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SPECTRUM ONE

Array Detection System

For InGaAs Array Detectors

With IGA-3000 Series Controllers

Part Number 81043 Rev. C

Revised July 22, 2002

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ABOUT THE MANUALS

You may have more than one manual, depending on your system configuration. To find the manual that has the information you need, these guidelines may help.

- Each manual generally covers a product and the features and accessories peculiar to and/or contained within that product.
- Accessories that can be applied to other products are normally covered by separate documentation.
- Software that is exclusively used with one instrument or system is covered in the manual for that product.
- Software that can be used with a number of other products is covered in its own manual.
- If you are reading about a product that interacts with other products, you will be referred to other documentation as necessary.

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INTRODUCTION:

The Spectrum ONE detection systems are a family of array detectors designed and manufactured by Jobin Yvon Inc.

The Spectrum ONE series array detectors include cooled linear Indium Gallium Arsenide (InGaAs) detectors and two-dimensional Charge Coupled Devices (not discussed in this manual) for spectrometric applications.
The glossary section of this manual starts on page 33. It contains definitions of terms and information about essential topics relating to array detection of spectra. Reading the glossary is recommended.

The Spectrum ONE InGaAs array detection system is well suited to Near IR applications such as:

- Absorption spectroscopy
- Emission spectroscopy
- Photoluminescence
- Photoreflectance
- Raman spectroscopy
- Fluorescence

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OPERATING PRINCIPLES

InGaAs Array sensors

InGaAs detector arrays are linear arrays of discrete InGaAs optical photodiodes. The photodiodes detect the infrared photons by a photoelectric effect and generate a voltage proportional to the number of photons incident upon the diode. Figure 1 shows a schematic of an individual pixel in an array[1].

Each photodiode has its own capacitive transimpedance amplifier circuit and all the diodes are read out through a silicon CMOS multiplexer circuit. However, because of the multiplexer circuit design the entire array must be read out at the end of each exposure. Further, because each pixel in the array is a discrete element, ***on-chip binning of pixels is NOT possible***.

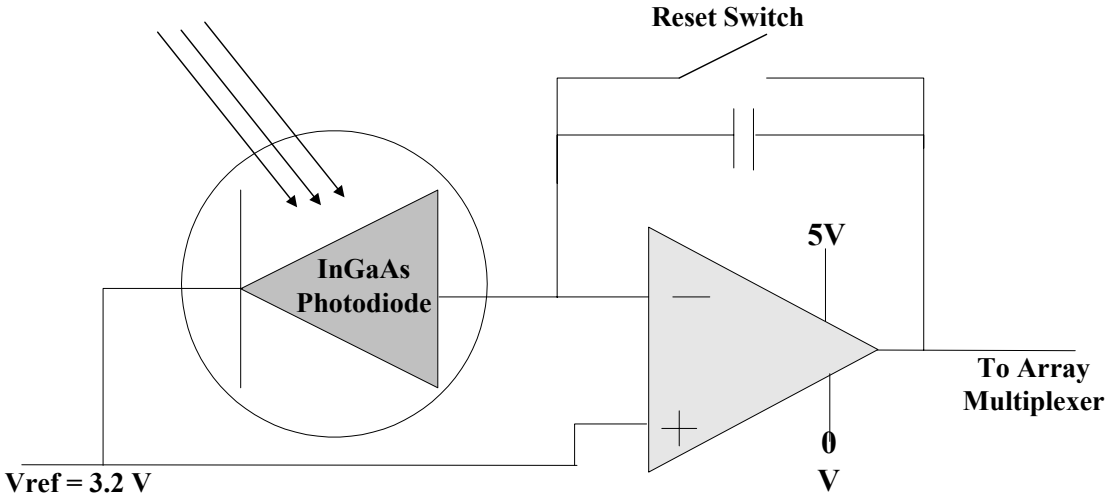


Figure 1: Schematic of a discrete InGaAs photodiode pixel in an array detector

[1] **"Full Well Capacity and Maximum Exposure Time in LX-series Arrays" Sensors Unlimited Technical Note, www.sensorsinc.com**

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SYSTEM DESCRIPTION AND SPECIFICATIONS:

The Spectrum ONE array detection system consists of a detector head, a detector controller and software. The detector head consists of the array sensor that is actively cooled by Liquid Nitrogen or forced-air circulated thermoelectric cooling. The controller acts as the interface between the detector and the operating computer. Model IGA-3000V is functionally identical to model IGA-3000, except that the 'V' versions incorporate the TE/PS auxiliary power supply, and are thus dimensionally larger. Communication is via IEEE-488. A National Instruments brand IEEE-488 GPIB interface is required to run SpectraMax for Windows software.

Caution: Electrostatic discharge (ESD) may damage components of the Spectrum ONE system if proper precautions are not taken. The JY warranty on the Spectrum ONE array detectors does not cover damage to the sensors that arises from any improper handling of the detector including ESD. Proper handling precautions must be taken at all times.

Detector Heads:

The Spectrum ONE InGaAs array detectors are available with two cooling options: compact "mini" thermoelectrically cooled detectors (MTE series) and cryogenic liquid nitrogen LN_2 cooled detectors. The compact, "mini" thermo electrically cooled units operate the sensor at less-cool temperatures and thus have higher dark current and are ideal for applications requiring short exposure times. No cryogenic cooling fluid is required in the thermoelectrically cooled systems. When the lowest noise and dark level is required, liquid nitrogen (LN_2) provides cryogenic cooling to reduce temperature and therefore dark current to the lowest level possible.

Both types of detector heads are described in more detail in the next section.

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Mini-Air-Cooled Thermoelectrically Cooled (MTE) Heads:

Figure 2 shows the compact air-cooled mini Spectrum ONE head. Only select sensors from Jobin Yvon are available in this housing. Typically, the distance between the chip and the external flange is 13.7mm (0.540 inches) for the MTE head. Dimensioned drawings of MTE thermoelectrically cooled housings are provided in Appendix D.

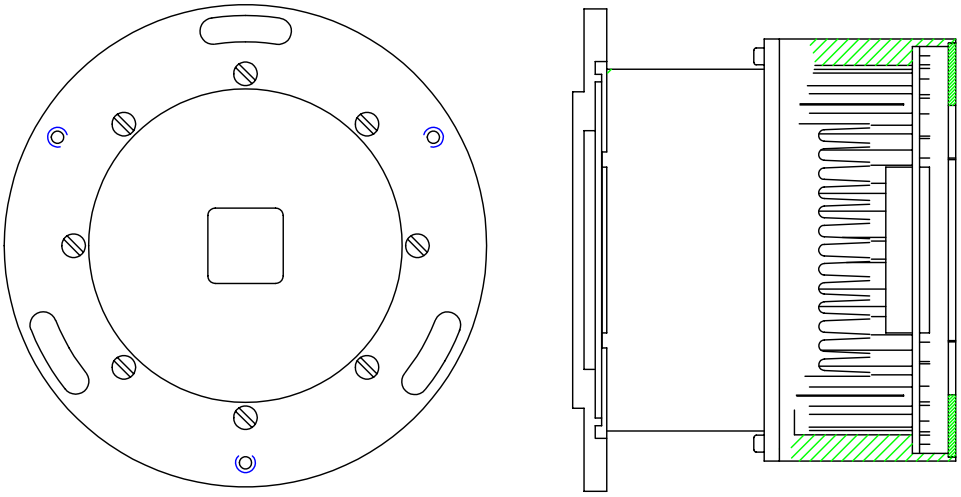


Figure 2: Spectrum ONE MTE air-cooled head

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LN_2 Cooled Heads:

LN_2 cooled Spectrum ONE InGaAs array detectors are mounted in one of three types of liquid nitrogen dewar configurations: Side-looking, down-looking and all-position configuration. In addition, each configuration is available in a 1-liter and a 3-liter capacity.

The standard side-looking dewar for the InGaAs array detector is shown in Figure 3. Figure 4 shows the standard down-looking dewar configuration. In both cases, the 1-liter capacity dewars are designed to maintain the array sensor at 140 K for at least 24 hours before refilling with liquid nitrogen. The 2.8-liter dewars require refilling about every 72 hours in a room temperature environment.

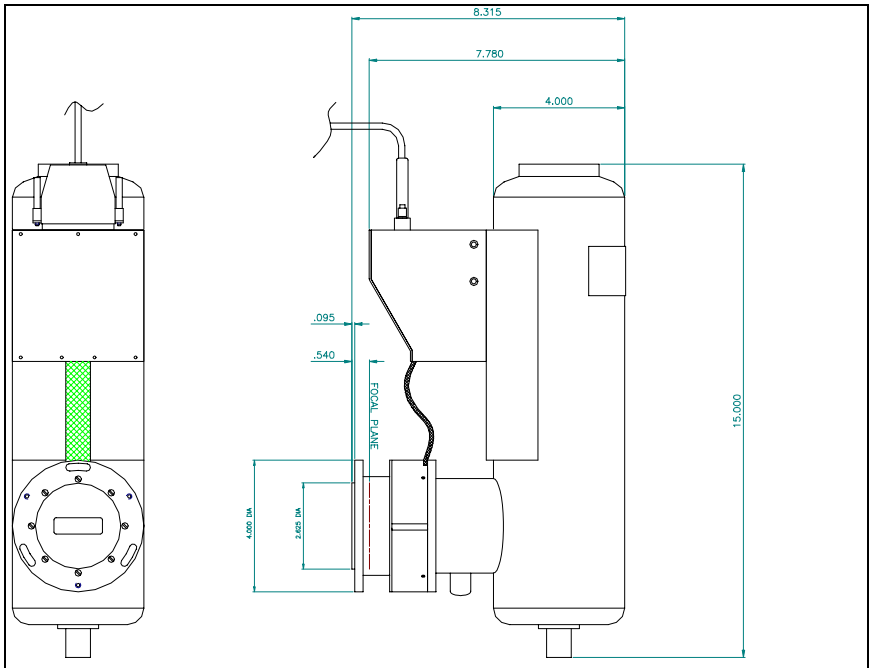


Figure 3: 1 liter side-looking dewar for LN_2 cooled Spectrum ONE InGaAs array detectors

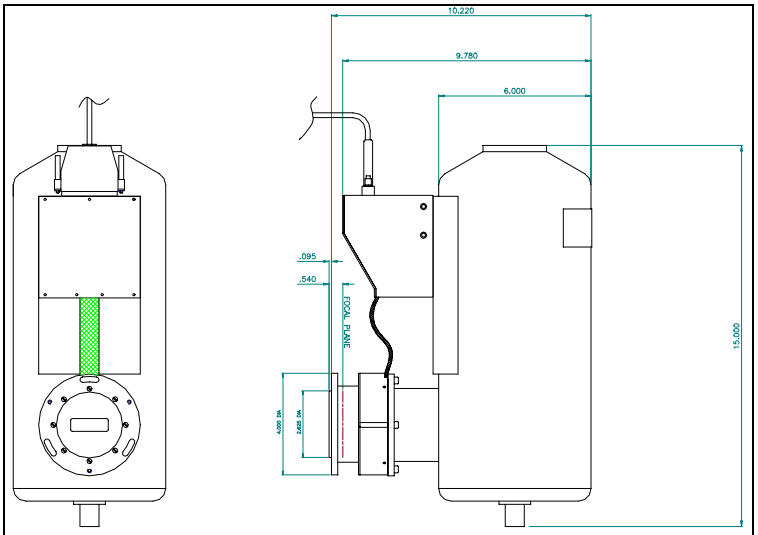


Figure 4: 2.8-liter down-looking dewar for LN_2 cooled Spectrum ONE InGaAs array detectors

An all-position LN_2 dewar is also available for the Spectrum ONE array detectors. In this case, the hold time for the 1-liter capacity dewars is typically 15 hours, while that for the 2.8-liter dewars is typically 26 hours.

