



# Detection Systems

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### Detection Systems

Sciencetech has a detector for virtually any spectroscopic application between the UV and the Far Infrared. They are available either as stand-alone items with head, power supply and readout unit, or as complete instrument-mountable systems, with electronics and PC interface.

#### Photomultiplier Detectors (PMT's)

Photomultiplier detectors are by far the most sensitive detectors for UV and Visible radiation. In fact, they provide a relatively noise-free signal, directly proportional to the incident light, with a sensitivity several orders of magnitude greater than that of any other system available. Sciencetech carries both conventional and photon counting PMT detection systems, covering a spectral range between 180 nm in the UV and 1100 nm in the IR. Although all of Sciencetech's standard PMT's are side-on and mountable (with both cooled and non-cooled housings) to all of our monochromators, any other tube configuration is available upon request. PMT housings include both preamplifier and electronics. A/D converter and data acquisition software for Windows based computers is optional.

#### Semiconductor Detectors

Operating upon the principles of solid-state physics, semiconductor detectors cover a much wider spectral range than PMT's. They are available in stand-alone housings or mounted in heads ready for attachment to any of our monochromators. The optional mounting head, which comes with a BNC connector, facilitates the use of various filters, difusers, or lenses. Stand-alone read-out units and an A/D converter for windows based computer are also available.

#### Silicon Photodiodes

Sciencetech silicon photodetectors are photovoltaic devices, available in either standard or UV-enhanced versions. Standard Si detectors have a spectral range between 350 nm and 1100 nm, and the UV-enhanced type extend the range down to 200 nm in the ultraviolet.

#### Germanium, Indium-Gallium Arsenide, and Indium Arsenide Photodiodes

Ge, InGaAs, and InAs are also photovoltaic devices with greater sensitivity in the infrared. The spectral responsivity of the three are very much dependent upon temperature. Sensitivity increases with decreasing temperature but the responsivity curve also becomes narrower. Thermoelectrically-cooled versions are available from Sciencetech, consisting of the detector and a two-stage thermoelectric cooler in one single package. Temperature differences with respect to ambient are about 55°C.

#### Lead Sulfide and Lead Selenide Photoconductive Cells

Sciencetech PbS and PbSe detectors are photoconductive semiconductors which experience a drop in resistance when irradiated by infrared radiation. In order to obtain a reasonable signal, these devices need to be biased through a load resistor.

At room temperature, PbSe has a peak responsivity at 3.8  $\mu\text{m}$  and a spectral range between 1.0 and 4.5  $\mu\text{m}$ . Available two-stage thermoelectrically-cooled units with Sapphire windows extend the usable range to 5.0  $\mu\text{m}$ , increase the sensitivity, and shift the IR cutoff to longer wavelengths.

PbS room temperature spectral range is from 1 to 2.9  $\mu\text{m}$  with a peak at 2.2  $\mu\text{m}$ . Thermoelectric cooling to -20°C increases the responsivity by a factor of 5 and moves the high wavelength cutoff to 3.2  $\mu\text{m}$ .

Although DC operation is possible, sensitivity is very weak. By far the most effective mode of operation is to chop the signal and use a lock-in amplifier. The best performance is achieved at kHz chopping frequencies. Sciencetech can provide the customer with both chopper systems and lock-in amplifiers.

## PMH-02 Photomultiplier Housing



The Sciencetech PMH-02 Photomultiplier housing is a self-contained compact unit for operation of photomultipliers in analog mode. The PMH-02 housing operates at room temperature. The PMH-04 is a Peltier cooled unit (see corresponding brochure).

A single housing includes the high voltage power supply and all the electronics for analog operation: a tube with a network divider and a low noise preamplifier. The photo tube is in its own chamber to minimize electrical interference and facilitate replacement. A microscope-type flange system allows easy mounting in Sciencetech monochromators or sample chambers.

The PMH-02 accepts 1-1/8" side window photomultiplier tubes. Most photo tubes of this type can be fitted in the housing. The units include high voltage adjustment, LCD display of the actual cathode high voltage or the output signal, BNC signal output, external high voltage control and output from and to a computer. Six different time constants are available to modify the noise filtering, allowing optimization between noise and stabilization time. A zero adjustment control can be used to cancel the effects of dark current and of stray light.

Sciencetech also offers an integrated photon-counting housing. Model PMH-01 features an integrated high voltage power supply and all electronics required for photon-counting operation. Also included are an external voltage adjustment control of high voltage and LCD display. This feature allows high voltage adjustments to be made to optimize the performance of different photon-counting PMT's, (as PMT's age, adjustments may be required to keep optimum performance). High voltage may be manual or computer-controlled. Model PMH-01 accommodates side-on 1-1/8" PMT's, making tubes easy to replace.

*Technical specifications and prices for PMT housings are on the following pages. Please see following pages for available PMT's.*

## PMH-04 Thermoelectric Cooled Photomultiplier System



*Cooling a photomultiplier tube helps substantially in the detection of weak signals. The dark current which sets the low detection limit is reduced by cooling the photocathode. Sciencetech Cooled Photomultiplier systems include a PMH-04 photomultiplier housing with thermoelectric cooling and a temperature controller.*

### Cooled PMT Housings

Similar to our room temperature housing, the PMH-04 is a self-contained system for operation of photomultipliers in analog mode. It consists of a housing with AC power pack and a display unit. The housing includes all electronics for the PMT: a tube with a network divider, a low noise preamplifier, and a high voltage power supply. The high voltage is externally adjustable through a control lead (gain = 1000 V per input volt). The readout includes an LCD display that shows either the actual cathode voltage or the output signal and controls for response time, offset and gain. The high voltage control line and the analog signal output are still available for computer control. The cooled housing features special construction to remove the heat generated by the thermoelectric system. A water heat exchanger is used to accomplish this. The housing includes drip-proof water line connectors. The unit is thermally insulated and includes a heated window to prevent condensation. A thermistor senses the temperature to be set and adjusted by the control unit.

The PMH-04 accepts any 1-1/8" (28 mm diameter) side-on photomultiplier tubes. Sciencetech photomultiplier housings can be mounted to any of Sciencetech's monochromators or sample chambers.

### Temperature Controller

The housing includes connectors for nitrogen purging to eliminate water condensation. An integrated power supply and temperature controller unit for the thermoelectric cooling completes the package. The PMT's can be cooled to a temperature of -20°C with a stability of 0.1°C.

Technical Specifications

PMH-02 PMT Housing		
HIGH VOLTAGE POWER SUPPLY		
High Voltage Output:	0 to -1200 V	
External Voltage Adjust:	Added to manual control	
	Voltage gain -1000 V/V	
Operating Temperature:	+5 to +50 °C	
PMT HOUSING		
Temp Coeff. of output voltage:	0.005 % /°C	
Warm-up time:	10 minutes	
Anode Ripple Noise:	1 mV (@ 0 to 2 kHz)	
Current Linearity:	0.5 (100 iA) anode output signal	
Input regulation:	0.005 % (/volt change of input)	
CONTROLLERANALOG UNIT		
Absolute Maximum Ratings	Max Input Control Voltage:	±10 V
	Max Output Signal Load:	1 kOhm minimum
Display:	4 digit LCD display, High voltage/signal switch	
Display Limits:	Linear ±10 V, Maximum ~±10.4 V	
Gain Settings (V/uA):	1, 10, 100, 1000	
Transimpedance (amplifier gain):	10 <sup>6</sup> , 10 <sup>7</sup> , 10 <sup>8</sup> , 10 <sup>9</sup> Ohm	
	(1X, 10X, 100X, 1000X range respectively)	
Time constant settings (msec):	0.01, 0.1, 1, 10, 100, 1000	
ZEROADJUSTMENT CORRECTION		
GAIN	1X	10X, 100X, 1000X
RANGE	30 mV -780 mV	multiply by the gain up to the saturation limit

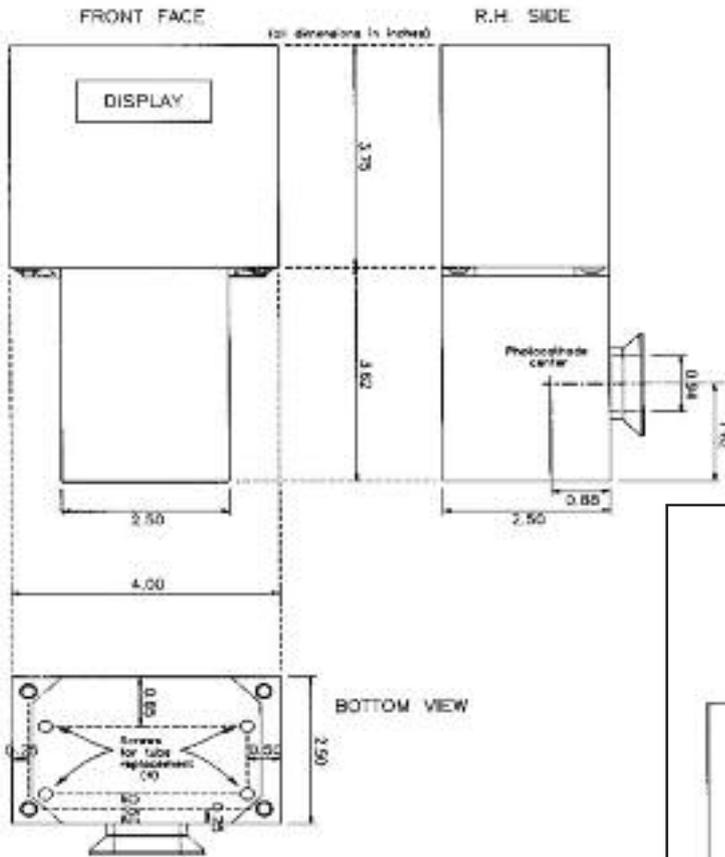
PMH-01 Photon-counting PMT Housing	
High Voltage Output:	300 to 1100 V
Maximum Photocounting Rate:	30 MHz
Maximum Number of Counts:	65,535
Pulse Pair Resolution:	10 ns

PMH-04 PMT Housing	
HIGH VOLTAGE POWER SUPPLY	
High Voltage Output:	300 TO -1100 V
External Voltage Adjust:	Added to manual control Voltage gain -100 V/V -10 to 10 V up to a maximum of -1000 V
Operating Temperature:	+5 to +50°C
Power Consumption:	7 mA
PMT HOUSING	
Temp Coeff of Output Voltage:	0.005 % per°C
Warm-up Time:	10 minutes
Anode Ripple Interference:	1 mV
Linearity of Anode	Output Signal Current: 0.5 (100 uA)
	Input Regulation (per volt change of input): 0.005 %
PHOTOMULTIPLIER CONTROLLER (PMH-04)	
Display:	4 digits LCD display. High voltage/signal switch
Gain Settings (V/uA):	1, 10, 100, 1000
Time Constant Settings (msec):	0.1, 1, 10, 100, 1000

Version Model	Version Description	Version Price (USD)
PMH-01	Photon counting PMT housing for side-on PMT's	—
PMH-02	Analog photomultiplier housing with all electronics	
PMH-02H	Analog PMT housing with separate readout/controller	
PMH-04	Thermoelectrically-cooled PMT housing	P.O.R
PMH-TC	Temperature controller for PMH-04	

