INSTALLATION

&

OPERATION

MANUAL

250W Ka-Band TWT Amplifier

For Use With Model Numbers . . .

T02KO
T03KO

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West Coast Operations

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PROPRIETARY INFORMATION

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CHAPTER
Safety

S.1 Introduction

This chapter provides the following safety guidelines for personnel:

- High Voltage Equipment Operating Guidelines
- Microwave Radiation Operating Guidelines
- Physical Safety Guidelines

In addition to the above items addressed in this chapter, included by reference are the following pertinent sections of the International Standard EN60215, *Safety Requirements for Radio Transmitting Equipment*:

- Appendix D, "Guidance on Assessing the Competence of Personnel for Designation as Skilled," and also Sub-clause 3.1 of the Standard.
- Appendix E, "Guidance on Safety Precautions to be Observed by Personnel Working on Radio Transmitting Equipment, "and also Sub-clauses 3.2, 3.7, and 22.1 of the Standard.

S.2 High Voltage Equipment

S.2.1 Personnel Operating Guidelines

This guideline document presents operating practices for operators and technicians who work with high voltage equipment. In the context of this discussion any voltage that is lethal is viewed as "high voltage." Therefore, even prime power (100 to 480 V_{AC}) is dangerous because prime power potentials have been known to cause death or injury.

Electrical circuits operate quickly and do not allow a careless individual a second chance. When dealing with high voltage, the results are very consistent and predictable. The hazards associated with high voltage are always present. **The fact that the control switch says OFF does not mean you are safe**. Many high voltage circuits are like loaded guns. **In general, you cannot see a high voltage hazard**. You can learn to recognize situations that present a threat and how to avoid them.

NOTE: THE GUIDELINES PRESENTED IN THIS DOCUMENT ARE NOT ACADEMIC. THEY ARE BASED ON THE EXPERIENCE OF ENGINEERS AND TECHNICIANS WHO HAVE YEARS OF EXPERIENCE WITH HIGH VOLTAGE CIRCUITS.

S.2.2 When is Voltage "High"?

As stated earlier, any voltage that will kill you should be treated as high voltage. Voltages associated with prime power generally do not jump the air gap between people and the equipment. Usually exposed circuit elements such as a terminal, bare piece of wire, or some non-insulated surface must be touched.

One of the problems associated with prime power is that some equipment can be "floating" above ground. In this case, if you place one hand on the equipment chassis and the other on earth ground, you can be jolted, injured, or killed. $480V_{AC}$ can stimulate an involuntary muscle response that can literally throw you across a room or seize and hold you across the voltage terminals. 600 or more volts can hold you indefinitely. If the potential is sufficient to drive 200 milliamps through your body you will be held indefinitely. Some people consider the 200 to 600 volt range to be worse than potentials of thousands of volts.

S.2.3 General High Voltage Guidelines

In addition to the above, the following practices have proven effective for personnel who deal with high voltage equipment.

a) **Hands off.** Avoid contact with any potential source of high voltage. Keep hands out of the equipment when it is operating.

b) **Avoid accidental contact.** Make sure that some other part of your body does not come in contact with the high voltage circuits. It is easy to forget the hazards when you are concentrating on a frustrating or interesting task. Pens and badges in shirt pockets could contact the equipment.

c) **Never work on high voltage circuits when you are alone.** If anything should happen to you, your only chance may be prompt action by some other person. Be sure someone else is present and knows what to do in any emergency (e.g., how to shut equipment off, first aid, who to call, etc.)

d) **Use one hand when working with high voltage circuits.** Many people recommend that you put one hand in your pocket when you use a probe or other piece of equipment inside a high voltage section.

e) **Do not float measuring equipment above ground.** Make all measurements with respect to ground. If you float an instrument, do not reach inside the equipment. Although it is more difficult to get the right setup, it is well worth the effort.

f) **Do not assume that the level of risk is a function of size.** Some large high power voltage equipment looks docile. One reason the equipment is so big is to get the proper separation between high voltage points. On the other hand, just because the equipment is small is no assurance of safety. Dense packaging results in more difficult access and increases the chance that you will accidentally hit the wrong point.

g) **Always discharge high voltage capacitors.** High voltage capacitors store a lot of energy for long periods of time. High voltage capacitors also exhibit a "memory" in that they can recover after discharge and reach lethal levels. In addition to the "memory" problem, there have been instances where the built-in safety features have failed or have been miswired. **Each and every time you go to work on a piece of high voltage equipment, use a discharge device with a long handle to discharge every high voltage capacitor.**

h) **Do not depend on the automatic features of the equipment to save you.** You never know when someone has left a circuit disabled, if there has been a wiring error, or if a component has failed.

i) **Take personal responsibility to assure that no one can turn on the high voltage circuits when you are working on the equipment.** Precautions would include taping down (or installing a keeper) on controls/circuit breakers and/or disconnecting the power source to the high voltage circuits, activating interlocks that prevent high voltage turn on, etc. Know where the disconnects are and use them. Do NOT rely on anyone not to turn on the high voltage.

j) **Set up your test equipment with the power off.** Conduct the power-on operations when you have your hands out of the equipment.

k) **Do not use short probes for high voltage measurements.** A short probe does not allow any margin for error. If your hand slips you could accidentally come into contact with a danger point. A long probe avoids the whole problem.

l) **Read the instruction manual.** The best insurance is foreknowledge of hazards.

m) **Create a favorable environment for safe operations.** This means that if people are crowding you, stop the operation if it involves high voltage. Pressure can lead to carelessness. In the same way, fatigue is also an enemy. STAY ALERT AT ALL TIMES WHEN WORKING WITH HIGH VOLTAGE.

n) **Do not become over-confident.** Maintain a healthy respect for high voltage.

o) **A good operating practice is to check the potential between the equipment chassis and earth ground before you complete the circuit with your body**. As voltage levels increase, the protection you get from insulation and air gap diminishes. For example, in a piece of equipment that involves beam voltages of about 16kV, the beam transformers look very safe with massive insulation on the outside of the coils. Physical contact with the beam coil when the system is operating can be fatal. Although the equipment is placard to warn people of the presence of high voltage, it is virtually impossible to placard every point of danger in a system.

p) **If you do not know how the equipment works and what the hazards associated with the equipment are in specific terms, do NOT handle the equipment**. The greatest protection you can have when dealing with high voltage equipment is specific detailed knowledge on that particular piece of equipment.

q) **Avoid "haywire" test setups**. It is easy to get in trouble if the setup you are using has a jumble of wires.

r) **Make sure your connections are secure**. Do NOT allow leads to slip off and move about in an uncontrolled fashion. Even if it is not one of the high voltage leads, a free lead could (and generally does) move exactly to where you do not want it. The only safe connection is a mechanically secure one.

s) **Watch out for unterminated high voltage leads**. Some connectors depend on circuit loading to avoid arcing between closely spaced terminals. Unloaded high voltage lines or plugs can lead to arcing situations.

t) **Shut off the high voltage when you are making low voltage measurements**. It does not make sense to increase danger needlessly. While there may be times when you cannot shut off the high voltage during a low voltage measurement, this is generally not the case.

u) **Remove the test equipment when you have finished a measurement program.** There have been many instruments destroyed or damaged because a test program was conducted in a haphazard manner, rather than in an orderly progression from start to finish. Experience has shown in many instances when a little order would have prevented a tragedy or avoided an expensive mistake.

v) **Be extremely wary when making filament voltage measurements.** The cathode of tubes is elevated above (or below) ground and the filament voltages usually cannot be measured with reference to ground. Do everything you can to assure that the high voltage cannot be turned on when you are making your measurements. This includes disconnecting the high voltage drive source, shorting out appropriate leads, taping down switches, and anything else you can think of to protect yourself.

w) **When troubleshooting a unit, assume that the switches and components are defective.** You may shut off the high-voltage switch in some systems, but if the switch were defective, the high voltage would still be on. Returned units are potential booby traps.

x) **Make sure that your workstation is stable.** Flimsy work surfaces or supports for the equipment or the test instruments represent a real threat. Do NOT use a setup that you know is unstable and/or dangerous.

y) **Use a 1-minute rule.** Wait 1 minute or more after you have shut off the equipment before you work on a unit. Part of the reason for a 1-minute rule is that some of the dielectrics (insulators) used for high voltage circuits can store a charge. While the amount of charge stored is a function of the size of the object, a 1-minute rule provides an additional margin of safety.

z) **Maintain a healthy respect for any kind of live circuit. Complacency can hurt or kill you.** Your continued wariness is your best insurance against injury or death.

S.3 Microwave Radiation

S.3.1 Personnel Operating Guidelines

This guideline presents operating practices appropriate for operators and technicians who work with equipment involving microwave radiation. Keep in mind that levels of microwave radiation that do not induce immediate physical discomfort in most individuals can be sufficiently high to induce long term effects.

CPI Satcom Division equipment usually is related to amplification of a RF signal from an external source. Even if a source is not connected to the amplifier you are working with, there are situations where the amplifier can go into a self-induced mode and generate high levels of RF energy. This condition can exist if the unit is operated with high voltage ON and without proper termination on the input and output of the amplifier.

ELECTRICAL HAZARD! PROTECT YOURSELF AND THOSE AROUND YOU FROM UNWANTED RF EXPOSURE. ALWAYS TERMINATE THE AMPLIFIER INPUT AND OUTPUT WITH A RF DUMMY LOAD BEFORE YOU TURN THE HIGH VOLTAGE ON. THIS WILL REDUCE THE CHANCES OF OSCILLATION DUE TO INTERNAL AMPLIFIER NOISE.

S.3.2 Microwave Discussion

Limit exposure to microwave radiation to prevent unwanted biological effects. There are other effects that can lead to problems if you are careless in operating or servicing microwave equipment. The permissible levels are quite low in comparison to the power levels of the amplifiers built by CPI (e.g., less than 10 mW vs. 20 to 10,000 Watts delivered by different units)

Local radiation levels can be detected with the proper equipment. The permissible levels are currently being studied by a number of organizations. In the past the U.S. Safety Codes established a dosage rate of 10mW/Cm^2. Recently the permissible level has been reduced to 1 mW/Cm^2. in the United States, as has been the case in several European countries.

S.3.3 General Microwave Guidelines

The purpose of these guidelines is to provide practical approaches to control unwanted microwave energy associated with the operation and servicing of CPI Satcom Division equipment.

The following approaches are effective in both laboratory or field environments:

a. **Always terminate the output waveguide or coaxial connector with a dummy RF load (capable of dissipating full CW RF power). Similarly, terminate the input to avoid the possibility of the amplifier being driven by stray leakage signals.** Incorporate the terminations prior to applying prime power to the amplifier. This procedure prevents self-oscillation and irradiation of the local equipment.

b. **Do not look into the output port of the powered RF amplifier.** Treat the powered amplifier as though it is a loaded gun. Your eyes are particularly vulnerable parts of your body.

c. **Shut off the unit if you are trying to locate a RF leak.** As noted earlier, the levels of concern are very low. Examine the physical unit with the high voltage OFF. If you have to survey the RF runs with the power ON to find the leaky joint or component, start by testing the system with low RF input and a radiation meter.

   If the microwave radiation exceeds 0.5mw/cm. sq., shut OFF the high power voltage and consult your supervisor. Work quickly (not at a panic pace) to minimize the dose level. The dose you get is directly proportional to the power level and the time you are exposed. Exposure to microwave radiation can induce both thermal and non-thermal biological effects, especially with the eyes. If you damage the lens of your eyes by exposure to microwave radiation, cataracts can result. Consider that small microwave ovens are very effective in cooking foods. If you follow these guidelines you can minimize exposure of yourself and other people in the operations that you control.

S.4 Physical Safety

S.4.1 Lifting Heavy Objects

Back and other injuries can result from one person trying to lift too much weight.

Use extreme caution when lifting the klystron. Klystrons weigh up to 100 pounds (45 kg) and require two persons to lift them.

Due to the weight of the drawers, at least two persons are required for installation of the drawers to the final rack assembly. At least two people are also required for removal of the drawers from the rack assembly.

S.4.2 Extending Rack Slides

1. Serious injuries can result from heavily loaded racks or drawers falling forward.
   Due to the weight of the drawers, the rack must be securely bolted to the floor in all four corners to prevent tipping when the drawer slides are extended.
   Verify that all slides are securely mounted and that all latches and stops are functioning properly.
2. Serious injuries can also result from hands, fingers, or clothing getting caught in slides and drawers when extended drawers are being pushed back into a rack.
   Exercise extreme caution when sliding extended drawers back into a rack.

CHAPTER 1
Introduction

1.1 Overview

The CPI Ka-Band TWTA (Traveling Wave Tube) ODU Amplifiers are designed for satellite communication earth stations, satellite newsgathering vehicles, and flyaway applications. The key feature of these amplifiers permits direct mounting to antenna structures, thereby eliminating transmission line losses encountered in conventional remotely mounted arrangements. For this reason, these amplifiers are referred to as " Ka-Band TWT Amplifiers."

Table 1-1 shows the model numbers, frequency ranges, and power outputs of these amplifiers. Figure 1-1 is a photograph of a Ka-Band TWT Amplifier. All models have the same appearance.

Table 1-1. Ka-BAND TWT Amplifiers

Model Number	Frequency Range (GHz)	Rated Power (Watts)
T02KO	27.5 to 31.0 GHz	250W Peak
T03KO	27.5 to 31.0 GHz	250W CW

By industry convention, the rated power of an amplifier is the output power of the high power-amplifying component, a traveling wave tube (TWT). The output power available to the user at the amplifier output flange is lower. Peak power amplifiers offer the same linear power as their CW (Continuous Wave) counterparts, except their rated CW power is typically 1.5 to 3dB below their peak rating. Depending on model selected, the operating frequency range and rated CW power level will vary.

Figure 1-1. Ka-Band TWTA (Front View)

The Ka-Band TWTAs operate with AC input (line) voltages of 100 - 240 ± 10% V_{AC} at any frequency between 47 and 63 Hz.

All of the Ka-Band TWTAs are the same size and nearly the same weight. The typical model weighs 52 pounds (23.6 kg.), the overall dimensions, excluding switches, connectors, and handles and mounting brackets, are 10.25 by 9.5 by 20.0 inches (260.4 X 508 X 241.3 mm).

These amplifiers are air-cooled. The cooling air enters the bottom of the unit and exits the rear end. A feature standard in Ka Band TWTAs regulates the fan speed control, using a sensor to vary the speed with TWT temperature. This greatly increases the fan life while reducing acoustical noise. (See Chapter 2 for more details.) Care should be taken to ensure the airflow path is not blocked. If the amplifier is to be powered up on a test bench, then it should be set on blocks or mounting brackets to prevent airflow blockage. Ka-Band TWTAs can operate in direct sunlight at ambient temperatures ranging from –40 to + 60°C.

Detailed specifications for the Ka-Band TWTAs ODU are provided in Chapter 7, "Drawings".

The Ka-Band TWTAs can be operated in either local or remote mode, the latter being the primary mode of operation. Remote operation is performed using either a CPI Remote Control Unit or a user-supplied IBM compatible computer.

The RF Block diagram is shown in Figure 1-2.

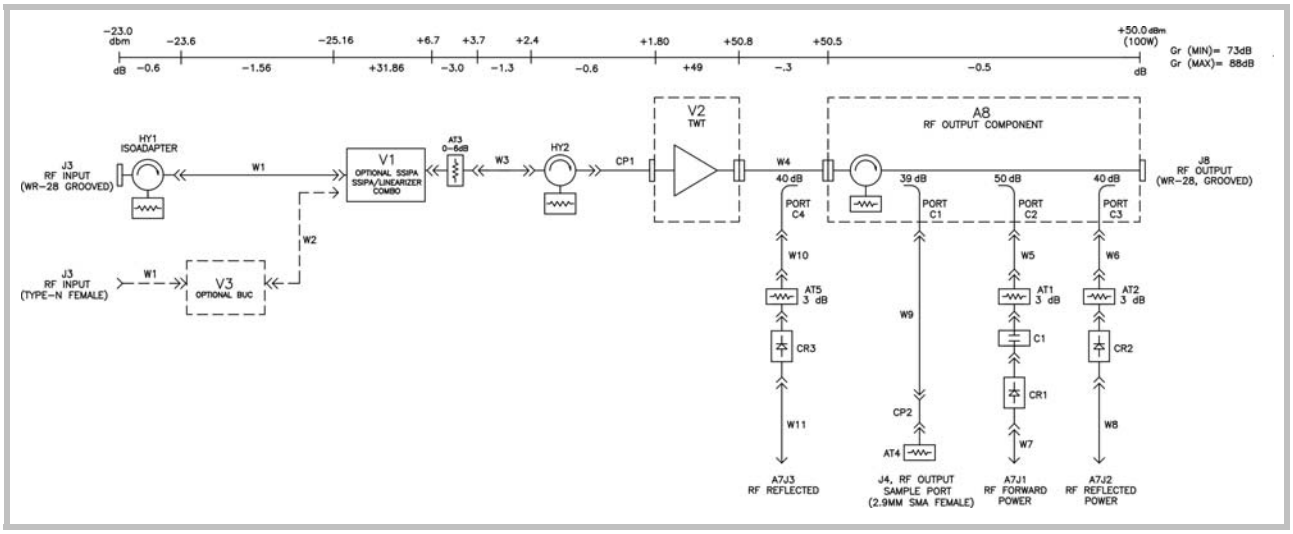

Figure 1-2. Typical Ka-Band TWTA RF Diagram

1.2 Optional Features

The Ka-Band TWTA has five main internal optional features:

- An IPA Option (with pin diode attenuator)
- A Linearizer option
- An internal 1:1 switch controller with drive option.
- An internal hybrid or 1:2 switch controller with drive option.
- A separate Ka-Band TWTA Remote Control Unit is also available.

1.3 About This Manual

This manual describes the Ka-Band TWTA installation and operation procedures.

The Safety section that precedes Chapter 1 provides practical guidelines regarding High Voltage and Microwave Radiation operating practices.

Chapter 1, "*Introduction*", contains a brief overview of the amplifier and this manual.

Chapter 2, "*Unpacking and installation*", contains procedures for unpacking and installing the Ka-Band TWTA.

Chapter 3, "*Initial Power ON and Checkout*", describes the controls and indicators on the front panel of the amplifier, the CPI Remote Control Unit controls and indicators, and the procedures to use for initial checkout after the amplifier has been installed.

Chapter 4, "*Interfaces*", describes:

- The ODU Amplifier external interfaces and external connector pinouts.
- The commands used to setup the serial interface hardware characteristics.

Chapter 5, "*Operation*," describes the procedures for normal start-up and shutdown, and describes the operational modes of the amplifier.

Chapter 6, "*Maintenance*," describes the procedures for scheduled maintenance and the procedures for return of equipment to CPI.

Chapter 7, "*Drawings*," contains relevant engineering drawings and specifications.

The Appendices contain additional topics such as "Service and Warranty." information and optional features.

1.4 Conventions

The following symbols and conventions are used in this manual. These symbols differ slightly from International symbols to emphasize the specific nature of the hazards.

1.4.1 Notes and Cautions

NOTE: *Notes provide additional commentary or technical information.*

CAUTION! Cautions identify conditions, operations, or procedures that could potentially damage the equipment.

1.4.2 Warnings

There are three different warnings, Electrical Hazards, Radiation (microwave) Hazards, and Physical Hazards (mechanical, chemical, miscellaneous).

ELECTRICAL HAZARD! DENTIFY CONDITIONS, OPERATIONS, OR PROCEDURES THAT EXPOSE THE OPERATOR TO POTENTIALLY LETHAL HIGH VOLTAGES.

RADIATION HAZARD! IDENTIFY CONDITIONS, OPERATIONS, OR PROCEDURES THAT EXPOSE PEOPLE TO MICROWAVE RADIATION SOURCES THAT COULD CAUSE SERIOUS INJURIES, PARTICULARLY TO YOUR EYES.

PHYSICAL HAZARD! IDENTIFY CONDITIONS, OPERATIONS, OR PROCEDURES THAT COULD INDUCE STRAIN, MAIM, OR KILL PEOPLE. THIS INCLUDES HEAVY WEIGHTS, SHARP EDGES OR PROTRUSIONS, AND CHEMICAL HAZARDS.

1.4.3 Text Conventions

When operator action is required for software entries, the action required is capitalized and the action object is capitalized and may be bold for emphasis. For example, PRESS **ENTER**.

Labels for Front Panel controls and indicators are capitalized, (e.g., RESET). Sometimes the actual labels are abbreviated (e.g., TWT TEMP).

References to other parts of the manual are shown in Italics, such as "See *Chapter 6, Operator Maintenance*."

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CHAPTER 2
Unpacking And Installation

2.1 Overview

This chapter contains instructions for unpacking and installing the Ka-Band TWTA.

2.2 Pre-Inspection

Inspect the exterior of the shipping container(s) for evidence of damage in shipment. If damage is evident, immediately contact the carrier that delivered the equipment and submit a damage report. Failure to do so could invalidate future claims.

2.3 Unpacking

Carefully unpack and remove all items from the shipping container(s). Inspect the interior of the container for damage. Save all packing material until all inspections are complete. It is recommended that all packing material be saved for potential future use. Verify that all items listed on the packing slips have been received.

Inspect all items for evidence of damage in shipment. If damage seems evident, immediately contact the carrier that delivered the equipment and file a claim. Failure to do so could invalidate future claims.

2.4 Installation

Installation of the Ka-Band TWTA includes:

- Mechanical installation
- Electrical power connections
- Remote control interface
- RF connections

2.4.1 Amplifier Installation

Refer to the appropriate Outline Drawing in Chapter 7 "Drawings" for outline and mounting information.

The amplifier may be mounted using the six tapped holes located on the side (refer to the Outline Drawing, *01031382*, in Chapter 7, "*Drawings*"). These holes are ¼-20 UNC-2B thread and are 0.50 inch deep. In order to provide secure mounting, screws with locking hardware must be used in all six holes.

If the amplifier is mounted to an antenna, the structure must be capable of supporting the additional load of the amplifier plus any wind loading effects, which may occur. It is recommended that locations subject to electrical interference, such as that from motor contactors, be avoided.

The amplifier is air-cooled. The intake and exhaust areas must not be blocked. For further information see the outline drawing and the yellow Operational Warnings document located at the front of this manual.

2.4.2 Cooling Considerations

The Ka-Band TWTA is forced air-cooled by an internal fan that draws air into the bottom of the unit. The air is exhausted through ducts located on the front panel. Refer to outline drawing, *01031382*, in Chapter 7, "*Drawings*".

To insure proper operation of the amplifier, the following guidelines must be observed:

- There must be at least two inches of clearance on the bottom of the unit (air intake).
- There must be at least four inches of clearance on the end of the unit that has the exhaust ducts (the end with the visible cooling fins).
- The hot exhaust air must be directed away from the air intake area.
- The area below the air intake must be free of foreign material, loose dirt, debris, and any other material that may be drawn toward the unit and block the air intake area.

2.4.3 Electrical Power Connections

All electrical connections to the amplifier are located on the front panel (Figure 2-1).

2.4.3.1 Prime Power (J1)

ELECTRICAL HAZARD! ELECTRICAL HAZARD! DO NOT APPLY POWER TO THE AMPLIFIER UNTIL YOU ARE DIRECTED TO DO SO IN THE PROCEDURE.

Prime power is applied to connector J1 (AC IN) located on the front panel of the amplifier. Prime power is 100 - 240V_{AC} +/- 10% (nominal), 47-63 Hz. The proper voltage is indicated on a label located on exhaust end of unit. A prime power mating connector is supplied in the ship kit with the unit. The pins of the prime power connector should be wired as follows:

- Pin 1 - line (or Phase A)
- Pin 2 – No connection
- Pin 3 - Neutral (or Phase B)
- Pin PE – Ground

Prepare the prime power cable but do not connect the cable to the amplifier at this time.

2.4.3.2 Grounding

Proper grounding of the Ka-Band TWTA ODU amplifier to the station ground bus or to earth ground is necessary for personnel and equipment safety. The 6-32 threaded ground hole on the amplifier front panel is used for grounding. #14AWG wire or larger is recommended for the grounding cable.

The amplifier should be protected against lightning.

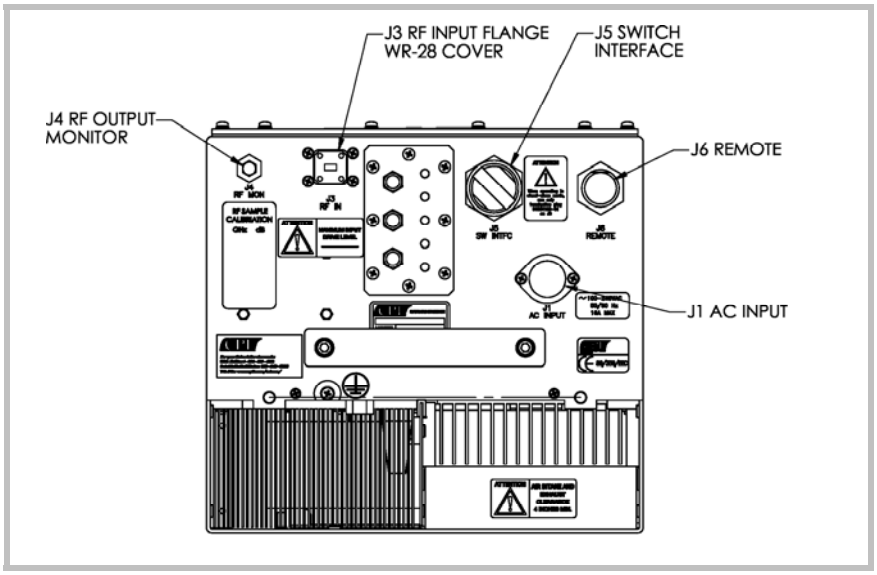

Figure 2-1. Ka-BAND TWTA Connector Locations

2.4.4 Remote Control Interface (J6)

The operator can use either a PC or the optional CPI Remote Control Unit connected to J6 ("REMOTE") to remotely monitor and control the amplifier. J6 is a 10-pin MS type connector, ITT Canon KPT07E12-10S. (A mating connector is supplied in the ship kit.) The PC can use either RS-232 or RS-422/485 communication standards, while the CPI Remote Control Panel uses only RS-422.

