-- Crescend Technologies --

Power Amplifiers P10-xxDE1-C5-001.

Unit Description and User Manual.

1. General description.

The power amplifier (PA) is nonlinear AB to C class unit that is intended for frequency (phase) modulated (manipulated) signals amplification.

There is the fan for forced cooling, which starts rotating, when the sufficient RF signal is applied to the unit input, or when the heatsink inside temperature reaches +85ºC. The automatic power control loop keeps the output power at the rated level. It reduces this level, when the load VSWR is above 2, when the heatsink temperature exceeds +85ºC or under the outer control.

Frequency range of operation (F), MHz . . . . . …138-144, 148-174;
Input power (Pin), W . . . . . see Table 1 in Block-Diagram;
Output power (Pout), W, not less than 100;
Relative harmonic level, dBc, less than . . . . . -70;

DC power supply voltage (Vsup), V, nominal 13.8;
Allowed DC power supply voltage tolerance, V, not greater than . . . . . $\pm$1.0;
DC current, A, not greater than 22;
Load VSWR, not greater than 2.5;
Input VSWR, less than 1.7;
Operating temperature range, ºC . . . . . -30 to +60;
RF connectors . . . . . 50 Ohm N (F);
DC connectors . . . . . # 6-32 screws.

2. Schematic Description.

RF Circuitry Description.

RF signal, applied to the connector “RF IN”, proceeds via the attenuator ATT1 and the coax cable to the pad J1 of Pre-Amplifier Board. There is the attenuator ATT2 (R10…R12). The part of RF power at the output of ATT2 comes to the input detector D1. The main of RF signal passes 10 dB attenuator (R6, R7, R8, R13) and comes to the input of power amplifier U1.

Amplified RF signal from the pad J2 of the Pre-Amplifier Board, comes to the pad J1 of the Final Stage Board. After 3.5 dB attenuator (RF1, R3) RF power distributes by the splitter Y1 evenly between two amplifying modules U31 and U51.

Combined by Y2 signals go the pad J2 of the Final Stage Board, and then, to the pad J1 of the Output Board. There is the low-pass filter (L1…L3; C12…C15), needed for the harmonics suppression, at the way of RF signal, as well as directional couplers Y1 and Y2. These couplers together with detectors D1, D2 form DC voltage, proportional to the forwarded and reversed RF powers at the unit output.

The unit output connector “RF OUT” is connected directly to the pad J3 of the Output Board.

Keying Circuitry Description.

DC power supply voltage is applied to clamps "+/- 13.8V". There is the power diode DR, which protects the unit against the polarity reversing.

The power supply voltage comparator (Q1 in the Control Board) open the key Q2, if the power supply voltage is less than 16.0 V. Open Q2 delivers the supply voltage to the input power comparator U1. Immediately after DC voltage is applied to the unit, the fan self-test is performed: Q4 opens, opening the fan key Q7 for several seconds.

When the voltage at the output of the input RF detector, coming to the pin J1-2 of the control board, exceeds 1.4 V, a high voltage at the output of U1 (pin U1/1) appears. Then:

- Q5 and Q7 in the Control Board open, switching the cooling fan on;
- the control circuits reference voltage, supported by D9 in the Control Board, appears. The right half of Q3 becomes closed, allowing the reference voltage to go to the circuits;
- 9.5 VDC sets at the output of control/monitoring circuits voltage regulator (Q9, Q10) in the Control Board;
- the bias voltage for RF amplifying modules U31 and U51 in the Final Stage Board appears. This voltage comes to the Pre-Amplifier Board, as well;
- Q11 and Q21 in the Control Board become open, sending the monitoring signal "TX" and the voltage to by-pass or T/R switching relays, if this is necessary;
- the local voltage regulator (Q5…Q9) is activated in the Pre-Amplifier Board, giving the supply voltage for the RF amplifying device U1;
- with the bias voltage coming, key transistors Q32…Q34 and Q52…Q54 in the Final Stage Board open, passing the bias voltage to pins 2 of modules U31 and U41, and giving the supply voltages to comparators of the module current limiters (U32, U52).

Power Control Circuitry Description.

The voltages, proportional to the output forwarded and reversed power, come from pads J4, J6 of the Output Board via the connector J2 of the Control Board to some inputs of operational amplifiers (OA) set U2 in the Control Board. These voltages are levered, i.e., they become equal, when the load VSWR reaches the threshold value ($\underset{\sim}{}$ 2.5). The threshold is setting by the resistor R12 in the Output Board. OA U2-A and U2-B together with D6 are selecting the maximum of forwarder and reversed voltages.

The selected voltage comes to the inverting input of OA U3-A. The reference voltage from the potentiometer RP1 is applied to another input of U3-A. The bias voltage (for modules U31, U51 of the Final Stage Board) is formed at the emitter of Q16. D7 does not allow this voltage to be greater than 5V. When this voltage reaches its maximum, Q15 opens, and LED D8 goes on, indicating that the RF output power control loop is open.

