System Description and Operation

There are two basic functions the SC-5500 provides for your integrating sphere system: the instrument displays the detector output, in either radiometric or photometric units, and exercises operating control over selected optical instruments. The instrument control function requires use of a host computer with either a standard Labsphere software package or your own software.

At the heart of the instrument is a Zilog Z180 8-bit microprocessor that performs all data collection and system control duties. The Z180 chip is an enhanced version of the time-tested Z80 MPU that featuring 1 Mb MMU, two DMA channels and 8 MHz on-chip oscillator. A functional block diagram of the instrument is provided in Appendix B. The radiometer features two detector inputs - one for current and one for voltage operation. Voltage signals from both detector channels are amplified and digitized before providing input to the microprocessor. Data processing commands for the microprocessor are held in system memory by a 8-bit 32K EPROM chip along with the necessary calibration data for displaying detector readings. The calibration data is embedded into the EPROM at Labsphere and provides accurate readings only when used in the configuration specified by the calibration documentation.

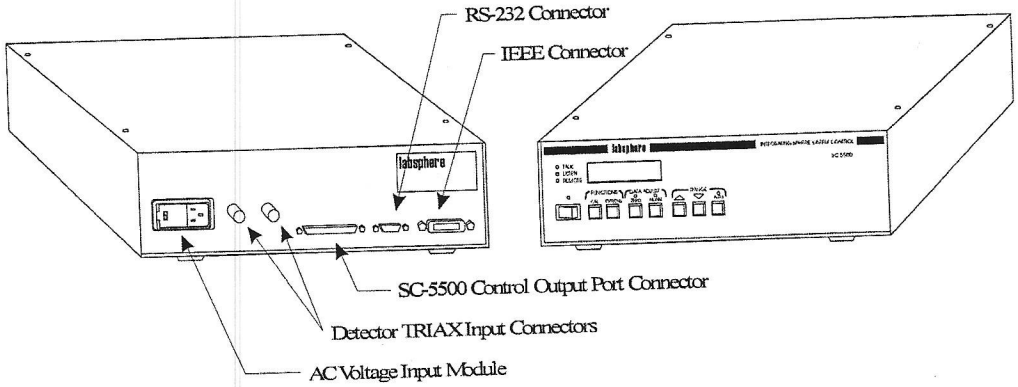

Figure 5. Front and back panels of the SC-5500 instrument.

Automatic or manually controlled ranging is provided for each detector channel over a control bus and three gain control networks. The gain network for the detector current channel consists

of a resistive bridge circuit operated by six low voltage relays. Seven decades of current amplification are available. The five decades of ranging for the detector voltage channel is accomplished in two stages. A resistive bridge network operated by a single relay pre-conditions the voltage signal before it reaches the multiplexer. The second stage of ranging for the voltage channel is accomplished in the JFET amplification circuit of the post amplifier.

The radiometer can be operated locally at the front panel of the instrument or from the host computer. Local operation is achieved through the use of seven control buttons that cycle the user through a sequence of menus. When connected to a detector and turned on, the SC-5500 takes continuous detector readings, displaying the results in the LCD display on the front panel or through the Windows software application on the host computer.

Detector Input

Triax connectors for two detector channels are provided on the back panel of the SC-5500. The connector labeled Silicon/Germanium should be used for current-based detectors such as the Labsphere SDA-050-U or the GDA-050-U photodiode assemblies. Current-based photodiodes are the most common form of light detection today - you will use the Silicon/Germanium connector for most of your applications. The SC-5500 and Labsphere photodiode detectors operate in photovoltaic mode. The connector labeled Thermopile/Lead Sulfide/PMT should be used for voltage-based detector systems such as the Labsphere PDA-050 photomultiplier tube. If you have both current and voltage based detectors, you can monitor the two detector inputs by cycling between the CAL0 and CAL1 options using the CAL function button on the SC-5500 front panel. If you need to monitor the signal input from more than one current-based detector, you will need to purchase a DM-1000 Detector Multiplexer.

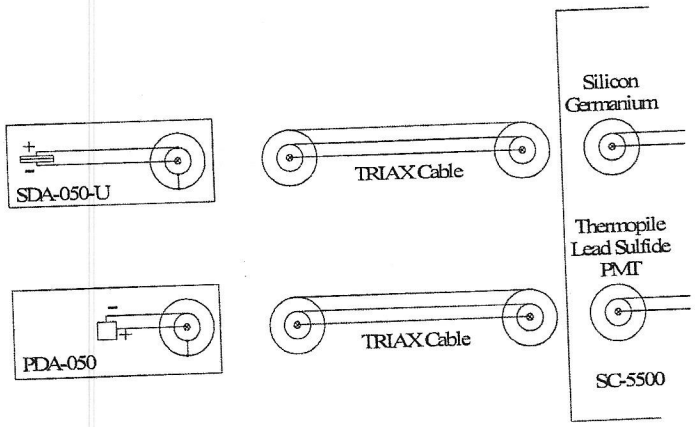

Figure 6. Wiring a custom detector to the SC-5500.

