



# **INSTALLATION & SERVICE** **MANUAL**

## **MODEL K-10** **CONTINUOUS DUTY** **POWER AMPLIFIER**

**850-870 MHz**

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## GENERAL DESCRIPTION

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### 1-1. INTRODUCTION

This manual contains information and procedures for installation, operation, and maintenance of Powerwave's K10 Continuous Duty Power Amplifier. The manual is organized into five sections as follows:

- Section 1. General Description
- Section 2. Installation
- Section 3. Operating Instructions
- Section 4. Principles of Operation
- Section 5. Maintenance
- Section 6: Troubleshooting

### 1-2. GENERAL DESCRIPTION

The K10 amplifier is designed for trunking and conventional repeater applications requiring high duty cycles. The K10 amplifier operates from RF power sources of 250 milliwatts up to 25 watts. The amplifier consists of an input attenuator, a predriver amplifier, a microprocessor control circuit, and two stages of amplification followed by a 7-pole distributed low-pass filter and associated control circuitry. The K10 amplifier has a microprocessor control board that maintains a constant output power under varying signal input and output load conditions. A system functional block diagram of the Model K10 amplifier is contained in section 4 of this manual.

### 1-3. FUNCTIONAL AND PHYSICAL SPECIFICATIONS

Functional and physical specifications for the K10 amplifier are listed in tables 1-2 and 1-3.

### 1-4. EQUIPMENT CHANGES

Powerwave Technologies, Inc. reserves the right to make minor changes to the equipment without notice, including but not necessarily limited to component substitution and circuitry changes. Such changes may or may not be incorporated in this manual, although it is our intention to keep each manual as up-to-date as possible. To that end, we ask that you, our customer, share with us information acquired in field situations which might be of assistance to another user. If you share it with us, we'll pass it around.

### 1-5. ORDERING INFORMATION

Table 1-1 following gives the part numbers and descriptions to be used when ordering either an entire amplifier or replacement fans.

Table 1-1. Major Amplifier Components

| MODEL NUMBER  | DESCRIPTION                          |
|---------------|--------------------------------------|
| K10           | 250 mW - 25 W 850-870 MHz Amplifier. |
| 800-00889-001 | Fan Assembly.                        |

Table 1-2. K10 Amplifier Functional Specifications

|                              |   |
|------------------------------|---|
| Frequency Range:             | 850-870 MHz.  |
| Operating Voltage:           | +28 Vdc (+1.0 Vdc)  |
| Current Draw                 | 9 Amperes Typical<br>11 Amperes Maximum   |
| Duty Cycle:                  | 100%  |
| Power Input:                 | 250 mW – 25 W.  |
| Power Output:                | 100 Watts   |
| Spurious & Harmonics:        | -70 dBc (Minimum)   |
| Input/Output Impedance       | 50 ohms (Nominal)   |
| Load VSWR Tolerance:         | See Chart   |
| Input/Output Connector:      | Type 'N' Female   |
| Vertical Mounting:           | 10.47"  |
| Horizontal Mounting:         | 3.38"   |
| Depth:                       | 17.0"   |
| Weight:                      | 20 Pounds Nominal   |
| Cooling Method:              | Fan Forced Air Over Heatsink  |
| Operating Temp. Range:       | 0 °C. to +60 °C.  |
| Storage & Transport:         | -10 °C. to +70 °C.  |
| Humidity:                    | 80% at +40 °C. (Noncondensing)  |
| Altitude:                    | 10,000 Feet Maximum   |
| <b>OPTIONS</b>               |   |
| Remote Control/Display Panel | <b>INDICATORS</b><br>DC PWR ON, LOW OUTPUT, LOW INPUT, HIGH INPUT, HIGH VSWR, OVER TEMP., L.E.D. POWER BAR METER<br><br><b>CONTROLS</b><br>PWR CONTROL (-10 dB) |

NOTES: Manufacturer's Rated Output Power of this Equipment is for Single Carrier Operation.

All specifications apply at +28 Vdc operating voltage.

