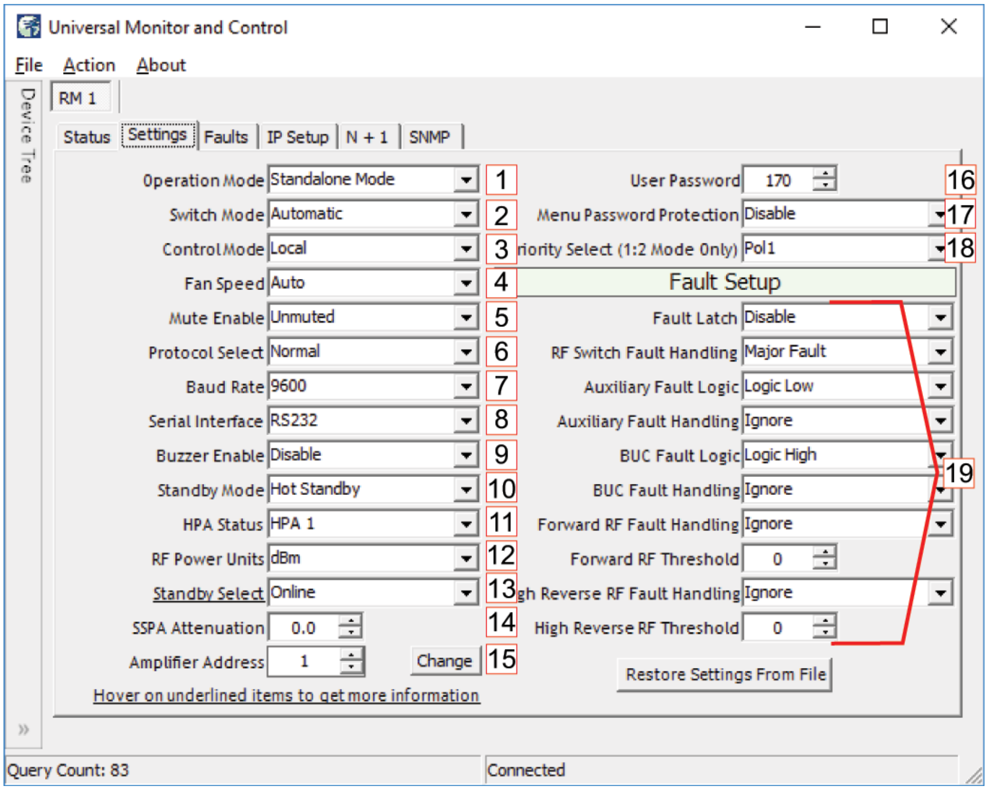


Figure 5: Universal M&C Software > Settings Tab

Operation Mode [1]

Select between Standalone Mode, (single unit), 1:1 Mode, 1:2 Mode, 1:1 Phase Combined or 1:2 Phase Combined.

If the amplifier will be configured in a redundant system and controlled with an external controller, each system amplifier should be set to Standalone Mode.

If the amplifier will be configured in a redundant system but will be controlled using internal control logic, each system amplifier should be set to the appropriate redundant mode. All amplifiers in the redundant system should be set to the same mode.

For more information on settings used for internal 1:1 redundancy mode, see the **Internal 1:1 Redundant System Operation** section.

For more information on settings used for internal 1:2 redundancy mode, see the **Internal 1:2 Redundant System Operation** section.

Switch Mode [2]

Select between Automatic switching, Manual switching or Switch Lock.

Control Mode [3]

Select between Local or Remote control.

Fan Speed [4]

Select between Low, High or Auto.

Mute Enable [5]

Select Muted or Unmuted.

Protocol Select [6]

Select Normal or Terminal. The operator will be asked to verify any to change to the Protocol Select setting. Communication with the amplifier may be affected.

Baud Rate [7]

Select a baud rate of 2400, 4800, 9600 (the default), 19200, or 38400. The operator will be asked to verify any to change to the Baud Rate setting. Communication with the amplifier may be affected.

Serial Interface [8]

Select the type of serial communications interface to use: RS232, RS485, IPNET or SNMP. The operator will be asked to verify any to change to the Serial Interface setting. Communication with the amplifier may be affected.

Buzzer Enable [9]

Enable or Disable the audible buzzer on the unit.

Standby Mode [10]

Select Hot Standby or Cold Standby. In Cold Standby mode, the RF module is muted when its Standby Select setting is set to Standby.

HPA Status [11]

Select HPA1, HPA2 or HPA3. For use in redundant systems.

RF Power Units [12]

Select the type of unit displayed on the front panel: dBm or Watts.

Standby Select [13]

Select the disposition of the amplifier in a redundant system: Standby or Online.

SSPA Attenuation [14]

The Gain Adjustment of the unit is adjustable here, from 0 to 20 in 0.1 dB steps.

Amplifier Address [15]

Sets a network address for the unit. Range is 0 to 255. Click the 'Change' button to change the address. The operator will be asked to verify any to change to the Amplifier Address setting. Communication with the amplifier may be affected.

User Password [16]

Sets a password for the unit. Range is 0 to 255.

Menu Password Protection [17]

Enable or Disable password protection for the unit.

Priority Select [18]

For use in 1:2 Mode only. Assign whether the standby unit will be switched to Pol1 or Pol2 if the amplifiers transmitting to both polarities exhibit failures and the standby unit must switch to one of the polarities. All units in a 1:2 configuration must use the same Priority Select setting.

Fault Setups [19]

The user may Enable or Disable fault latching, and set the fault logic and handling for RF Switch faults, Auxiliary faults, BUC faults, Forward RF faults and High Reverse RF faults. Logic settings are Logic Low or Logic High.

RF Switch Fault Handling settings include Ignore, Minor Fault, Major Fault, and Switchover Mute.

Auxiliary Fault Handling settings include Ignore, Minor Fault, Major Fault, Minor Fault with Mute, and Major Fault with Mute.

Forward RF Fault Handling settings include Ignore, Low RF Major Fault, Low RF Minor Fault, ALC On, High RF Major Fault, High RF Minor Fault, and High RF Major Fault with Mute.

High Reverse RF Fault Handling settings include Ignore, Major Fault, and Minor Fault.

The user can also set the threshold levels for Forward RF and High Reverse RF.

Faults Tab

The third screen is the "Faults" tab, shown in Figure 6. It shows the user the status of all faults on-board the SSPA. These include: Summary, Module # faults, Standby State (green = Online; red = Standby); Power Supply, Low DC Voltage and Current, Fans, BUC, High Temperature, Forward RF and High Reflected RF, Auxiliary, switch faults (for units configured in a redundant system), and optional faults.

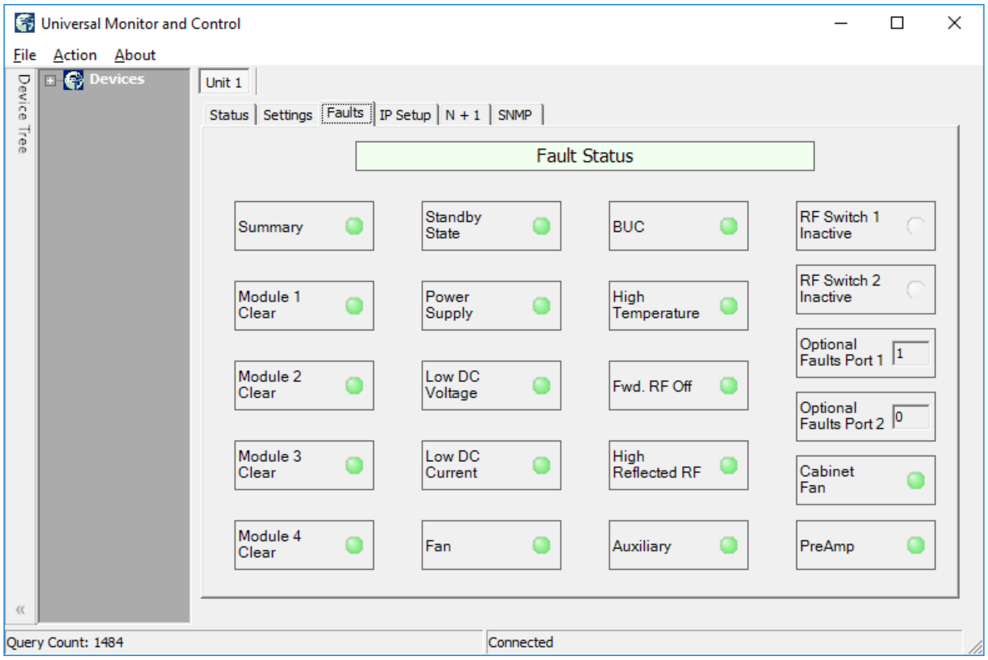


Figure 6: Universal M&C Software > Faults Tab

Each RF Module in the SSPA is monitored for faults in addition to the SSPA itself. If the SSPA does not include a module, non-existant modules will show up with a status of 'N/A' in the Module Status box, and the indicator will turn yellow.

IP Setup Tab

The fourth screen is the "IP Setup" screen, shown in Figure 7. It displays all of the TCP/IP settings on the SSPA.

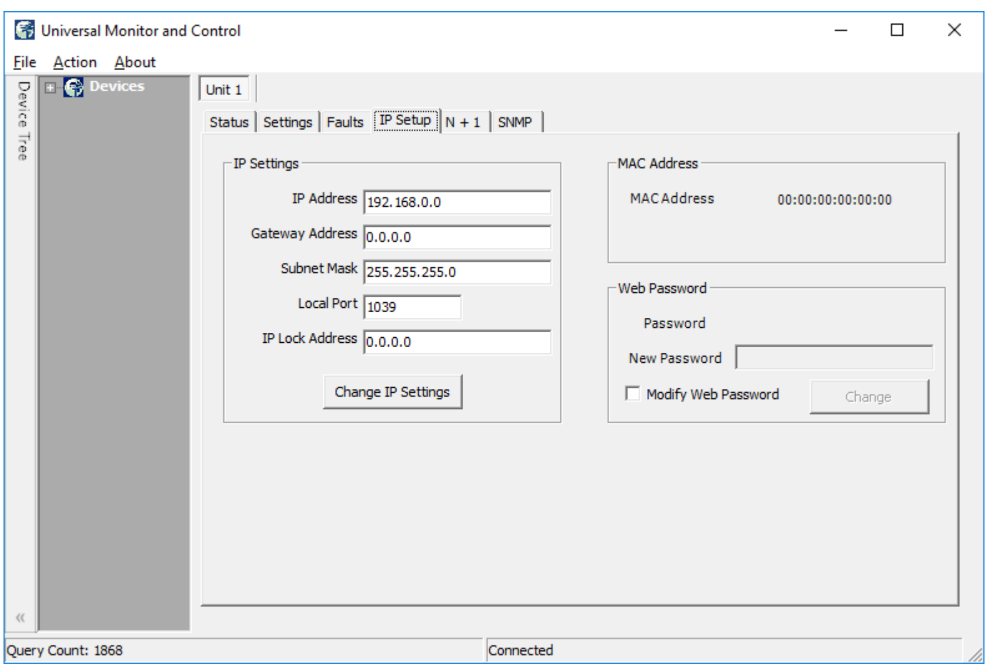


Figure 7: Universal M&C Software > IP Setup Tab

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

The Gateway Address and Subnet Mask are standard settings for TCP/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.

N+1 Settings Tab

The fifth window is the "N+1 Settings and Conditions" tab, as shown in Figure 8. This screen is used for setting N + 1 system parameters, and monitoring N+1 system conditions. Note that only the master module in an N+1 system will show the N+1 Master settings.

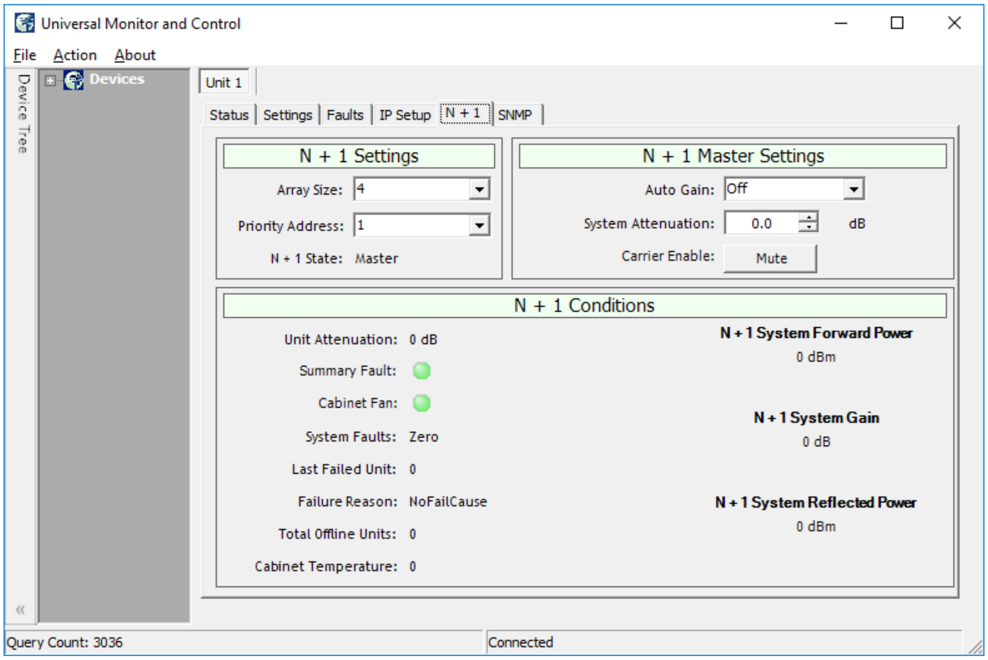


Figure 8: Universal M&C Software > N+1 tab

See the **Overview of the PowerMAX M&C** section for more information on Master/Slave functions using the N+1 Settings Tab.

SNMP Tab

The sixth window is the "SNMP Settings" tab, as shown in Figure 8. This screen is used for setting SNMP communication parameters, and for assigning trap conditions.

