

Power Amplifier AMP-4-150-30-00

User Manual

1. General parameters.

- Frequency range, MHz 136 – 174;
- Output power, W;
 - o nominal ≥ 30 ;
 - o minimum set by local or remote control ≤ 20 ;
 - o in stand-by mode operation < 0.2 ;
- Harmonic level at the output, dBc < -70 ;
- Reversed intermodulation attenuation, dB ≥ 40 ;
- Input power, W:
 - o nominal 6.4;
 - o maximum 8.0;
 - o guaranteeing the stand-by mode operation < 0.5 ;
- Input VSWR ≤ 1.8 ;
- Carrier attack time, ms < 5.0 ;
- Remote control voltage, V:
 - o working range 0 – 9.5;
 - o guaranteeing the nominal output power > 7.0 ;
 - o guaranteeing the stand-by mode operation < 1.0 ;
- Enhancer:
 - o nominal passband gain. 6.7 dB;
 - o nominal bandwidth. 136-174 MHz;
 - o rated mean output power 6.7 dB;
 - o input and output impedances50 ohms;

The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

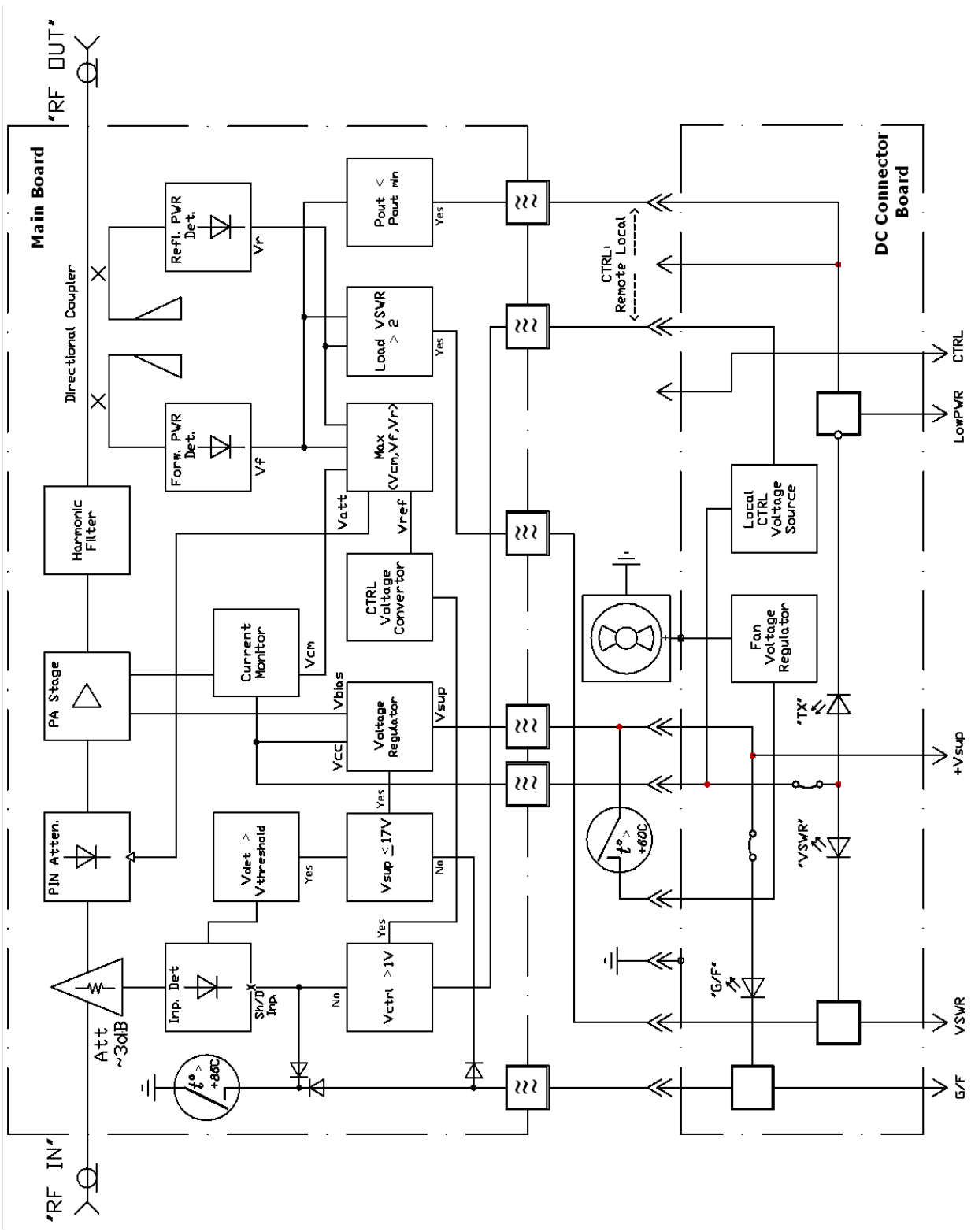


Fig. 1. Block-Diagram.

- Current consumption by the remote control input, mA < 1.5;
- Fan rotation thresholds: heatsink temperature, °C:
 - o activation +(60±5);
 - o reset ≥ + 40;
- Overheat protection thresholds: heatsink temperature, °C:
 - o activation +(85±5);
 - o reset +(70±7);
- Overvoltage protection thresholds, V;
 - o activation 17.8±0.2;
 - o reset 17.3±0.2;
- Load mismatch protection activation threshold, VSWR 2.1 – 4.0;
- LOW level voltage at remote monitoring output, V ≤ 2.0;
- Current, allowed for incoming in any remote monitoring output, mA <10;
- Power supply voltage, V:
 - o working range 10.0 – 17.0;
 - o allowed voltage increase up to 24.0;
