SCIENTECH®

Series
Laser Power/Energy Meters

Setup and Operating Procedures

Indicator Model No._____

Serial No._____

P/N9467J
5205

DETECTOR CALIBRATION DATA

Calorimeter # 1:
Model No:
Serial No:
Calibration Wavelength: _____nm
Output Sensitivity (S): _____V/W
Time Constant (1/e): _____sec.
Calibration Temp: _____°C
Sub. Heater Resistance (R_c): _____ohms
Sub. Heater Voltage (V_h): _____volts
Sub. Heater Wattage (W_h): _____watts

Calorimeter # 2:
Model No:
Serial No:
Calibration Wavelength: _____nm
Output Sensitivity (S): _____V/W
Time Constant (1/e): _____sec.
Calibration Temp: _____°C
Sub. Heater Resistance (R_c): _____ohms
Sub. Heater Voltage (V_h): _____volts
Sub. Heater Wattage (W_h): _____watts

Pyroelectric Detector # 1:
Model No:
Serial No:
Calibration Wavelength: _____nm
Output Sensitivity: _____V/J
Calibration Temp: _____°C

Pyroelectric Detector # 2:
Model No:
Serial No:
Calibration Wavelength: _____nm
Output Sensitivity: _____V/J
Calibration Temp: _____°C

Thank you for choosing a Scientech laser power and energy measurement system. The Scientech employees are pleased to provide you with instruments designed and manufactured for years of reliable service.

Please read this manual completely before using the equipment. This information will enable you to fully utilize the instruments.

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Astral ™ Calorimeter Specifications:

Model	AC2500	AC25HD	ACX25HD	AC2501	ACX2501	AC25UV	AC2504
Type Absorber	Surface	Surface	Surface	Volume	Volume	Volume	Volume
Max Beam Diameter	25 mm	25 mm	8 mm	25 mm	8 mm	25 mm	25 mm
Spectral Response	.25-35 µm	.19-12 µm	.4-2 µm	.266-1.2 µm	.4-1.2 µm	.19-.36 µm	.85-4.2 µm
Average Power (max)	10 W						
Average Power (min)*	1 mW						
Noise Level	10 µW or µJ						
Power Density (max)	200 W/cm²	1.5 kW/cm²	12 kW/cm²	Note 1	Note 2	Note 3	Note 4
Peak Power Density (max)	1 MW/cm²	100 MW/cm²	800 MW/cm²	Note 5	8.5 GW/cm²	Note 6	Note 7
Single Pulse Energy (max)	10 J						
Energy Density (max)	Note 8	Note 9	Note 10	Note 11	Note 12	Note 13	Note 14
Precision	< 1%						
Accuracy	3%						
Response Time	3 sec (if attached to a Scientech indicator and indicator is in watts mode)						
Dimensions DxL (in.)	3.75 x 2.2	3.75 x 2.2	3.75 x 3.82	3.75 x 2.2	3.75 x 3.82	3.75 x 2.2	3.75 x 2.2
(cm)	9.53 x 5.6	9.53 x 5.6	9.53 x 9.7	9.53 x 5.6	9.53 x 9.7	9.53 x 5.6	9.53 x 5.6
Weight (lbs)	1.5	1.5	1.7	1.5	1.7	1.5	1.5
(kgs)	0.68	0.68	0.77	0.68	0.77	0.68	0.68
Indicator Compatibility	H310, H310D, H410, H410D, S310, S310D, D200PC, D200C						

Model	AC5000	AC50HD	ACX50HD	AC5001	ACX5001	AC50UV	AC5004
Type Absorber	Surface	Surface	Surface	Volume	Volume	Volume	Volume
Max Beam Diameter	50 mm	50 mm	16 mm	50 mm	16 mm	50 mm	50 mm
Spectral Response	.25-35 µm	.19-12 µm	.4-2 µm	.266-1.2 µm	.4-1.2 µm	.19-.36 µm	.85-4.2 µm
Average Power (max)	30 W						
Average Power (min)	100 mW						
Noise Level	1 mW or mJ						
Power Density (max)	200 W/cm²	1.5 kW/cm²	12 kW/cm²	Note 1	Note 2	Note 3	Note 4
Peak Power Density (max)	1 MW/cm²	100 MW/cm²	800 MW/cm²	Note 5	8.5 GW/cm²	Note 6	Note 7
Single Pulse Energy (max)	30 J						
Energy Density (max)	Note 8	Note 9	Note 10	Note 11	Note 12	Note 13	Note 14
Precision	< 1%						
Accuracy	3%						
Response Time	3 sec (if attached to a Scientech indicator operating in watts mode)						
Dimensions DxL (in.)	4.75 x 2.3	4.75 x 2.3	4.75 x 3.92	4.75 x 2.3	4.75 x 3.92	4.75 x 2.3	4.75 x 2.3
(cm)	12.07 x 5.8	12.07 x 5.8	12.07 x 9.96	12.07 x 5.8	12.07 x 9.96	12.07 x 5.8	12.07 x 5.8
Weight (lbs)	2.9	2.9	3.1	2.9	3.1	2.9	2.9
(kgs)	1.3	1.3	1.4	1.3	1.4	1.3	1.3
Indicator Compatibility	H310, H310D, H410, H410D, S310, S310D, D200PC, D200C						

*Calorimeter installed in an Isoperibol enclosure

Note 1: AC2501, AC5001 — 30 W/cm² @ 1064nm, 23 W/cm² @ 532nm, 8.5 W/cm² @ 355nm, 175mW/cm² @ 266nm

Note 2: ACX2501, ACX5001 — Note 1 specs x 8 for 400nm to 1.2um

Note 3: AC25UV, AC50UV — 50 W/cm² @ 355nm

Note 4: AC2504, AC5004 — 35W/cm² @ 1064nm

Note 5: AC2501, AC5001 — 100GW/cm² @ 1064nm, 78GW/cm² @ 532nm, 29GW/cm² @ 355nm, 580MW/cm² @ 266nm

Note 6: AC25UV, AC50UV — For repetitive pulses; 101MW/cm² @ 355nm
For single pulses; 305GW/cm² @ 355nm

Note 7: AC2504, AC5004 — 125GW/cm² @ 1064nm

Note 8: AC2500, AC5000 — Max J/cm² = 1000 x (pulse width)$^{1/2}$ to a maximum of 200 J/cm².

Note 9: AC25HD, AC50HD — Max J/cm² = 4500 x (pulse width)$^{1/2}$ to a maximum of 14 J/cm².

Note 10: ACX25HD, ACX50HD — Max J/cm² = 36,000 x (pulse width)$^{1/2}$ to a maximum of 42.5 J/cm².

Note 11: AC2501, AC5001 — For repetitive pulses: 4.1 J/cm² @ 1064nm, 3.2 J/cm² @ 532nm, 1.2 J/cm² @ 355nm, 24mJ/cm² @ 266nm
For single pulses: 8 J/cm² @ 1064nm, 6.2 J/cm² @ 532nm, 2.3 J/cm² @ 355nm, 46mJ/cm² @ 266nm

Note 12: ACX2501, ACX5001 — Note 11 specs x 8 for 400nm to 1.2um

Note 13: AC25UV, AC50UV — For repetitive pulses; 1.1J/cm² @ 355nm
For single pulses; 40J/cm² @ 355nm

Note 14: AC2504, AC5004 — For repetitive pulses; 4.8J/cm² @ 1064nm
For single pulses; 10J/cm² @ 1064nm

Vector ™ Pyroelectric Detector Specifications

Model	PHF 02	PHF 05	PHF 09	P 05	P 09
Active Diameter	2 mm	5 mm	9 mm	5 mm	9 mm
Voltage Response				3.0 V/m J	0.8 V/m J
S,I	15 V/m J	2.5 V/m J	1 V/m J		
L	.15 V/m J	.025 V/m J	.01 V/m J		
Electrical Decay Time				2.0 msec	2.0 msec
(RC Time Constant)					
S	0.05 msec	0.05 msec	0.05 msec		
I	0.5 msec	0.5 msec	0.5 msec		
L	2.5 msec	2.5 msec	2.5 msec		
Noise Equivalent Energy				15 nJ	35 nJ
S, I	3 nJ	15 nJ	35 nJ		
L	150 nJ	750 nJ	3500 nJ		
Rep Rate (max)				400 pps	200 pps
S	4000 pps	4000 pps	4000 pps		
I	400 pps	400 pps	400 pps		
L	80 pps	80 pps	80 pps		
Pulse Width (max)				50 µsec	100 µsec
(For Calibrated Response)					
S	5 µsec	5 µsec	5 µsec		
I	50 µsec	50 µsec	50 µsec		
L	250 µsec	250 µsec	250 µsec		
Voltage Output (max.)	4.5 V				
Average Power (max)	1 W	2 W	2 W	2 W	2 W
Accuracy	7%	7%	7%	5%	5%
Maximum Energy Dens	Max J/cm^2 = 316 x (pulse width)$^{1/2}$				
Indicator Compatibility	S310, S310D, D200PC, D200P				

Model	P 25	PHF 25	PHD 25	PHDX 25	PHDX25UV	SP 25	SPHF 25	SPHD 25
Max Beam Diameter	25 mm	25 mm	25 mm	7 mm	7mm	25 mm	25 mm	25 mm
Spectral Response	UV to mid-IR			.4-2um	UV to mid-IR			
Average Power (max)	5 W *	5 W *	5 W *	5 W *	5 W *	5 W *	5 W *	5 W *
Noise Equivalent Energy	4 µJ							
Energy Density (max)	Note 1		Note 2	Note 3	Note 4	Note 1		Note 2
Accuracy	5%	5%	8% ^	8% ^	8% ^	5%	5%	8% ^
Output Sensitivity	8 V/J	8 V/J	2 V/J	2 V/J	2 V/J	8 V/J	8 V/J	2 V/J
Rep Rate (max)	100 pps	400 pps	40 pps	40 pps	40 pps	100 pps	400 pps	40 pps
Pulse Duration (max)	0.2 msec	0.045 msec	0.2 msec	0.2 msec	0.2 msec	0.2 msec	0.045 msec	0.2 msec
Dimensions (in.)	2.4dia.x2.3	2.4dia.x2.3	2.4dia.x2.3	2.4dia.x3.9	2.4Dx3.9L	2.3x2.3x0.6	2.3x2.3x0.6	2.3x2.3x0.6
(cm)	6.1dia.x5.8	6.1dia.x5.8	6.1dia.x5.8	6.1dia.x9.9	6.1Dx9.9L	5.8x5.8x1.4	5.8x5.8x1.4	5.8x5.8x1.4
Weight (lbs)	0.9	0.9	0.9	1.1	1.1	0.3	0.3	0.3
(kgs)	0.41	0.41	0.41	0.5	0.5	0.14	0.14	0.14
Indicator Compatibility	H310, H310D, H410, H410D, S310, S310D, D200PC, D200P							

Model	P 50	PHF 50	PHD 50	PHDX 50	PHDX50UV	SP 50	SPHF 50	SPHD 50
Max Beam Diameter	50 mm	50 mm	50 mm	15 mm	15 mm	50 mm	50 mm	50 mm
Spectral Response	UV to mid-IR			.4-2um	UV to mid-IR			
Average Power (max)	10 W *	10 W *	10 W *	10 W *	10 W *	10 W *	10 W *	10 W *
Noise Equivalent Energy	16 µJ							
Energy Density (max)	Note 1		Note 2	Note 3	Note 4	Note 1		Note 2
Accuracy	5%	5%	8% ^	8% ^	8% ^	5%	5%	8% ^
Output Sensitivity	2 V/J							
Rep Rate (max)	50 pps	400 pps	20 pps	20 pps	20 pps	50 pps	400 pps	20 pps
Pulse Duration (max)	0.4 msec	0.045 msec	0.4 msec	0.4 msec	0.4 msec	0.4 msec	0.045 msec	0.4 msec
Dimensions (in.)	3.5dia.x2.3	3.5dia.x2.3	3.5dia.x2.3	3.5dia.x3.9	3.5dia.x3.9L	3x3x0.6	3x3x0.6	3x3x0.6
(cm)	8.8dia.x5.8	8.8dia.x5.8	8.8dia.x5.8	8.8dia.x9.9	8.8diax9.9L	7.6x7.6x1.5	7.6x7.6x1.5	7.6x7.6x1.5
Weight (lbs)	1.5	1.5	1.5	1.7	1.7	0.4	0.4	0.4
(kgs)	0.68	0.68	0.68	0.77	0.77	0.18	0.18	0.18
Indicator Compatibility	H310, H310D, H410, H410D, S310, S310D, D200PC, D200P							

