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A430 INSTRUCTION MANUAL

A430 OPTICAL AMPLIFIER BOARD

AND

THRESHOLD DETECTOR CIRCUIT

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1. Introduction: You have purchased an O.E.M. Optical amplifier board that can be used as part of any system to amplify small negative current signals from photo detectors from compatibility with Data Loggers, and other electronic systems.

2. Objective: The A430 OPTICAL AMPLIFIER BOARD increases the power of the small photo currents, converts these weak analog negative currents to a strong positive analog voltage signal that is gain adjusted to be appropriate for the application at hand. In addition the A430 will make a decision both by Light Emitting Diode (LED) output, or by a 0-5 volt logic signal, to indicate whether the signal is greater than or less than the upper third of the voltage range. In addition, the A430 as an inverting power supply to provide a negative bias voltage for vacuum photodiodes or photo conductive detectors. The gain is fully regulated to maintain the same output with changes in supply voltage from 5 to 9 volts d.c. Since the Optical amplitude of different light systems can vary over great extremes, we have given the user the ability to adjust the gain over a range of 300 to one using a 27 turn potentiometer. If you add a factor of three for the most sensitive range, you get a user range of 1000 to 1 to match the application. If your light is too bright, you may use optical attenuators to meet your application.

3. Input Devices:
   a. Detectors: These first prototype boards were designed to accept our SEL series of detectors. Later production versions will probably accept the SED series of detectors. The SED types have a male 15 pin DB-15 plug on them which is readily available should you want to use your own device. Pin 6 is the input pin and pins 5 and 7 are the ground return pins. For photovoltaic operation, the cathode of a semiconductor type detector is connected to the input. Conversely the anode of a vacuum photodiode or photomuliplier is connected to the input pin 6. Pin 9 provides a negative bias voltage approximately equal to the positive input voltage (5-9 volts), for use to bias a photoconductive device or vacuum photodiode, and for increasing the speed of response for fast dynamic applications. In the a.c. situation, the anode of a semiconductor is put to the negative bias voltage to prevent junction saturation. Normal small signal applications and for lower leakage applications, connect the anode to ground on pins 5 or 7.

3. Continued
   b. Current Range: The gains adjust is designed to accept currents from 100 nanoamps up to 40 micro amps. This gives the user a large range to work in before he must attenuate the optical input.

4. Threshold Output: Another feature of the A430 is its ability to make a threshold determination to be used as an alarm or to perform the initial gain adjustment. This decision is available as a LED display light, or by 5 volt logic level, where the low level alarm condition is 5 volts on the logic output or light “ON” for the LED output.
   a. LED for optimum gain adjusts: The LED helps set up the amplifier. The user adjusts the LED until the light goes out then turns the gain down (counter clockwise adjustment) until the light just comes on. This is the gain point where the output is 60 percent of full scale. If an alarm condition is to be established, you can adjust the gain ‘pot’ clockwise above the threshold by the amount of alarm margin. The potentiometer will adjust 24% per turn. A half turn is 12% and so on.
   b. Analog Gain adjust: If you use a voltmeter on the analog output, the threshold is at three (3) volts, so you can adjust the gain to an appropriate voltage for your application. The amplifier will go up to the power supply input voltage. In other words if the supply voltage is 5 volts the amplifier will saturate at 5 volts as the upper limit.
   c. Logic Output: If you want to use logic into a computer, you can put a voltmeter on the logic output and adjust the voltage to the transition point between 5 and zero volts. Since the gain adjust changes the gain by 24% per turn, you can set the operating point above or below the threshold by an appropriate percentage.

5. Analog Output: In 4b above, we mentioned the use of the analog output to adjust the gain. The analog output is also the signal that represents the magnitude of the light level. Once you establish the desired gain, the analog output voltage can be inserted into a data logger, recorder, or computer, to represent the light level as a measured quantity. This can also be used into an oscilloscope for fast events.
   a. Zero Adjust: The 20 K potentiometer is the zero adjust. This can be trimmed by covering the detector and adjusting the analog output for zero volts.
   b. Voltage Range: The voltage range is from zero (0) volts to a hundred millivolts below the power input voltage. If the power input voltage is 5 volts, then full scale is 4.9 volt
   c. Dynamic Considerations (ac signals): If you have an interest in rapidly changing light functions, you may want to observe the analog output using an oscilloscope, or capture the data using an a-d converter into a computer. The output is the lower impedance output of an operational amplifier, which can drive more than 5 milliamps into a users load at speeds up to 20 kHz. The speed changes as a function of current, but generally audio frequencies are obtainable. For faster response the 500 Pico farad capacitor around the first amplifier (U1) could be reduced

6. Ambient Operating Conditions: The amplifier was designed to remain stable over the temperature range of 0 to 40 degrees Celsius. The operational amplifiers and the log amplifier are all differentially matched to compensate for a change in temperature.
7. Protective mounting Considerations: The Printed Circuit (PC) board is designed so you can mount the board by putting screws through the rubber feet up against the metal bulkhead. The inside of an instrument case will give the proper electrical and mechanical protection for the sensitive electronics.