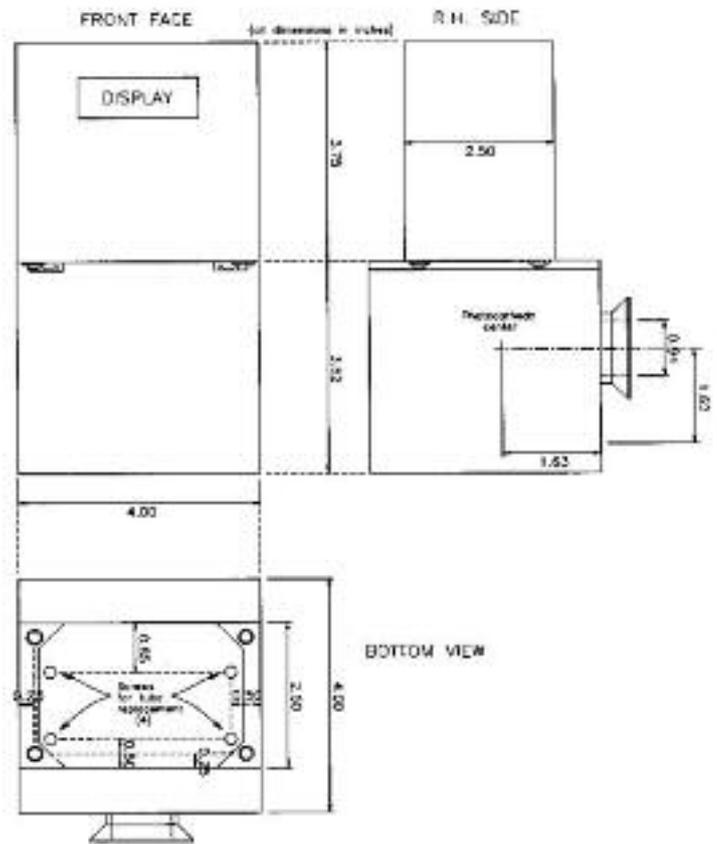
**PMH-02 PMT Housing**

OUTLINE: PMT HOUSING # PMH-02



**PMH-04 PMT Housing**

OUTLINE: PMT HOUSING #PMH-04



Modular Instruments

Integrated Systems & Instruments

Light Sources

Monochromators & Spectrographs

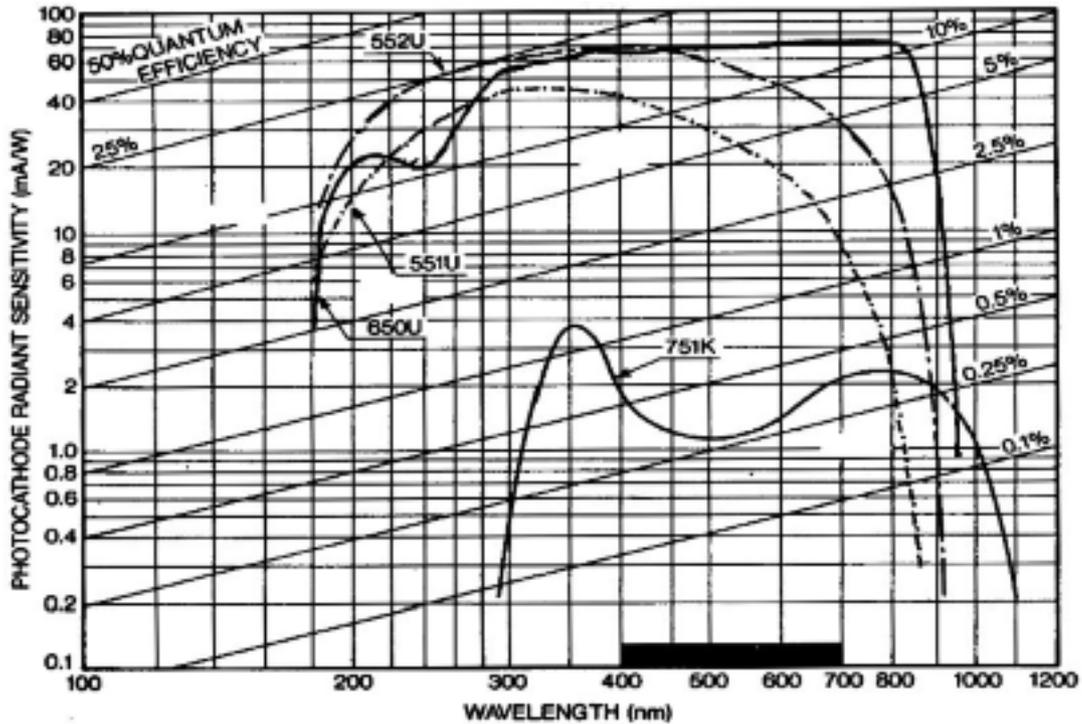
Detection Systems

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# PHOTOMULTIPLIER DETECTION SYSTEMS

## PMT Spectral Responses



### Available Photomultiplier Tubes

Model	Type	Description	Spectral Range (nm)	Peak Wave-length (nm)	Hamamatsu Model #	Similar to Curve Code	Price (USD)
PMT-01	Multialkaline	High sensitivity PMT	185-900	400	R928	552U	
PMT-01-PC	Multialkaline	Photon-counting PMT	189-900	400	R2949	552UAAA	
PMT-02E	Multialkaline	General purpose PMT	185-870	330	R446	551U	
PMT-03	Bialkaline	High sensitivity, low dark current PMT	185-710	410	R4220	456U	AAA
PMT-03-PC	Bialkaline	Photon-counting, high sensitivity, low dark current PMT	185-710	410	R4220P	456U	
PMT-04	GaAs photocathode	High quantum efficiency PMT	185-930	300-800	R636-10	650U	AAA
PMT-05 S-1	AgOCs photocathode	For cooled housing only	300-1200	800	R5108	751K	
PMT-06	Bialkaline S-4 SbCs photocathode	High gain, low dark current PMT	300-650	400	R105	350K	AAA
PMT-07	Bialkaline S-4 SbCs photocathode	General purpose visible range PMT	300-650	400	931A	350K	
PMT-08	Bialkaline S-5 SbCs photocathode	General purpose UVVIS PMT	185-650	340	1P28	350U	

## Infrared Detectors



### Infrared Detectors Available:

Germanium / Indium-Gallium Arsenide / Indium Arsenide / Indium Antimonide / Lead Sulfide / Lead Selenide Mercury-Cadmium Telluride

### Cooling:

In many cases, IR detectors are cooled during use. This cooling affects the spectral response, responsivity, and response speed. Spectral response characteristics of PbS, PbSe, and HgCdTe (MCT) shift to the long wavelength side with cooling, while Ge, InAs, and InSb shift to the short wavelength side. Also, note that the response speeds of PbS and PbSe become slower with cooling. Methods of cooling include thermoelectric cooling and dewar cooling using dry ice, liquid nitrogen, etc.

1. Detector head with integral amplifier, Peltier cooler, temperature sensor.
2. Temperature control unit with integral power supply.

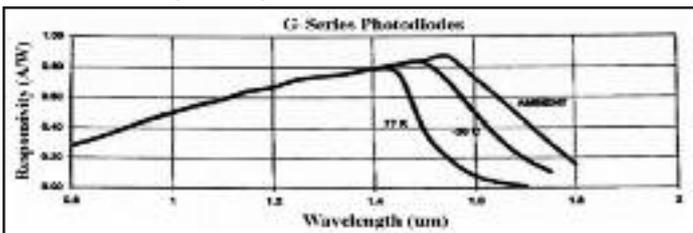
### Nitrogen Cooled Detector Systems Include:

Detector head with integral amplifier mounted in dewar.

### Options Available:

1. Mount adapters for all Sciencetech monochromators.
2. Computer data acquisition board A/D for use with windows-based computer.

Standard 12 bit DC up to 110 KHz frequency. Others available upon requested.



## Ge Detectors 0.8 - 1.8 Microns

Germanium photodiode detectors are designed for operation in the 0.8 to 1.8 micron range. Included are state-of-the-art detector components, detector/amplifier hybrids, and TE-cooled and cryogenically cooled modules.

Standard active areas (mm):

0.1 dia	0.3 dia	1.0 dia	2.0 dia
3.0 dia	5.0 dia	10x10	

Specifications for Ge Detectors	
Active Area	5 mm diameter
Spectral Range	800 -1800 nm @ 298 k 800 - 1500 nm @ 77 k
Shunt Resistance	10 kW @ 289 k > 1000 MW @ 77 k
Shunt Capacitance	40000 pF typical
NEP	< 1.5 x 10 <sup>-12</sup> W/Hz <sup>1/2</sup> @ 298 k < 5 x 10 <sup>-15</sup> W/Hz <sup>1/2</sup> @ 77 k
Responsivity @ 1.3 um	0.8 A/W minimum , 0.9 A/W typical
Dewar Hold Time	12 hours minimum with liquid N <sub>2</sub>
Field of View	60 nominal
Amplifier	Dual - Gain Transimpedance
Gain	1 x 10 <sup>10</sup> V/A / 1 x 10 <sup>9</sup> V/A
Bandwidth	DC - 30 Hz / DC - 300 Hz
Connections	BNC signal; Shielded cable power

Specifications for Ge Detectors	
Active Area	10 mm x 10 mm
Spectral Range	800 -1800 nm @ 298 k 800 - 1500 nm @ 77 k
Shunt Resistance	10 kW @ 289 k > 1000 MW @ 77 k
Shunt Capacitance	50000 pF typical
NEP	< 3 x 10 <sup>-12</sup> W/Hz <sup>1/2</sup> @ 298 k < 5 x 10 <sup>-15</sup> W/Hz <sup>1/2</sup> @ 77 k
Responsivity @ 1.3 um	0.8 A/W minimum , 0.9 A/W typical
Dewar Hold Time	12 hours minimum with liquid N <sub>2</sub>
Field of View	60 nominal
Amplifier	Dual - Gain Transimpedance
Gain	1 x 10 <sup>10</sup> V/A / 1 x 10 <sup>9</sup> V/A
Bandwidth	DC - 30 Hz / DC - 300 Hz
Connections	BNC signal; Shielded cable power

## INFRARED DETECTORS

<b>GELN-50. Ge detector in liquid N2 dewar with integral preamplifier</b>	
<b>Spectral range</b>	800-1500 nm @ 77 K
<b>Active area</b>	5mm
<b>Operating temperature</b>	77K
<b>Responsivity</b>	0.80 A/W minimum, 0.9 A/W typical
<b>NEP</b>	$< 1.5 \times 10^{-15}$ W/Hz <sup>1/2</sup> @ 77 K
<b>Shunt Resistance</b>	10 KOhm @ 298 K > 1000 MOhm @ 77 K
<b>Shunt Capacitance</b>	30000 pF typical
<b>Dewar type</b>	metal, side view
<b>Dewar holding time</b>	10 hours
<b>Dewar size</b>	6.75" height, 2.5" diameter.
<b>Height (from the bottom) of the detector window</b>	1.45"
<b>Field of View</b>	60 degrees nominal
<b>Amplifier</b>	Dual-Gain Transimpedance
<b>Bandwidth</b>	DC-15 Hz/ DC- 150 Hz

### Indium Gallium Arsenide Detectors, 0.9 - 1.7 Microns (InGaAs)

Standard InGaAs photodiode detectors are designed for operation in the 0.8 to 1.7 µm spectral range. Included are state-of-the-art detector components, detector/ amplifier hybrids, and TE-cooled and cryogenically cooled modules. These units offer better performance than germanium detectors. Standard active areas (mm):

0.1 dia 0.3 dia 1.0 dia 2.0 dia 3.0 dia

<b>Indium Gallium Arsenide InGa As Specifications room temperature and two-stage cooled</b>	
<b>Active area</b>	3 mm
<b>Room temperature model</b>	IGA-030
<b>Two stage thermoelectric cooled model</b>	IGA-030/TE2
<b>Operating Wavelength</b>	1.0 - 1.7 um ( 298 K ) 1.0 - 1.6 um ( 243 K )
<b>Responsivity (min)</b>	0.9 @ 1.3 um A/W
<b>Shunt Resistance</b>	1 M - Ohm (298 K ) 20 M- Ohm (243 K )
<b>Shunt C apacitance (typ)</b>	900 pF
<b>NEP (@ peak wavelength and 100 Hz)</b>	$1.5 \times 10^{-13}$ W/Hz <sup>1/2</sup> ( 298 K ) $3.0 \times 10^{-14}$ W/Hz <sup>1/2</sup> ( 243 K )

### Indium Arsenide (InAs) / 1.0-3.6 Microns

Indium Arsenide photodiodes are effective between 1 µm and 3.6 µm with an active area of 1 mm. These detectors operate at room temperature (or thermoelectrically cooled) with thermal noise limited performance. Also available are integrated transimpedance amplifiers, TE cooling and two colour configurations.

### Mercury Cadmium Telluride 1-20 Microns

These high performance HgCdTe photoconductors can cover wavelength regions from 1 to greater than 20 µm. A specific detector's cutoff wavelength depends on its alloy composition which can be tailored for any region of interest.

Short wave MCT detectors are available for applications where increased detectivity is required. Both thermoelectrically-cooled and Nitrogen-cooled versions are offered.

Standard active areas (mm): (quad)

0.0025 x 0.025	0.5 x 0.5	0.25 x 2.0	1.0 x 1.0
0.0500 x 0.050	1.0 x 1.0	0.50 x 2.0	2.0 x 2.0
0.1000 x 0.100	2.0 x 2.0	0.50 x 4.0	4.0 x 4.0
0.2500 x 0.250	4.0 x 4.0	1.00 x 4.0	6.0 x 6.0

### Mercury Cadmium Telluride HgCdTe Specifications

<b>Specified spectral range:</b> 2-12 mm	<b>Active area:</b> 2.0 x 0.5 mm
<b>Package:</b> LN6 dewar	<b>Hold time:</b> 12 hours
<b>Preamplifier type:</b> E20	<b>Dewar window:</b> ZnSe
<b>FOV:</b> 60 Nom deg.	<b>Peak wavelength:</b> 10.6 mm
<b>Cut-off wavelength:</b> 11.8mm	<b>Bias current:</b> 7 mA
<b>Noise equivalent power:</b> $2.0 \times 10^{-12}$ W/Hz <sup>1/2</sup>	
D* (peak, 10KZ, 1 Hz) $4.9 \times 10^{10}$ cm-Hz <sup>1/2</sup> /W	
<b>Responsivity:</b> $8.7 \times 10^5$ bb, V/W @AMP OUT H1	
<b>Responsivity:</b> $2.0 \times 10^6$ pk, V/W @AMP OUT H1	
<b>Noise:</b> $4.1 \times 10^{-6}$ V/Hz <sup>1/2</sup> @AMP OUT H1	
<b>Time constant:</b> 300 ns	<b>Shunt resistance:</b> 120ohms
<b>Amplifier bandwidth:</b> 5-50k/500k Hz	

### Indium Antimonide

The indium antimonide photodiodes are sensitive over the 1.0 to 5.5 micron spectral range. Operated at cryogenic temperatures these units are background noise limited. Standard active areas (mm):

0.10 x 0.10	1.0 dia	4.00 dia
0.25 x 0.25	1.5 dia	5.00 dia
0.25 dia	2.0 dia	7.00 dia
0.50 dia	2.0 dia	10.0 dia

# INFRARED DETECTORS

## Lead Sulfide and Lead Selenium Detectors, 1-3 and 1-5 Microns

These detectors are designed to operate in the 1-3 and 1-5  $\mu\text{m}$  spectral range. They are offered as room temperature or thermoelectrically-cooled detectors. The units have state-of-the-art sensitivity and offer accessories such as optical filters, integral preamplifiers and temperature control systems.