*Full illumination of the sensor

^Beam centered on absorber

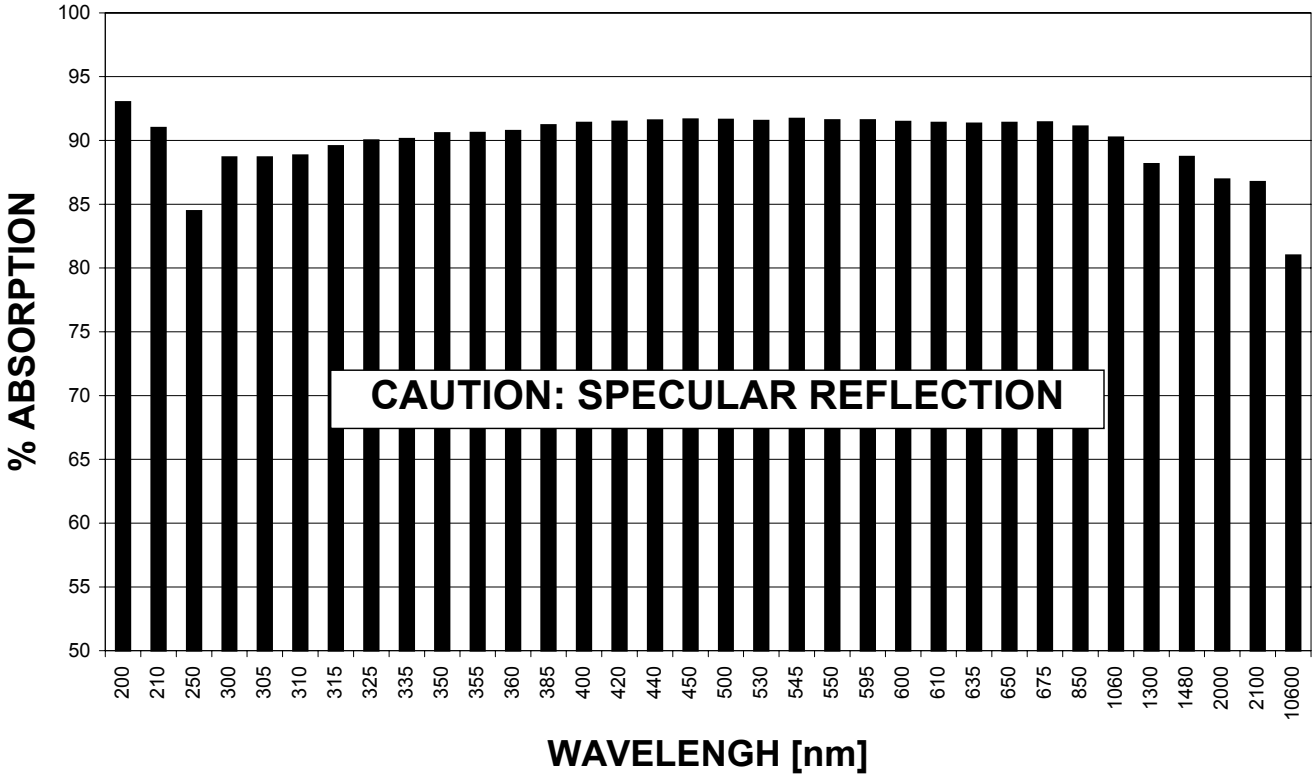
Note 1: Max J/cm^2 = 316 x (pulse width)$^{1/2}$

Note 2: HD models Max J/cm^2 = 4500 x (pulse width)$^{1/2}$ to a maximum of 1.4 J/cm^2.
Maximum pulse width of the pyroelectric detector must be observed.

Note 3: HDX models Max J/cm^2 = 36,000 x (pulse width)$^{1/2}$ to a maximum of 12.6 J/cm^2.
Maximum pulse width of the pyroelectric detector must be observed.

Note 4: HDXUV models Max J/cm^2 = 18,000 x (pulse width)$^{1/2}$ to a maximum of 5.6 J/cm^2.
Maximum pulse width of the pyroelectric detector must be observed.

ABSORPTION OF HD ABSORBER vs WAVELENGTH



NOTE: Please exercise caution when using HD detectors. They exhibit spectral reflection of between 7% and 33%, of the input power, back out of the aperture. Please refer to figure above to determine the reflectance for the wavelength you are measuring. These detectors should be treated as a partial mirror or any other type of reflective optic and the appropriate caution level observed, especially in the CO_2 wavelength.

CE Mark Certification: All of the detectors listed in this manual have been certified for the european CE mark *except* the following:

All of the Vector Series slim profile pyroelectric detectors: Models: SP25, SPHF25, SPHD25, SP25YAG, SP25UV, SP25AL, SP50, SPHF50, SP50YAG, SP50UV, SP50AL.

Unpacking and Setup

The indicator and the sensor and accessories are packed in corrugated supports. All packing material should be saved for future damage free shipments.

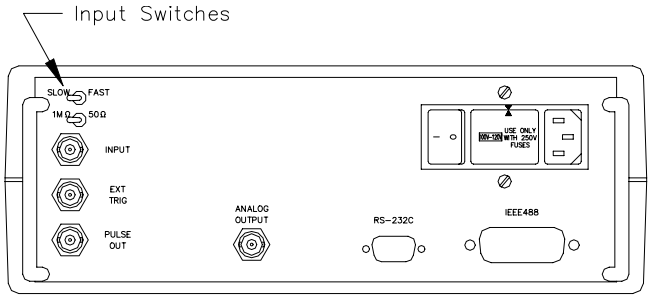
Before making any connections, verify that the power (VAC) requirement shown on the *power entry module* is compatible with the actual AC power outlet to which the indicator will be connected. The power requirement of the instrument is easily change by removing the *fuse holder and voltage selector* which is the center portion of the power entry module. To remove, insert a screwdriver into the slot on the right side of the fuseholder and pry out. Slide the voltage selector out, flip over and re-insert into the fuse holder. Plug the fuseholder back into the power entry module.

Connect the removable power line cord between the power entry module and a grounded AC outlet. **Defeating the ground plug on the line cord will adversely effect the performance of the indicator.**

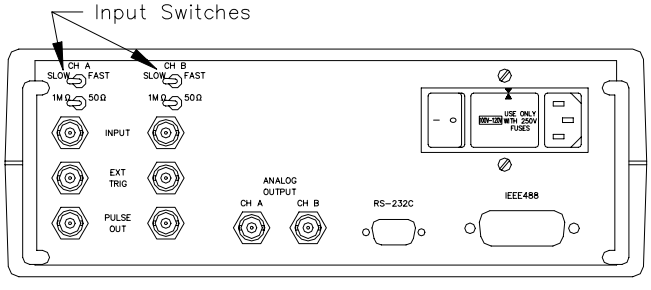
MODELS S200 and D200P

BNC interconnect cables are included with the pyroelectric sensors. Connect the cable between the pyroelectric sensor and the input and the input connector of the indicator. With the dual channel ratiometer Model D200P choose either channel A or B. **Using an interconnect cable with a different length will change the capacitance and therefore the joulemeter calibration by a factor of 0.8%/ft. for the 25 mm sensors and 0.2%/ft. for the 50 mm sensors.**

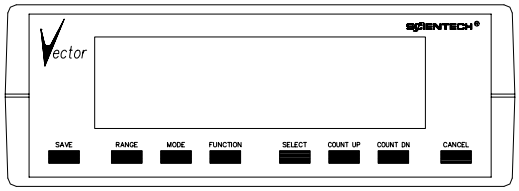
Set the rear panel *input switches* to the 1 MΩ and SLOW settings when using the Models P25, SP25, P50, SP50, PHD25, SPHD25, PHD50, and SPHD50 sensors. Set the input switches to the 1 MΩ and FAST settings when using the Models PHF25, SPHF25, PHF50, and SPHF50. Set the input switches to the 50Ω and FAST settings when using Models P05,.P09, PHF02, PHF05, PHF09.



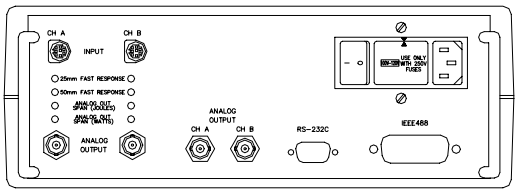
Model S200 Rear Panel



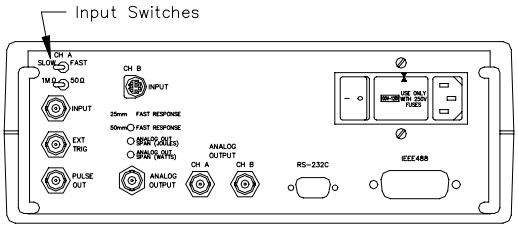
Model D200P Rear Panel



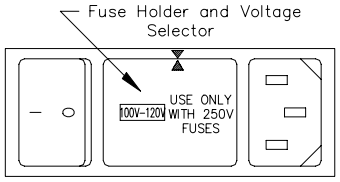
Indicator Front Panel



Model D200C Rear Panel



Model D200PC Rear Panel



Power Entry Module

MODEL D200PC

Any Scientech Vector™ pyroelectric sensor may be connected to channel A and any Scientech Astral™ calorimeter to channel B. The input switches on channel A should be configured per the previous instructions for the S200 and D200P set up. The interconnect cable for the calorimeter terminates with mini-DIN connectors. The "D" shaped connector shows the orientation for hook-up.

MODEL D200C

Both channels of the D200C are dedicated for use with any Astral™ calorimeters. Any model can be connected to either channel.

Operation

FRONT PANEL CONTROLS

RANGE

Pressing the *RANGE* button begins a cycle through 6 ranges in the pyroelectric channel or 5 ranges in the calorimeter channel. In the pyroelectric channel if the 1 MΩ input impedance is selected the range cycle is 2 m, 20 m, 200 m, 2, 20, AUTO. If the 50Ω input impedance is selected, the range cycle is 2 μ, 20 μ, 200 μ, 2 m, 20 m, AUTO. In the calorimeter channel if a 25 mm calorimeter is connected the range cycle is 10 m, 100 m, 1, 10, AUTO (watts mode only). If a 50 mm calorimeter is connected the range cycle is 30 m, 300 m, 3, 30, AUTO (watts mode only). When the desired range appears in the display, press the *SELECT* button to activate that range. When the AUTO range is selected, the indicator automatically selects the most appropriate range with the greatest resolution. Therefore, as the displayed values reach a boundary, the indicator will automatically switch to the next higher or lower range as appropriate. In a manual range,
-OF- will appear in the display if the input laser power or energy level exceeds the range capability.

MODE-

MODE-MODELS S200, D200P

Pressing the *MODE* button begins a cycle between MODE and CAL. Pressing the *SELECT* button when MODE appears in the display
begins a cycle of VOLTS, ENERGY, AVG ENERGY, AVG POWER. Pressing the *SELECT* button when the desired mode appears activates that mode. Pressing the *SELECT* button when CAL appears in the display begins a cycle of V/mJ, V/J, ATTEN. Pressing the *SELECT* button when the desired calibration mode appears activates that mode.

MODE-Model D200PC

Pressing the mode button when setting up channel A is the same as the S200 and D200P. Pressing the mode button when setting up channel B begins a cycle of AVG POWER, ENERGY. Pressing the *SELECT* button when the desired mode appears activates that mode.

