

A/D Converter Modifications Instructions for the Palomar Telecom Controller RBC-7XX Version 2.02

Palomar Telecom Controller Software Version 2.02 includes changes to enable the Analog to Digital Converters to operate properly. These instructions detail hardware modifications that must be checked and incorporated into the Palomar Controller to enable the A/D function to work.

Analog to Digital Converter Hardware Modifications and Testing

1. Turn the controller power switch to "Off".
2. Remove the Voice Card, slot #9.
3. Verify that the A/D IC is installed in socket U-16. It is a 28 Pin ADC0808 located next to Pin A on the card edge connector. An ADC0809 will also work in this application. The chips are commonly available for about \$6.00.
4. Next, check the card cage for the proper wiring. On some cages, the wires were in the wrong holes on the back plane. Pay careful attention to the wires on the right side (from the back) of the socket and note that they are offset by one hole as shown on the diagram on page 2. Some cages were not wired at all. In this case the wires will need to be added going from the backplane to Barrier Strip F. See the diagram and table on page 2.
5. Part of the problem with getting the card to read correctly has to do with the card address timing. Add a capacitor to the start/ALE line of the ADC0808. Install a .005uf cap between pins 22 (ALE) and 16 (GND) of the ADC0808. You may have to experiment a little with values to get the board to work correctly.
6. Install the Version 2.02 firmware. You will need to re-initialize the eeprom.
7. You can test the various sections of the chip using the controller's built-in monitor.

Function "**Display Mode 'D'**" followed by the ram storage address in HEX for each section: E206 – E20E. You will see the A/D raw data in HEX from 00 – FF on the display. Use * for E and # for F

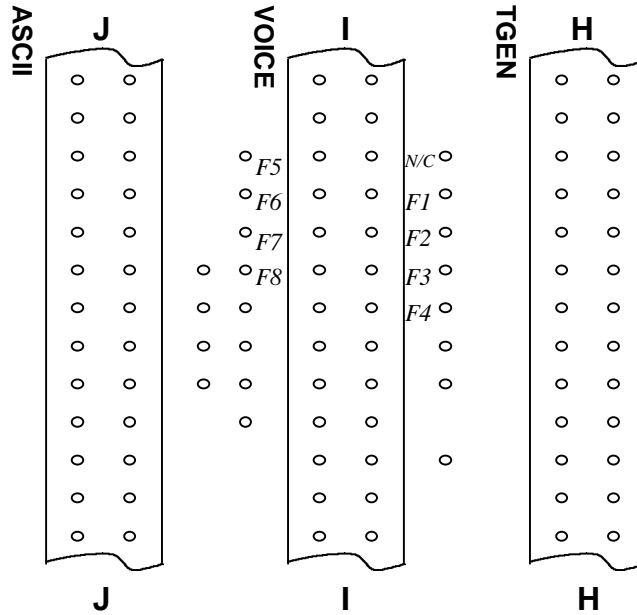
Example for Section 1: Function "**Display Mode 'D'**" then *206 - This enters ram address E206. The display will show the contents of the address.

Example for Section 7: Function "**Display Mode 'D'**" then *20D - This enters ram address E20D. The display will show the contents of the address.

H. The input to the A/D **CANNOT** exceed +5Vdc otherwise the A/D chip will be damaged.

Do not exceed 5 volts on the input to the chips. A simple voltage divider consisting of a series 22K fixed resistor and 10K trim pot, connected between the source and ground, will allow you to easily scale a 12 volt source to be read by the A/D Converter.

To check the wiring of the A/D from the backplane to Barrier Strip F, open the rear swing out panel that the Barrier strips are on. View the hole pattern around Voice Card socket, Slot #9, from back of card cage as shown below. Wires should be routed from the 'F1' through 'F8' feedthrough holes around the Voice Card to "Terminal Strip F" pins 1 through 8. See the diagram and table below for the connections.



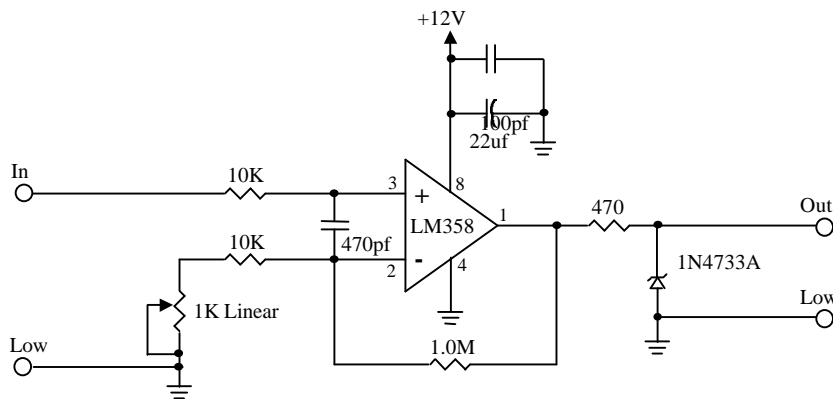
Backplane Feedthrough	Barrier Strip F Terminal
F1	1
F2	2
F3	3
F4	4
F5	5
F6	6
F7	7
F8	8

A/D Wattmeter Instructions

The Version 2.02 software contains a lookup table to convert the A/D Input to a Bird wattmeter reading scaled from 0 watts to 50 watts. The instructions below provide the information needed to configure the wattmeter indicator. The lookup table was developed using a Bird wattmeter and a 50 watt 200 – 500 MHz element connected to the transmitter output. Since the input to the buffer circuit is taken from the input to the meter, the wattmeter function should work with any frequency range Bird 50 watt element, but has not been verified.

Several Op Amps are usable for the Power Meter buffer amplifier schematic shown below, including the LM358, LM258, LM158, LM2904, LM3900, MC33171, MC33172 and MC33174 although pinouts may vary from the schematic drawing. The circuit can be built on a portion of a general purpose circuit board material, such as Radio Shack (Part #910-3808) or others. The Bird 50 watt 200 – 500 MHz element will provide about 0.045mv DC at an indicated output of 50 watts. The input to the Op Amp is high impedance and the output is clamped with a 5.1 V Zener to protect the A/D Converter. The pot in the circuit can be adjusted for full scale gain to reflect the correct output level as indicated by interrogating the Palomar Controller. To read the A/D Converter as if it were a wattmeter from 0-50 watts, use the function "**Read A/D X Analog Input as Wattmeter**", where X = the appropriate A/D input. The data embedded in the software is a table of values emulating the Bird wattmeter's non-linearity.

The input to the Op-Amp circuit below comes from the meter connections of the Bird Wattmeter. The positive (+) connection is wired to the Op-Amp circuit "In" connection. The "Out" connection is wired to the desired A/D Input on Barrier Strip F. Due to the very small voltages being measured, it is recommended that the low side connection of the meter also be utilized. A ground connection to Barrier Strip F, such as Pin 16, should be wired to the card cage ground.



Thanks to KD7DR who supplied additional documentation and the variable voltage source for testing and to KB7RFI who helped map out the wattmeter scale and especially to W7IXA who designed the op-amp interface circuit.