MODEL 476
SCANNING INTERFEROMETER DRIVER

INSTRUCTION MANUAL

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The Model 476 Scanning Interferometer Driver provides a control voltage to regulate the expansion and contraction of the piezoelectric element contained within an electronically tunable interferometer. The Model 476 adjusts the air-spacing between interferometer mirrors, shifting the frequencies of optical transmission peaks of the interferometer.

The major electronic circuits of the Model 476 are:
- Scan Generator and Scan Amplifier
- High-voltage Amplifier
- Vertical Amplifier
- Heater Control
- Power Supplies

SCAN GENERATOR AND SCAN AMPLIFIER

The scan generator circuit (lower left corner of Figure 1) produces sawtooth waveforms of fixed amplitude but variable duration. The duration of each single sawtooth waveform is determined by the setting of the variable Sweep Time control on the front panel (see Figure 2).

The scan amplifier (lower center of Figure 1) amplifies the sawtooth waveforms generated by the scan generator. The output of the scan amplifier is available at the Horizontal Output jack at the back panel for controlling scope horizontal sweep. Horizontal sweep is designed to be proportional to the change in frequency of the interferometer transmission peaks. This is an indication of relative frequency, not absolute frequency.

The Dispersion and Variable controls (see Figure 2) provide attenuation of the sawtooth signal before it is fed into the high-voltage amplifier. This voltage controls the frequency width of the scan. The scan amplifier also has a blanking switch on the back panel just above the vertical amplifier output jack which provides blanking of the vertical amplifier output at each end of a scan and during retrace.

CONNECTIONS

A block diagram is provided (see Figure 3).

HIGH-VOLTAGE AMPLIFIER

The input signal to this amplifier comes from the scan generator via the scan amplifier. The amplifier (right side of Figure 1) contains provision for setting the DC level of its input signal (Centering control) as well as provision for limiting the maximum output voltage to 300 VDC rather than 1000 VDC.

VERTICAL AMPLIFIER

The separate vertical amplifier (Figure 4) is designed to amplify signals from current sources such as silicon photodiodes and for display on an oscilloscope. Blanking is available to eliminate the initial, final, and retrace portions of a scan. The amplifier has a maximum sensitivity of 0.5 VDC/nA and can be driven by a voltage source through a series resistor.

The vertical amplifier can be used to sum two or more current sources at its input. For example, the outputs of two photodiodes can be connected directly to the input to generate a difference signal for two light beams. Voltage sources can be summed through externally mounted resistors as in conventional operational amplifiers.

HEATER CONTROL

The heater control circuit (Figure 5A & 8) provides temperature-regulated current to an interferometer heater to maintain air-spacing at a nearly constant value as ambient temperature changes. The adjustable potentiometer (R71, Figure 5A), which sets the equilibrium temperature, is inside the Model 476. To be sure that the potentiometer is set for proper regulation of heater voltage, check heater voltage at pin 8 (see Figure 6).

POWER SUPPLIES

The Model 476 is capable of operation on either 115 or 230 VAC input and the power supply (top of Figure 1) provides high and low voltages for use by other circuits.
MODEL 476 FRONT PANEL CONTROLS

POWER:

ON/OFF  A slide switch that applies power to the Model 476.

VERTICAL GAIN:

A 5 position switch that changes the gain of the vertical amplifier in steps of 10x. Maximum gain is 0.5 VDC/μA.

VARIABLE  A continuous control that varies the gain of the vertical amplifier from nil to the maximum setting of the Vertical Gain control switch.

SWEEP:

TIME  A continuous control for sweep speed. Full clockwise is maximum speed.

FREE RUN/HOLD/SINGLE SWEEP  A toggle switch that selects repetitive triggering in Free Run, a single trigger pulse in Single Sweep, and prevents triggering in Hold.

DISPERSION:

A six-position rotary switch that selects the maximum sweep amplitude to be a precise fraction of the minimum possible sweep amplitude (i.e. 2, 10, etc.).

VARIABLE  A continuously variable control that adjusts the sweep amplitude (dispersion) from nil to the maximum set by the Dispersion (discreet) control.

CENTERING:

Controls the interferometer central frequency. It applies a DC bias to the interferometer piezoelectric element.