 - o guaranteeing the nominal output power 13.8 – 17.0;
- DC current, A:
 - o nominal 5.3;
 - o maximum 7.0;
 - o in stand-by mode operation < 0.0025;
- Input and output RF connectors N-type (F);
- DC connector 32 pin (M).

2. Construction.

Unit is realized as a plug in module – see Fig. 2.

Front panel items:

- RF connectors
- Fan, which brings in air from the front and across the internal heat sink
- Status LEDs
- Access hole to the power set potentiometer
- Handle for moving the unit into/from a subrack
- Four quick release fasteners for fastening the unit in the subrack.

The front panel dimensions are 5.585”(W) x 5.055”(H). The full length of PA does not exceed 8.2”.

The PA module contains two PCB assemblies: the Main Board Assembly and the DC Connector Board.

The Main Board is placed inside a shielded compartment and is fastened on the flat metal surface of Main Plate. The heatsink is attached to the outer side of Main Plate, as well as the fan controlling thermal switch.

The Main Board contains the RF circuits and the majority of DC circuits. The DC Connector Board includes the LEDs, power control potentiometer, fan voltage regulator and three DC connectors. The control, monitoring and supply lines between Main Board Assembly and the DC Connector Board are

routed through feedthrough filters screwed into the Main Plate through an 8-wire cable and two pairs of connectors (6-pin and 3-pin on the cable side, 6-pin and 4-pin on the DC Connector Board). This allows the same cable to handle the two modes of operation (remote or local, depending the which pins are connected).