The SC-5500 detector input channels are configured to accommodate Labsphere detector assemblies. Labsphere photodiode detectors are wired in a manner opposite to most detectors. The positive detector signal output from the semiconductor is wired to the center ring of the detector

assembly TRIAX output connector - the negative lead is wired to the center pin. If you decide to connect your own photodiode detector to the SC-5500, you may need to reverse the detector leads. A simple electrical diagram is shown in Figure 6. The Thermopile/Lead Sulfide/PMT connector is wired in the normal fashion. Both connectors on the SC-5500 instrument are TRIAX configured. You may need an adapter if your detector uses a BNC cable.

SC-5500 Computer Interface

The rear panel of the SC-5500 provides standard RS-232C and IEEE-488 connectors for maintaining communications with the computer. You can elect to use either communications protocol. If your integrating sphere system includes one or more peripheral instruments, you must establish a computer link for control of these devices.

If you decide to use the IEEE-488 computer interface, you will need a GPIB board and IEEE-488 cable. Normally, these items are not provided by Labsphere. The default IEEE address for the SC-5500 and most Labsphere software applications is 10. Values between 1 and 15 are possible. To set the primary address on the radiometer, scroll to the IEEE ADDRESS menu option using the OPTIONS button and select your new address using the Up Δ and Down ∇ buttons on the front panel. Refer to your system manual when setting the IEEE address in your software application.

You will need a null modem if you decide to use the RS-232C communications interface. If your SC-5500 was purchased as part of an integrating sphere system, the null modem is provided. Refer to your system manual when configuring the serial port in your software application.

Lamp Power Supply, Detector Multiplexer and Variable Attenuator Operation

A custom designed cable connecting the SC-5500 with a lamp power supply, variable attenuator, detector multiplexer, or other peripheral accessory normally is supplied when your SC-5500 is part of an integrating sphere system. This cable connects to the DB37 connector on the rear panel of the radiometer and the input connectors of your peripheral equipment. A total of 32 output bits are provided on the DIGITAL OUTPUT CONTROL connector. The pinout for the connector is given in Table 2. There are no input bits.

Not all 32 bits over the DIGITAL OUTPUT CONTROL port are available for custom use. The DM-1000, VAC-1000 and lamp power supplies all utilize a certain number of the bits. The number and identification of the bits available to the user depends on system configuration. The lamp power supplies each use up a single bit, for example. The bits utilized by the VAC-1000 depend on the number of variable attenuator units attached. A map describing the utilization of SC-5500 output bits is provided in Appendix B.

General Specifications

Temperature Coefficient	± (0.02% of reading + 0.5 counts) per °C
Noise Referred to Input	100 nV RMS/$(Hz)^{1/2}$
Input Bias Current	10 pA maximum
Input Impedance	100 Meg Ohm in parallel with 100 pF
Analog Input	Single Channel
Input Connector	twist-lock-type triaxial
Isolation	500 volts to ground
Common Mode Voltage	10 volts
CMRR	120 dB at DC to 60 Hz
Bandwidth	Detector dependent;10 Hz at full bandwidth
Maximum Reading Rate	3 readings per second
Maximum Input	± 70 volts or 10 mA
ADC Resolution	20 bits
Nonlinearity	± 1 count
Calibration	No trim pots. All calibrations done digitally and correction factors stored in the EPROM. Up to 100 calibration coefficients may be stored in the EPROM
Compatible Detectors	Si, Ge, PbS and PMT
Power	100-120/220-240 VAC; 50/60 Hz, 1/0.5 Amp
Operating Environment	0° to 50°C 0% to 70% relative humidity at 35°C Linearly derates 3% relative humidity per °C from 35° to 50°C
Dimensions	16.5" W x 16" D x 5" H
Weight	14 lbs. (4.75 kg.)
Sensitivity	0.1 pA/1.0 µV
Resolution	4.5 digits
Computer Interface	IEEE-488 RS-232C (Default settings: 8 data bits, 1 stop bit, no parity, 9600 baud)