Table 1-3. Load Mismatch Tolerance

|                                      |             |
|--------------------------------------|-------------|
| Full Power, Sustained Operation      | 2:1 Maximum |
| Sustained Operation at Reduced Power | 3:1         |
| Microprocessor Shutdown              | 10:1        |



## INSTALLATION

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### 2-1. INTRODUCTION

This section contains installation recommendations, unpacking, inspection, and installation instructions for the K10 amplifier. Carefully read all material in this section prior to equipment unpacking or installation. Also read and review the operating procedures in Section 3 prior to installing the equipment. It is important that the licensee perform these tasks correctly and in good faith. If applicable, carefully read Parts 73 and 74 of the Federal Communications Commission (FCC) rules to determine how they apply to your installation. **DON'T TAKE CHANCES WITH YOUR LICENSE.**

### 2-2. ELECTRICAL SERVICE RECOMMENDATIONS

Powerwave Technologies recommends that proper AC line conditioning and surge suppression be provided on the primary AC input to the +28 Vdc power source. All electrical service should be installed in accordance with the National Electrical Code, any applicable state or local codes, and good engineering practice. Special consideration should be given to lightning protection of all systems in view of the vulnerability of most transmitter sites to lightning. Lightning arrestors are recommended in the service entrance. Straight, short ground runs are recommended. The electrical service must be well grounded.

Each amplifier system should have its own circuit breaker, so a failure in one does not shut off the whole installation. Circuit breakers should be thermal type, capable of handling an inrush current of 90 Amps, in a load center with a master switch.

### 2-3. UNPACKING AND INSPECTION

This equipment has been operated, tested and calibrated at the factory. Only in the event of severe shocks or other mistreatment should any substantial readjustment be required. Carefully open the container(s) and remove the amplifier module(s). Retain all packing material that can be reassembled in the event that the unit must be returned to the factory.

#### CAUTION

Exercise care in handling equipment during inspection to prevent damage caused by rough or careless handling.

Visually inspect the amplifier module for damage that may have occurred during shipment. Check for evidence of water damage, bent or warped chassis, loose screws or nuts, or extraneous packing material in the connector or fans. Inspect the rear panel connector for bent connector pins. If the equipment is damaged, a claim should be filed with the carrier once the extent of any damage is assessed. We cannot stress too strongly the importance of IMMEDIATE careful inspection of the equipment and the subsequent IMMEDIATE filing of the necessary claims against the carrier if necessary. If possible, inspect the equipment in the presence of the delivery person. If the equipment is damaged, the carrier is your first area of recourse. If the equipment is damaged and must be returned to the factory, write or phone for a return authorization. Powerwave may not accept returns without a return authorization. Claims for loss or damage may not be withheld from any payment to Powerwave, nor may any payment due be withheld pending the outcome thereof. **WE CANNOT GUARANTEE THE FREIGHT CARRIER'S PERFORMANCE.**

## **2-4. INSTALLATION INSTRUCTIONS** (Refer to figures 1-1 and 2-2)

The K10 amplifier module is designed for installation in a subrack that permits access to the rear of the subrack for connection of DC power, RF, and monitor cables.

To install the amplifier proceed as follows:

1. Install subrack in equipment rack and secure in place.
2. Install the plug-in K10 amplifier module(s) in the subrack. Tighten top and bottom thumbscrews.
3. Connect 50-ohm antenna cable to RF OUT connector on rear of amplifier module.
4. Connect the transceiver/exciter output to RF IN connector on rear of amplifier module.
5. Connect alarm and control cable to 9-pin D-sub connector on rear of amplifier module. Refer to paragraph 2-5 for connector definition.

### **WARNING**

**Turn off external primary DC power before connecting DC power cables.**

6. Connect positive primary power to +28V terminal and negative primary power to GND terminal on rear of amplifier module. Tighten the power connections.
7. Check your work before applying DC voltage to the system. Make certain all connections are tight and correct.
8. Measure primary DC input voltage. DC input voltage should be +28 Vdc  $\pm$ 1.0 Vdc. If the DC input voltage is above or below the limits, call and consult Powerwave before you turn on your amplifier system.
9. Refer to section 3 for initial turn-on and checkout procedures.

## **2-5. AMPLIFIER MODULE ALARM AND CONTROL CONNECTOR**

The alarm and control connections on the amplifier are made through a female 9-pin D-sub connector (figure 2-1) and are listed and described in table 2-1.