Default settings are as follows: STX/ETX protocol, 9600 baud rate, even parity, seven (7) data bits, with one (1) start bit and one (1) stop bit. The operator may change these settings. Refer to Drawings (chapter 7) for the Computer interface protocol document.

Interconnect cables should be wired for either RS-232 or RS-422/485, but not both. A cable assembly similar to CPI drawing *01032322* (see Chapter 7) should be used for RS-422/485 communication. A wiring diagram for a cable using RS-232 is shown in Figure 2-2.

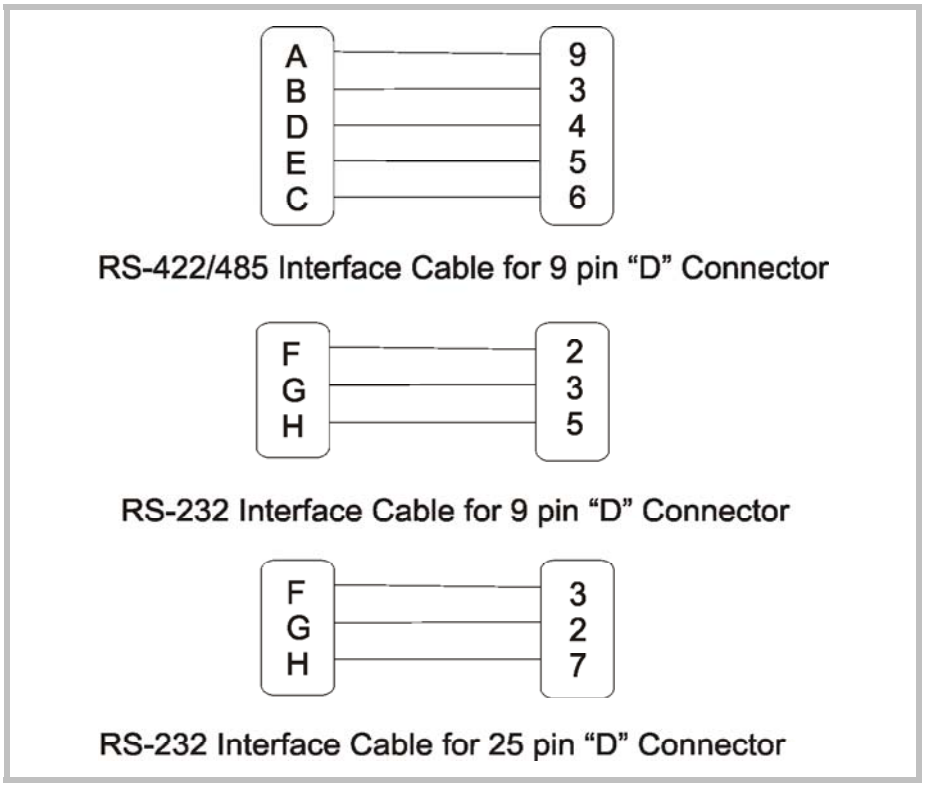

Figure 2-2 RS-232 Cables

2.4.5 Switch Interface Connector (J5)

Connector J5 is a round 26-pin female (socket) connector that is used for redundant system operation.

NOTE: *A mating, wired connector (jumper plug) is supplied with the unit. If the amplifier is to be used in a standalone configuration, this connector must be used.*

2.4.6 RF Coaxial Cable Connections (J4)

Refer back to Figure 2-1 for connector locations. A power monitor cable can be connected directly to front panel connector J4 (40 dB nominal coupling). Tighten the connector.

CAUTION! Position the coaxial cables so that there is no stress on connectorJ4.

CAUTION! Only use a 2.92mm SMA or "K" type connector. Other connector types will NOT properly interface with J4, and could cause damage to the connector center conductor.

2.4.7 RF Input Waveguide Flange Connection (J3)

The input waveguide flange of the Ka-Band TWTA is located on the front panel (Figure 2-1). The mating connection is WR-28G grooved waveguide flange with four through holes (4-40 clearance). An O-ring gasket is supplied in the ship kit in Chapter 7, "*Drawings*".

To install the waveguide flange, proceed as follows:

1. Install the O-ring gasket (supplied) in the input flange.
2. Position the interconnecting waveguide so that it aligns precisely with the waveguide flange at the rear of the Ka-Band TWTA.

CAUTION! If flange alignment is not precise or if the installation is subject to motion or severe vibration, a flexible waveguide section should be installed between the output of the Ka-Band TWTA and the interconnecting waveguide.

3. After alignment is verified in all three planes, loosely attach the interconnecting waveguide to the input waveguide flange of the Ka-Band TWTA with 4-40 stainless steel screws, flat washers, lock washers, and nuts. Start all bolts and verify proper alignment.
4. A progressive tightening procedure is recommended. Tighten each bolt until the lock washer starts to compress and then proceed to the next bolt, until you have partially tightened all the bolts.
5. Starting with the first bolt, fully tighten them to the desired torque level (4.3 in. lbs. for 4-40 screws). Do not over-tighten the screws because this can strip the threads or distort the mating flange.

2.4.8 RF Output Waveguide Flange Connection (J8)

The output waveguide flange of the Ka-Band TWTA is located on the rear panel (Figure 2-3). The mating connection is either a WR-28 or WR-34 flat waveguide flange with four through holes (4-40 clearance), depending on which option was specified at the time of order. An O-ring gasket is supplied in the ship kit in Chapter 7, "*Drawings*".

To install the waveguide flange, proceed as follows:

a) Install the O-ring gasket (supplied) in the output flange.

6. Position the interconnecting waveguide so that it aligns precisely with the waveguide flange at the rear of the unit.

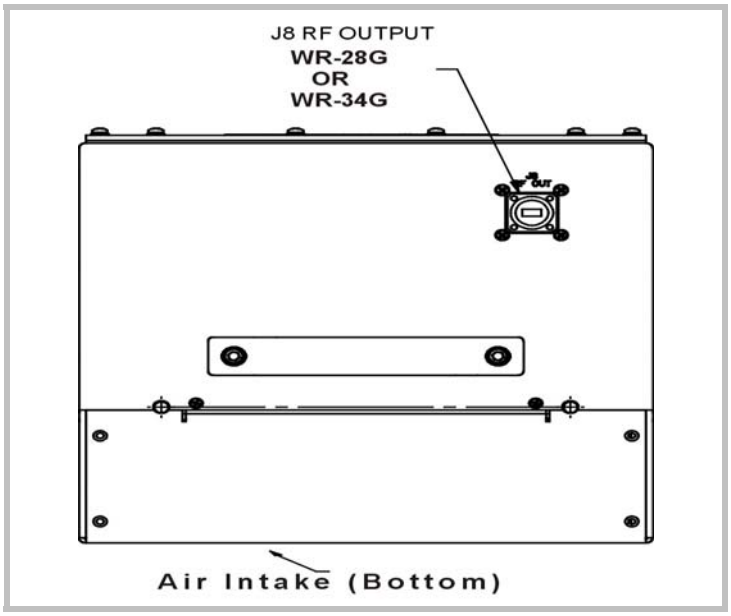

Figure2-3 Ka-Band TWTA Rear Panel

CAUTION! If flange alignment is not precise or if the installation is subject to motion or severe vibration, a flexible waveguide section should be installed between the output of the Ka-Band TWTA and the interconnecting waveguide.

7. After alignment is verified in all three planes, loosely attach the interconnecting waveguide to the output waveguide flange of the Ka-Band TWTA with 4-40 stainless steel screws, flatwashers, lockwashers, and nuts. Start all bolts and verify proper alignment.
8. A progressive tightening procedure is recommended. Tighten each bolt until the lockwasher starts to compress and then proceed to the next bolt, until you have partially tightened all the bolts.
9. Starting with the first bolt, fully tighten them to the desired torque level (4.3in.lbs. for 4-40 screws). Do not over-tighten the screws because this can strip the threads or distort the mating flange.
10. Proceed to Chapter 3 for startup procedures.

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CHAPTER 3
Initial Power On And Checkout

3.1 Overview

The Ka-Band TWTA is normally operated in the REMOTE mode via the serial interface. The remote control device can be an optional CPI Remote Control Unit (*01032300*), an IBM compatible computer with an RS-232 or RS-422/485 serial port or an Ethernet connection. In the LOCAL mode, three push button switches control the amplifier and its state is monitored by five LEDs.

Once the amplifier has been manually set for REMOTE operation, all of the amplifier monitor and control functions can be used. This chapter describes:

- LOCAL controls and indicators (Section 3.2)
- The optional Remote Control Unit controls and indicators (Section 3.3)
- Operation with P.C. computer and remote control software (Section 3.4)
- Pre-power checks (Section 3.5)
- The procedures for the first time power-up and initial checkout of the system in LOCAL mode (Section 3.6).
- Verify RF Output (Section 3.7)
- Setup for operational service (Section 3.8)

NOTE: *Some of the LEDs on the front panel blink for one condition and remain lit but do not blink for other conditions. In the text of this manual, LEDs that blink for a particular operation are flagged (LED blinking) in the text. If the LED is lighted and does not blink, the text indicates that the LED is lit.*

3.2 Front Panel Controls and Indicators

The front panel of the Hub-Mount Ka-Band TWTA is shown in Figure 3-1. Table 3-1, which is keyed to Figure 3-1, lists the front panel controls and indicators and defines the function of each listed item.

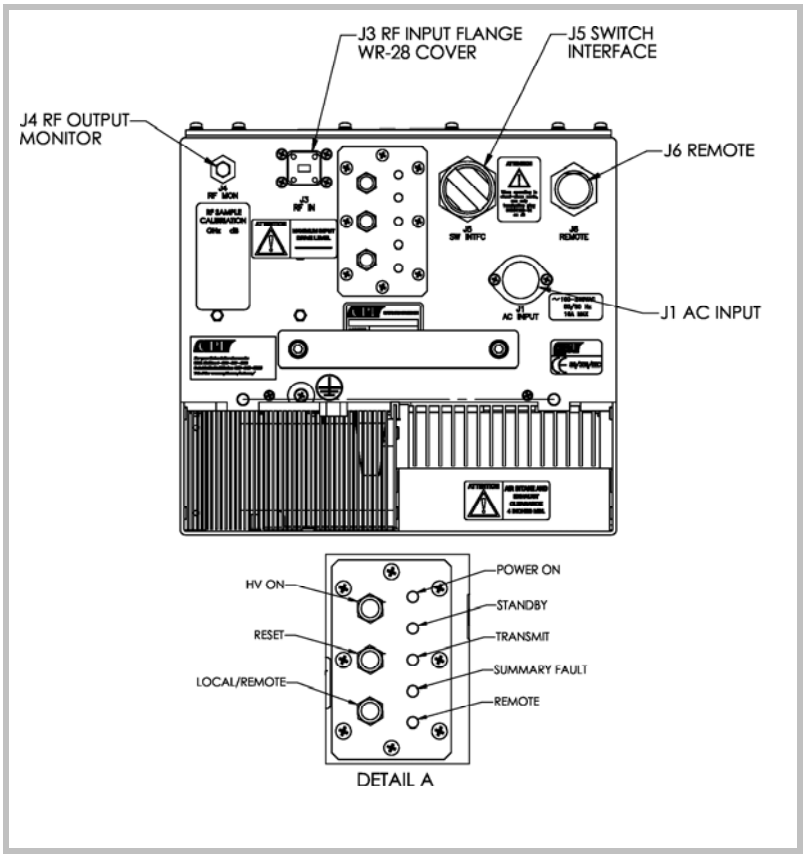


Figure 3-1 Amplifier Front Panel Controls and Indicators

Table 3-1 Ka-Band TWTA Front Panel Controls and Indicators

Classification / Label	Type	Function
RESET (Note 2)	Momentary Pushbutton Switch	When pressed, resets the amplifier after a latched fault. After reset, the FLT (fault) LED is OFF and the STBY (STANDBY) LED is lighted.
HV ON (Note 2)	Momentary Pushbutton Switch	Toggles between high voltage (HV) ON and high voltage OFF each time the pushbutton switched is pressed. When high voltage is on, high voltage is applied to the TWT after BONS (note 1) is complete (beam ON), the XMT (transmit) LED is lit and the amplifier provides RF output.
PWR	LED (green)	Lights when unit completes POST.
STBY (Standby)	LED (amber)	Lights when there are no faults, HV is OFF, and unit is ready for XMT (transmit).
XMT (Transmit)	LED (green)	LED blinks during BONS, steady in XMT (TRANSMIT) mode. (See Note 1.)
FLT	LED (red)	Blinks when unit is in latched fault state. Press RESET to clear fault.
RMT	LED (amber)	Lights when unit is set for Remote Control Operation
LCL/RMT	Momentary Pushbutton Switch	Toggles between LOCAL and REMOTE control each time the pushbutton is pressed. RMT LED lights in REMOTE mode. When the amplifier is operated in the LOCAL mode, the user cannot set system parameters or trip points. When the amplifier is operated in the REMOTE mode, the user can set and monitor system parameters and trip point values via a remote control device. This control mode can be changed at between LOCAL and REMOTE operation by pressing the LCL/RMT pushbutton.

Note 1: See 3.6.2 for a description of the Beam On Sequence (BONS).

Note 2: This switch is active in LOCAL mode only.

3.3 Optional RCU Controls and Indicators

The Rack Mount Remote Control Unit is normally operated in the REMOTE mode via the one of three serial interface types connected to an M&C system (via LAN for Ethernet).

The front and rear panels of the Remote Control Unit are shown in Figure 3-2. Firmware Updates are discussed in Multi-drop operation, section 3.3.1, see below.

Refer to the Rack Mount Remote Controller I&O manual, *01032319* for the detailed information.

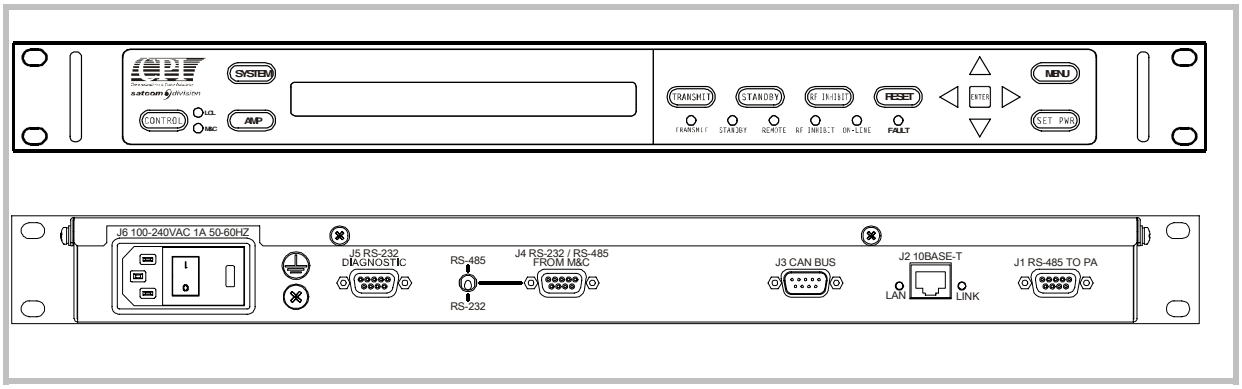


Figure 3-2. Remote Control Unit Front and Rear Panels

The AC Power switch is on the left end of the rear panel. The power required is 100 – 240V_{AC} 47/63 Hz, single phase, < 10Watts.

3.3.1 Multi-Drop Operation

Multi-Drop Functionality can control up to 10 units of the same type (types cannot be mixed) or a Single Switch System (1:1, 1:1 Power Combined, 1:2). After installation, the first step is to assign amplifier addresses.

3.3.3.1 Amplifier Address Assignment

The Remote Panel has a built-in utility to easily change the address (from 48 to 111) of the units to be connected together in any of the above modes. In order to assign an address, only one unit can be operational at a time. All other amplifiers **must be powered off**.

For simplification of this section, key-in commands will be in *Italics* and items shown in the display will be in **Bold**.

1. After the first unit is powered up, press the *MENU* key until **P** is displayed at the left end of screen. Use the arrow keys to highlight **CIF Ports** box then press *ENTER* key twice.
2. Use the *up / down* keys to highlight **AMPLIFIER ADDRESS RESCAN: NO**. Press the *up* arrow to change the display from **NO** to **YES** then press *ENTER*. The RCU will restart and rescan. Only one amplifier should be found.

3. Press *MENU* and verify unit **1** and **SETTINGS** are selected. Press *ENTER* and then down arrow four times until **UNIT ADDRESS:** is displayed in the bottom left of screen. Press *ENTER* and then the left arrow until **UNIT ADDRESS:** is highlighted.
4. Use the *up / down* arrows to change to desired address. Press *ENTER* to set the change. The new address will only take effect after power cycling the amplifier.

The Remote Panel can also monitor and control the optional internal 1:1, 1:1 Power Combined or 1:2 switch controller in an amplifier if so equipped. The desired unit can be selected using the *AMP* or *left / right* keys as described above. Switch position is monitored using the *SYSTEM* key to scroll to the Status Screen until the switch position (**ON-line/OFF-line**) is shown on the display. The Amplifier state (**STBY/XMIT/FLT**), Output Power and switch mode (**AUTO** or **MANUAL**) is also displayed in this screen.

1. Press the *SYSTEM* key a second time to acquire the Configuration screen. The switch mode (**Auto/Manual**) and **ON-line/OFF-line** status of the selected unit can be manually changed by pressing the *ENTER* key and then the *left /right* arrow keys to toggle between positions to first place the units in Manual.
2. Once the desired amplifier is reached, pressing the *up/down* arrows followed by the *ENTER* key will change the state of the selection. If the Manual mode is selected, the switch position can be changed between A1 and A2 by using the *ENTER* key followed by the *left / right* arrow keys to cycle to either amplifier **ON-line** or **OFF-line** position. Once the desired amplifier is selected, use the *up / down* arrows to change state followed by the *ENTER* key to activate the selection.
3. If the units are to be used in a switch system they must also be given a **SYSTEM ID** number. After pressing *ENTER* to activate the UNIT ADDRESS, press *ENTER* again to select **SYSTEM ID:** Use *up/down* arrows to select **SYSTEM ID:** from **1** to **3**. On a 1:2 switch system, the backup amplifier must be selected as **AMPLIFIER 3**. Press *ENTER* to activate selection. The amplifier power must now be recycled to allow the address changes to be accepted and set.
4. Power down the first amplifier, and repeat the above process for the remaining amplifiers, one at a time. Once all amplifiers in the chain have been assigned their own address, apply power to the entire system, including recycling to power to the RCU.

3.3.1.2 Operational Summary of the Remote Control Unit (RCU)

At start up, the Panel will scan the full address range looking for units and assigning a unit number to the units found (1 for the first, 2 for the second, etc).

SCANNING: 54

When an amplifier is found, the type and address will show briefly before scanning resumes. Scanning stops at address 111 or restarts at 48 if no amplifiers are found.

FOUND 400W AT 55

After the address scanning is complete, the display will show the Amplifier status screen or the System screen if a switch system was found. The number on the left-hand side of the display shows which amplifier is currently being monitored.

System Screen:

A1: XMIT 53.3 dBm ON-line A2: FLT 00.0 dBm OFF-line A3: XMIT 52.1 dBm ON-line MANUAL

Amplifier Screen:

1	RMT TRANSMIT	47.8 dBm MANUAL
	REFL RF:18 W	HELIX I:5 mA HELIX V: 8.61 kV

The RCU will continue to monitor the fault status of all units found but can only display the settings and meter readings for one unit at a time. To select a different unit, press the *AMP* key or press the *left / right* arrows. The address of the newly selected unit is shown at the far left side of the display. Pressing the *ENTER* key takes you to the Main menu for that unit.

If a fault occurs in a unit not currently selected, the Panel will automatically switch to the faulted unit and display its fault status. Other units can be selected as described above, but the alarm will sound as long as any unit has a fault.

If another fault occurs in a unit other than the first faulted one, the Panel will switch to the second faulted unit. The Remote Panel will always switch if there is a communication fault.

The Menu selections for the amplifier are shown when the *MENU* key is pressed. Press the *left / right* arrows or repeat pressing the *MENU* key to show the menu selections for other amplifiers. Use the *up / down* arrows to make a selection then press *ENTER* to go to the selected screen.

1	□ SETTINGS	□ METERS	□ METER LOG
	□ TIME	□ VERSION	

To configure the RCU, change the amplifier number by pressing the *MENU* or *left / right* arrows until a **P** is shown on left-hand side of the display. The Menu now shows the configuration selections for the RCU. Use the *up / down* keys to make a selection then press *ENTER* to go to the selected screen.

P	□ UNITS	□ BUZZER	□ DISPLAY
	□ IP CONFIG	□ CIF PORT	□ VERSION

3.3.2 Control Keys

The Remote Control Unit Control Keys are functionally grouped as described in Table 3-2. These keys are shown in Figure 3-3.

Table 3-2. Front Panel Control Keys

Key	Description
CONTROL	Sets the control point for the amplifier. Toggles between Local, Serial and Ethernet. In local mode the LCL LED will be lit and only the RCU can control the amplifiers. An M&C system can still query on the Serial or Ethernet ports. In Serial or Ethernet mode the M&C LED will be lit and only the Serial or the Ethernet port can control the amplifiers. The RCU can still query the amplifiers.
SYSTEM	If a switch system is detected (1:1, 1:1 Power Combined, 1:2): 1st press: Switch system status screen 2nd press: Switch system configuration screen
AMP	Shows the amplifier status screen. When several amplifiers are connected, use LEFT / RIGHT keys to switch amplifier as indicated by the amplifier number on the left-hand side of the display.
TRANSMIT	If the RCU control point is local, a transmit command will be sent to the amplifier.
STANDBY	If the RCU control point is local, a standby command will be sent to the amplifier.
RF INHIBIT	Sets / Resets the RF Inhibit state of the Amplifier.
RESET	Resets the fault state of the Amplifier.
MENU	Displays the menu selections for the amplifier. Repeat pressing the key to show the menu for other amplifiers or to set RCU configuration (P shown on the left hand side of the display).
SET PWR	Displays the output power and attenuation set points of the amplifier.

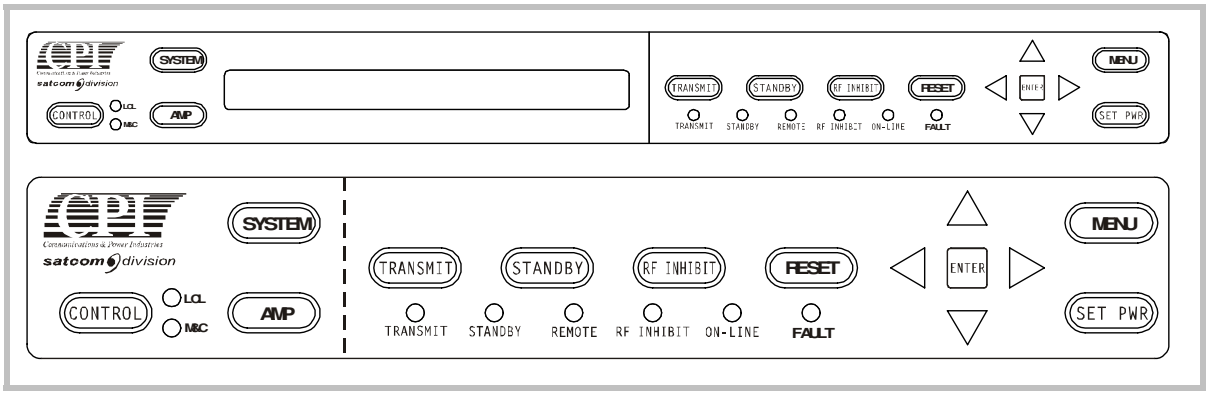


Figure 3-3. Remote Control Unit Control Keys

3.3.3 LED Group and Display

Refer to Table 3-3 for the Display and LED Group details. Figure 3-4 shows the Display and LED Groups.

Table 3-3 LED Group and Display Description

Indicator	Color	Description
LCL	Amber	On if the control point is set to Local.
M&C	Amber	On if the control point is set to Serial or Ethernet.
DISPLAY	Amber	Displays Amplifier and RCU information.
TRANSMIT	Green	On when the amplifier is in Transmit state.
STANDBY	Amber	On when the amplifier is in Standby state.
REMOTE	Amber	On if the amplifier is in Remote control mode. Off when in Local control mode.
FAULT	Red	Flashes whenever any amplifier is in fault state.
RF INHIBIT	Red	On if the amplifier is in RF Inhibit mode.
ONLINE	Amber	On if the amplifier is Online.

Note: When in System screen, Indicators showing the state of a single amplifier will be turned off (REMOTE, TRANSMIT, STANDBY, RF INHIBIT and ONLINE).