MODE-Model D200C

Same as channel B of D200PC.

FUNCTION

FUNCTION-Model S200

Pressing the *FUNCTION* button begins the menu cycle of STATS, TUNE BAR, E, REMOTE (only if optional digital output is installed). Press the *SELECT* button when the desired function annunciator appears in the display.

FUNCTION-Model D200P

Pressing the *FUNCTION* button begins the menu cycle of CH AB RATIO, STATS TUNE BAR LOG E REMOTE, TRIG A TRIG B.

Pressing *SELECT* when CH AB RATIO appears allows selection of channel A, channel B, the ratio of A/B or B/A.

Pressing *SELECT* when STATS TUNE BAR LOG E REMOTE appears allows selection of the statistics mode, analog tune bar, log units, display in scientific notation, RS232 and IEEE488 configuration.

Pressing *SELECT* when TRIG A TRIG B appears allows selection of the trigger channel.

FUNCTION-Model D200PC

Pressing the *FUNCTION* button when in channel A is identical to the D200P. Pressing the *FUNCTION* button when in channel B begins the menu cycle of STATS, TUNE BAR, E, REMOTE. Press *SELECT* when the desired function appears to activate it.

FUNCTION-Model D200C

Same as channel of D200PC.

SELECT

Activates a particular mode or function. Also turns the display backlighting on and off.

COUNT UP COUNT DOWN

Allows numeric entry into the display when in the calibration mode, statistics mode, or average energy mode.

CANCEL

If pressed during any menu cycle the indicator will return to its previous mode of operation. Pressing the *CANCEL* button is also the exit out of the statistics mode and is used to zero the display.

SAVE

Press the *SAVE* button to save the current setup to memory. This enables you to power cycle the indicator and return to the same indicator setup. The *SAVE* button must also be pressed after a calibration.

OPERATING PROCEDURES

Joulemeter sensor models P25, P50, SP25, SP50 P05,and P09 are coated with a special black absorbing material which provides a very flat spectral response over a broad wavelength band. The PHF25, PHF50, SPHF25, SPHF50,PHF02, PHF05, and PHF09 have a partially absorbing and partially reflecting chromium coating. The relative spectral responses of these sensors are given in Figure 1.

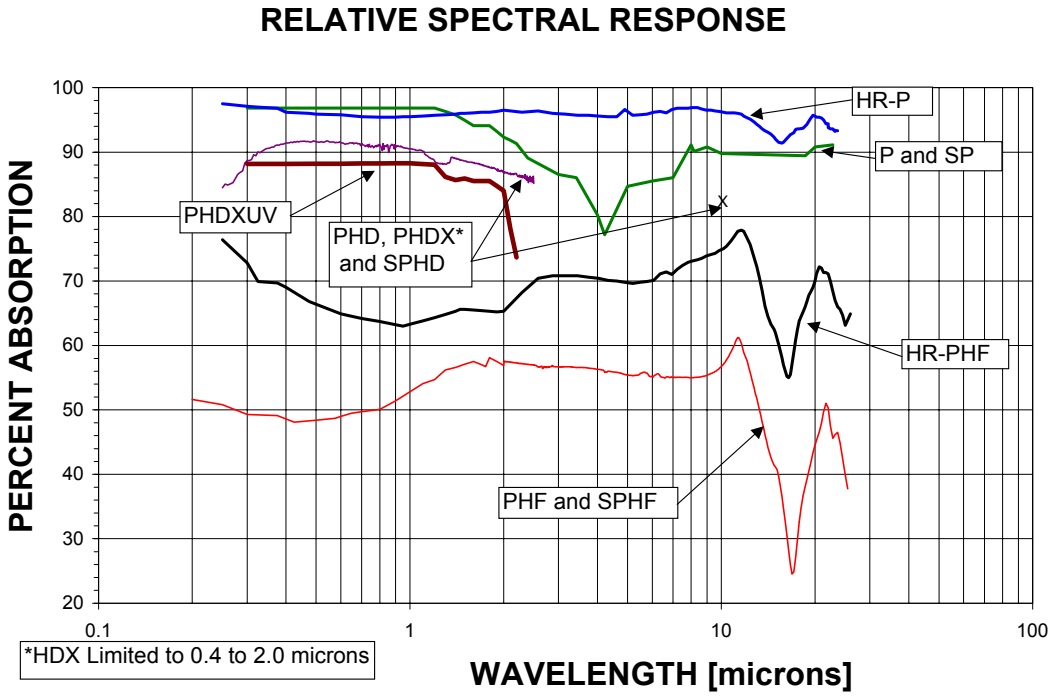


Figure 1

Before using you Vector joulemeter system, please review the energy density ratings given in the chart on page 2, which apply to all models of Vector pyroelectric joulemeter sensors. Familiarize yourself with all of the specifications of the sensor models which you are using (given at the front of this manual).

HR Battery Installation

A 9 volt alkaline battery comes installed with all **HR** Series detectors. Always select the OFF position of the power switch when the detector is not in use to spare the lifetime of the battery. Replace the battery when the low battery LED indicator lights up.

Remove the two slotted 4-40 binder head screws located on the underside of the detector. Pull off the outer housing to expose the battery. Remove the used battery from the battery holder and snap in the new battery. Slide the outer housing back in to place and secure with the screws.

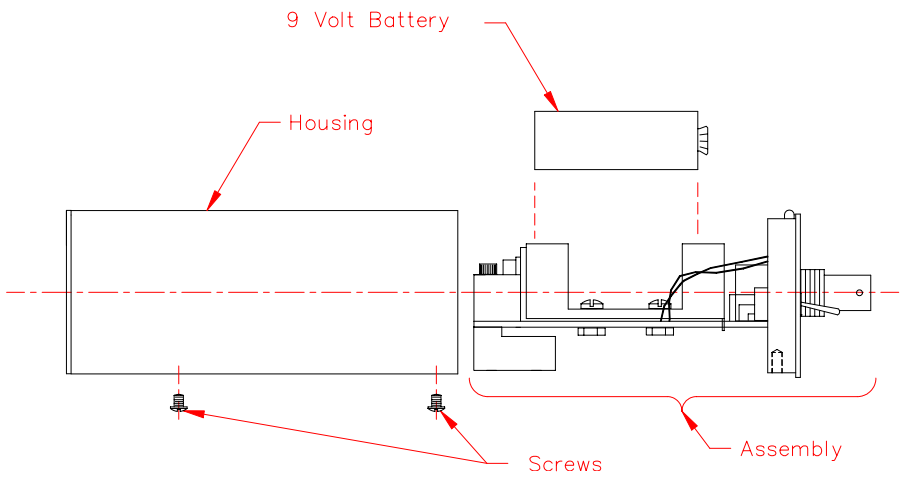


Figure 2

Do not touch the delicate pyroelectric crystals in the HR Series detectors. They should only be cleaned with a stream of clean air; nitrogen or CO_2.

Set Electrical Time Constants for Model PHF02, PHF05 and PHF09

The range switch located on the rear of the PHF02, PHF05, and PHF09 detectors selects one of three electrical time constants and should be set as follows:

S (Short Pulses): Select for pulse durations of 5 µsec. or less. Repetition rates up to 4 kHZ can be measured.

I (Intermediate Pulses): Select for pulse durations of 50 µsec. or less. Repetition rates of up to 400 HZ can be measured.

L (Long Pulses): Select for pulse durations of 250 µsec. or less. Repetition rates of up to 80 HZ can be measured.

There are no range settings on the P05 and P09 detectors which utilize a highly absorbing material on the crystal. The pulse duration considerations merely function in the determination of damage thresholds. Repetition rates up to 100 HZ using the P05 and 50 HZ using the P09 can be measured.

Calibration

Calibration-MODELS S200, D200P

Press the *MODE* button. When the CAL annunciator appears press the *SELECT* button. A menu of V/mJ, V/J, ATTEN will cycle. When calibrating for joulemeter sensor models P25, PHF25, SP25, SPHF25, P50, PHF50, SP50, and SPHF50, press the *SELECT* button when the V/J annunciator appears. Use the *COUNT UP, COUNT DOWN* buttons to enter into the display the V/J output sensitivity listed on the sensor ID tag. Press the *SELECT* button. **PRESS THE *SAVE* BUTTON TO SAVE THE CALIBRATION IN THE EPROM MEMORY.** To calibrate Molectron J3 series sensors, select the V/mJ annunciator and enter the V/mJ output sensitivity as described above.

Calibration-Models D200PC, D200C

Use the same procedure as above when calibrating channel A of Model D200PC.

Channel B of the Model D200PC and both channels of Model D200C are calibrated as follows. The time constant values listed on the serial tag of the Astral calorimeters, must be entered into memory. If not in energy mode, enter into energy mode by pressing the *MODE* button. When the ENERGY annunciator appears, press the *SELECT* button. Press the *MODE* button. A menu of MODE, CAL will cycle. Press the *SELECT* button when the CAL annunciator appears. SET CAL will appear in the display. Use the *COUNT UP, COUNT DOWN* buttons to enter into the display the time constant value listed on the calorimeter ID tag. Press the *SELECT* button to enter the new value. **PRESS THE *SAVE* BUTTON TO SAVE THE CALIBRATION IN THE EPROM MEMORY**.

Attenuation factors

Entering Attenuation Factors-Models S200, D200P, D200PC

When attenuators are used in conjunction with the joulemeter sensors, the attenuation factor may be entered into the indicator memory to allow the actual (pre-attenuated) power/energy level to be displayed. To enter attenuation factors, follow the same procedure as the V/J calibration except press the *SELECT* button when the ATTEN annunciator appears in the display. Use the *COUNT UP, COUNT DOWN* buttons to enter the desired attenuation factor into the display. For example, if you were using a 4X attenuator, you would enter 4.0 into the display. Press the *SELECT* button to enter the attenuation factor into memory. **PRESS THE *SAVE* BUTTON TO ENTER THE FACTOR INTO EPROM MEMORY.** The attenuation calibration applies to pyroelectric sensors only.

Transfer Calibration

The Vector Indicators' pyroelectric channels can be calibrated in the average power mode by setting the power reading to match that of a calorimeter which has had its calibration certified at the National Institute of Standards and Technology. A typical setup would be to direct the laser beam into a calibrated beam splitter.

A portion of the beam would be measured by the transfer standard while the other portion is directed into the pyroelectric joulemeter.

Select the average power mode by pressing the *MODE* button. Press the *SELECT* button when the mode annunciator appears. The menu will cycle through VOLTS, ENERGY, AVG ENERGY, and AVG POWER. Press the *SELECT* button when the avg power annunciator appears. Select the AUTO range by pressing the *RANGE* button. Press the *SELECT* button when the AUTO annunciator appears in the display. Press the *MODE* button. Press the *SELECT* button when the CAL annunciator appears. The menu will cycle through V/mJ, V/J, ATTEN, and AVG POWER. Press the *SELECT* button when the AVG POWER annunciator appears. Use the *COUNT UP COUNT DOWN* buttons to change the power reading to match that of the transfer standard. **PRESS THE *SAVE* BUTTON TO ENTER THE CALIBRATION INTO EPROM MEMORY.**

Energy Mode

Energy Mode - S200, D200P

Select the appropriate range for the energy levels to be measured. Auto range may be selected if the energy levels of repetitive pulses are to be measured. However, *do not* select auto range if you want to measure the energy of one single shot at a time. Select the energy mode by pressing the *MODE* button. A menu cycle of MODE, CAL will begin. Press the *SELECT* button when MODE appears in the display. A menu cycle of VOLTS, ENERGY, AVG ENERGY, AVG POWER will begin. Press the *SELECT* button when ENERGY appears in the display.

The energy level of each pulse will now be displayed on the front panel LCD display (up to 40 HZ). The RS232 can transmit data at repetition rates up to 80 HZ, IEEE488 up to 100 HZ, and STATS mode can collect data at repetition rates up to 200 HZ.