Standard active area (mm):  
 1 x 1      2 x 2      3 x 3      5 x 5

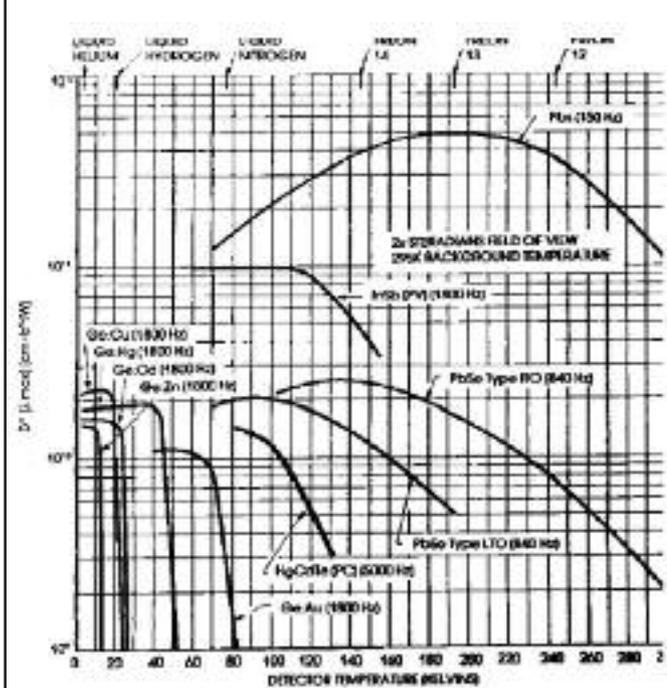
### Thermal Detectors

Thermal detectors give a flat wavelength response. They are much less sensitive than the semiconductor detectors described above but are the only option for detection in the far infrared region. Thermopiles, pyroelectric and bolometers (generally cooled at He temperatures) are a few of the possible detectors. Contact Sciencetech with your specifications and we will help you select a suitable system which will satisfy your needs.

### Dewars

Liquid nitrogen cryostats are available in either side view or end view geometry. These dewars have a typical coolant hold time exceeding 10 hours. Preamplifiers are integrated into the dewar achieving optimum sensitivity, with minimum microphonics. Larger sizes available upon request.

## Dependence of detectivity on Operating Temperature for Typical Detectors

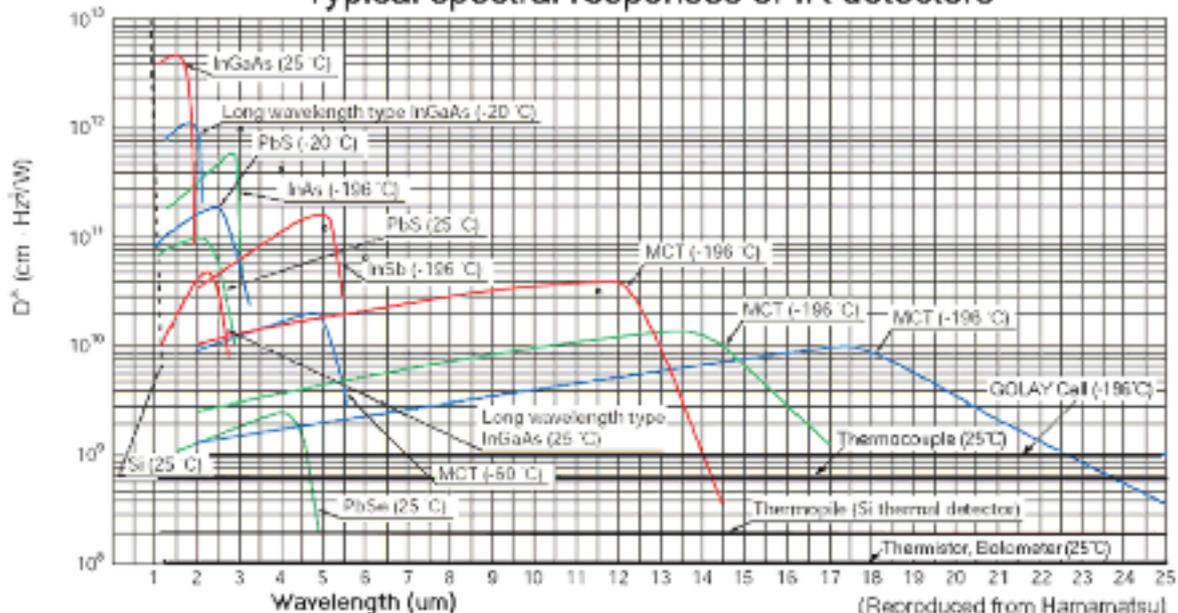


Source: Hamamatsu Corporation catalog.

\* All liquid Nitrogen cooled detector prices include dewar and preamplifier.

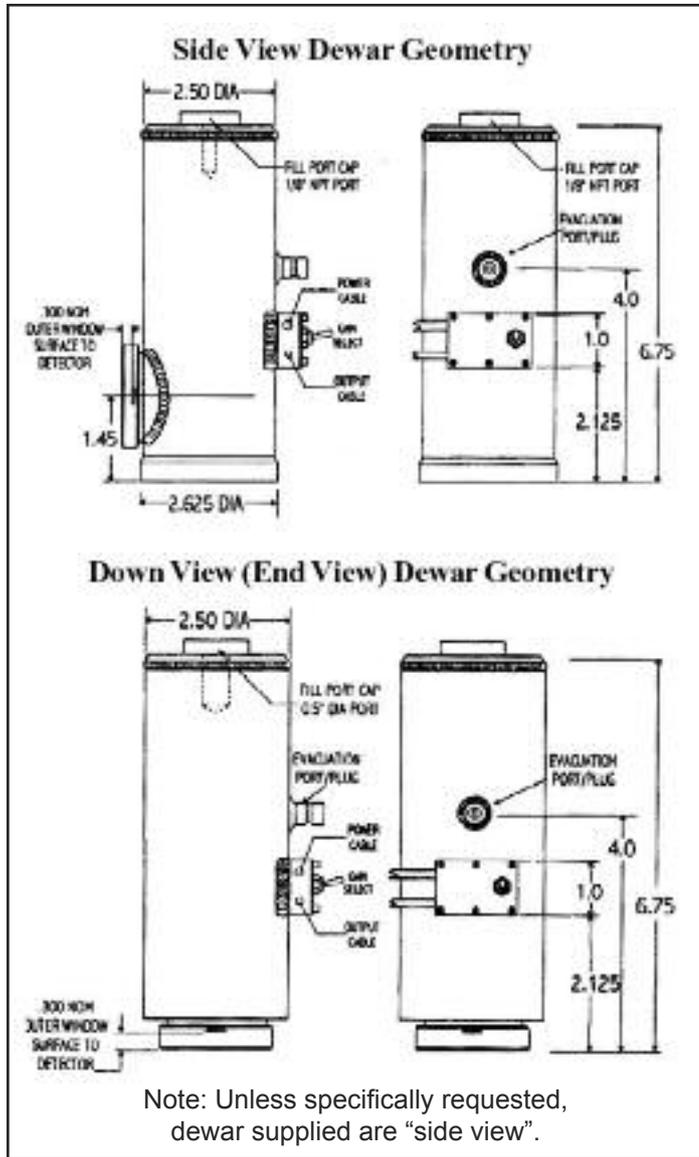
\* All Thermoelectric cooled detector prices include preamplifier.

## Typical spectral responses of IR detectors



(Reproduced from Hamamatsu)

# INFRARED DETECTORS

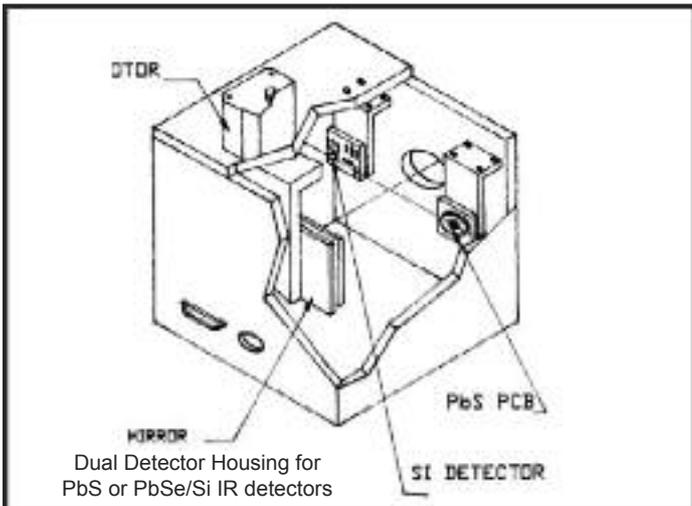


InSb/MCT 2-Colour Detectors		
Model	Description	Price(USD)
SC-InSb-MCT12-10LN	1mm dia InSb Photodiode (2-5.5µm)/mm x 1mm MCT12 (5.5-14µm) detector	\$\$\$
SC-InSb-MCT12-20LN	2mm dia InSb Photodiode(2-5.5µm)/2mm x 2mm MCT12 (5.5-14µm) detector	.

Liquid Nitrogen-Cooled Detectors			
Model	Active Area	Wave-length	Price (USD)
SC-Ge30-LN	3mm Diameter	0.8 – 1.7µm	\$\$\$
SC-Ge50-LN	5mm Diameter	0.8 – 1.7µm	
SC-Ge100-LN	10mm Square Area	0.8 – 1.7µm	
SC-INSB10-LN	1mm Diameter	1.0 – 5.5 µm	\$\$\$
SC-INSB20-LN	2mm Diameter	1.0 – 5.5 µm	\$
SC-INSB30-LN	3mm diameter	1.0 – 5.5 µm	\$\$\$
SC-INSB40-LN	4mm diameter	1.0 – 5.5 µm	\$
SC-INSB50-LN	5mm Diameter	1.0 – 5.5 µm	\$
SC-INGAAS10-LN	1mm Diameter	0.9 – 1.7 µm	\$\$
SC-INGAAS20-LN	2mm Diameter	0.9 – 1.7 µm	\$
SC-INGAAS30-LN	3mm Diameter	0.9 – 1.7 µm	\$
SC-MCT10-10LN	1mm Square Area	2 -12 µm	\$
SC-MCT10-20LN	2mm Square Area	2 -12 µm	\$
SC-MCT12-10LN	1mm Square Area	2-14 µm	\$
SC-MCT14-10LN	1mm Square Area	2-15 µm	\$
SC-MCT14-20LN	2mm Square Area	2-15 µm	\$
SC-MCT16-10LN	1mm Square Area	2-16 µm	\$
SC-MCT20-10LN	1mm Square Area	2-20 µm	\$
PS-1	Power Supply for LiquidNitrogen Cooled Detectors		\$

# INFRARED DETECTORS

## IR Detector Units



Dual PbS-Si and PbSe-Si detectors are excellent detectors for the infrared range. They feature an Si detector in dual housing with PbS or PbSe detector and a compact PC board which integrates the PbS or PbSe detector, a lock-in amplifier and optical chopper onto one board. Detector selection is computer controlled. A DC power supply provides the system with the means for excellent infrared measurement. The PbS detector has a spectral range of 1mm to 2.9 mm. PbSe detector has a spectral range of 1.5 mm to 4.8 mm. Refer to previous page for spectral response curves.

### Dual PbS or PbSe/Si detector system for infrared detection

- Dual detector housing
- PbS or PbSe detector in compact PC board with integrated lock-in amplifier and optical chopper.
- Si detector with integrated preamplifier
- Power supply for system
- All cables and electronics required for system
- Motor controller

#### Technical Specifications

	PbS	PbSe
<b>Response Speed:</b>	0.5 Hz	0.5 Hz
<b>Chopping Frequency:</b>	14 Hz	14 Hz
<b>Lower Detection Limit:</b>	100pW	10nw
<b>Spectral Range:</b>	1-2.9mm	1.5-4.8mm
<b>Detector Area</b>	3mm x 3mm	3mm x 3mm

Sciencetech offers room temperature PbSe photoconductor detectors for operation in the 1.0 - 4.5 mm spectral range. The units have state-of-the-art sensitivity and may be supported by accessories such as optical filters (longpass and bandpass), integral preamplifiers and infrared source assemblies. These units find applications in industrial control systems, gas analyzers, thermal sensors and general infrared instrumentation.

## PbS and PbSe Detectors (room temperature in PC board with integral lock-in amplifier and chopper)

Specifications PbS Unit	
<b>Spectral Range</b>	1-2.9 um
<b>Peak Sensitivity Wavelength</b>	2.2 um
<b>Detector Size</b>	3x3 mm
<b>Response Speed</b>	0.5 Hz
<b>Photosensitivity</b>	3x10 <sup>6</sup> V/W typical
<b>Temperature Stability of Gain</b>	+/- 10% typical
<b>Maximum Detection Energy</b>	5 uW
<b>Lower Detection Limit</b>	110 pW
<b>Chopping Frequency</b>	14 Hz
<b>Noise</b>	2 m Vp-p typ

Specifications PbSe Unit	
<b>Spectral Rangel</b>	1.5 to 4.8 um
<b>Peak Sensitivity Wavelength</b>	3.8 um
<b>Detector Size</b>	3x3 mm
<b>Response Speed</b>	0.5 Hz
<b>Photosensitivity</b>	3x10 <sup>4</sup> V/W typical
<b>Temperature Stability of Gain</b>	+/- 5% typical
<b>Maximum Detection Energy</b>	500 uW
<b>Lower Detection Limit</b>	10 pW
<b>Chopping Frequency</b>	14 Hz
<b>Noise</b>	2 m Vp-p typ

Version Model	Version Description	Version Price(USD)
<b>PBS-CL1 (PBSE)</b>	IR detector unit with PbS (PbSe) detector on PC boardwith lock-in amplifier and optical chopper	P.O.R
<b>DDS-IR (DHSi)</b>	Dual detector system including IR detector unit, dual housing, Si detector, power supply and motor controller	P.O.R

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# INFRARED DETECTORS

## InGaAs Near-Infrared Multichannel Detector



Sciencetech's InGaAs Detector systems are specifically designed for near-infrared spectroscopy applications. It can also be used for radiation thermometry and optical fibre transmittance measurement.