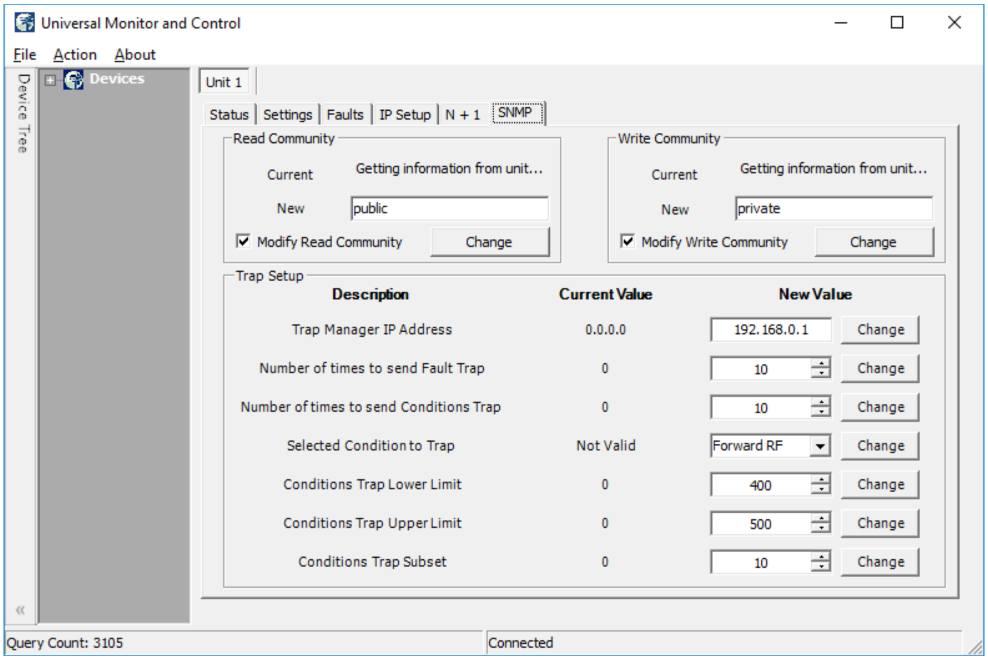


Figure 9: Universal M&C Software > SNMP tab

Add CO Unit to M&C

Launch the Teledyne Paradise Datacom Universal Monitor and Control software from the Programs Menu of your PC. Upon installation, a shortcut to the software may have been added to your desktop.

Click the 'Action' menu and select 'Add Unit' from the pull-down menu. Select 'Compact Outdoor SSPA' from the menu choices. See Figure 10.

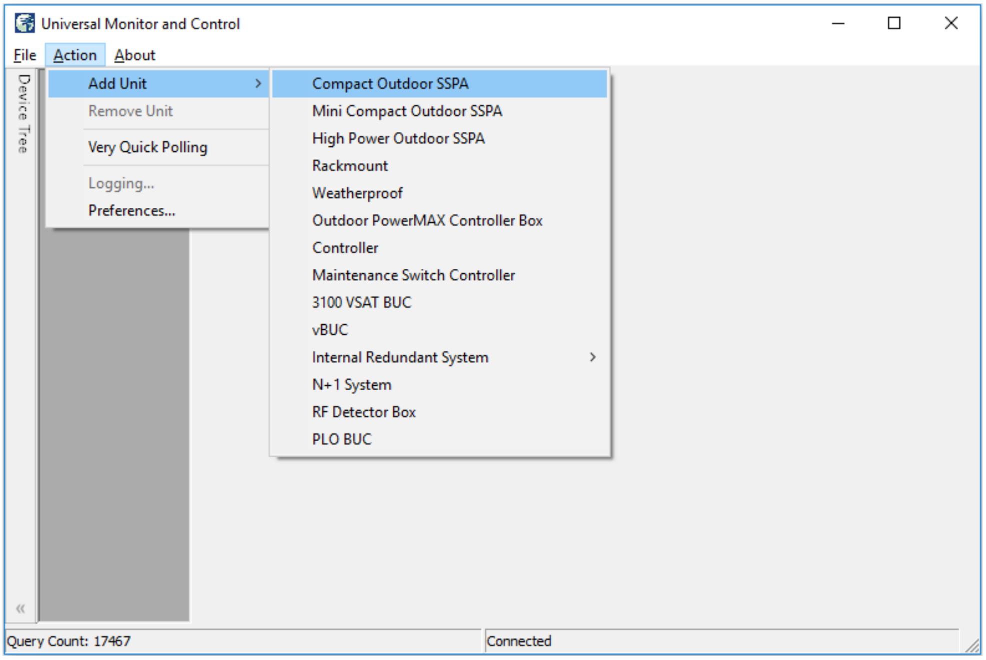


Figure 10: Universal M&C > Add Unit > Compact Outdoor SSPA

A new dialog window will open. Enter the following information where applicable: Unit ID; if using a RS-232 Connection, the Serial Port and Baud Rate. See Figure 11.

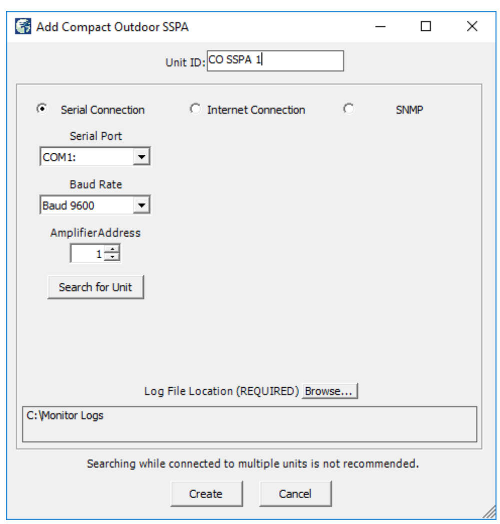


Figure 11: Add Compact Outdoor SSPA > Serial Connection

If using an Ethernet Connection, enter the unit's IP Address and Port number. See Figure 12.

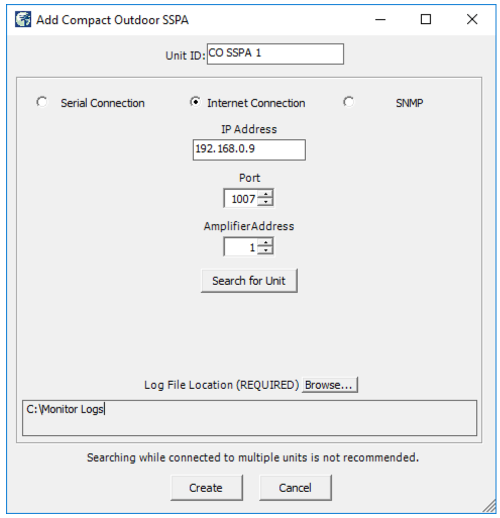


Figure 12: Add Compact Outdoor SSPA > Internet Connection

Specify the unit's Address in the Amplifier Address box. If you don't know the address of the unit you may search for it. Be aware that this search feature is only useful when you have only one unit connected to your PC at a time.

If you wish to change the log file location, click on the 'Browse' button and navigate to the desired location.

Click on the 'Create' button to generate the operation window for this unit.

Overview of the CO M&C

The operational status, settings and conditions of the connected Compact Outdoor amplifier are displayed in the Universal M&C application's four tabs:

- Status Tab
- Settings Tab
- IP Setup Tab
- SNMP Settings Tab

Status Tab

The Universal M&C Software will initialize and open to the Status tab, the main monitoring display. See Figure 13. The Status tab shows the the current conditions (or state) of the Compact Outdoor SSPA. In addition, the status screen allow the user to alter the Mute condition of the carrier and adjust the on-board Attenuator for gain control.

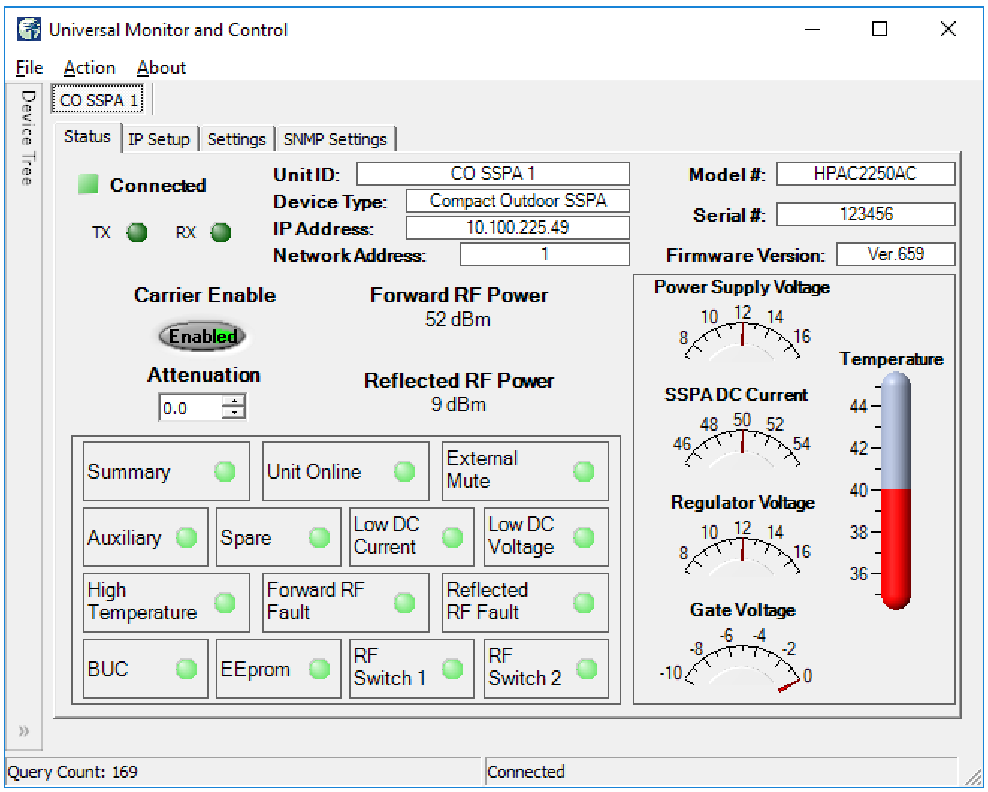


Figure 13: Compact Outdoor SSPA > Status Tab

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

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

Signal Indicators

Three rows of indicators show the connection status of the connected amplifier. Top-most is an indicator that displays a green square when Connected, or a red square when Disconnected. Immediately below are two indicators for the TX and RX paths. The third row displays the mute state (Carrier Enable). The operator may click on the indicator to toggle between enabling or muting the amplifier. See Figure 14.

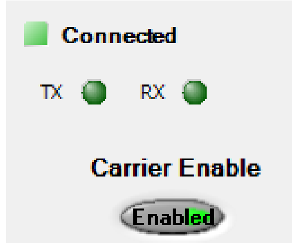


Figure 14: Status Tab > Signal Indicators

Fault Status Indicators

The Fault Status frame in the lower left side of the Status tab contains a 3x4 grid of SSPA fault lights. See Figure 15.

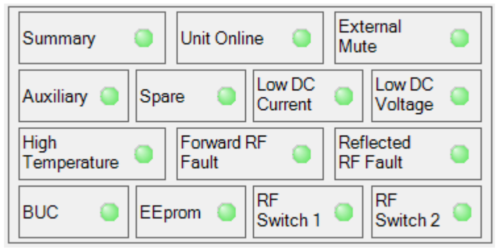


Figure 15: Status Tab > Fault Status Indicators

- Summary Alarm: The Summary Alarm is simply a logical 'OR' of any major alarm indicators.
- Unit Online: This is a status indicator that illuminates green when the unit is online.
- External Mute Alarm: The External Mute line gives an indication that the SSPA has been externally muted by J4-Pin B. This alarm can be configured to trigger a summary alarm if desired. Factory default is to signal a External Mute fault but no summary alarm.
- Auxiliary & Spare Alarms: The Auxiliary and Spare Alarms are configurable from the Settings Window.

These alarms can be configured to trigger a summary alarm. See the **Settings Tab** section.

- Low DC Current Alarm: The Current Fault is factory preset to alarm if the SSPA module current falls below 60% of its nominal value. This alarm will also trigger a summary alarm.
- Low DC Voltage Alarm: The Voltage Alarm is factory preset to alarm if the SSPA module current falls below 80% of its nominal value. This alarm will also trigger a summary alarm.
- High Temperature Alarm: The Temperature Fault indicator is factory preset to alarm at 80°C. The amplifier will continue to operate up to 90°C. Beyond 90°C the DC power will be interrupted to the SSPA module. This measure will protect the sensitive microwave transistors from catastrophic failure. The fans and monitor and control circuitry will continue to operate normally. This function has approximately a 5°C hysteresis window which will allow the amplifier to re-enable itself when the ambient temperature is reduced by 5°C. This alarm will also trigger a summary alarm.
- Forward RF Alarm: The Forward RF Fault Alarm indicates when the RF output of the amplifier falls below the threshold set in the Settings Window.
- BUC Alarm: The BUC fault is only active in units that are supplied with an optional L-Band Block Up Converter module. If the Up Converter's phase locked local oscillator loses lock, a BUC alarm is set and the amplifier is muted so that spurious RF cannot be transmitted. This alarm can be configured to trigger a summary alarm.
- EEPROM Alarm: The EEPROM Alarm is primarily used as a Fiber RX Link alarm for Compact Outdoor SSSPA units configured with a fiber-optic interface.
- RF Switch Alarms: The RF Switch 1 Alarm is only active if a 1:1 Redundant System has been configured in the M&C program. The RF Switch 2 Alarm is only active is a 1:2 Redundant System has been configured. These configurations are covered in Section 7.

Voltage, Current and Temperature Display

On the right side of the Status window is a thermometer display that reports the present baseplate temperature of the amplifier. The baseplate temperature typically experiences a 20-30 degree rise above ambient on the highest power Compact Outdoor amplifiers and 15-20 degree rise on lower power units. See Figure 16.

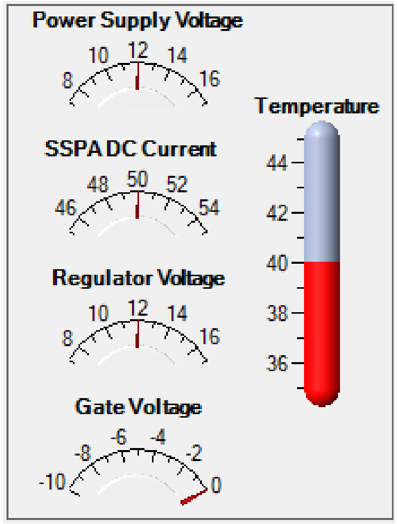


Figure 16: Status Tab > Signal Indicators

To the left of the thermometer display are several indicators that show various operating conditions of the Compact Outdoor Amplifier in real time. These indicators are helpful for any diagnostic procedures and consist of: Power Supply Voltage monitor SSPA DC Current monitor Regulator Voltage monitor Gate Voltage monitor.

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

Gain Adjustment (Attenuation Control)

The Gain Attenuation Control is located above the Fault Condition Indicators and below the Carrier Enable status. See Figure 17.

Figure 17: Status Tab > Attenuation Control

The gain can be adjusted by setting the Attenuation Control. An Attenuation Control of 0 dB is the maximum gain (typically 75 dB) setting on the amplifier. By setting the Attenuation Control to 20 dB; the gain is set to 55 dB. The Attenuation Control can be varied using the up/down arrows to the right of the displayed value or by typing a value between 0 and 20 in the field and hitting the Enter key.