Energy Mode - Model D200PC

Energy mode in channel A (dedicated to pyroelectric sensors) is the same as above. Energy mode in channel B (calorimeter channel) will display the energy of one single pulse at a time. You must wait a few seconds to several seconds between shots depending upon the time constant of the calorimeter you are using. If the pulse to pulse energy values decrease, increase the time between firing pulses. Pressing the *MODE* button begins a cycle of ENERGY, POWER. Press the *SELECT* button when the ENERGY annunciator appears. ***Make sure you have entered the calorimeter time constant as explained in the calibration section. Each calorimeter has a different time constant.***

Energy Mode - D200C

Same as Channel B above.

Average Energy Mode - Models S200, D200P, D200PC

The average energy mode displays a running average of a selectable number of pulses from 2 to 9999. Enter into the AVG ENERGY mode by following the same procedure as ENERGY mode only press the *SELECT* button when the AVG ENERGY annunciator appears. The number of pulses to be averaged will appear in the display. To change the number, press the *COUNT UP, COUNT DOWN* buttons. When the desired number of pulses to be averaged appears in the display, press the *SELECT* button. To change the number of pulses to be averaged during any run, simply press the *COUNT UP, COUNT DOWN* buttons.

The AVG ENERGY mode in the D200PC only exists in channel A - the pyroelectric channel.

Power Mode

Average Power Mode - Models S200, D200P, D200PC (channel A)

Select the appropriate range for the average power level to be measured. The average power mode displays the average power (watts) of repetitively pulsed lasers Minimum rep rate of 10 pps). To enter into the average power mode, follow the same procedure as the energy mode except press the *SELECT* button when the AVG POWER annunciator appears.

Power Mode - Models D200C, D200PC (channel B)

The power mode displays the average power level of repetitively pulsed lasers or the power level of CW lasers. Enter into the power mode by following the same procedure as energy mode only press the *SELECT* button when the POWER annunciator appears.

Volts Mode

Volts Mode - Models S200, D200P, D200PC (channel A)

The volts mode displays the peak voltage of the pyroelectric joulemeter sensor. To enter into the volts mode, follow the same procedure as energy mode except press the *SELECT* button when the VOLTS annunciator appears.

Function Menu Cycles

Pressing the *FUNCTION* button begins menu cycles which allows the selection of channel A, channel B or ratios (dual channel models), statistics mode, tune bar, log units (ratio mode), display in scientific notation, and digital output configuration. The menu cycles are as follows:

Model S200: STATS TUNE BAR E REMOTE
Press the *FUNCTION* button to begin the above menu cycle. Press the *SELECT* button to activate the statistics mode (STATS), the analog tune bar (■ ■ ■ ■ ■ ■), display in scientific notation (E), digital output configuration (REMOTE). To change any condition, re-select it. For example, if the tune bar is active and you want to de-activate it, press the *FUNCTION* button to start the menu cycle, then press *SELECT* when the tune bar annunciator appears.

Model D200P: CH AB RATIO
STATS TUNE BAR LOG E REMOTE
TRIG A TRIG B
Channel Selection: Press the *FUNCTION* button to begin the above menu cycle. Press the *SELECT* button when the CH AB RATIO annunciator appears in the display. This begins the cycle of CH A CH B RATIO A/B RATIO B/A. Press the *SELECT* button when the desired annunciator appears to activate channel A

(CH A), channel B (CH B), the ratio of channel A to channel B (RATIO A/B), or the ratio of channel B to channel A (RATIO B/A).

Trigger Channel Selection: Press the *FUNCTION* button to begin the menu cycle. Press the *SELECT* button when the TRIG A TRIG B annunciator appears. A cycle of TRIG A, TRIG B will begin. Press the *SELECT* button when the desired trigger channel annunciator appears. **If you are operating only one channel at a time, the trigger channel of the channel in operation must be selected.**

Models D200PC and D200C: CH AB RATIO, STATS TUNE BAR LOG E REMOTE
Press the *FUNCTION* button to begin the above menu cycle. Press the *SELECT* button to configure the indicator as desired.

Statistics Mode

The statistics mode will collect data on a selectable pulse population of up to 1000 pulses. At your prompting, the indicator will display the number of pulses delivered, average energy, maximum energy, standard deviation, and coefficient of variation. When the statistics mode is selected, the energy mode and AUTO range are automatically activated regardless of the mode and range settings prior to the selection of statistics mode.

Use the *FUNCTION* button to begin the menu cycles as explained in the Function Menu Cycles section. Press the *SELECT* button when the STATS annunciator appears to activate the statistics mode. Use the *COUNT UP COUNT DOWN* buttons to change the display to the desired number pulses (up to 1000). Press the *SELECT* button to enter the pulse population to memory. Press the *FUNCTION* button to begin the run. The indicator will automatically stop when the data has been collected. Pressing the *SELECT* button recalls the data to the display. The *SELECT* button must be pressed to recall each event. Once all of the data has been recalled, pressing the *FUNCTION* button starts a new run. Pressing the *CANCEL* button returns the indicator to the mode of operation in effect prior to statistics mode.

Analog Tune Bar

The tune bar graphically depicts any measured change in power by the indicator. To activate or de-activate the tune bar press the *FUNCTION* button to begin the menu cycles as described in the Function Menu Cycles section. Press the *SELECT* button when the
■■■■■■■■■ annunciator appears.

Display Backlighting

Pressing the *SELECT* button when the indicator is not in a menu cycle turns the backlighting on and off. Press the *SELECT* button down until the display light is on or off then release.

Log Units of Measure

When a dual channel indicator is being used as a ratiometer, log units of measure may be displayed. Use the *FUNCTION* button to start the menu cycles as described in the Function Menu Cycles section. Press the *SELECT* button when the LOG annunciator appears.

Analog Output

`Pyroelectric Channels`

Analog output is accessible from the 50 ohm terminated BNC connector on the rear panel labeled *Analog Output*. The analog output is calibrated to 10 volts full scale on all ranges.

The 50 ohm terminated BNC connector labeled *Pulse Out* provides a profile of the analog signal from the pyroelectric sensor. The peak voltage level is set to 10 volts full scale on all ranges.

`Calorimeter Channels`

In power mode, the analog output is calibrated to 10 volts full scale and is accessible via the 50 ohm terminated BNC connector labeled *Analog Output.* In energy mode, the analog output is an amplified voltage signal representative of the voltage generated by the calorimeter thermopile. To calculate energy using the analog output, follow the equation:

$$J = \frac{(Vpk)(TC)}{Cal} \div \begin{cases} 1 & \text{(10/30 range)} \\ 10 & \text{(1/3 range)} \\ 100 & \text{(.1/.3 range)} \\ 1000 & \text{(.01/.03 range)} \end{cases}$$

where:

Vpk is the peak voltage, TC is the time constant listed on the calorimeter serial tag, and Cal is the calorimeter output in V/W.

The analog output is set at Scientech and should not be adjusted without consulting the factory.

Joulemeter Sensor Operation With Oscilloscope

The joulemeter sensors may be hooked-up directly with a 1 MΩ input oscilloscope. The peak output voltage of the sensor divided by the V/J sensitivity = energy (joules).

Calibration Using Electric Substitution Heating

The electric substitution heating option must be ordered and installed at the factory when the calorimeter is purchased. It can not be retrofitted to a calorimeter at a later time. To calibrate using electric substitution heating proceed as follows.

1 Remove the screws holding the calorimeter's ID tag and remove the plate to expose the circuit board.

2 Connect the calorimeter to the indicator, turn the power on and let the system equilibrate.

3 Connect theDVM to the test points labeled SUB and HTR on the calorimeter circuit board.

4 Measure the resistance of the substitution heater making sure to subtract the resistance of the patch cables from the total resistance measurement. Compare this resistance to R_c in the calibration data in front of the manual. The two should agree within 2%. If not contact Scientech.

5 Remove the DVM. Connect a power supply to the SUB and HTR test points and connect the DVM to monitor the power supply.

6 Set up the indicator in Watts Mode and 10 range for 25mm calorimeters or 3 range for 50mm calorimeters.

7 Apply V_h volts in the stated calibration data, to the substitution heater.

8 Adjust the calibration trim pot, R4 on the calorimeter board, until W_h Watts, from the calibration data, is displayed on the indicator.

Operation of Astral Calorimeters with a Digital Volt Meter

Astral calorimeters are powered up by the indicator. To use the calorimeter with a digital volt meter or chart recorder as a read out, you must apply +/- 8 VDC to the calorimeters connector on pins 5 & 4 as show in Fig. 3. The voltage output of the calorimeter is available on pins 6 and 8 as shown below.

* Connect the output of the calorimeter to the DVM using the adaptor cable.

* Select the DC volts mode.

* Direct the laser beam on to the absorbing surface of the calorimeter.

* When the display of the DVM has stabilized (about 1 1/2 minutes), calculate the laser power using the formula:

$$W=V/S$$

where:

W=Laser power in watts
V=Voltage reading of the DVM in mV
S=Sensitivity of the calorimeter which is
0.5 V/W for 25 mm calorimeters and
0.167 V/W for the 50 mm calorimeters.

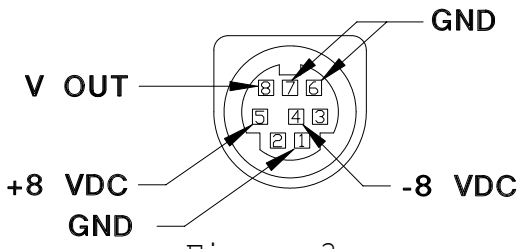


Figure 3

Operation of Astral Calorimeters with an Analog Chart Recorder

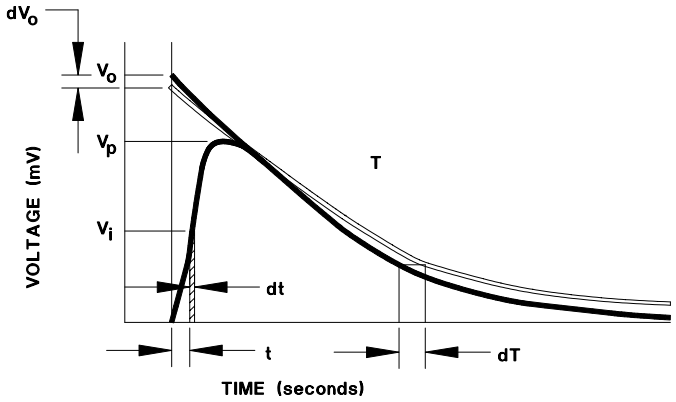


Figure 4

Calorimeter Response

The response of a calorimeter to a single pulse input as displayed by a chart recorder appears as in Figure 4.

The output voltage from a chart recorder can be converted to wattage at any time by:

$W=V/S$, $W_i=V_i/S$

V=Chart recorder voltage level in mV
S=Calorimeter sensitivity in mV/W

The total energy (E) in the pulse can be found by integrating the instantaneous wattage over time:

$$E=\int_0^\infty W(t)\,dt$$

The following methods may be used to compute the total integrated energy:

1. Numerical Integration

Finding the area under the curve in Figure 4 is the equivalent procedure for determining pulse energy. Choose an appropriate time interval, dt, and perform the summation:

$$E=\sum_{i=1}^{N} W_i x dt=(dt/S)\sum_{i=1}^{N} V_i$$

The error caused by this procedure is:

$$dE=(dt/S)\sum_{i=1}^{N} dV_i$$

The error, in theory, is only dependent upon the value of $\sum dV_i$, that is the cumulative random error of V_i. This number should approach zero if data is carefully taken. The accuracy is also increased if the time interval, dt, is minimized. Numerical integration can
yield accurate results, but is a tedious task.

