



# **USER MANUAL HMS SERIES RF POWER AMPLIFIER**

**3370 SAN FERNANDO RD., #206  
LOS ANGELES, CA 90065  
TEL: (323)256-3000 FAX: (323)254-3210  
[www.tplcom.com](http://www.tplcom.com)**

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# PRODUCT DESCRIPTION

The **HMS** series of TPL power amplifiers are intended for use in base station or repeater applications. They are high power units and in various configurations cover the frequency range extending from Low Band VHF to 960 MHz.

An **HMS** series RF power amplifier is a self contained unit which allows operation, metering, and remote monitoring of all parameters of an RF power amplifier. Its major components are: enclosure, front panel, rear panel, power amplifier, power supply, cooling fans, metering, control, and monitoring circuits. The entire assembly is designed to be installed in a nineteen inch rack.

For operator convenience views of the front and rear of the amplifier are presented in the illustrations section of **APPENDIX 1**.

## GENERAL SPECIFICATIONS

**MODEL: PA9096-350**

<b>FREQUENCY RANGE:</b>	920-940 MHz
<b>POWER INPUT:</b>	100 mW – 50 W (model dependent)
<b>NOMINAL POWER OUTPUT:</b>	350 watts
<b>EIA DUTY CYCLE:</b>	100% / Continuous.
<b>MODULATION MODE:</b>	FM.
<b>IN/OUT RF CONNECTORS:</b>	Type “N” – IN; 7/16 DIN - OUT
<b>OPERATING TEMPERATURE RANGE:</b>	-20° to +50° Celsius.
<b>OPERATING VOLTAGE:</b>	110 VAC Standard, 220 VAC Optional.
<b>HARMONICS and SPURIOUS EMISSION ATTENUATION:</b>	Meets or exceed FCC type acceptance requirements.
<b>CIRCUIT PROTECTION:</b>	Provided by the circuit breaker.
<b>REMOTE MONITORING:</b>	A DB-25 connector for remote access to metering and indicators is a standard feature on all <b>HMS</b> RF amplifiers ( <b>See Table 1</b> ).
<b>OPERATING HUMIDITY:</b>	0%-85% RH (Non-condensing).
<b>STORAGE HUMIDITY:</b>	0% -95% RH (Non-condensing).

## **CAUTION!**

Check the amplifier upon receipt for visible damage. If any is noticed, please call **TPL** at **800 HI POWER** to request an RMA number (Return Material Authorization). If purchased through a dealer, ask them to follow this procedure for best results.

**EXPENSIVE COMPONENTS MAY BE DESTROYED IF THE AMPLIFIER IS TURNED ON IN A DAMAGED CONDITION.**

## **OPERATING PRECAUTIONS**

**CAUTION:** This amplifier produces RF voltages that can cause painful and dangerous RF burns. Use caution! Connect and disconnect all RF connectors with the AC power and drive power off.

**DRIVE POWER:** RF power transistors, although quite rugged in most respects, are easily damaged by overdrive. Be careful not to overdrive this amplifier, even for an instant. Higher than rated drive power may destroy the transistors and **VOID ANY WARRANTY**.

**TERMINATIONS:** The parameters of this amplifier will degrade if it is operated into anything but a 50 Ohm load. That may mean any, or all, of the following; lower power output, increased current drain, higher operating temperature, lower efficiency and reduced lifetime.

# INSTALLATION

This unit is designed for mounting in a standard nineteen inch rack. When picking a location in the rack, considerations must be given to the lengths of the RF coaxial cable, as well as cooling.

Mount the unit where dust and other debris are not likely to clog the cooling fans. Avoid mounting the amplifier directly above hot pieces of equipment that could artificially raise the amplifier temperature.

Connect the radio transmitter to the “**RF INPUT**” N connector and an antenna to the “**RF OUTPUT**” 7/16 DIN connector on the amplifier. Use 50 Ohm coaxial cable with appropriate RF power rating.

Plug the AC line cord into the system AC power receptacle.

For safety, make sure the rack and all equipment connecting to the amplifier have proper AC grounds. Do not rely on coaxial cable shields for AC grounding.

Assure the installation has proper lightning protection.

# MAINTENANCE

There are two maintenance tasks to be performed on the **TPL Communications HMS** Series RF Amplifiers. These tasks are listed below.

- 1.) Perform regular inspections of the air intake and exhaust fans. Clean or clear any dust or debris that may have collected. This will prevent the amplifier from overheating.
- 2.) Every month record the data displayed on the **HMS** status display on the Front Panel Meter Reading Data Sheet in **APPENDIX 1** of the **HMS** users manual. This will aid the technicians in servicing the amplifier should a problem develop.

