

# M302A OPERATING MANUAL

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## Product Overview:

The Model 302A amplifier is designed to drive a number of different Conoptics E.O. modulators 350, 360 and 370 series. All types of modulators supplied with the system are configured as lumped capacitors (two terminal devices). The amplifier has a 50/1K ohm, single ended input (J3 SIGNAL INPUT) and a push/pull output (J1 & J2).

## Special Notes:

Special instructions for Model 302A with Model 350-160 for Thorlabs

1. The Model 350-160-02-BK is very close to "0" volts null when operating between crossed polarizer's
2. The Model 302A when set for "Uni-Polar Positive" input automatically puts 175Volts across the modulators terminals
3. Do No Adjust the Bias for "0". Adjust the Bias Meter Voltage to +175Volts, which should then yield close to zero volts across the modulator

## CAUTION: BEFORE APPLYING POWER



Please review this manual and become familiar with all safety markings and instructions.

Insure that the equipment mains (line) voltage as specified on the rear panel is in accordance with desired AC source. Safe operation of this equipment may be jeopardized by use other than specified by Conoptics.

## INTENDED USE

This equipment is designed for general laboratory use. It is intended to be used with a number of Conoptics Electro-Optic Modulators only. The amplifier is designed to drive a capacitive load that is floating with respect to ground. Any use other than in direct connection with supplied optical modulator can result in severe damage to the amplifier and potentially hazardous voltages to external equipment and personnel. This amplifier must only be used in accordance with the detailed instructions provided in the manual.

## WARNING: HAZARDOUS VOLTAGES



Hazardous AC and DC voltages are present on the center pins of the BNC connectors on the rear panel marked J1 and J2 “AMPLIFIER OUTPUT”. No attempt should be made to come into contact with these pins or to attempt to verify operation of the amplifier by monitoring these connectors with an oscilloscope or other test equipment. In addition, the equipment should be turned off before any of the supplied cables are connected to or disconnected from the driver or modulator.

## SAFETY GROUND

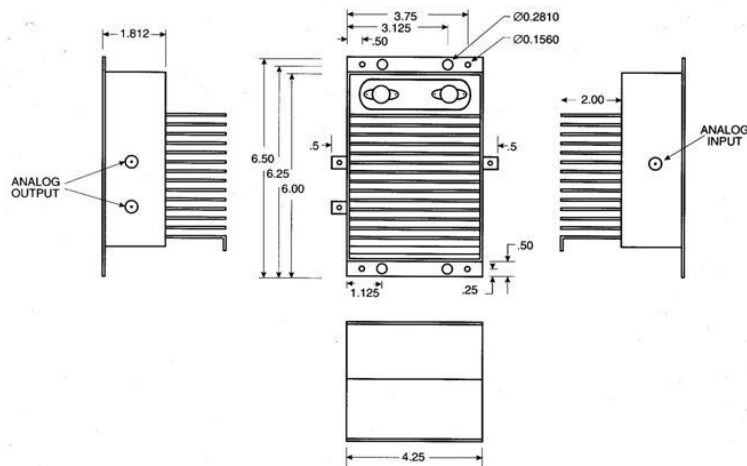
This equipment is equipped with a protective earth terminal. This terminal is provided by a common or ground wire in the power cord. The main power source must supply an uninterrupted return to an earth ground. The equipment must not be used if this earth return is not supplied.

## SERVICE CAUTION



Only qualified personnel must perform adjustment, maintenance, or repair of the equipment. Hazardous voltages are present within the instrument and contact may result in personal injury. Any attempt to trouble shoot or adjust any controls within the system should be discussed with Conoptics first at [support@conoptics.com](mailto:support@conoptics.com).

## Model 302A Driver Specifications



### Typical Applications

- Driver for 360 LTA Series Phase & Intensity Modulators
- Driver for Model 370 ADP Series Phase & Intensity Modulators
- Driver for Model 380/390 ADP Series Modulators
- Driver for Model 310A Beam Deflector

#### **Key features:**

Input Requirement:	2 Volts p-p
Input Impedance:	50 ohm
Output Voltage:	350 Volts p-p
-3db Bandwidth:	1.0 MHz with 90pf load
dc bias:	+/- 450 Volts
Driver Cabinet:	6.5" W x 4.125" L x 4.15: H
Power Supply:	19" Rack x 5.25" H

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## Model 302 Theory of Operation:

The amplifier is DC coupled and is capable of putting out a maximum of 400 Volts Peak-to-Peak into a capacitive load. The bandwidth of the amplifier is limited by load capacitance, but typical response times of 400nm ( $T_r$  and  $T_f$ ) are obtainable with load capacitance of 90pf or less. The high voltage output is obtained by two high power operational amplifiers, operating push-pull. One operating in the inverting connection, while the other operating non-inverting.