2. Initial Voltage Interpolation

A method used to eliminate the tedious numerical integration task is to project the
thermal decay envelope on to the voltage axis, determine the 1/e decay time constant T, and estimate the total energy value (E):

$$E=(V_o/S) \times T$$

The change from thermal absorption to thermal transport phenomena near the peak causes difficulty in accurately projecting the envelope on to the voltage axis introducing an error, dV_o. Further, the determination of the time constant T, introduces another error, dT. The total error is the sum of the two errors.

$$dE=(V_o/S)dT + (T/S)dV_o$$

The difficulty in eliminating the potential error makes this method typically less accurate than numerical integration, but much faster in application.

3. Peak Voltage Estimate

The peak voltage method requires using an independent determination of total energy and referencing it back to the peak voltage value, V_p.

For a given pulse, use the numerical integration method to obtain E. Note the peak voltage, V_p. Compute the value, F:

$$F=E/V_p$$

For the next pulse compute the total energy:

$$E=F \times V_p$$

The error in using this method yields:

$$dE=FdV_p + V_pdF$$

The accuracy of this measurement depends upon the error in the original calibration, dF, and the error in the peak voltage dV_p. A careful numerical integration yields a value for dF near zero. The value of dV_p can be minimized by maintaining the geometry of the system (i.e. beam intensity, beam profile, wavelength and environment) during operation to be the same as during calibration. Under controlled circumstances, the peak method accuracy usually falls between the numerical integration and initial voltage interpolation methods.

Calorimeter Damage Considerations

1. Surface Absorbers

Surface absorbing calorimeters have been found to safely withstand 200 W/cm^2. This heat input is diffused across the thermopile surface so that the local surface temperature is acceptable. Experience has indicated the damage threshold for a single pulse to be 1 joule/cm^2 in a 1 microsecond guassian pulse. The recommended operating limit is illustrated in the chart on page 1, please review the energy density ratings given.

Heat is produced in the thin pigment layer on the thermopile directly heating the thermopile. Lateral diffusion of heat across the thermopile is quite effective so that the hot side of the thermopile does not have gross hot spots. The structure of the thermoelectric junctions is such that each shares the heat flow in parallel and sums the thermoelectric potential in series. Thus the response is linear with the total heat flow and independent of heat distribution. The thermopile conductance is about 0.2 watts per degree celsius and the maximum recommended power of 10 watts raises the average temperature of the absorbing surface about 50° C above ambient.

2. Volume Absorbers

See the sensor specification chart for maximum pulse energy densities. The surface temperature will rise to 100° C for the briefest instant at these fluency levels. The initial exponential temperature variation with penetration would rapidly decay as the heat flows through the absorber to the thermopile surface which remained at ambient temperature during the laser pulse.
If a CW laser beam is being absorbed, a considerably different situation occurs. The continuous supply of laser power produces steady state temperature distribution from front to back and across the absorber. The absorption region is small compared to the absorber thickness so the temperature drop is substantially linear

front to back. Because the absorber (glass) is a poor conductor of heat, the same laser power density will produce a much higher surface temperature than it would produce on the surface absorber. Furthermore, the glass will confine the heat laterally while the surface absorber does not. The maximum power density for the volume absorber is nearly one tenth that of the surface absorber.

If a repetitively pulsed laser is supplying a steady power input the situation is even more complicated. Superimposed upon the average linear temperature drop is the pulse by pulse instantaneous temperature rise. If we ask how these various parameters of the laser input can vary we obtain a family of curves for the same glass absorber. (See Figures 5 and 6). For ACX2501 multiply the Power Density and the Energy Density by 8.

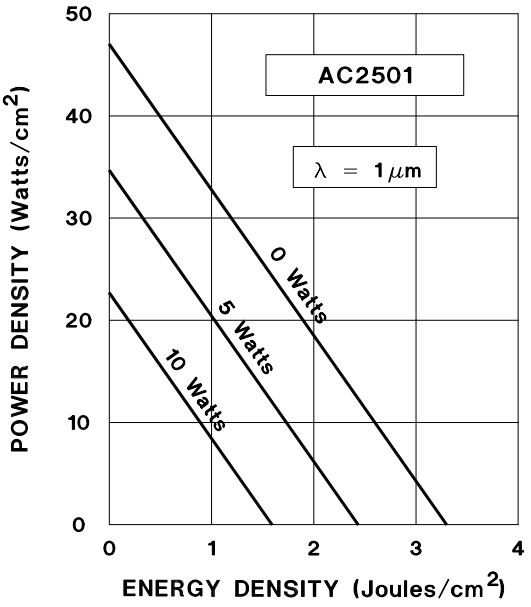


Figure 5

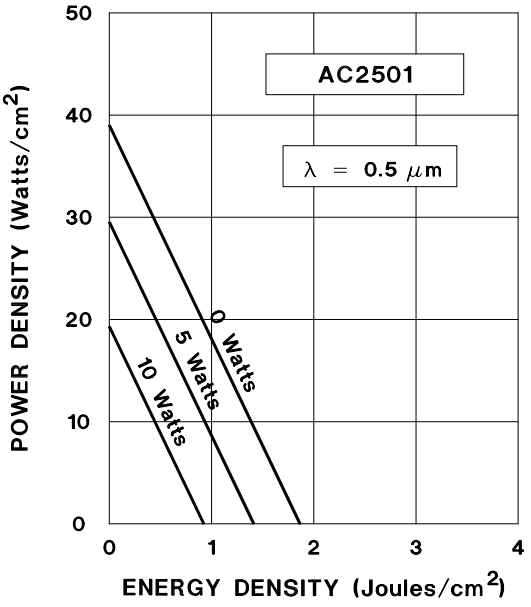
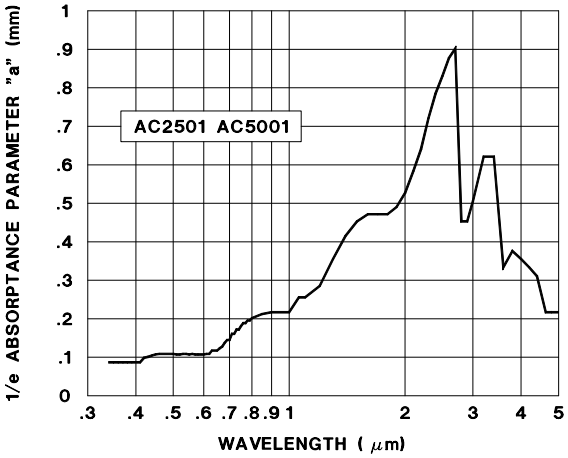


Figure 6

The variation of absorptance with wavelength is depicted in Figure 7. The parameter "a" is the depth of penetration 1/e reduction in laser intensity.


1/e ABSORPTANCE PARAMETER "a" (mm)
1
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
AC2501 AC5001
.3 .4 .5 .6 .7 .8 .9 1 2 3 4 5
WAVELENGTH (μm)
Figure 7

REMOTE INTERFACE

REMOTE INTERFACE FOR MODEL AD30 AND PYROELECTRIC JOULEMETER INDICATOR MODELS S200 AND D200P, D200PC, D200C

These units have two remote interface options: RS232, or IEEE488.

Units with one or both of these options may be operated remotely via the interface selected. The remote interface language is compatible with the IEEE488.2 standard, and provides complete access to all instrument functions.

FRONT PANEL REMOTE INTERFACE SELECTION

If your instrument has only one remote interface, you will not need to select which interface to use. If it has both interfaces, only one may be active at any given time. As it comes from the factory, the unit will power up with the RS232 interface active. You can change the active interface from RS232 to IEEE488 or back using the front panel procedure described below:

Press the FUNCTION button.

If you have dual channel indicator, you will be presented with a menu consisting of alternate groups of function choices. Select the group which includes the REMOTE annunciator. The display will begin to flash the sequence RS232....IEEE. Press the SELECT button when the name of the desired interface is present. If you chose the RS232 interface, you may then go ahead and select RS232 setup options, or press cancel to return to the idle menu state. If you chose the IEEE interface, you have the option of entering the desired IEEE bus address, or pressing CANCEL to return to the menu idle state.

If you have an S200 (single channel pyro) or an AD30 (single channel calorimeter, the function menu will consist of a series of single choices, one of which is the word REMOTE. The display will begin to flash the sequence RS232....IEEE. Press the SELECT button when the name of the desired interface is present. If you chose the RS232 interface, you may then go ahead and select RS232 setup options, or press cancel to return to the idle menu state. If you chose the IEEE interface, you have the option of entering the desired IEEE bus address, or pressing CANCEL to return to the menu idle state.

NOTE: The act of choosing either the RS232 or the IEEE488 interface makes that the active remote interface. It remains the active interface until the next time the *RCL 0 command or the *RST command is executed or the instrument is powered up. To make the interface selection permanent, press the SAVE button after selecting the interface.

REMOTE INTERFACE SELECTION FROM THE ACTIVE INTERFACE

If your instrument has both the RS232 and the IEEE488 interfaces installed, only one may be active at any given time. You can change the active interface from the front panel or from the remote interface itself.

If the remote interface is the RS232 interface, and you wish to change it to the IEEE488 interface, you may enter the command "io ieee" from the RS232 interface. This command will change the instrument's saved interface choice. Then, the next time the instrument is powered up, or the next time a "*rcl 0" or *rst command is executed, the IEEE488 interface will become the active interface. Similarly, if the active interface is the IEEE488 interface, you may change it by entering the command "io rs232" followed by a power cycle, or the commands "*rcl 0" or *rst.

RS232 INTERFACE

The RS-232 connector is a 9 pin D subminiature connector located on the instrument rear panel. The pinout and pin descriptions are shown below:

1. UNUSED
2. DATA IN (RXD)
3. DATA OUT (TXD)
4. DTR (IS GENERATED)
5. GROUND
6. DSR (IS IGNORED)
7. RTS (IS MARKING)
8. CTS (IS EVALUATED IF REQUESTED)
9. UNUSED

This interface does not strictly adhere to the official RS232 standard. However, it emulates what has become commonplace in the microcomputer industry. The instrument will evaluate CTS if the CTS handshake method is selected from the front panel, or by a remote command.

RS232 SPECIFICATIONS

Type: EIA-RS232C
Method: Half-duplex, Asynchronous Transmission, Bi-directional
Format: 300, 600, 1200, 2400, 4800, 9600 baud rate selectable
Data bits: 7
Parity bit: Even Odd or None
Stop bit: 1
Code: ASCII
Total number of bits: 10

RS232 FRONT PANEL CONFIGURATION

As it comes from the factory, the configuration of the RS232 interface is 9600 baud, No Parity, No handshake. Should you desire to change this configuration, you can do it from either the front panel or the remote interface. Changing the setup from the front panel takes two steps:

1) Obtain the RS232 setup menu
2) Select the options desired

Step 1) Obtaining the RS232 setup menu

Proceed as described under FRONT PANEL SELECTION OF REMOTE INTERFACE.
Once you have selected the RS232 interface, go on to Step 2.

Step 2) Selecting the Desired Options

Having chosen the RS232 interface, the RS232 setup menu will be displayed. This menu consists of the repeating sequence: bAUd...PAr...HndS, referring to baud rate, parity, and handshake. Press select when the item you wish to set is shown in the display.

If you chose the bAUd entry, you will be presented with a baud rate menu consisting of the sequence 300..600..1200..2400..4800..
9600. Press SELECT when the desired baud rate is shown.

If you chose the PAr entry, you will be presented with a parity menu consisting of the sequence EuEn (for Even)...Odd...nOnE. Press SELECT when the desired parity is shown.
If you chose the HndS entry, you will be presented with a handshake menu consisting of the sequence onoF (for XON/XOFF)
...CTS...nOnE. Press SELECT when the desired handshake option is shown.

RS232 REMOTE CONFIGURATION

The RS232 interface can be configured remotely from either an RS232 remote terminal, or from an IEEE488 remote controller. This configuration is done by entering one or more of the commands from the remote command language. Those commands which affect RS232 configuration are described below:

BAUD <decimal number from set 300, 600, 1200, 2400, 4800, or 9600> This command sets the RS232 baud rate to the value supplied. If this command is issued from the RS232 interface, you must be sure to change the baud rate on your terminal before proceeding with further remote interaction.