# METERING AND INDICATORS

The following signals and voltages are indicated on the front panel **HMS** status meter, (a liquid crystal display). The parameters to be monitored are selectable via the front panel momentary contact toggle switch. The status meter has two lines of text. The top line indicates the parameter to be measured while the bottom line indicates the measured value and its units. Refer to the front panel drawing in the illustrations section for the location of the meter and switch. The following is a list of display positions and functions.

Display Position	Function
<b>HMS STATUS</b> .....	Meter default position
<b>FWD PWR</b> .....	Output RF Forward Power Level
<b>RFL PWR</b> .....	Output RF Reverse (Reflected) Power Level
<b>RF INPUT</b> .....	Input RF Power Level (Relative Reading Only)
<b>DRIVER V</b> .....	DC Voltage, Driver Amplifier
<b>FINAL V</b> .....	DC Voltage, Final Amplifier
<b>A CURR</b> .....	Amplifier side "A" DC Current (Usually the driver stage)
<b>B CURR</b> .....	Amplifier side "B" DC Current (Usually the final stage)
<b>TOT CURR</b> .....	Total DC Current

The switch can be toggled in either direction. If the switch is not toggled for approximately three minutes the display reverts to the **HMS STATUS** position.

The primary purpose for the front panel switch is to provide a tool for maintenance of the RF amplifier system. A table for recording values for each parameter shown by the panel meter is included as APPENDIX 1 of this manual. It is strongly recommended that these parameters be entered in the table upon initial installation of the RF amplifier and at regularly scheduled intervals after that. In case of a system failure, values can be recorded in the table and the table furnished to TPL Communications. This will greatly aid our technical personnel to make any necessary repairs to the system.

In addition to the front panel metering, a visual system status monitoring is provided by front panel indicators. Five indicators are used and have the following functions and characteristics:

Indicator	Functions/Characteristics
<b>RF ON</b> .....	Steady green LED indicating that adequate RF drive power is being applied to the amplifier.
<b>SWR</b> .....	Flashing red alarm LED when output load SWR exceed the internally preset level.
<b>OTEMP</b> .....	Flashing red alarm LED when amplifier heat sink temperature is above an internally preset level.

## Metering and Indicators (Continued)

**LOPWR** ..... Flashing red alarm LED when RF output power is below an internally preset level.

**FANS** ..... Flashing red alarm LED when a fan failure occurs.

## OPERATOR ADJUSTMENTS

The operator can turn the main power on or off with the switch located in the lower right hand corner of the front panel. The **HMS** status can be checked by toggling the meter select switch located in the lower left hand corner of the front panel and viewing the status display. A display contrast adjustment is provided on the front panel, between the status display and the meter select switch. This is a ten turn potentiometer.

Ref. Design	Function/Adjustment
<b>P1 (VR1)</b> .....	RF output power level adjustment. This is a 10-turn potentiometer.
<b>P3(VR3)</b> .....	VSWR threshold set to determine the alarm level for the front panel indicator.
<b>P4(VR4)</b> .....	Determines the threshold for a valid input RF power level.
<b>P5(VR5)</b> .....	Low RF power output threshold set to determine the alarm level for the front panel indicator.
<b>P6(VR6)</b> .....	Meter calibration potentiometer for RF power output.
<b>P7(VR7)</b> .....	Meter calibration potentiometer for RF reflected power.
<b>P8(VR8)</b> .....	Calibration setting for relative input power.
<b>SW1</b> .....	Determines the method of RF output power control. The up position provides regulated DC control. The down position provides RF feedback leveling control.

A basic understanding of RF principles is necessary before making any adjustments to the unit. This includes knowledge of the relationship of forward and reflected power relative to SWR etc. Adjustment also requires the familiarity and use of test equipment. If in doubt, consult your dealer or the manufacturer about changes.

The necessary adjustment procedure to change the RF power level must be done in the sequence shown as follows:

Provide a proper low VSWR RF termination for the amplifier.

**SW1** Set this switch to the up (test) position.

## **Operator Adjustments (Continued)**

**P1** This is a basic power adjustment for the unit. It is a 10 turn potentiometer which sets the RF output power level. Changing its setting may require resetting all other adjustments. To make this adjustment it is necessary to monitor the output with a calibrated RF power meter. As a reference, set the adjustment to produce nominal RF output.

**P5** Lower the RF input drive (from its nominal level) until the RF output drops to its lowest acceptable value. Adjust P5 until the front panel LED begins to flash. Restore normal drive power. The LED should then extinguish.

**P4** Set the RF input drive to a level 6dB below the nominal drive level. Adjust P4 to activate the amplifier and its fans at this threshold.