Forward/Reflected RF Power Display

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

Units with the reflected power meter option also display the Reflected RF Power. See Figure 18.

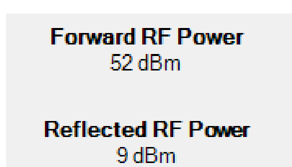


Figure 18: Status Tab > Forward/Reflected RF Power Display

Settings Tab

Figure 19 shows the Settings tab of the Universal M&C software. The Settings tab contains many of the global settings that are available in the SSPA.

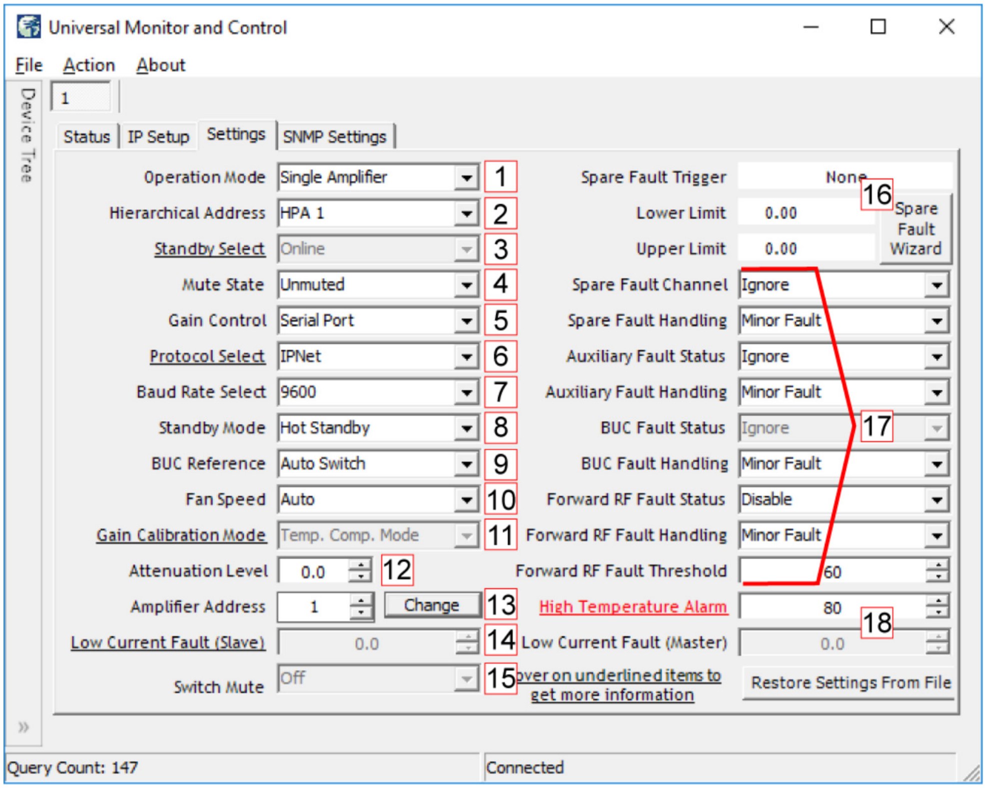


Figure 19: Compact Outdoor SSPA > Settings Tab

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

Operation Mode [1]

Select between stand-alone (single unit), Dual 1:1 mode, 1:1 Redundant mode, or Maintenance Switch mode.

Hierarchical Address [2]

Identifies each amplifier in a redundant system as HPA 1, HPA2 or HPA 3.

Standby Select [3]

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

Mute State [4]

Determines if the unit should start up muted (transmit disabled) or mute cleared (transmit enabled).

Gain Control [5]

Select between serial communication control of the unit's gain or analog voltage gain control via J4.

Protocol Select [6]

The operator may select either the standard string protocol, Terminal mode, IPNET or SNMP (as well as legacy Binary Mode and NDSatcom protocols). The operator will be asked to verify any change in protocol. Communication with the amplifier may be affected.

Baud Rate Select [7]

Sets the baud rate of the unit. The supported baud rates include: 2400, 4800, 9600, 19200, and 38400 baud. The factory default baud rate is 9600. The operator will be asked to verify any change to the baud rate. Communication with the amplifier may be affected.

Standby Mode [8]

Selects between Hot and Cold standby mode for units in redundant systems.

BUC Reference [9]

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

Fan Speed [10]

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

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

Gain Calibration Mode [11]

This feature is disabled for most users. Should be set for Temp. Comp. (Temperature Compensation) Mode. Consult the factory if set for Calibration Mode.

Attenuation Level [12]

The Gain Adjustment of the unit is adjustable here, from 0 to 20 in 0.1 dB steps.

Amplifier Address [13]

Sets a network address for the unit. Range is 0 to 255. Click the 'Change' button to change the address. The operator will be asked to verify any to change to the Amplifier Network Address. Communication with the amplifier may be affected.

Low Current Fault (Slave) [14]

This feature is not available on all units. Consult the factory.

Switch Mute [15]

This is a read-only view of the Switch Mute setting. Higher power amplifiers which include a maintenance switch or are configured in a system which includes a transfer switch may be set to mute on switch (setting = On) at the factory.

Spare Fault Wizard [16]

This feature allows the user to set the Spare Fault Trigger using the Spare Fault Wizard.

Click on the Spare Fault Wizard button, which opens a new window. See Figure 20. Select between the following fault triggers: Analog Gain Adjust Voltage, Gate Voltage, Regulator Voltage, Power Supply Voltage, SSPA Current, External Mute, or None.

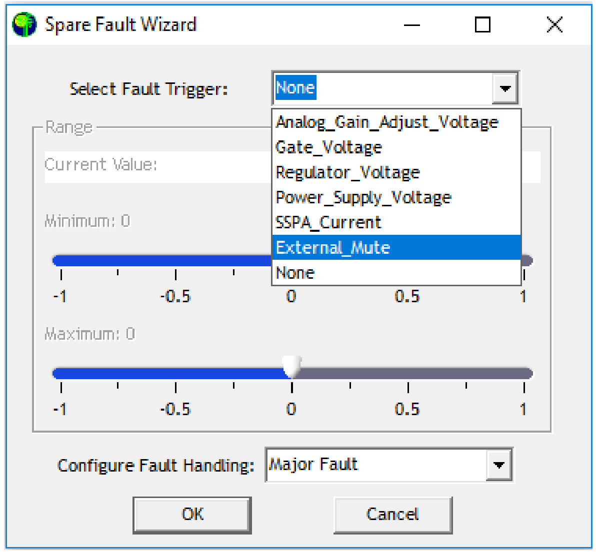


Figure 20: Spare Fault Wizard

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

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

Fault Setups [17]

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

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

Fault Thresholds [18]

Allows the user to set the limit for triggering the unit's Current Fault or High Temperature Fault.

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

> ⚠ **Take care not to adjust the High Temperature Alarm Threshold within the temperature range of the amplifier's normal operation. Doing so will trigger unneccessary high temperature alarm faults.**

IP Setup Tab

If the user wishes to set up the networked Compact Outdoor SSPA with custom IP settings, the internal IP settings need to be modified. Click on the IP Setup Tab. See Figure 21.

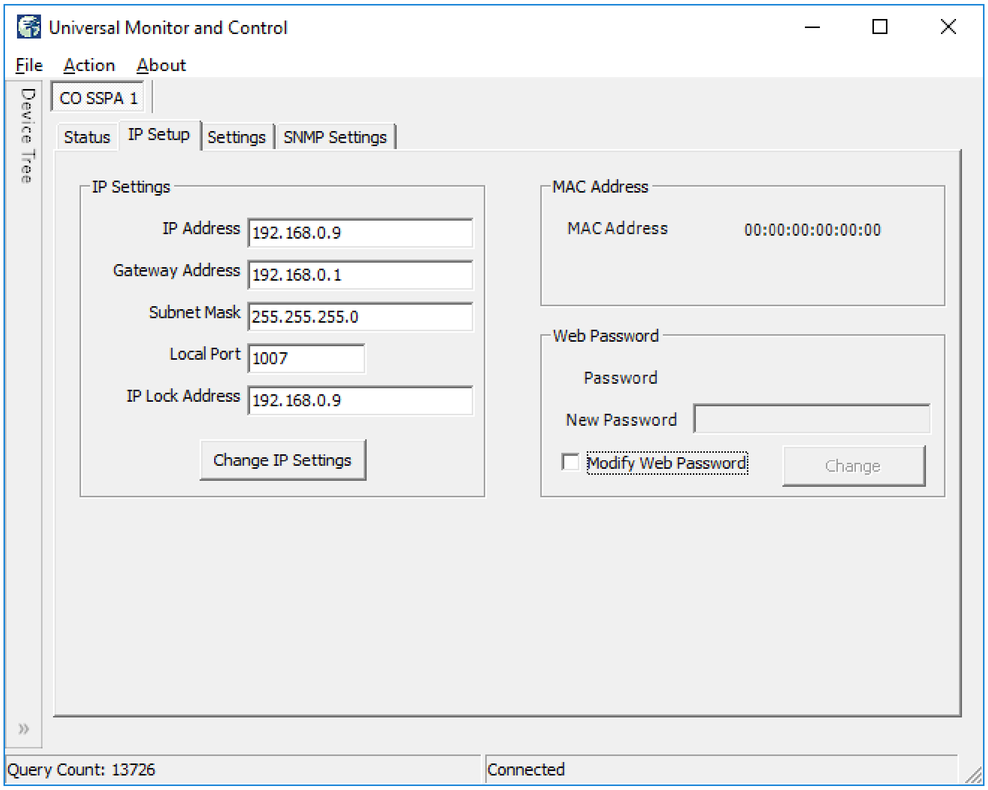


Figure 21: Compact Outdoor SSPA > IP Setup Tab

In this window, the user may enter custom IP settings, including the IP Address of the unit, the Gateway Address, the Subnet Mask and the Local Port.

The IP Lock Address allows the operator to set the IP address from which the amplifier will accept requests. This selection gives the operator the ability to increase the security measure for the IPNet protocol. The SSPA will only answer a request which comes from the assigned IP address.

To disable this feature in firmware versions prior to 6.00, set the Lock IP Address value to 0.0.0.0 or 255.255.255.255. The Lock IP address function was updated in firmware version 6.00 to allow "Binding" and "Masking" functions. "Binding" means that the first datagram re-trieved for this socket will bind to the source IP address and port number. Once binding has been set, the SSPA will answer to the bound IP source until the unit is restarted or reset. Without binding, the socket accepts datagrams from all source IP addresses. Address 0.0.0.0 allows all peers, but provides binding to the first detected IP source; Address 255.255.255.255 accepts all peers, without binding. If the Lock IP Address is a multicast address, then the amplifier will accept queries sent from any IP address of the multicast group.

Click on the 'Change IP Settings' button to save the entered settings into non-volatile memory.

The user may also modify the web password used when accessing the web-based remote M&C. Tick the 'Modify Web Password' checkbox to enable the New Password field. Enter a new password and click on the 'Change' button to save.

Using Custom IP Settings with Quick Start Cable

If the Quick Start Cable is connected to Port J4 when power is applied to the amplifier, it will use the default settings.

Default Settings with Quick Start Cable Connected:

```
Interface: IPNET
IP Address: 192.168.0.9
Local Port: 1007
Gateway: 192.18.0.1
Subnet Mask: 255.255.255.0
IP Lock: 255.255.255.255
Web password: paradise
Read Community: public
Write Community: private
Unit Starts Up: Unmuted
```

To use custom IP settings while using the Quick Start cable, remove power from the amplifier.

Unplug the Quick Start cable from the M&C connector, J4. (If the unit is restarted with the Quick Start cable connected, it will always come up with default IP settings).

Connect power to the SSPA.

Connect the Quick Start cable to J4, and check connectivity with the custom IP settings. Make sure that the Protocol setting in the Settings tab of the Universal M&C is set to IPNet.

If custom IP settings will be used in normal operation, the user will need to construct an IP cable or modify the Quick Start Cable by disconnecting the interface control pins (pins j and e, Baud Select 0 and Baud Select 1) from ground.

In this configuration, the SSPA will always use the saved communication control settings rather than the default configuration.

SNMP Settings Tab

The SNMP Settings Tab allows the operator to change the Read/Write Community strings and the Trap settings (if communicating over SNMP protocol). See Figure 22

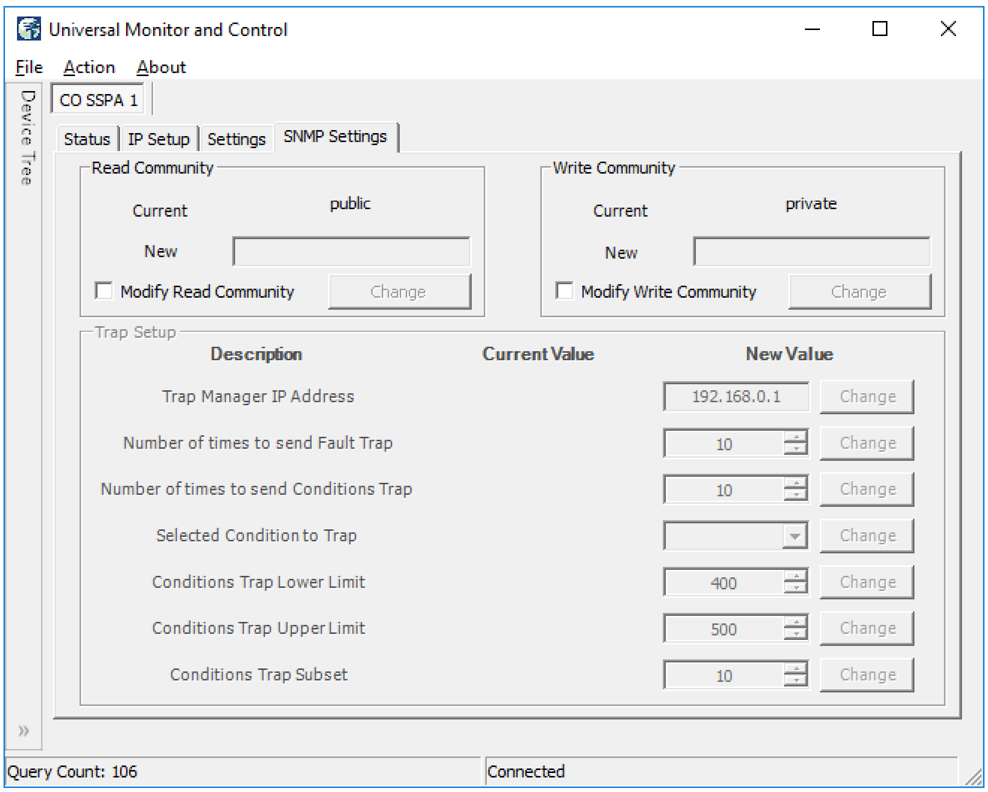


Figure 22: Compact Outdoor SSPA > SNMP Settings Tab

The current Read/Write Community strings are displayed as read from the connected unit. Tick the Modify Read/Write Community checkbox to enable the New Read/Write Community field. Enter a new password and click on the 'Change' button to save.