Figure 2-1. Alarm and Control Connector (on Rear of K10 Module)



Table 2-1. Amplifier Module Alarm and Control Connections

| PIN NUMBER | FUNCTION            | DESCRIPTION   |
|------------|---------------------|---|
| 1          | Low Input Power     | Indicates alarm when input drive is approximately 2.5 dB below specified range. |
| 2          | GND                 | System Ground   |
| 3          | Over Temperature    | Indicates alarm if junction temperature exceeds 60 °C                           |
| 4          | VSWR                | Indicates alarm for VSWR >3:1   |
| 5          | Fwd Detect $V_{dc}$ | Input drive range set   |
| 6          | External Reset      | Resets microprocessor after alarm condition is set                              |
| 7          | DC Power            | Indicates alarm condition when 24 Vdc > power supply > 30 Vdc                   |
| 8          | RF Output Status    | Indicates alarm if an output transistor fails                                   |
| 9          | Not used            | No connection   |

Figure 2-2. K10 Amplifier, Rear View

## **OPERATING INSTRUCTIONS**

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### **3-1. INTRODUCTION**

This section contains operating instructions for the K10 Amplifier.

### **3-2. LOCATION AND FUNCTION OF AMPLIFIER MODULE CONTROL AND INDICATORS.**

The location and function of the K10 amplifier module control and indicators is shown in figure 3-1 and is described in detail in table 3-1.

Figure 3-1. K10 Amplifier Module Control and Indicators

Table 3-1. Amplifier Module Control and Indicators

| NO. | NAME  | FUNCTION   |
|-----|---|--|
| 1   | DC PWR ON Indicator                               | Green LED. Continuous illumination at voltages from 26-29.9 Vdc (this is the acceptable operating range for the K10 amplifier). At DC voltages from 24-25.9 Vdc, the LED will flash and the output power will remain at its specified level. At voltages less than 24 and greater than 30 Vdc, the K10 will shut down, and the DC POWER ON LED will flash. |
| 2   | LOW OUTPUT Indicator                              | Red LED. Activates when:<br>1. The op amp in the automatic gain control becomes saturated at its rails, or<br>2. One of the finals in the amplifier becomes faulty.  |
| 3   | LOW INPUT Indicator<br><br>(Refer to figure 3-2)  | Red LED. Activates when input drive to the K10 drops by 1.5 dB from its rated input drive. At this point, the led will flash, but the output will remain at its rated power. Should the RF input drive drop by another 1 dB, the LED will illuminate continuously and there will be no output from the K10 amplifier.                                      |
| 4   | HIGH INPUT Indicator<br><br>(Refer to figure 3-2) | Red LED. Activates when input drive to the K10 is increased by 1.5 dB from its rated input drive. At this point, the led will flash, but the output will remain at its rated power. Should the RF input drive increase by another 1 dB, the LED will illuminate continuously and there will be no output from the K10 amplifier.                           |
| 5   | HIGH VSWR Indicator                               | Red LED. Activates at loads greater than 3:1. At this point, the amplifier output will drop by -3dB. Should the output load open (VSWR >10:1) the indicator will still be lit and there will be no output from the amplifier.  |
| 6   | OVER TEMP Indicator                               | Red LED. Activates when the heatsink of the amplifier exceed 63 degrees Celsius. At this point, the K10 amplifier will shut down, and there will be no output. When the amplifier has sufficiently cooled, the K10 will resume normal operation.   |
| 7   | PWR CONTROL Adjustment                            | Allows user to reduce the power output by more than 10 dB below the factory-set 100 watts.   |
| 8   | POWER Indicator                                   | Output LED bar level indicator. Each bar represents 10 watts of output power.  |



### 3-3. INITIAL START-UP AND OPERATING PROCEDURES

To perform the initial start-up, proceed as follows:

1. Double-check to ensure that all input and output cables are properly connected.

#### CAUTION

Before applying power, make sure that the input and output of the amplifier are properly terminated at 50 ohms. Do not operate the amplifier without a load attached. Refer to table 1-2 for input power requirements. Excessive input power may damage the amplifier

#### NOTE

The output coaxial cable between the amplifier and the antenna must be 50 ohm coaxial cable. Use of any other cable will distort the output.

2. Verify that power supply measures  $28 \pm 1$  Vdc. Apply power to the amplifier(s). Do not apply an RF signal to the amplifier system.
3. Visually check the indicators on each amplifier module, and verify the following:
  - a. The DC PWR ON indicator (green) on all amplifier modules should be on.
  - b. The LOW INPUT indicator (red) on all amplifier modules should be on.
4. Turn on external exciter/transceiver and apply RF input signals. All red LEDs should turn off within 2.5 seconds.