The distance between the chip and the external flange is 13.7mm (0.540 inches). Dimensioned drawings for the different dewars are available in Appendix D.

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Liquid Nitrogen Precautions

Warning: Liquid Nitrogen requires special handling, and should be used by trained personnel only. Review this section carefully before filling the dewar.

Ventilation:

In confined spaces lacking adequate ventilation, nitrogen gas can displace and can potentially cause asphyxiation. Always use and store liquid nitrogen in well-ventilated spaces.

Extreme Cold:

The boiling point of liquid nitrogen at atmospheric pressure is 77.3 K (about -196^{o}C). This extreme cold can cause tissue damage similar to a severe burn. Therefore, exposure of the skin or eyes to the liquid, cold gas, or liquid-cooled surfaces must be avoided.

The liquid should be handled so that it will not splash or spill. Gloves impervious to liquid nitrogen and goggles should be worn when handling the liquid. Feet can be protected by wearing rubber boots, with trousers (without cuffs) on the outside.

Storage and Transfer:

Liquid nitrogen should always be stored in vacuum-insulated containers, which should be loosely covered but not sealed. Covering prevents moisture condensing out of the air to form ice that may cause blockage inside the dewar. Sealing results in pressure buildup. **DO NOT ATTEMPT TO SEAL THE MOUTH OF THE DEWAR!**

The gas-to-liquid volume ratio is about 680:1. All containment vessels must therefore be fitted with exhaust vents to allow evaporating gas to escape safely. If these vents are sealed, pressure will build up rapidly and may result in the fracture of the containment vessel.

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LN_2 Filling Instructions:

Using a pressurized storage vessel:
Remove the cap and insulating plug at the top of the detector dewar, insert the fill tube, and let the nitrogen flow into the dewar.

Using a funnel and transfer dewar:

Insure that the funnel has ribs to provide gaps to vent the boiled off vapor inside the camera dewar as the liquid nitrogen is added. Set the funnel into the mouth of the dewar. Pour the liquid nitrogen into the funnel slowly.

The dewar is full when the liquid nitrogen reaches the bottom of the narrow neck of the dewar. A probe such as a clean wooden dowel may be inserted and removed to reveal a frost line indicating the nitrogen level.

Periodic Filling:

The larger, 2.8 liter dewar permits continuous cooled operation of the detector by virtue of its 72-hour hold time. The smaller, 1 liter dewar, with a hold time of 24 hours, is designed for more intermittent operations.

Replace the cap when the dewar is full. The cap is insulated to help extend the interval between fills. It also minimizes moisture condensation into the dewar. The loose fit of the cap prevents pressure buildup in the dewar by allowing evaporating nitrogen to escape.

When filling the dewar, an initial period of nitrogen boiling and overflow occurs until the internal components of the dewar have cooled to liquid nitrogen temperatures. After this initial boil-off period, refill the dewar as needed to extend the cold temperature hold time.

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Detector Head Evacuation:

All Spectrum ONE detector heads except the MTE Mini head have a high vacuum chamber that holds the sensor. In the MTE head the chamber is dried and back filled with dry nitrogen at the factory. This chamber, along with other insulating measures, isolates the chip from the ambient temperature. The heads are evacuated or purged at the factory. They are designed to maintain insulating properties for a minimum of one year between pumping or purging cycles. A vacuum leak will result in a decrease in the insulating capability of the head. Thermoelectrically cooled heads will be unable to achieve their rated operating temperatures and the sensors will have high dark currents. LN_2 heads will rapidly consume the liquid nitrogen, and frost may form on the exterior of the dewar. In either case, condensation may form on the array during cool down cycles, degrading optical performance and fostering corrosion. You may notice spreading of light to nearby pixels. Spectral features may become blurred. While rare, the sensor can be physically damaged

If the head cannot maintain operating temperature, contact JY to arrange for re-pumping the vacuum or for re-purging instructions. Any attempts to evacuate the Spectrum ONE head at user locations are not recommended. Some types of vacuum pumps can backstream oil, causing *irreparable damage* to the electronics. In the event of loss of vacuum, please contact the Jobin Yvon Service Department according to the directions given on page 51.

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Detector Controller

IGA-3000 Series Detector Controllers:

The IGA-3000V Detector Controller Unit shown in Figure 5 is a compact controller that controls the detector head based on commands from the computer. This unit supplies power, clocking signals, and biases to the InGaAs array. The Controller unit, provided with a 166 kHz, 16 bit ADC, also amplifies and digitizes the signal as it is collected from the detector.

The physical dimensions of the IGA-3000V controller are: 28mm wide x 25mm deep x 18.5mm high (11" wide x 9.75" deep x 7.25" high). The weight of the controller is 21.2 lbs (9.62 kg).

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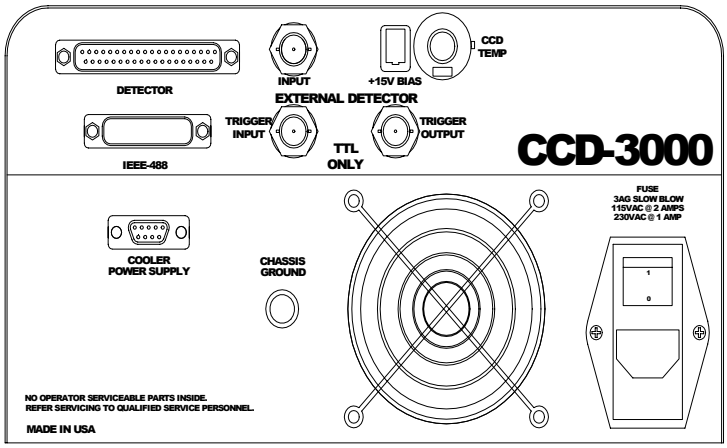


Figure 5. IGA-3000V Controller

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Temperature control with IGA-3000 Series Controllers

The temperature control knob is the black knob located on the back panel of the IGA-3000 series controller, as shown in Figure 6a. This knob is factory set for the optimal performance of your specific InGaAs sensor and reads in ***Kelvin***.

Do not adjust the temperature below the default settings for each type of detector head:

- MTE: 240K (-33 ºC)
- LN: 140K (-133 ºC)

If you wish to increase the temperature, you can do so by first unlocking the temperature control knob and then turning 'center control knob' to the desired temperature (refer to the diagram below). Changing the temperature below the recommended level will reduce the quantum efficiency of the chip. Changing the temperature above the recommended value will increase your noise level. A single digit number in the outer ring of the knob indicates hundreds of degrees K, and the two-digit number on the inner circle indicates tens and ones. For example, a reading of 1 on the outer ring and 47 on the inner circle indicates a temperature setting of 147K, equivalent to –126 ºC.

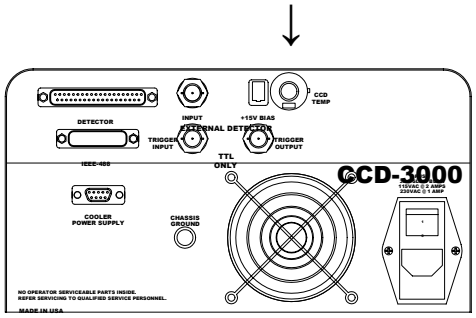


Figure 6a. Temperature knob location on IGA-3000 series controller.

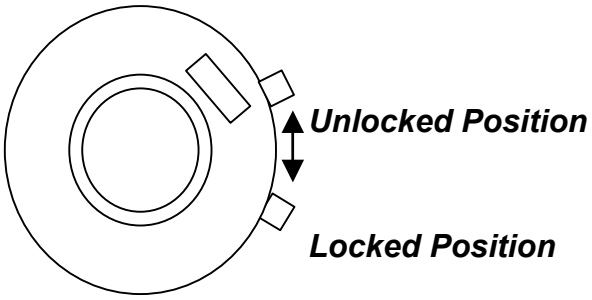


Figure 6b. Example of how to lock knob in position.

Caution: For liquid nitrogen cooled detectors do not set the temperature below 140K. Do not adjust the temperature unless needed. Please contact the Service Department if you wish to vary the temperature more than ±10° from the original factory setting.

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Shutter:

A mechanical shutter is supplied with every Spectrum ONE detection system. A variety of shutters are available from JY, and can be mounted inside or outside the spectrograph, depending on which spectrograph is used. The table below lists some commonly used spectrographs and the shutters with which they are compatible.

Table 1. Shutter information.

Spectrograph	Location	Shutter Part #	Cable Part #
Triax 180/190	Front Only	MSL-TSHCCD	32617 for each shutter BNC to 9-pin
Triax 320 Triax 550	Front (axial) Side (lateral) alone Side (lateral) both	227MCD MSL-TSHCCD MSL-TSCCD2	
500M 750M 1000M 1250M	Front (axial) Side (lateral) alone Side (lateral) both	1425MCD 1425MCD-B 1425MCD-C	
CP140 CP200	External Only	23009030	

Connect the BNC-to-9-pin cable (#32617) to the 9-pin connector on the cable coming from the detector head. Connect the BNC end of the cable (female) to the male BNC socket on the outside of the shutter mechanism. Contact the JY Service Department for assistance in installing the shutter (see the Service Policy section page 51). See the appropriate spectrograph manual for detailed installation instructions. Note that one shutter and one shutter cable come automatically with the Spectrum ONE detection system. Additional shutters may be purchased separately.

