Model 275 Linear Amplifier

SPECIFICATIONS

OUTPUT:

- Output Drive level: > 275 V p-p push –pull into a capacitive load.
- Bandwidth: DC > 8MHz with 90pf load and 3 M RG-62 between driver output and modulator.
- Bias Voltage: > +/- 400VDC summed into output signal. Infinitely adjustable via ten turn potentiometer on front panel.
- Gain: approximately 275V/V.
- Output Impedance: approx 200 Ohms resistive, (Differential) output is not short circuit proof!

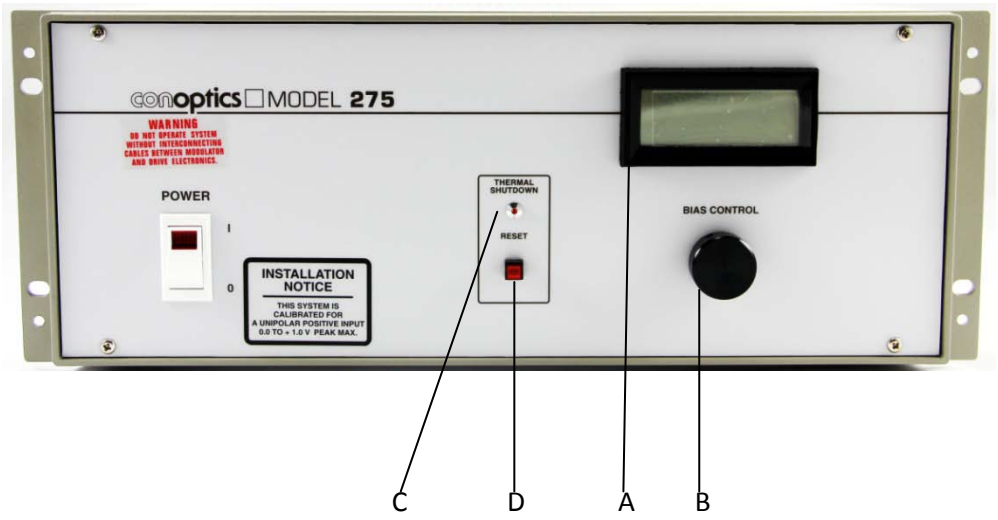
INPUT:

- Input Impedance: 50 Ohms nominal.
- Input Signal Level: 1V p-p Max into 50 ohms.
- System will accept unipolar as well as bipolar input formats. Requires internal adjustment to change input format.
- Line Voltages: 100VAC through 240VAC 50/60Hz. System employs wide input range switching mode supplies except for HV Bias supply which requires primary wiring for differing line voltages.
- Input power: Approximately 350W
- System is air cooled and thermally protected from loss of forced air or high ambient temperatures.

DIMENSIONS:

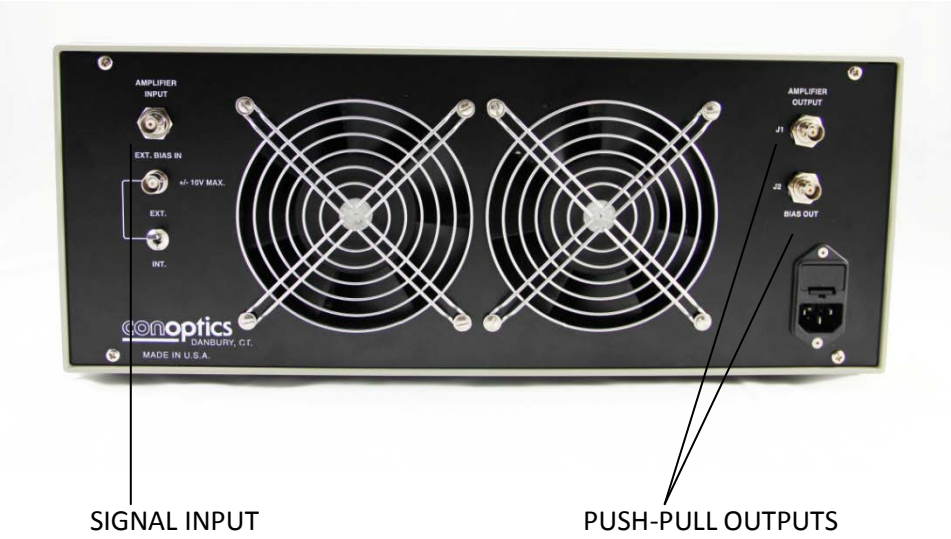
- 22.7”(577mm)deep X 8.75”(222mm)high X 16.88(429mm)wide
- Weight: 45lbs (20.4kg)