These detector systems include everything to get going from the Hamamatsu detector head, power supply, and A/DPCI interface board to a Window-based computer, cables, and real-time data acquisition software with Active-X controls. Sciencetech's InGaAs Detector systems are the most economical and easy to integrate near infrared detection solution for new and existing flat field spectrographs and monochromators.

### Spectrograph/Monochromator Compatibility

Sciencetech InGaAs near infrared detectors can be mounted on the exit port of any flat field spectrograph/monochromator, and not just those manufactured by Sciencetech. Custom adaptor plates are available for mating Sciencetech to non-Sciencetech spectrographs and monochromators. Sciencetech can be mated to all Sciencetech flat field spectrograph models.

Please note the sensors have a linear width of 12.8mm, and thus may not span the entire spectral field of view of some monochromators.

### Real-Time Data Acquisition Software

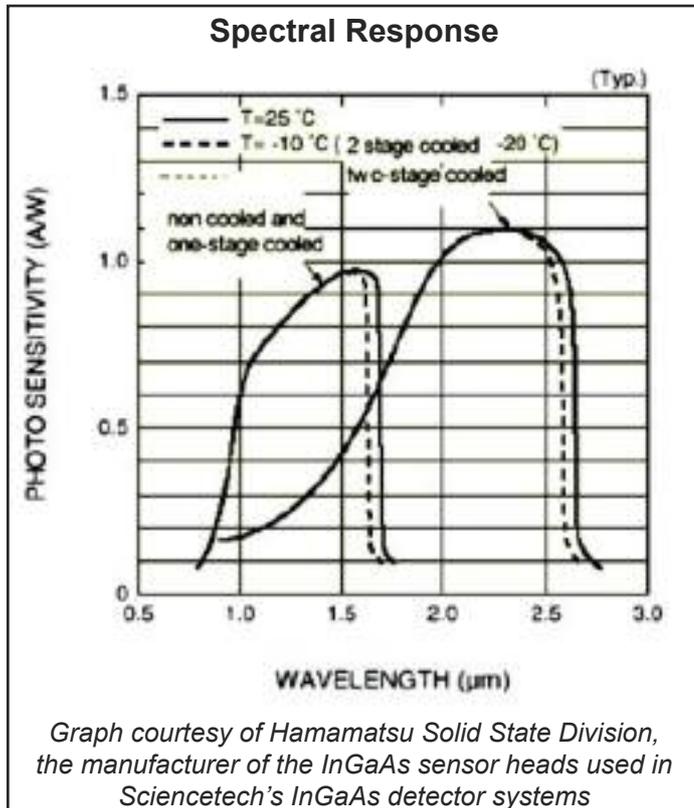
Sciencetech's SCI-LDA software is a universal Windows-based data acquisition application that captures realtime spectral data from Sciencetech's LDA2000, linear CCD, area CCD, and InGaAs near infrared detectors. The acquisition software then displays the real-time spectral data in graphical format, which can be printed, saved to a bitmap file, or saved as a series of data points in ASCII format for importation to third party analytical software packages. Please note that data printing and saving features refer to "one instant" in time and not as a continuous stream

### Highlights

- Complete InGaAs detector system with sensor head, power supply, A/DPCI interface board, cables, and real time data acquisition software
- 900nm ~ 1,670nmspectral response
- 1,200nm ~ 2,550nmspectral response (two stage cooled version)
- 256 and 512 element models
- 12-bit non-cooled version
- 16-bit single and two stage cooled version
- Windows based Active-X real-time data acquisition software
- Reliable Hamamatsu InGaAs sensor head

of real-time data. Users can also customize the graphical display such as set scale factors, axis units wavelength vs. wave number, magnification, even centering of data around grating position. Detector functions such as integration time, input voltage scaling, shutter control (CCD detectors only), and cooling (if available) can also be set through the acquisition software. Other features include hardware setup, acquisition routine setup, load calibration files, and simultaneous display of different scans for comparison purposes. Data can be averaged and shown as individual scans with available offset subtraction. Application is written in Active-X for possible incorporation into existing software.

Un-Cooled InGaAs Models	
256 elements, 12-bit (900nm ~ 1,670nm)	LINGAAS-256
512 elements, 12-bit (900nm ~ 1,670nm)	LINGAAS-512
Single Stage Cooled InGaAs Models	
256 elements, 16-bit (900nm ~ 1,670nm)	LINGAAS-256C
512 elements, 16-bit (900nm ~ 1,670nm)	LINGAAS-512C
Two Stage Cooled InGaAs Models	
256 elements, 16-bit (1,200nm~2,550nm)	LINGASS-256C2
Options	
Tall Pixel Elements for higher sensitivity (Not available on two-stage cooled models)	0.5mmPixel
Zero Pixel Defect (Avail on single-stage cooled models only)	ZeroPixelDefect
Std Mount (Sciencetech spectrographs)	Standard Mount
Custom Mount (All other spectrographs)	CustomMount



### A/D PCI Interface Board Specifications

- National Instrument Compatible 12-bit A/DPCI board at 150kHz (for un-cooled detectors)
- National Instrument Compatible 16-bit A/DPCI board at 200kHz (for one and two stage cooled detectors)
- 16 channel single ended or 8 channel differential
- Burst mode
- Three on-board counters
- Windows Drivers and plug and play capability
- Auto-calibrating  
Universal Library for development in Visual C++, Visual Basic, Delphi and LabView.
- LabView library available at extra cost

### Mounting to Monochromators and Spectrographs

Sciencetech standard detector mount allows the InGaAs detector system to mate with any Sciencetech flat field spectrographs such as the model 8030, 8010, 9055, 9060, 9040, 9057, and 9490 (ask a Sciencetech representative for entire list of flat field spectrographs).

Sciencetech also has custom mounts that can mate the InGaAs detector to any flat field monochromator or spectrograph. However, it is important to know the exact location of the focal plane and field of view for proper mating. Due to the small 12.8mm length of InGaAs sensors, it may not cover the entire spectral field of view of some monochromators and spectrographs. Please check its specifications first.

### Non-Cooled and One Stage Cooled Sensor

<b>Sensor Type:</b>	InGaAs photo diode array
<b>Spectral Response:</b>	900nm~1,700nm
<b>Peak Sensitivity Wavelength:</b>	1,500nm
<b>Standard Pixel Element Size:</b>	50 µm x 0.25 mm (256) 25 µm x 0.25 mm (512)
<b>Optional Tall Pixel Element Size:</b>	50 µm x 0.50 mm (256) 25 µm x 0.50 mm (512)
<b>Sensor Active Area:</b>	12.8 mm x 0.25 mm /0.5mm
<b>Pixel Defects:</b>	=<5pixelsin256 =<10pixelsin512
<b>Optional Zero Pixel Defects:</b>	Cooled Version only
<b>Dark Current (Non-cooled):</b>	2pA/pixel
<b>Dark Current (One stage cooled):</b>	0.1pA/pixel
<b>Conversion Gain incl. Circuit Gain:</b>	0.3V/pC
<b>One Stage Cooled (TE cooler):</b>	-10°C
<b>Photo Response Non-Uniformity:</b>	+/-5%

### Two-Stage Cooled Sensor

<b>Sensor Type:</b>	InGaAs photodiode array
<b>Spectral Response:</b>	1,200nm~2,600nm
<b>Peak Sensitivity Wavelength:</b>	2,300nm
<b>Pixel Element Size:</b>	50 µm x 0.25 mm (256)
<b>Sensor Active Area:</b>	12.8 mm x 0.25mm
<b>Pixel Defects:</b>	=< 12 pixels in 256
<b>Optional Zero Pixel Defects:</b>	Not Available
<b>Dark Current (double stage cooled):</b>	1000pA/pixel
<b>Conversion Gain incl. Circuit Gain:</b>	0.3 V/pC
<b>Two Stage Cooled (TE cooler):</b>	- 20°C
<b>Photo Response Non-Uniformity:</b>	+/- 10%

### Detector System Specifications

#### Sensor Head Specifications

<b>Integration Time:</b>	10ms minimum
<b>Analog Output Signal:</b>	+1Vto +10V
<b>Digital Output Signal:</b>	12 or 16 bit scalable to 1.25V, 2.5V, 5V, 10V

#### Sensor Head Dimensions

<b>Non-Cooled:</b>	100mm x 90mm x 34mm
<b>One Stage Cooled:</b>	100mm x 90mm x 69mm
<b>Two Stage Cooled:</b>	100mm x 90mm x 99mm
<b>Focal Plane:</b>	Recessed 2.5 mm from surface

#### Operating Temperature

<b>Un-cooled version:</b>	0°C~+50°C
<b>Cooled version:</b>	+10°C~+30°C

### Power Supply Specifications

The power supply provides all correct voltages and current necessary to drive the sensor head.

<b>Supply Voltage:</b>	120/240VAC input
<b>Sensor Head Voltage:</b>	+15V,-15V, +5V, +12V, +6V

# SINGLE CHANNEL DETECTION SYSTEMS

## Single Channel Detectors

Sciencetech has many different single element detectors that have a wide range of operating wavelengths. These units are high performance photodiodes/receivers operated at ambient temperature with a dual gain FET input transimpedance amplifier. Please note that these detectors are available in various sensor area sizes and have an available thermo-electric cooler for lower dark current and an improved signal-to-noise ratio. The output is an analog signal available through a BNC connector at the back of the detector housing. Since the signal is analog, an optional 12-bit and 16-bit data acquisition system and software are available to digitize its output into a computer. A DC power supply for this detector (sold separately) is also required. These detectors are designed for use with scanning monochromators to capture the intensity of one wavelength at a time. An optional mount allows them to mate to any Sciencetech scanning monochromator. Sciencetech can also provide an optional custom mount for mating to non-Sciencetech monochromators and spectrographs. The output voltage is proportional to the input signal current:  $V_{out} = I_{signal} \cdot R_f$ . The PD/AMP is a DC coupled dual gain system. Care should be taken in shielding these units from stray light during operation to prevent saturation of the amplifier (and potential failure).

## Accessories

### ThermoElectric (TE) Cooler (SC-TE2-H)

Thermo-electric cooler for stabilization/cooling with a dual gain FET input transimpedance amplifier.

### Single Element Detector Data Acquisition System (SC-DAS)

This option includes all cables, power supply, and data acquisition AD board. The Sci-Spec Windows application software to interface a Sciencetech single element or PMT detector to a Windows-based computer is required and is sold separately. Such detectors output an analog signal through a BNC connector which then gets digitized into 12-bits (4,096 counts) or 16-bits (65,536 counts) via a computer interface PCI AD board.

### NIST Detector Calibration Certificate (NISTDetCalib)

A spectral response curve for the specific detector can be generated and compared to the NIST (USA) or NPL (UK) standard. This is an additional service offered by Sciencetech. Various versions of this service are available, depending on the spectral range and resolution requirements.

### Group Accessories

Please check the appropriate sections in the catalogue for the following:

<b>Power Supplies for Single Channel Detectors</b>	(SC-PS1)
<b>Single-Channel Detector Mount Selections</b>	(SC-DETMOUNT)
<b>Data Acquisition Components</b>	(SC-DAS-COMP)
<b>Single-Channel Detector Data Acquisition Software</b>	(SOFTWAREGROUP3)