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Software

GPIB Interface

IGA-3000V controllers are designed to transfer data via IEEE-488 communication. A National Instruments card must be used with JY software. The following cards are approved National Instruments GPIB interface boards for use with a PC:

- AT-GPIB/TNT and AT-GPIB/TNT (PNP)
- PCI-GPIB; NI P/N 777158-51 (JY P/N 973027, includes 2m IEEE-488 cable)
- PCMCIA-GPIB IEEE-488; NI P/N 777157-02 (JY P/N 973009, includes 2m IEEE-488 cable)

JY offers these National Instruments boards in our sales catalog for your convenience. Other vendors' boards can function in a SIMILAR fashion. As we **cannot support** or **guarantee** reliable communications with other boards and software, we **require** that you use the National Instruments products described above. Please contact the Service department at JY if you have a newer version of a National Instruments board and for the latest compatibility information.

IGA Disk

Included with you SpectrumONE system is a disk containing the data files required for correct operation of your system. These files include factory calibration files for your detector, and must not be modified.

Software:

A variety of software options are available from Jobin Yvon to operate the Spectrum ONE array detector system. Complete control over every aspect of the detector and powerful data acquisition routines are available in SpectraMax for Windows. Please refer to the documentation provided with the software shipped with the system. A Software Development Kit (SDK) is also available, as well as LabVIEW VIs.

Jobin Yvon is committed to continuous development and improvement of software. To the extent possible, new software options are developed with backward compatibility. In this way, normally an existing system can be upgraded as new software is developed. Please contact JY periodically to check on current software upgrade options.

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INSTALLATION

Unpacking and Inspection

1. Verify that all items listed are contained in the shipping package and inspect for damage:
    a. IGA-3000V Controller
    b. InGaAs array detector head
    c. Instrument cable (P/N 35872 Rev. E: black divided cable with 36-pin male end to controller, 25-pin female end to detector head and 9-pin male end to shutter cable)
    d. Shutter cable (P/N 36217 Rev. A: BNC to 9-pin female cable)
    e. AC power cord
    f. This Manual (P/N 80119)
    g. Thermoelectric cooling cable for MTE and ATE units (P/N 37661: 9-pin gray cable male-female)
    h. Optional: IEEE 488 GPIB cable (P/N CCA-2M488)
    i. Optional: IEEE card, as ordered.
    j. Optional: mounting flange

2. Unpack your SpectrumONE InGaAs array system.

3. Review the diagrams shown in figures 7a and 7b.



Figure 7a. Front view of IGA-3000V controller, with labeled parts.

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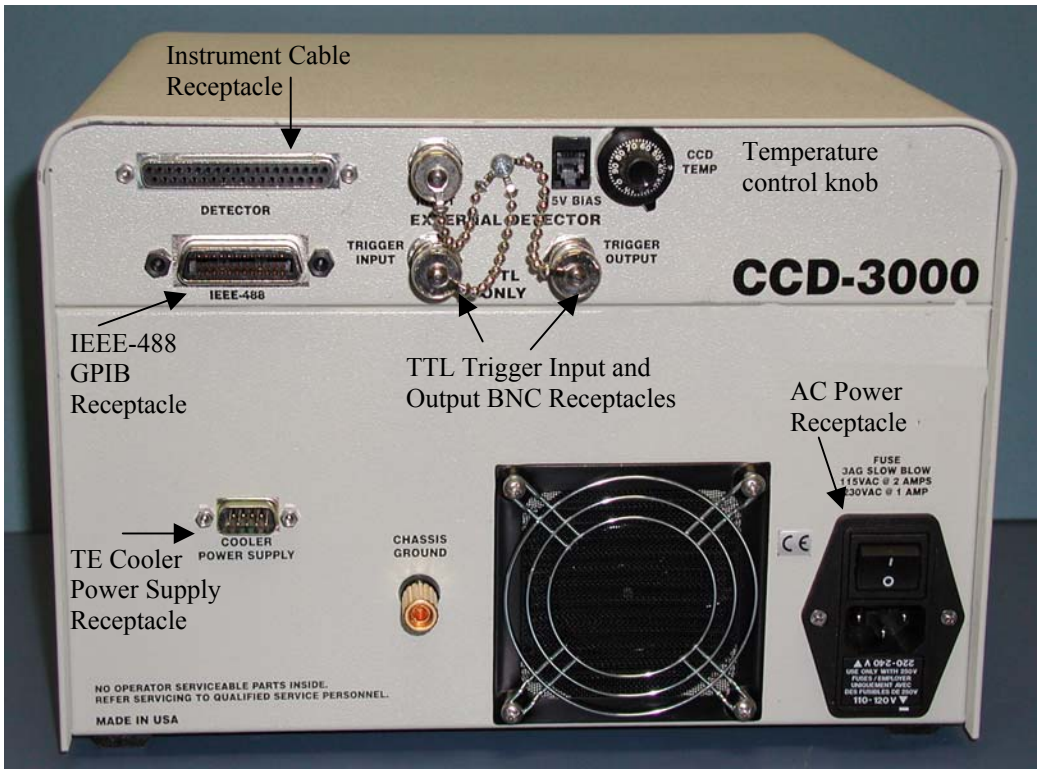


Figure 7b. Rear view of IGA-3000V controller, with labeled parts.

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Instrument Connections and Installation

Software

The controlling software must be configured for the InGaAs array and installed properly in order for the Spectrum ONE detector to operate. When the system is ordered with the computer, the software will be installed and tested at the factory. In those cases where the user must install the software, the configuration files for the system are provided on installation diskettes CD-ROM. Simply follow the installation directions in the manual provided with the software.

NOTE: When configuring the software to work with the IGA-3000 series controllers using SpectraMax for Windows software, the IEEE 488 address of the controller must be set to 6.

Mechanical Installation

A Spectrum ONE array detector can be fitted to any Jobin Yvon or Spex monochromator that can be equipped with a spectrograph exit port. If a spectrograph port is already installed, note the mask on the face of the detector before mounting. This mask is offset to one side to accommodate the tilt of the focal plane without vignetting.

1. Remove the protective plastic cap from the front flange of the detector head.
2. Prepare the monochromator for mounting of the detector by loosening the mounting screws on the multichannel adapter mount (see monochromator manual for instructions, or consult factory for assistance.
3. Ground yourself with a ground strap or other device.
4. Carefully pick up the detector head with the Spectrum ONE label facing up. The sensor should be aligned along the optical axis of the monochromator.
5. Tighten the mounting screws so that the detector head is securely positioned at the focal plane of the monochromator. This adjustment will be fine-tuned in the section on Focusing and Alignment.

Note: A number of array adapters are available for the array detectors when working with the TRIAX series of spectrographs. These arrays are optimized to give the best resolution or the best imaging. The adapter consists of two sections, one of which fits into the other. With any MAI-T adapter mount the snout to the detector head using three 8-32 flat head bolts. Slide the flange into the adapter and clamp the flange down using the 6-32 clamping screw. Refer to the TRIAX manual for more detailed instructions.

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Electrical Connections

1. Connect AC power cord to IGA controller into using a surge protector, but **do not turn the unit on.**
2. With the power off, connect the host computer to the IGA controller using IEEE-488 (GPIB) cable. Figure 8 shows a wiring diagram for a TE cooled InGaAs array, with optional trigger connections.
3. Plug the detector cable (P/N 35872) in the back of the controller using 37-pin connector.
4. Remove the 25-pin grounding connector (P/N 36430) from the detector head and immediately plug in the instrument cable (P/N 35872).

<u>NOTE</u>: To prevent Electrostatic Discharge (ESD) damage, insert grounding plug into connector on detector head whenever head is disconnected.

5. Connect the BNC-to-9-pin cable (P/N 36217) to the 9-pin branch on the cable coming from the detector head (P/N 35872).
6. For internally mounted shutters, connect the BNC end of cable (P/N 36217) to the BNC connection inserted through the Multi Channel Detector Adapter directly under the detector head. For the externally mounted shutter, connect the BNC end to the BNC connector on the outside of the shutter mechanism.
7. For TE-cooled InGaAs arrays: Connect thermoelectric cooler on the detector head to power supply on the back of the controller with the 25-pin cable (P/N 37661).

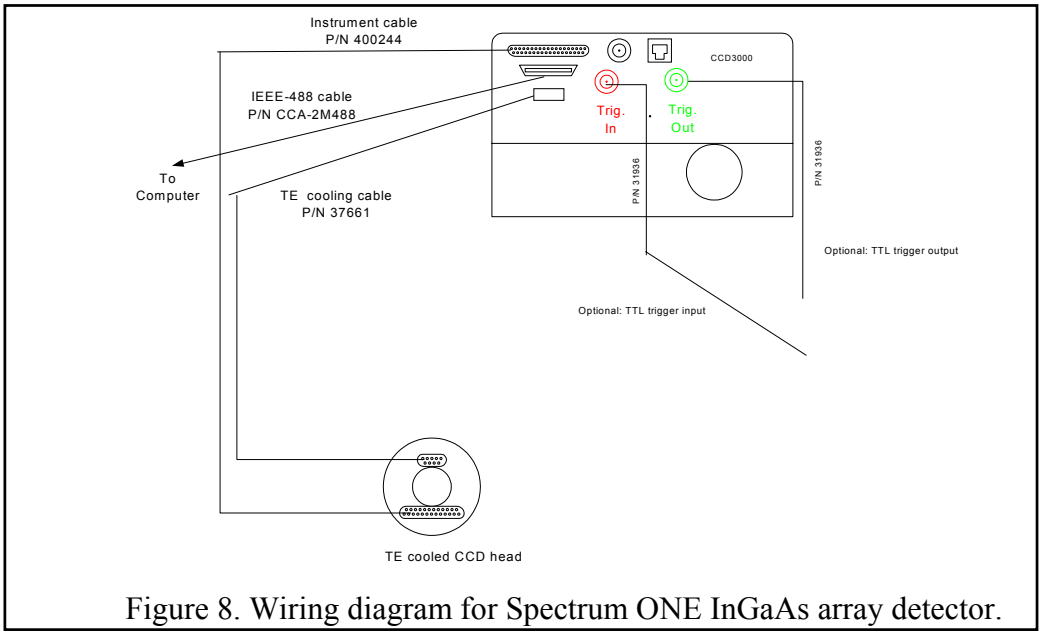


Figure 8. Wiring diagram for Spectrum ONE InGaAs array detector.

