MOTOROLA

POWER AMPLIFIER MODULE

403 to 470 MHz
MODEL CLN1230, 40 W
MODEL CLN1231, 30 W

1 DESCRIPTION

The Models CLN1230, CLN1231 Power Amplifier Modules are described in this section. A general description, identification of inputs / outputs, functional block diagram, and functional theory of operation are provided. The information provided is sufficient to give service personnel a functional understanding of the module, allowing maintenance and troubleshooting to the module level. (Refer also to the Troubleshooting section of this manual for detailed troubleshooting procedures for all modules in the station.)

General Description

The Power Amplifier Module (PA) accepts a low-level modulated RF signal from the Exciter Module and amplifies the signal for transmission via the site transmit antenna. The output power is continually monitored and regulated by a feedback and control loop, with a power output control voltage being generated by the transmitter control circuitry located on the PA Input / Output boards.

Overview of Circuitry

The PA contains the following circuitry:

- Intermediate Power Amplifier (IPA) – hybrid substrate amplifier stage which accepts low-level input from Exciter Module, amplifies the signal, and outputs a 0 W to 10 W RF signal
- Butterfly Module – hybrid substrate amplifier stage which accepts output from IPA Hybrid and provides final amplification to 50 W (maximum)
- Directional Coupler / Power Detector / Low Pass Filter – couples amplified RF signal to transmit antenna connector; also generates dc voltages proportional to forward and reflected power for use in TX power control loop; provides harmonic suppression for the station
- Dual Circulator (CLN1231 only) – provides isolation between Power Amplifier output and transmit antenna
- Temperature Sense Circuitry – provides variable resistance signal proportional to heat sink temperature; signal is monitored by the PA power control circuitry

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2 IDENTIFICATION OF INPUTS/OUTPUTS

Figure 1 shows the PA Module input and output external connections.

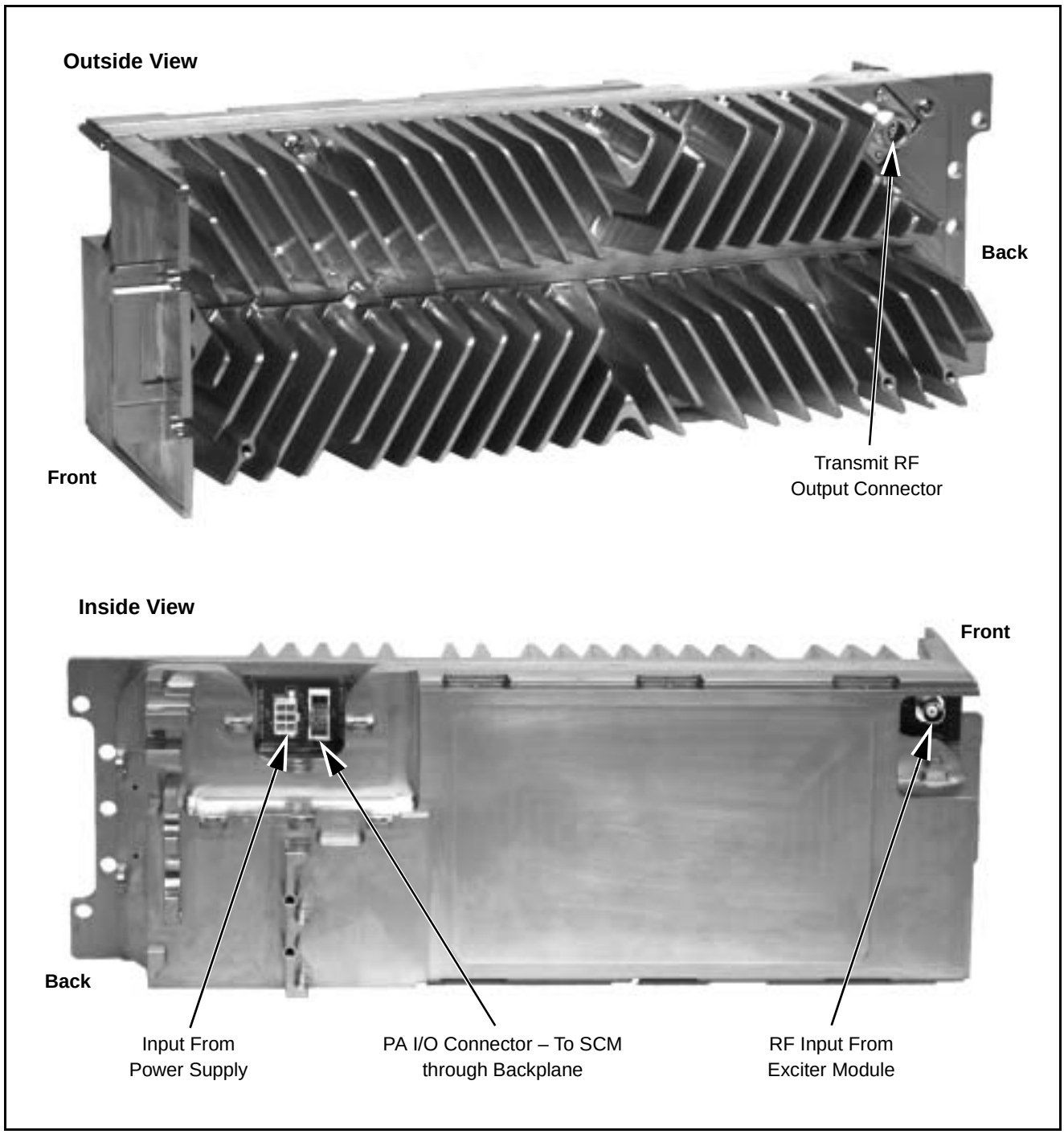

Figure 1. UHF 30 / 40 W Power Amplifier Module Inputs/Outputs

3 FUNCTIONAL THEORY OF OPERATION

The following theory of operation describes the operation of the PA circuitry at a functional level. The information is presented to give the service technician a basic understanding of the functions performed by the module in order to facilitate maintenance and troubleshooting to the module level. Refer to Figure 2 for the following functional theory of operation.