### 3-4. VARIABLE INPUT SWITCH

If the RF input to the K10 amplifier should change, figure 4-1 shows which DIP switch to activate for various inputs. This should only be performed by a trained technician, and with prior approval and instructions from Powerwave's service department. Failure to receive prior permission to open the amplifier could void the warranty.

1. Verify that no DC or RF is applied to the K10.
2. If necessary, remove K10 from subrack.
3. Remove the lid from the K10.
4. Locate the variable toggle switch (S1) on the 500-00800-001 driver PCB.
5. Refer to figure 4-1 for various switch settings.

## PRINCIPLES OF OPERATION

### 4-1. INTRODUCTION

This section contains a functional description of the K10 Amplifier.

### 4-2. RF INPUT SIGNAL

K10 amplifiers are equipped with an input variable switch that ranges from 250mW to 25W (see figure 4-1). They have a predriver module that consists of an input attenuator pad, variable input attenuator, and a power amplifier module that provides up to 13dB of gain. The microprocessor uses detector circuitry to maintain a constant output level by sensing RF input, output, VSWR, temperature, and driver/final failures. Input VSWR to the K10 should not exceed 2:1 for best performance.

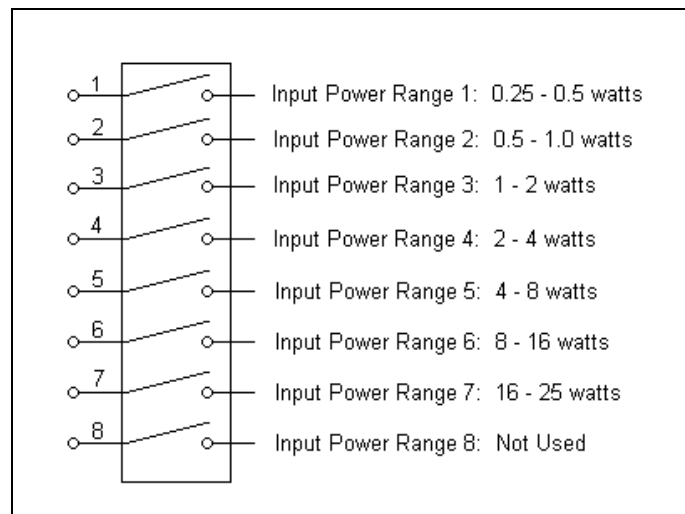


Figure 4-1. Variable Input Switch

### 4-3. RF OUTPUT LOAD

The load impedance should be as good as possible (2:1 or better) in the working band for good power transfer to the load.

### 4-4. FUNCTIONAL DESCRIPTION

The K10 amplifier (see block diagram figure 4-2) is a linear, single channel amplifier that operates in the frequency band from 850 MHz to 870 MHz. The amplifier specifications are listed in table 1-2. Each amplifier is a self-contained plug-in module and is functionally independent of other amplifier modules. The amplifier modules are designed for parallel operation to achieve high peak power output, and for redundancy in unmanned remote locations. Each amplifier in the system can simultaneously transmit carrier frequencies, at an average total power output of 100 watts.





#### **4-5. K10 AMPLIFIER MODULE**

The amplifier module has an output of 100 watts power with all harmonics suppressed to better than -70 dBc below carrier level. The amplifier module is comprised of:

- Microprocessor board/alarm monitoring
- Pre-driver board/splitter
- Two final gain stages
- Alarm monitoring, control, and display panel
- Distributed low pass filter board/ combiner board

##### **4-5.1. MAIN AMPLIFIER**

The input and output of the amplifier employ three-stage, class AB amplifiers which provide approximately 54 dB of gain in the 20 MHz frequency band from 850 MHz to 870 MHz. The amplifier operates on +28 Vdc, and a bias voltage of +6 Vdc, and is mounted directly on a heat sink. The alarm logic controls the +6 Vdc bias voltage which shuts down the amplifier.

##### **4-5.2. LOOP CONTROL**

The loop control circuitry consists of a microprocessor (see paragraph 4-2), which prevents the RF output and input power from exceeding the safe operating maximum power levels.