Add HPO Unit to M&C

Launch the Teledyne Paradise Datacom Universal Monitor and Control software from the Programs Menu of your PC. Upon installation, a shortcut to the software may have been added to your desktop.

Click the 'Action' menu and select 'Add Unit' from the pull-down menu. Select 'High Power Outdoor SSPA' from the menu choices. See Figure 23.

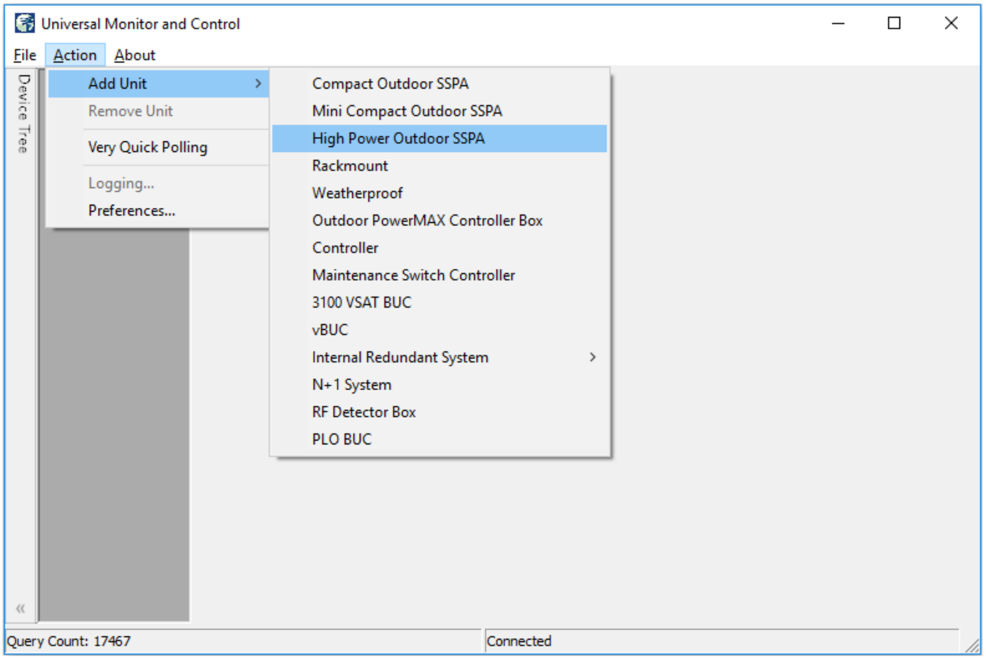


Figure 23: Universal M&C > Add Unit > High Power Outdoor SSPA

A new dialog window will open. Enter the following information where applicable: Unit ID; if using a RS-232 Connection, the Serial Port and Baud Rate. See Figure 24.

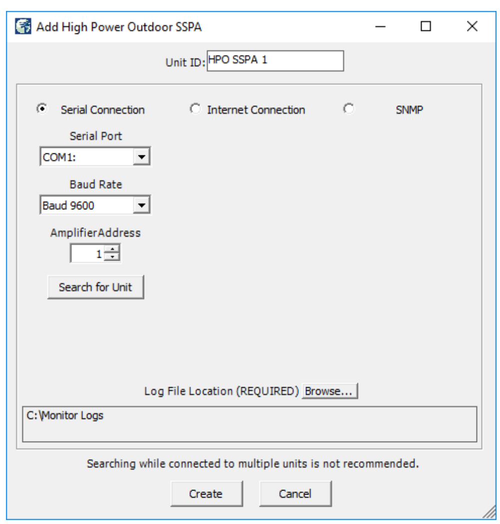


Figure 24: Add High Power Outdoor SSPA > Serial Connection

If using an Ethernet Connection, enter the unit's IP Address and Port number. See Figure 25.

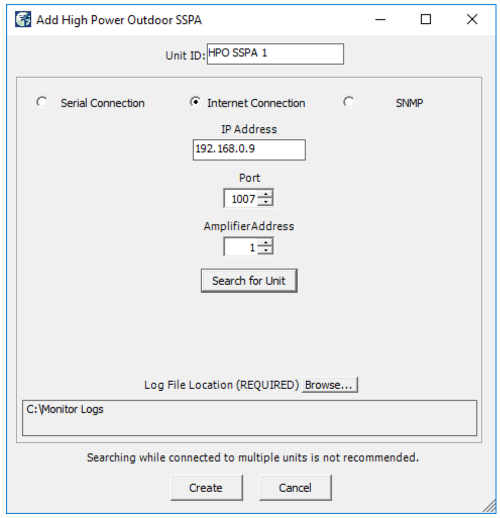


Figure 25: Add High Power Outdoor SSPA > Internet Connection

Specify the unit's Address in the Amplifier Address box. If you don't know the address of the unit you may search for it. Be aware that this search feature is only useful when you have only one unit connected to your PC at a time.

If you wish to change the log file location, click on the 'Browse' button and navigate to the desired location.

Click on the 'Create' button to generate the operation window for this unit.

Overview of the HPO M&C

The H-Series High Power Outdoor SSPA uses the same protocol as the Compact Outdoor SSPA, and also the same structure of Universal M&C.

See the **Overview of the CO M&C** section when using the software with a High Power Outdoor SSPA.

Add Indoor PowerMAX System to M&C

Launch the Teledyne Paradise Datacom Universal M&C software from the Programs Menu of your PC. Upon installation, a shortcut to the software may have been added to your desktop. An Indoor PowerMAX system requires Universal M&C version 4.4.8b or later.

Add Each RM SSPA to M&C

Each individual amplifier in the PowerMAX System should first be added to the Universal M&C. Follow the instructions detailed in the **Add RM Unit to Universal M&C** section.

PowerMAX systems are typically configured with four, eight or 16 amplifiers.

Set the N+1 Settings for each individual unit to include the Array Size (four, eight or 16) for the PowerMAX System and the unique Priority Address for each unit. The amplifier assigned with the lowest Priority Address (typically 1) is granted the Master status for the N+1 system, and controls the other (Slave) amplifiers in the system.

Add PowerMAX System to M&C

To add the PowerMAX System, click the 'Action' menu and select 'Add Unit' from the pull-down menu. Select 'N+1 System' from the menu choices. See Figure 26.

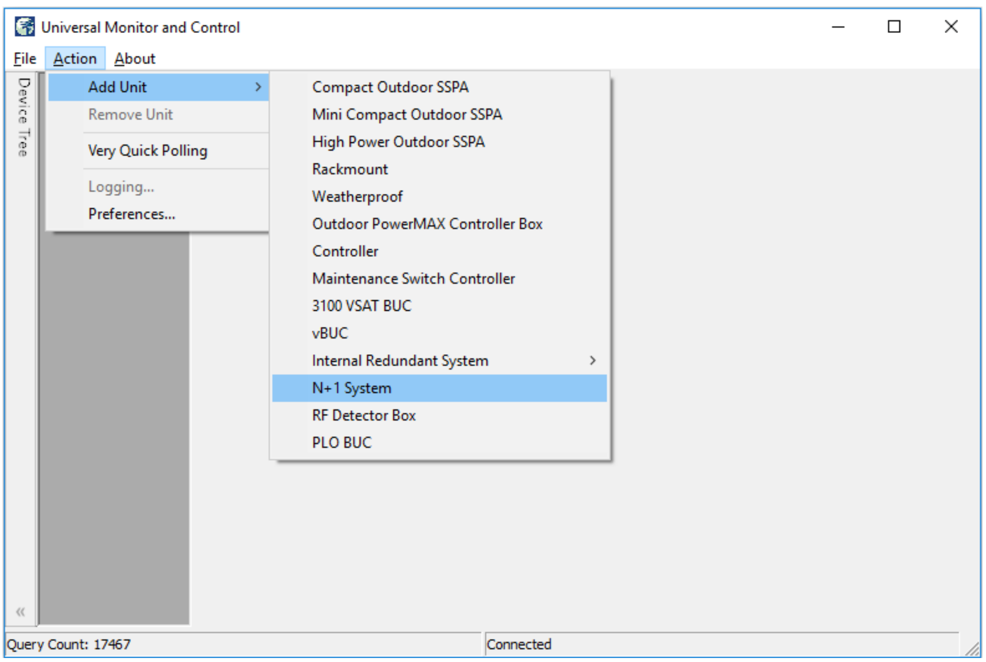


Figure 26: Universal M&C > Add Unit > N+1 System

A new 'Add N+1 System' dialog window will appear, as shown in Figure 27. If the individual amplifier N+1 settings were properly set, the Unit #s should automatically populate in ascending Priority Address order, using the Unit ID entered in the M&C. Otherwise, select the Unit # for each unit in the system and enter a System Name in the field at the bottom of the window. Click on the 'OK' button to initialize the system.

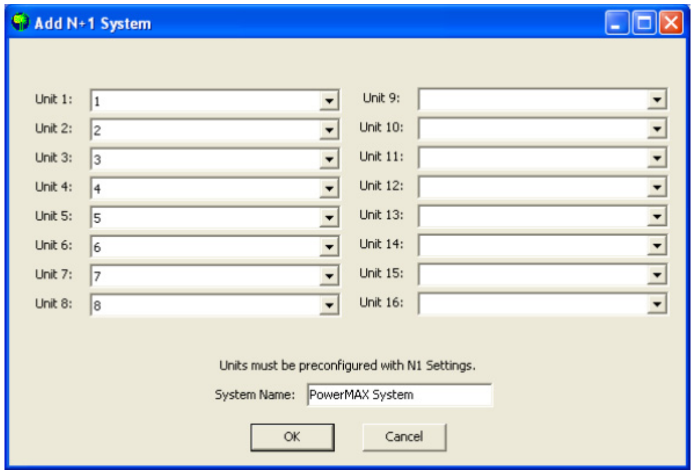


Figure 27: Add N+1 System Selection Window

⚠ **The System window may take several moments to load as the software collects and compiles the data from each unit in the system.**

Overview of the Indoor PowerMAX M&C

The N+1 System tab displays an overview of each unit in the system, and overall system performance. The Universal M&C screen shown in Figure 28 displays the N+1 system tab (labeled PowerMAX System), as well as tabs for each of the eight (8) SSPA units (labeled 1, 2, 3, 4, 5, 6, 7 and 8) being monitored.

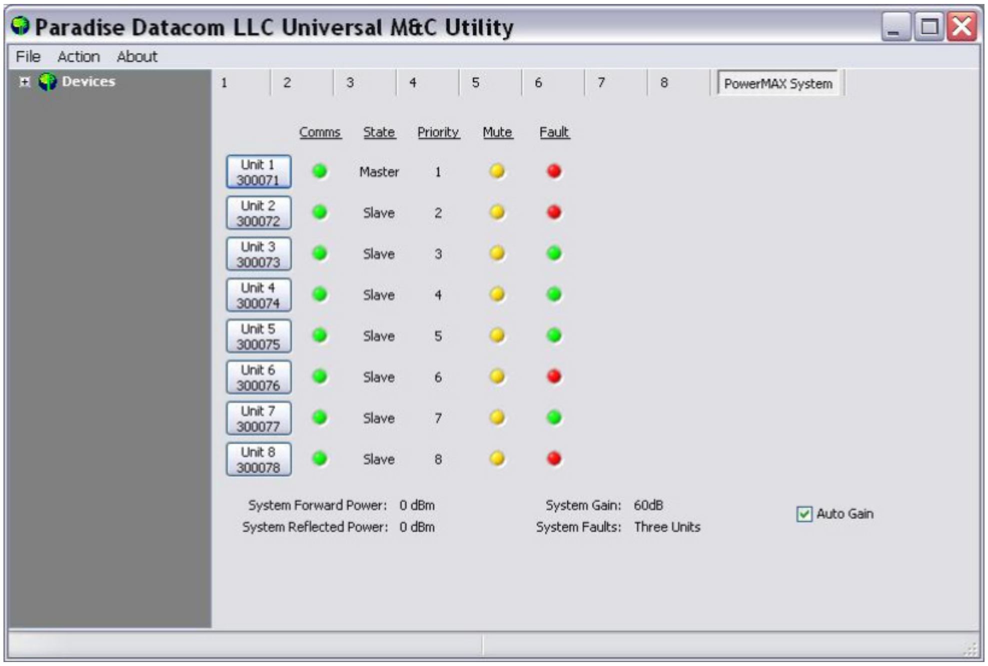


Figure 28: N+1 System Tab

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 System Forward Power, Reflected Power, System Gain and number of System Faults. A checkbox at the lower right of the window allows the user to quickly enable or disable the Auto Gain function. See the Auto Gain description in the **Touchscreen Menu Structure** section.

By hovering the mouse over the individual unit buttons, as shown in Figure 29, the unit's condtions are detailed.

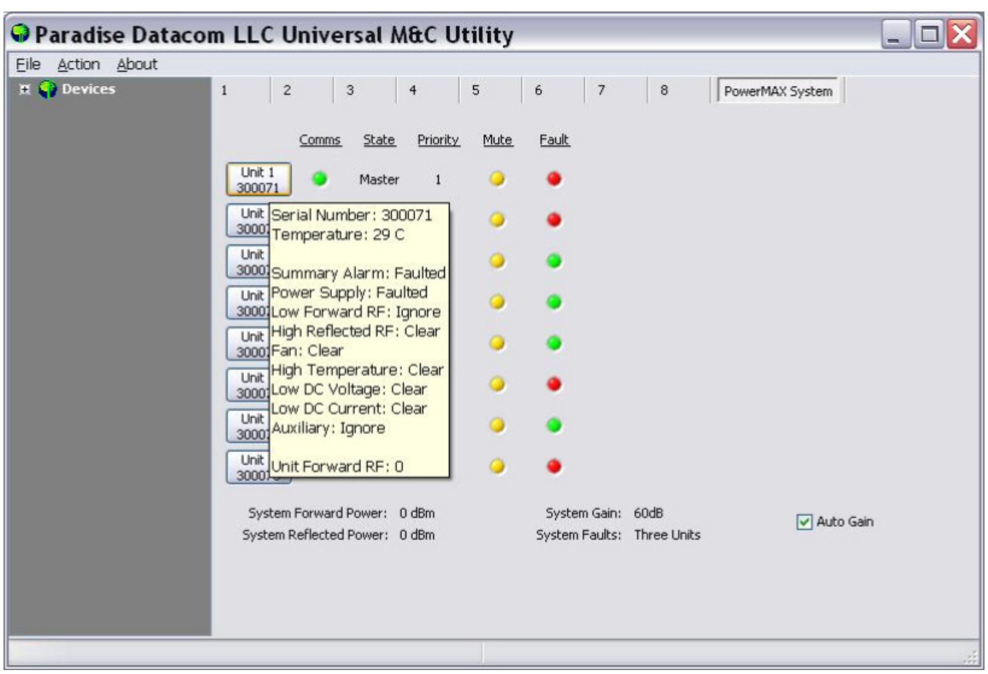


Figure 29: N+1 System Tab > Unit Info on Hover

Clicking on the Unit # button to switch to the Status tab for that unit. You may also click on the unit's tab to navigate to the M&C windows for that unit.