RF Signal Path

A low-level modulated RF signal (approximately +12 dBm) from the Exciter Module enters the PA Input board via a coax cable. The signal is input to the IPA and amplified to approximately 0 to 10 W (depending on the dc power control voltage (V_CNTL) from the PA output board). The IPA output is then fed to the Butterfly Module where final amplification occurs. The output of the Butterfly (40 W maximum) exits from the PA Output board via an N-type coax connector.

Circulator

A double circulator is built into the CLN1231 Power Amplifier Module to provide additional isolation between the PA module and the transmit antenna.

Heat Sink Temperature Sense

A thermistor mounted on the PA printed circuit board outputs a variable resistance proportional to the heat sink temperature. This signal is fed to the power control circuitry on the PA output board, which monitors the signal and reduces the PA output power if the PA temperature exceeds set limits.

Output Power Control

A feedback and control loop configuration is used to regulate the PA output power. The Directional Coupler generates a dc voltage proportional to the PA Module output power. This voltage is fed to power control circuitry on the PA output board where it is compared to reference voltages to generate a dc power control voltage. The Station Control Module sends current and power limit signals to a D / A converter (via the SPI bus) to control the maximum current / control voltage levels. The control voltage is fed to the IPA module where it controls the IPA output, thus controlling the overall output from the PA Module.

A/D Converter Circuitry

Analog signals from various strategic operating points throughout the PA module are fed to an A/D converter, which converts them to a digital signal and, upon request by the Station Control Module, outputs the signal to the Station Control Module via the SPI bus.

For example, the directional coupler generates a dc voltage proportional to the reflected power. This signal is converted to a digital signal and sent to the SCM. If the sense line indicates an impedance mismatch (high VSWR), the PA is either cut back in power or shut down completely.

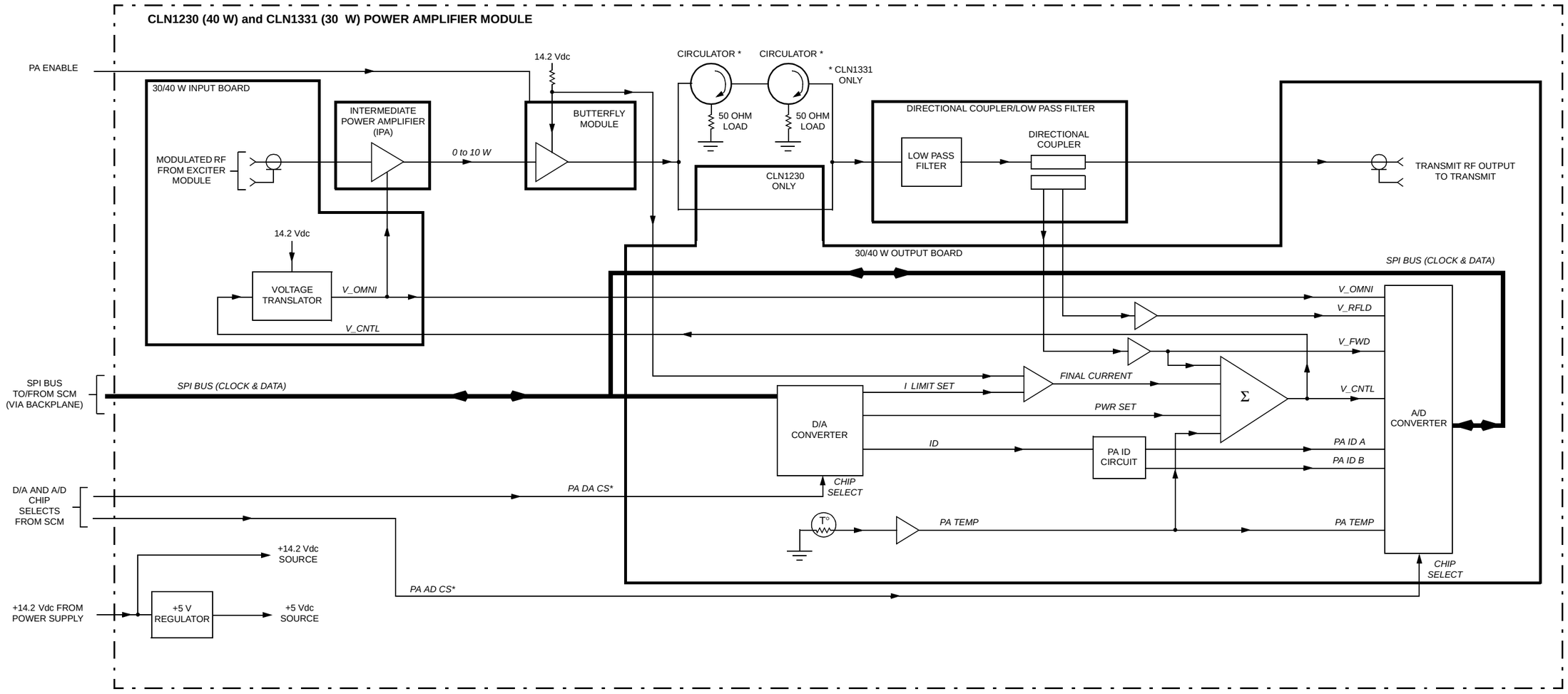

Figure 2. UHF 30/40 W Power Amplifiers Functional Block Diagram