CONTROLS AND INDICATORS



- **A: <u>Bias voltage</u>**; Indicates the differential DC bias applied to the optical head
- **B: <u>Bias Control</u>**; Ten turn potentiometer for control of DC bias applied to optical head, approximate range is +/- 420 VDC.
- **C: <u>Thermal Shutdown LED</u>**; when lit indicates driver heat sink has exceeded internal preset limit and all DC power with the exception of -550VDC power has been shut down. Driver will no longer function until manually reset. LED will stay on until sink temperature has decreased to a level that normal operation may resume.
- **<u>D: Reset Pushbutton</u>**; Illuminated pushbutton switch that, when flashing, will command all power supplies to resume normal operation. Thermal shutdown LED <u>MUST</u> be off and reset pushbutton <u>MUST</u> be held in for 7-8 seconds for the reset to occur.

REAR PANEL CONNECTORS



SIGNAL INPUT PUSH-PULL OUTPUTS

1) SIGNAL INPUT: The amplifier is designed to accept three types of input signal formats.

1.1) BIPOLAR- This type of signal extends both in a positive and negative

- direction about ground (0.0v) the maximum excursion allowed is 0.50
- positive above gnd and – 0.5v in a negative direction. Any signal peaks
- Exceeding these limits will drive the amplifier into the DC rails of the internal power supply. This will result in " clipping" of the output waveform with severe distortion.

THE INPUT SIGNAL SHOULD BE OBSERVED WITH AN OSCILLOSCOPE BEFORE CONNECTING THE SIGNAL TO INPUT CONNECTOR TO INSURE THE ABOVE LIMITS ARE NOT EXCEEDED. LARGE INPUT OVERDRIVES MAY CAUSE THE AMPLIFIER TO FAIL.

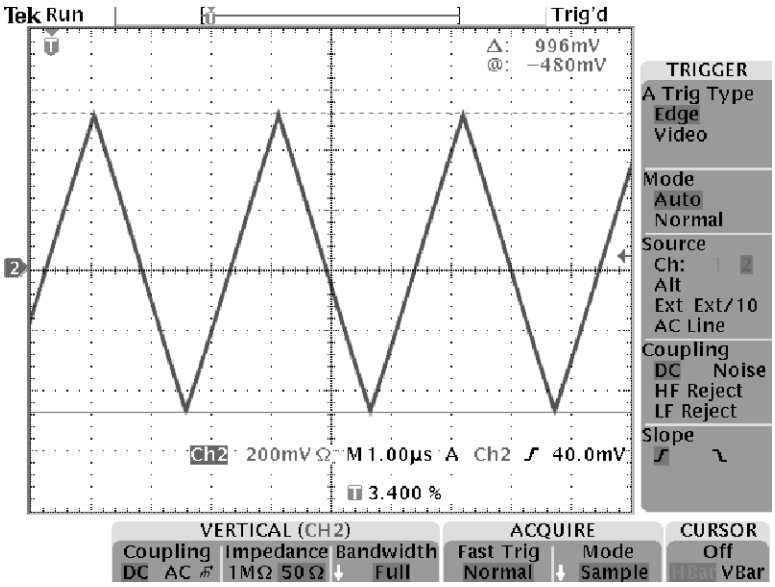
1.2) UNIPOLAR POSITIVE:

This type format is typical of most digital logic signals, pulse generators and D/A converter outputs. The amplifier, when setup to accept this format, will operate properly with a 0.0v to +1.0v peak signal into 50 ohms at J4 rear panel connector. The maximum input signal must not exceed 1.0v peak even if the peak-to-peak signal is less than 1.0v. This condition maybe be due to the input signal having a small DC offset when at “logic 0” typical of TTL logic (“ Vol’). As this amplifier is DC coupled, any offset appears as a “signal” to the amplifier. No adjustment within the amplifier is available to remove this offset, it must be removed, if desired, by external circuitry.

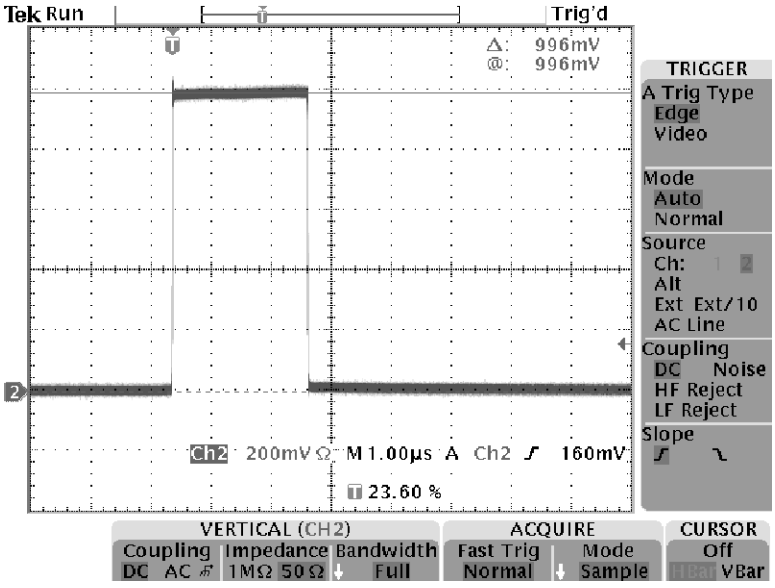
1.3) UNIPOLAR NEGATIVE:

This type of input may be used but is seldom employed. The requirements for this format are the same as in the POSITIVE UNIPOLAR input with the exception being that the limits extend from 0.0v to – 1.0vdc.

Two examples of the more frequently used input are depicted in the scope photos below.



BIPOLAR INPUT



UNIPOLAR POSITIVE

The amplifier outputs are differential and each will deliver approximately 140v p-p into the capacitive load of either an E.O. modulator or beam deflector. The outputs are 180 degrees out of phase and thus deliver a total of 2Vo or 280v p-p out. The bias voltage is summed into the output and provides a means of setting the quiescent operating point of the moduator or centering adjustments for beam deflector applications. By adjusting the static DC voltage across the modulator, the proper “no signal” operating point may be set. Typically, all transverse E.O. modulators exhibit some intrinsic “static birefringence” which maybe be minimized by applying a DC voltage with the proper polarity across the crystals.

$$vi := 0, .01 .. 1$$

vi represents typical unipolar input signal to driver (linear ramp)

$$V(vi) := \left(\sin\left(\pi \cdot \frac{vi}{2}\right)\right)^2$$

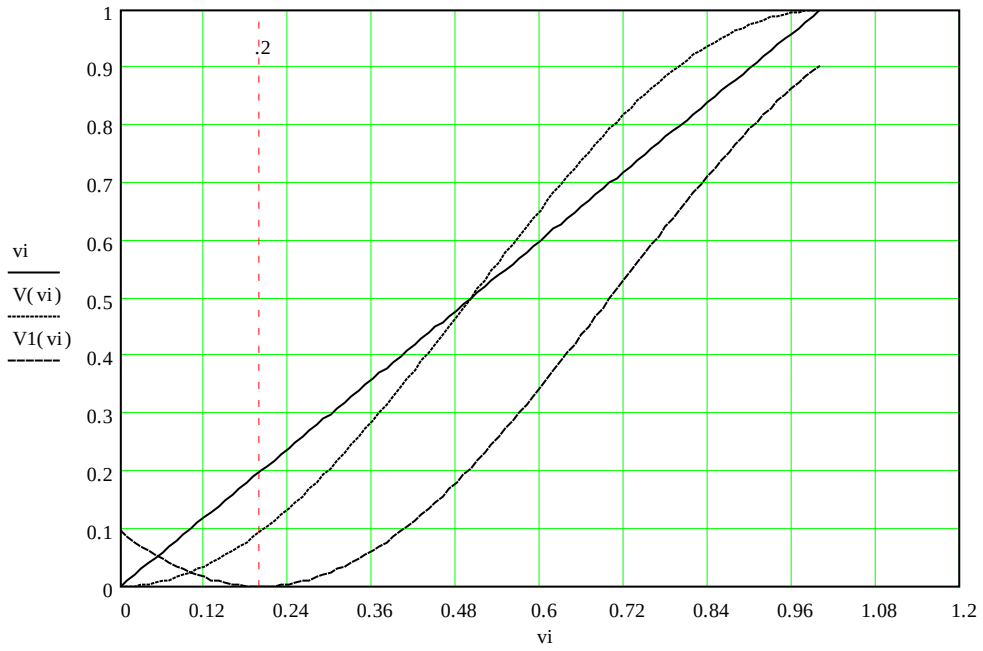
V(vi) represents typical modulator/polarizer response to applied voltage

with no residual birefringence.