**P8** Adjust this potentiometer to a nominal 20 units at nominal input drive.

**SW1** Return the switch to the down (ALC ON) position.

**P6** Toggle the front panel switch until the top line of the display reads FWD PWR. With the proper RF termination still in place, monitor the RF forward power output on a calibrated power meter. Set P1 to provide nominal power output. Adjust P6 so that the front panel Meter is in agreement with the calibrated power meter. Note this power reading.

Note: The recommended output power range is from the specified maximum output level to one half that value. Consult the manufacturer if a lower power level is required. In all cases, a spectrum analyzer should be used to assure that no spurious signals are generated when the power level is changed.

**P7** Attach a 3:1 VSWR load to the output and, with an external calibrated power meter, measure the reflected power. Toggle the front panel switch until the top line of the display reads RFL PWR and adjust P7 so that the front panel meter is in agreement with calibration power meter.

**P3** The optimum setting for this VSWR threshold adjustment is to have the trigger with a 3:1 VSWR. It may, however, be set anywhere at the users discretion. With the 3:1 VSWR used in the previous step still terminating the amplifier, apply normal RF drive and adjust the potentiometer until the front panel SWR LED begins to flash. The LED should extinguish when the VSWR is reduced or the normal load is connected.



# REMOTE MONITORING

The monitored functions are described in other sections. These same functions, some of which are displayed by LED's on the front panel, are available in the **REMOTE MONITOR** DB-25 connector on the rear panel. The outputs are as follows:

**Table 1**

**Monitor Signals**

Function	Pin	Signal Definition	Source	Mode	Voltage	Current
INS	2	Input RF Power	Source R=5K	Analog	5V=100 units	-----
PRS	3	Reflected Power	Source R=5K	Analog	5V=600W	-----
VDS	4	Driver Voltage	Source R=5K	Analog	0.1V=1V	-----
IBS	5	B Current	Buffer Amp	Analog	0.1V=1A	-----
LOPWR	6	Low Power Alarm	Open collector, series 100 Ohms	Active Low	15 V Max.	50 mA Max.
SWR	7	Standing Wave Ratio Alarm	Open collector, series 100 Ohms	Analog Low	15 V Max.	50 mA Max.
OTEMP	8	Over Temperature Alarm	Open collector, series 100 Ohms	Active Low	15 V Max.	50 mA Max.
PFS	10	Forward Power	Source R=5K	Analog	5V=600W	-----
VCS	11	Final Voltage	Source R=5K	Analog	0.1V=V	-----
IAS	12	A Current	Buffer Amp	Analog	0.1V=1A	-----
RF ON	13	RF ON Indicator	Open collector, series 100 Ohms	Active Low	15 V Max.	50 mA Max.
TEMP	14	Temperature	Buffer Amp, series 1000 Ohms	Analog	10 V Max.	10 mA Max.
SFLT	15	System Fault Alarm	Open collector, series 100 Ohms	Active Low	15 V Max.	50 mA Max.
FOF	16	Fans Alarm Failure	Open collector, series 100 Ohms	Active Low	15 V Max.	50 mA Max.
AOF2	17	Amp off	Command Input	Active Low	15V Max 0V Min	2mA Max
GND	1,9	Ground	Chasis and signal ground	-----	0V	-----