# SINGLE CHANNEL DETECTION SYSTEMS

Model	Description	Price (USD)
<b>Germanium (Ge) detectors</b>		
SC-Ge20	Ge Detector (0.8 – 1.7nm), <b>2mm</b> Diameter	
SC-Ge30	Ge Detector (0.8 – 1.7nm), <b>3mm</b> Diameter	
SC-Ge50	Ge Detector (0.8 – 1.7nm), <b>5mm</b> Diameter	
SC-Ge100	Ge Detector (0.8 – 1.7nm), <b>10mm</b> Square	
<b>Indium Arsenide (InAs) Detectors</b>		
SC-InAs10	InAs Detector (1.0-3.5 $\mu\text{m}$ ), <b>1mm</b> Diameter.	
SC-InAs20	InAs Detector (1.0-3.5 $\mu\text{m}$ ), <b>2mm</b> Diameter	
<b>Indium Gallium Arsenide (InGaAs) Detectors</b>		
SC-InGaAS10	InGaAs Detector (0.9 – 1.7 $\mu\text{m}$ ), <b>1mm</b> Diameter.	
SC-InGaAS20	InGaAs Detector (0.9 – 1.7 $\mu\text{m}$ ), <b>2mm</b> Diameter.	
SC-InGaAS30	InGaAs Detector (0.9 – 1.7 $\mu\text{m}$ ), <b>3mm</b> Diameter	
SC-InGaAS50	InGaAs Detector (0.9 – 1.7 $\mu\text{m}$ ), <b>5mm</b> Diameter	
<b>Extended Indium Gallium Arsenide (InGaAs Ext) Detectors</b>		
SC-InGaAS10-Ext1.9	InGaAs Detector (1.2 – 2.1 $\mu\text{m}$ ), <b>1mm</b> Diameter	
SC-InGaAS10-Ext2.2	InGaAs Detector (1.3 – 2.6 $\mu\text{m}$ ), <b>1mm</b> Diameter.	
SC-InGaAS30-Ext1.9	InGaAs Detector (1.2 – 2.1 $\mu\text{m}$ ), <b>3mm</b> Diameter	
SC-InGaAS30-Ext2.2	InGaAs Detector (1.2 – 2.6 $\mu\text{m}$ ), <b>3mm</b> Diameter	
<b>Sciencetech Lithium Tantalate (LiTa) Pyroelectric Detectors</b>		
SCISDEX1011	LiTa Detector (100nm-1000 $\mu\text{m}$ window limited), <b>5mm</b> Diameter	
SCIEL404CM	LiTa Detector (100nm-1000 $\mu\text{m}$ window limited), <b>5mm</b> Diameter	
SCIEL420CM	LiTa Detector (100nm-1000 $\mu\text{m}$ window limited), <b>2.7mm</b> Square Area	
SCIEL420BJ	LiTa Energy Detector (100nm-1000 $\mu\text{m}$ window limited), <b>2.7mm</b> Square Area	
<b>Mercury Cadmium Telluride (MCT) Detectors</b>		
SC-MCT4.5-10	MCT Detector (1 - 4.5 $\mu\text{m}$ ), <b>1mm</b> Square Active Area	
SC-MCT4.5-20	MCT Detector (1 – 4.5 $\mu\text{m}$ ), <b>2mm</b> Square Active Area	
SC-MCT5-10	MCT Detector (1 - 5 $\mu\text{m}$ ), <b>1mm</b> Square Active Area	
SC-MCT5-20	MCT Detector (1 - 5 $\mu\text{m}$ ), <b>2mm</b> Square Active Area	
<b>Lead Sulfide (PbS) Detectors</b>		
SC-PbS10	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>1mm</b> Square Area	
SC-PbS20	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>2mm</b> Square Area	
SC-PbS30	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>4mm</b> Square Area	
SC-PbS50	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>5mm</b> Square Area	
SC-PbS60	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>6mm</b> Square Area	
<b>Lead Selenide (PbSe) Detectors</b>		
SC-PbSe10	PbSe Detector (1.0-4.8 $\mu\text{m}$ ), <b>1mm</b> Square Area	
SC-PbSe20	PbSe Detector (1.0-4.8 $\mu\text{m}$ ), <b>2mm</b> Square Area	
SC-PbSe30	PbSe Detector (1.0-4.8 $\mu\text{m}$ ), <b>3mm</b> Square Area	
SC-PbSe50	PbSe Detector (1.0-48 $\mu\text{m}$ ), <b>5mm</b> Square Area	
<b>Silicon (Si) Detectors</b>		
SC-Si10	Si Detector (0.3-1.0 $\mu\text{m}$ ), <b>1mm</b> Diameter Active Area	
SC-Si25	Si Detector (0.3-1.0 $\mu\text{m}$ ), <b>2.5mm</b> Diameter Active Area	
SC-Si50	Si Detector (0.3-1.0 $\mu\text{m}$ ), <b>5mm</b> Diameter Active Area	
SC-Si100	Si Detector (0.3-1.0 $\mu\text{m}$ ), <b>10 x 10mm</b> Active Area	
SC-SiUV25	Si Detector (0.2-1.0 $\mu\text{m}$ ), <b>2.5mm</b> Diameter, UV Enhanced	
SC-SiUV50	Si Detector (0.2-1.0 $\mu\text{m}$ ), <b>5mm</b> Diameter, UV Enhanced	
SC-SiUV100	Si Detector (0.2-1.0 $\mu\text{m}$ ), <b>10x10mm</b> Active Area, UV Enhanced	
<b>Thermopile Detector</b>		
SC-TH20	TH Detector (2-16 $\mu\text{m}$ ), <b>2mm x 2mm</b> Active Area	
SC-TH60	TH Detector (2-16 $\mu\text{m}$ ), <b>6mm</b> Diameter Active Area	

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## SINGLE CHANNEL DETECTION SYSTEMS

List of Two-Colour Detectors				
Model	Active Area	Operating Wavelength (µm)	TE Cooling Available	Price (USD)
<b>Two-Colour Silicon / Germanium Detectors</b>				
SC-SiGe-25-20	2.5 mm dia. Si Photodiode / 2 mm dia. Ge Photodiode	0.2 - 1.0/1.0 - 1.8	Yes	
<b>Two-Colour Silicon / InAs Detectors</b>				
SC-SiInAs-25-20	2.5 mm dia. Si Photodiode / 2 mm dia. InAs photodiode	0.2 - 1.0/1.0 - 3.5	Yes	
<b>Two-Colour Silicon / InGaAs Detectors</b>				
SC-SiInGaAs-25-20	2.5 mm dia Si Photodiode / 2 mm dia InGaAs Photodiode	0.2 - 1.0/1.0 - 1.7	Yes	
SC-SiInGaAs-25-10--EXT	2.5 mm dia Si Photodiode / 1 mm dia ex-InGaAs Photodiode	0.2 - 1.0/1.2 - 2.6	Yes	
<b>Two-Colour Silicon / PbS Detectors</b>				
SC-SiPbs-25-20	2.5 mm dia Si Photodiode / 2 x 2 mm PbS Photodiode	0.2 - 1.0/1.0 - 1.7	Yes	

### Cryogenic Detectors

Sciencetech has many different single element detectors that have a wide range of operating wavelengths. Please note that these detectors are available in various sensor area sizes and include a dewar to hold liquid nitrogen for significantly lower dark current and an improved signal-to-noise ratio. The output is an analog signal available through a BNC connector at the back of the detector housing. Since the signal is analog, an optional 12-bit and 16-bit data acquisition system and software are available to digitize its output into a computer. A DC power supply for this detector (sold separately) is also required. These detectors are designed for use with scanning monochromators to capture the intensity of one wavelength at a time. An optional mount allows it to mate to any Sciencetech scanning monochromator. Sciencetech can also provide an optional custom mount for mating to non-Sciencetech monochromators and spectrographs.

### Accessories

#### Single Element Detector Data Acquisition System (SC-DAS)

This option includes all cables, power supply, and data acquisition AD board. The Sci-Spec Windows application software to interface a Sciencetech single element or

PMT detector to a Windows-based computer is required and is sold separately. Such detectors output an analog signal through a BNC connector which then gets digitized into 12-bits (4,096 counts) or 16-bits (65,536 counts) via a computer interface PCI AD board.

#### NIST Detector Calibration Certificate (NISTDetCalib)

A spectral response curve for the specific detector can be generated and compared to the NIST (USA) or NPL (UK) standard. This is an additional service offered by Sciencetech. Various versions of this service are available, depending on the spectral range and resolution requirements.

#### Group Accessories

Please check the appropriate sections in the catalogue for the following:

<b>Power Supplies for Single Channel Detectors</b>	(SC-PS1)
<b>Data Acquisition Components</b>	(SC-DAS-COMP)
<b>Single-Channel Detector Data Acquisition Software</b>	(SOFTWAREGROUP3)

## SINGLE CHANNEL DETECTION SYSTEMS

Thermoelectrically Cooled Detectors		
Model		Price (USD)
<b>TE-cooled Ge Detectors</b>		
SC-Ge10-TE	Ge Detector (0.8 – 1.7nm), <b>1mm</b> Diameter, Thermoelectrically Cooled	\$
SC-Ge20-TE	Ge Detector (0.8 – 1.7nm), <b>2mm</b> Diameter, Thermoelectrically Cooled	\$.
SC-Ge30-TE	Ge Detector (0.8 – 1.7nm), <b>3mm</b> Diameter, Thermoelectrically Cooled	\$.
SC-Ge50-TE	Ge Detector (0.8 – 1.7nm), <b>5mm</b> Diameter, Thermoelectrically Cooled	\$
SC-Ge100-TE	Ge Detector (0.8 – 1.7nm), <b>10mm</b> Square, Thermoelectrically Cooled	\$
<b>TE-cooled InAs Detectors</b>		
SC-InAs10-TE	InAs Detector (1.0-3.4 $\mu\text{m}$ ), <b>1mm</b> Diameter, Thermoelectrically Cooled	\$
SC-InAs20-TE	InAs Detector (1.0-3.4 $\mu\text{m}$ ), <b>2mm</b> Diameter, Thermoelectrically Cooled	\$
<b>TE-cooled InGaAs Detectors</b>		
SC-InGaAs10-TE	InGaAs Detector (0.9 – 1.7 $\mu\text{m}$ ), <b>1mm</b> Diameter, Thermoelectrically Cooled	\$.00
SC-InGaAs20-TE	InGaAs Detector (0.9 – 1.7 $\mu\text{m}$ ), <b>2mm</b> Diameter, Thermoelectrically Cooled	\$.00
SC-InGaAs30-TE	InGaAs Detector (0.9 – 1.7 $\mu\text{m}$ ), <b>3mm</b> Diameter, Thermoelectrically Cooled	\$.00
SC-InGaAs50-TE	InGaAs Detector (0.9 – 1.7 $\mu\text{m}$ ), <b>5mm</b> Diameter, Thermoelectrically Cooled	\$.00
<b>TE-cooled PbS Detectors</b>		
SC-PbS10-TE	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>1mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-PbS20-TE	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>2mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-PbS30-TE	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>3mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-PbS50-TE	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>5mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-PbS60-TE	PbS Detector (1.0-2.8 $\mu\text{m}$ ), <b>6mm</b> Square Area, Thermoelectrically Cooled	\$.00
<b>TE-cooled PbSe Detectors</b>		
SC-PbSe10-TE	PbSe Detector (1.0-4.5 $\mu\text{m}$ ), <b>1mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-PbSe20-TE	PbSe Detector (1.0-4.5 $\mu\text{m}$ ), <b>2mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-PbSe30-TE	PbSe Detector (1.0-4.5 $\mu\text{m}$ ), <b>3mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-PbSe50-TE	PbSe Detector (1.0-4.5 $\mu\text{m}$ ), <b>5mm</b> Square Area, Thermoelectrically Cooled	\$.00
<b>TE-cooled MCT Detectors</b>		
SC-MCT4.5-10TE	MCT Detector (1.0-4.5 $\mu\text{m}$ ), <b>1mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-MCT4.5-20TE	MCT Detector (1.0-4.5 $\mu\text{m}$ ), <b>2mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-MCT5-10TE	MCT Detector (1.0-4.5 $\mu\text{m}$ ), <b>1mm</b> Square Area, Thermoelectrically Cooled	\$.00
SC-MCT5-20TE	MCT Detector (1.0-4.5 $\mu\text{m}$ ), <b>2mm</b> Square Area, Thermoelectrically Cooled	\$.00

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# LINEAR PHOTO-DIODE ARRAY DETECTORS

## LDA2000 Linear Photo-Diode Array Detector



Sciencetech's LDA2000 series linear photo-diode array detectors are designed for use in spectrophotometer systems by mating it to the exit port of flat field spectrographs. They can also be used in other spectroscopic applications that need to capture dispersed spectral data in real time. They are cost effective compared with CCD detector systems and boast a wide spectral sensitivity range from 200nm ~ 1000nm (mid UV to near IR) making it a practical choice for most applications.

### Available Models

The LDA2000 series detectors are available in 512 and 1024 linear pixel array elements. The sensors have a linear width of 25.6mm for both models. These detectors utilize Hamamatsu's S390X and S838X series NMOS linear image sensor chips. Such sensors are available in standard, extra large element size, and high infrared sensitivity versions.

### System Components

Sciencetech's complete LDA2000 detector system includes the camera head module, 2ft cable, power supply adapter, 16-bit A/D PCI computer interface card (12-bit available), and Sciencetech's SCI-LDA real-time data acquisition software.

### Spectrograph Compatibility

Sciencetech LDA2000 series detectors can be mounted on the exit port of any flat field spectrographs, and not just those manufactured by Sciencetech. Custom adaptor plates for mating LDA2000 detectors to non-Sciencetech spectrographs are available. The LDA2000 is compatible with all Sciencetech spectrograph models. When mated to Sciencetech Model 8010 flat field spectrograph, the resulting spectrophotometer system allows rapid acquisition and storage of up to twenty-four 1024 spectral points. Even Sciencetech's smallest spectrographs, Model 8030 (with

## Highlights

- 512, 1024 element NMOS sensor
- 200nm ~ 800nm spectral response
- High IR sensitivity and large area sensor element versions available
- Mates to any flat field spectrograph using custom adaptor plate
- Shutterless system
- 16-bit output
- 15msec ~ 2sec integration time
- Digital and analog outputs
- Real-time data acquisition software with Active-X Library

100mm focal length and holographic grating) and Model 9070 (with 100mm focal length and flat grating) can be mated to the LDA2000 detector. The LDA2000 can also be mounted to Sciencetech's larger monochromator models such as Models 9055, 9060, 9040, 9057, 9490, and 9150 in manual, motorized, and high-resolution versions.