PARITY EVEN | ODD | NONE Sets the parity to the state supplied. If this command is issued from the RS232 interface, be sure to change the parity on your communications terminal to match.

HANDS XON | CTS | NONE Sets the handshake method.

Setting the handshaking method to NONE causes the instrument to ignore the state of the CTS signal and to ignore any received XOFF or XON characters.

Setting the handshake method to CTS causes the communications software to check the state of the CTS signal before transmitting. If the signal is OFF (negative voltage, binary one, signal mark), the instrument will delay transmission. If CTS is ON (positive voltage, binary zero,signal space), the instrument will go ahead and transmit.

Setting the handshake method to XON causes the instrument to cease transmission upon receipt of an XOFF character (ASCII 19, CONTROL-S), and to resume transmission upon receipt of an XON character (ASCII 17, CONTROL-Q).

Care should be taken when setting the handshake method from an RS232 communications device, to insure that the device then begins using the handshake method chosen.

IEEE488 INTERFACE

When IEEE488 is selected, the front panel display is non-functional. The D200P, D200PC, D200C, S200, and AD30 devices may be equipped with an ANSI/IEEE Std 488.2-1987 interface. Section 4.9 of that standard requires that certain documentation accompany devices with such an interface. The following paragraphs have the same numbers as the paragraphs of Section 4.9 in the standard document to which they refer:

(1) Interface Functions subsets implemented:
SH1 -- Source Handshake Capability
AH1 -- Acceptor Handshake Capability
T6 -- Talker (basic talker, serial poll, unaddressed to talk if addressed to listen)
L4 -- Listener(basic listener, unaddressed to listen if addressed to talk)
SR1 -- Service Request Capability
RL1 -- IEEE488.2 Remote/Local Capability
PP0 -- No parallel poll capability
DC1 -- Device clear capability
DT0 -- No device trigger capability

(2) IEEE Address Out of Range:
The instrument address is set from the front panel, and the instrument firmware accepts addresses only within the range 0-30.

(3) Effective time of user address change:
This is described under IEEE 488 SETUP.

(4) The device settings at power On are described separately for the D200, S200, and AD30 in Appendix B to the Setup and Operating Procedures.

(5) Message Exchange Options

a) The input buffer is seventy five characters. Each character received generates an interrupt to the processor, which notifies an input routine that an input byte is available. The input routine places the character in the input buffer for examination by the parser. The characters are removed from the input buffer and translated with appropriate syntax checking. If any input message exceeds the length of the input buffer, a COMMAND ERROR is generated, and the message is ignored.

b) The RPT?, COL?, and DUMP? queries generate more than one response message unit.
c) All queries generate a response when parsed.

d) No queries generate a response when read.

e) The IO command is coupled to the *RCL and the *RST command, in that it puts a new value into the saved value for the active remote interface. This means that the use of the IO command may cause the RS232 remote interface to become the active interface the next time the unit is powered up, or the *RCL0 or *RST command is executed.
In the D200, the CAL,CAL?, ATTEN, ATTEN?, RANGE, and RANGE? commands operate on the channel selected by the SEL command.

(6) The following elements can be used in constructing device-specific commands:
Command Program Header
Query Program Header
Character Program Data
Decimal Numeric Program Data
Compound Command Program Headers are not used.

(7) Block data is not used.

(8) Expression Program Data Elements are not used.

(9) Response Syntax for each query is described in REMOTE INTERFACE LANGUAGE.
(10) The RPT? query generates an unending stream of response message units which may be terminated by entering another command or query. This deviation from the 488.2 standard was done for performance purposes. Purists may avoid the use of the RPT? query by issuing a series of SND? queries.

The IO command may alter the saved value for active remote interface, making it possible for the RS232 interface to take over the instrument the next time a power up happens, or the *RCL or *RST commands are executed.
(11) There are no block data responses.

(12) A list of common commands and queries implemented is included in the section REMOTE INTERFACE LANGUAGE.

(13) Self calibration is not supported by the devices described. There is a CAL? query, but this is not the *CAL? query referred to in this section of documentation requirements.

(14) *DDT not implemented.

(15) Macros not implemented.

(16) The *IDN? query and its response are described in REMOTE INTERFACE LANGUAGE.
(17) *PUD and *PUD? not implemented.

(18) *RDT and *RDT? not implemented.

(19) On *RST and *RCL the following states are changed:
Device is forced into OCIS state.
Device is forced into OQIS state.
Event Status byte is cleared
All device specific states are set to their power up values, except for the output queue, the 488.1 address, the standard status register enable setting, the Standard Event Status Enable setting, and the power-on-status-clear flag setting. (The upper bound on the argument to the *SAV and *RCL commands is

zero. To save the current instrument state, the user issues the *SAV 0 command. To restore the saved state, the user may issue either the *RST or the *RCL 0 commands). The *LRN? query is not supported.

(20) The self test instigated by the *TST? query checks the ROM checksum against the contents of ROM, and it does a non-destructive RAM test.

21) There are no status structures beyond those required by Std IEEE488.2.

22) There is only one overlapped command. That is the statistics gathering command COL.

23) When the operation complete message is generated after a COL command, all of the requested data points have been collected, and the mean, max, sigma, and coefficient of variation have been computed. There are no other overlapped commands, so the setting of operation complete in any other context simply means that no command was in progress when the *OPC command was issued.

IEEE488 SETUP

The only setup necessary for the IEEE interface is the setting of its bus address. This is done from the front panel through a series of menu choices, followed by the entry of the numeric address (a number between 0 and 30). The sequence of menu choices depends upon the type of instrument, and is described below:

Step 1) Obtaining the IEEE address setup screen

Proceed as described in FRONT PANEL REMOTE INTERFACE SELECTION until you have selected the IEEE488 interface. The carry out step 2 below.

Step 2) Entering the IEEE bus address

You will be presented with a screen that is blank except for the number which denotes the IEEE bus address. Use the Count Up and Count Down Keys to adjust that address. (Only numbers 0 through 30 are allowed.) When the desired address is present, press the SELECT key. The new bus address becomes effective immediately. To make the setting permanent, press the SAVE button.

IEEE488 REMOTE CONFIGURATION

The IEEE488 interface may not be configured remotely. The only way to set the address is to use the front panel configuration described on the previous page.

REMOTE INTERFACE LANGUAGE

The Remote Interface Language is compatible with Std-IEEE488.2 and also works with the RS232 remote interface.

REMOTE INTERFACE LANGUAGE SYNTAX

Remote interface messages consist of zero or more commands or queries separated by semicolons and terminated by a linefeed (IEEE488) or a carriage return(RS232). A command or query consists of a command or query header followed by zero or more arguments separated by commas.

cmd1 arg1;cmd2 arg1,arg2;cmdN arg1

Typical Remote Message

Messages must be less than 75 characters.

The queries RPT?, SND?, COL?, and *OPC?, and the commands COL and *OPC are intended to be placed as the last command in a message. Placing them elsewhere will not result in harm to the instrument, but it may produce results which seem unusual.
Queries which have not finished will be aborted by the receipt of additional commands or queries. This will result in Query Errors in the IEEE488 interface. If a RPT? COL? or SND? query is immediately followed by another command, it is likely that no data will be transmitted. If COL is followed by another command, statistics gathering will be halted unless the command *WAI appears between the two commands.

REMOTE INTERFACE LANGUAGE COMMANDS AND QUERIES

Most commands and queries may be used with D200's, S200's, and AD30's. Some commands; however, are suitable only for use on the D200; and others work only with the IEEE interface. The commands common to all instruments are presented first, followed by those used only for the D200, then those used only by the AD30, and finally by those commands used only in the IEEE488 interface. In the descriptions that follow, the command will be presented first, followed optionally by one or more arguments, separated by commas. When the vertical bar "|" is used, it denotes the word "or", and signifies that one of the items separated by bars may be inserted into the space of the argument. For example, the command:

*XXX A | B,C

has two arguments, the first of which may be 'A' or 'B', and the second of which is the letter 'C'.

COMMON COMMANDS

Commands in this group are available on the AD30, D200P, D200PC, D200C, and S200 from either the RS232 or the IEEE488 remote interface.

*IDN? This query takes no arguments, and returns a comma separated collection of four strings, describing respectively the manufacturer of the instrument (Scientech Inc), the model number (D200,S200, or AD30), the serial number, and the firmware version number.

*SAV 0 This is the IEEE488.2 common command. It takes the single argument 0 (zero). When used from either remote interface, it saves the current instrument configuration to the configuration save area. The next time the instrument is powered up, or the *RST or *RCL 0 command is executed, the configuration will be restored to the values saved.

RANGE? The RANGE query returns a decimal number between 1 and the maximum range of the instrument. The meaning of the number returned varies depending upon the particular instrument, certain

switch settings (on pyros), or the type of sensor plugged into the amplifier (AD30). The meaning of the integer is described further in specifications of the individual instruments.

RANGE <dec num> | auto Sets the range to the decimal number supplied, or makes range selection automatic.

RPT? This query causes the remote interface to begin sending a sequence of comma-separated sequence of readings. A new reading is sent each time one is taken by the instrument. This activity will continue until the remote interface is interrupted by a new command or query.

COL <dec num> This command causes the instrument in energy mode to begin collecting readings for statistical analysis. This command continues until <dec num> data points are collected, or until it is interrupted by another command. If it is interrupted, no statistics are computed. If it terminates normally, it computes values for the mean, max, standard deviation, and coefficient of variation of the data points collected. Those values may then be accessed with the queries mean?, max?,sigma?, and cv?. The individual data points may be dumped with the dump? query.
COL? <dec num> This command is like the COL command, except that the individual data points are sent to the remote interface as they are collected. The COL? query is slower than the COL command.

SND? The SND? query causes the instrument to send the next reading to the remote interface.

MEAN? If statistics have been collected from the front panel, or by the COL or COL? commands, this command returns the mean of the collection. If no statistics have been collected, it returns zero.

MAX? If statistics have been collected from the front panel, or by the COL or COL? commands, this command returns the maximum value of the collection. If no statistics have been collected, it returns zero.

SIGMA? If statistics have been collected from the front panel, or by the COL or COL? commands, this command returns the standard deviation of the collection. If no statistics have been collected, it returns zero.

CV? If statistics have been collected from the front panel, or by the COL or COL? commands, this command returns the coefficient of variation of the collection. If no statistics have been collected, it returns zero.

DUMP? If statistics have been collected from the front panel, or by the COL or COL? commands, this command returns all of the data values in the collection. If no statistics have been collected, it does nothing.

BAUD <dec num> Sets the RS232 baud rate to the value supplied. The decimal number must be one of the following: 300, 600, 1200, 2400, 4800, 9600.

PARITY EVEN | ODD | NONE Sets the parity of the RS232 interface to even parity, odd parity, or no parity, as specified.

HANDS XON | CTS | NONE Sets the handshake method of the RS232 interface to XON/XOF, CTS, or NONE as specified.

IO RS232 | IEEE On units with both IEEE and RS232 interfaces, this command makes the named interface the SAVED active interface. The next time the instrument is powered up, or the *RCL 0, or the *RST command is executed, it becomes the active interface.

*RST This is the ieee488.2 common command by the same name. When executed from the RS232 interface, it has the effect of restoring the saved instrument configuration. It has the additional function in the IEEE488 interface of forcing the interface into the OCIS state and the OQIS state.

TUNE ON | OFF Turns the tune bar on or off.

LIGHT ON | OFF Turns the LCD backlight on or off.

MODE? Returns the instruments operating mode. The possible responses for the model AD30 are "ENERGY" and "AVGP". For the D200 and S200 instruments, the possible responses are "VOLTS", "ENERGY","AVGE", and "AVGP".

MODE <instrument specific mode string> Sets the instruments operating mode. The permissible mode names are the same as those returned by the MODE? query.

*TST? This is the IEEE488.2 common query. From either RS232 or IEEE interface it cause ROM Checksum, and non-destructive RAM tests to be run. If the test succeeds, this query returns 0 (zero). If the ROM test fails, a 1 is returned. If the RAM test fails, a 2 is returned.