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Note: Once the software, mechanical connections and electrical connections have been installed, you may continue with the Operation section.

Warranty Disclaimer:

The sensor head, the Detector Interface Unit and the computer are very sensitive to electrostatic discharge (ESD). ESD precautions must be followed.

The installer should stand on a conductive mat and wear a grounded wrist strap during installation. The computer must be turned off, but its power cord should be connected to a grounded outlet to take advantage of the outlet ground.

Always turn the power off to all components before connecting or disconnecting any cables.

Before inserting a connector, touch the connector shell to the component case to discharge any accumulated static charge.

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OPERATION

Powering up

NOTE: To prevent Electrostatic Discharge (ESD) damage, insert the grounding plug into the connector on the detector head whenever the head is disconnected.

1. Connect all cables as described in on page 19 in the Installation section.
2. Turn on the controller. A red power light on the front of the controller lights up to indicate the unit is turned on.
   - If the detector is TE-cooled, you should hear the fan on the back of the detector head start, and the TE Status LED on the controller should turn green.
   - If detector is LN_2-cooled, carefully fill the dewar with LN_2 according to the procedure in the next section
   - In 30 - 40 minutes, the chip temperature should stabilize for optimum performance.
3. Verify that the monochromator, computer and any other supporting equipment are connected to AC power.
4. Turn on the computer and start the software
5. After 20 minutes check the temperature according to the appropriate instructions given in the software manual. After the detector has reached its target temperature, you may proceed to the next section.
6. Note: For LN_2 heads, it will take approximately 30 to 40 minutes from the beginning of cooling the detector until it reaches its target temperature. Thermoelectrically cooled heads will reach operating temperature in 15-20 minutes. This time will also vary depending on the size of the chip. Note that for best results in the most demanding measurements, it is best to allow 60 to 90 minutes for the chip to stabilize completely.

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Focusing and Alignment on Monochromator

The SpectrumONE InGaAs Array Detector can be mounted on most standard imaging monochromators. Consult your monochromator manual to determine the correct way to mount the detector. Before starting this procedure, make sure that:

- Software is running
- InGaAs Array detector head is properly mounted on monochromator with Spectrum ONE label facing up
- InGaAs Array detector is cooled to correct operating temperature

Procedure:

1. Mount Tungsten lamp on entrance slit of monochromator
2. Set the height limiter to 1 mm.
3. Turn out the room lights
4. Open monochromator cover and verify that collimating mirror is fully illuminated
5. Loosen the screw on the detector mount to allow forward-backward and rotational adjustment of the detector
6. Open SpectraMax for Windows
7. Select RTD mode

Focusing the detector:

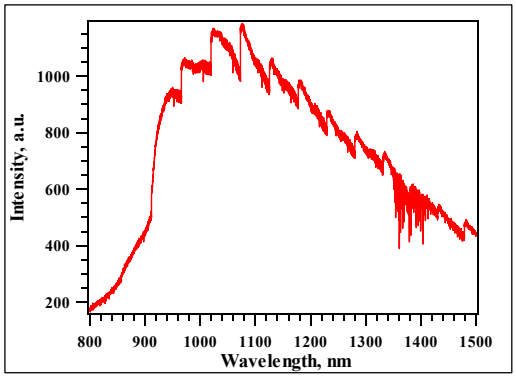
8. Set the grating position to 1380 nm, in the region of water absorption
9. Set the integration time to 0.05 s and the entrance slit to 0.05 mm, to avoid saturating the detector (these values may require some adjustment)
10. Select continuous acquisition (center button)
11. Move the detector in and out and maximize the signal; the peaks should be most intense when the detector is in the focal plane.
12. Stop acquisition

Aligning the detector:

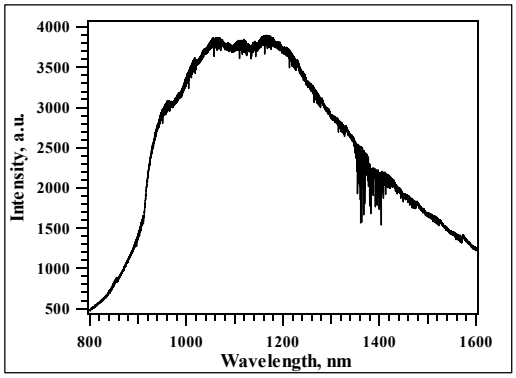
13. Set the grating position to 1200 nm.
14. Select continuous acquisition.
15. Rotate the detector slightly clockwise and counter-clockwise to obtain a flat response over the spectral region.
16. Stop acquisition and tighten screw on detector mount.
17. Select continuous acquisition to verify that the detector has not moved, and that the response is still flat. If it has changed, loosen the screw and repeat steps 14-16 until you have optimized the detector position.
18. Open the Experiment window

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19. Run an experiment with spectral coverage from 800-1600 nm. If the detector has been properly focused and aligned, the resultant spectrum (composed of spectra from the different regions "glued" together) will be smooth, without jagged edges resulting from uneven illumination of the detector. If the spectrum is not smooth, the focusing and alignment procedure should be repeated.
20. For additional information about alignment and calibration, refer to the monochromator manual and software manuals, or contact JY for support.



Spectrum with incorrect alignment



Spectrum with correct alignment

Note: With the InGaAs array the entire chip must be read out – no partial readout is possible.

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Other Modes of Data Acquisition

The versatile Spectrum ONE detection system with IGA-3000 series controllers allow a variety of data acquisition modes:

- Standard spectral acquisition

- Blast Mode—A single experiment can be setup to be run a series of acquisitions sequentially, with pre-programmed delay time and integration time, and choice of flushing the chip between acquisitions or not, and choice of closing the shutter between acquisitions or not.

- Triggered experiments—The IGA-3000 series controllers can accept a TTL input trigger, and can also generate a TTL output trigger.

- Multiple Accumulation Mode—multiple spectra can be averaged or summed. Certain InGaAs array sensors, including the extended arrays, have significantly larger dark signal values and thus are require short integration times (sometimes as short as 50ms). In order to overcome the noise and integration time conflict, we recommend that customers with such InGaAs arrays use Multiple Accumulation mode to average a series of individual scans. This procedure has the effect of improving the collected signal, and improving the signal-to-noise ratio in proportion to the square root of the number of scans. A specific procedure for Multiple Accumulation mode data acquisition using SpectraMax for Windows is given in Appendix G.

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Powering Down and Disassembly of the System

1. Turn off software.
2. Turn off power switch on controller. It is safe to leave all cables connected while detector is not in use.
3. Ground yourself with a ground strap or other device.
4. **To disassemble a system with a TE cooled detector**, remove the TE cooler cable first from the detector head and then from the controller.
5. Remove the instrument cable from the detector head and immediately connect the protector plug in its place to prevent ESD damage.
6. Remove the other end of the instrument cable from the controller.
7. To mechanically remove the detector head from the monochromator, loosen the mounting screws and carefully pull the detector towards you, out of the mount. This is the reverse of the installation procedure.
8. Replace the plastic protector cap on the front flange of the detector.
9. Unplug the controller from the AC power.
10. **To disassemble a system with a LN_2 cooled detector, first make sure the liquid nitrogen has evaporated from the dewar (approximately 24 hours from fill time; consult factory for assistance).**
11. Then continue with steps 3 – 8.

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Triggering with IGA-3000 Series Controllers

(See also Appendix G)
The Spectrum ONE IGA-3000 series Detection Systems have both input and output TTL trigger functions. Both can be enabled via the software. Note: the fastest triggering rate possible is 50 Hz for experiments using a mechanical shutter. For experiments without a shutter, the fastest triggering rate compatible with the controller is 3KHz. Two hardware triggers are available as BNC receptacles on the back of the controller: one for input and one for output.

The IGA-3000 controller has two external trigger ports: TRIGGER INPUT and TRIGGER OUTPUT. If SpectraMax for Windows software is used with Triggers Enabled, when the controller is ready to acquire, the TRIGGER OUTPUT line is moved high and the controller waits for a positive pulse from the TRIGGER INPUT to start the acquisition. When an input pulse is received, the output line is moved low until the controller is ready for the next acquisition. The triggers can also be controlled via a user-programmed interface (See programming manual for more information).

Triggering can be activated at the start of each experiment of at the start of each acquisition during the course of one experiment.

1. Input Trigger Parameters

    a. Input Trigger On Start—The experiment will start as soon as the controller receives a TTL high signal. If the controller receives multiple input triggers, only the first one will have any effect on the experiment.

    b. Input Trigger Per Acquisition—In a multiple acquisition experiment (such as an experiment where Multiple Accumulations or Blast Mode is selected), sometimes it is desirable to wait for a trigger to start each acquisition. In this case each acquisition will start only after the controller receives a TTL high signal.

2. Output Trigger Parameters—The TTL output from the Trigger Out BNC port on the controller will stay high for the duration of the software-specified integration time.

3. If you are using SpectraMax for Windows software, see Appendix G for a more detailed discussion of triggering with the IGA-3000 controller.

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System Requirements

A. IGA-3000 Controller Electrical Specifications:

Parameter	IGA-3000V
ADC Precision	16-bit
Data conversion speed	166KHz
Dynamic Range	65,535 max
Gain Settings	Gain 1: 75e^-/ct Gain 2: 2000e^-/ct
External Trigger In	TTL, programmable
External Trigger Out	TTL, fixed
Input Line Voltage	100/120/230 VAC (configured at purchase)
Input Line Frequency	50/60 Hz
Communication Protocol	GPIB/IEEE-488
Exposure time	5ms minimum, maximum depends on sensor

B. Environmental Requirements for detector heads and controllers

Parameter	Value
Ambient Temp./Humidity	60 °F to 85 °F (16 °C to 29 °C)/25-55% Relative Humidity
Storage Temp./Humidity	-20 °C to + 50 °C/95% Relative Humidity maximum

C. Mechanical specifications

Parameter	Value
Typical Sensor Operating Temperature LN_2 head MTE head	 -133°C -30°C
Optical Distance from sensor to front flange LN_2 head MTE head	 13.7mm (0.540”) 13.7mm (0.540”)
Sensor format 512 x 1 pixels, 25.6 mm x 0.5 mm area 256 x 1 pixels, 12.8 mm x 0.5 mm area 128 x 1 pixels, 6.4 mm x 0.5 mm area 512 x 1 pixels, 12.8 mm x 0.5 mm area	 50µm wide, 500µm pitch 50 µm wide, 500µm pitch 50 µm wide, 500µm pitch 25 µm wide, 500µm pitch
Controller Dimensions	28mm wide x 25mm deep x 18.5mm high (11” wide x 9.75” deep x 7.25” high)
Controller Weight	21.2 lbs (9.62 kg)

Note: All specifications are subject to change without notification.

