

PA POWER CONTROL

The Power Control circuitry performs three basic functions. It keys and unkeys the PA, sets the PA output power, and protects the PA against adverse conditions.

Keying and Unkeying the PA

To key the PA, the digital controller places 5 volts on the PA key line, J201-2. Zero volts on the PA key line causes the PA to unkey. If the control cable (W13) is disconnected, with nothing actively driving the PA key line, the PA will remain unkeyed.

PA Output Power Set

PA output power is set according to the level of the Power Set line. Four (4) volts on this line will produce minimum power. As the voltage increases toward eight (8) volts, the power will increase to its maximum rated output. The PA output power is initially set at the factory. This is done by adjusting R43* while injecting a 10 mW signal at J1 and applying 8 volts to J201-3. After setting the maximum power level, changing the output power is done by varying the voltage applied on the Power Set line.

PA Protection

The Power Control also protects the PA against over temperature and high VSWR conditions.

An over temperature condition exists when the flange temperature of the final output transistor reaches 80°C. At this point the output power will drop below its set level. The output power will continue to drop such that when the flange temperature reaches 125°C the PA output drops at least 10 dB below its set level.

Reflected power is limited to 25% of the set power. If the output VSWR degrades to worse than 3:1, the forward power will be reduced to limit the reflected power to 25% of the set power. The Power Sensor line indicates when the PA is operating in a cutback condition. If the PA is keyed and the power control is cutting back, the Power Sensor line will drop to zero (0) volts and the PA alarm light on the station will turn on.

Theory of Operation

Power control of the MASTR® III Power Amplifier is accomplished with a feedback control loop. The three possible feedback signals are: representation of forward power, temperature sensitive scaled representation of forward power, or representation of reflected power. These three signals are input to a diode summing junction which selects the largest of the three for use as the feedback.

The microstrip directional coupler samples the output power and produces a voltage, V_f , proportional to the forward output power. The power control compares the forward voltage, V_f , to a reference voltage at U3. The output of U3 controls the current flow thru Q5 and the output of Q203. The collector output of Q203 adjusts the control voltage, V_{ct1} and V_{ct2} . This control voltage is

capable of adjusting the total PA output power since it provides the first two stages DC supply to the Low Level Amplifier, U1.

During over-temperature operation, a scaled representation of the forward power is maintained constant by varying the control voltage line. Thermal resistor RT1, sensing an increase in temperature, causes the output of U3.1 to increase. If the output of U3.1 becomes larger than the other feedback lines, the output of U3.4 will begin to decrease. This in turn will cause the output of Q203 to decrease reducing the supply voltage to U1. Since the scaling is a function of temperature, the power is reduced as the temperature increases.

Under VSWR cutback operation the reverse voltage, V_r , representative of the reflected output power, is held below a threshold by reducing the control voltage as necessary. If V_r increases at U3.2 beyond the preset threshold, an increase at U3.4 will result. This causes a subsequent reduction in the control voltage to U1. Thus the power control circuit reduces the output power in order to limit the reflected power to 25% of the set power.