*OPC? This is the IEEE488.2 common query. From either interface, it waits until no overlapping command is in progress, and then it returns a 1.

*WAI This is the IEEE488.2 common command. From either interface, it causes the command processor to wait until any overlapping command is finished before continuing to process commands.

CLR This command halts RPT?, SND?, or COL? commands in progress. It also terminates statistics gathering started by the COL command. This command is automatically issued whenever a carriage return that is not preceded by a command is typed into the RS232 interface. When the IEEE488 interface receives a linefeed terminated message with no commands, the CLR command is executed.

*RCL 0 This is the IEEE488.2 common command. It takes the single numeric argument 0(zero). When used from either remote interface, it restores the instrument configuration to the saved power up values. It also places the IEEE interface into the OCIS and OQIS states.

VECTOR ONLY COMMANDS

COUNT? Returns the number of pulses making up each average in average energy mode.

COUNT <dec num> Sets the number of pulses making up the average in average energy mode.

CAL? Returns the calibration constant in volts/joule of the pyroelectric sensor or the time constant in seconds of the calorimeter. In the D200P, D200PC, and the D200C this query applies to the channel selected by the SEL command.

CAL <dec num> Sets the calibration constant volts/joule of the pyroelectric sensor or the time constant inn seconds of the calorimeter. In the D200P, D200PC, and D200C this command applies to the channel selected by the SEL command.

ATTEN? Returns the attenuation factor to apply in the calculation of energy or power. In the D200P this query applies to the channel selected by the SEL command.

ATTEN <dec num> Sets the attenuation factor to apply in the calculation of energy or power. In the D200 this command applies to the channel selected by the SEL command.

D200P, D200PC, D200C SPECIFIC COMMANDS

DSP A | B | A/B | B/A This command tells the dual channel indicator what to display on the front panel. An argument of A means display readings from channel A in the front panel. A value of B/A tells it to display the ratio of the reading on channel B to the reading on channel A on the front panel.

DSP? This query returns either A, B, A/B, or B/A, to indicate what is currently displayed on the front panel.

SEL A | B | A/B | B/A | AB The SEL command is the channel selector for the remote interface. It tells the Indicator what readings to transmit out the remote interface. An argument of A means transmit readings from channel A. An argument of AB tells it to transmit readings from both channels. Merely using the SEL command does not guarantee that readings will be transmitted. The user must then issue a specific request to transmit readings, such as RPT?, SND?, or COL?. The SEL command has the further effect of specifying to indicator to which channel it should apply the CAL, CAL?, ATTEN, ATTEN?, RANGE, and RANGE? commands. If the most recent SEL command involved both channels, then the six commands above become invalid until the user issues a SEL A or SEL B command.

SEL? This query returns A, B, A/B, B/A, or AB to indicate which channels will be output in the event of a RPT?, SND?, or COL? query, which channel will be collected in the event of a COL command, and to what channel the CAL, ATTEN, and RANGE commands apply.

LOG ON | OFF This command turns on or off the logarithmic display of the ratio of channel A to channel B or the ratio of channel B to channel A. This command turns on or off a flag that has effect only when DSP or SEL has been used to select a ratio for display or output.

TRIG A | B Tells the D200P which channel to trigger from.

TRIG? Returns A or B depending upon the current trigger channel.

AD30 SPECIFIC COMMANDS

ZERO This command sets the zero point in watts mode to the ambient reading from the calorimeter.

CAL? Returns the time constant in seconds of the calorimeter.
CAL <dec num> Sets the time constant constant in seconds of the calorimeter.

IEEE488 SPECIFIC COMMANDS

These commands may be used only from the IEEE488.2 interface. They are all members of the collection of so-called "common commands" described in the standard.

*CLS Clears the Standard Event Status Register and forces the device into Operation Complete Command Idle state and Operation Complete Query Idle state.

*ESR? Returns a decimal number which is the value of the Standard Event Status Register. Reading that register clears it.

*ESE <dec num> Sets the bits of the Standard Event Status Enable Register to the binary representation of the decimal integer supplied.

*ESE? Returns a decimal number representing the contents of the Standard Event Status Enable Register.

*SRE <dec num> Sets the bits of the Service Request Enable Register to the binary representation of the decimal integer supplied.
*SRE? Returns a decimal number which represents the contents of the Service Request Enable Register.

*OPC Sets the "Operation Complete" event bit in the Standard Event Status Enable Register when pending device operations have been completed.

*STB? Returns a decimal number which is the value of the IEEE488.1 status byte and the Master Summary Status message.

D200P, S200PC, D200C DEFAULT POWERUP SETTINGS

The first time the dual channel indicator is powered up, the following settings have the values shown:
RS232 Baud Rate: 9600 Baud
RS232 Handshake Method: NONE
RS232 Parity: NONE

Channel A Range: 1
Channel A Autorange: OFF
Channel B Range: 1
Channel B Autorange: OFF
Channel Displayed: A
Remote Interface Channel Selected: A
Trigger Channel: A

Mode of Operation: ENERGY MODE
Pulses per average for average energy mode: 10

Backlight Switch: OFF

Logarithmic Display of Ratios: OFF

Tune Bar Display: OFF

Floating Point Display Mode (Normal vs Scientific): NORMAL

Volts/Joule Channel A: 1.0
Volts/Joule Channel B: 1.0
Attenuation Factor Channel A: 1.0
Attenuation Factor Channel B: 1.0

Active Remote Interface: RS232

IEEE Bus Address (if installed): 4

S200 DEFAULT POWERUP SETTINGS

The first time the S200 is powered up, the following settings have the values shown:

RS232 Baud Rate: 9600 Baud
RS232 Handshake Method: NONE
RS232 Parity: NONE

Range: 1
Autorange: OFF

Mode of Operation: ENERGY MODE
Pulses per average for average energy mode: 10

Backlight Switch: OFF
Tune Bar Display: OFF

Floating Point Display Mode (Normal vs Scientific): NORMAL

Volts/Joule: 1.0
Attenuation Factor: 1.0

Active Remote Interface: RS232

IEEE Bus Address (if installed): 4

AD30 DEFAULT POWERUP SETTINGS

The first time the AD30 is powered up, the following settings have the values shown:

RS232 Baud Rate: 9600 Baud
RS232 Handshake Method: NONE
RS232 Parity: NONE

Range: 1
Autorange: OFF

Mode of Operation: POWER MODE

Backlight Switch: OFF

Tune Bar Display: OFF

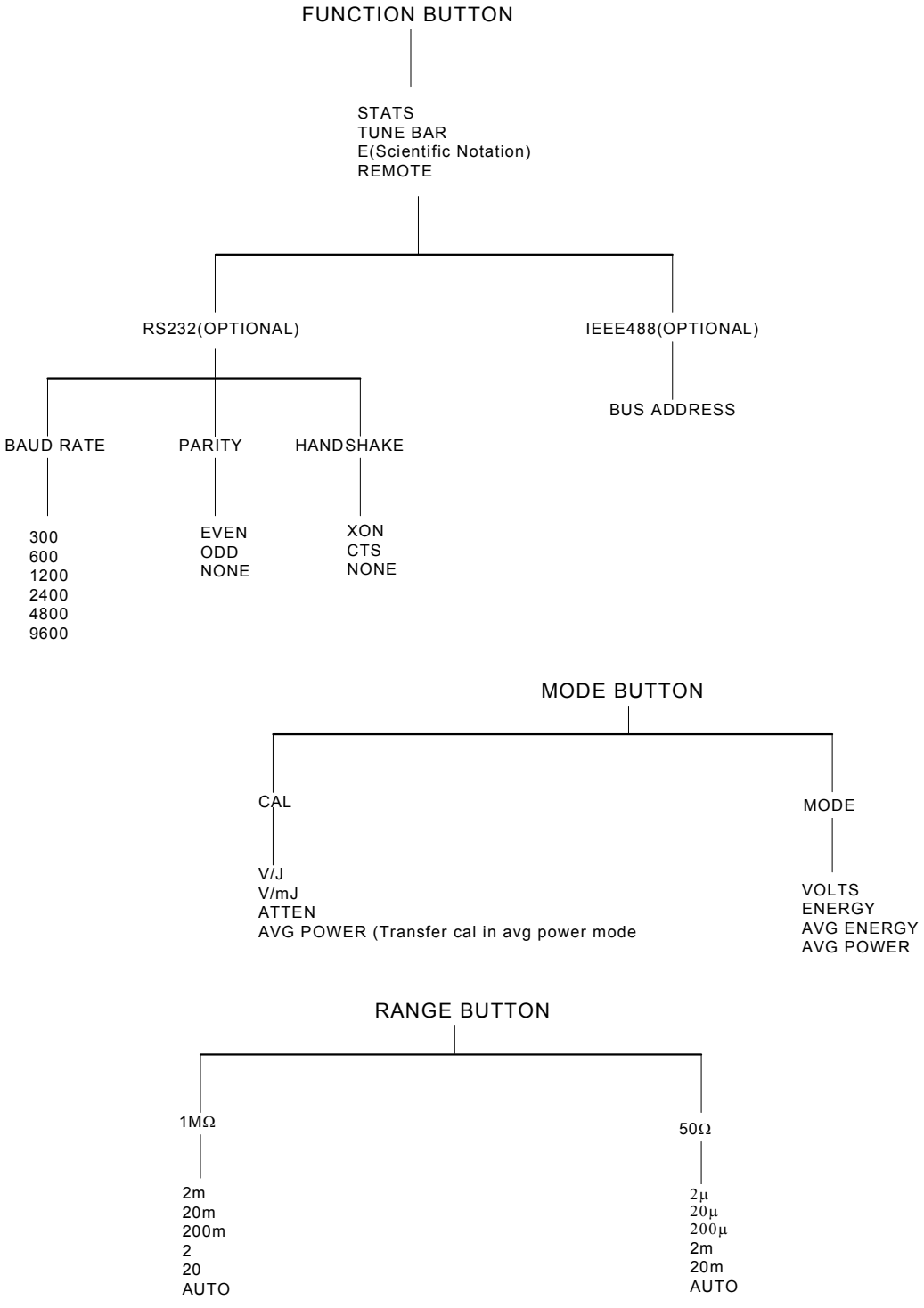
Floating Point Display Mode (Normal vs Scientific): NORMAL