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Spectral Response Curve of Regular InGaAs Array Detector

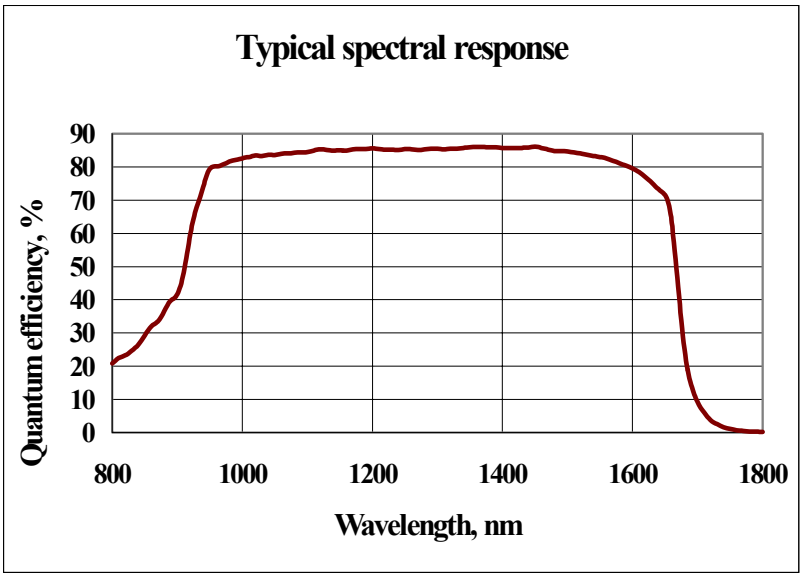


Figure 9. Typical spectral response of Spectrum One InGaAs detectors at 25ºC.

For information about availability and specifications of extended wavelength response arrays from Jobin Yvon, contact the OSD Customer Service Department (see page 51 for contact information).

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Troubleshooting

The Spectrum ONE detection system is designed to perform for years with minimal maintenance.

Vacuum: The detector head is evacuated or purged, and eventually will need re-pumping or re-purging. For evacuated heads, the level of vacuum required is beyond the capabilities of mechanical vacuum pumps. Do not attempt to re-pump your detector head. The user's responsibility in this regard is to regularly monitor the detector operating temperature. Refer to the specifications listed on page 28 for the temperature appropriate for each type of detector head. When the cooling circuitry can no longer maintain the specified temperature, contact the factory for assistance.

Shutter: If the shutter should fail to actuate, contact the factory for assistance.

Noise: If the detection system detects high levels of noise, a grounding strap connected from the detector head to a ground may solve this problem. NEVER disturb the screws that hold the vacuum-sealed flanges together. The best place to attach a ground wire varies depending on the type of head used. For side-looking LN_2 heads, attach a ground wire to the threaded hole at the bottom of the dewar. For down-looking LN_2 heads, use one of the mounting screws on the 25-pin connector. For TE-cooled detectors, use one of the mounting screws on the 9-pin connector on the head.

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In Case of Power Interruption:

For thermoelectrically cooled heads, restart as normal. For LN_2 cooled heads, if power is interrupted while the detector is cooled the system can be restored to normal operation by performing the following steps:

- Repower the system as usual
- Reinitialize the detector
- Note that the sensor may be at a *lower* than normal operating temperature due to loss of thermostat control while unpowered. Allow enough time for the sensor to return to normal operating temperature.
- Run a series of full area readouts with short integration time. This will flush most trapped charges from the sensor. For most cases, normal operation can be resumed at this point.
- For those cases where very long integration times are used, an increase in dark charge may be noticeable. If the effect does not affect the validity of your data, you may choose to proceed as normal; we recommend to take background spectra at more frequent intervals. If this effect happens to be large compared to the desired signal, the dewar should be allowed to warm to room temperature and then restarted as normal to clear all trapped charges.

If the signal is too noisy:

- Try to increase the strength of the optical signal at the detector.
- Do what you can to eliminate or reduce the non-signal stray light that is allowed to enter the spectrograph entrance slit, whether on the optical axis or not.
- Check for light leaks as suggested under "Background signal too high" in this section.
- Ground loops and electromagnetic interference (EMI) may cause a variety of problems. Refer to Appendix C: System Optimization for more help.
- If turning off the spectrometer power switch reduces noise, rearrange power connections to be sure the spectrometer, source, and detector are tied to the same ground and, if possible, the same power circuit.

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If dark signal appears large so that only short integration times can be used

Certain InGaAs array sensors, including the extended arrays, have significantly larger dark signal values and thus are require short integration times (with certain sensors this value can be as short as 50ms), Multiple Accumulation Mode is recommended in this case; in this mode of operation, a series of scans are averaged or summed. This procedure has the effect of improving the collected signal, and improving the signal-to-noise ratio in proportion to the square root of the number of scans. A specific procedure for Multiple Accumulation mode data acquisition using SpectraMax for Windows is given here:

1. Start SpectraMax for Windows software.

2. Open the *Experiment Acquisition* dialog box, shown below (Collect Menu>>Experiment).

3. Specify a short integration time, such as 50 ms as shown in Figure 10.

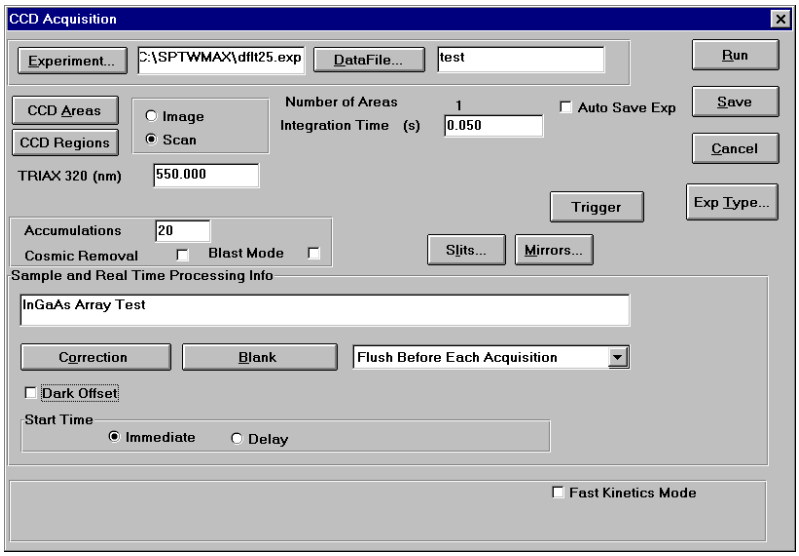


Figure 10. Experiment dialog window with 50ms integration time selected.

4. Choose a number of scans greater than one, such as 20 or 500.

5. Type a name for the data file.

6. Click on “Run”

7. A dialog box will ask: “Show and Save the Intermediate Results?” If you answer “yes” by clicking on the check box, each spectrum will be saved in the *temp* directory (c:\sptwmax\data\temp), but only the averaged result will be shown.

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APPENDIX A: GLOSSARY

The discussion of detection with multi-channel array detectors requires some familiarity with the terminology used. This section includes definitions specific to this context for some familiar terms, as well as several unique terms, abbreviations and acronyms.

ADC

An Analog to Digital Converter (ADC) converts a sample of an analog voltage or current signal to a digital value. The value may then be communicated, stored, and manipulated mathematically. The value of each conversion is generally referred to as a data point.

Charge Coupled Device

The CCD is a solid-state photodetector array made silicon. It is essentially one continuous photosensitive material. Individual pixels or picture elements are defined by a grid of usually three electrode gates in the X and Y directions. The charge is collected of under the gate with the greatest potential. During the readout cycle, the voltages applied to the gate electrodes are manipulated to move the charge across the pixels to the output register at the edge of the array. In contrast, PMTs and other single channel detectors can measure only one intensity at a time. PDA detectors measure both intensity and position (wavelength). The CCD simultaneously measures intensity, X-position (wavelength) and Y position (slit height) differences projected along the spectrograph image plane. The Spectrum ONE CCD detector systems from Jobin Yvon come in liquid nitrogen and TE-cooled versions.

Correlated Double Sampling (CDS)

This is a technique used to increase the signal to noise ratio of each data point detected. Minute charges are unavoidably retained in the readout register between one sample and the next. Even though the readout register is reset after each point is read, some charge will persist. At the extremely low signal levels that are typical for cooled array detectors, these charges are significant. By sampling this retained charge, amplifying and inverting it, it can be canceled by combining it with the actual signal which is amplified, but not inverted. The combined signal is then passed to the ADC to be processed as a data point. This process ensures that only the charge due to the signal in each pixel is measured, allowing wide changes in dynamic range between adjacent pixels to be accurately recorded. Faster and less accurate methods include single sampling methods like Clamp and Sample.

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Cosmic Ray Events

Cosmic Rays are high-energy particles from space, mostly from the sun. Although they penetrate all detectors, dark current usually masks their effect. The dark signal of an LN_2 cooled InGaAs array detector is so low that cosmic rays will be detected. In the active area of a typical array, about 5 events per minute per cm^2 may occur. Compared to very weak signals, detected cosmic ray events can be quite distracting. Mathematical treatment of the data can also be used to remove the spurious spikes in spectra. Refer to the software manual for more about cosmic ray spike removal.

Dark Signal

Dark signal is generated by thermal agitation. This signal is directly related to exposure time and increases with temperature. The dark signal doubles with approximately every 7^oC increase in chip temperature. The more the dark signal, the less dynamic range will be available for experimental signal. This signal accumulates for the entire time between readouts or flushes, regardless of whether the shutter is open or closed. Dark signal is also generated during the charge transfer cycles of the array detector. The problem is not necessarily the dark signal, but the noise in measuring the signal that adversely affects the data.

Dark Signal Nonuniformity (DSNU)

Dark signal nonuniformity (DSNU) is the peak-to-peak difference between the dark signal generation of the pixels on an array detector in a dark exposure.

Dynamic Range

The **Dynamic Range** is the ratio of the maximum and minimum signal measurable. The dynamic range of the chip can be greater than that of the assembled system, which is limited by the **ADC**. A 16-bit ADC limit is 65,535 (2^{16}-1) counts in the dynamic range. A 14-bit ADC is limited to a dynamic range of 16,383 counts. **Variable Gain** can be used to shift the ADC range to match the potential well capacity, or to extract statistical noise in the baseline of a given spectral measurement. In this way, stronger or weaker signals can be accommodated with optimal Dynamic Range.