The N+1 tab for each unit shows the N+1 settings for that unit. Depending on whether the unit is assigned Master status or Slave status, the N+1 screen will show slightly different information. Figure 30 shows the display for the Master unit.

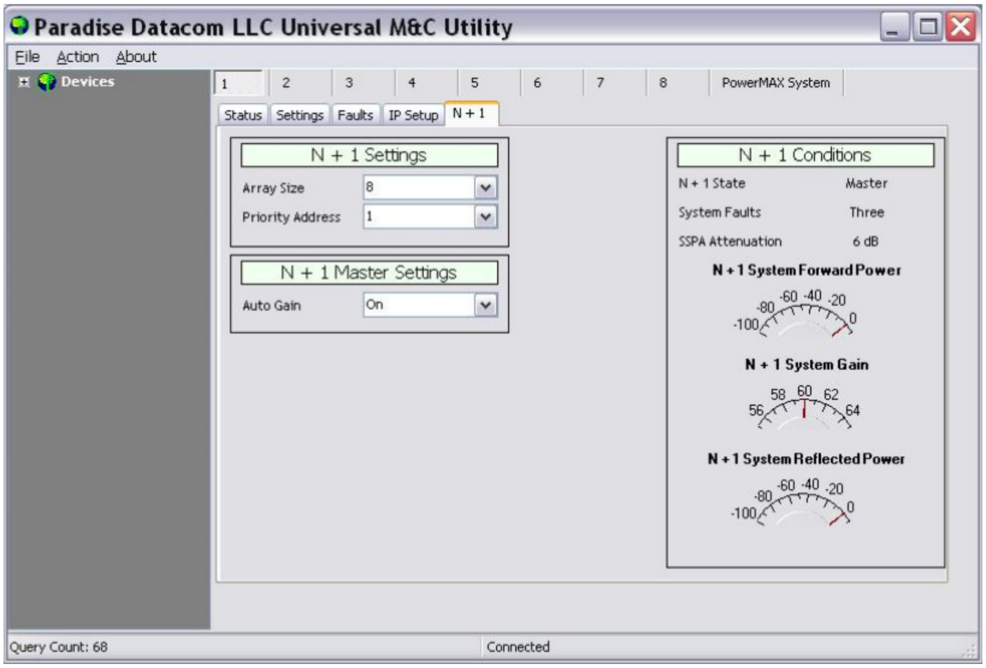


Figure 30: N+1 Tab > Master Unit

Figure 31 shows the display for the Slave units.

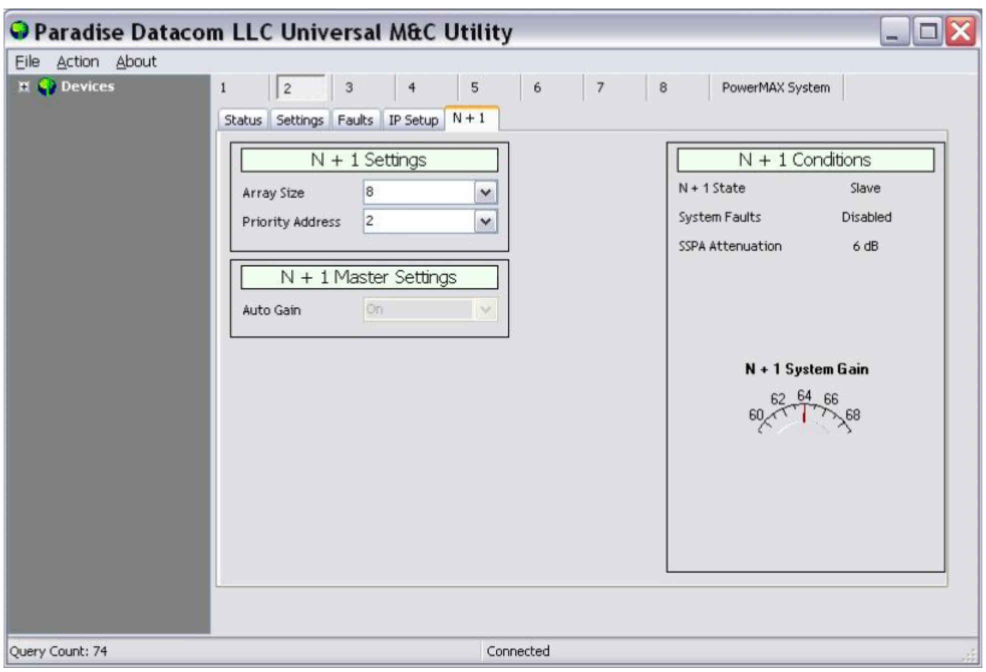


Figure 31: N+1 Tab > Slave Unit

Add Outdoor PowerMAX System to M&C

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

The operator must load each of the Outdoor SSPA Controllers individually. Refer to Table 1 for the default IP addresses to use.

Table 1: Outdoor SSPA Controllers, IP Addresses for Universal M&C

Controller ID	IP Address
Outdoor SSPA Controller 1 (Master)	192.168.0.11
Outdoor SSPA Controller 2 (Slave)	192.168.0.12

Launch the Teledyne Paradise Datacom Universal Monitor and Control software from the Programs Menu of your PC. Upon installation, a shortcut to the software may have been added to your desktop.

With the system operating, select the Action pull-down menu, select Add Unit, and select Outdoor PowerMAX Controller Box. See Figure 32.

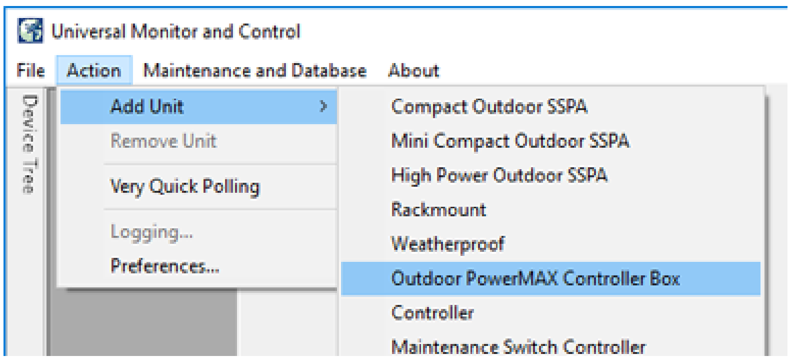


Figure 32: Universal M&C > Add Unit > Outdoor PowerMAX Controller Box

A new dialog window will open. Select the Internet connection. See Figure 33.

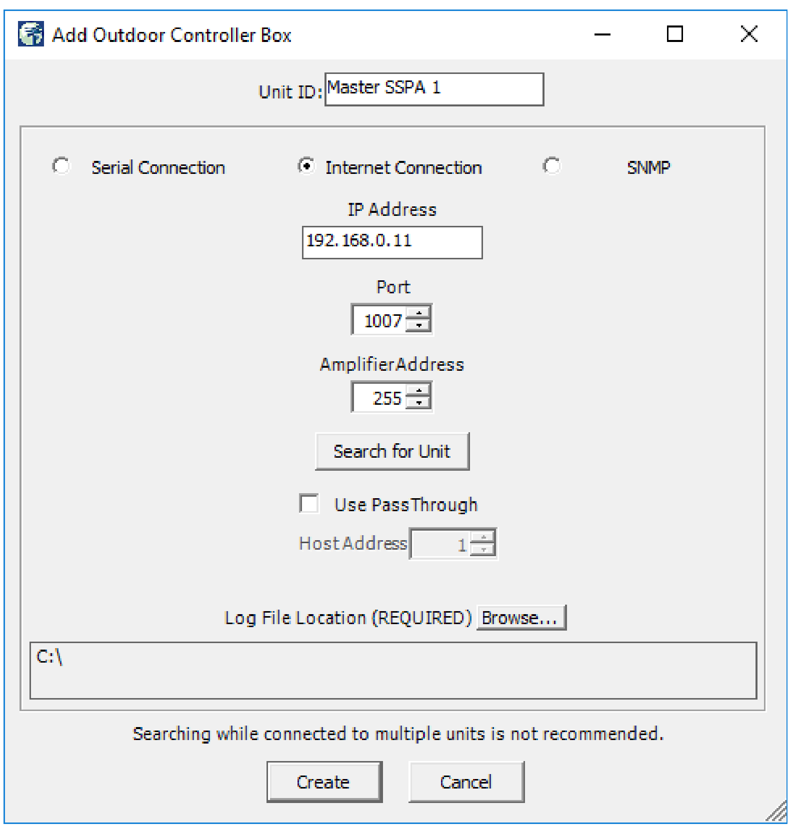


Figure 33: Add Outdoor PowerMAX Controller Box

Enter the Unit ID text that will be used to identify the unit in the M&C application. For example, "Master SSPA 1" for Controller 1.

Enter the IP address of the Master or Slave unit . Refer to Table 1.

Use the default port 1007, or change to reflect the local network.

Enter the global address (255) in the Amplifier Address field, and click on the [Search for Unit] button. The utility will locate the unit on the network. See Figure 34. Click on the [OK] button.

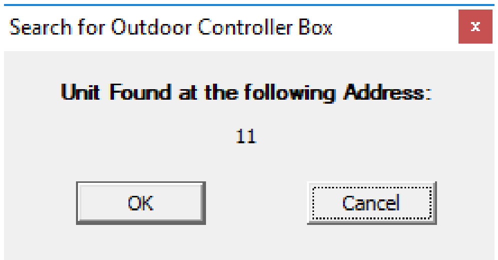


Figure 34: Dialog Window, Search for Outdoor Controller Box

Click on the [Create] button to open the M&C windows.

Repeat for each Outdoor SSPA Controller.

Overview of the Outdoor PowerMAX M&C

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

Status Window for Outdoor SSPA Controllers

The Status Window for the Outdoor SSPA Controllers (Controller 1, typically the Master controller) shows the operational status of the array of four (4) SSPA modules for that system. See Figure 35.

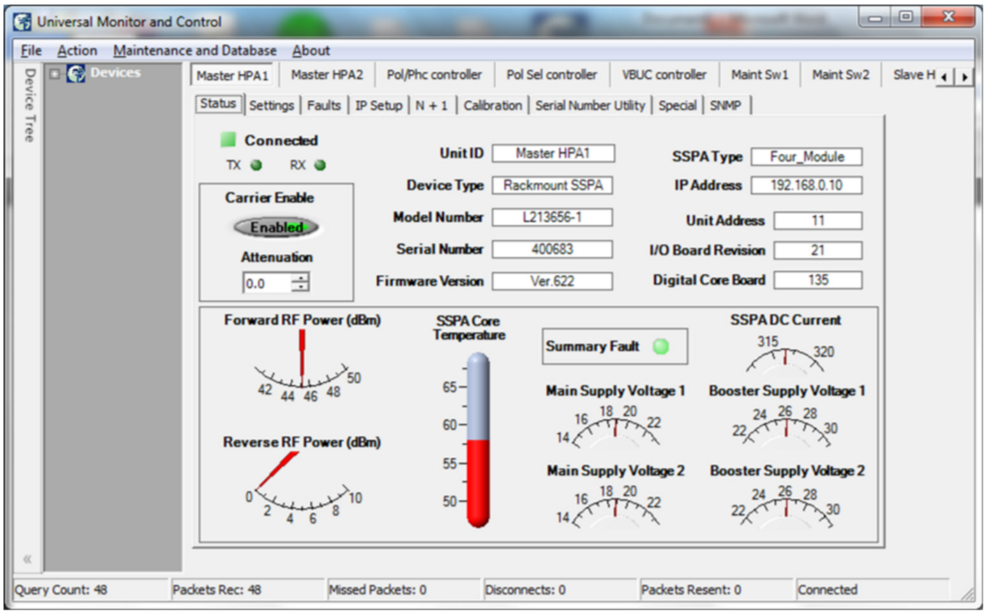


Figure 7-10: Status Window, Outdoor SSPA Controllers

Figure 35: Status Window, Outdoor SSPA Controllers

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

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

Settings Window for Outdoor SSPA Controllers

The Settings Window, shown in Figure 36, is common for all controllers, and is used to select the operation settings for the unit.

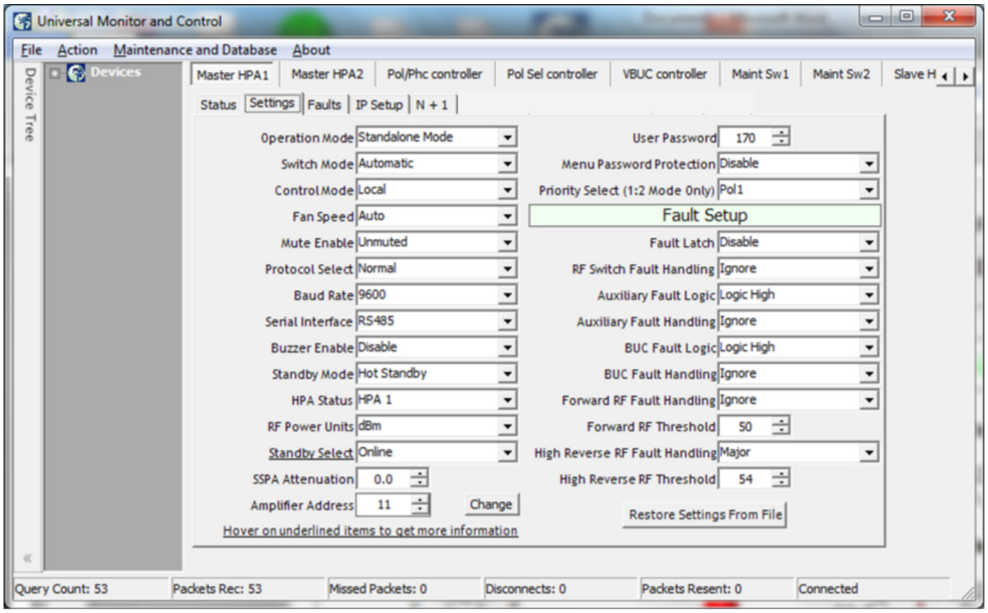


Figure 36: Settings Window, Outdoor SSPA Controllers

See your system manual for the required settings for each controller.