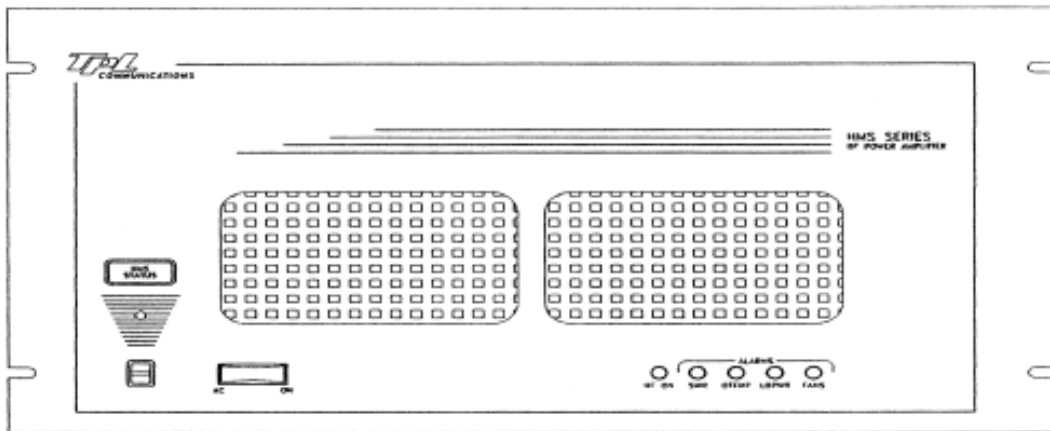
## APPENDIX 1

## FRONT PANEL METER READINGS

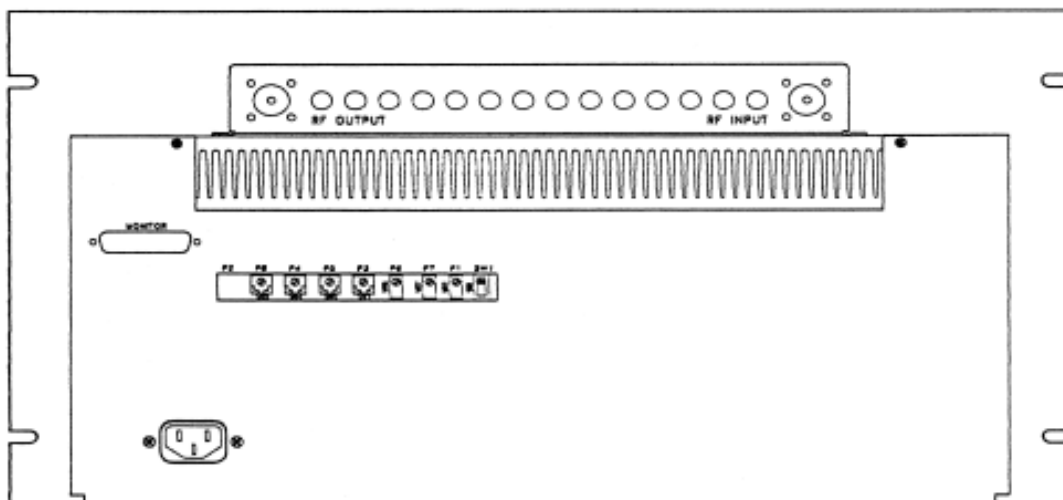
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# HMS ILLUSTRATION

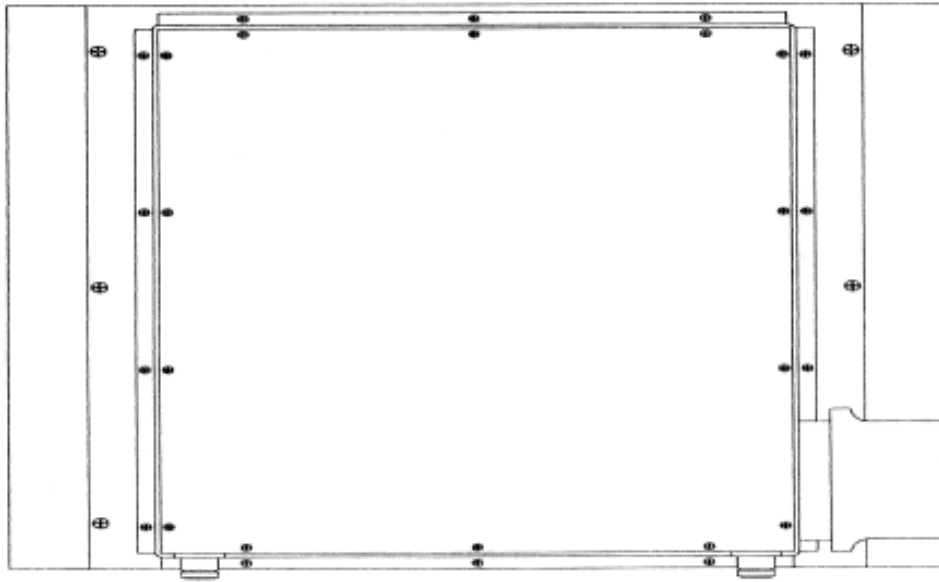
## FRONT VIEW



## REAR VIEW



## TOP VIEW



# WARRANTY

**TPL COMMUNICATIONS** has tested and found this unit to function properly and to operate within the parameters of its stated specifications.

**TPL COMMUNICATIONS** warrants that this product is free from defects in material and workmanship. If found to be defective within two (2) years from the date of purchase the factory at its discretion, will either repair or replace the unit at no cost provided the unit is delivered by the owner to the factory intact. Warranty does not apply to any product which has been subjected to misuse, neglect, accident, improper installation or used in violation of instructions furnished by us, nor does it extend to units which have been repaired or altered outside our service department, nor where the serial number has been removed, defaced or changed.

## SERVICE

For service on this amplifier, contact:

**TPL COMMUNICATIONS**  
**Customer service department**  
**Phone: (323) 256-3000**  
**(800) HI POWER**  
**FAX: (323) 254-3210**  
**EMAIL: [tech.support@tplcom.com](mailto:tech.support@tplcom.com)**

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