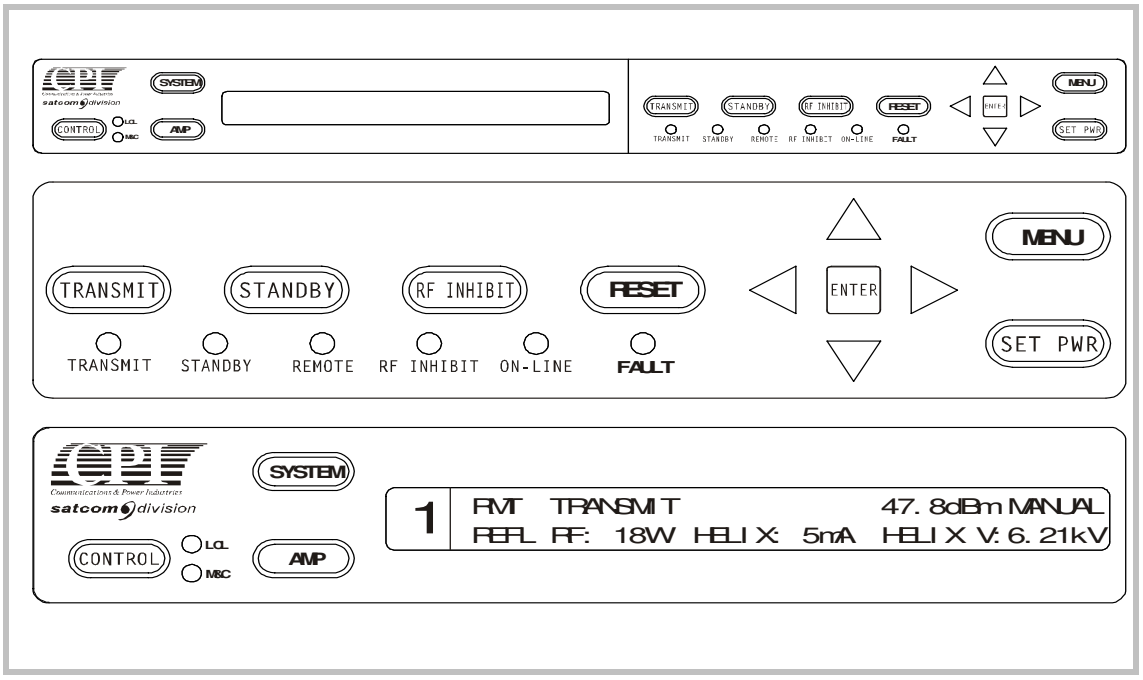


Figure 3-4. LED and Display Group

The menu tree shown in Figure 3-5 identifies the first level displayed messages associated with each of the main Remote Control Unit display modes with an Amplifier selected.

For a more complete Menu tree, refer to Figures E-1/E-2 in Appendix E or Figures 3-6a/3-6b in chapter 3.

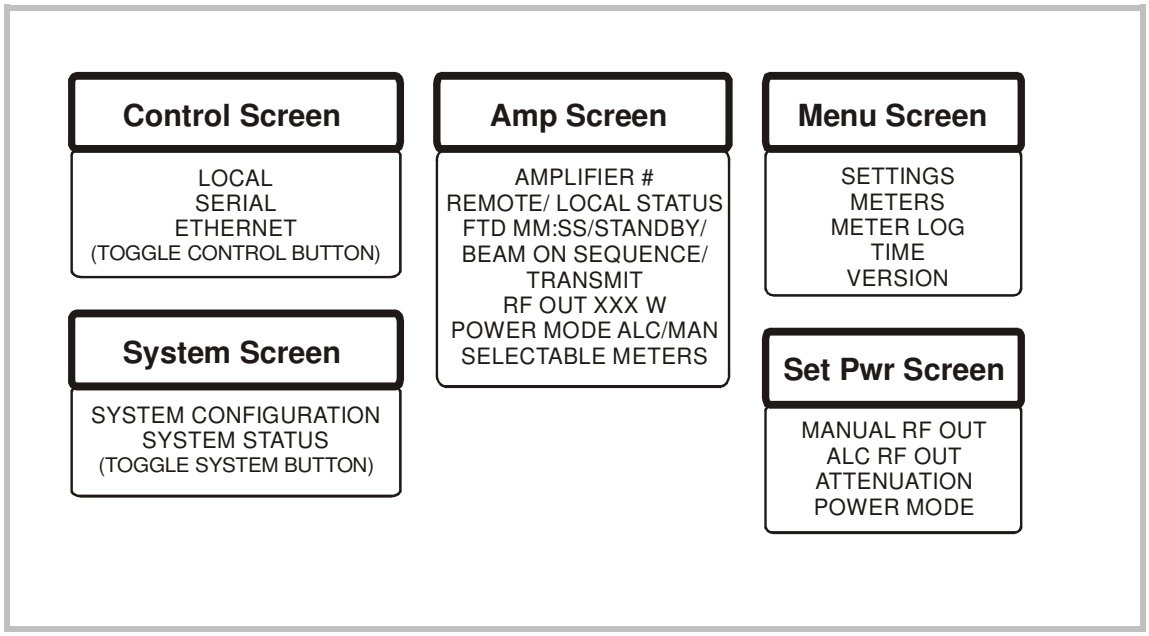
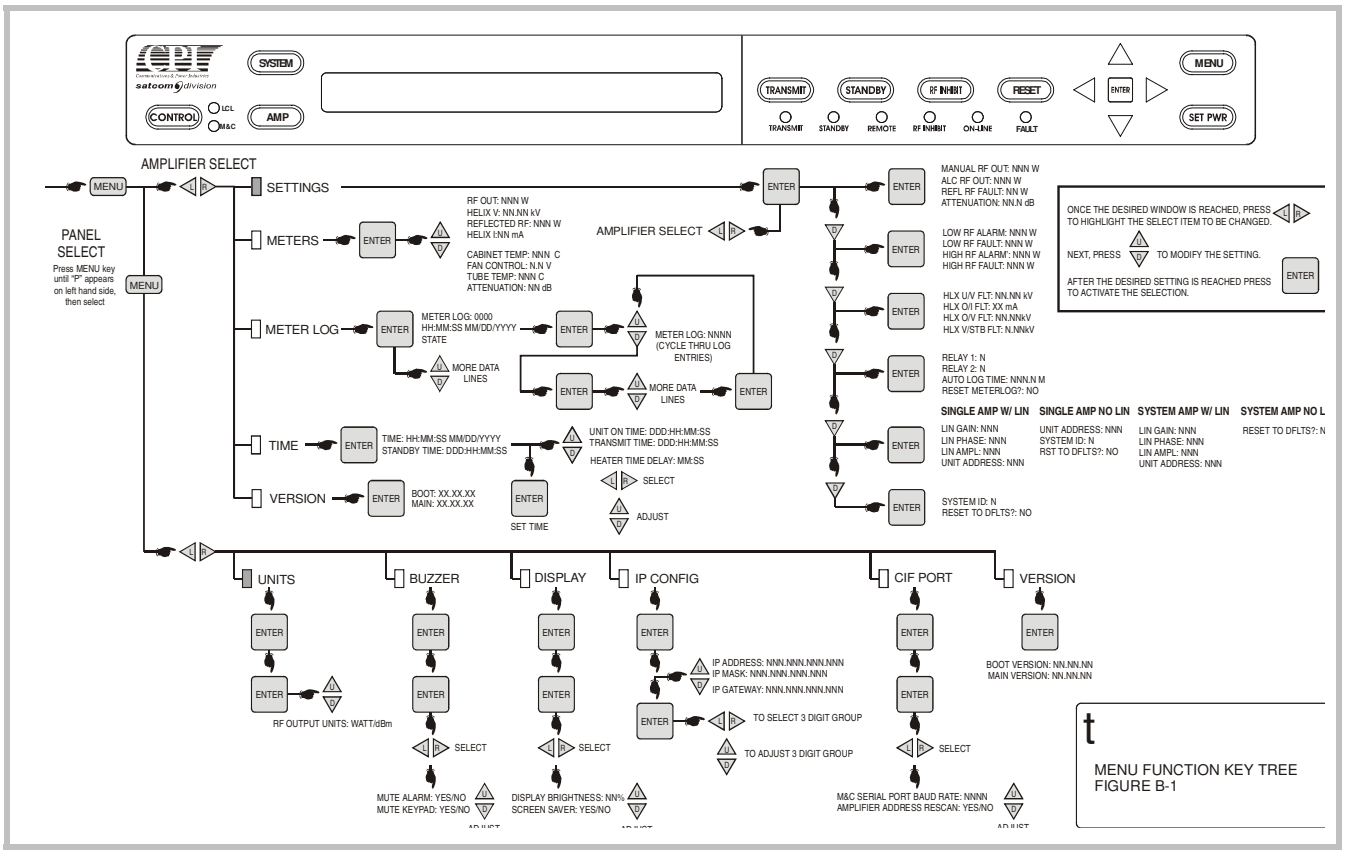


Figure 3-5. Remote Control Unit Menu Tree



t

MENU FUNCTION KEY TREE
FIGURE B-1

Figure 3-6-a. Remote Control Unit Menu Tree

(Refer to Appendix E for the 11x 17 copy)

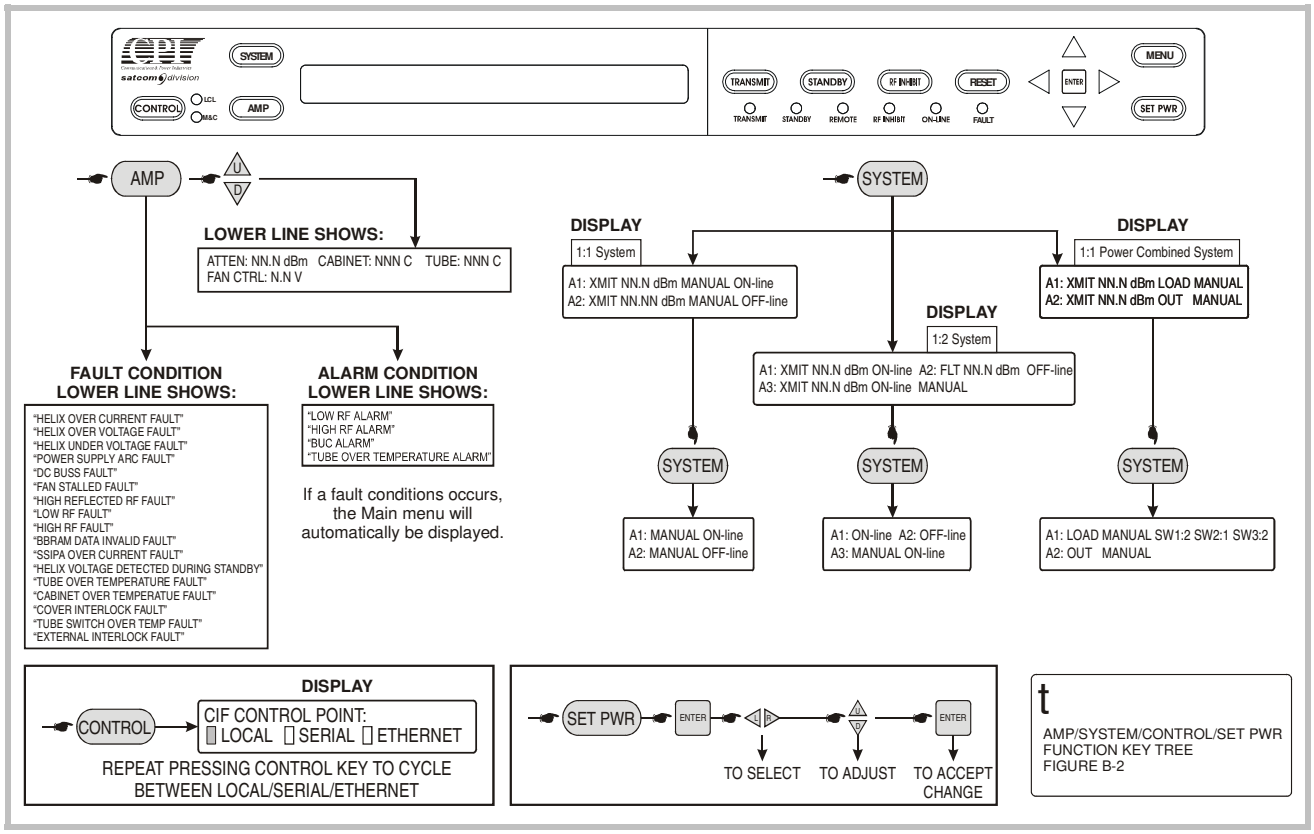


Figure 3-6-b. Remote Control Unit Menu Tree

(Refer to Appendix E for the 11x 17 copy)

3.4 Operation with PC Computer and Setup & Remote Control Software

This software allows the user to set up and remotely control the Ka-Band TWTA via a PC computer running in Windows with the CPI supplied GUI (Graphical User Interface) remote software provided with the amplifier, *01033839*. The functions, controls and monitors are the same as those accessed by the remote control panel.

Refer to Appendix B for a complete description of operation with this software program.

3.5 Operation with Ethernet

Refer to chapter 4 “External Interfaces” for detailed information on utilizing the Ethernet communication feature.

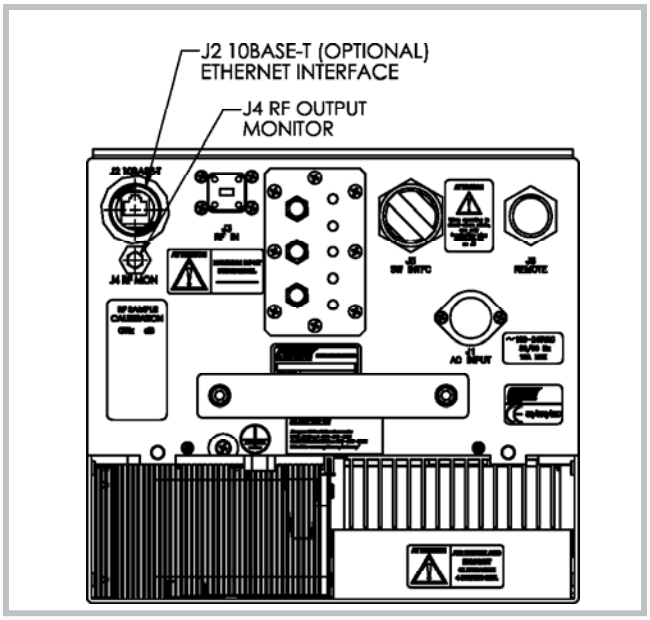


Figure 3-7. Ethernet Option

3.6 First Time Pre-Power Procedure

Before applying prime AC power to the Ka-Band TWTA, verify that the following conditions are met:

- AC prime power is 100 - 240 VAC +/- 10%, 47-63 Hz, as indicated by the label located on exhaust end of unit, and single phase.
- The AC power cord is connected to J1, but the AC power is not turned on.
- A ground strap is connected from the station's ground bus to the 6-32 ground screw-mounting hole located on the amplifier front panel.
- The RF Input and RF Output are connected to a matched source and test load. RF input power is off.
- All RF connections are terminated and tight.
- If the system includes a Remote Control Unit, the optional RCU Remote Control Unit is connected to serial interface port (J6).

- The optional Remote Control Unit is connected to a single-phase 100-240 +/- 10% V_{AC} 47-63 Hz prime power source.
- There is at least 4 inches of clearance at the front and rear of the amplifier and 2 inches of clearance of the bottom of the amplifier. (The fan and exhaust areas are not blocked.)

3.7 Power-On Sequence

Initial power on should not be attempted until all pre-power procedures (Section 3.5) have been successfully completed.

3.7.1 Initial Check, High Voltage OFF

Each time the Ka-Band TWTA power is switched on, the microprocessor controller performs a series of self-tests to ensure that it has the ability to control and monitor the amplfiier. Once the initial tests (POST) are successfully completed, the amplifier initiates a heater time delay cycle of about three minutes to allow the TWT (traveling wave tube) heater to warm up. Proceed as follows:

1. Temporarily disconnect the remote/CIF connector at J6 (if used).
2. Turn on the prime power distribution system so that AC power is applied at J1.
3. Verify that the following sequence occurs after AC power is applied:
4. PWR ON LED lights.
5. The cooling fan comes on.

NOTE: *The fan will come on initially during SELF-TEST, but may remain Off until the TWT collector temperature increases above a specific threshold.*

6. All front panel LEDs light momentarily
7. After three minutes, the STBY LED lights.

If a fault occurs during heater warm up, the FLT LED lights. If this occurs, press RESET. If RESET fails to clear the fault, disconnect AC power from the unit and refer to Chapter 5.

NOTE: *If the system includes a Remote Control Unit skip to 3.6.1.2; otherwise, refer to 3.6.1.1.*

3.7.1.1 Check Factory Set Values via a Computer

Connect the serial interface port (J6) to an IBM compatible computer with a user-supplied cable. Power up the amplifier with high-voltage OFF (XMT LED not blinking or lighted). Refer to Appendix B, for a description of the CPI supplied Setup & Remote control software program. Refer to tables 3-2 through 3-4 and record factory set values for each parameter.

3.7.1.2 Check Factory Set Values via RCU

In the following procedure you check and record the values currently set for the amplifier. You will be able to change these values to the desired operational values before you place the amplifier in operational service.

If you want to verify RF output levels, connect a power monitor to amplifier connector J4 ("K" type or 2.92 mm SMA, 40 dB nominal coupling) before you power up the amplifier.

Proceed as follows:

1. Press the LCL/RMT switch once for RMT control mode (RMT LED lighted).
2. Set the Remote Control Unit AC Power Switch to ON.

NOTE: *For all the choices available on the FUNCTION submenu, refer to the message list for the FUNCTION key in Figure 3-5.*

3. Press *FUNCTION* until.
   The display reads "**`RF INHIBIT NO`**".
   If the display reads "`Yes`" use the ▲ ▼ keys to change the value to "`NO`" and press ENTER to accept the new value.

These functions are used to set alarm and fault limit levels. The factory set values for these functions is shown in Tables 3-4, 3-5, and 3-6.

Table 3-4. Helix and RF Settings Fault and Alarm Ranges: 120W CW/250W Peak

Fault Name	Minimum Setting	Factory Preset	Default Settings	Maximum Setting	Remarks
Low RF Alarm	0 W	0 W	0 W	120 W	See 3.8 for normal operation.
Low RF Fault	0 W	0 W	0 W	120 W	See 3.8 for normal operation.
High RF Alarm	0 W	110/130W	110/130 W	130 W	See 3.8 for normal operation.
High RF Fault	0 W	115/140W	115/140 W	140 W	See 3.8 for normal operation.
High Reflected RF Fault	0W	10 W	10 W	25 W	Factory Set. Do not change.
Helix Over Voltage	13.0 kV	TWT NPV + 300V	14.0 kV	14.5 kV	Factory Set. Do not change.
Helix Under Voltage	0.00 kV	TWT NPV - 300V	13.5 kV	14.0 kV	Factory Set. Do not change.
Helix Over Current	1.0 mA	3.0 mA	3.0 mA	5.0 mA	Factory Set. Do not change.
Helix voltage in standby	1.00 kV	4.00 kV	4.00 kV	4.00 kV	Factory Set. Do not change.

Table 3-5. Helix and RF Settings Fault and Alarm Ranges: 175W CW / 250W Peak

Fault Name	Minimum Setting	Factory Preset	Default Settings	Maximum Setting	Remarks
Low RF Alarm	0 W	0 W	0 W	170 W	See 3.8 for normal operation.
Low RF Fault	0 W	0 W	0 W	175 W	See 3.8 for normal operation.
High RF Alarm	0 W	155W	155 W	175 W	See 3.8 for normal operation.
High RF Fault	0 W	160W	160 W	185 W	See 3.8 for normal operation.
High Reflected RF Fault	0W	10 W	10 W	25 W	Factory Set. Do not change.
Helix Over Voltage	13.0 kV	TWT NPV + 300V	14.0 kV	14.5 kV	Factory Set. Do not change.
Helix Under Voltage	0.00 kV	TWT NPV - 300V	13.5 kV	14.0 kV	Factory Set. Do not change.
Helix Over Current	1.0 mA	3.0 mA	3.0 mA	5.0 mA	Factory Set. Do not change.
Helix voltage in standby	1.00 kV	4.00 kV	4.00 kV	4.00 kV	Factory Set. Do not change.

Table 3-6. Helix and RF Settings Fault and Alarm Ranges: 250W/275W CW

Fault Name	Minimum Setting	Factory Preset	Default Settings	Maximum Setting	Remarks
Low RF Alarm	0 W	0 W	0 W	250 W	See 3.8 for normal operation.
Low RF Fault	0 W	0 W	0 W	250 W	See 3.8 for normal operation.
High RF Alarm	0 W	230/255 W	230/255 W	230/275 W	See 3.8 for normal operation.
High RF Fault	0 W	250/260 W	250/260 W	250/285 W	See 3.8 for normal operation.
High Reflected RF Fault	0W	20 W	20 W	20 W	Factory Set. Do not change.
Helix Over Voltage	13.0 kV	TWT NPV + 300V	14.0 kV	14.5 kV	Factory Set. Do not change.
Helix Under Voltage	0.00 kV	TWT NPV - 300V	13.5 kV	14.0 kV	Factory Set. Do not change.
Helix Over Current	1.0 mA	3.0 mA	3.0 mA	5.0 mA	Factory Set. Do not change.
Helix voltage in standby	1.00 kV	4.00 kV	4.00 kV	4.00 kV	Factory Set. Do not change.

4. Press *FUNCTION* until.
   The display reads "**`LOW RF ALARM ON`**"
5. Continue to scroll through the remaining functions and record the value for each parameter until you reach the last item on the list**.**
6. You now have a listing of the factory set values for the items available via the FUNCTION mode.
7. Press *FUNCTION* to return to the Main Menu.

NOTE: *The amplifier should be in the STANDBY mode at this time.*

Successful completion of steps (a) through (c) and 3.6.1.1 and 3.6.1.2 indicates:

- Self-tests were successfully completed.
- Alarm and fault limit levels are properly set.
- The TWT (Traveling Wave Tube) heater is warmed up.
- High Voltage can be turned ON.

3.7.2 Initial Check, High Voltage ON

Proceed as follows:

1. Verify that the amplifier output (J8) is terminated with a RF load capable of dissipating full rated power.
2. Verify that the RF Drive is OFF.
3. Verify that the RMT LED is not lighted.
4. Verify that the amplifier is in STBY state; the STBY LED should be on. (If the FLT indicator is ON, press **RESET** to clear the fault.
5. Verify that a power meter is connected to the RF monitor (J4).
6. Press the HV ON switch.

NOTE: *The Low and High RF limits are set at the factory for initial checkout purposes. These values can be set to the desired operational values via the serial interface after initial checkout.*

7. After approximately 3 seconds, the Beam On Sequence (BONS) should complete and the XMT LED should light.
8. Starting at –40 dBm, slowly increase the RF drive until rated output is achieved.

CAUTION! Do not exceed a RF drive of -16 dBm. The HPA utilizes an RF protection fold back circuit that will increase input attenuation if the amplifier is driven beyond its rated power. Beyond the fold back limit, an alarm will indicate, followed by a fault that will latch the unit into a Fault state.

9. Press the HV ON switch to end initial checkout. The STBY LED should light.

3.8 Verify RF Output

If you want to verify RF output levels, connect a power meter to J4 before you power-up the amplifier. Proceed as follows:

1. Verify that the amplifier output is terminated with a RF Load capable of dissipating full rated output.
2. Verify that no RF drive is applied to the amplifier input.
3. Verify that the amplifier is in the STANDBY state (amplifier Yellow STBY LED lighted), Remote Control Unit STANDBY LED lighted, and display reads. "**REMOTE STANDBY**".

NOTE: *Pressing TRANSMIT in the REMOTE mode is equivalent to setting the amplifier HV ON/OFF switch to ON in the LOCAL mode.*

4. Press TRANSMIT.
   The TRANSMIT LED will blink while the amplifier goes through the Beam On Sequence (BONS). The display will read "**REMOTE BEAM ON SEQ**".
   When BONS is complete, the TRANSMIT LED will stop blinking and remain lighted (Green). The display will read
   "**REMOTE RF OUT 0W**".
5. Starting at –40 dBm, slowly increase RF drive until rated output power is achieved. Shut off RF input.
6. Press STANDBY.
   The amplifier should go to the STANDBY mode.

3.9 Setup for Operational Service

Before committing the amplifier to operational service, you can set the amplifier operating and interface parameters (for computer controlled operations).

If computer controlled operation is desired, refer to Chapter 4 to select the desired interface configuration and to drawings in chapter 7 for CIF protocol document.

If the optional Remote Control Panel is to be used, the interface parameters do not require adjustment. To change operational parameters via the Remote Control Panel, use the procedure below to change selected parameters:

- Press *FUNCTION* until the option for the desired parameter is displayed.
- Use the ▲ ▼ keys to change the parameter to the desired value and press ENTER to accept the new value.

The unit is ready for operational service.

CHAPTER 4
External Interfaces

4.1 Overview

This chapter describes the external interfaces available to the user. The Ka-Band TWTA external interface connectors (J5 and J6) are located on the front panel of the unit (Figure 2-1).

4.1.1 Control Mode Hierarchy

The Ka-Band TWTA may be controlled from the front panel of the unit (LOCAL mode), via a serial interface connector J6 (REMOTE mode) or an optional Ethernet connection. The RF Switch Interface connector (J5) provides additional control functions for redundant system operation and user external interlock circuits.