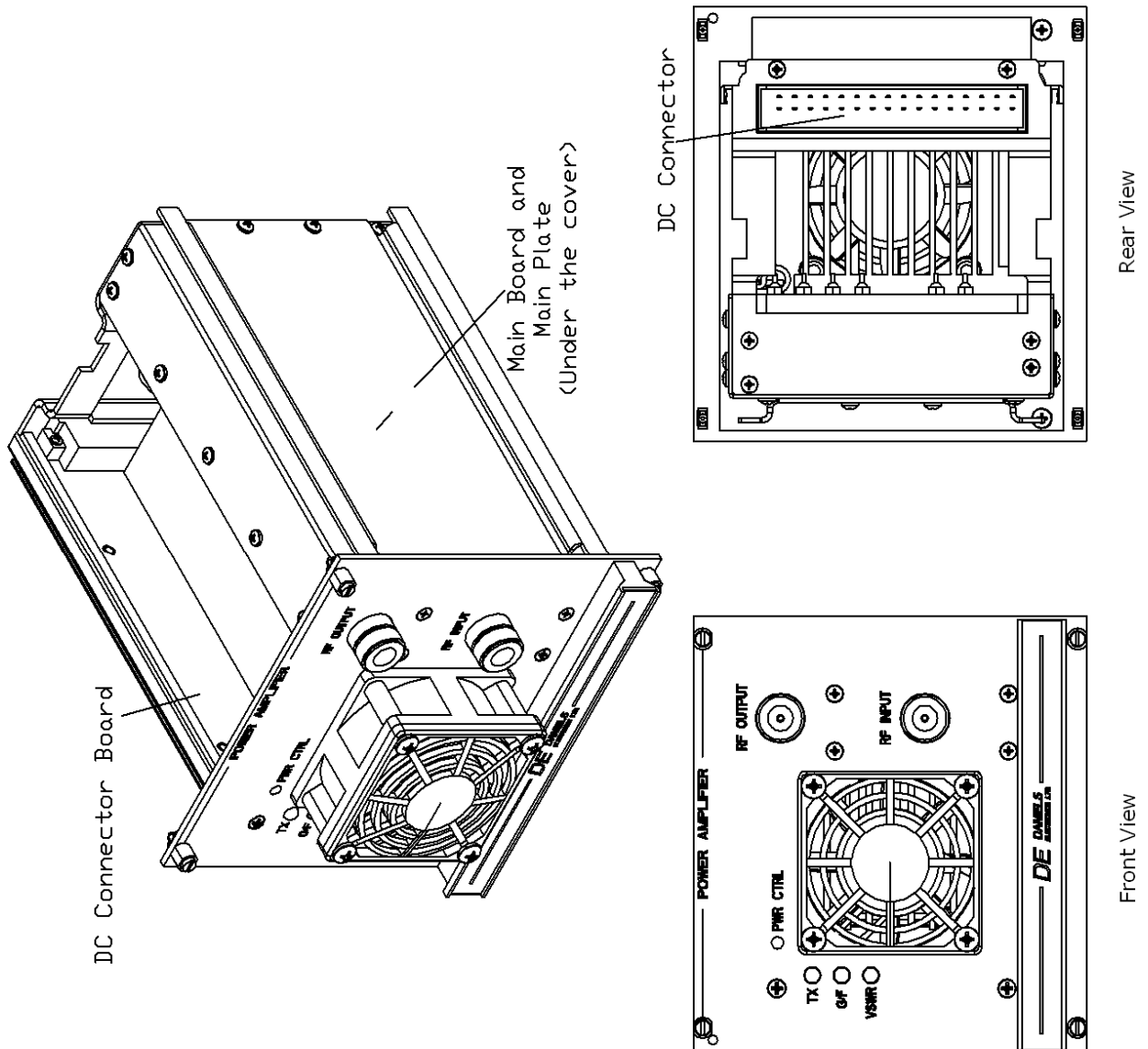


Fig. 2. Construction.

3. Main Board Description.

RF signal from the input connector comes through the attenuator RA1-RA2-RA3 and PIN attenuator (D2, D3) to the input of the amplifying stage (Q100). Amplified power passes the harmonic filter (CF, LF), directional coupler (TR1, TR2) and goes to the output connector.