The RF output power from the model K10 amplifier is controlled by the microprocessor. A coupled detector on the low-pass filter PCB monitors the final RF output level and generates a DC voltage (VFWD) proportional to the RF output level. VFWD is fed back to the microprocessor. The microprocessor compares this voltage to a reference voltage, and varies the output gain of the driver module to maintain a constant 100-watt output. The microprocessor also provides over-temperature protection for the amplifier. All RF modules in the amplifier are mounted on a common heatsink. The modules all have temperature-sensing ICs mounted on them which constantly monitor heat and convert it to a DC voltage. This voltage is sent to the microprocessor which shuts down the amplifier should temperatures exceed 63 degrees Celsius. When the amplifier has sufficiently cooled down, the microprocessor re-enables the amplifier.

The output of the driver amplifier, approximately five watts of power, is fed to a 2-way power splitter, amplified by the two parallel final amplifier modules, then combined and fed to the 7-pole distributed low-pass filter. The filter attenuates any spurious and harmonic signals that may have been produced by the various gain stages, for a final RF output of 100 watts. Double shielded Teflon cable is used for all high power RF interconnections.

##### **4-5.3. AMPLIFIER MONITORING**

In the main amplifier modules, all normal variations are automatically compensated for by the microprocessor. However, when large variations occur beyond the adjustment range of the loop control, a low output alarm will occur. The alarms are displayed in the front panel indicators.

Status indicators on the front panel include DC PWR ON, LOW OUTPUT, LOW INPUT, HIGH INPUT, HIGH VSWR, and OVER-TEMP. AN RF power-level adjustment potentiometer is also provided on the front panel. The power adjustment allows the user to reduce the power output by more than 10 dB below the factory-set 100-watt output. An output LED bar level indicator is also provided on the K10. Each bar represents 10 watts of output power.

##### **4-5.4. AMPLIFIER MODULE COOLING**

Although each amplifier module contains its own heat sink, It is cooled with forced air. Two fans are used for forced air cooling and redundancy. The fans, located on the rear of the amplifier module and operating continuous duty from applied DC, draw ambient air in through the front of the amplifier and exhaust hot air out the rear of the module. The fans are field replaceable.

#### **4-6. POWER DISTRIBUTION**

Primary DC power for the system is provided by the host system. This system supplies each amplifier module with +28 Vdc directly via a 15-amp fuse located on the rear panel of the

amplifier. The amplifier module has a DC/DC converter that converts the +28 Vdc to +6 Vdc to provide bias.

## MAINTENANCE

### 5-1. INTRODUCTION

This section contains periodic maintenance and performance test procedures for the K10. It also contains a list of test equipment required to perform the identified tasks.

#### NOTE

Check your sales order and equipment warranty before attempting to service or repair the unit. Do not break the seals on equipment under warranty or the warranty will be null and void. Do not return equipment for warranty or repair service until proper shipping instructions are received from the factory.

### 5-2. PERIODIC MAINTENANCE

Periodic maintenance requirements are listed in Table 5-1. Table 5-1 also lists the intervals at which the tasks should be performed.

#### **WARNING**

Wear proper eye protection to avoid eye injury when using compressed air.

Table 5-1. Periodic Maintenance

| TASK                                       | INTERVAL  | ACTION   |
|--|-----------|--|
| <b>Cleaning</b><br>Air Vents               | 30 Days   | Inspect and clean per paragraph 5-4  |
| <b>Inspection</b><br>Cables and Connectors | 12 Months | Inspect signal and power cables for frayed insulation. Check RF connectors to be sure that they are tight. |
| <b>Performance Tests</b>                   | 12 Months | Perform annual test per paragraph 5-5.   |

### 5-3. TEST EQUIPMENT REQUIRED FOR TEST

Test equipment required to test the amplifier system is listed in Table 5-2. Equivalent test equipment may be substituted for any item.

#### NOTE

All RF test equipment must be calibrated to 0.05 dB resolution. Any deviation from the nominal attenuation must be accounted for and factored into all output readings.

Table 5-2. Test Equipment Required

| NOMENCLATURE               | MANUFACTURER | MODEL        |
|----------------------------|--------------|--------------|
| Signal Generator           | H.P.         | 8648B        |
| 40 dB Attenuator, 250 Watt | Tenuline     |              |
| DC power supply            | H.P.         | 6269B        |
| Spectrum Analyzer          | H.P.         | 8560E        |
| Dual Directional Coupler   | Narda        |              |
| Power Meter / Sensor       | H.P.         | 437B / 8481A |
| Linear Discreet Amplifier  |              |              |
| Digital Multi-Meter        | Fluke        | 73           |
| Current Probe              |              |              |

**5-4. CLEANING AIR INLETS/OUTLETS**

The air inlets and outlets should be cleaned every 30 days. If the equipment is operated in a severe dust environment, they should be cleaned more often as necessary. Turn off DC power source before removing fans. If dust and dirt are allowed to accumulate, the cooling efficiency may be diminished. Using either compressed air or a brush with soft bristles, loosen and remove accumulated dust and dirt from the air inlet panels.