The LCL/RMT switch on the front panel of the amplifier determines the amplifier control mode (LOCAL or REMOTE). The LCL/RMT switch transfers the control point from the amplifier front panel to a remote control device. At any time, the LCL/RMT switch can be used to establish LOCAL mode operation. (Remote control devices cannot affect selection of the LOCAL or REMOTE control mode).

NOTE: *If the amplifier is to be operated via the optional Remote Control Unit, section 4.2 can be skipped.*

4.2 Serial Interface

4.2.1 Interface Configuration

Two user selectable communication protocols are available for this port STX/ETX (default) or ASCII. Both RS-422/485 (4-wire multi-drop) and RS-232 serial-communications hardware standards are supported. The RS-422/485 standard allows communication over distances as great as 4000 feet (1200 meters) at 9600 baud. RS-232 cable lengths are limited to approximately 50 feet.

In the multi-drop configuration, up to sixteen other addressable RS-422/485 equipped devices may share the same serial bus. Termination resistors should be installed on the last device on the bus. If the bus has multiple runs, the terminating resistor should be engaged on the last device at the end of each run.

Selection of the serial hardware interface is automatic based on which pin connections are used for the serial interface cable.

4.3 RF Switch Interface (J5)

On standard units not equipped with optional internal 1:1 switch controller, the RF Switch Interface provides the relay-reported Ka-Band TWTA status and RF inhibit command required by an external waveguide switch controller as well as two external interlock inputs. The status relays can be configured for several purposes, as described below. The only command on this interface, RF Inhibit, is active at all times and is not subject to the control mode hierarchy.

The RF Switch Interface is located on connector J5, located on the Ka-Band TWTA front panel. J5 is a 26-pin MS type connector with pin assignments as shown in Table 4-1.

NOTE: *For alternate switch configuration options such as 1:2 or Hybrid Switch Option, Table 4-1 does not apply.*

NOTE: *If the RF Switch Interface is not used, it must be terminated with a mating connector (supplied in the ship kit) wired as follows: jumper pin G to pin H, pin J to pin K, and pin L to pin M (for 1:1 configuration Only). For a 1:2 or Hybrid Switch Option, use the mating connector supplied with the system.*

4.3.1 Relay Definitions

Each of the two status relays can be programmed to indicate one of several conditions. The configuration of these relays is controlled through the computer interface (CIF) port. The provided Remote & Setup control software allows control of this configuration on the RF control tab. See Appendix B.

The configuration definitions are given below.

FAULT	Fault status indicates that the Ka-Band TWTA ODU is in the Fault state. The MPA ODU features Auto Fault Recycle capabilities and is capable under some circumstances of cycling back to a normal operating state. **Note:** During normal operation, the relay is energized. (There is continuity between the "NO" and "COM" contacts.) The relay will de-energize when a fault occurs.
LOW RF	The Low RF status indicates that the Ka-Band TWTA ODU's RF output is below the Low RF Alarm level or that the MPA ODU is in the Fault state. A waveguide switch can use this information to trigger automated switching action. The Low RF status has two modes, Flexible and Rigid. In Rigid mode the Low RF status will indicate that the Ka-Band TWTA ODU's RF output is below the Low RF Alarm level any time this condition occurs, except during an RF Switch port RF Inhibit command. The Rigid mode can be thought of as the strictest operation of the Low RF status. In Flexible mode the Low RF status will indicate that the Ka-Band TWTA ODU's RF output is below the Low RF Alarm level any time this condition occurs *during the Transmit state*, except during an RF Inhibit*. (The Low RF status will not assert during a Fault state.) The Flexible mode allows the user to operate a switch controller in Automated Switching mode without triggering waveguide switch action while operating the Ka-Band TWTA ODU in any normal operating state or issuing RF Inhibit commands. *If RF Inhibit is activated while the Low RF Relay indicates a low RF condition, the Low RF Relay will not change state. (It will continue to indicate Low RF.) Once the RF Inhibit disappears, the Low RF Relay will report existing conditions. **Note:** During normal operation, the relay is energized. (There is continuity between the "NO" and "COM" contacts.) The relay will de-energize when a fault occurs.
SUM FAULT	The Sum Fault status indicates that the Ka-Band TWTA ODU is latched into the Fault state. When the Ka-Band TWTA ODU is latched into the Fault state, the user must clear the fault source and issue a Reset command to return it to a normal operating condition. **Note:** During normal operation, the relay is energized. (There is continuity between the "NO" and "COM" contacts.) The relay will de-energize when a fault occurs.
TRANSMIT	Transmit indicates that the Beam is turned on and the RF is not inhibited. This is the normal operating state of the amplifier. **Note** that the amplifier will cease transmitting (and the Transmit indication will be negated) when any of the interlock circuits (External Latching I/L, External Non-Latching I/L, or RF Inhibit) opens.

	Note: When the amplifier is in the Transmit state, the relay is energized. (There is continuity between the "NO" and "COM" contacts.) The relay will de-energize when a fault occurs.
BEAM ON	Beam On tracks the Beam state (HV applied to TWT). **Note:** When the Beam is On, the relay is energized. (There is continuity between the "NO" and "COM" contacts.) The relay will de-energize when a fault occurs.

Table 4-1. RF Switch Pin Assignment (J5): 1:1 Switch Option

Pin #	Signal Name	Remarks
A	Status Relay 1 NO	Relay 1 normally-open contact. Function defined by switch S1.
B	Status Relay 1 NC	Relay 1 normally-closed contact. Function defined by switch S1.
C	Status Relay 1 COM	Relay 1 common contact.
D	Status Relay 2 NO	Relay 2 normally-open contact. Function defined by switch S1.
E	Status Relay 2 NC	Relay 2 normally-closed contact. Function defined by switch S1.
F	Status Relay 2 COM	Relay 2 common contact.
G	External Latching I/L	Open from Return (pin H) for latching Beam Off interlock.
H	External Latching I/L Rtn	Latching interlock return.
J	External Non-Latching I/L	Open from Return (pin K) for non-latching (RF Inhibit) Interlock.
K	Ext. Non-latch I/L Rtn	Non-Latching interlock Return.
L	RF Inhibit	Open from Return (pin M) for non-latching RF Inhibit.
M	RF Inhibit Rtn	RF Inhibit Return.
N	Reset to Defaults	Shorting this to return (pin P) while unit is turned on will reset the serial communication parameters to the factory defaults.
P	Reset to Defaults Rtn	Reset Return.
R	WG SW POS 1 OUT	Drive to Waveguide Switch for position 1
S	WG SW GND	Waveguide Switch Drive Return
T	WG SW POS 2 OUT	Drive to Waveguide Switch for position 2
U	WG SW POS 1 IN	Contact indicating Waveguide Switch position 1
V	WG SW GND	Waveguide Switch position return
W	WG SW POS 2 IN	Contact indicating Waveguide Switch position 2
X	FAULT	Fault relay from other amplifier
Y	GND	Digital Ground

Table 4-1 Notes:

1. Outputs are dry-circuit relay contacts rated up to 50 V_{DC}, 50 mA.
2. External interlocks and RF Inhibit inputs are optically isolated. Maximum open circuit voltage present is 16 V_{DC}. Typical operating current is 3 mA.
3. The RF Inhibit requires a maintained closed-contact with RF Inhibit return for normal operation. (An open will cause a RF Inhibit.) This RF Inhibit command is executed regardless of the current control mode.
4. The External Interlocks (both Latching and Non-latching) require a maintained closed-contact with their respective interlock returns for normal operation. (An open will cause either a Fault or RF Inhibit condition.)
5. Pins 'R' through 'Y' are used only when the Switch Option has been installed.
6. For alternate switch configuration options, such as 1:2 or Hybrid Switch Options, Table 4-1 does not apply.

4.4 Ethernet Interface

This interface allows amplifier to be accessed via 10BASE-T Ethernet. Refer to Table 4-2 for optional drawings. This interface has the following functionality:

- Monitoring and control of the amplifier via TCP using the ASCII Based CIF protocol and the STX/ETX header/ending byte message format, using TCP port 50000.
- Monitoring and control of the amplifier via a Java based application, which provides access to meters, trip-point settings, meter log and switch configuration.
- Downloading and programming the amplifier Control System flash memory via FTP.
- Synchronize the amplifiers internal clock to GMT via UDP.
- Browse the amplifier to monitor Status, Meter Readings, and Latched Fault History.
- Browse the amplifier to configure the four E-Mail Groups that permits the Amplifier to send E-Mail to the recipients in the list if any of the configured events have occurred.

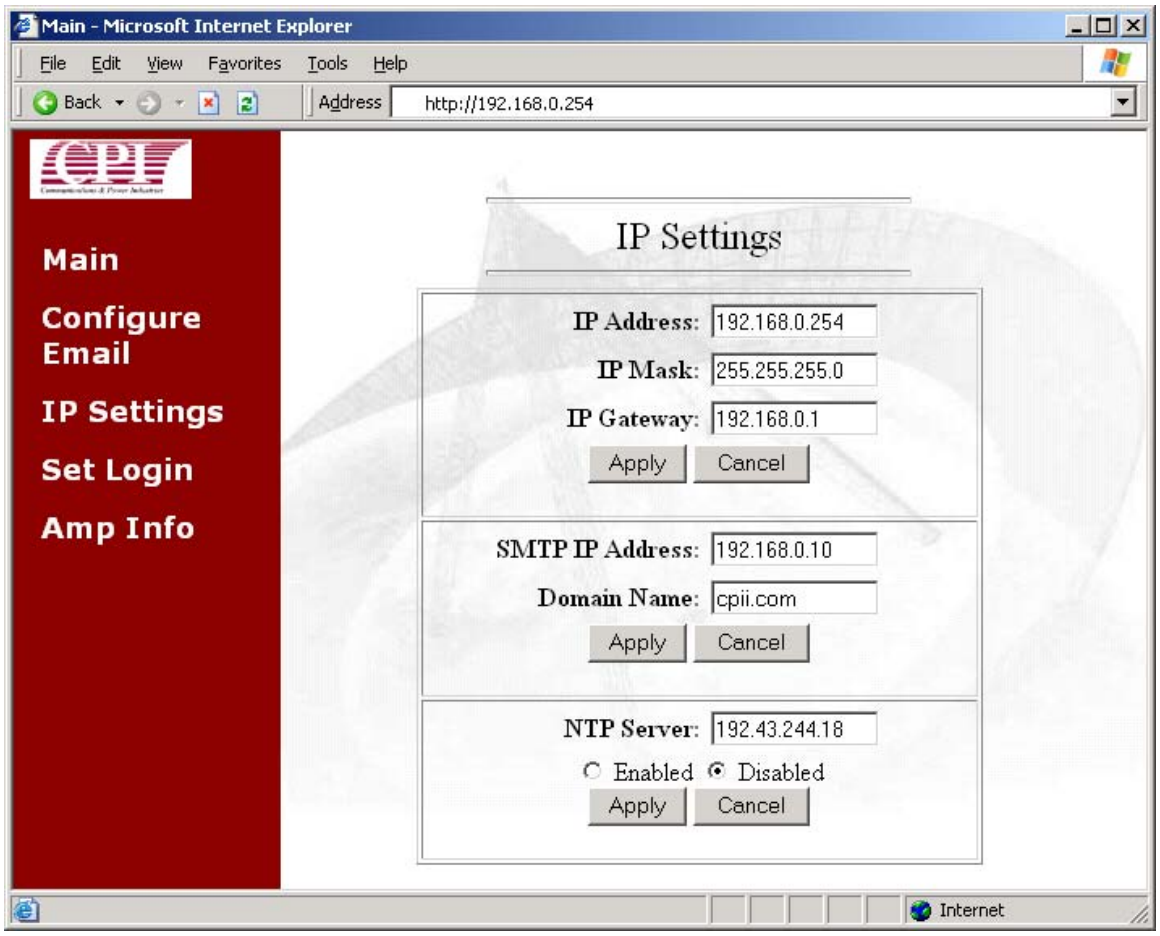
4.4.1 IP Setup

Table 4-2. Default Configuration-Ethernet Interface Option

Parameter	Factory Defaults	Function
IP Address	192.168.000.254	Amplifier IP Address
IP Mask	255.255.255.000	Used to determine the subnet for the amplifier
IP Gateway	192.168.000.001	Used to direct packets addressed to non-local networks
SMTP IP Address	192.168.0.10	Address of mail server
Domain Name	-	Domain Name of sender
NTP Server Address	192.043.244.018	IP address of Network Time Server
Time Server Enabled	No	Enables the HPA to request time data from the Time Server at the above address.
Username	'cpi'	
Password	'cpi'	

To change the default settings, use a web-browser to connect the amplifier. Make sure that the PC is configured for the same subnet as the amplifier, e.g. set the IP-address/mask of the PC to 192.168.0.100/255.255.255.0.

In the address field of the web-browser, type in the IP-address of the amplifier, e.g. http://192.168.0.254. If a login-prompt appears, type in *cpi* for both the login name and the password.



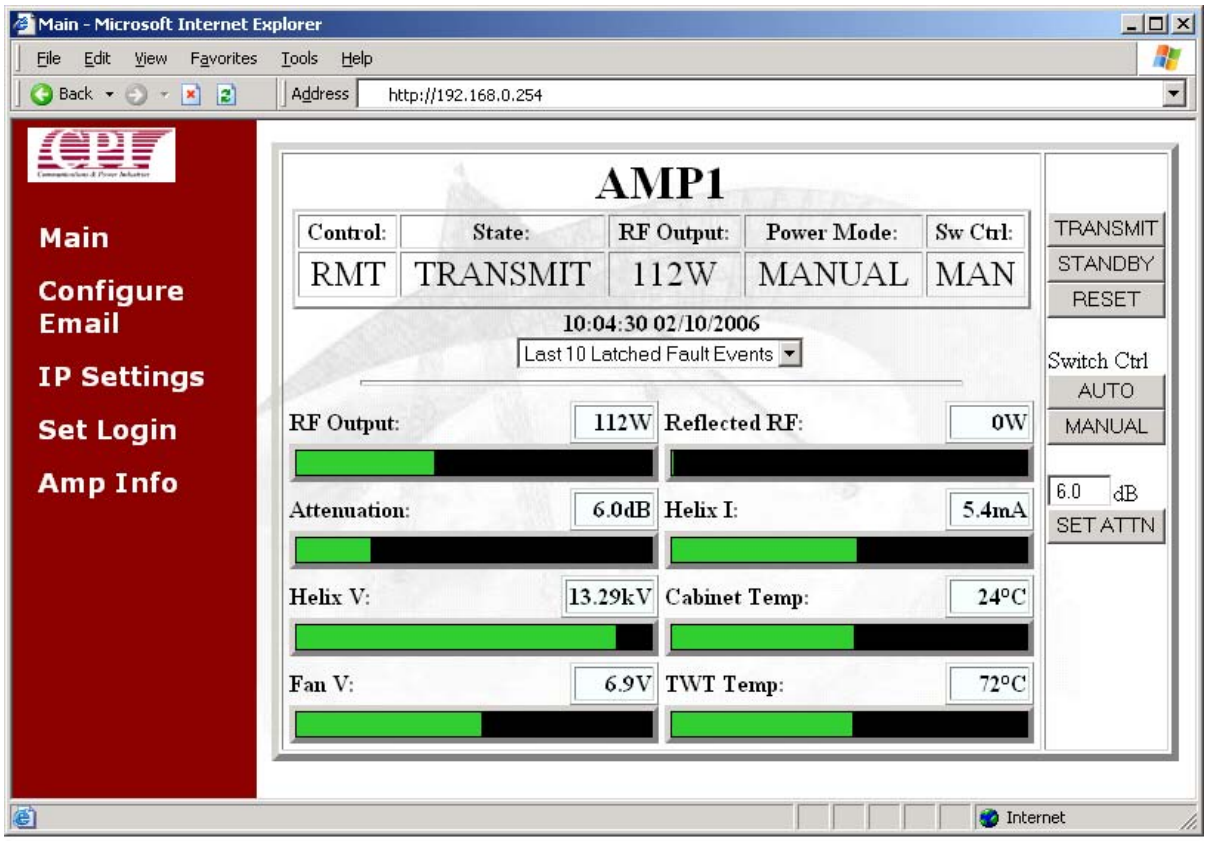
Change the IP-settings to the desired configuration and hit "Apply". The changes will take effect when the amplifier is restarted.

When configuring the SMTP address, make sure to enter a domain-name that is recognized by the SMTP server. The domain-name will appear in the "from" field of the email, as in "AMP1@cpii.com".

To quickly configure the amplifier, connect using FTP and drag-and-drop a config.ini file as shown in section 3.6.

4.4.2 Web Interface

The amplifier can be monitored over the Internet by connecting to the amplifier using a web browser like Internet Explorer. The main screen shows the Amplifier state, Power mode, RF Output, Switch Control and the meter readings. Also the last 10 latched fault events can be checked using the drop-down menu.

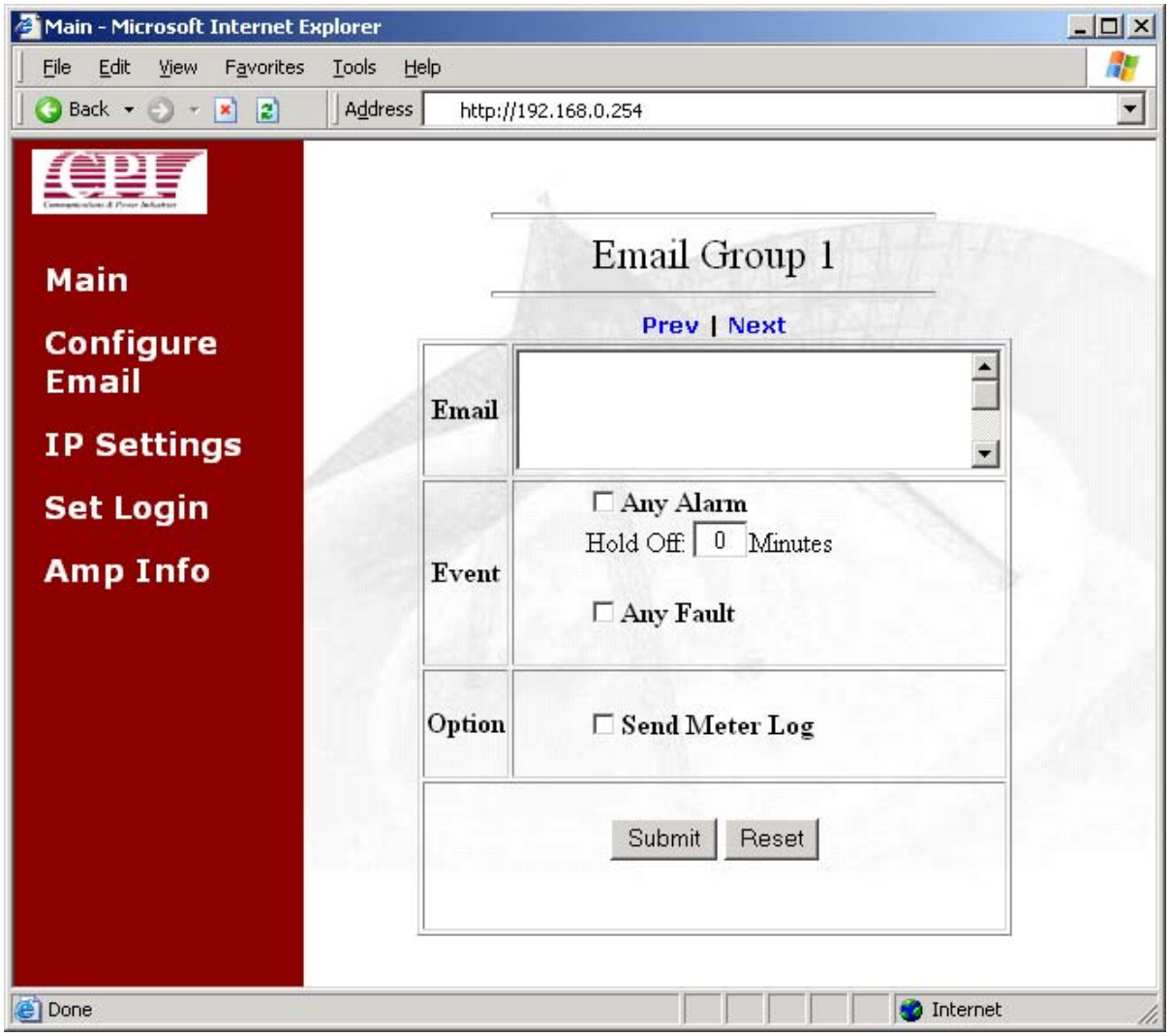


The buttons on the right hand side of the screen can be used to put the TWTA into Transmit or Standby, reset any current faults, set the switch controller to either Manual or Auto mode and change the attenuation level of the TWTA.

4.4.3 Configuring Email

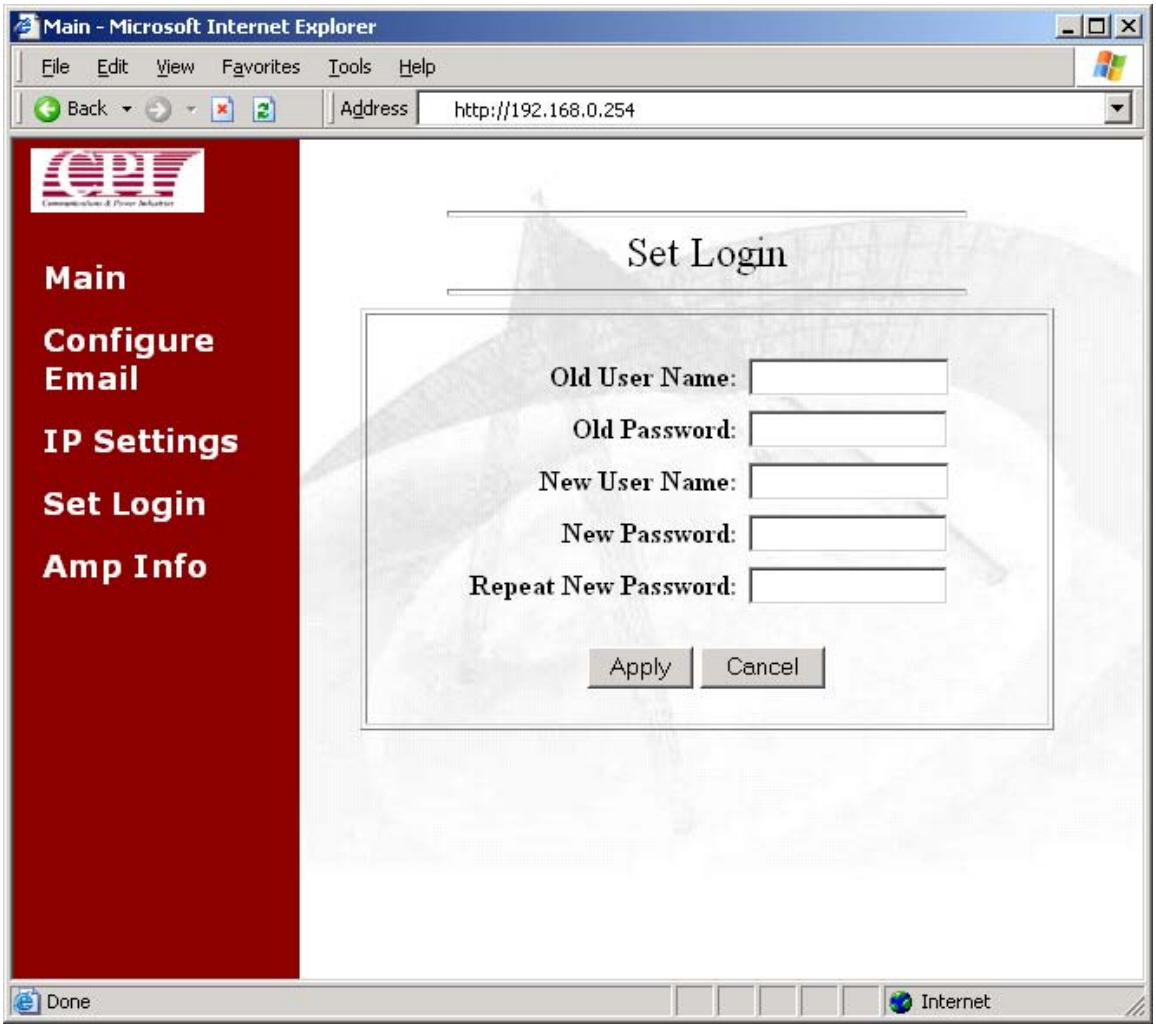
The amplifier can be configured to send emails on alarms or faults. Up to 4 groups with up to 8 email recipients each can be configured.

Select any combination of events to trigger email and select "Send Meter Log" to have the amplifier attach a file containing the log. When all fields have been filled out, hit the "submit" button to store the configuration.