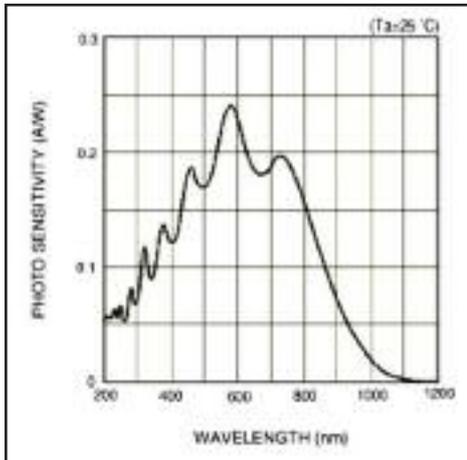
### Detector Data Acquisition Software

Sciencetech's SCI-LDA software is a universal Windows-based data acquisition application that captures real time spectral data from Sciencetech's LDA2000, linear CCD, and area CCD detectors. The acquisition software then displays the real-time spectral data in graphical format, which can be printed, saved to a bitmap file, or saved as a series of data points in ASCII format for importation to third party analytical software packages. Please note that data printing and saving features refer to "one instant" in time and not as a continuous stream of real-time data. Users can also customize the graphical display such as set scale factors, axis units (wavelength vs. wave number), magnification, and even centering of data around grating position. Detector functions such as integration time, input voltage scaling, shutter control (CCD detectors only), and cooling (if available) can also be set through the acquisition software. Other features include hardware setup, acquisition routine setup, load calibration files, and simultaneous display of different scans for comparison purposes. Data can be averaged and shown as individual scans with available offset subtraction. Application written in Active-X for possible incorporation into existing software.

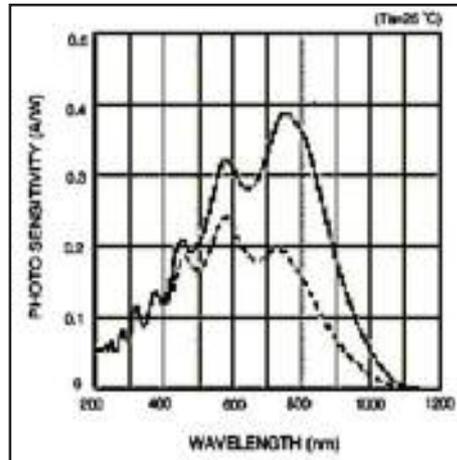
Model	Description
LDA2000-512	512 Element Sensor
LDA2000-1024	1024 Element Sensor

# LINEAR PHOTO-DIODE ARRAY DETECTORS

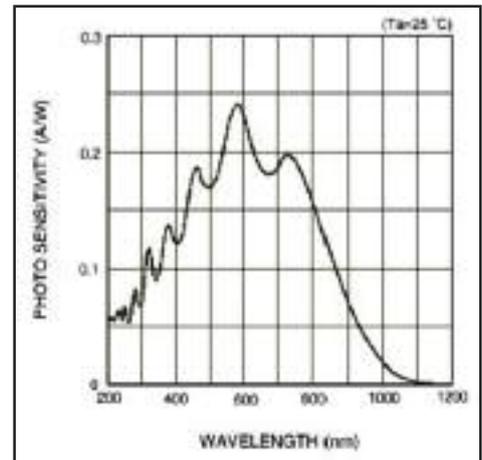
## Spectral Response



**Standard Sensor**



**High Infrared Sensitivity Sensor**



**Extra Large Element Size Sensor**

Graphs courtesy of Hamamatsu Solid State Division manufactures of the imaging sensors used in Sciencetech's LDA2000 series detectors

### Image Sensor Specifications

There are three available sensor versions, Standard, High Infrared Sensitivity, and Extra Large Element Size. All versions are available in 512 and 1024 element sizes. Please check with our representative for details and inquire about availability of other sensor sizes.

<b>Standard Sensor</b>	
Sensor Type	NMOS w quartz window
Number of Elements	512, 1024
Element Size W x H	25µm x 0.5mm (for 1024) 50µm x 0.5mm (for 512)
Spectral Response (10% peak)	200nm to 1000nm
Peak Sensitivity Wavelength	600nm
Dark Current:	0.04pA
Photodiode Capacitance	2pF
Saturation Exposure:	180 m/x*s
Saturation Output Charge	5pC
Photo response non-uniformity	+/- 3% @ 50% saturation

<b>High Infrared Sensitivity Sensor</b>	
Sensor Type	NMOS w quartz window
Number of Elements	512, 1024
Element Size W x H	25µm x 0.5mm (for 1024) 50µm x 0.5mm (for 512)
Spectral Response (10% peak)	200nm to 1000nm
Peak Sensitivity Wavelength	750nm
Dark Current:	0.1pA
Photodiode Capacitance	10pF
Saturation Exposure:	90 m/x*s
Saturation Output Charge	25pC
Photo response non-uniformity	+/- 3% @ 50% saturation

### Detector System Specifications

#### Detector Head Specifications

Input Voltage	84 to 264 VAC, 50Hz~60Hz
Camera Voltage	-12VDC to +12VDC
Analog Output Signal	+0.1V~+7.0V
Digital Output Signal	12-bits scalable to 5V, 10V
Operating Temperature	0°C~50°C

#### Data Acquisition Specifications

The A/D converter is part of the data acquisition system responsible for digitizing the detector output signal. 16-bit A/D PCI Board (12-bit available) for Windows-based computer. Optional 16-bit A/D PCI Board available but not recommended.

#### Mating to Non-Sciencetech Spectrographs

The LDA2000 series detector can be mounted to any flat field spectrograph using a custom designed adaptor plate. Since the location of the focal plane at the spectrograph exit slit is required, Sciencetech recommends sending the spectrograph to its facilities for mating. Please speak to a Sciencetech representative first.

<b>Extra Large Element Size Sensor</b>	
Sensor Type	NMOS w quartz window
Number of Elements	512, 1024
Element Size W x H	25µm x 2.5mm (for 1024) 50µm x 2.5mm (for 512)
Spectral Response (10% peak)	200nm to 1000nm
Peak Sensitivity Wavelength	600nm
Dark Current:	0.1pA
Photodiode Capacitance	10pF
Saturation Exposure:	180 m/x*s
Saturation Output Charge	25pC
Photo response non-uniformity	+/- 3% @ 50% saturation

# CCD DETECTORS

## Area CCD Detector



Picture shown with optional adjustable mount

Sciencetech's Area CCD Detector systems can be used in imaging spectroscopy applications, such as simultaneous multi-spectra spectrophotometry or in typical spectroscopy applications such as fluorescence and Raman spectroscopy by operating in line-binning linear mode. Being a complete detector system with easy to integrate Windows Active-X software, it can be adapted to new and existing spectrographs for applications that require low light level detection within the 200nm~1,100nm (UV~ infrared) spectral range.

### System Components

Detector system includes sensor head by Hamamatsu, power supply, 16-bit A/D data acquisition board for PCs, Sciencetech's SCI-LDA Active-X real-time data acquisition software, cables, and optional mechanical shutter.

### Models Available

Sciencetech's Area CCD detector systems are available in different sensor sizes (512x60, 512x124, 512x252, 1024x60, 1024x124, or 1024x252), with optional back-thinned versions (having slightly smaller pixel counts) that have high quantum efficiency (up to 90% compared to 40%) and high UV sensitivity, optional thermal electric Peltier cooler (to 10C for superior low level light detection), and optional twin blade mechanical shutter (10ms response time).

### Spectrograph Compatibility

Sciencetech CCD detectors can be mounted on the exit port of any flat field spectrographs, and not just those manufactured by Sciencetech. Custom adaptor plates for mating Sciencetech CCD detectors to non-Sciencetech spectrographs are available making it a viable upgrade option. Sciencetech CCD detectors can be mated to all Sciencetech spectrograph models.

## Highlights

- Complete CCD detector system with sensor head, power supply, A/D data acquisition board for PCs, real time data acquisition software, cables, and optional mechanical shutter
- Wide selection of sensor sizes from 512x60 to 1024x252 active elements
- Wide 350nm~1,100nm spectral response
- Line binning linear array mode
- 16-bit output
- Available TE cooler for lowlight detection
- Available back-thinned type CCD sensor for high UV sensitivity and quantum efficiency
- Windows based Active-X real-time data acquisition software for easy incorporation into custom software, and for flexible detector control and data acquisition.
- Low Cost fully integrated detector system utilizing reliable Hamamatsu CCD sensor head

### Standard Front Illuminated CCD Sensors

512 x 60 pixels (12.29mm x 1.44mm)	CCD-0906
512 x 124 pixels (12.29mm x 2.97mm)	CCD-0907
512 x 252 pixels (12.29mm x 6.05mm)	CCD-0908
1024 x 58 pixels (24.58mm x 1.44mm)	CCD-LIN-FR58
1024 x 122 pixels (24.58mm x 2.98mm)	CCD-LIN-FR122
1024 x 250 pixels (24.58mm x 6.05mm)	CCD-LIN-FR250

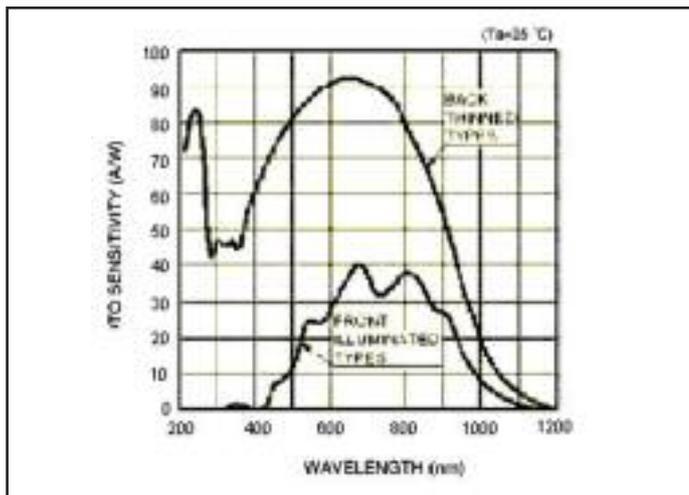
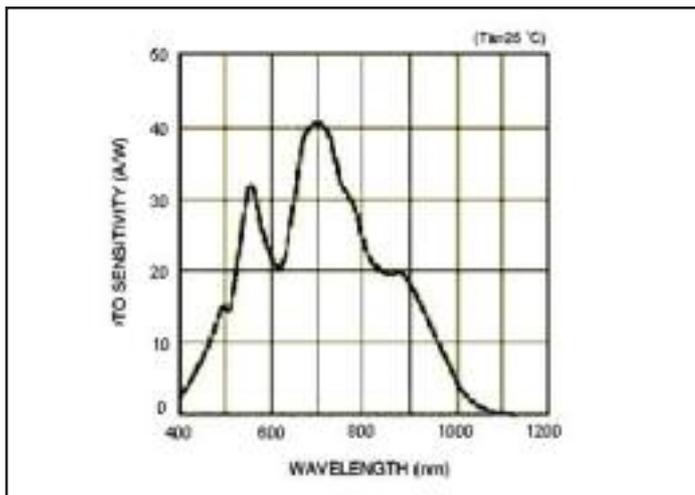
### Optional Back-Thinned CCD Sensors

512 x 58 pixels (12.29mm x 1.39mm)	CCD-0906/B
512 x 250 pixels (12.29mm x 6.0mm)	CCD-0908/B
1024 x 58 pixels (24.58mm x 1.39mm)	CCD-LIN-BT58
1024 x 122 pixels (24.58mm x 2.93mm)	CCD-LIN-BT122
1024 x 250 pixels (24.58mm x 6.0mm)	CCD-LIN-BT250

### Other Options

Thermoelectric Peltier Cooler	TE Cooler
240VAC@50Hz Input Voltage	240VAC
Mechanical Shutter	Shutter

## Spectral Response



Graphs courtesy of Hamamatsu Solid State Division manufactures of the imaging sensors used in Sciencetech's LDA2000 series detectors

### Detector Data Acquisition Software

Sciencetech's SCI-LDA software is a Windows-based Active-X data acquisition application that captures real-time spectral data from Sciencetech's linear photo-diode array detectors and CCD detectors. In CCD linear scan mode, all pixels are vertically binned together to produce one linear array of 512 or 1024 elements before they are acquired. In CCD area scan mode, the entire 2D array is acquired as separate pixels, but can be segregated into individual or "groups" of pixel rows each acting as a separate linear array channel for display and analysis purposes. The acquisition software displays the real-time spectral data in graphical format, which can be printed, saved as a bitmap image, or saved as a series of data points in ASCII format for importation into third party analytical software. Users can also customize the graphical display such as set scale factors, axis units (wavelength vs. wave number), magnification, and even centering of data around grating position. Detector functions such as integration time, input voltage scaling, shutter control and cooling (if available) can also be set through the software. Active-X based controls allow such features to be incorporated into custom software applications.