**5-5. PERFORMANCE TEST**

Performance testing should be conducted every 12 months to ensure that the amplifier system meets the operational specifications listed in table 1-2. Also verify system performance after any amplifier module is replaced in the field. The test equipment required to perform the testing is listed in table 5-2, and the test setup is shown in figure 5-1.

**NOTE**

The frequencies used in this test are typical for an amplifier with a band from 850 MHz to 870 MHz.

**5-5.1. AMPLIFIER PERFORMANCE TEST.**

This test is applicable to a subrack equipped with one to five plug-in K10 amplifier modules. Perform the tests applicable to your system. To perform the test, proceed as follows:

1. Connect test equipment as shown in figure 5-1.

**NOTE**

Do not apply any RF signals at this time.

2. Turn on DC (28 V). Turn on signal generator and set frequency to 860 MHz.

**HARMONICS TEST**

3. With the power amplifier set at 100 watts power output, use the spectrum analyzer and check the frequency band from 850 MHz to 870 MHz for harmonics. Harmonics should be -70 dBc maximum.

**SPURIOUS TEST**

4. With the power amplifier set at 100 watts power output, use the spectrum analyzer and check the frequency band from 850 MHz to 870 MHz for spurious signals. Spurious signals should be -70 dBc maximum.

GAIN TEST:

5. Disconnect spectrum analyzer from test setup, and connect the power meter.
6. Apply the rated input RF drive to the K10. Verify that the unit delivers 100W out for rated input.