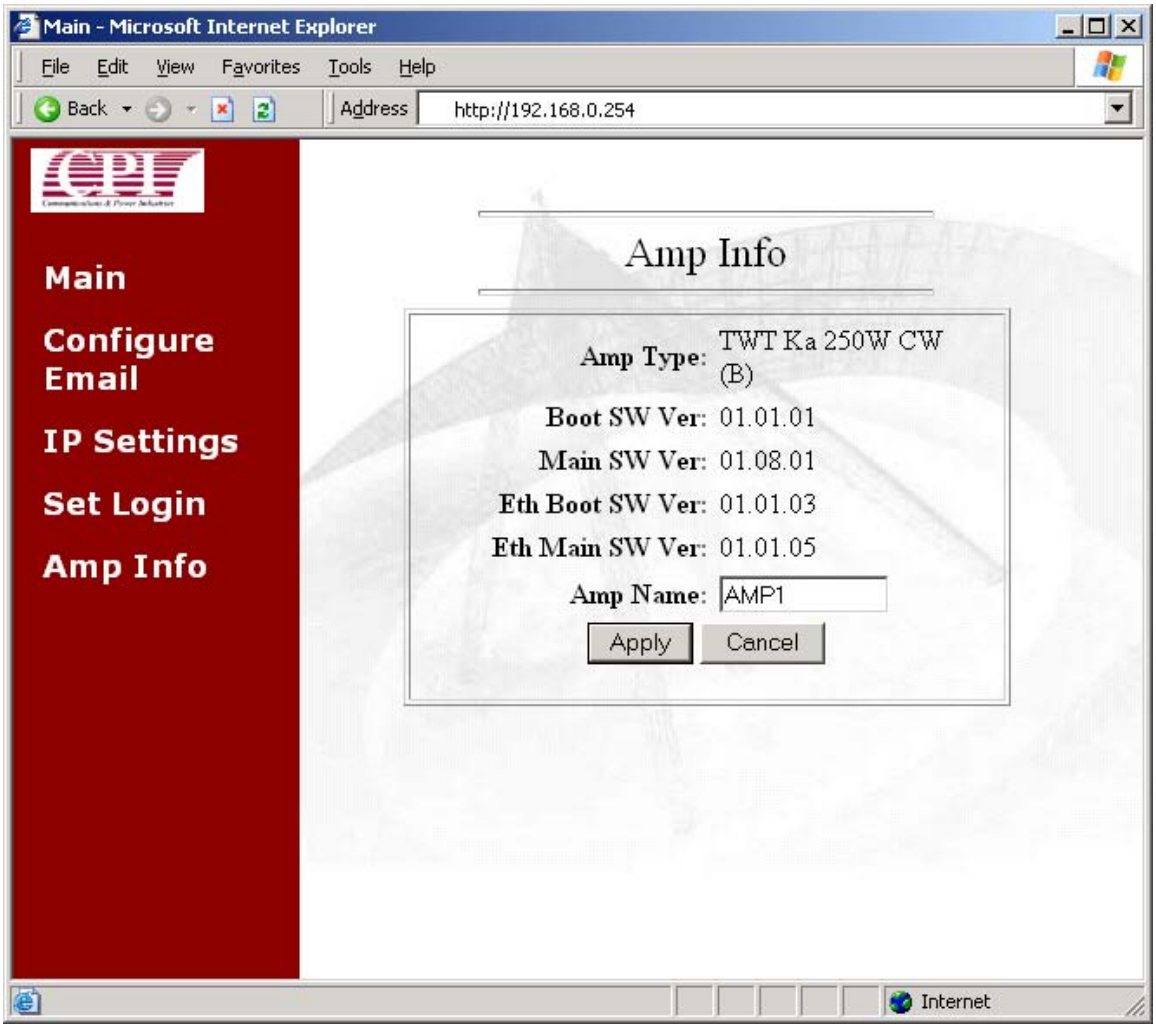
4.4.4 Changing the Login

To change the login user name and password, select the "Set Login" menu on the left hand side of the screen. Type in the old user name and password (default is *cpi*), the new user name and password and hit the apply button.



4.4.5 Amplifier Information

Select "Amp Info" on the menu-bar to show the Amplifier type and firmware version numbers. To change the name of the amplifier, type in a name and hit Apply. The amplifier name will show on the top of the Main menu and is also used as the senders name for emails.

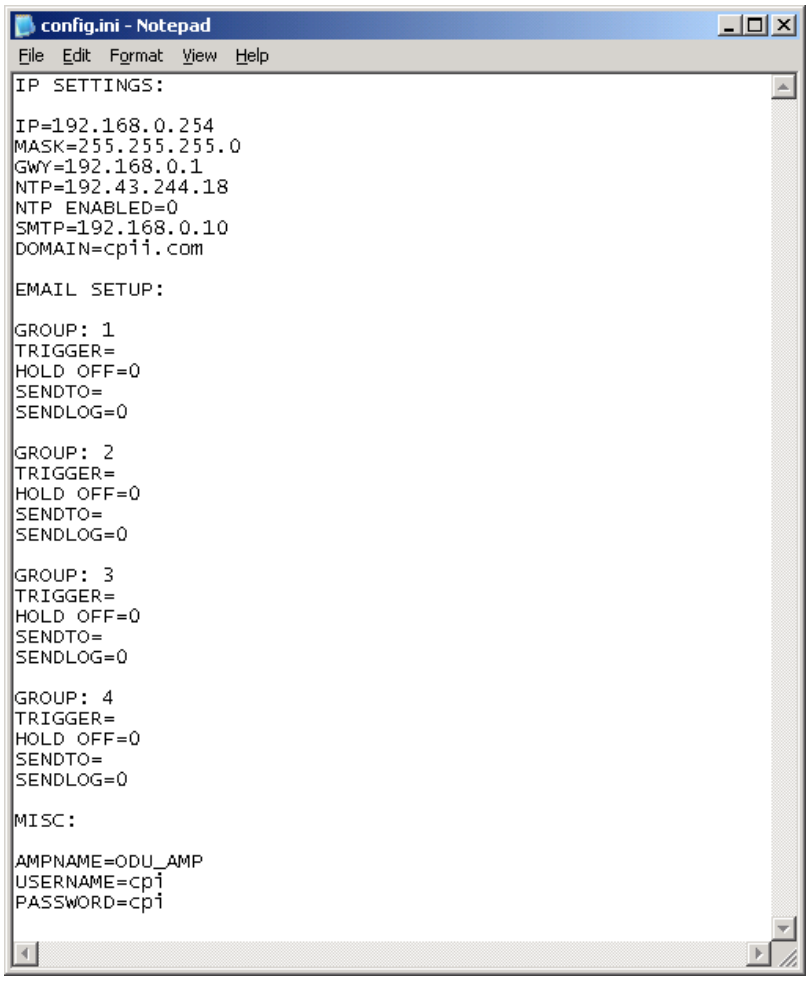


4.4.6 Download / Upload Files using FTP

Connect to the amplifier using an FTP client or a web browser. The login user name and password is the same as for the web-interface (default is *cpi*). The window should contain two files: config.ini and the meter log for the amplifier.

The meter log file contains the fault and alarm events recorded by the amplifier and can be drag-and-dropped to a local directory.

The config.ini file contains the IP and email configurations for the amplifier. This file can be downloaded and edited and then uploaded to another amplifier to quickly set up other amplifiers in a system.



To enable/disable the NTP, set the "NTP ENABLED" field to either 1 or 0. To set up an email group, set the "TRIGGER" field to "alarm" or "fault" or both "alarm, fault". Set the "HOLD OFF" field to a number between 0 and 9999 to set the number of minutes the amplifier will wait before sending an email after an alarm or fault occurred. Enter the email addresses in the "SENDTO" filed, comma delimited if multiple addresses are entered. Set the "SENDLOG" field to 1 to attach the meter log to the email.

4.4.7 Firmware updates

Using an FTP client or web browser, new firmware can be uploaded to the TWTA. Simply drag and drop the new firmware file to the FTP window. When the transfer is done, close the FTP window and the amplifier will reprogram the flash and restart. Contact CPI for latest firmware updates.

4.4.8 LAN Interface Port Numbers

Table 4-3. Ethernet Interface Port Numbers

Port Number	Description	Protocol
21	FTP Server	TCP
80	HTTP Server	TCP
123	NTP Client	UDP
50000	CIF Protocol Server	TCP

4.5 JAVA CIF Remote Program

The CIF Remote program is a Java application that is loaded from the TWTA and is used to monitor and control the meters, trip-point settings, meter log and switch configuration.

Java JRE

To run the CIF Remote, the Java Runtime Environment (JRE) must be installed on the PC. The Java Runtime Environment can be downloaded from:

http://www.java.com/en/download/index.jsp

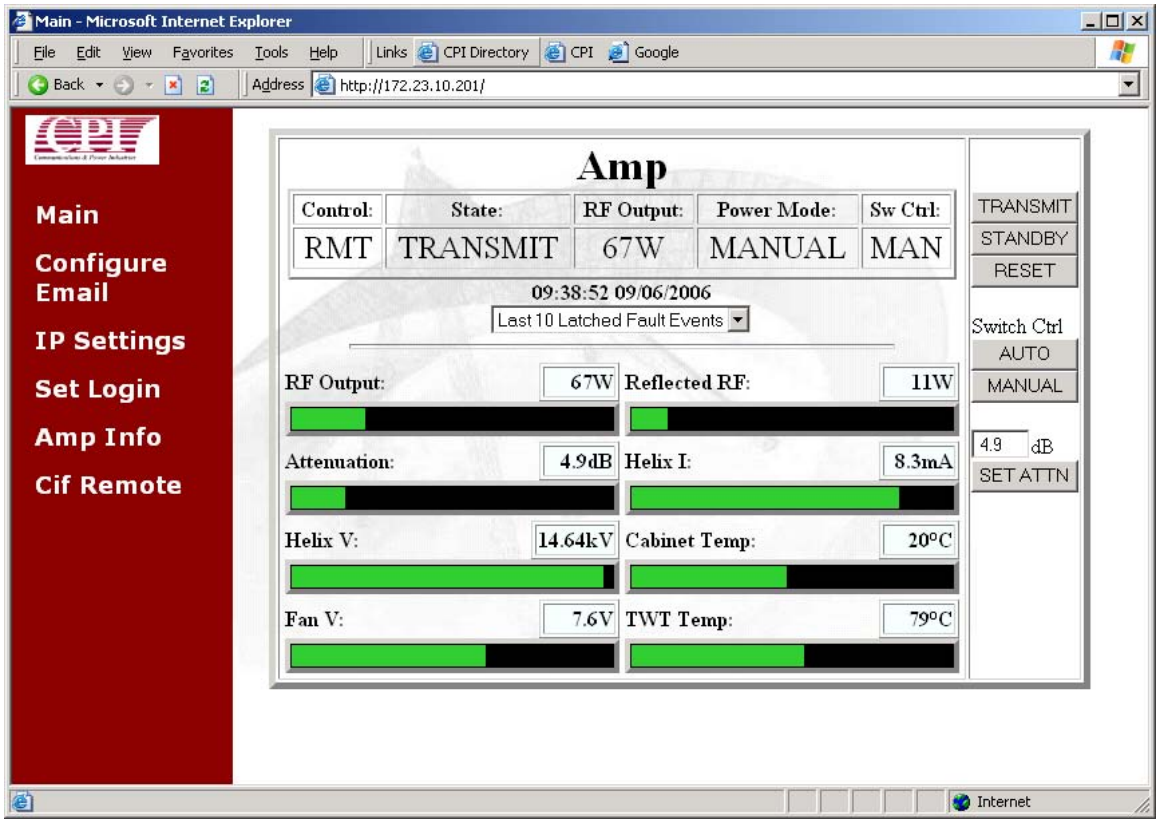
4.5.1 Running CIF Remote:

Open a web browser and make an http connection to the TWTA:

Ex: If the IP address of the ODU is 172.23.10.20, type http://172.23.10.201 in the Address field of the browser and hit enter.

Type in login and password info when the login prompt appears.

The default login and password is 'cpi'

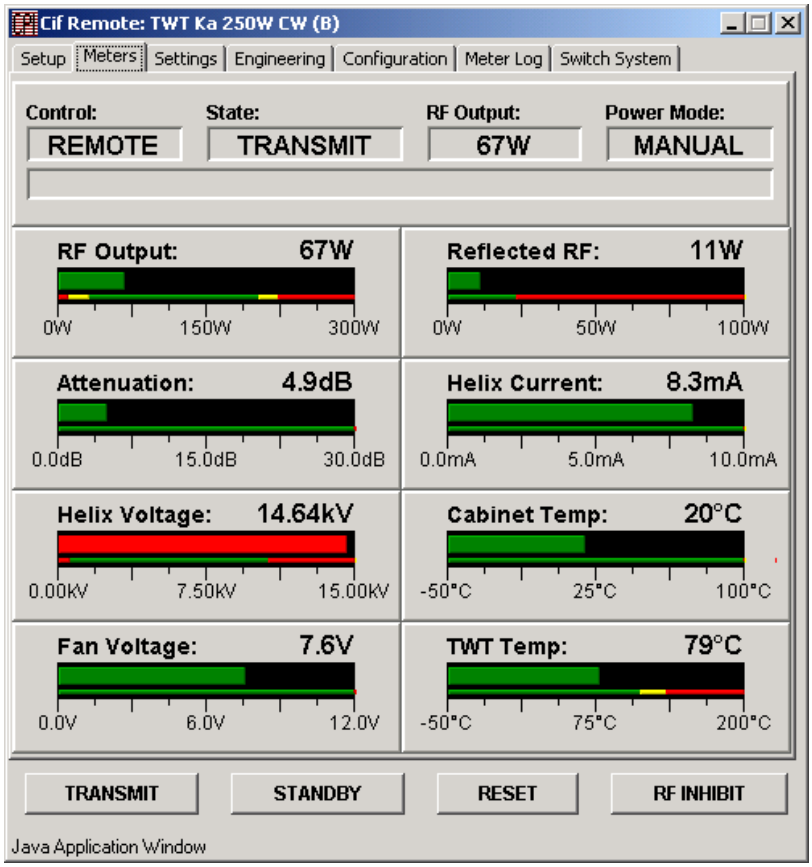


To start the CIF Remote application, click on "CIF Remote" in the side bar.

The Java program will load and automatically make a connection to the TWTA.

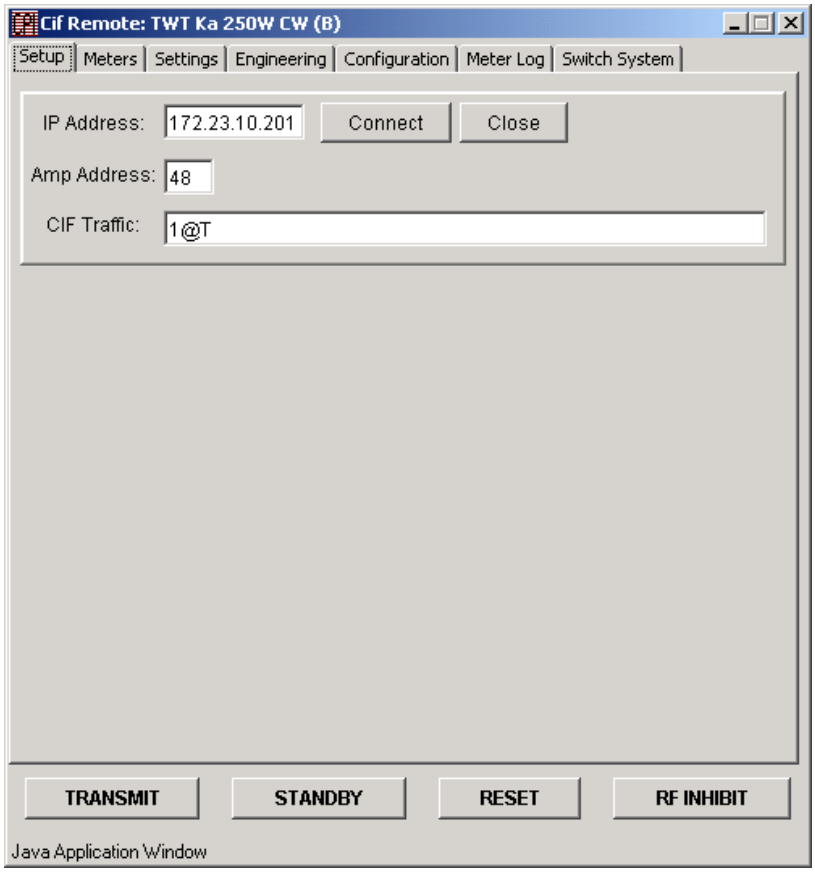
4.5.2 Meters

Shows the CIF control state (Local/Remote), Amplifier state, RF Output power, Power mode (Manual/ALC) and the meter readings. Any faults/alarms will be shown in the status bar above the meter readings. The buttons on the bottom of the screen are used to put the amplifier in Transmit or Standby mode, Reset a fault or enable/disable RF Inhibit.



4.5.3 Setup

The Setup menu shows the IP address, Amplifier address and the CIF traffic status.



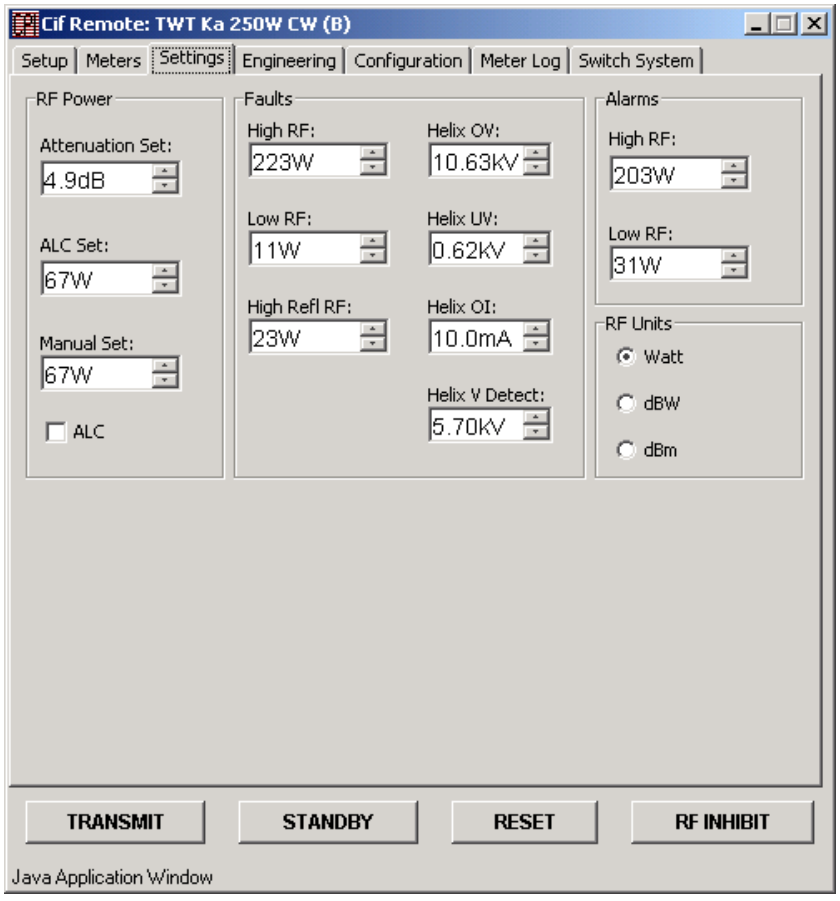
4.5.4 Settings

In this menu the trip-point settings can be adjusted.

The "RF Power" windows sets the power output, attenuation and Manual/ALC gain control.

The "Faults" and "Alarms" windows shows the high/low faults and alarm trip points.

Use the up/down arrow on the side to adjust a setting or click in the text-field and type a new value and hit enter.

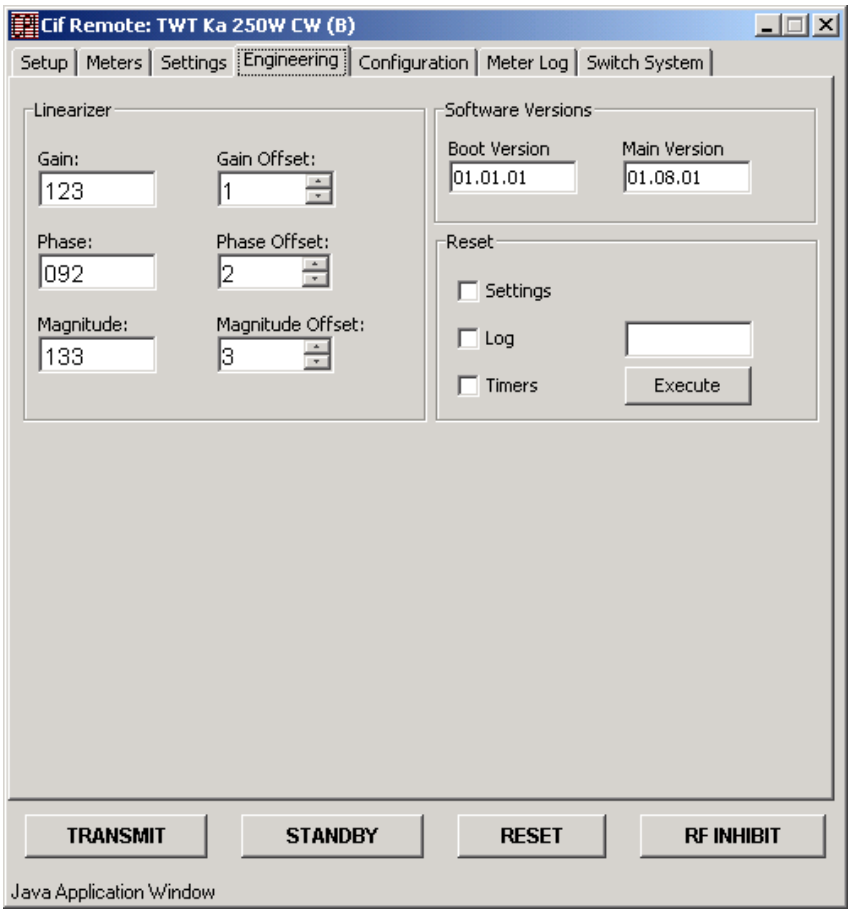


4.5.5 Engineering

The "Linearizer" window shows the current linearizer settings. To adjust the offsets use the up/down arrows on the side or click in the text field and type a new number (0-255) and hit enter.

The "Software Versions" window shows the ODU boot and main software versions.

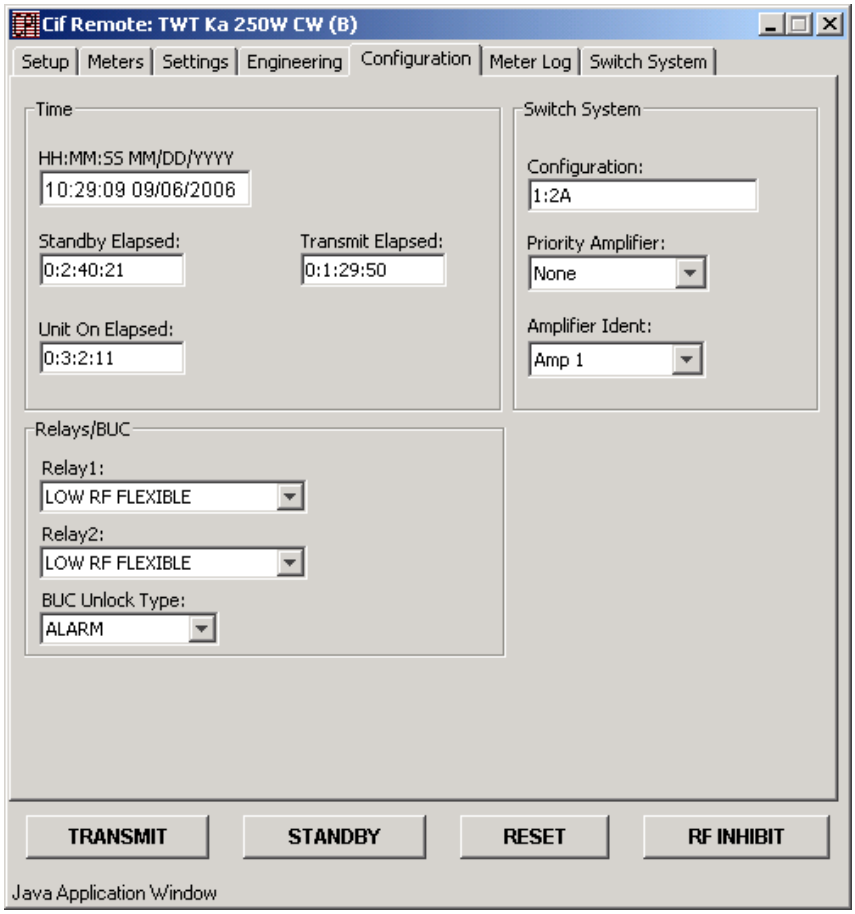
In the "Reset" window the Settings (trip points) can be reset to default and the Meter Log and Timers cleared. To clear, select one of the options and type "123456" in the text-field and hit "Execute"



4.5.6 Configuration

The "Time" window shows the current time and date. The other fields show the Standby, Transmit and Unit on elapsed time. To set the time, click in the time/date field and type in a new time and date in the correct format. The "Switch System" window shows the switch system type, the priority amplifier and the Amplifier ID. Use the drop-down menu to change the Priority amplifier or ID.

The "Relays/BUC" shows the current configuration of the 2 relays and the BUC unlock type. Use the drop-down menus to change.