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

Faults Window for Outdoor SSPA Controllers

The Faults Window, shown in Figure 37, is common for all controllers, and is used to monitor the various fault conditions for the SSPA Modules connected to the unit.

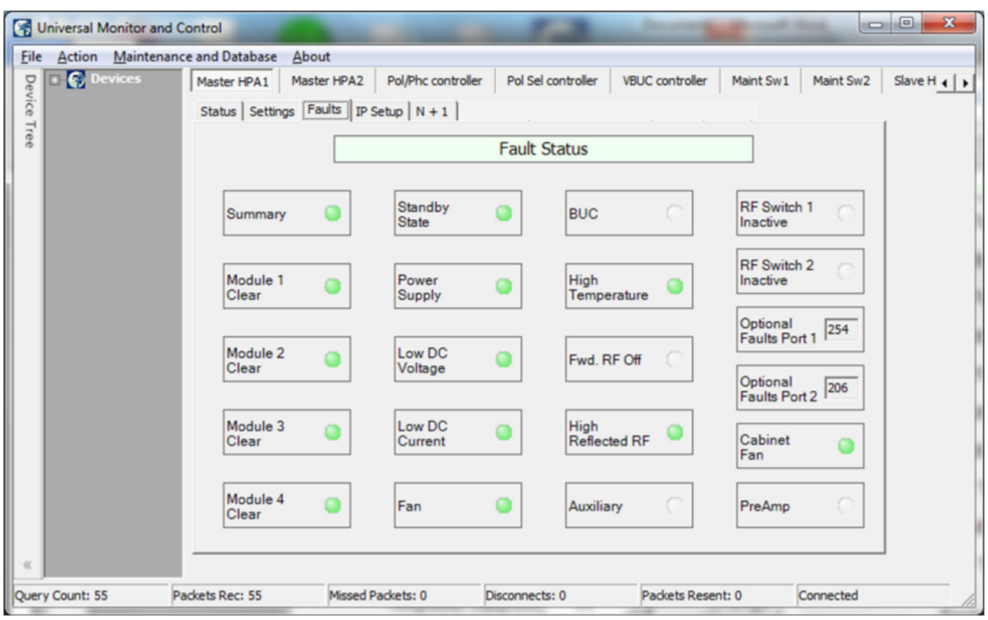


Figure 37: Faults Window, Outdoor SSPA Controllers

Table 2 shows how the fault LEDs in this window correspond with the SSPA Modules for the indicated Outdoor Controller.

Table 2: Identifying SSPA Module Faults in Universal M&C Faults Window

Module # Fault LED	SSPA Module

Module 1 for the Faults Window of Controller 1	SSPA 1.1
Module 2 for the Faults Window of Controller 1	SSPA 1.2
Module 3 for the Faults Window of Controller 1	SSPA 1.3
Module 4 for the Faults Window of Controller 1	SSPA 1.4
Module 1 for the Faults Window of Controller 2	SSPA 2.1
Module 2 for the Faults Window of Controller 2	SSPA 2.2
Module 3 for the Faults Window of Controller 2	SSPA 2.3
Module 4 for the Faults Window of Controller 2	SSPA 2.4

IP Setup Window for Outdoor SSPA Controllers

The IP Setup Window is common for all controllers, and is used to adjust the IP settings for the connected unit. The IP Address, Gateway Address, Subnet Mask, Local Port and IP Lock Address may all be modified. See Figure 38. Changes to these settings require a unit restart before they are applied.

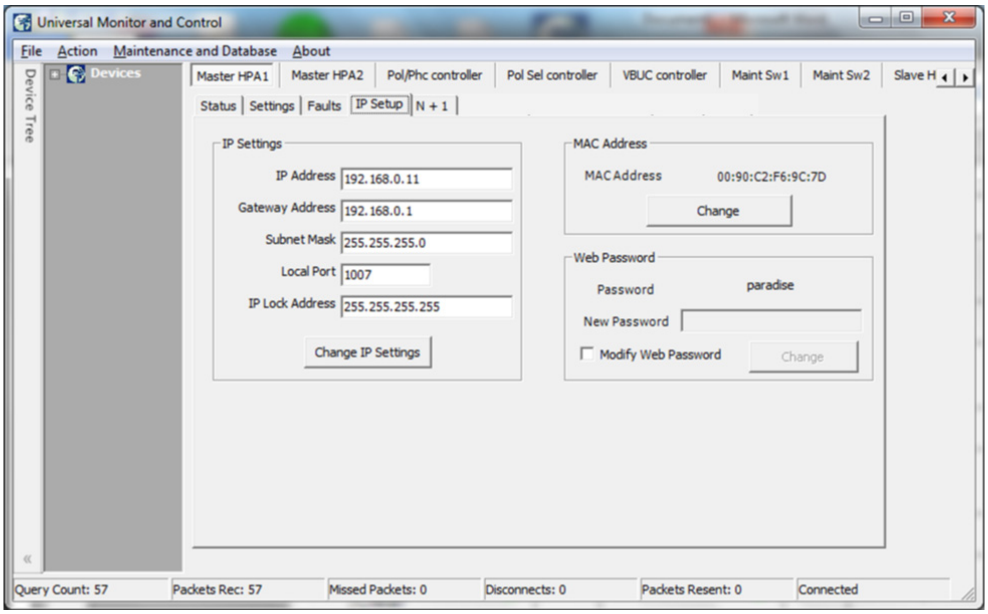


Figure 38: IP Setup Window, Outdoor SSPA Controllers

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

Add RCP Unit to M&C

Launch the Universal M&C software. Click on the Action menu and select "Add Unit", then choose "Controller" from the pull-down menu. See Figure 39.

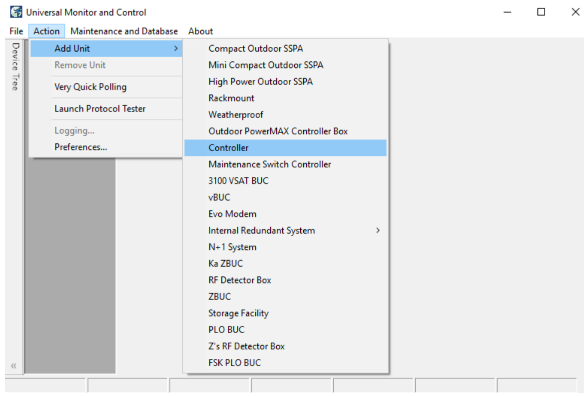


Figure 39: Universal M&C, Add New Controller Unit

A new dialog window will appear. See Figure 40. Select the method of communication (Serial Connection, Internet Connection, or SNMP).

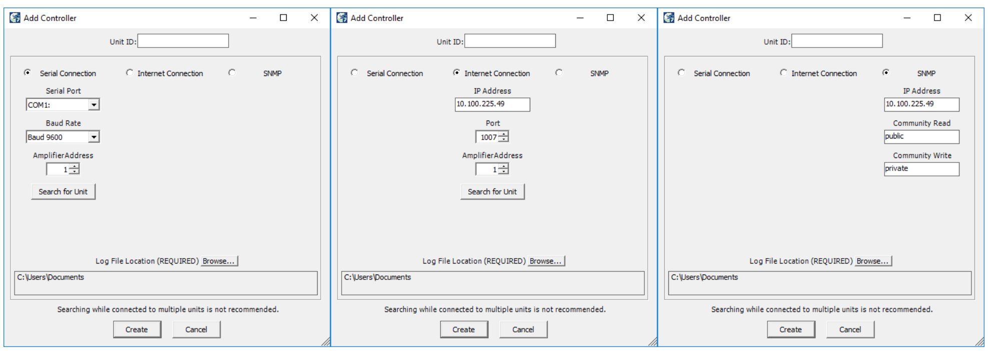


Figure 40: Add Controller (Serial, Internet or SNMP Connection)

For Serial Connections, select the Serial Port and Baud Rate, and select the amplifier address. If you don't know the address of the unit you may search for it. Click the Search for Unit button.

For Internet Connection, enter the IP address of the unit, and select the port and amplifier address. Click the Search for Unit button if you don't know the address of the unit.

> ⚠ **Note: The Search for Unit feature is only useful when you have only one unit connected to your PC at a time.**

For SNMP, enter the IP address of the unit and the community read/write passwords.

The default Community Read password is **public**.

The default Community Write password is **private**.

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. Click the Create button to open the M&C windows.

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

Click on the Create button to open the M&C windows.

Overview of the RCP2 M&C

The Universal M&C user interface features five screens which are used to monitor and control the system.

- Status
- IP Setup
- Conditions
- Settings
- HPA Control Panel

Status Tab

The first screen is the "Status" window shown in Figure 41.

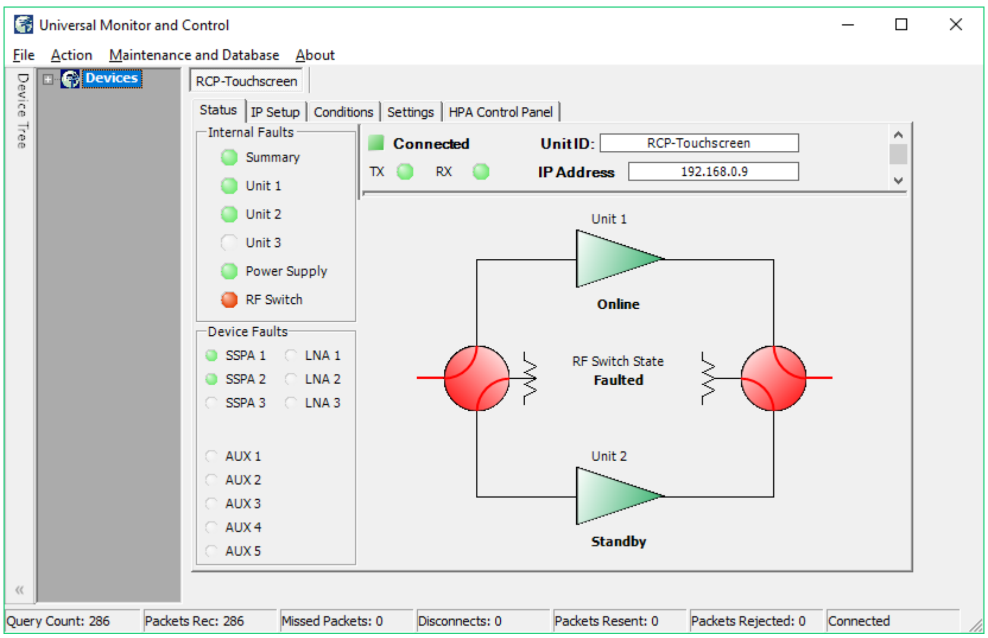


Figure 41: Universal M&C, Status Tab

The status screen reflects the Online/Standby status of each amplifier in the system, and the switch position of each waveguide switch in the system. In addition, Internal and Device fault indicators are displayed. When there is no fault condition on a given unit, the indicator illuminates green. When a fault condition exists, the indicator illuminates red.

⚠ **Note that in Figure 41 above, there is an RF Switch Fault. The RF Switch fault indicator is illuminated red in the Internal Faults panel, and the RF Switch State in the mimic panel shows "Faulted". In addition, the baseball switch icons are colored red to indicate a switch fault.**

The user may click on one of the triangular amplifier icons to set that amplifier as the Standby unit in the system.

IP Setup Window

The second screen is the "IP Setup" window, shown in Figure 42.

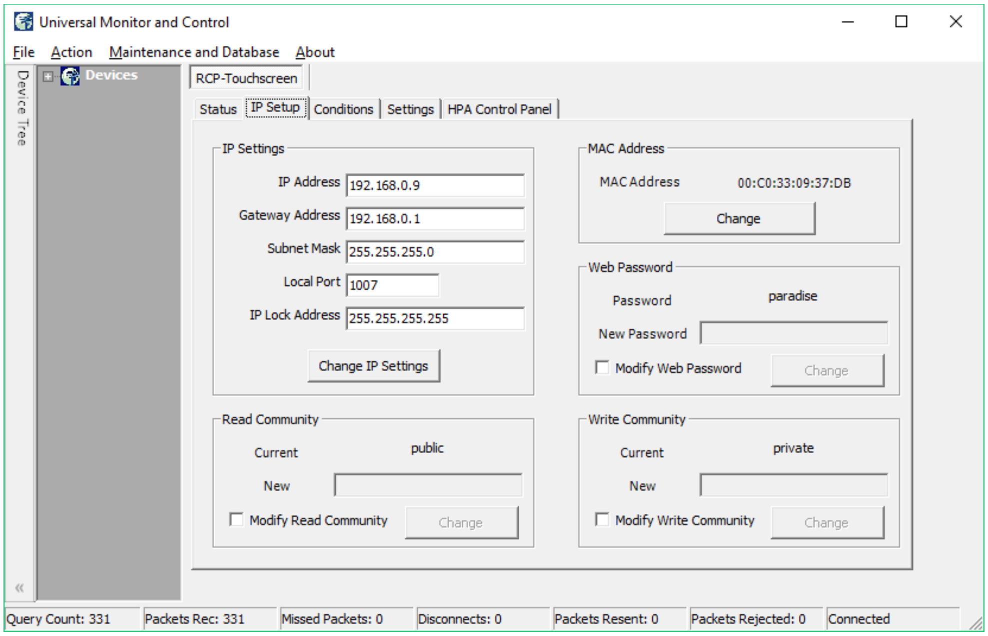


Figure 42: Universal M&C IP Setup Window

It shows the user all of the TCP/IP settings on the unit. When the IP Address is modified the unit must be reset for it to use the new IP Address. Until the unit is reset it will use the old IP Address. The Amplifier Local Port is the port that the unit monitors for UDP requests. The unit also answers requests using the same port.

If the Amplifier Local Port is changed the unit must be reset. The Gateway Address and Subnet Mask are standard settings for TCPI/IP communications. If either of these settings is changed the unit 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 unit.

Conditions Window

The third screen displays the Conditions of the units connected to the controller, as shown in Figure 43.