### CCD Sensor Specifications

#### Standard Front Illuminated CCD Sensor

Sensor Type:	Front Illuminated CCD
Scan Modes:	Area & full vertical binning
Element Size:	24 $\mu\text{m}$ x 24 $\mu\text{m}$
Spectral Response:	400 nm ~ 1100 nm
Peak Sensitivity Wavelength:	700 nm
Dark Current:	900 e-/pixel/s @ 25C
Dark Current with TE Cooler:	15 e-/pixel/s @ -10C

Full Well Capacity:	300,000 e- vertical 600,000 e- horizontal
Conversion Gain incl. Circuit Gain:	15 $\mu\text{V}/\text{e}^-$
Dynamic Range:	30,000
Photo Response Non-Uniformity	+/- 10%

#### Optional Back-Thinned CCD Sensor

Sensor Type:	Back-thinned CCD
Scan Modes:	Area & full vertical binning
Element Size:	24 $\mu\text{m}$ x 24 $\mu\text{m}$
Spectral Response:	200 nm ~ 1100 nm
Peak Sensitivity Wavelength:	650 nm
Dark Current:	5000 e-/pixel/s @ 25C
Dark Current with TE Cooler:	50 e-/pixel/s @ -10C
Full Well Capacity:	300,000 e- vertical 600,000 e- horizontal
Conversion Gain incl. Circuit Gain:	15 $\mu\text{V}/\text{e}^-$
Dynamic Range:	30,000
Photo Response Non-Uniformity:	+/- 10%

*For high UV sensitivity and high quantum efficiency applications (up to 90% efficiency compared with 40% for front illuminated sensors)*

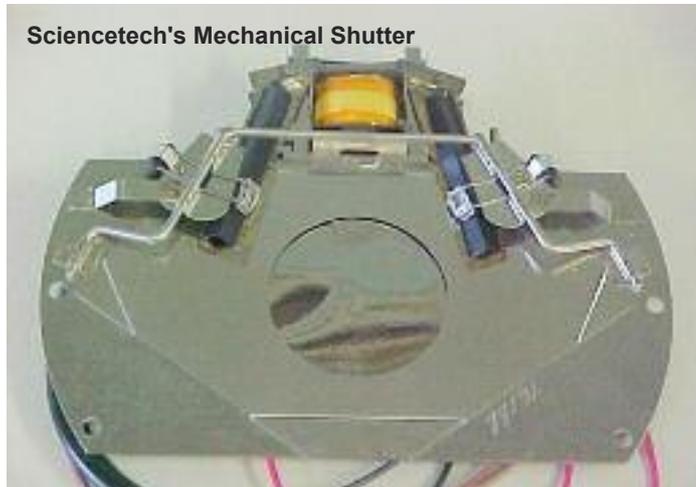
#### Optional Thermo-Electric Peltier Cooler

Cooling Temperature:	-10C +/- 1C
Cool Down Time:	5 min
Power Dissipation of Cooler:	7W
Software Control:	Start, Stop, Monitor

#### Data Acquisition Specifications

- 16-bit A/D Converter data acquisition board for computer
- Separate PCI counter board
- Computer running Windows 98/ME/NT/2000 (not included)

# CCD DETECTORS



Sciencetech's Mechanical Shutter

## Optional Shutter

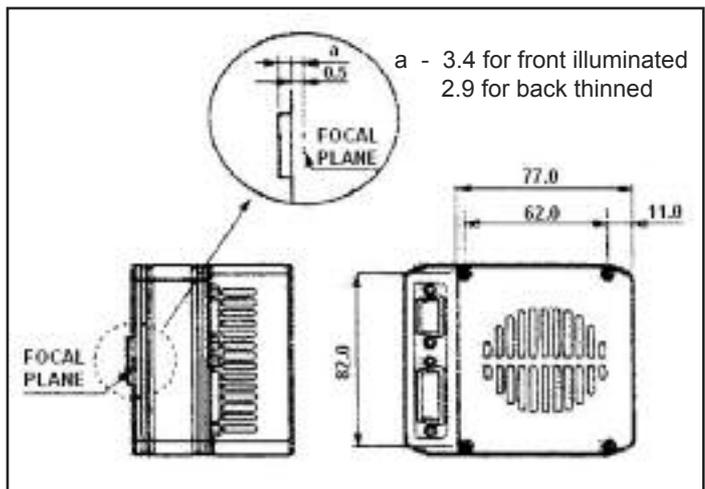
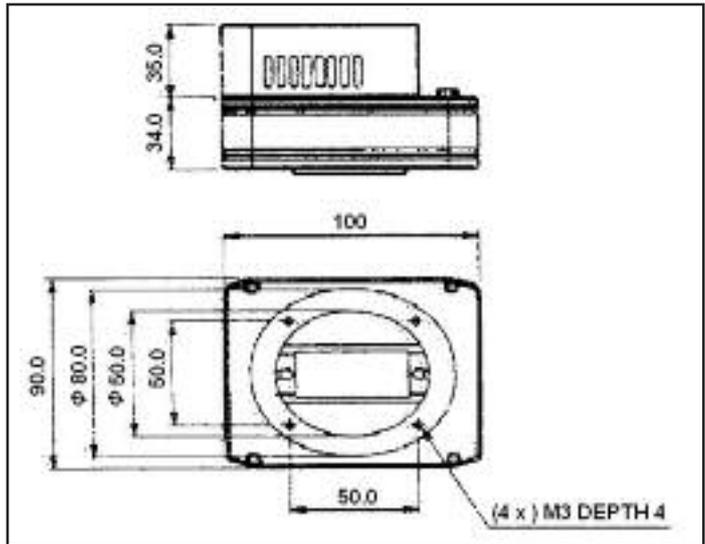
Sciencetech's mechanical shutter is a modular component that mates right in front of the sensor head. It can also be placed inside the spectrograph if the focal plane alignment does not permit it to be mounted in front of the sensor.

- 1" diameter opening
- 2 blade design, horizontal traversing
- 10ms delay
- Software Controlled (through SCI-LDA)

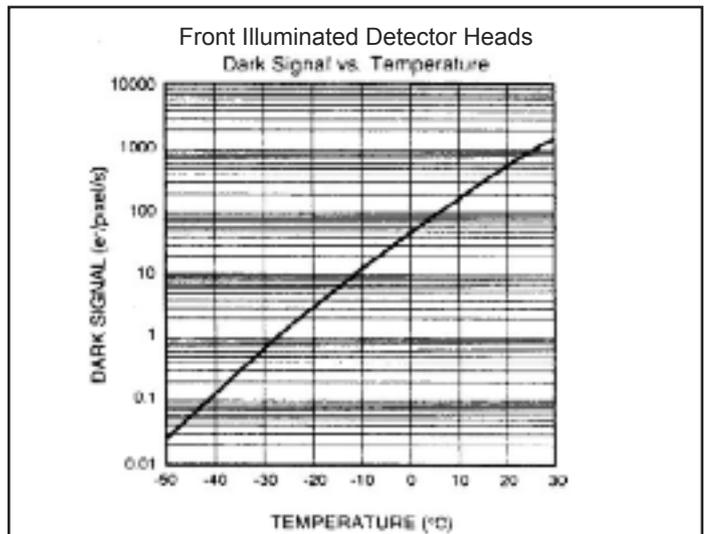
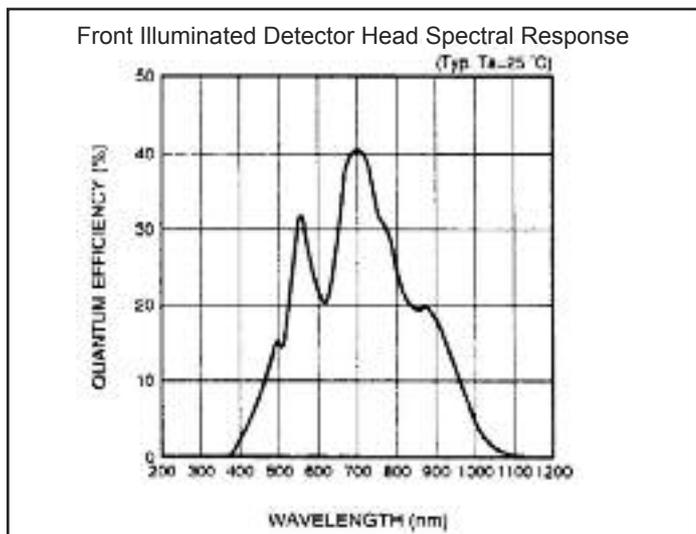
## Mating to Non-Sciencetech Spectrographs

Sciencetech CCD detectors can be mounted to any flat field spectrograph using a custom designed adaptor plate. Since knowing the exact location of the focal plane at the spectrograph exit slit is required, Sciencetech recommends sending the spectrograph to its facilities for CCD detector mating. Please speak to a Sciencetech Representative for details.

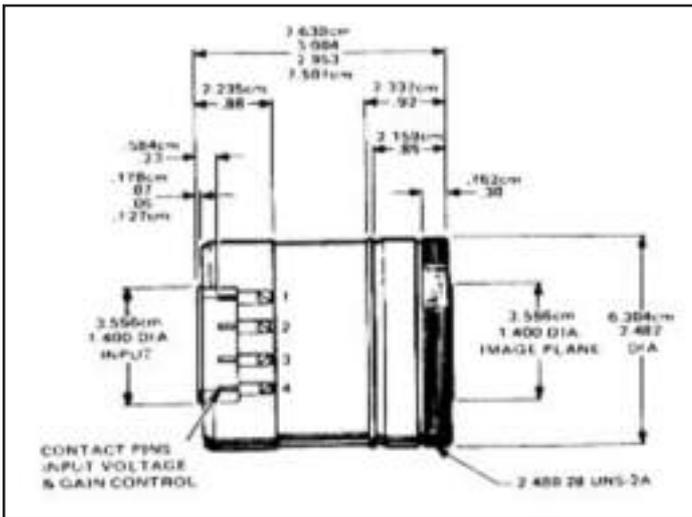
## Spectroscopy CCD Detector Head Dimensions (in mm)



## Two-Dimensional Detector Head Spectral Curves



## Intensifier Systems for CCD Detectors



Sciencetech offers intensifier systems for photodiode array detector cameras and CCD cameras. The system could be an add-on to Sciencetech multichannel detectors or a retrofit to other CCD cameras. This add-on is for non-gating applications. A Generation II Multichannel plate image intensifier (inverter tube) is optically coupled to the active detector with a high-throughput, multi-element lens system.

### Intensifier system includes

- 25 mm GEN II MCP image intensifier
- Inverter tube
- S20 photocathode with spectral response 350 -910 nm
- MIL -1-49040C requirements
- Integral high voltage power supply
- Manual gain control

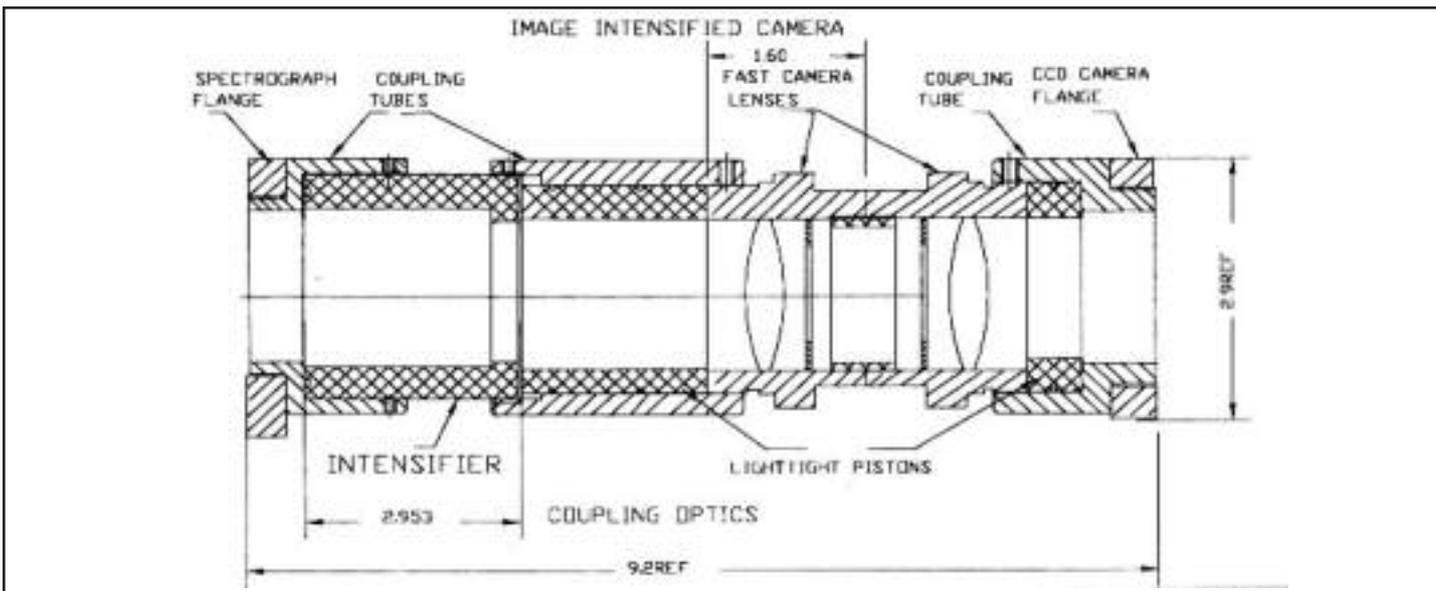
## Technical Specifications

*These specifications are in Mil-spec (min)*

Nominal Operating Voltage:	2.65 V DC
Resolution-Centre:	28 lp/mm
Magnification:	0.96 to 1.04
Luminous Gain:	30,000
Cathode Sensitivity:	240 mA/lumen
Response at 800 nm:	15 ma/W
Phosphor Type:	P-39 Modified
Decay to 10% brightness:	80ms
Equivalent Background Input:	2 x 10 <sup>-11</sup> lm/cm <sup>2</sup>
Distortion:	5% max
Intensifier Dimensions:	6 cm diameter, 7.6 cm length
Lens Optical System Aperture:	f/1.4
Lens Active Diameter:	35 mm
System Dimensions:	9.2" long, 2.9" diameter (23 cm long, 7.25 cm diameter)

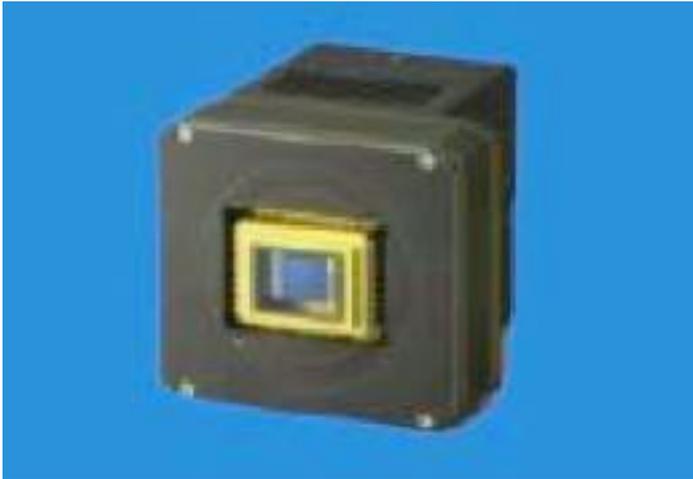
Description	Price (USD)
Retrofit of customer CCD camera with intensifier	
Add on intensifier to Sciencetech CCD or multichannel detectors	

*Note: Prices above include image intensifier, power supply, optical and mechanical coupling and mount. Camera must be sent to Sciencetech for this purpose.*



## CCD DETECTORS

### Low Temperature Cooled Multi-Channel CCD Detector System



This multi-channel detector head is for use with frontilluminated CCD area image sensors that offer high quantum efficiency. This multi-channel detector incorporates a low-noise driver/amplifier circuit that provides reliable operation from simple external signals. It includes a highly stable temperature controller that cools the sensor to a present temperature level ( $T_S = -50^\circ\text{C}$ ) as soon as the power is turned on. If the cooler fails and causes internal circuitry to overheat, the built-in protection circuit automatically turns off the power to the thermo-electric cooler. Despite its compact size, the housing configuration is designed for good heat dissipation, and threaded mounting holes on the front panel allow connections to other devices such as monochromators.