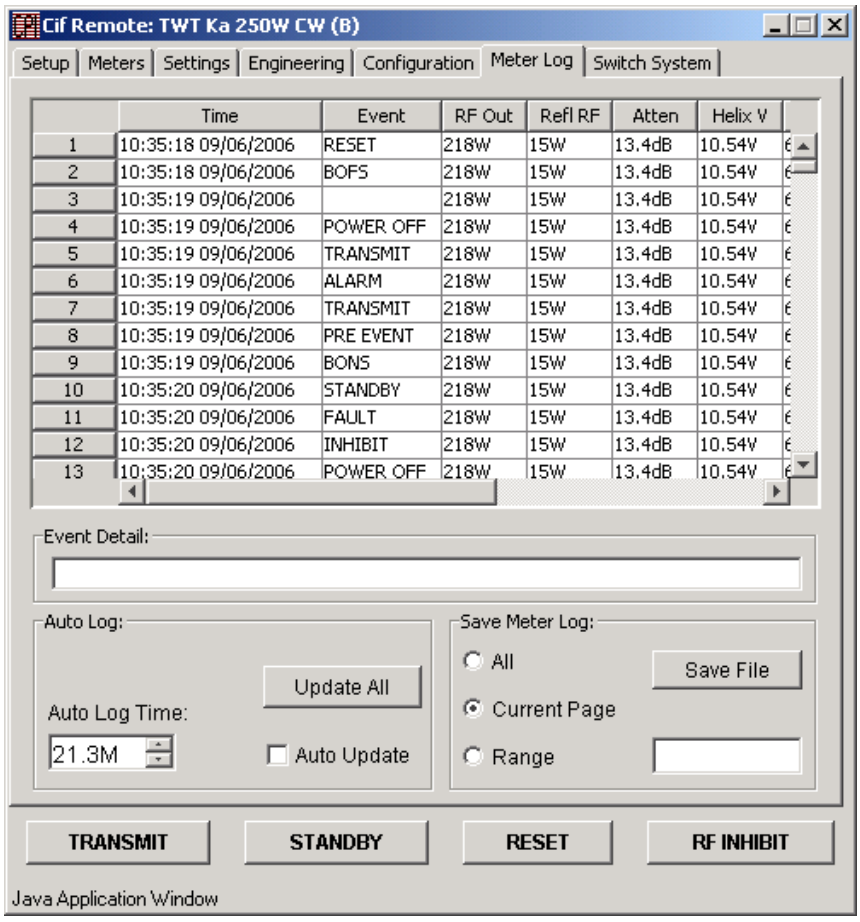
4.5.7 Meter Log

Shows the Meter Log (up to 2000 entries). The columns in the table can be re-arranged by clicking on the header and dragging it either left or right.

Use the scrollbars to browse the log and click on an event to see more details in the "Event Detail" window.

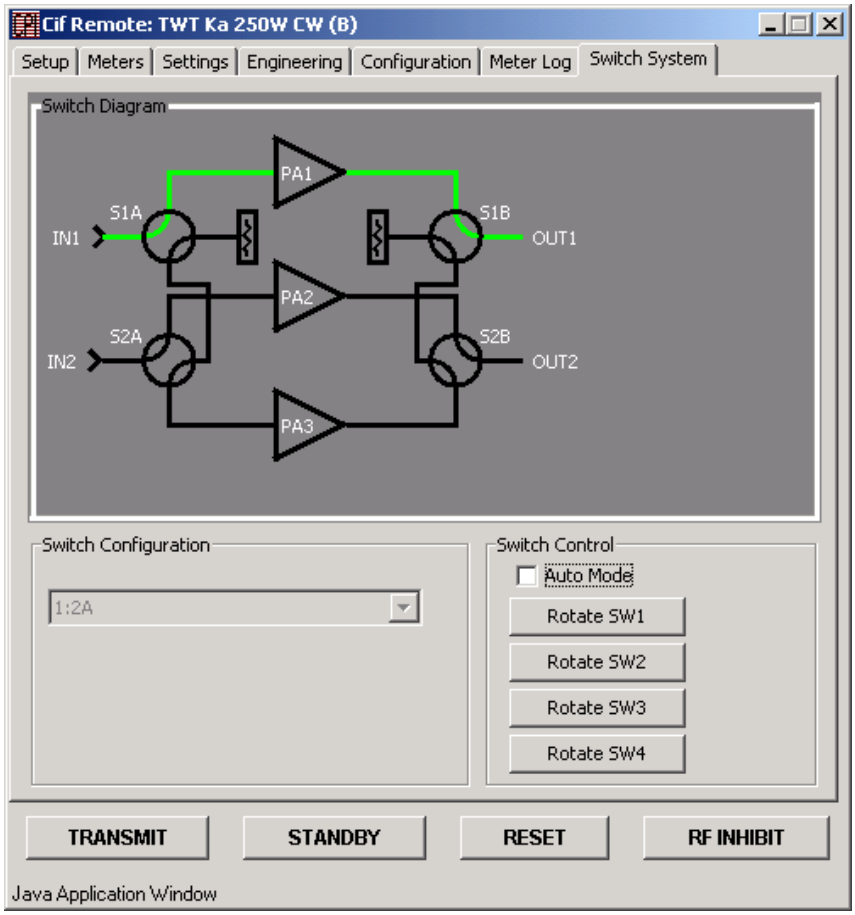
In the "Auto Log" window the Auto Log Time can be set. Setting the Auto Log Tome to 0.0 disables the Auto Log. By Enabling "Auto Update" the current view of the Meter Log will automatically refresh every 20 seconds. By clicking the "Update All" button the complete Meter Log will be updated.

In the "Save Meter Log" window the Meter log can be saved as a text file. Select all, current page or select a range and hit "Save file"



4.5.8 Switch System

The Switch System screen shows the current switch configuration. In the “Switch Control” window switch control mode can be set (Auto/Manual) and clicking a “Rotate sw” button can rotate each switch.



CHAPTER 5
Normal Operation

5.1 General

The REMOTE mode is the control mode for normal operation of the amplifier. In this mode, the full set of monitoring and control functions are available to the remote control device. For remote control operations, the user has the choice of:

- Remote Control via a CPI Remote Control Unit
- Remote Control via an IBM PC compatible computer with CPI supplied Remote Control Software or custom monitor and control equipment developed & supplied by the user.
- Remote Control via Ethernet Interface

NOTE: *Only one remote control device can be connected to the amplifier (to connector J6) at one time.*

If the amplifier has been set up for normal operation and the remote control device is temporarily unavailable, the amplifier can be set for operational service in the LOCAL mode until the remote capability is restored for operational service.

Control commands from the remote control device that affects the operating status of the amplifier, such as TRANSMIT or STANDBY, are accepted only when the amplifier is set for the REMOTE control mode.

The Remote Control Unit Menu tree is shown in Figure 3-5 in chapter 3 or Figures E-1 and E-2 in Appendix E.

5.2 Overview of Operation

The amplifier can be turned on using the front panel controls. When operated in this manner (LOCAL), the following sequence of events occurs after the AC power is applied by the operator:

- POST (Power On Self Test) - Self tests are initiated. These take several seconds to complete.
- HTD (Heater Time Delay) - Three minutes are allowed for the cathode of the TWT to reach operating temperature. Following completion of warm-up, the amplifier STBY LED is lit.
- If the amplifier is in the STBY state, the HV ON switch is pressed to initiate the Beam On Sequence (BONS). During this sequence the amplifier XMT LED blinks.

Two different fault conditions may occur during the turn-on sequence:

- *Fault (Non-Latched) - Beam-off malfunction state*. The amplifier will automatically recycle to the state that existed prior to the fault.
- *Fault (Latched) - Beam-off malfunction state.* The SDBY LED is OFF and the FLT LED is ON. The operator must intervene to return the amplifier to its normal operating state. This is accomplished by pressing the RESET switch (momentary pushbutton switch). After successful reset, the standby (STBY) LED stays ON.

5.3 Normal Operating Procedures

CAUTION! Before starting or operating the amplifier for the first time, be sure that “Initial Power-On And Checkout" procedures described In Chapter 3 have been performed.

5.3.1 LOCAL Mode Operation

For normal operation in LOCAL mode, proceed as follows:

c) Apply AC power. The power on self tests (POST) start.

16. Set the amplifier for LOCAL control mode. (Press the LCL/RMT switch once if the RMT LED is ON.)
17. Verify that the amplifier FLT LED is not flashing. Refer to 5.6.7 any time the FLT LED flashes.
18. Verify that the amplifier STBY LED lights after the 3-minute heater time delay.

19. Press the HV ON switch once, the amplifier XMT LED flashes during the Beam On Sequence, and stays ON if BONS was successful. The amplifier is now in the XMT mode.

NOTE: *If high voltage was ON when the unit was shut down (amplifier was in the XMT state), high voltage will automatically be restored when the HTD and BONS cycles are complete.*

20. *Alternate method*: press the HV ON switch once during HTD; this causes the XMT LED to flash (XMIT select mode). BONS and Transmission of RF will occur automatically at the completion of HTD.
21. Ensure that a RF input is applied to RF input J3.
22. To change to the STBY state, press the HV ON switch once. (The XMT LED will go off and the STBY LED will light.)

5.3.2 Remote Control Mode, Computer Control

Refer to Chapter 2 for connection details and *01033829* (CIF protocol) for communication and command details. Also refer to Appendix B for operation with CPI supplied Setup & Remote Control Software (ODUremote.exe).

In the LOCAL mode, turn the amplifier ON and set it for the REMOTE control mode. Install the supplied ODUremote.exe program or a user-supplied amplifier control program in the computer to be used for normal operations. Using this program, setup the operating parameters and operate the amplifier.

5.4 Shutdown

5.4.1 Normal Shutdown

If no transmission is planned for an hour or two, the amplifier AC power should be switched off to conserve electricity and prolong the life of the TWT (traveling wave tube). Proceed as follows:

- Place the amplifier in "STANDBY" mode. Verify that the STANDBY LED is lit.
- Wait approximately 5 minutes to allow the TWT to cool off. (The fan will still be operating.)
- Switch off the applied AC power.

5.4.2 Prime Power Interrupts

The amplifier will automatically recover after a prime power failure. Transient prime power interrupts result in proportional time delays before the amplifier returns to the pre-interrupt operational state. (See 5.6.2.) The purpose of the proportional delay cycle is to re-establish the proper cathode operating temperature before the high voltage is turned ON.

5.5 Making Routine Safety Checks

It is very important that the user confirm the Ka-Band TWTA trip settings. These have been set at the factory for checkout. Verification of the trip settings should be made more often if several operators have used the equipment. Failure to operate the Ka-Band TWTA with the correct settings can result in damage that is not covered by the warranty. For this reason, the procedure that changes the trip settings should be given only to the authorized personnel.

5.6 Description of Amplifier States

The operation of the Ka-Band TWTA may be divided into several states and sequences. They are as follows:

POST (Power On Self Test)-Initial power on.

HTD (Heater Time Delay)-Beam off state while cathode heats to operating temperature.

STANDBY- Normal beam off state. (High Voltage not applied to the TWT.)

BONS (Beam On Sequence)-Transition from the STANDBY state (beam off) to the TRANSMIT state (beam on).

TRANSMIT-Beam on state (in this state, the ODU Ka-Band TWTA amplifies the RF input signal to the rated output level).

BOFS (Beam Off Sequence)-Transition from TRANSMIT state to any beam-off state.

Fault (Non-latched)-Beam-off malfunction state; the amplifier will automatically recycle to the state that existed prior to the fault.

Fault (Latched)-Beam-off malfunction state. User intervention required to return the amplifier to a normal operating state.

Each operating state is described in greater detail in the following text.

5.6.1 Post

The microprocessor-based controller performs a list of tests that establish its ability to control and monitor the amplifier. Some areas covered by POST include checking validity of information in the battery-backed RAM, EPROM checksum, and other controller specific aspects. During this test the amplifier will accept no user inputs that affect the beam state.

If there is no POST failure, the amplifier starts the heater time delay cycle (HTD).

If there is a POST failure, the system halts at the failed test and reports the error (FAULT LED lights).

5.6.2 Heater Time Delay (HTD)

HTD (Heater Time Delay) allows the TWT heater to warm the cathode to its operating point. HTD is nominally 3 minutes, but can be a shorter period after a prime power failure as follows:

HTD proportional time delay:

- If time off <5 seconds, no HTD.
- If 5 seconds<time off<1.5 minutes, HTD = 1.5 x time off.
- If time off >1.5minutes, HTD = 3 minutes.

Heater Reduce is off during this time.

If the TRANSMIT state is commanded during the HTD cycle, the amplifier will automatically transition to the TRANSMIT state when the cycle is complete (if there is no fault).

If a fault occurs during HTD, the unit will transition to the Fault state. The HTD countdown clock continues after a fault occurs.

5.6.3 Standby State

The STANDBY state is the normal beam-off state. During STANDBY, high voltage is off and the unit does not amplify the RF input drive signal.

While the unit is in the STANDBY state, the STBY LED is lit. After the beam is off for one minute, the Heater Reduce command is activated.

CAUTION! Leaving the amplifier in Standby for more than 4 hours is not recommended. TWT longevity can be reduced.

5.6.4 Beam On Sequence

Beam on sequence (BONS) covers the transition from Standby (beam off) to Transmit (beam on). During BONS the green Transmit light will flash.

5.6.5 Transmit State

Transmit is the normal beam-on state (high voltage on, heater reduce off). RF Inhibit may be on or off.

If a fault occurs, the unit will transition via the BOFS (Beam Off Sequence) to the Fault state. A successful fault recycle attempt will return amplifier operation to Transmit.

5.6.6 Beam Off Sequence

The BOFS (Beam off sequence) describes the transition from Transmit or BONS to any beam-off state.

5.6.7 Fault State

If a fault condition is detected, the unit transitions to the Fault state. The fault system is always in auto recycle mode for most faults , which allows the controller to return the unit to the pre-fault state after a transient fault (or a series of transient faults).

Three consecutive transient faults will place the unit into "summary fault" mode and a reset command is required to return to normal operation.

CAUTION! All Faults should be investigated. Damage can occur if a Reset is made without corrective action.

5.6.7.1 Auto Fault Recycle Mode Rules

Latch into Fault state (sum fault):

If three faults occur within a 20 second period, the unit latches in the Fault state.

Recycle to prior state:

If fewer than three faults occur within 20 seconds, the system recycles back to the appropriate operational state.

During a Fault event

High Voltage is off. Heater Reduce is on after one minute of Fault state. RF Inhibit is on.

Since all faults are ignored during Fault, a hard fault (such as a stuck Interlocks Open) will be seen three times as the unit cycles between Fault and another operational state. This guarantees that a hard fault will ultimately latch the unit into Fault. If a recycle decision is made, the unit remains in the Fault state for, an additional 0.5 second before cycling back to the original state.

If the unit enters Fault from HTD, the HTD countdown will continue.

While the unit is in the Fault state, the Fault LED flashes. Once the unit leaves the Fault state, the Fault LED is OFF.

If the unit is latched into the Fault state, the Fault LED flashes. To exit the latched Fault state, the user must clear the fault cause, then toggle the RESET switch. The amplifier returns to Standby.

5.6.7.2 Meter log

A meter log is available to the user via either the remote panel or the CPI supplied remote software. Refer to either chapter 3 (Figure 3-5) or to Appendix B for more information on how to access the log.

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CHAPTER 6
Operator Maintenance

6.1 Introduction

This chapter describes the procedures for Preventive Maintenance tasks that can be performed by operators.

NOTE: *There are additional Preventive Maintenance tasks that require that the service technician has attended a formal training program for service of the amplifier. (See Table 6-2.) Refer to the Service Manual for this product for a discussion of these tasks.*

It is recommended that a daily log should be kept of all the meter readings. This can be helpful in identifying trends and potential problems. The daily log is a good source for clues that could indicate an intermittent or marginal condition. Any increase in reflected power or unexplained fault conditions could point to a deteriorating condition.

6.2 Preventive Maintenance Tasks

To function safely and effectively, the Ka Band TWTA requires periodic maintenance. This consists of inspection, cleaning, testing, and calibration of the subsystems at designated intervals. Refer to Table 6-1 for the Preventive Maintenance tasks to be performed by operators. Table 6-2 outlines preventive maintenance tasks to be performed by a service technician.

Operator Preventive maintenance includes visual inspection and cleaning per Table 6-1. Most of these tasks are performed with the AC power removed. Details are listed in the following paragraphs.

Table 6-1 Preventive Maintenance Performed by Operators

Tasks	Daily	1 Mo.	3 Mo.	6 Mo.	1 Yr.
Log meter readings	X				
Perform visual inspection (Note 1)		X			
Air system maintenance			X		
Cooling fan (Note 2)			X		
Perform external cleaning (Note 1)			X		

Note 1 Cleaning may be required more or less frequently than shown, depending on the site environment.

Note 2 Replace fan after 50,000 hours of operation (Service Technician Task).

ELECTRICAL HAZARD! THE PERSONS PERFORMING MAINTENANCE PER TABLE 6-2 MUST BE SERVICE PERSONNEL WHO HAVE ATTENDED A FORMAL TRAINING PROGRAM FOR SERVICE OF THE KA-BAND TWTA ODU.

Table 6-2 Preventive Maintenance Performed by Technician

Tasks	Daily	1 Mo.	3 Mo.	6 Mo.	1 Yr.
Perform initial Power ON check			X		
Verify limit settings				X	
Verify Helix setting and metering					X
Run performance tests					X

6.2.1 Visual Inspection

(*AC Power Off Task*) At one-month intervals, the Amplifier should be visually inspected for physical defects. If the equipment is subject to severe environmental conditions, inspections should be performed more frequently.

PHYSICAL HAZARD! BEFORE ATTEMPTING ANY CLEANING, REMOVE ALL POWER. WHEN USING SOLVENTS, PROVIDE ADEQUATE VENTILATION AND AVOID BREATHING FUMES. WHEN CLEANING WITH AIR, WEAR SAFETY GOGGLES AND USE CLEAN, DRY COMPRESSED AIR NOT EXCEEDING 25 PSI (1.75 KG/CM).

(*AC Power Off Task*) Perform the following visual inspection:

1. With the AC power removed, check that all connector plugs are properly seated in their mating connectors and have not been damaged. Have the service technician replace any bad connector plugs and reset any that are dislodged.
2. Inspect cables for signs of discolored, broken, or bad insulation. Have a service technician repair or replace as needed.
3. Look for signs of dirt or moisture contamination, which can cause short-circuiting, arcing, corrosion, or overheating. Clean contaminated areas with a lint-free cloth, a small vacuum cleaner, or a compressed-air blower at low pressure.
4. Inspect all waveguide for discoloration, cracks, loose connectors, and improper sealing. Have a service technician tighten or replace waveguide as required.
5. Check for other defects. These include, but are not limited to, wear, breakage, deterioration, fungus, excess moisture, and mounting integrity. Contact your service technician for repairs.

6.2.2 Air System Maintenance

The air path should be checked and cleaned with dry compressed air every three months.

(*AC Power On Test*) The amplifier airflow system must be open to ensure proper transfer of heat to the air stream created by the fan. Periodically inspect and eliminate any airflow constraints. After inspection and cleaning, verify that airflow is strong and unimpeded.

The recommended cycle is three months but inspection may be required more often if local air pollution warrants it. To verify proper TWT cooling proceed as follows:

6. Put the amplifier in STANDBY mode and allow the TWT to cool; then set the amplifier main power to OFF.
7. Visually check the TWT heatsink fins. Check for build up of foreign material that creates a reduction in airflow. If there are air flow restrictions or extensive dust deposits, have the service technician remove the Amplifier fan shroud and/or fan assembly and clean the fins with a small vacuum cleaner or compressed air.
8. Monitor the operation of the fan with AC power ON.
9. With the amplifier in STANDBY State, verify that the fan is operating smoothly. If a mechanic's stethoscope is available, check for bearing rumble (which indicates wear). If a fan is faulty, have the service technician replace it
10. Check for dust in the fan assembly. An accumulation of dust is a sign that the TWT heatsink fins need more frequent cleaning.

6.3 Other Preventive Maintenance Tasks

Refer to the Preventive Maintenance Chapter of the Service Manual for additional preventive maintenance tasks (Requires a service technician who has attended a formal training program for service of the amplifier to perform these tests).

6.4 Customer Service

Refer to Appendix A, "*Warranty and Support Information*", for CPI Satcom contact, service, and return information.

CHAPTER 7
Drawings

The Ka-Band TWTA drawings listed below are included in this chapter.

Table 7-1 Drawings

Drawing Number	Title
01031048-02	Ship Kit, Ka-Band LM
01031370	Power Supply, Ka-Band TWTA*
01031371-00	Interconnect Diagram, Power Supply Assembly, Anode version
01031372	Specification, Ka-Band TWTA, 250W Peak
01031381	RF Diagram, Ka-Band TWTA
01031382	Outline Drawing, Ka-Band TWTA
01031490	Fan Assembly*
TBD	Option, 1:1 Switch Controller*
TBD	Option, 1:2 Switch Controller*
01031640	Assembly, RF, Ka-Band TWTA*
01032322	Cable, Remote
01033829	CIF protocol
01033839	ODU Setup & Remote Control Software, Windows version (supplied with manual on CD)

NOTE: *Paper Manual: Printed drawings follow this page.*
CDROM Manual: Drawing files are in the "Drawing" folder.
** Refer to service manual for the respective LM's*
Drawings are in numerical order

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APPENDIX A
Warranty And Support Information

For details, refer to separate supplement included with this manual.

HARD COPY: Refer to Warranty and Support supplement located at the front of this manual.

CD: Refer to separate folder titled “Warranty and Support.”

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APPENDIX B


Communications & Power Industries
REMOTE SOFTWARE UTILITY
satcom division

B.1 Introduction

The Outdoor Unit Remote Panel Software (ODU Remote) provides a basic means of remotely monitoring and controlling up to ten outdoor power amplifiers from a single PC. It is not a substitute to a professional M&C program, but a utility program used for amplifier configuration and troubleshooting.

The software communicates using the host PC's serial communication port (COM1-COM4) or an Ethernet LAN interface. Meter readings and status information for each amplifier may be displayed simultaneously. User specified media files can automatically be played to alert an operator when an amplifier fault condition occurs.

B.2 Installation

Copy ALL files located on the supplied ODU Remote software CD to a directory on your PC's hard drive, or run directly from the CD. If storing files on a computer, be sure to keep all the files in a common folder and create a shortcut to the desktop if needed.

B.2.1 Connecting to the Amplifier(s)

5. To start the program, double-click on the ODU Remote ICON: 

The program will start with the blank startup window and a Disclaimer will appear.

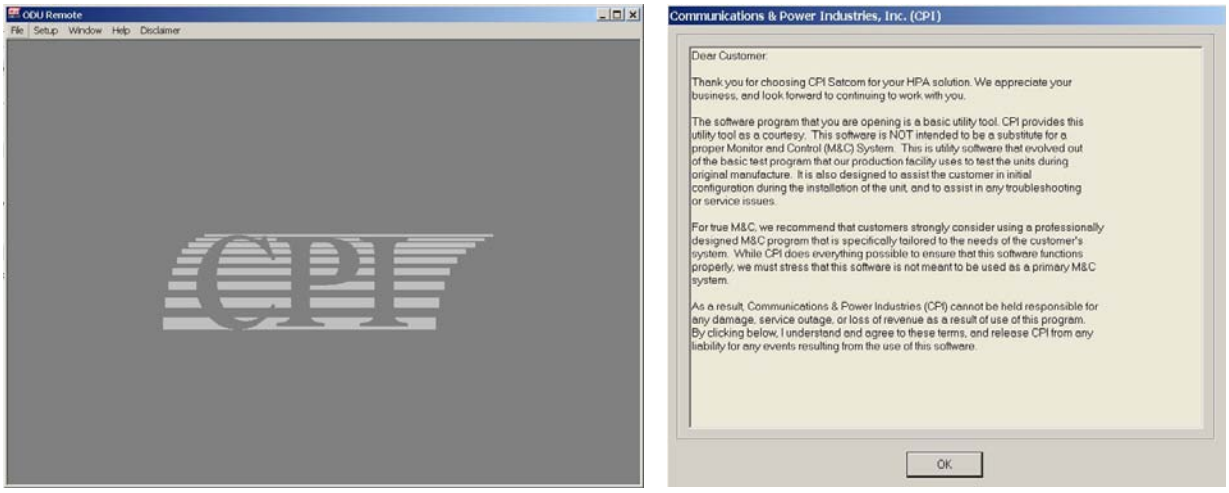


Figure B-1 Startup Screens

This disclaimer simply states this is utility software and not a substitute for a professional M&C program. Click OK to continue.

6. From the **Setup** menu select **Configuration**.

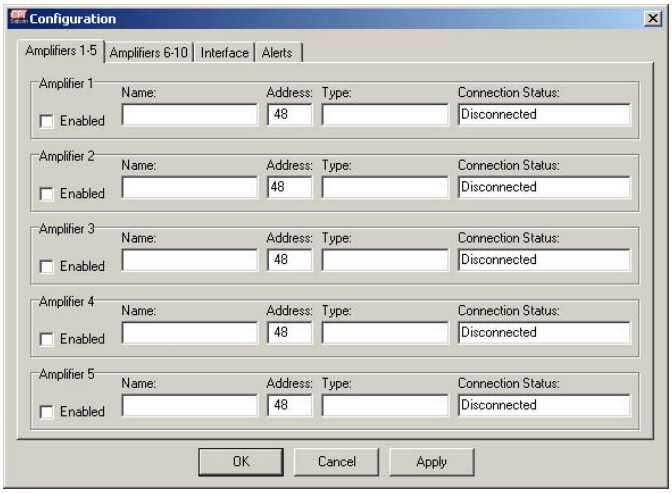


Figure B-2 Configuration Screen / Amplifiers 1-5 Tab

7. Select the **Interface** tab.

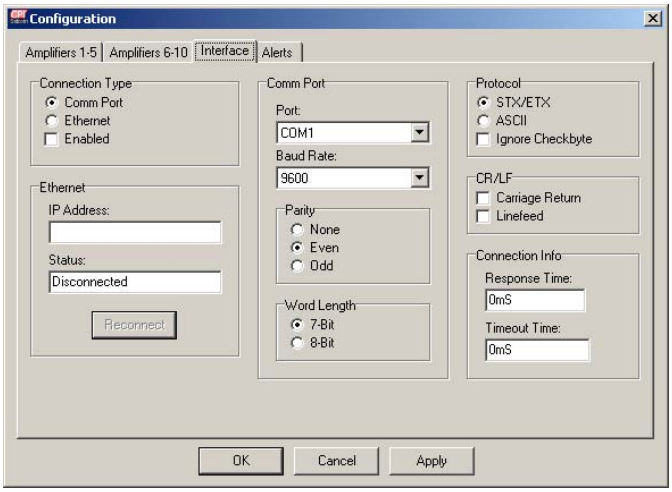


Figure B-2a Configuration Screen / Interface Tab

8. Select the **Baud Rate**, **Parity**, **Word Length**, **Protocol**, and **CR/LF** settings that match the amplifier's configuration.
9. If connecting using the PC's serial communication port, select the appropriate **Port** and select **COM Port** as the **Connection Type**.