On a pixel-by-pixel basis, the most intense detectable signal, the saturation level, is the lesser of either the **Potential Well Capacity** of the pixel or the ADC maximum limit. When pixels are binned, individual pixels within a binned area may saturate if the intensity is concentrated. Also, the well capacity of the readout register will limit the total signal that can be binned from a given row or column of a binned area.

$$\text{Dynamic range of an array} = \frac{\text{Full well capacity of readout register of individual pixel}}{\text{Readout noise of detector}}$$

The weakest detectable signal is limited by the quadrature sum of all noise sources. The Maximum signal is the largest signal less the dark bias.

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Electrons/Count:

Electrons per count is a gain value indicating how many electrons it takes to be identified by the **ADC** as the smallest measurable unit, or ***count***.

Fellgett's Advantage:

Multichannel detection provides an improvement in signal to noise ratio, as compared to single channel (scanned) spectral detection. Because the multichannel detection acquires a number of spectral elements simultaneously, the S/N is improved by a factor proportional to the square root of the number of channels acquired given the experiment times are equal. In another application of Fellgett's advantage, when ***n*** spectra are acquired, the S/N of the resultant averaged spectrum is improved by $\sqrt{n}$. Also called the multiplex advantage.

Flush

To reduce noise and maximize dynamic range at the detector, the dark charge that has accumulated on the chip can be rapidly removed by flushing. The effect of flushing the array is similar to a readout cycle in that the charges are cleared from the pixels. A flush is much faster than a frame readout since it dumps the charges without conversion. Flushing is only necessary when there is an appreciable time between readouts.

Gain

Gain is the conversion between electrons generated in the detector to counts reported in the software. Gain is typically set to be just below the read noise for most low light measurements, or set to take advantage of the full dynamic range for larger signals. See also **Variable Gain.**

Linearity

When photo response is linear, if the light intensity doubles, the detected signal will double in magnitude as well. Nonlinear response at medium to high intensities is usually due to amplifier problems, and at very low light levels poor charge transfer efficiency. A CCD's response is linear, once the bias is subtracted. Another definition of linearity is applied to the spectral positioning accuracy or tracking error of a spectrometer drive mechanism, as a single wavelength is viewed at different positions across the chip.

Multiplex Advantage

See Fellgett's Advantage.

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Noise

Noise is common to all detectors. The total amount of signal that exists is less important than the signal-to-noise ratio (S/N). With a high signal-to-noise ratio a signal peak can be discerned even though signal counts per second may be low. The noise components for InGaAs arrays are as follows:

- **Amplifier Noise:** Noise introduced in the process of electronically amplifying and conditioning the signal read from the detector before conversion to a digital value. Part of **Readout Noise**.

- **Conversion Noise:** During the conversion of an analog signal to a digital data point, statistical variations occur in the least significant bit of the converted data. Part of **Readout Noise**.

- **Dark Signal:** The current that flows in a photodetector when there is not optical radiation incident on the detector and operating voltages are applied is called **Dark Signal** or **Dark Current**. Most of the dark signal is a steady state level that can be subtracted, and so will not ultimately contribute to the noise. However, a component of **Dark Current** is **Dark Noise (see next entry).** Cooling the detector can reduce dark signal.

- **Dark Noise**: Dark noise is caused by statistical variations in the dark current, and increases as the square root of the Dark Current. Cooling can reduce dark current, and therefore dark noise. If the signal level is below saturation, increasing the signal integration time per readout will minimize the effect that dark noise has on the acquired signal. If the signal level is too high, summing multiple reads can give similar improvement. (See **Readout Noise** and **Fellgett's Advantage.)**

- **Fixed Pattern Noise:** Since each individual InGaAs photodiode pixel in an array is connected to its own capacitive transimpedance preamplifier, the bias voltages are often different from pixel-to-pixel. These minute differences lead to a predictable and repeatable noise source known as fixed pattern noise.

- **Readout Noise:** The electronic noise impressed on the signal during the readout and digitizing of the signal. For convenience, usually all of the noise associated with resetting, amplifying, and converting the signal are considered as readout noise. When averaging signal by acquiring over a long interval of time, increasing the signal integration time per readout rather than summing multiple readouts is preferred. This will proportionately reduce the readout noise component in the acquired signal. However, the integration time must be short enough to prevent saturation of any individual pixels and to keep the digital signal for any data point below the ADC limit.

- **Reset Noise:** Following pixel or bin readout, the readout register is reset to a level approaching zero charge. **Reset Noise** is the non-uniformity in the resetting. This is canceled by **Correlated Double Sampling**. Part of **Readout Noise**.

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- **Shot Noise:** This is due to the random statistical variations of light. It includes both experimental and dark signal components. Shot noise is equal to the square root of the number of electrons generated. Its effect can be minimized by increasing signal intensity, signal integration time, or summing a number of readouts.

Photoelectric Effect

When light of sufficient energy hits a photosensitive material, an electron is freed from being bound to a specific atom. Such materials include most metals as well as the P-N junctions of the photodiodes used in JY array detectors. The energy of the light must be greater than or equal to the binding energy of the electron to free an electron (work function). Einstein won the Nobel Prize in 1906 for this discovery. Light with a shorter wavelength has higher energy ($E = hc/\lambda = h\nu$).

Photoelectron

A photoelectron is an electron that is released through the interaction of a photon with the active element of a detector. The photoelectron could be released either from a junction to the conduction band of a solid-state detector, or from the photocathode to the vacuum in a PMT. A photoelectron is indistinguishable from other electrons in any electrical circuit.

Photo Response NonUniformity (PRNU)

PRNU is the peak-to-peak difference in response between the most and least sensitive elements of an array detector, under a uniform exposure giving an output level of $V_{Sat}/2$. These differences are primarily caused by variations in doping and silicon thickness.

Quantum Efficiency (QE)

The efficiency of the photoelectric effect of a detector can be quantified. The quantum efficiency of a detector is the ratio of number of photoelectrons produced to the number of photons impinging on a photoactive surface. A QE of 20% would indicate that one photon in five would produce a distinguishable photoelectron.

Readout Time

The **Readout Time** of an array detector is the interval required to move the charges from their locations in the array to the readout registers, sample the charges, amplify them and convert them to data points. The correlated double sampling readout technique requires more time per pixel than other less accurate methods. Faster ADCs can reduce the readout time at the cost of more noise and/or less dynamic range.

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Responsivity

Responsivity is the ratio of output energy to corresponding exposure ($\mu J/cm^2$). Technically it is measured at $V_{Sat\ min}/2$ under specified conditions of illumination, readout rate, and temperature. Typically, array detectors specify QE, counts, and gain (measured in electrons per count) instead of responsivity.

Saturation Level

The maximum signal level that can be accommodated by a device is its saturation level. At this point, further increase in input signal does not result in a corresponding increase in output. This term is often used to describe the upper limit of a detector element, an amplifier, or an ADC.

Spectral Response

Most detectors will respond with higher sensitivity to some wavelengths than to others. The spectral response of a detector is often expressed graphically in a plot of responsivity or QE versus wavelength.

Variable Gain

Variable Gain is the ability to match the range of the ADC to the usually larger range of the detector without losing valuable information.

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APPENDIX B: AC POWER SELECTION AND FUSING

The power input module combines the line voltage selection, fuse holder, on / off (1 / 0) switch and power line cord entry into one compact unit. If you suspect a fuse needs replacement, understand first why the fuse failed to avoid consequent damage to the system. Contact the factory for assistance.

Circuit	Line Voltage	Fuse rating (3AG type)
Input Power	100 VAC	2 Amp slow blow
	120 VAC	2 Amp slow blow
	220 VAC	1 Amp slow blow
	240 VAC	1 Amp slow blow
Shutter Fuse (internal)	N/A	1 Amp fast blow

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APPENDIX C: SYSTEM OPTIMIZATION

After completing the installation, some applications demand special attention to assure that the detection system is yielding the best possible signal to noise ratio. The following topical discussions may be helpful in extracting optimal performance from the system.

Optical Optimization

In many cases, it may be a simple matter to increase signal strength at the detector by increasing optical power at the source. Reducing losses by improving optical coupling from the source to the sample and/or from the sample to the spectrograph entrance slit can also yield dramatic results.

Try to reduce the possibility of stray light entering the system. Check for light leaks by darkening the room or by covering any open segments of the optical system. Use an opaque black cloth to cover portions of the system. Further isolation of leaks may be possible by shining a flashlight at suspected portions of the optical system while monitoring the signal.

Environmental Noise Reduction

Because of the extreme low internal noise characteristics of the liquid nitrogen and thermo-electrically cooled sensors, special precautions to minimize noise pickup from external sources is required.

Important: Do not place a computer monitor on or near the Controller. The because of the extreme sensitivity of the signal electronics required to take full advantage of the sensor's low noise, electromagnetic noise radiated by the monitor may be picked up. This may be seen in the spectral data as an increase in read-out noise.

Although shielded, the detector head and cables can still be sensitive to electromagnetic fields. For best results the detection system should be isolated from devices generating such fields.

- Electromagnetic interference (EMI) from a variety of sources may be picked up by the sensitive input channels. Try isolating any other apparatus suspected to be a noise source by turning it off while monitoring the IGA signal in real time. If possible, connect them to power circuits separate from the detector controller.
- Note that the room lights may radiate EMI based on the (50 or 60 Hz) power line frequency. A battery-powered flashlight will not.

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- If turning off the spectrometer power switch reduces noise, rearrange power connections to be sure the spectrometer, source, and detector are tied to the same ground and, if possible, the same power circuit.
- A redundant grounding strap connected from the detector to a centrally located system ground may help. The binding post on the IGA-3000V rear panel adjacent to the power input module is provided as a chassis ground point. Ground loops and electromagnetic interference can be challenging problems. The best place to attach a ground is usually discovered by a trial and error process. In extreme cases, the best approach is to patiently experiment by trying various combinations of grounding connections. As a general rule, try to keep ground wires short, make tight connections, and avoid painted, coated, and anodized surfaces when possible. Consider a "star ground" of redundant ground wires radiating from a single, central location, preferably connected to a grounded metal table surface under the system.
- Adding redundant ground wires to various points in the system sometimes helps. Guard against the creation of ground loops that may occur when power grounds and signal grounds are connected. Also keep digital grounds and their typical high frequency noise separate from signal ground.
- In extreme cases, such as working with or around high powered pulsed lasers or other high energy apparatus, it may be helpful to construct RFI / EMI shields or cages to contain the noise at its source, or to isolate the detection system from the noise. In these cases, colleagues who are working with a similar apparatus may be your best resource for noise control suggestions.