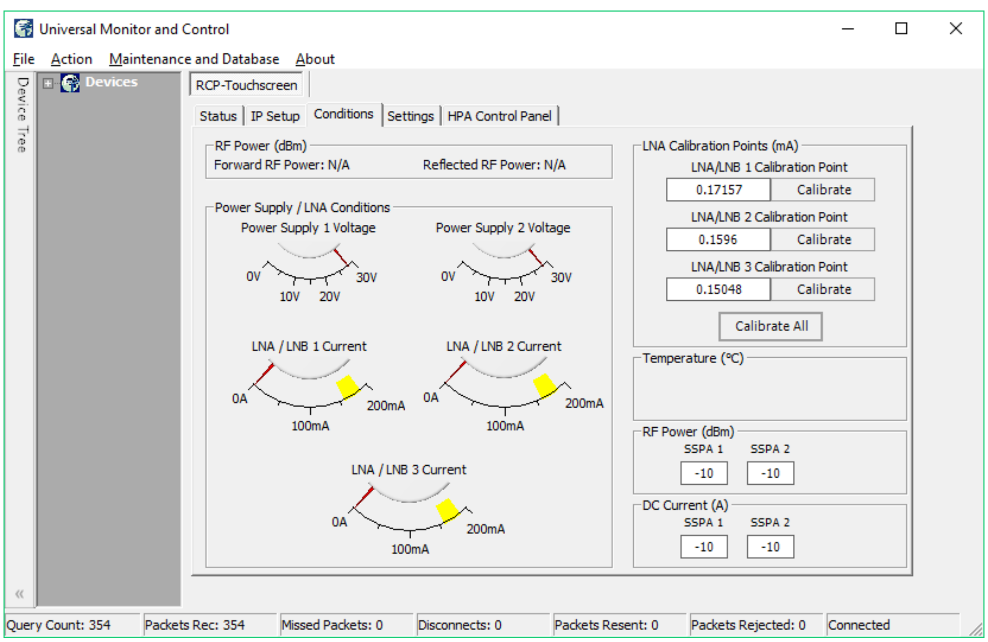


Figure 43: Universal M&C, Conditions Window

The system forward power, reflected power, power supply voltages and LNA/LNB currents and temperatures are all monitored. In addition, the calibration points of each LNA/LNB are displayed.

Settings Window

The fourth screen is the "Settings" screen, shown in Figure 44.

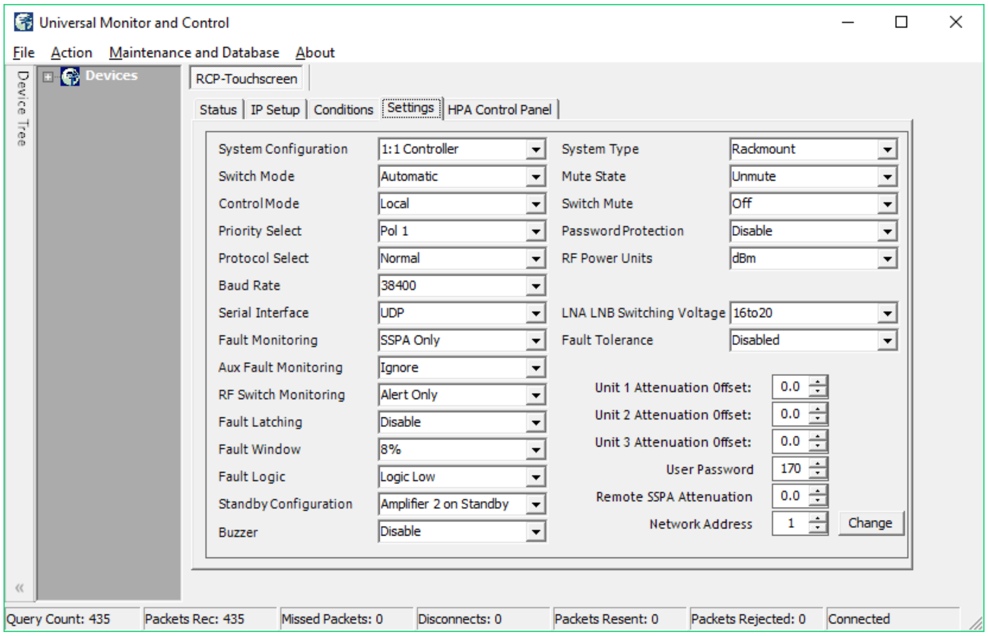


Figure 44: Universal M&C, Settings Window

It shows the user all available settings on the unit. All user-adjustable settings may be modified to suit the specific needs of the customer. However, it should be noted that the units are pre-configured for the customer at the factory. If modification of any settings is necessary, refer to the Table 7 of the **Remote Control Interface** section.

HPA Control Panel Window

The fifth screen is the "HPA Control Panel" screen, shown in Figure 45.

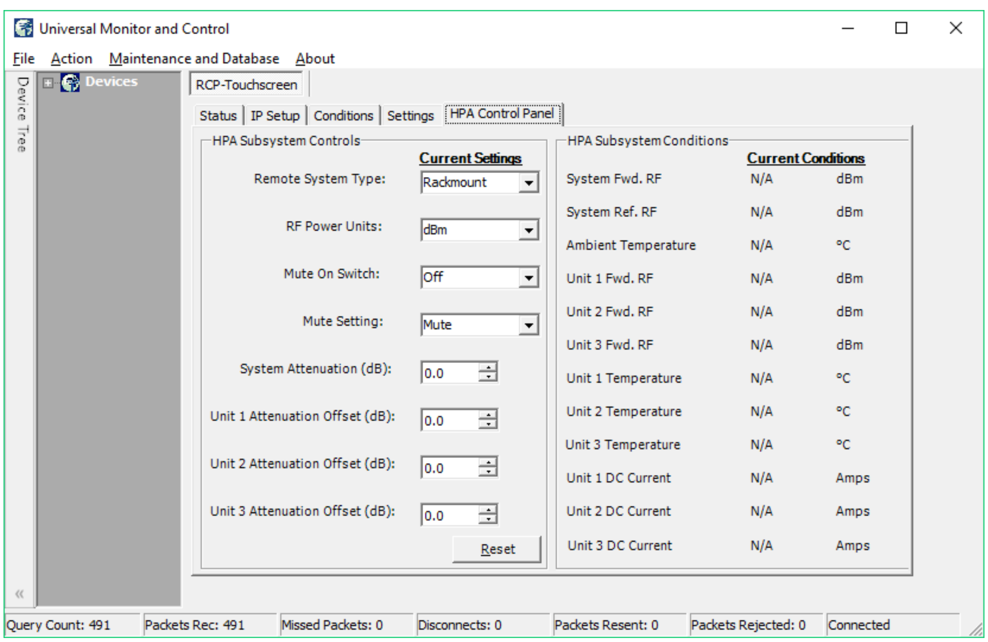


Figure 45: Universal M&C, HPA Control Panel Window

From this window, the user may select the type of amplifier used in the system, choose the RF power units displayed, mute or unmute the system, and set the attenuation levels of the system or individual amplifier offsets. The user may also monitor the forward RF, temperature and DC current conditions of the HPA subsystem.

Universal M&C Advanced Features

Universal M&C Preferences

The user can adjust certain preferences of the Universal Monitor and Control software. Click on the Action pull-down menu and select Preferences. See Figure 46.

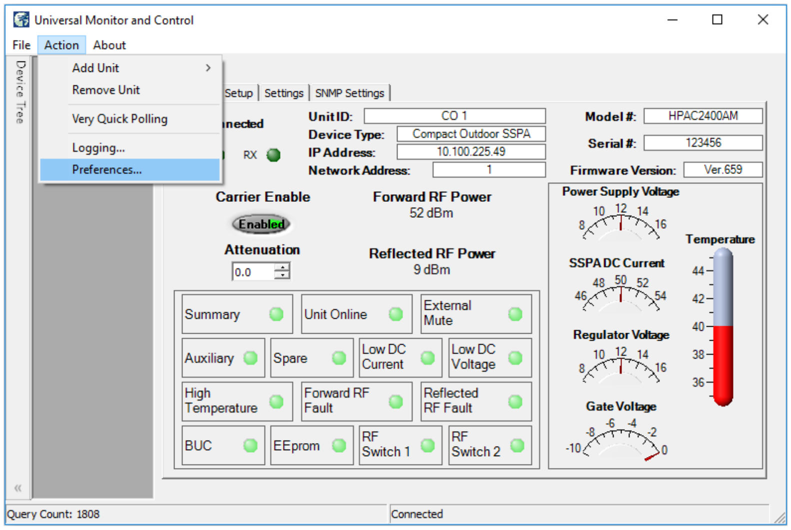


Figure 46: Universal M&C > Action > Preferences

Queries

Click on the Queries icon at left to open the Query Settings menu. Select the PC Source Address. Adjust the interval that the software queries the unit. Tick the Queries Enabled checkbox to begin sending queries to the connected unit. Note that if queries are disabled, there will be no communication with the unit at startup. Untick the bottom checkbox to disable commands on units set to Local Control Mode. See Figure 47.

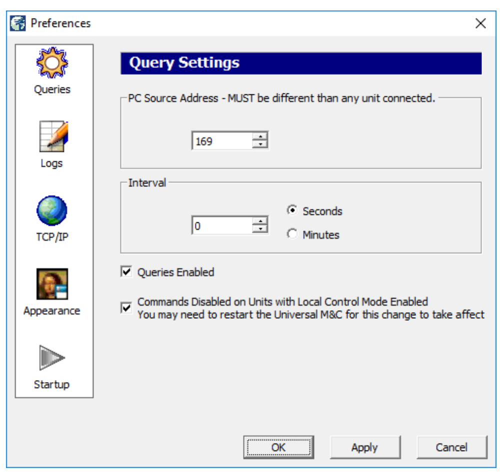


Figure 47: Universal M&C Preferences > Queries

Logs

Click on the Logs icon at left to open the Log Settings menu. Adjust the interval that selected parameters are recorded (in minutes or seconds). Tick the checkbox to enable logging. See Figure 48.

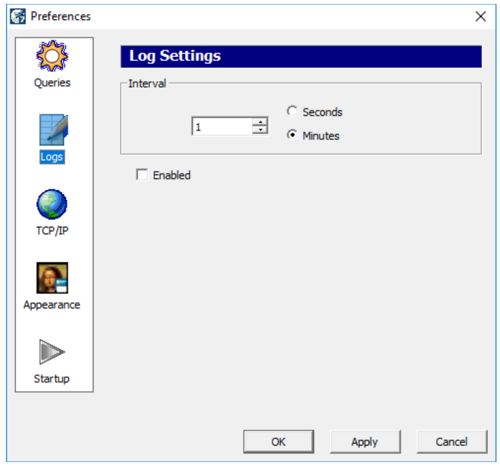


Figure 48: Universal M&C Preferences > Logs

TCP/IP

Click on the TCP/IP icon at left to open the TCP/IP Settings menu. Select the Local UDP Port (the software must be restarted to take effect). Note that each UDP address must be unique. Default Unit UDP Port is 1007. See Figure 49.

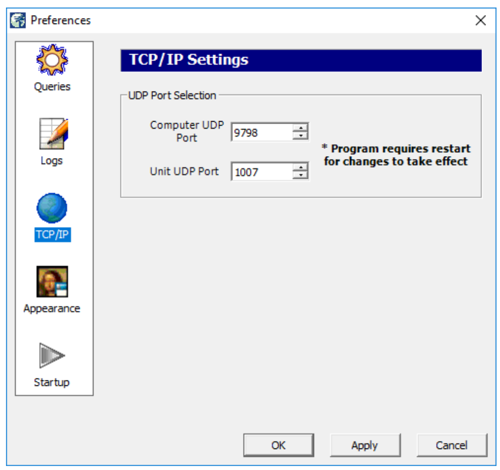


Figure 49: Universal M&C Preferences > TCP/IP

Appearance

Click on the Appearance icon at left to open the Appearance menu. Set the transparency of the M&C Windows. A setting of 0 indicates no transparency. Maximum value is 80. See Figure 50.

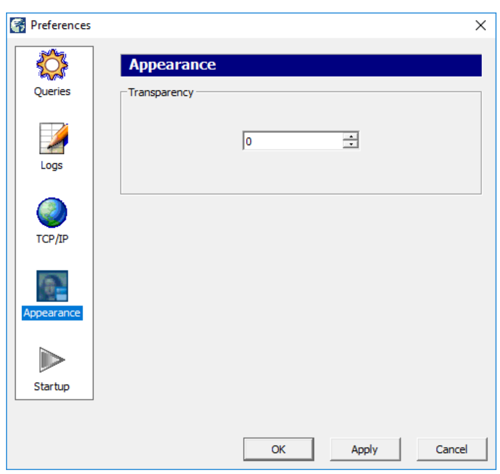


Figure 50: Universal M&C Preferences > Appearance

Startup

Click on the Startup icon at left to open the Startup menu. Tick the checkbox to enable auto-loading of the last-used device configuration. See Figure 51.

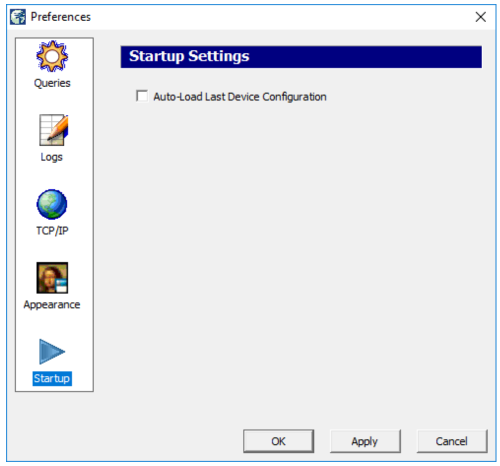


Figure 51: Universal M&C Preferences > Startup

Using the Device Logger

The Universal Logger may be used to show a real-time log of selected parameters. Before opening the logger, at least one unit must be connected and added to the Universal M&C. To open the Logger, click on the Action pull-down menu and select 'Logging...' as shown in Figure 52.

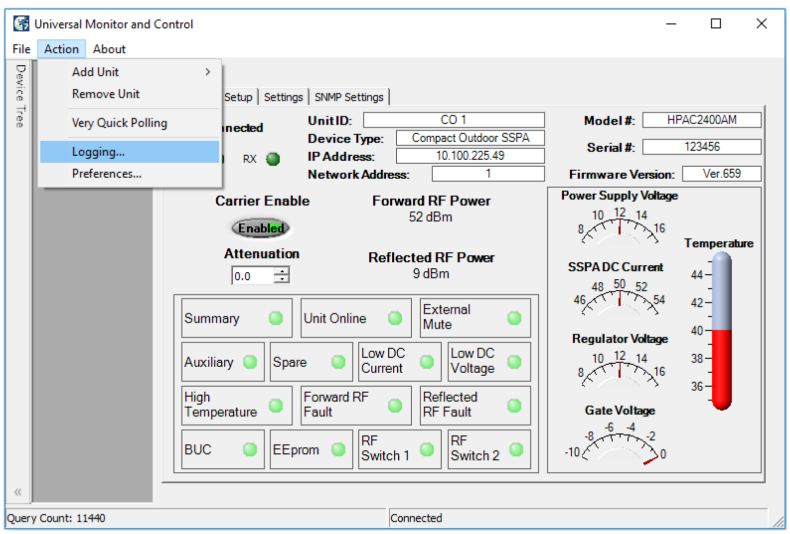


Figure 52: Universal M&C Action > Logging...

The Device Logger will open, as seen in Figure 53.