   If connecting via Ethernet, enter the appropriate IP address in the **IP Address** edit box and select **Ethernet** as the **Connection Type**. Check the **Enabled** check box.
10. Select the **Amplifiers 1-5** tab (Refer to Figure B-2).

11. Click the checkboxes to enable the amplifier(s) connected to the host PC. The default address is 48, with each additional amplifier having a consecutive address (49,50,51...). Each amplifier can also be given a reference name for clarification. This name will appear in the title bar of all windows associated with that amplifier. If no name is given a default name will be assigned.
12. For more than five amplifiers, select the **Amplifiers 6-10** tab and repeat step 7. Note: Do **NOT** check the **Enabled** check box if an amplifier does not exist or is not turned on. Doing so will significantly slow down communications between the host PC and the amplifiers.
13. Click **Apply** to establish communication with each enabled amplifier. The connection status will read, "Connected" if successful and the amplifier model will appear in the **Type** field. If connection is unsuccessful, an "Unable to Connect" message will appear in the **Connection Status** field.

B.2.2 Meters Window

Once connected a Meters Window will appear for each amplifier. The Meters Window consists of the Status Bar, Meters, and Control Buttons.

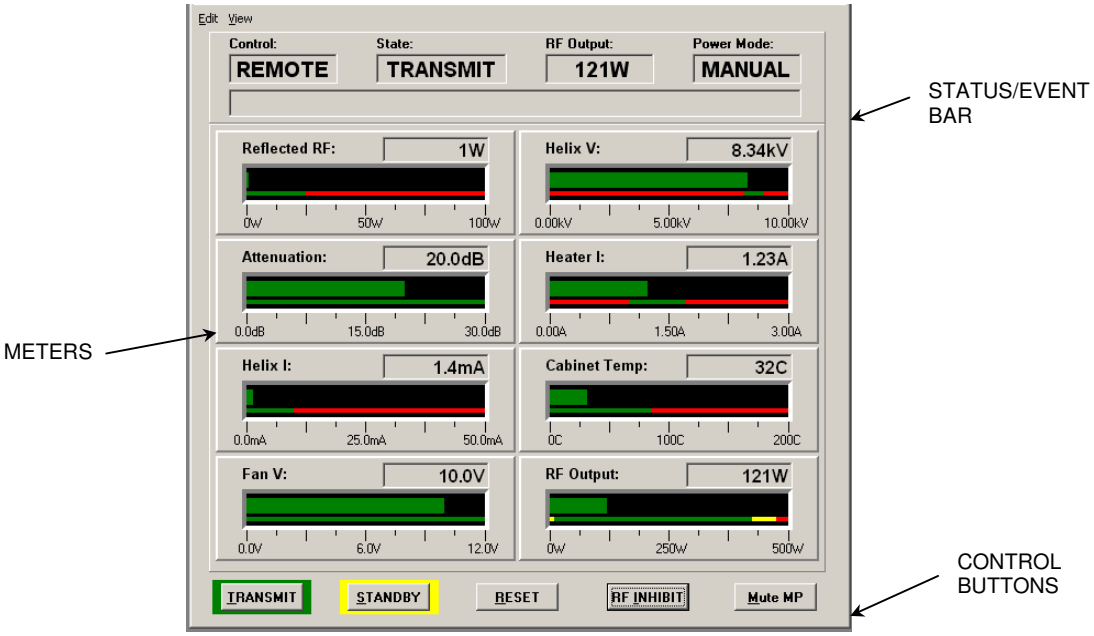
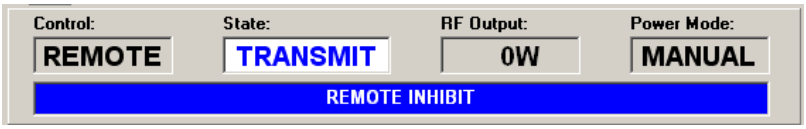
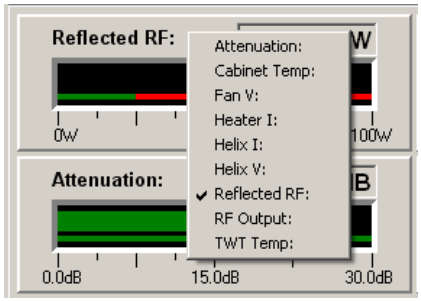


Figure B-3 Typical Meter Screen

The control point (local/remote), system state (BONS/Standby/Transmit), RF output power (dBm/W/dBW), and RF power mode (Manual/Auto) are displayed on the Status Bar. Events such as faults, alarms, and inhibits are displayed in the Event Box. (See below)



Each meter can be configured for a different reading by right clicking on the meters and selecting the desired reading. (See below)



The control buttons are located at the bottom of the window. **TRANSMIT** places the amplifier in transmit state. **STANDBY** places the amplifier in standby state. **RESET** resets an amplifier latched in a fault condition. **RF INHIBIT** inhibits the amplifier's RF output. **Mute MP** mutes the ODU Remote Media Player, which sounds when a fault occurs.

B.2.3 Settings Window

From the **Edit** menu select **Settings**. This window consists of four tabs, each containing settings specific to the individual amplifier.

B.2.3.1 General

The **General** tab contains RF power, fault, and alarm settings as well as RF unit options. These settings are pre-set at the factory. It is recommended not to dramatically change any of these values.

ALC (Automatic Level Control) automatically adjust the attenuation of the amplifier to provide a pre-set power level with a fixed input.

The attenuation adjusts the output power of the amplifier with a fixed input. The typical range is 30dB.

Heater Enable can remotely disable the heater on the TWT. It is recommended to keep this selected.

Note: (Millitron/ EIK/ TriBand products) If a unit is left in Standby state for more than 3 hours, the amplifier will go into Heater Time Out (HTO) where the TWT heater is disabled to prolong life. The Heater Enable must be re-selected after this occurs. The amplifier will then go into Heater Time Delay (HTD) to warm the heater.

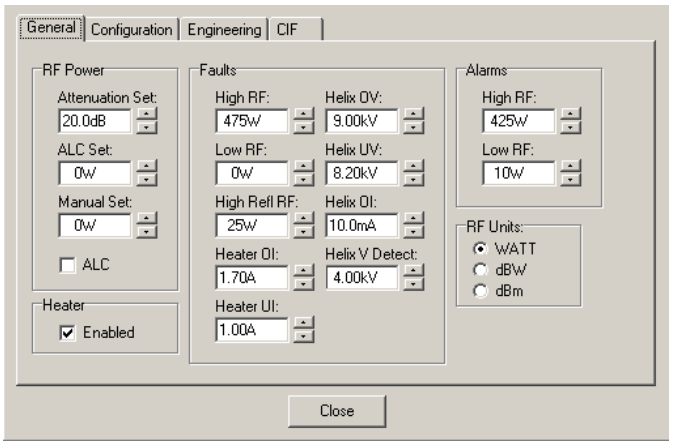
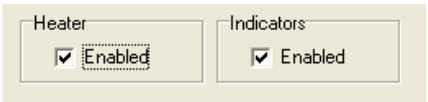


Figure B-4 Typical Setting Screen / General Tab

In Military version products, the front panel Local indicators can also be turned on or off.



B.2.3.2 Configuration

The **Configuration** tab contains the system clock, timers, switch system and relay configuration settings.

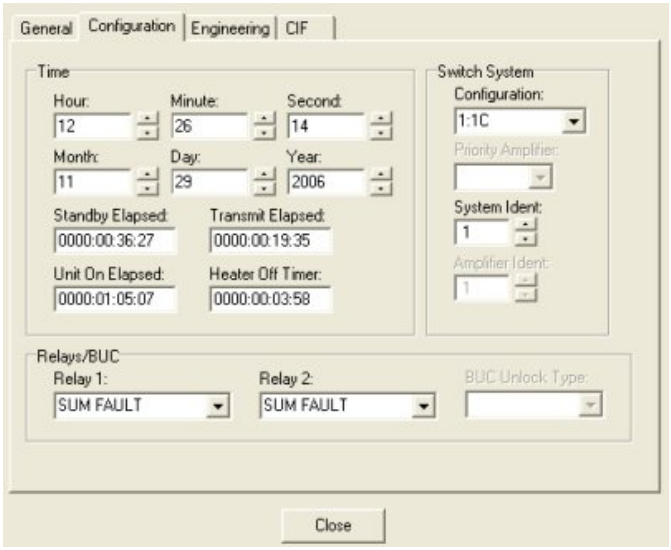


Figure B-4a Configuration Tab

B.2.3.3 Engineering

The **Engineering** tab contains the version of the amplifier's controller software, factory-adjusted settings for the optional linearizer and the system reset. The linearizer settings should not be changed, as it can affect the RF performance of the amplifer. Settings, timers, and meter log can be reset to factory defaults by checking the appropriate **Reset** check boxes, typing in the password "**123456**", and pressing the **Execute** button.

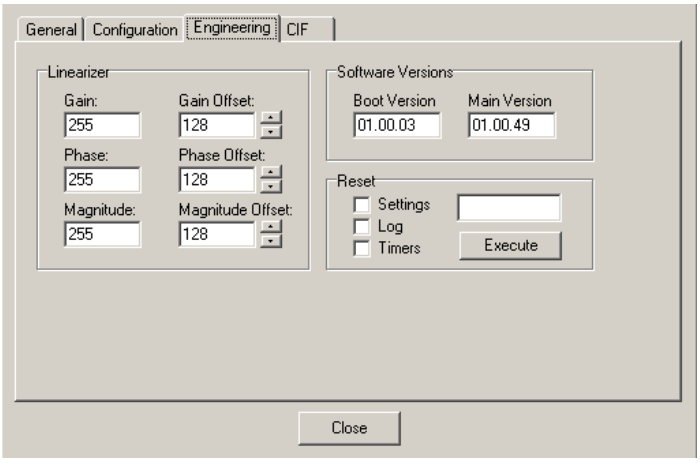


Figure B-4b Engineering Tab

B.2.3.4 CIF

The **CIF** tab is used to change an amplifier's CIF configuration. The default address is '48'.

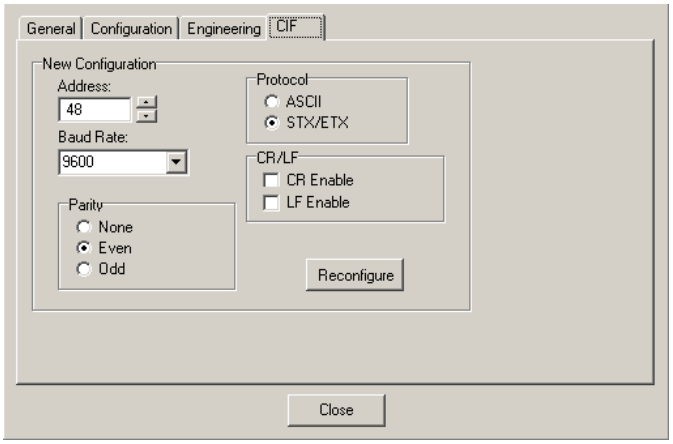


Figure B-4c CIF tab

B.2.4 Meter Log

From the **View** menu select **Meter Log**. The meter log displays up to sixteen meter log entries at a time. Use the scroll bar on the right side of the window to scroll through the log. Click on an entry to get further details. This information is displayed in the **Event Detail** box.

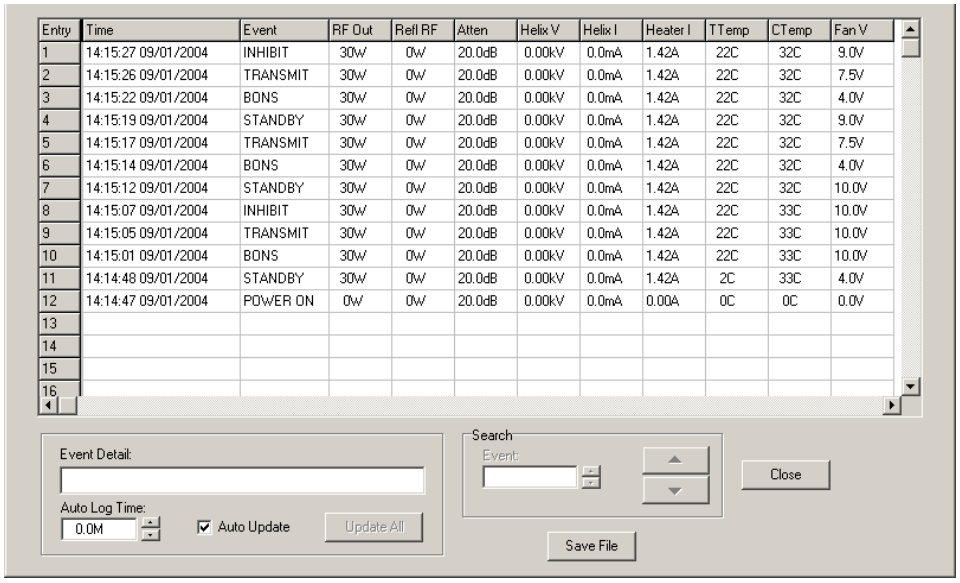


Figure B-5 Typical Meter Log Screen

B.2.4.1 Auto Update

The software automatically checks the amplifier meter log for changes at a frequency of once per second. Adjusting the Auto Log Time can change this value (see section B.2.4.2). If a change is detected then the amplifier refreshes the display with the new data. Clearing the **Auto Update** check box will disable this feature.

B.2.4.2 Auto Log Time

The amplifier stores an entry in the meter log anytime an event occurs. During normal operation events may occur infrequently. Setting the **Auto Log Time** to a value other than 0.0M will cause the PA to automatically log an entry at the specified interval (ex. 0.5M=log every 30 seconds).

B.2.4.3 Search

The **Search** feature is used to quickly search through the meter log for a specific type of event such as a fault or alarm. To use the search feature the entire meter log must be downloaded from the amplifier. This is accomplished by first clearing the **Auto Update** check box then pressing the **Update All** button.

Once the meter log is downloaded select an event using the **Event** edit box. Use the up/down arrow buttons to the right of the **Event** edit box to search for the selected event.

B.2.4.4 Save File

Save File saves the meter log to a tab delimited text file, which can be accessed using a program such as notepad. Readings and settings are placed at the end of the file.

Press the **Save File** button. The save log range dialog box will appear. Select the range of log-entries to be saved.

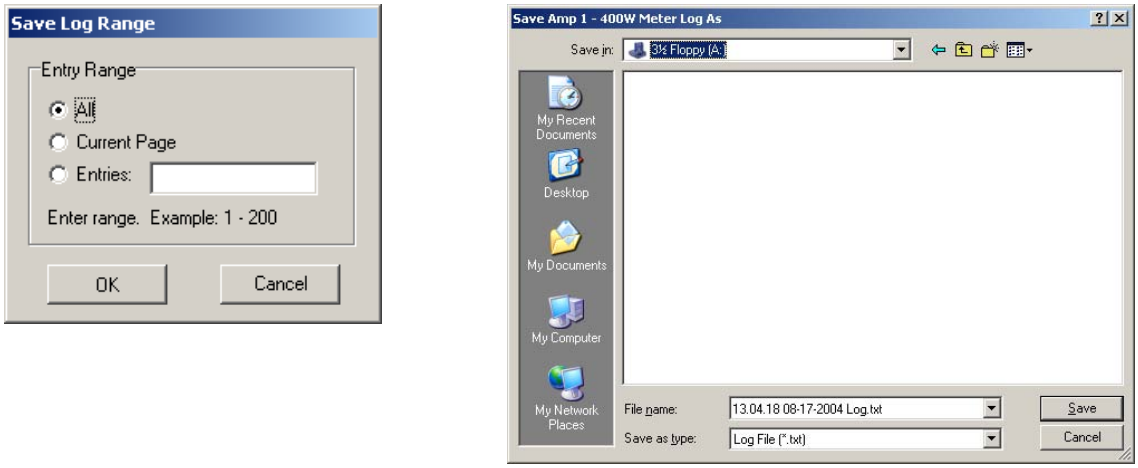
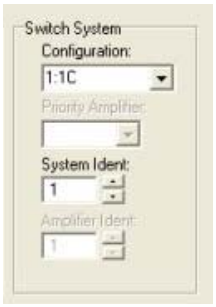


Figure B-6 Save Log File Screens

Press **OK** once the desired range is selected. The save log file dialog box will appear with the filename set to the current time and date. Specify a new filename and directory if desired, and then press **Save**. The software will first download the entire log if required, then format and save the data to the file. It is recommended to save the log file before performing any firmware updates or changes to the controller.

B.2.5 Switch Systems

When an optional switch system is present, from the **View** menu select **Switch Diagram**. A schematic representation of the system will be displayed, based on the setting in the **Settings/Configuration** tab, such as 1:1A, 1:1B, etc. The amplifier/system identifier should match the switch diagram in order for proper switching control. (Ex. PA1 Amplifier Ident=1 PA2 Amplifier Ident=2 etc.)



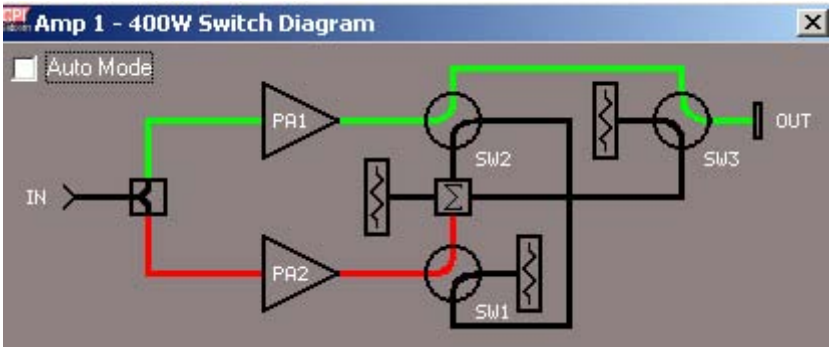


Figure B-7 Typical Switch Diagram Screen

When the path is green, it indicates that communication is present. A red path indicates the connection has been lost or the amplifier is not present.

Switches can be toggled by double clicking the switch to activate it.

Selecting "Auto Mode" will enable the software to control the switching. When an amplifier goes offline, the switch(es) will re-route the path to the back-up amplifier automatically. When not selected the system is in "Manual Mode" where the user must toggle the switches manually.

The switch diagrams for all available configurations are shown below.

B.2.5.1 Switch Configuration Diagrams

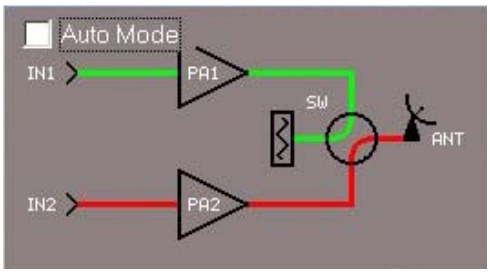


Figure B-8a 1:1A

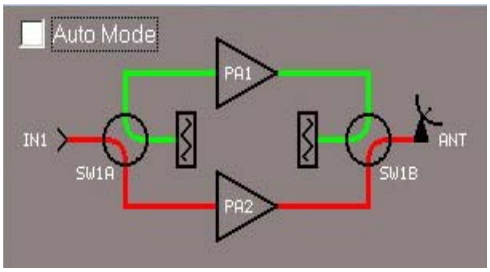


Figure B-8b 1:1B

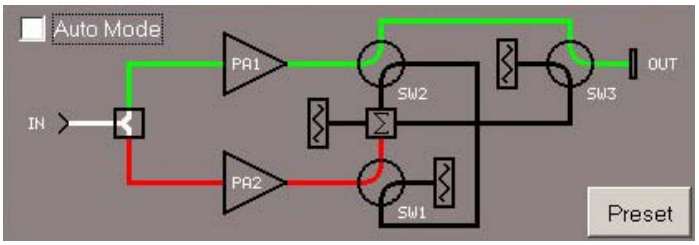


Figure B-8c 1:1C

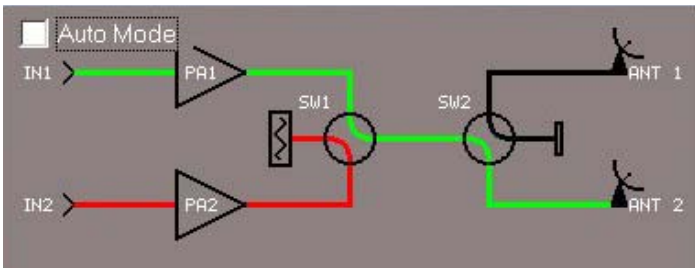


Figure B-8d 1:1D-P

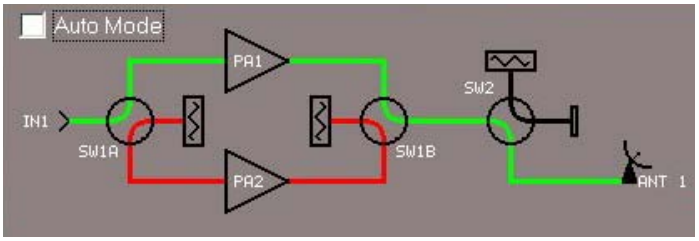


Figure B-8e 1:1E

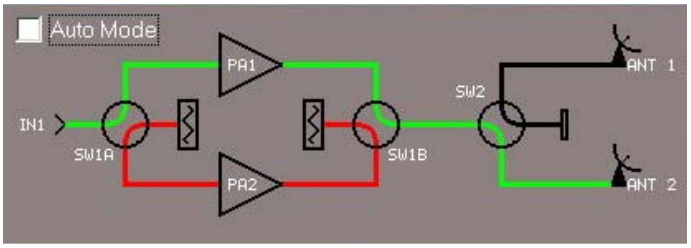


Figure B-8f 1:1E-P

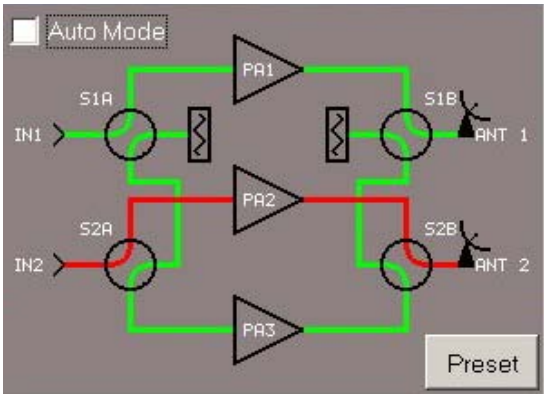


Figure B-8g 1:2A

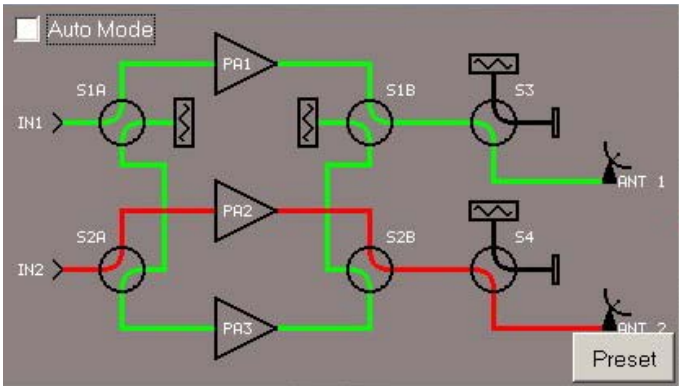


Figure B-8h 1:2B

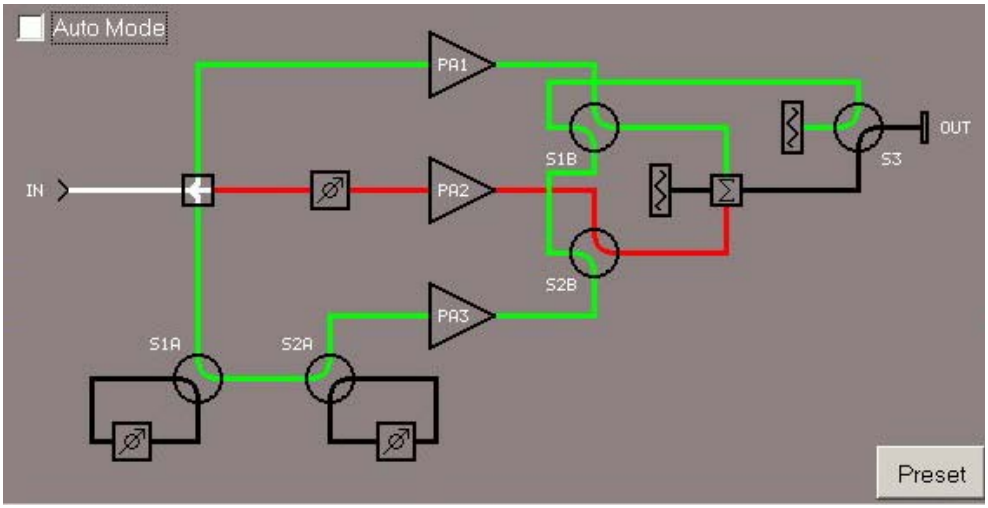


Figure B-8i 1:2C

B.2.6 Alerts

From the **Setup** menu select **Configuration** then select the **Alerts** tab. Select the amplifier to be configured using the **Amplifier** list box.