When the voltage coming from the output of input detector (D1) reaches about 1.2V at the base of Q1, the key Q3 opens and activates the power supply voltage comparator (Q4, Q5). If the power supply voltage is less than $(17.8 \pm 0.2)V$, 5V appears at Zener diode D8, which serves as the source of gate bias voltage for RF transistor Q100, as well as the reference voltage for the main voltage regulator (Q9). This regulator limits the output voltage at the level of about 13.6V or, if the power supply voltage is less than 13.6V, provides the voltage drop on itself of less than 0.15V. Transistor Q6 provide about 0.4V hysteresis in the power supply voltage comparator and keys “G/F” alarm signal of overvoltage.

In the case of overheating, the thermal switch SW1 via D9 blocks the input power detector and keys “G/F” alarm signal.

The PA has a power control loop, which is controlled by levered signals, coming from the output forwarded power detector (DD1), output reversed power detector (DD2) and the sensor of RF transistor DC current (R13, U1). Operational amplifiers U2-A, U2-C and diodes D20, D21 form the circuitry that levers the mentioned sensors signals and sends the biggest of them to the loop comparator (U3-B), which controls the current of PIN attenuator (D2, D3) – the loop performing element. Increase of this current is followed by the attenuation increase.

The circuit U2-B, Q14 controls the output power level and sends the “LOW PWR” alarm signal (i.e., turns off LED “TX”), if the output power is below the rated minimum. The circuit U2-D, Q12 sends the “VSWR” alarm signal, when the levered voltage from the reversed power sensor exceeds the voltage from the forwarded one. Both circuits are not active in stand-by mode of operating.

Operational amplifiers U3-A, U3-C, U3-D convert the outer control voltage to the reference voltage for comparator U3-B, providing the needed law of power regulating and thermal changing. Transistors Q10, Q11 form the circuit that blocks the input power detector, when the control voltage is less than 1V.

There are four potentiometers in the Main Board: RP1 sets the DC current limit; RP2 sets the output power; RP3 sets the “TX” indication threshold; RP4 sets the quiescent current of Q100.

4. DC Connector Board Description.

Diodes D1, D2, D3 combine the circuits of local (LED DL1, DL2, DL3) and remote (via J3) PA status monitoring. The current source (Q1, D4) provide the constant current for alarm LED DL2. Q4 shunts LED DL1, when the output power is below the minimum level.

The fan voltage regulator (Q2, Q3, D5) does not allow the fan voltage to be over 13.5V or keeps it at about 1.1V less than the power supply voltage.

With the aid of potentiometer RP1 a customer may set the desirable output power. Diodes D6, D7, D8 neutralize the circuit, blocking the input detector, when the control voltage is less than 1V.

There are two jumpers (JP1, JP2) in the board – see Fig. 3. When JP1 is cut, “G/F” alarm LED at the front panel is disconnected. When JP2 is cut, both “TX” and “VSWR” LED are disconnected.

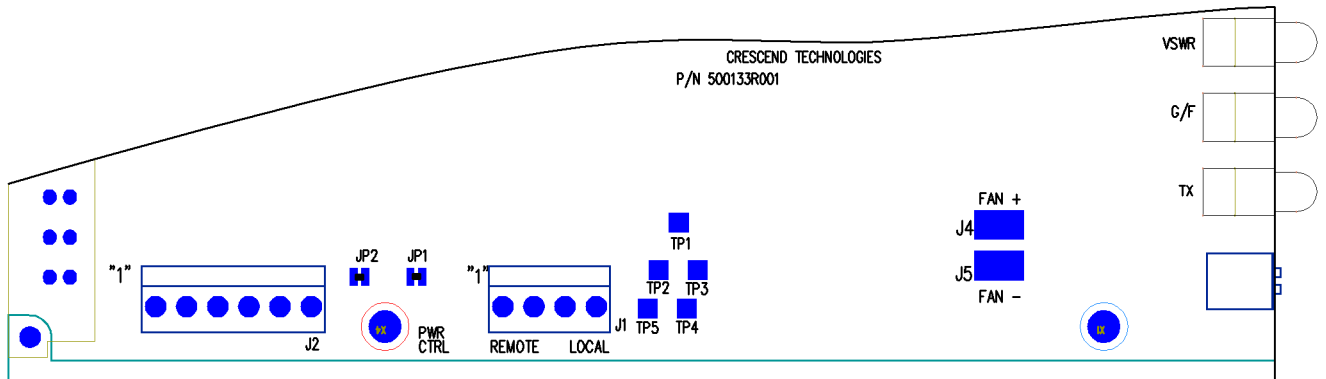


Fig. 3

5. Installation Instruction.

The PA is intended to be installed in unique slot in the Daniels subrack. Before the unit installation, make sure that:

- No mechanical damage exists
- The DC and RF connectors are clean (no dust or debris)
- Jumper JP1 and/or JP2 in DC Control Board is cut, if LED indication at the front panel is not desired
- 3-pin connector is in position, correct for the chosen power control method – see Fig.4;

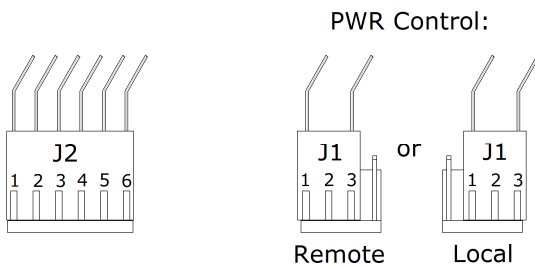


Fig. 4



Fig.5

- DC cables, going to DC Connector board, are inside the unit outline;
- All four quick release fasteners are in position: their screws shall be pushed into the plastic cylinders and slots in heads of screws shall be directed horizontally, as it is showed in Fig. 5.

Provide the correct positioning of leading rails of PA and subrack, then slide PA all way through inside a subrack. Press and turn screws of all quick release fasteners by 90° clockwise or counter clockwise, until PA is fixed in subrack.

Connect RF cables to RF connectors at the front panel of PA.

6. Output power control.

In the local control mode, the 3-turn potentiometer “PWR CTRL” is used for the output power setup. The range of regulation lays between more than 30 W (when the potentiometer is rotated completely clockwise) and less than 20 W in opposite potentiometer position (both numbers are valid for the nominal power supply voltage, greater than 13 V, and RF drive, greater than 6 W). The potentiometer limit is indicated by a clicking noise.

In the remote control mode the output power depends on the voltage applied to pin Z22 of DC connector (Vctrl). This voltage may change from 0 to 9.5 V. When $V_{ctrl} < 1$ V, the PA works as an attenuator, and no more than 0.2 W goes from its output. The minimum rated power (20 W) is reachable with $V_{ctrl} \approx 4$ V; the maximum rated power (more than 30 W) is reachable, when $V_{ctrl} = 6...7$ W.

The output power is also controlled by the load mismatch, overvoltage and overheating protection circuits. In the case of the load mismatch, the power is reduced proportionally the VSWR value, starting from $VSWR > 2$. In the case of overheating (when the temperature of heat sink exceeds $+85^{\circ}\text{C}$), the PA switches to stand-by mode. When the power supply voltage exceeds 17 V, the output power falls to less than 0.2 W.

7. Unit Status Monitoring.

There are two features of PA status monitoring: front panel LEDs and signals at pins of DC connector.

LED “TX” is on, when the output power is not less than 20W.

LED “G/F” is on, when the power supply voltage exceeds 17 V (in active mode only), or if the temperature of heat sink exceeds $+85^{\circ}\text{C}$ (in both active and stand-by modes).

LED “VSWR” is on, if the load VSWR is greater than 2:1.

LOW level of voltage (less than 2 V) at the monitoring pin of DC connector witnesses about the alarm:

- at pin B24: The power supply voltage exceeds 17 V (appears in active mode only), or heat sink temperature is greater than $+85^{\circ}\text{C}$;
- at pin B26: The output power is less than 20 W(appears in active mode only);
- at pin Z26: The load VSWR is greater than 2:1.