Time Constant: 8.0 seconds

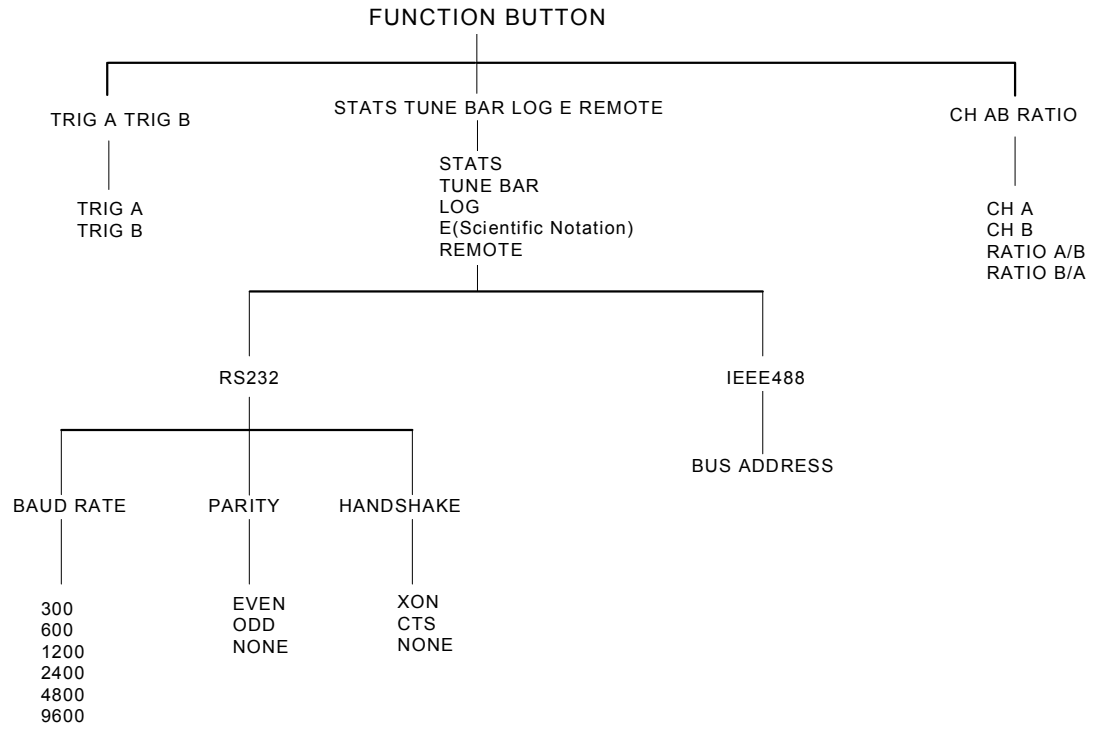
Active Remote Interface: RS232

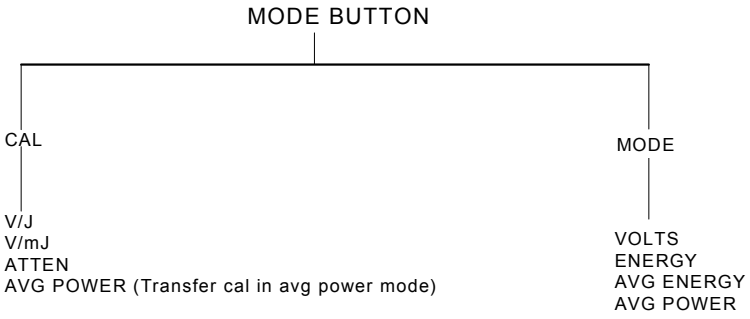
IEEE Bus Address (if installed): 4

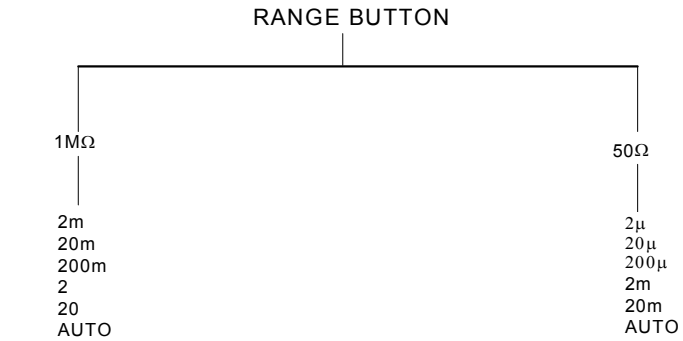
MODEL S200 MENU TREES



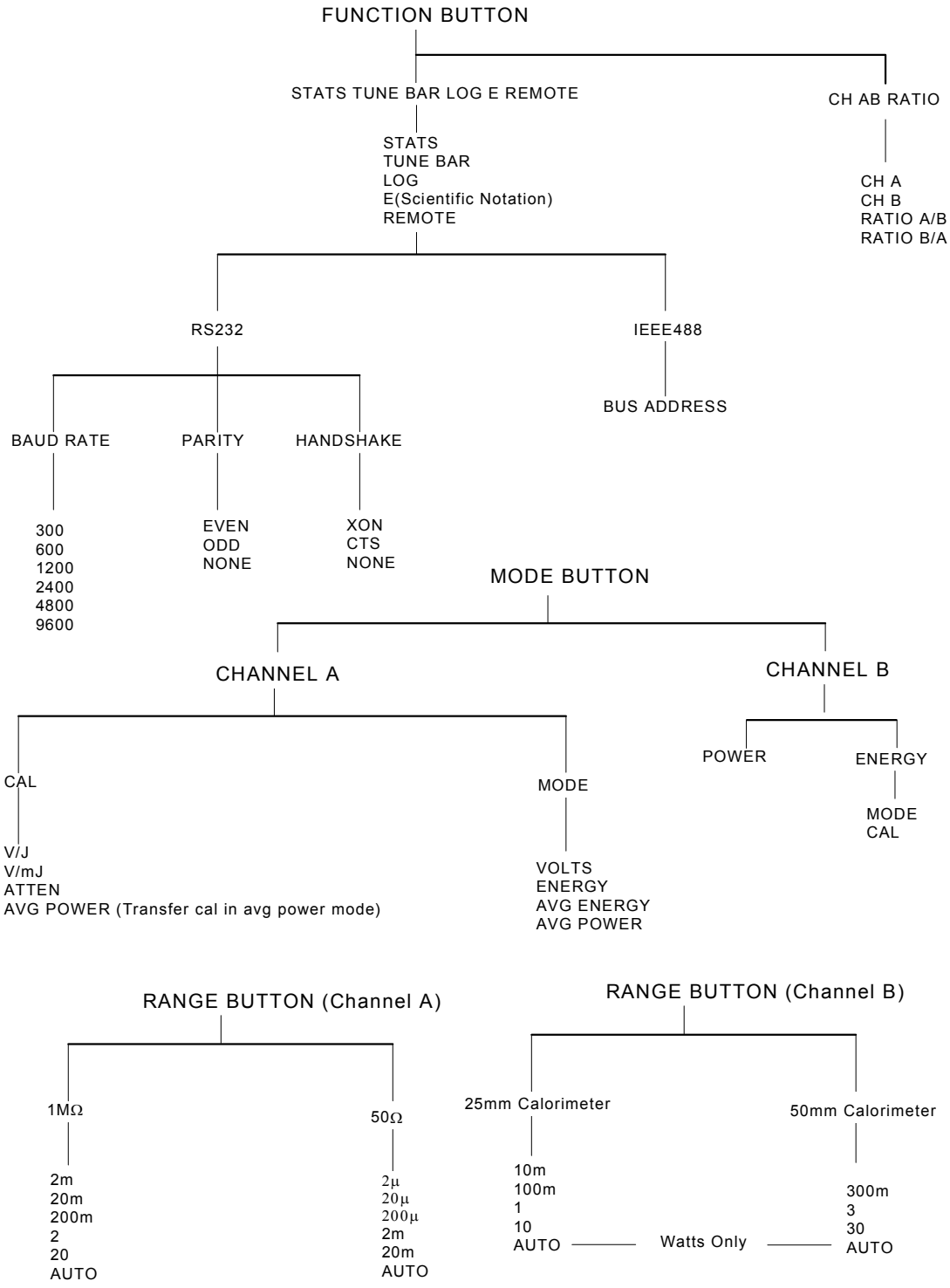
MODEL D200P MENU TREES



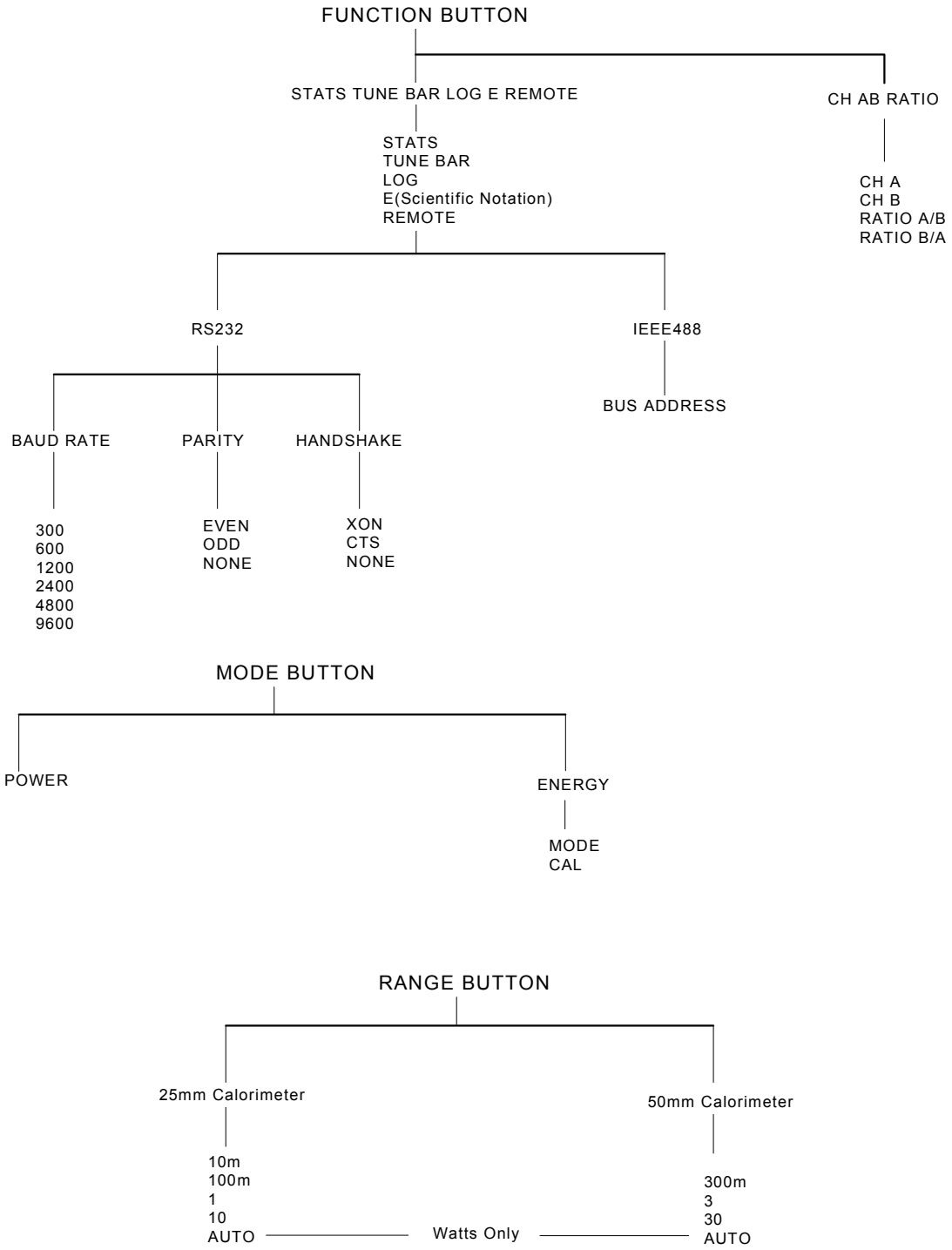




MODEL D200PC MENU TREES



MODEL D200C MENU TREES



Limited Warranty

All Scientech Laser Power and Energy Measurement Systems are warranted against defects in materials and workmanship for two (2) years from date of delivery. During the warranty period, Scientech will repair, or at its option replace at no charge, components that prove to be defective. The equipment must be returned, shipping prepaid, to Scientech's product service facility. This limited warranty does not apply if the equipment is damaged by accident or misuse or as a result of service or modification by other than a Scientech service facility. The foregoing warranty is in lieu of all other warranties expressed or implied including but not limited to any implied warranty of merchantability, fitness, or adequacy for any special incidental or consequential damages whether in contract, tort, or otherwise.

Returned Goods Procedure

Should it become necessary to return any item to Scientech for any reason, please contact our Product Service Department at (800)525-0522 or (303)444-1361 or Fax (303)444-9229. When you call, please be ready to provide model number, serial number, and a description of the problem. Frequently we can provide self-help information which will eliminate the need for returning the unit(s).

If equipment return is required, please pack the items in the original box and packing material. As an alternate, place the equipment in a snug-fitting box, then pack that box in a larger box with at least four inches of packing material. Scientech does not assume responsibility for underpacked items.

Please include the name and phone number of the person we should contact regarding repair questions.

Normally, products are repaired and shipped within 5 working days after their arrival at the product service facility. This is an average time and could vary depending on the workload.

Shipping Address:

Scientech, Inc.
Product Service Department
5649 Arapahoe Ave.
Boulder, Colorado 80303
U.S.A.