Should the detection system detect high levels of noise, a grounding strap connected from the detector head to a ground may help. It is important to avoid disturbing the screws that hold the vacuum-sealed flanges together. The best place to attach a ground varies depending on the type of head used. For side looking LN_2 heads, use the threaded hole at the bottom of the dewar. For down-looking LN_2 heads, use one of the mounting screws on the 25-pin connector. For water or air cooled, use one of the mounting screws on the 9-pin connector on the head.

Setting Gain with the IGA-3000 series controller

To take full advantage of the dynamic range of the InGaAs sensor, the IGA-3000 series controller is provided with 2 different gain settings. Two options are available: Gain 1 (typically 75 electrons/count), Gain 2 (typically 2000 electrons/count). See the software manual for specific instructions on how to change the gain (With SpectraMax for Windows software the gain can be selected using the Visual Instrument Window.).

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APPENDIX D: INTERFACE DRAWINGS

The bolt patterns on the LN_2 version mounting flanges have six through-hole slots, so that the detector can be mounted in either of 2 orientations by selecting the group of 3 slots (with an angle of 120^o between them). Adjacent slots have an angle of 30^o between them. A second flange variation found on TE units uses three threaded holes and three through-hole slots to allow maximum mounting flexibility. The three slots/ threaded holes and mechanical dimensions conform to the accepted 'OMA' flange pattern. The dimensions in all drawings are given in inches. The distance from the front of the mounting flange to the sensor (labeled "focal plane") is 0.540 inches (13.7mm).

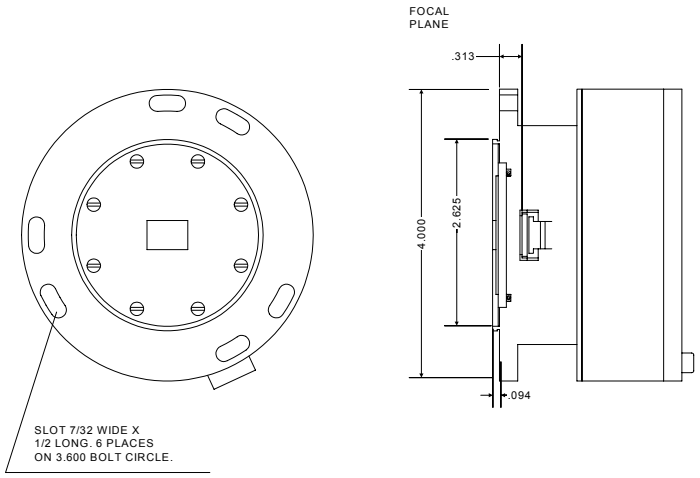


Figure 11: LN_2 Head Mounting Flange

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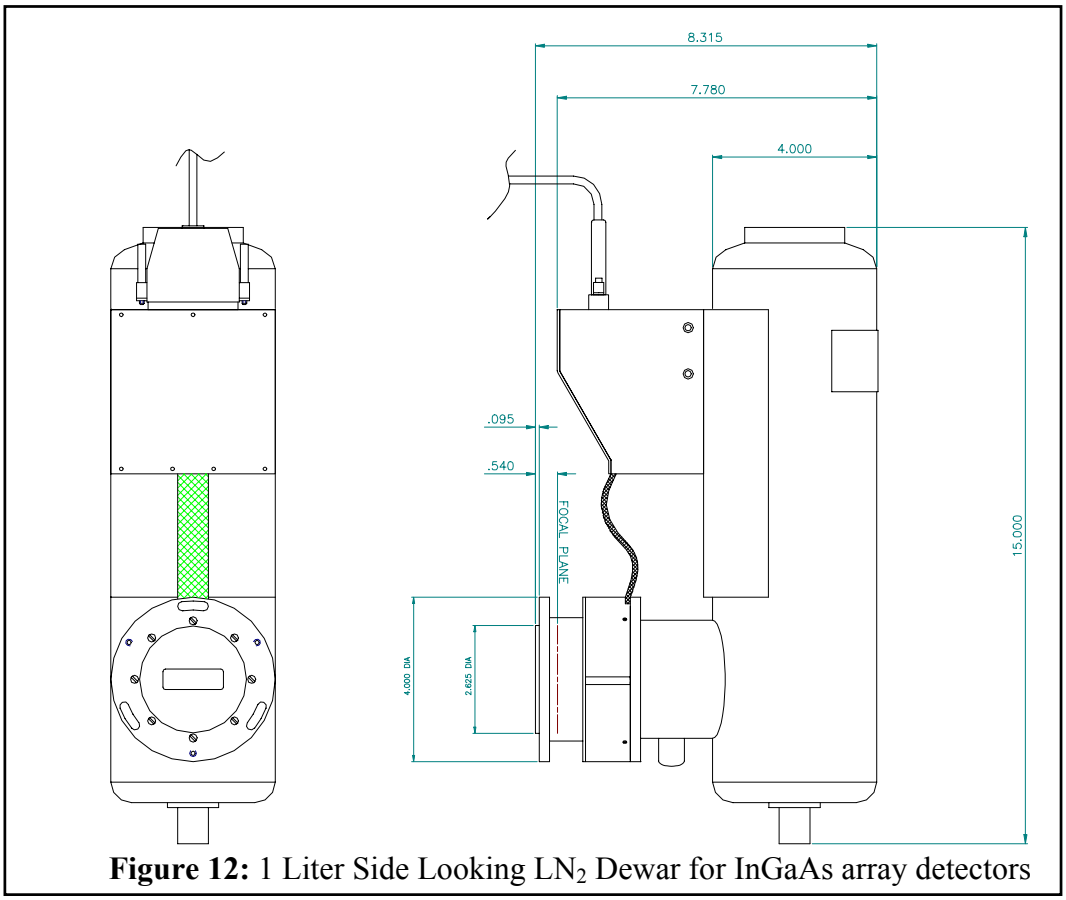