#### CCD Area Image Sensor

The image sensors available for this detection system are specifically designed for low-light-level detection in scientific applications. By using the binning operation, the sensors can be used as a linear image sensor having a long aperture in the direction of the device length. This makes the image sensors ideally suited for use in spectrophotometry. The binning operation offers significant improvement in S/N and signal processing speed compared with conventional methods by which signals are digitally added by an external circuit. These image sensors also feature low noise and low dark signal (MPP mode operation). These enable low-light-level detection and long integration time, thus achieving a wide dynamic range. These sensors have a pixel size of  $24\ \mu\text{m} \times 24\ \mu\text{m}$  and are available in active area of  $24.576\ \text{(H)} \times 2.976\ \text{(V)}$  and  $24.576\ \text{(H)} \times 6.048\ \text{(V)}$  mm. A four-stage Peltier element is built into the same package for thermoelectric cooling. At room temperature operation, the device can be cooled down to  $-70\ ^\circ\text{C}$  using forced air cooling. In addition, since both the CCD chip and Peliter element are hermetically sealed, no dry air is required, thus allowing easy handling.

## HIGHLIGHTS

### CCD Multi-Channel Detector Head

#### Designed for front-illuminated CCD area image sensor

- Line binning operation/area scanning operation
- Driver/amplifier circuit for low noise CCD operation
- Highly stable temperature controller  
Cooling temperature:  $-50 \pm 0.05\ ^\circ\text{C}$  ( $T_a = 10$  to  $35^\circ\text{C}$ )
- Simple signal input operation
- Compact configuration

### Four-Stage TE-Cooled, Front-Illuminated CCD Area Image Sensor

#### CCD1007-LOW/CCD1008-LOW

- $1024\ \text{(H)} \times 124\ \text{(V)}$  and  $1024\ \text{(H)} \times 252\ \text{(V)}$  pixel format
- Pixel size:  $24\ \mu\text{m} \times 24\ \mu\text{m}$
- 100% fill factor
- Wide dynamic range
- Low dark current
- Low readout noise
- MPP operation
- Four-stage TE-cooled

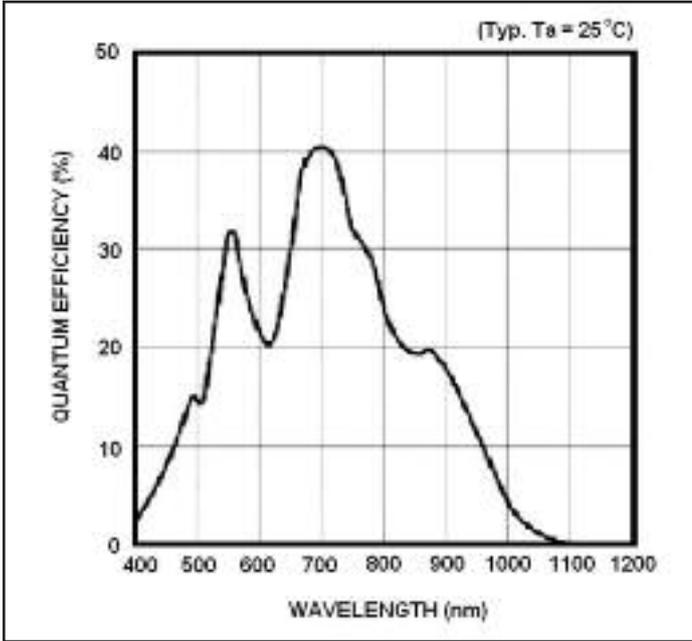
### High IR Sensitivity, Four-Stage TE-Cooled, Front-Illuminated CCD Area Image Sensor

#### CCD1007-IR/CCD1008-IR

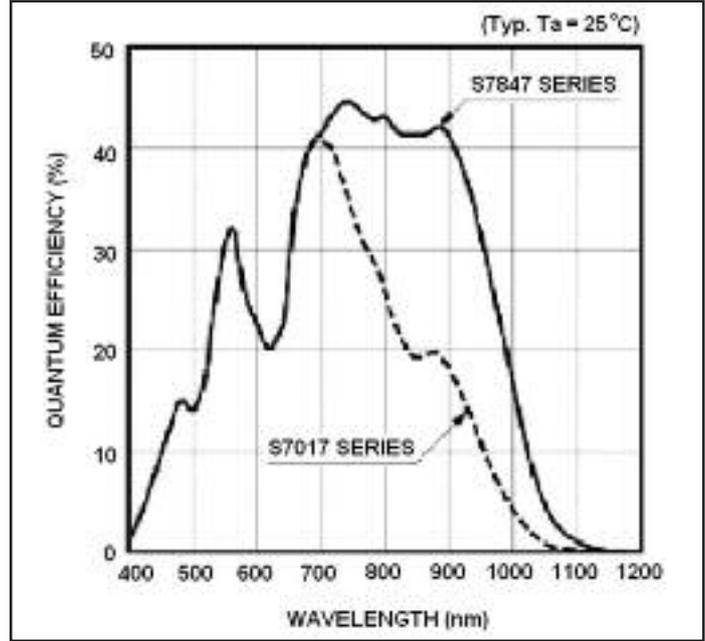
- $1024\ \text{(H)} \times 124\ \text{(V)}$  and  $1024\ \text{(H)} \times 252\ \text{(V)}$  pixel format
- Pixel size:  $24\ \mu\text{m} \times 24\ \mu\text{m}$
- 100% fill factor
- Wide dynamic range
- Low dark current
- Low readout noise
- MPP operation
- Four-stage TE-cooled
- High IR response

Version Description	Version Code	Version Price(USD)
Head & Sensor, Active Pixels $1024 \times 124$	CCD1007-LOW	
Head & Sensor, Active Pixels $1024 \times 252$	CCD-008- LOW	
Head & Sensor, Active Pixels $1024 \times 124$ High IR	CCD1007- IR	
Head & Sensor, Active Pixels $1024 \times 252$ High IR	CCD1008- IR	

Spectral Response



CCD1007-LOW/CCD1008-LOW



CCD1007-IR/CCD1008-IR

SPECIFICATIONS				
	CCD1007-LOW	CCD1008-LOW	CCD1007-IR	CCD1008-IR
<b>Cooling</b>	Four-Stage TE-Cooled	Four-Stage TE-Cooled	Four-Stage TE-Cooled	Four-Stage TE-Cooled
<b>Number of Pixels</b>	1044 x 128	1044 x 256	1044 x 128	1044 x 256
<b>Number of Active Pixels</b>	1024 x 124	1024 x 252	1024 x 124	1024 x 252
<b>Pixel Size</b>	24 μm x 24 μm	24 μm x 24 μm	24 μm x 24 μm	24 μm x 24 μm
<b>Active Area Length</b>	24.576 mm	24.576 mm	24.576 mm	24.576 mm
<b>Active Area Height</b>	2.976 mm	6.048 mm	2.976 mm	6.048 mm
<b>Wavelength Min.</b>	400 nm	400 nm	400 nm	400 nm
<b>Wavelength Max.</b>	1100 nm	1100 nm	1100 nm	1100 nm
<b>Full Well Capacity</b>	300k e <sup>-</sup>	300k e <sup>-</sup>	300k e <sup>-</sup>	300k e <sup>-</sup>
<b>Dark Current Typ.</b>	0.03 e <sup>-</sup> /pixel/s	0.03 e <sup>-</sup> /pixel/s	0.3 e <sup>-</sup> /pixel/s	0.3 e <sup>-</sup> /pixel/s
<b>Dark Current Max.</b>	0.1 e <sup>-</sup> /pixel/s	0.1 e <sup>-</sup> /pixel/s	1 e <sup>-</sup> /pixel/s	1 e <sup>-</sup> /pixel/s
<b>Readout Noise Typ.</b>	15 e <sup>-</sup> rms	15 e <sup>-</sup> rms	15 e <sup>-</sup> rms	15 e <sup>-</sup> rms
<b>Readout Noise Max</b>	45 e <sup>-</sup> rms	45 e <sup>-</sup> rms	45 e <sup>-</sup> rms	45 e <sup>-</sup> rms

## MULTICHANNEL DETECTORS: PRICES

InGaAs Multichannel Infrared Detector		
Version Model	Version Description	Version Prices(USD)
LINGAAS-STD-256	256 pixels, 50um x250um pixel size	1
LINGAAS-STD-512	512 pixels, 25um x250um pixel size	1
LINGAAS-LRG-256	256 pixels, 50um x 500um pixel size	1
LINGAAS-LRG-512	512 pixels, 25um x 500um pixel size	1
LDA Detectors		
Version Model	Version Description	Version Prices(USD)
LDA2000-512IR	(High IR Sensor Type)	
LDA2000-512STD	(Standard Sensor Type)	
LDA2000-512LA	(Large Area Sensor Type)	
LDA2000-1024IR	(High IR Sensor Type)	
LDA2000-1024STD	(Standard Sensor Type)	
LDA2000-1024LA	(Large Area Sensor Type)	
Front Illuminated CCD Prices		
Version Model	Version description	Version Prices(USD)
CCD-LIN-FR58	1024 * 58 pixels	
CCD-LIN-FR122	1024 * 122 pixels	
CCD-LIN-FR250	1024 * 250 pixels	
Options		
(CCD--LIN-FR/58/122/)	(Single Stage Cooled)	+
(CCD-LIN-FR250)	(Single Stage Cooled)	+
Back-Thinned CCD		
Version Model	Version Description	Version Prices(USD)
CCD-LIN-BT58	1024 * 58 pixels	
CCD-LIN-BT122	1024 * 122 pixels	
CCD-LIN-BT250	1024 * 250 pixels	
Options		
(CCD-BT58/122/250)	(Single Stage Cooled)	+
(CCD-BT58/122/250)	(Two Stage Cooled)	+

## ACCESSORIES

### High Speed Shutter (600-VS25-INT)

\$USD

Sciencetech's Model 600-VS25 high speed shutter is a required accessory with Sciencetech's area scan CCD detectors, but can also be used with Sciencetech's LDA photodiode or InGaAs linear array detectors (optional, but not necessary). The external version of this shutter can also be used with Sciencetech small beam SF150 Solar Simulator. The model 600-VS25INT is an internal version that mounts inside a Sciencetech spectrograph behind the input port. The model 600-VS25ext is an external self enclosed version designed to be mounted outside the input or output port of non-Sciencetech spectrographs or with Sciencetech SF150 Solar Simulator. Due to focal plane spatial constraints of the output port on most spectrographs, the Model 600-VS25Ext is typically mounted at the input port via coupling tubes. The 600-VS25 series high speed detector shutter is computer controlled via Sciencetech's multi-channel detector's PCI A/D data acquisition board (sold separately with the detector). Sciencetech's Sci-LDA software application or Read-LDA (ActiveX Control) is also required to control the shutter in synchronization with the detector. The shutter has its own power supply, electronics module, and cable that connect it with the Sciencetech PCI A/D data acquisition board. It has a 25mm diameter aperture, minimum exposure time is 6ms (40Hz), and maximum exposure time is several minutes. Time to open is 3ms.

### Multi-Channel Detector Data Acquisition System (MC-DAS 16bit)

\$USD

This option includes all cables, and PCI data acquisition A/D board to interface a linear CCD, InGaAs, or Photodiode array detector head to a Windows-based computer. Although the linear array detector head output signal is analog, it is digitized into 12-bits (4,096 counts) or 16-bits (65,536 counts) via a computer interface PCI A/D board. For CCD detectors, only the 16-bit system is recommended. The power supply is not included here, as it is included with the detector head itself. A fully featured Sci-LDA software application that operates the detector with Sciencetech spectrographs is sold separately.

### GROUP ACCESSORIES

Please check the appropriate sections in the catalogue for the following:

Detector Mount Selections (For Detector Mating)	(DETMOUNT)
Data Acquisition Components	(MC-DAS-COMP)
Multi-Channel Detector Data Acquisition Software	(SOFTWARE-GROUP2)