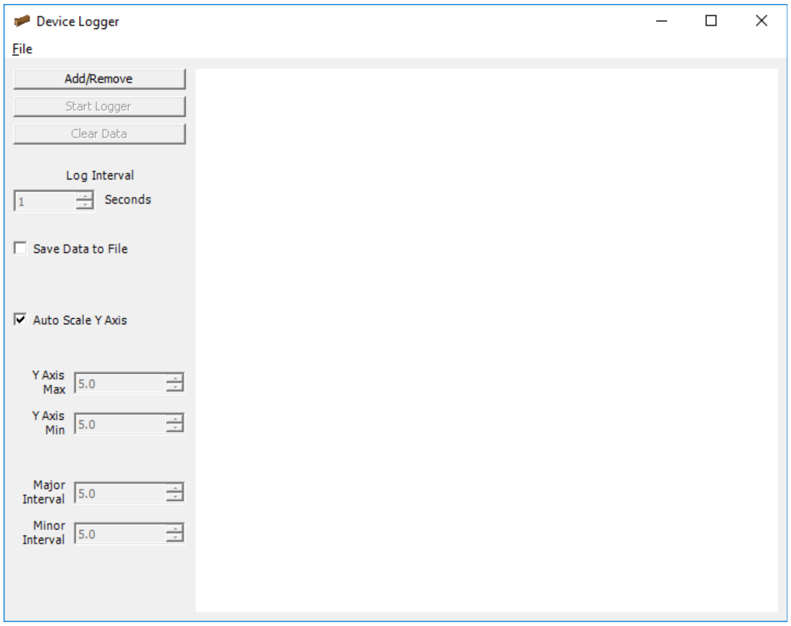


Figure 53: Universal M&C Device Logger Window

Click on the 'Add/Remove' button, which opens a new window as shown in Figure 54. Select the desired device in the Available Devices pull-down menu. Individually select which parameters to log (or remove unwanted parameters).

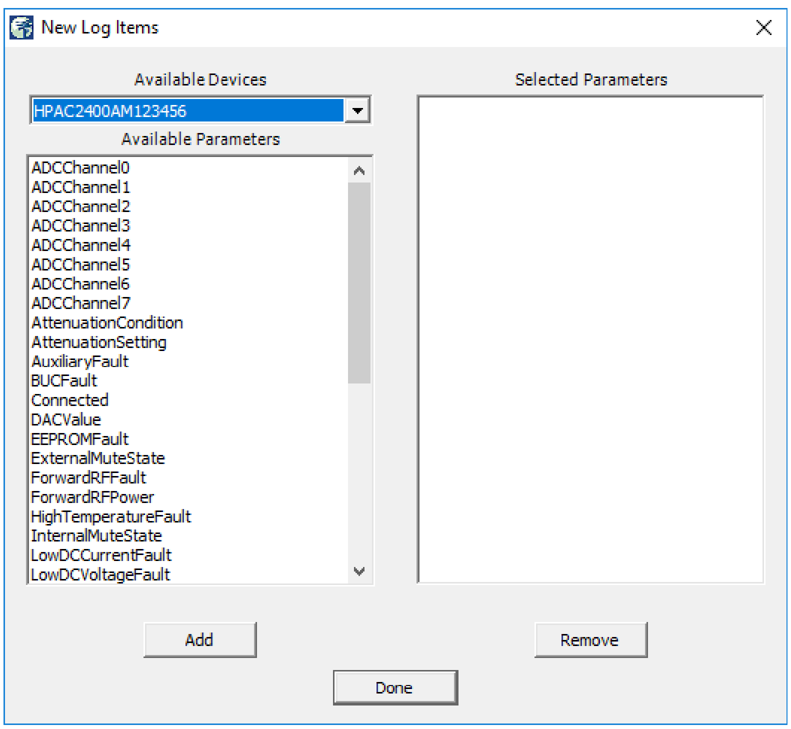


Figure 54: Universal M&C Device Logger > New Log Items Window

After choosing the parameters, the Logger window will be similar to Figure 55. Click on the Done button to accept the list of selected parameters.

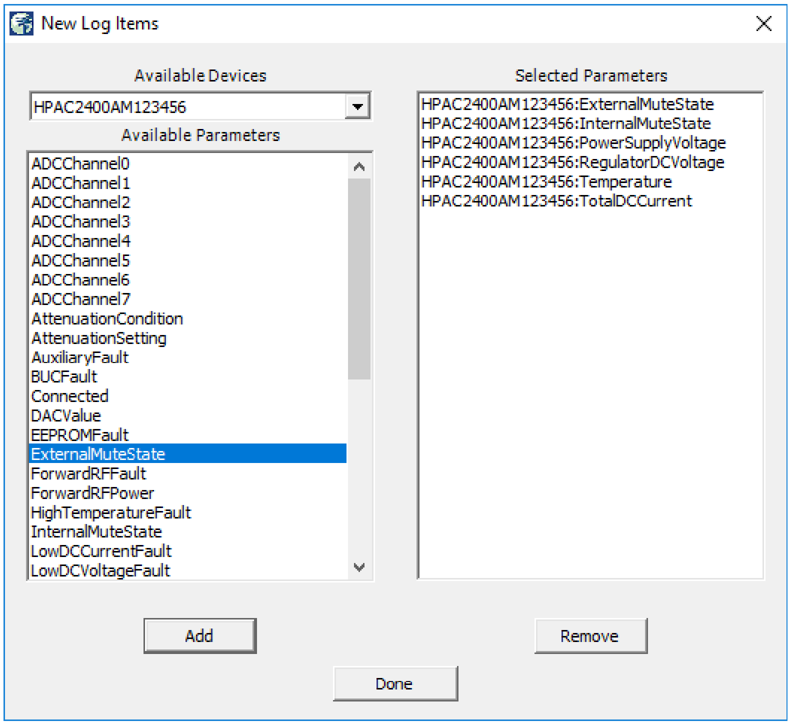


Figure 55: Universal M&C Device Logger > New Log Items > Items Selected

You may modify the log interval by entering the number of seconds between each record. Default interval is 1 second. Click on the Start Logging button to begin logging the selected parameters.

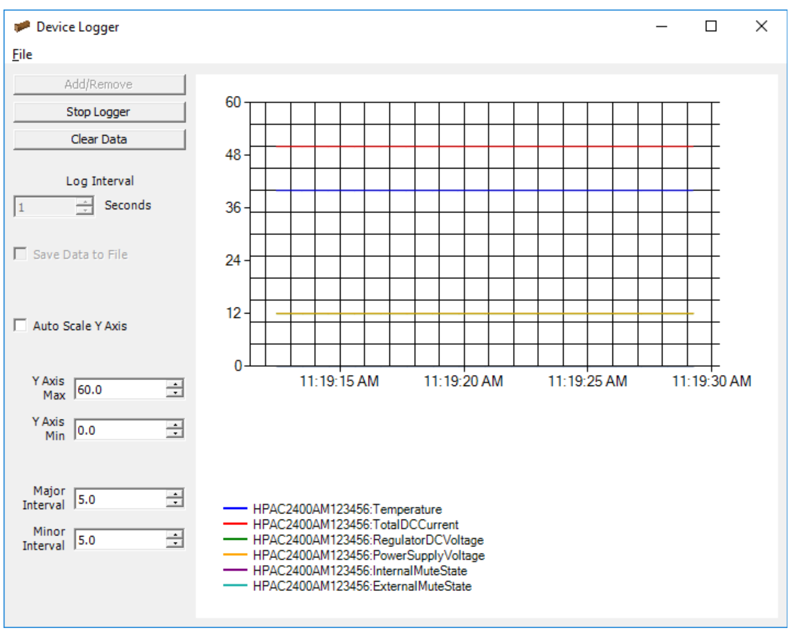


Figure 56: Universal M&C Device Logger > Start Logging

Click on the 'File' menu and select 'Print' to print the graph and legend as shown in Figure 56. You may stop, start, and clear the data at any time.

⚠ **While running the Logger, you may continue to use the Universal M&C to monitor the status of or make settings modifications to any connected unit.**

Saving M&C Configurations

The Universal M&C allows users to save multiple configurations to a variety of units. In addition, the software features a 'Load Last Configuration' option that will reload the last configuration used by the M&C.

Save a Single Configuration

To save a single configuration, add the desired units to the Universal M&C and select 'Save Configuration' from the 'File' menu. See Figure 57. After saving, a confirmation message will appear that states the success of the save. This saved configuration may be reloaded even after a computer restart. It is important to note that the Universal M&C will occasionally perform this save automatically.

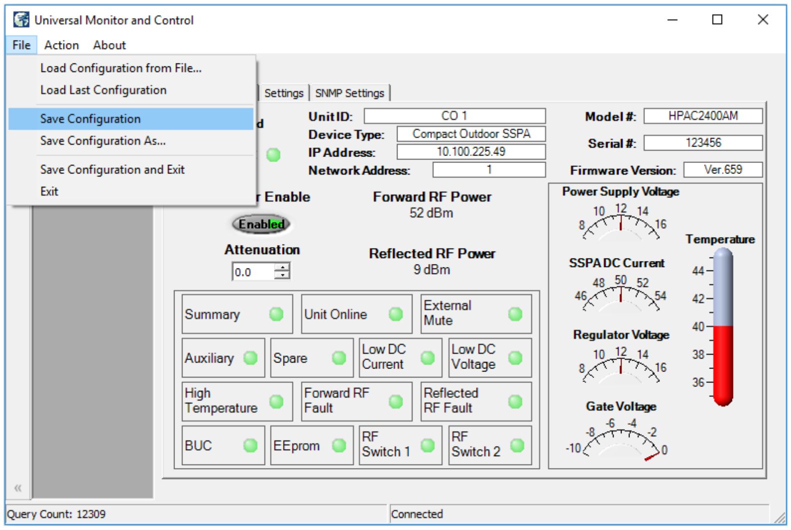


Figure 57: Universal M&C File > Save Configuration

To be certain the proper configuration is saved, select 'Save Configuration As...' from the 'File' menu, and navigate to a directory to which the file will be saved. You may wish to name the file with descriptive text about the connected unit.

Load the Last Configuration

To load the last configuration, select 'Load Last Configuration' from the 'File' menu. See Figure 58. The M&C will load whatever unit(s) were previously loaded. You may set the Universal M&C Preferences to automatically load the last configuration used by the Universal M&C software when the software is run. See the Startup Preferences section.

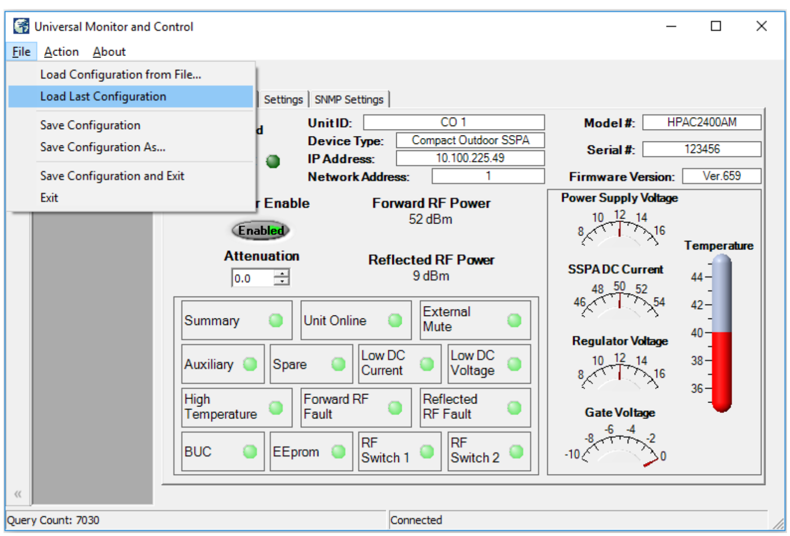


Figure 58: Universal M&C File > Load Last Configuration

Load a Configuration from a File

To load a specific configuration from a file, select 'Load Configuration from File...' from the 'File' menu. Select the location of the file as shown in Figure 59. Click the Open button to load the configuration to the Universal M&C.

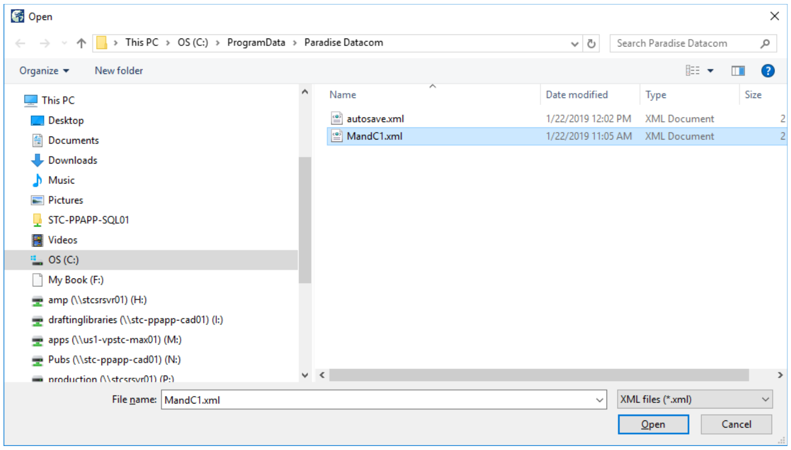


Figure 59: Universal M&C File > Load Configuration from File

Teledyne Paradise Datacom
Drawing Number 216594-2 Revision A
ECO 18855
Last Modified: 11 October 2019

Use and Disclosure of Data

Teledyne Paradise Datacom
Drawing Number: 216594-1 Revision A
ECO 18855
11 October 2019

UNCONTROLLED WHEN PRINTED!
You can view the latest revision of this manual section on the Teledyne Paradise Datacom web site:
http://www.paradisedatacom.com/xml/216594/216594-1.xml

USE AND DISCLOSURE OF DATA
EAR99 Technology Subject to Restrictions Contained in http://www.paradisedatacom.com/xml/216594/216594-1.xml.

Use and Disclosure of Data

Proprietary and Confidential

About Teledyne Paradise Datacom

Teledyne Paradise Datacom, a division of Teledyne Defense Electronics LLC, is a single source for high power solid state amplifiers (SSPAs), Low Noise Amplifiers (LNAs), Block Up Converters (BUCs), and Modem products. Operating out of two primary locations, 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
328 Innovation Blvd., Suite 100
State College, PA 16803 USA
(814) 238-3450 (switchboard)
(814) 238-3829 (fax)

Teledyne Paradise Datacom Ltd
2&3 The Matchyns, London Road, Rivenhall End
Witham, Essex CM8 3HA England
+44 (0) 1376 515636
+44 (0) 1376 533764 (fax)

Copyright

Teledyne Paradise Datacom
Drawing Number 216594-1 Revision A
ECO 18855
Last Modified: 11 October 2019

THIS PAGE LEFT INTENTIONALLY BLANK