REAR PANEL CONTROLS AND CONNECTORS

POWER:

CORD  Permanently affixed three-pronged power cord for 115/230 VAC receptacles.

115/230  A slide switch to select 115 or 230 VAC operation

Fuse  Fuse holder turns counterclockwise to remove the AC power line fuse.

HV SCAN AMP:

A BNC jack to apply an external voltage scan amplifier. It goes to pin 25 on the Scan Control PCB, the high-voltage amplifier input summing point. In "Hold" position you can put your own scan waveform into the input (eg. sine or triangular waves). One volt input lowers high voltage by about 235 volts.

A slide switch to provide maximum output of either 300 VDC or 1000 VDC from the high voltage scan amplifier to the interferometer piezoelectric element.

A BNC connector for the cable from the interferometer assembly. Output of the high-voltage amplifier to the interferometer piezoelectric element.

HORIZONTAL:

OUTPUT  A BNC connector for the oscilloscope display, attaches to the X-input of the oscilloscope. Output is a sawtooth signal whose amplitude is proportional to change in interferometer transmission frequency from initial frequency.

SIZE  A continuous adjustment for matching the Model 476 horizon-
tal output amplitude to oscil-
oscope sensitivity. Scope
should be set at 1 V/cm.

BLANKING:

OUTPUT
Blanking signal is a step from
-15 to +15 VDC. Derived from
the horizontal scan to blank the
vertical amplifier during
retrace. Can be used to gate
other detectors (as used in
integrating experiments, for
example).

VERTICAL AMP:

PHOTO-
DETECTOR
INPUT
Input jack for photodiodes or
other detectors used to monitor
laser output power. A current-
amplifier that gives a positive
voltage output for a positive
current input. Will not respond
to negative input. Vertical
amplifier can sum several
currents directly. Can be used
as a general purpose amplifier.
Maximum sensitivity is 0.5
VDC/nA.

OUTPUT
Output jack for vertical ampli-
fier. Should be connected to
the oscilloscope Y-axis input.
Scopes should be set at 1
V/cm.

BLANKING
OFF/ON
A slide switch that unblanks the
vertical amplifier in the OFF
position. It does not affect
the Blanking Output signal.

TRIGGER:

INPUT
A BNC jack for external trigger
pulses. Operates on a switch
closure or a 5 V negative-going
edge. Front panel toggle switch
must be in Hold position.
The heater control circuit (see Figure 5A) provides temperature-regulated current to an interferometer heater to maintain air-spacing at a nearly constant value as ambient temperature changes. The adjustable potentiometer (R71, Figure 5A) which sets the equilibrium temperature is inside the Model 476. This potentiometer has been set to give good temperature control at 20°C (68°F) ambient temperature for the typical thermistor characteristics of Spectra-Physics' scanning interferometer heaters. If the ambient temperature where your Model 476 is being used is significantly different from this temperature and/or you wish to be sure that the potentiometer setting is matched to the thermistor in a particular heater unit, follow the procedure below.

Attach a voltmeter or oscilloscope probe to pin 8 (see Figure 5A). Optimum temperature control is obtained when the pin 8 voltage is 6 ± 2 VDC (Normal condition in Figure 6). Turn R71 by 1/2-turn steps, pausing to allow pin 8 voltage to come out of saturation after each step, until a position is found where the pin 8 voltage stabilizes at a value within 1 volt of 6 VDC.

NOTE: It is best to perform this calibration when room temperature is midway between the extremes expected during operation.
The Dispersion Controls (Discrete and Variable) adjust how far in voltage (and therefore frequency) the scan goes.

The Centering Control adjusts the DC level of the output.

The Sweep Time Control adjusts the time to complete a scan.

FIGURE 2 Model 476 High-Voltage Output Schematic
FIGURE 3 Block Diagram and Rear Panel Connections
FIGURE 4 Model 476 Vertical Amplifier Schematic
FIGURE 6  Heater Control Operation
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PRODUCT NAME or MODEL NUMBER

SERIAL NUMBER

PROBLEM

SUGGESTED SOLUTION(S)

LASER INSTRUMENTS DIVISION