Amplifiers  $U_1$  and  $U_2$  are the output drive amps. Each has a supply rail of  $\pm 140V$ .  $U_2$  is operating non-inverting, and  $U_1$  is inverting. They are driven by a single high speed op-amp,  $U_4$ . The output amps run at a forward gain of 100, thus delivering a total forward gain of 200v/v.  $U_{10}$  and  $U_5$  are used to regenerate the "tweaker pulses" derived by the sampled auto bias servo card in the power supply electronics when the system is configured with this option. In order to obtain the maximum dynamic range out of the amplifier, some method must be employed to account for differing types of video input formats, for example:

1. Bipolar, ( $\pm 1v$  about gnd)
2. Unipolar pos. or Unipolar neg.

If the output amplifier's output voltage were zero volts for zero volts in, then each amplifier would be cable of taking  $\pm 1$  volt at it input, amplifying it to  $\pm 100v$  without going into saturation because of the power supply rails. If the input signal were set to Unipolar (0V to +2V) and the output amplifies were zero volts out for zero in, the maximum output for each amplifier would be limited to 140v, for a maximum of 280V output swing total. Thus the operating point of the output stage should be optimized for different types of input signals. This operation is performed by  $U_3$  with inputs from  $U_6$ ,  $U_7$  and  $U_9$ . For Bipolar input signals  $U_3$  output is zero volts, making  $U_4$  quiescent output zero volts. This sets the output amplifiers at zero volts out for zero volts in (video in). For Unipolar Positive input signals,  $U_3$  output is approximately +2V, making  $U_4$  quiescent output -2V. This forces  $U_2$  to go to -125V,  $U_1$  to +125V, for the zero input volts. Now the amplifiers are able to swing from -125 to +125 and from +125 to -125 respectively, in response to a zero to +2V video input signal. For Unipolar Negative inputs,  $U_3$  output is -2v, making all the amplifiers "flip" to the opposite operating extreme.  $U_3$  operates as a buffer with  $U_7$  selecting the appropriate input reference voltage from  $U_6$  and  $U_9$ .

Bias voltage for positioning the modulators quiescent operating point obtained from the differential amplifier  $Q_1$ ,  $Q_2$ ,  $Q_4$  and  $Q_5$ . This amplifier is capable of  $\pm 550V$ , bias voltage at the driver output terminals.

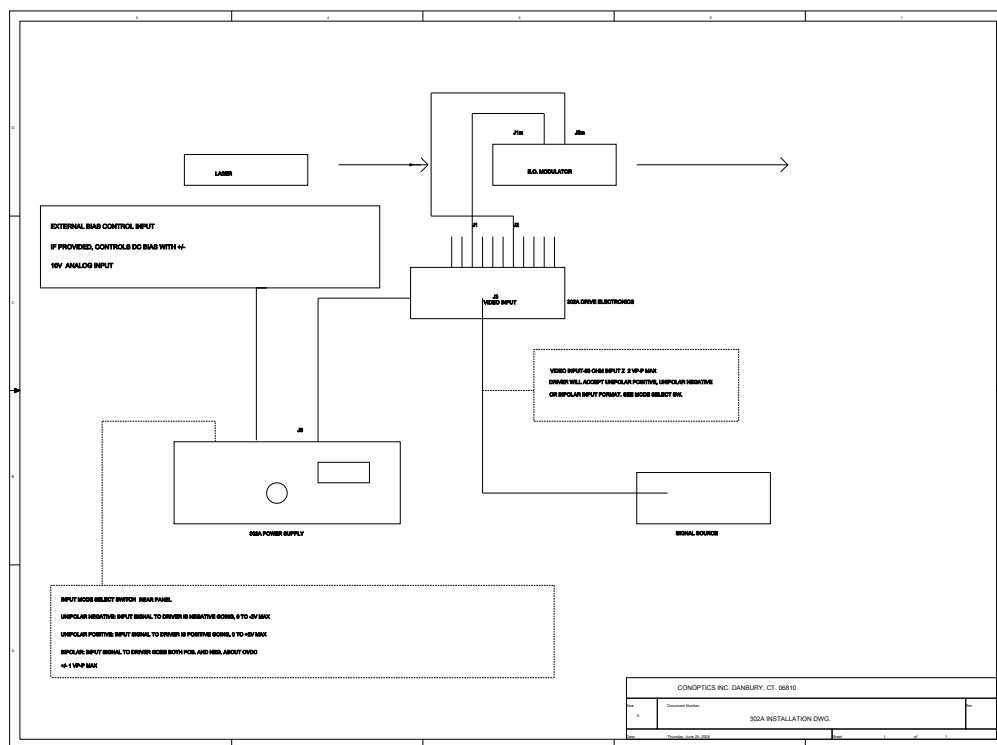
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## User Operation

In order to minimize the static DC operating potential across the E.O. cell, the bias voltage as noted n the front panel of the power supply should be adjusted as follows:

1. When operating in the Unipolar Positive Mode, the bias should be adjusted in a positive direction to reduce the static offset introduced by the drive electronics when operating in this mode.
2. When operating in the Unipolar Negative Mode, the bias should be adjusted in a negative direction to reduce the static offset
3. When operating in the Bipolar Mode, either direction is acceptable as the static offset of the driver is zero volts.



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