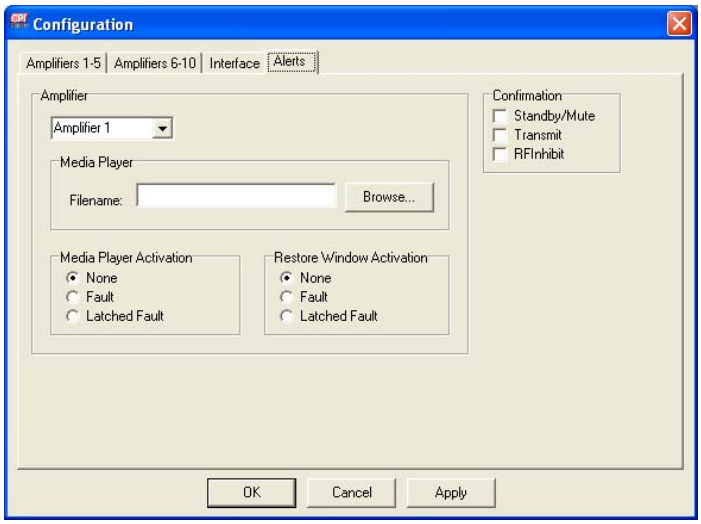


Figure B-8 Alerts Tab

B.2.6.1 Media Player

The **Media Player** feature plays a user specified media clip if a fault occurs or the amplifier is latched into fault state. The Media Player supports a number of formats including .WAV, .MP3, MPG, and .AVI. Connecting the host PC's audio output to speakers or local amplifier system provides an additional means of alerting operators when a amplifier has failed.

To use the Media Player, first select a media file then select the condition that will activate the Media Player. When the Media Player is activated it will play and continuously repeat the specified media clip until the fault condition is cleared or the **Mute MP** control button is pressed. The player can be chosen to be activated when a fault or latched fault occurs, or both.

When muted the **Mute MP** control button will flash. The mute condition will not take affect until the Media Player is at the end of the media clip. Mute is cleared either by pressing the **Mute MP** control button again or clearing the fault condition.

B.2.6.2 Restore Window

The **Restore Window** feature restores a minimized Meters Window if a fault occurs or the amplifier is latched into fault state.

B.2.6.3 Confirmation

There are confirmation options available which will prompt the user to confirm when changes are made to the transmit state of the amplifier, such as Transmit, Standby and RF inhibit.

B.2.7 Tuning Screen Setup

B.2.7.1 Millitron

Within the Engineering tab, the tuning screen allows channel specific parameters to be changed. Tuning a channel consists of adjusting the beam voltage until the desired center frequency response is obtained.

Figure B-9 Millitron Channel Tuning/Changing screens

For bandwidths up to 1000 MHz, a single voltage setting can be used for the Millitron. Over 1000 MHz, it is recommended that multiple bands be set up corresponding to the individual transponders being used. For instance, a common split of bands for commercial satellite uplink is 28.35-28.60 and 29.0-29.5 GHz.

In this case,

- Band 1 would be set up for a 250 MHz BW 28.35-28.60
- Band 2 for 500 MHz BW 29.0-29.5 GHz.

Band switching can be commanded through the remote control port. The time to change bands will be limited by the M&C timing, typically less than 50 milliseconds. There is no limit to the number of times the band can be switched. Along with voltage settings, each band will also store linearizer adjustments.

CAUTION! The tuning voltages and DAC settings are preset at the factory and should NOT be changed except by factory-trained technicians. Consult the CPI service center for training class information.

B.3 Troubleshooting

B.3.1 Communication

If communications problems are occurring, check to make sure the addresses set in the amplifier's controller and the software match. To change the amplifier address in the controller, use the Address Scanner program also located on the software utility CD (see below). This program can also be used when the amplifier address is unknown. **Scan** first to establish a connection, and then **Set** the new address.

Select the new CIF configuration parameters and press the Reconfigure button. The new settings will take affect once the amplifier's power is cycled off and on.

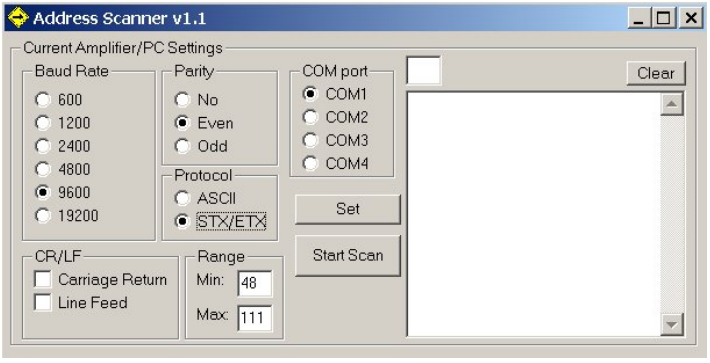


Figure B-11 Address Scanner Screen

NOTES:

To improve the response time of Meter Log and Settings windows when connected to multiple PAs, it is recommended that the Meters Windows of other PAs be minimized.

Setting changes are only accepted if the amplifier control point is set to ***REMOTE.*** *Settings will be colored in gray if the control point is incorrect.*

Settings will be colored in gray if the amplifier is not configured to support them.

For proper ODU Remote operation use the ***STX/ETX*** *protocol.*

APPENDIX C
Replaceable Parts

Table C-1 Replaceable Parts

Description	CPI Part Number
CCA, Power Factor Correction	01024660-00
CCA, Power Processor	01024980-04
HV Module (Anode 250W Peak)	01031469-00
HV Module (Anode 250W CW)	01031469-02
CCA, Fan Power	01035290-00
CCA, DC/DC Converter	01031740-00
CCA, Controller	01030520- 05
Assy, Control status	01027260-00
CCA, RF Monitor	01030530-01
ASSY Fan Housing	01031490-00
Fan Assy, PS Wash Fan	01031035-00
Tunnel Diode, Ka-Band	01031397-00
TWT Assy, Ka-Band, 250W Peak/120W CW, NEC	01031462-00,01
TWT Assy, Ka-Band, 250W Peak/175W CW, NEC	01031462-04,05
TWT Assy, Ka-Band, 250W CW, NEC	01031643-00,01
Output Component, Ka-Band, 3-Port	01031386-XX
Output Component, Ka-Band, 4-Port	01031625-XX

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APPENDIX D
Optional Linearizer

D-1 Optional Linearizer

The optional Linearizer has been adjusted for optimum performance at the factory. Tube replacement will require readjustment of the Linearizer at the factory by trained personnel (see the service manual for more details).

The user may modify the linearizer settings from the factory values. Doing so may cause the Ka-Band TWTA performance to degrade. For this reason it is recommended that if the user wants to change these settings, they should always record the factory set values (below) before making any changes.

Linearizer Adjustment	Factory set value (0-255)
Gain	
Phase	
Magnitude	

The Linearizer settings can be accessed via the optional CPI remote panel or through the supplied "Setup & Remote control" Software (see Appendix B).

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APPENDIX E
250w ODU
Functional Trees

The trees displayed in Figures E-1 and E-2 are a roadmap to viewing, selecting and modifying the various functions of the RCU. Figure E-1 describes the controls that will be found using the MENU key. Figure E-2 describes the controls that will be found using the AMP, SYSTEM, CONTROL and SET PWR keys.

Find the item on the tree that you wish to view or modify then follow the map, pressing the appropriate keys as shown, until you reach the function you the item.

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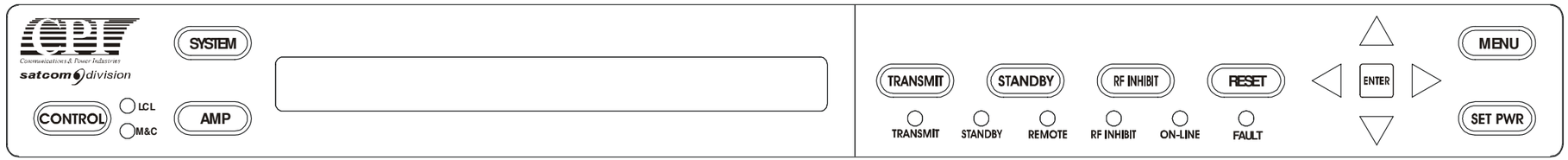


AMPLIFIER SELECT

MENU

PANEL SELECT
Press MENU key until "P" appears on left hand side, then select

MENU

L R

SETTINGS

ENTER

AMPLIFIER SELECT L R

ENTER

ENTER

MANUAL RF OUT: NNN W
ALC RF OUT: NNN W
REFL RF FAULT: NN W
ATTENUATION: NN.N dB

D

ENTER

LOW RF ALARM: NNN W
LOW RF FAULT: NNN W
HIGH RF ALARM': NNN W
HIGH RF FAULT: NNN W

D

ENTER

HLX U/V FLT: NN.NN kV
HLX O/I FLT: XX mA
HLX O/V FLT: NN.NNkV
HLX V/STB FLT: N.NNkV

D

ENTER

RELAY 1: N
RELAY 2: N
AUTO LOG TIME: NNN.N M
RESET METERLOG?: NO

D

ENTER

LIN GAIN: NNN
LIN PHASE: NNN
LIN AMPL: NNN
UNIT ADDRESS: NNN

SINGLE AMP W/ LIN

UNIT ADDRESS: NNN
SYSTEM ID: N
RST TO DFLTS?: NO

SINGLE AMP NO LIN

LIN GAIN: NNN
LIN PHASE: NNN
LIN AMPL: NNN
UNIT ADDRESS: NNN

SYSTEM AMP W/ LIN

RESET TO DFLTS?: NO

SYSTEM AMP NO LIN

D

ENTER

SYSTEM ID: N
RESET TO DFLTS?: NO

ONCE THE DESIRED WINDOW IS REACHED, PRESS L R TO HIGHLIGHT THE SELECT ITEM TO BE CHANGED.

NEXT, PRESS U D TO MODIFY THE SETTING.

AFTER THE DESIRED SETTING IS REACHED PRESS ENTER TO ACTIVATE THE SELECTION.

METERS

ENTER

U D

RF OUT: NNN W
HELIX V: NN.NN kV
REFLECTED RF: NNN W
HELIX I:NN mA

CABINET TEMP: NNN C
FAN CONTROL: N.N V
TUBE TEMP: NNN C
ATTENUATION: NN dB

METER LOG

ENTER

METER LOG: 0000
HH:MM:SS MM/DD/YYYY
STATE

ENTER

U D

METER LOG: NNNN
(CYCLE THRU LOG ENTRIES)

U D

MORE DATA LINES

ENTER

U D

MORE DATA LINES

ENTER

TIME

ENTER

TIME: HH:MM:SS MM/DD/YYYY
STANDBY TIME: DDD:HH:MM:SS

U D

UNIT ON TIME: DDD:HH:MM:SS
TRANSMIT TIME: DDD:HH:MM:SS

HEATER TIME DELAY: MM:SS

L R SELECT

U D ADJUST

ENTER

SET TIME

VERSION

ENTER

BOOT: XX.XX.XX
MAIN: XX.XX.XX

L R

UNITS

ENTER

ENTER

U D

RF OUTPUT UNITS: WATT/dBm

BUZZER

ENTER

ENTER

L R SELECT

MUTE ALARM: YES/NO
MUTE KEYPAD: YES/NO

U D

ADJUST

DISPLAY

ENTER

ENTER

L R SELECT

DISPLAY BRIGHTNESS: NN%
SCREEN SAVER: YES/NO

U D

ADJUST

IP CONFIG

ENTER

ENTER

U D

IP ADDRESS: NNN.NNN.NNN.NNN
IP MASK: NNN.NNN.NNN.NNN
IP GATEWAY: NNN.NNN.NNN.NNN

ENTER

L R TO SELECT 3 DIGIT GROUP

U D TO ADJUST 3 DIGIT GROUP

CIF PORT

ENTER

ENTER

L R SELECT

M&C SERIAL PORT BAUD RATE: NNNN
AMPLIFIER ADDRESS RESCAN: YES/NO

U D

ADJUST

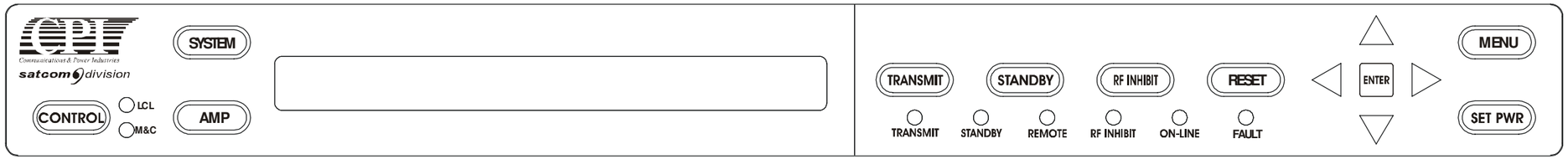
VERSION

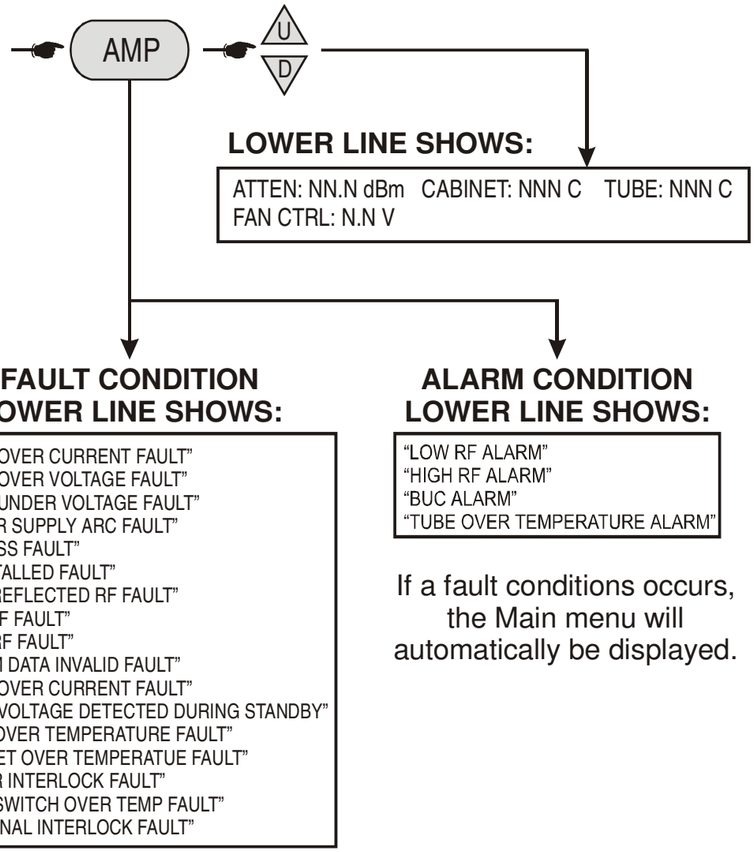
ENTER

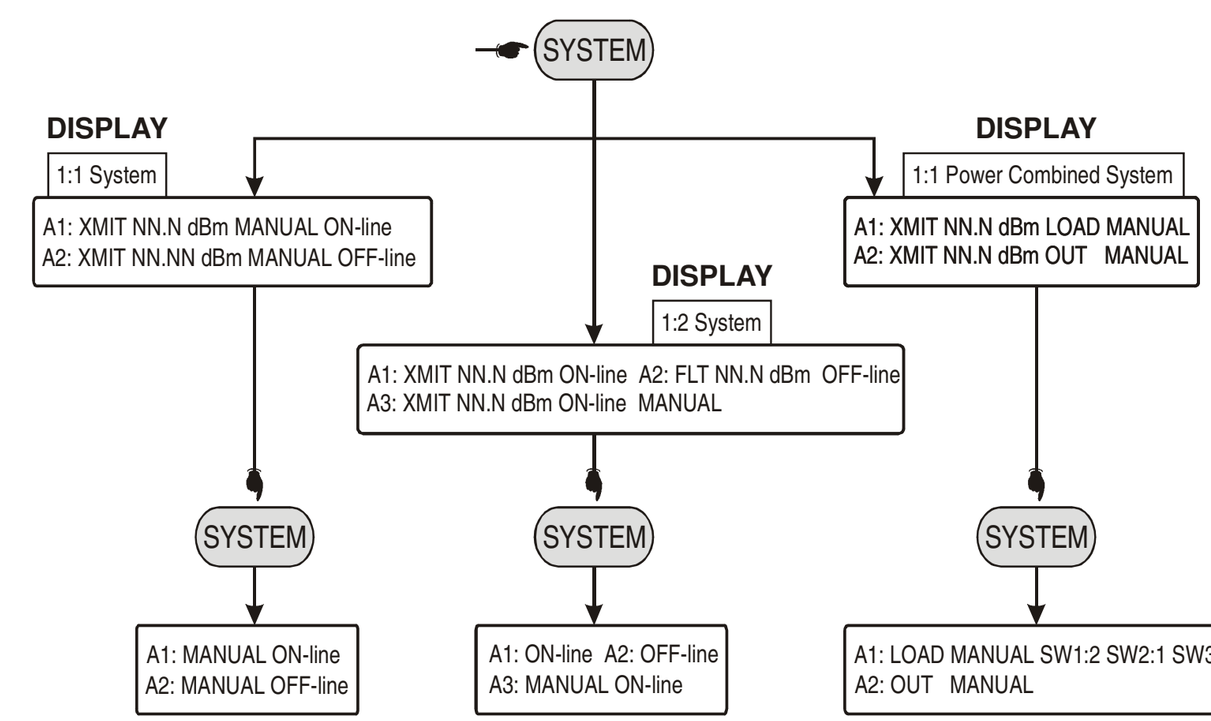
BOOT VERSION: NN.NN.NN
MAIN VERSION: NN.NN.NN

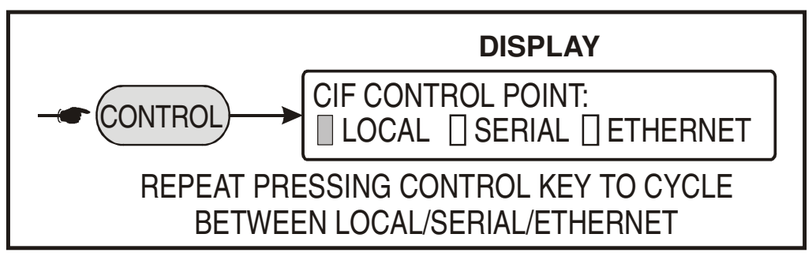
t

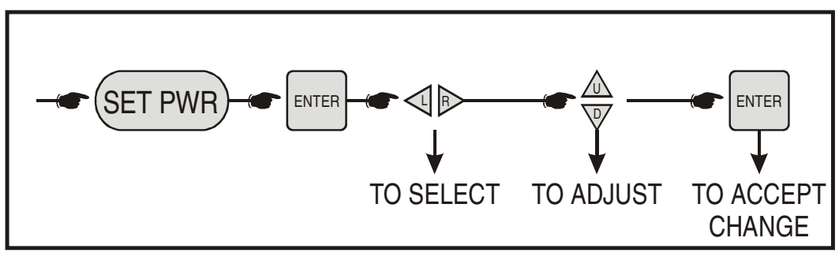
MENU FUNCTION KEY TREE











t

AMP/SYSTEM/CONTROL/SET PWR
FUNCTION KEY TREE

APPENDIX F
Optional Internal 1:1 Switch Controller

F.1 Optional Internal 1:1 Switch Controller

The optional Internal switch controller allows users to operate two Ka-Band TWTA ODU amplifiers in a 1:1 redundant system. The internal controller also has the output to drive the switch directly. The user only needs to connect a harness between the two amplifiers and a wave-guide switch. This harness and the necessary wave-guide between the switch and the two amplifiers can be custom designed by CPI as part of a redundant 1:1 system or designed by the user into their own custom configuration. Connection details are shown in Figure F-1.

This option is installed in both amplifiers. Each amplifier can receive and send status to the other amplifier.

When PA-1 and PA-2 are configured for this option, they can also report switch position back to the user through the CIF (computer interface) and are reported on either the CPI remote control panel or the supplied setup & remote control software (Note: See Appendix B for info on remote software). Additionally, the user can change modes or remotely toggle the wave-guide position through the remote or computer CIF control.

The internal controller receives external relay status signals from the other amplifier. These relays can be configured for multiple types of 1:1 switch systems. The relays are normally configured to switch the wave-guide when a “Low RF Alarm” occurs. The “Low RF Alarm” can be in “Rigid” or “Flexible” mode. See chapter 4.3 in this manual for more information on the relay configuration modes.

The switch controller can be set to be in either auto or manual mode. If in auto mode, and a relay fault occurs the contacts open and the switch controller will toggle the wave-guide switch to the other amplifier. In order for the switch controller to respond to toggle commands, its mode must first be changed from auto to manual.

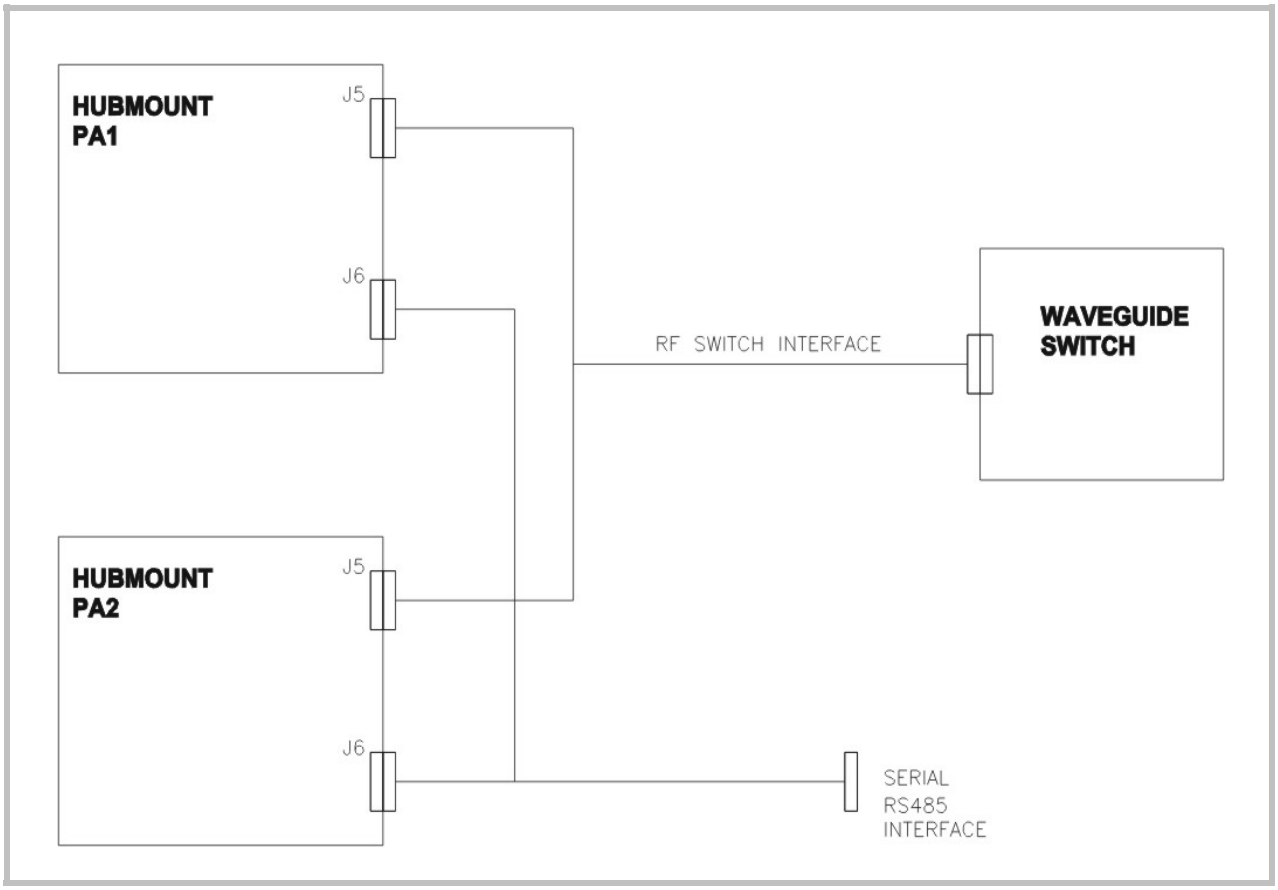


Figure F-1. Interconnect diagram (optional SW controller)

F.2 Drawing List

Table F-1. Ka Band TWTA Drawings

Title	Drawing Number Ka-Band
Assembly 1:1 Switch Ka Band TWTAs	TBD
Switch Interface Cable Assembly	01031513 - 01*
Switch Interface Assembly	01031514 - 01*
Interconnect Diagram 1: 1 Switch	01031553
RF Block Diagram	TBD

NOTE:

Paper Manual: Printed drawings follow this page.

CDROM Manual: Drawing files are in the "Drawing" folder.

** Refer to service manual for respective LM's*

Drawings are in numerical order

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