The voltage regulator in the Pre-Amplifier Board (Q5…Q8) is also the part of the power control system. This voltage value is about equal to doubled value of the bias voltage and follow the changes of it.

There are two potentiometers in the Control Board for the power control loop (i.e., the unit output power) setup: RP1 and RP2. RP2 has the access via the hole in the chassis side wall and is intended for the customer usage. Usually, this potentiometer is rotated completely CW, when the output power is setting in the factory. Thus, the customer can only reduce the output power against the set maximum level.

The output power may be reduced automatically with the load VSWR raising (the reversed power detector signal intercepts the power control). If the unit heatsink temperature reaches +85˚C, the contacts of the thermal switch close, and the output power fails by ~ 3 dB down.

The outer power control can be performed by connecting filters “CTRL” or “Sh/D” to the ground, or by connecting a resistor between one of mentioned filters and the ground. Usage of the filter “CTRL” allows to reduce the output power down to – 1 dB relatively to the set up level. Connecting of the filter “Sh/D” to the ground gives a power decrease down to -6.5 dB.

The current limiters in the Final Stage Board do not allow for DC current of the module U31 or U51 to rise above 11A. The voltage drops on the current shunts R49 and R69 are monitored by the microcircuits U33 and U53. The voltages at the outputs of U33 and U53 come to comparators U32, U52. If one of mentioned voltages exceeds 2.5 V, the voltage at the output of U32 or U52 decreases, and the voltage at the emitter of Q32 or Q52 (the bias voltage of U31 or U51) goes down, reducing the gain of U31 or U51. At the same moment, Q31 or Q51 opens and LED D31 or D51 start shining, indicating the current limiter activation.

Monitoring Circuitry Description.

There is the LED Board for the status indication of unit. Green LED “DC ON” goes on, when DC power supply voltage is applied. Any red LED is on in the case of alarm. Also, with the aid of Q17 in the Control Board, the circuitry produces the common alarm signal: low voltage at the filter “ALARM” of the unit.

“LOW OUTPUT” LED turns on, when the output power fails below -1 dB down from the set up level. The activating signal is produced by the OA U3-B in the Control Board, which opens the key Q14, sending the voltage to LED. This signal may be blocked by the open Q13 in the case of high load VSWR that can be the primary cause of the power decrease. Q13 is connected to the output of OA U2-C, which compares voltages, coming from forwarded and reversed power detectors.

“HIGH VSWR” LED turns on, when the voltage of reversed power detector is greater than ~117% of the levered voltage of forwarded power detector. Both levels are compared by OA U2-D. In the case of alarm, the key Q12 opens, sending the voltage to LED.

“HIGH TEMP” LED turns on, when the temperature of heatsink reaches +85˚C; the thermal switch contacts are Closed, and the key Q8 is open.

3. Construction.

Unit dimensions are 19” W x 6-3/4” H x 5” D. It is intended for the rack mounting in the 19’ cabinet.

Four indicating LED are visible through holes in the front panel. All connectors are accessible from the back side of unit. The cooling fan is also placed on the back of chassis.

4. Installation Guide.

Unit is intended for a rack installation in a standard 19” cabinet, where it requires 4U high slot. The installation shall provide a proper air access to the unit; no obstacle for air is allowed closer than 3” from fan and air exits.

Copper wires # 10 AWG shall be use in DC power line. Wires shall be crimped to ring terminals.

5. Operation Guide

- The power supply voltage should be in the limits 12.8 V…14.8 V;
- Do not apply RF signal out of rated 136…174 MHz frequency range;
- The input RF power should be in the rated range - see Table 1 in Block-Diagram;
- Do not destroy the sealing and other labels.

Green LED “DC ON” shines, if the power supply voltage is applied to the unit.

The fan rotates, when the rated RF signal is present at the input.

Red LED “LOW OUT” goes on, if the output power fails to more than 1 dB below the rated level.
It may indicate a problem inside the unit. Be sure that the power supply voltage and input power are in the allowed limits.

Red LED “HIGH VSWR” goes on, when the load VSWR is greater than 2 – 2.5.

Red LED “HIGH TEMP” goes on, when the heatsink temperature exceeds +85ºC.

Part 90 Amplifier This is a 90.219 class B device

Warning: This is not a Consumer device. It is designed for installation by FCC Licensees and qualified installers. You must have an FCC license or express consent of an FCC licensee to operate this device. You must register Part 90 Class B Signal boosters online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in a significant forfeiture penalties, including in excess of $100,000 for each continuing violation

RF EXPOSURE:

The antenna gain used with this transmitter should be 0 dBi or less and all persons should maintain a minimum safety separation distance of 204.4 cm for the United States and 254.4 cm for Canada.