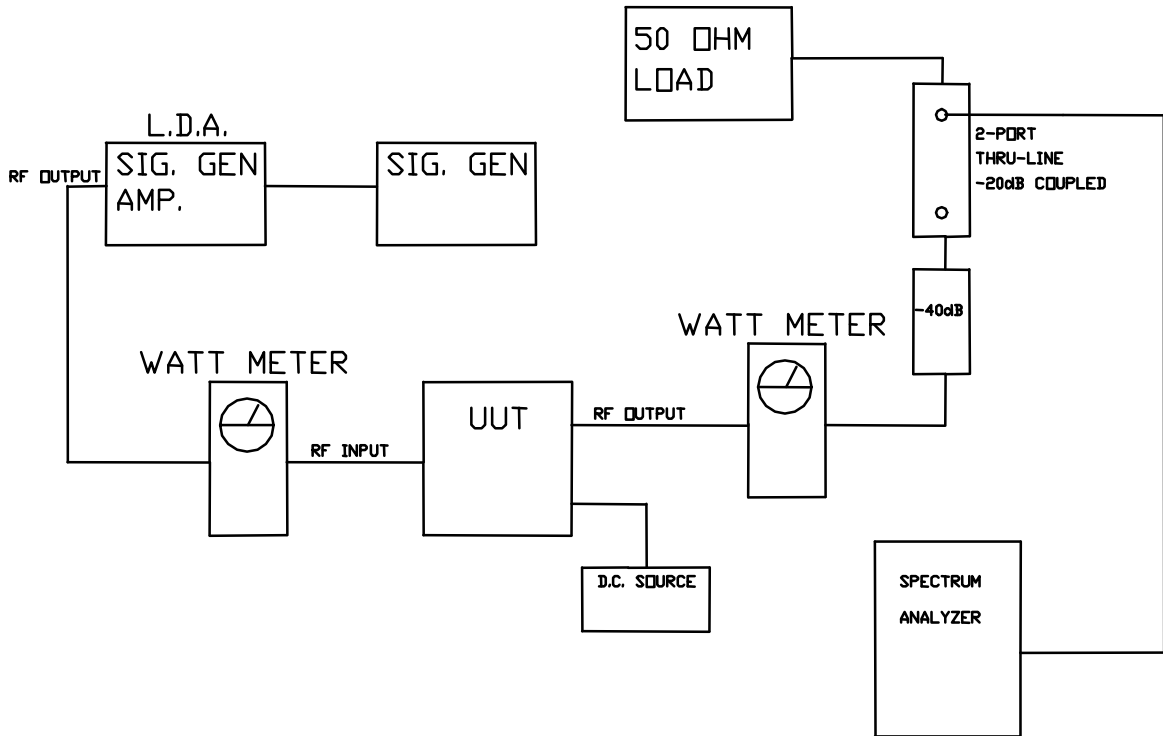


Figure 5-1. Amplifier Test Setup Diagram

## 5-6. FIELD REPLACEABLE PARTS AND MODULES

The following parts and modules can be replaced in the field on site by a qualified technician with experience maintaining RF power amplifiers and similar equipment:

1. K10 Power Amplifier Modules
2. Cooling Fans
3. 15 Amp Fuse

### 5-6.1. K10 POWER AMPLIFIER MODULE

To replace a K10 module, proceed as follows:

1. Loosen two thumbscrews that secure amplifier module to subrack.

#### CAUTION

When removing the amplifier from the subrack, it is very important to support the amplifier such that the rear of the module does not suddenly drop when the guide rail disengages from the track. A drop such as this could damage the rear of the amplifier.

2. Use the handles on the front of the module, and with a steady even pressure, pull the module out of chassis.

### 5-6.2. COOLING FANS

To replace a cooling fan, proceed as follows:

1. Remove amplifier module from subrack.
2. Loosen three screws that secure fan to amplifier module. Disconnect fan power connector from amplifier module.
3. Install replacement fan in reverse order of steps 1 and 2 above.

### 5-6.3. FUSE

The K10 amplifier 28 Vdc power input line contains a single fuse as follows:

|                        |                   |
|------------------------|-------------------|
| Manufacturer:          | Littlefuse        |
| Manufacturer's Number: | 313015            |
| Rating:                | 15 amps           |
| Style                  | 3AG Slo-Blo       |
| Size:                  | 1/4 inch diameter |
|                        | 1-1/4 inches long |

## TROUBLESHOOTING

### 6-1 INTRODUCTION

This section contains a list of problems which users have encountered and a few suggested actions that may correct the problem. If the suggested corrective action does not eliminate the problem, please contact your Powerwave field representative or the factory for further instructions.

#### NOTE

Check your sales order and equipment warranty before attempting to service or repair the unit. Do not break the seals on equipment under warranty or the warranty will be null and void. Do not return equipment for warranty or repair service until proper shipping instructions are received from the factory.

### 6-2 TROUBLESHOOTING

Refer to table 6-1 for troubleshooting suggestions.

Table 6-1. Troubleshooting.

| SYMPTOM   | SUGGESTED ACTION  |
|---|---|
| Any voltage indicators (green) are <u>not lit</u> or blinking | <ol style="list-style-type: none"> <li>1. Check that subrack power connection is secure.</li> <li>2. Check for proper power supply voltage.</li> <li>3. Check fuses or circuit breakers on amplifier or subrack.</li> <li>4. Verify that amplifier is fully inserted into subrack.</li> </ol> |
| OVER TEMP alarm (red) is lit                                  | <ol style="list-style-type: none"> <li>1. Verify fan(s) are operating properly.</li> <li>2. Check ambient temperature (not to exceed spec – see table 1-2)</li> </ol>   |
| HIGH/LOW INPUT alarm (red) is lit                             | Verify RF input level does not exceed spec – see table 1-2  |
| HIGH VSWR alarm (red) is lit                                  | Check output connections and cables for integrity and tightness   |
| LOW OUTPUT alarm (red) is lit                                 | Contact Powerwave field representative or factory.  |

### **6-3 RETURN FOR SERVICE PROCEDURES**

When returning products to Powerwave, the following procedures will ensure optimum response.

#### **6-3.1 Obtaining an RMA**

A Return Material Authorization (RMA) number must be obtained prior to returning equipment to the factory for service. Please contact our Customer Service Department at (949) 757-0530 to obtain this number. Failure to obtain this RMA number will result in considerable delays in receiving repair service.

#### **6-3.2 Repackaging for Shipment**

To ensure safe shipment of the amplifier, it is recommended that the package designed for the amplifier be used. The original packaging material is reusable. If it is not available, contact Powerwave's Customer Service Department for packing materials and information.