$$V1(vi) := \left[\sin\left[\pi \cdot \frac{(vi - .2)}{2}\right]\right]^2$$

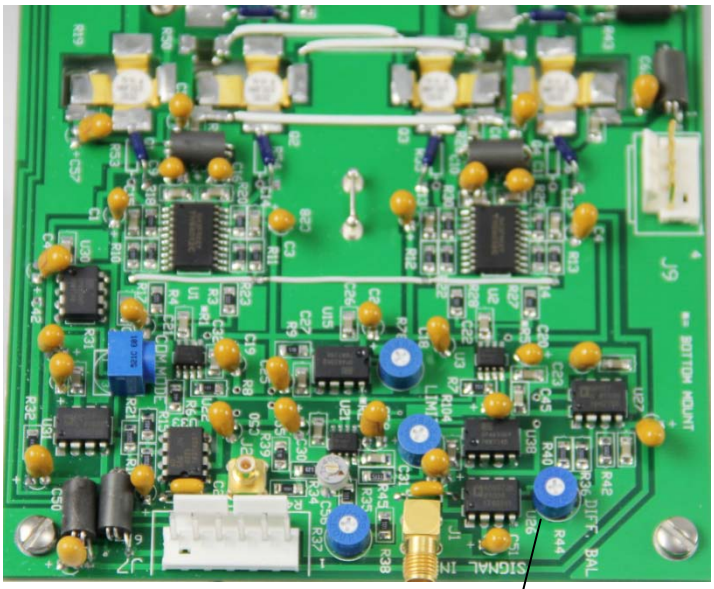
V1(vi) represents typical modulator/polarizer response to applied voltage including the effect of some fixed residual birefringence.

The plot below shows the resultant normalized intensity response of the modulator/polarizer with and without residual birefringence to the applied input signal.



Assuming that the desired optical response from the modulator is minimum transmission @ vi = 0 and maximum transmission when vi = 1, it is evident that the response for V1(vi) will require the plot to be moved in a negative direction to fit the plot V(vi). By applying the required negative DC bias voltage to the cell, the "0 volt birefringence" is pulled out. The modulator's operating point is also somewhat sensitive to ambient temperature and throughput laser power (high power applications), the bias control should also be used to insure the proper operating point is maintained for these effects.

PROCEDURE FOR CHANGING INPUT SIGNAL FORMAT



DIFFERENTIAL BALANCE (R44)

In order to achieve the greatest dynamic range out of the amplifier, some method must be employed to position the operating point of the amplifier such that it can deliver the maximum peak to peak swing out for differing waveforms. For example, if the desired input signal is a bipolar type such as a sine wave or triangular wave, the driver quiescent operating point would be in the middle of it's dynamic range so that it can swing both positive and negative by an equal amount without "clipping" the waveform. In the event that the waveform is going to be unipolar, like a pulse, the driver should be set such that the non-inverting side of the driver is at the most negative point of the driver dynamic range and the output stage swings from this point in a positive direction to the maximum positive point in its dynamic range. The inverting side should do just the

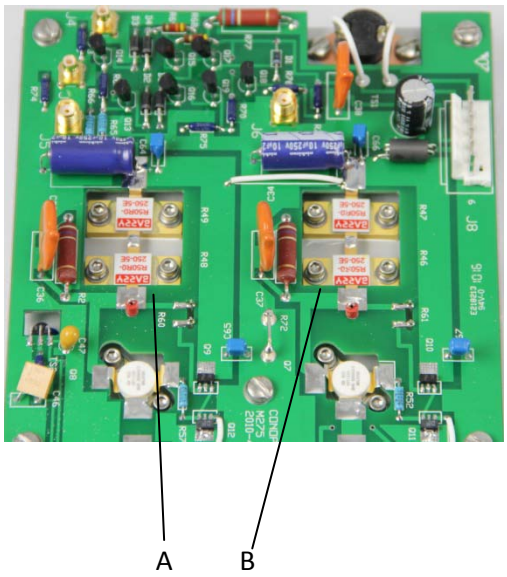
opposite. This adjustment is accomplished by the DIFFERENTIAL BALANCE CONTROL. This adjustment puts a " tip" in the amplifier to allow for various input signal types.

By applying an offset voltage to the "undriven" side of the differential amplifier, the static operating point of the driver my be adjusted to accept any typical signal input without forcing the driver into saturation and cutoff at the extremes of the input signal.

ADJUSTMENT PROCEDURE

1) Disconnect any input signal from the driver.
2) Remove top cover (4 philips head screws)
3) Dual channel oscilloscope w Ten Meg probes.

OUTPUT STAGE TEST POINTS



Test point **A** is the inverting side of the amplifier, Test point **B** is the non-inverting side of the amplifier.

UNIPOLAR POSITIVE INPUT: Monitor both sides of the amplifier with a dual channel scope and 10 Meg probes, adjust **R44**, (DIFFERENTIAL BALANCE) fully CCW. This pot has no stop @ either of it's limits, 5 full turns should be adequate to reach the correct operating point.

UNIPOLAR NEGATIVE: Same as above but rotate **R44** fully clockwise.

BIPOLAR: Monitor both test points and rotate **R44** until both test point **A** and test point **B** are the same voltage (approx + 100v). This adjustment does not affect the gain of the amplifier.