Figure 12: 1 Liter Side Looking LN_2 Dewar for InGaAs array detectors

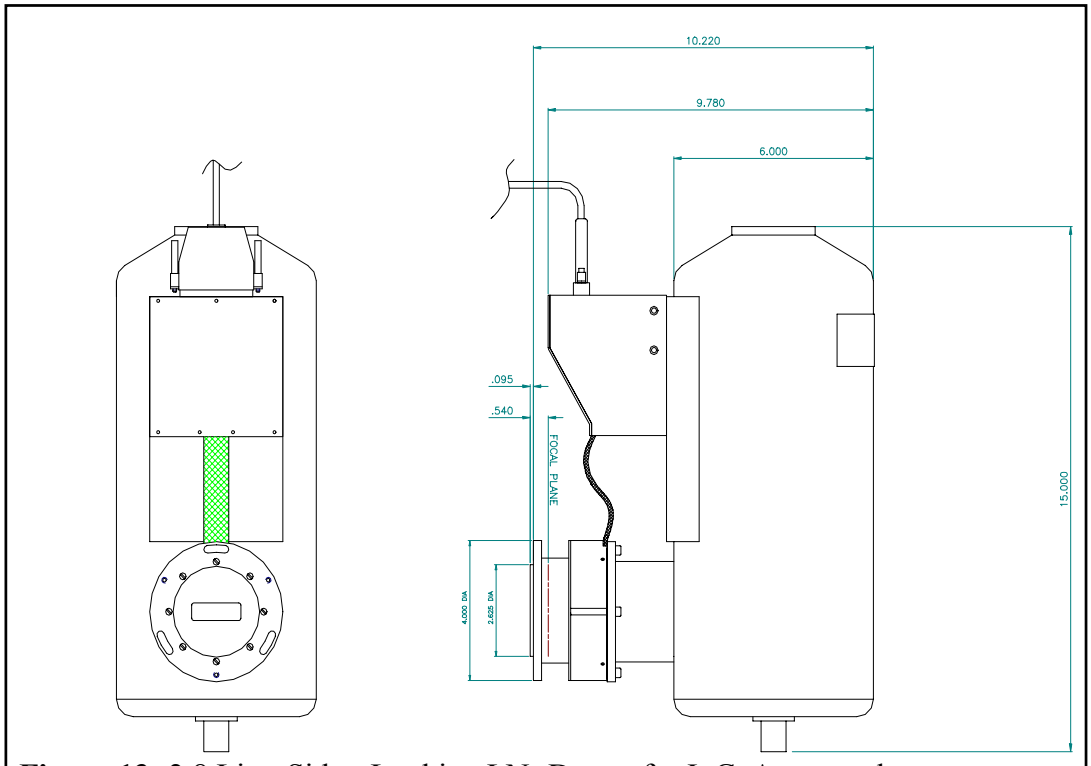


Figure 13: 2.8 Liter Side - Looking LN_2 Dewar for InGaAs array detectors

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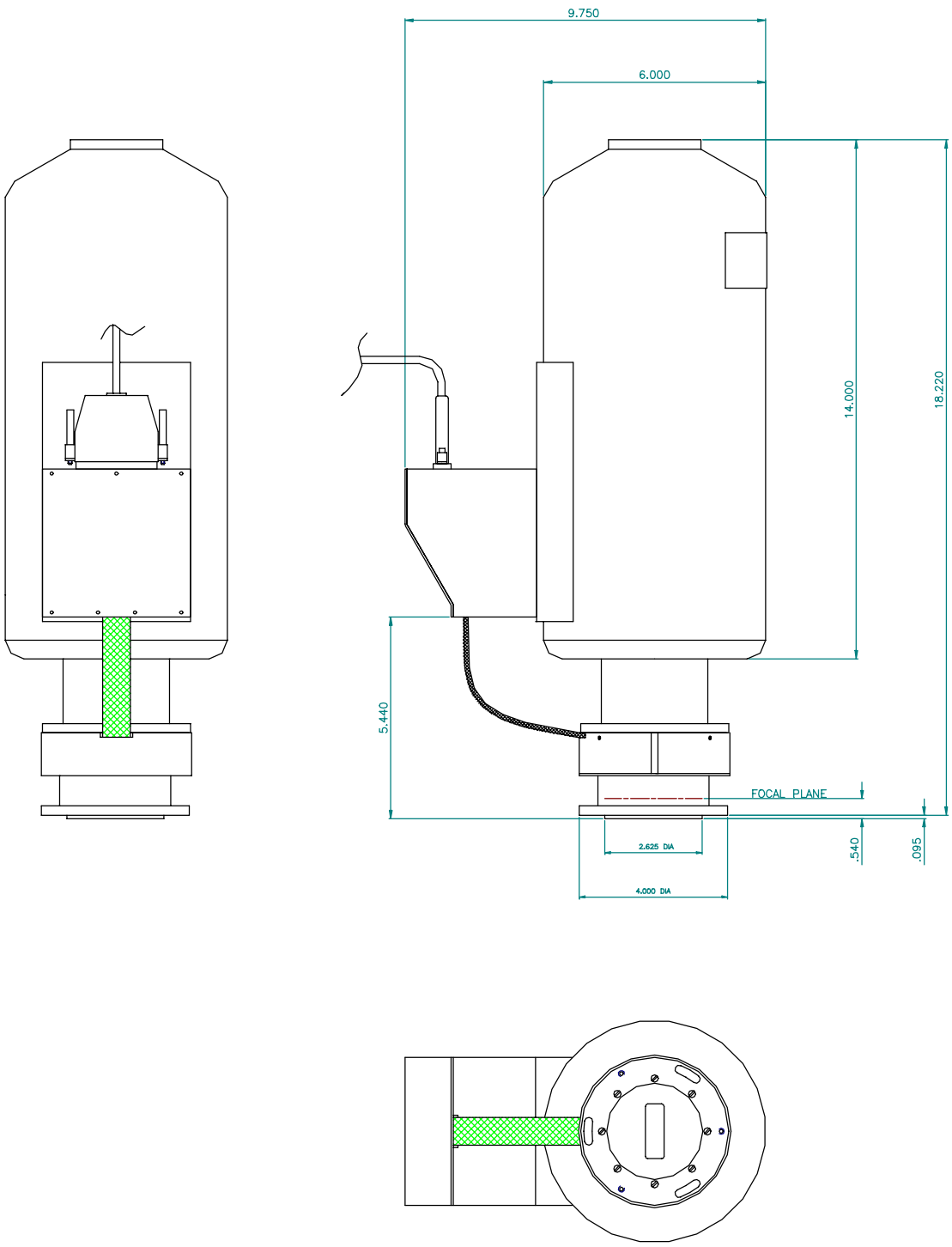


Figure 14: 2.8 Liter Down - Looking LN_2 Dewar for InGaAs array detectors

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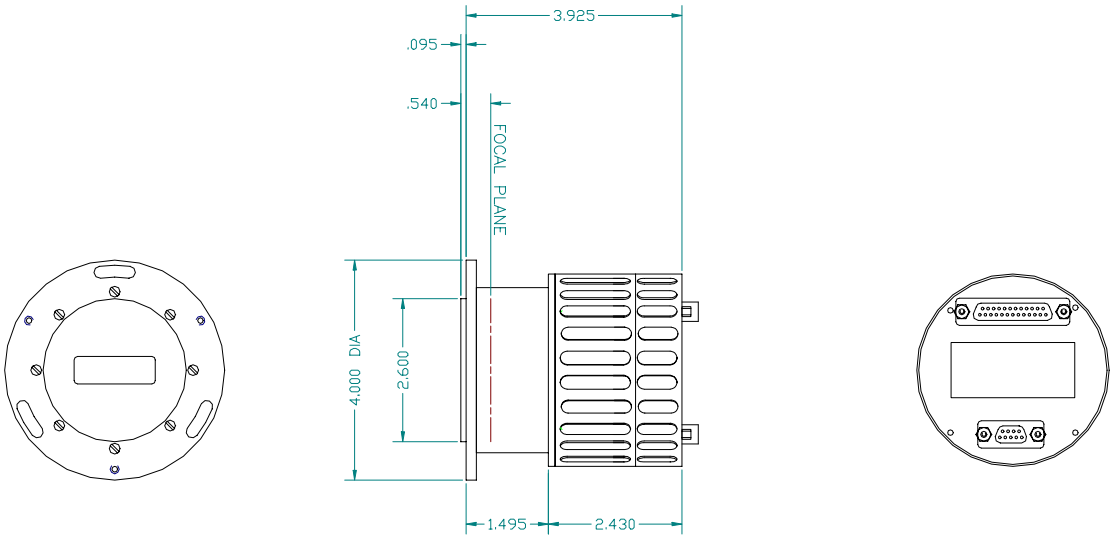


Figure 15: Compact Mini-Thermo-electrically cooled housings for InGaAs array detectors

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APPENDIX E: SHUTTER OPTIONS

Shutter models 225MCD or 227MCD for the 270M, TRIAX180, TRIAX190, TRIAX320 and TRIAX550 spectrographs.

Important: On shutters using a BNC cable for the shutter signal, the shell of the cable is NOT ground. While protected by a fuse, failure to isolate this connector can cause damage to the sensor, controller, or equipment contacted by the cable.

The 225MCD shutter mounts outside on the axial (front) or lateral (side) entrance slit. Alternatively, the model 227MCD mounts inside the front axial entrance port. See the appropriate spectrograph manual for detailed installation instructions.
Connect the BNC-to-9-pin cable to the 9-pin connector on the cable coming from the detector head. For the externally mounted 225MCD shutter, connect the BNC end to the BNC connector on the outside of the shutter mechanism. For internally mounted 227MCD shutters, connect the BNC end to the BNC connection inserted through the purge port.

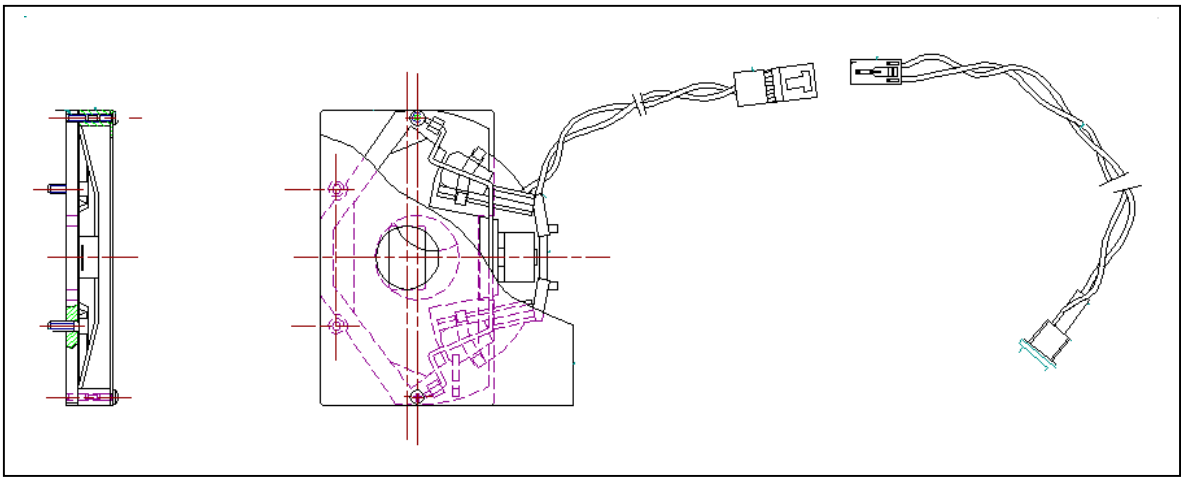


Figure 16. Shutter model 227MCD diagram.

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Shutter model 1425MCD(-series), for the 1681C, 340E/S, 500M, 750M, 1000M, 1250M, 1269, 1403, and 1404 Spectrometers.

Mount the model 1425MCD (See figure 15) shutter internally on the axial (front) slit. For the 1000M and 1250M, it can also be mounted internally on the lateral (side) entrance slit. For the lateral (side) entrance of the 500M or 750M, use the 1425MCD-B. For dual entrance spectrometers, if shutters are required at both entrances, choose the correct shutter for the lateral slit, and add a 1425MCD-C for the axial slit. For all listed spectrometers *except* the 1681C and 340E, use two 1/4 -20 capscrews to attach the shutter support to the inside of the instrument wall. For the 1681C and 340E, use two 10-32 screws, and mount the shutter vertically, to avoid interference with the light baffle.

Remove the plug from the purge port/tapped hole of the spectrometer, and using the wired BNC connector, screw the threaded end of the BNC connector into the purge port such that the wire hangs inside. Route the wires avoiding the optical path and moving parts inside the spectrometer. Connect the wiring from the shutter to the BNC connector.

Connect the 36217 BNC-to-9-pin connector cable to the BNC connector just installed, and to the 9-pin connector on the 35872 cable coming from the detector head. The BNC connector must not be grounded.

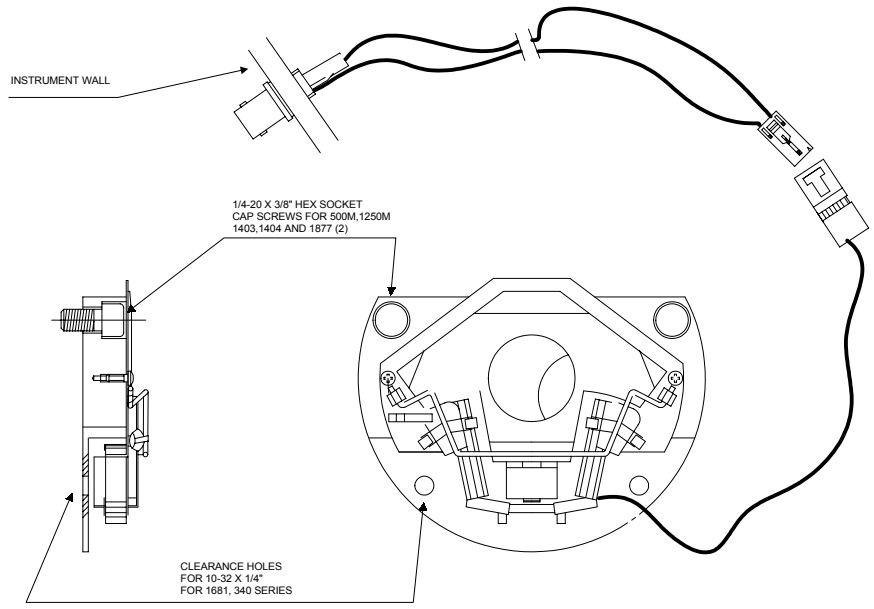


Figure 17: 1425MCD Shutter for 1681C, 340, 500-1250M, 1400 Spectrometers
MAN 0106

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Shutter model 22.900.109, for the CP200, HR320, THR640, THR1000, & THR1500 Spectrometers

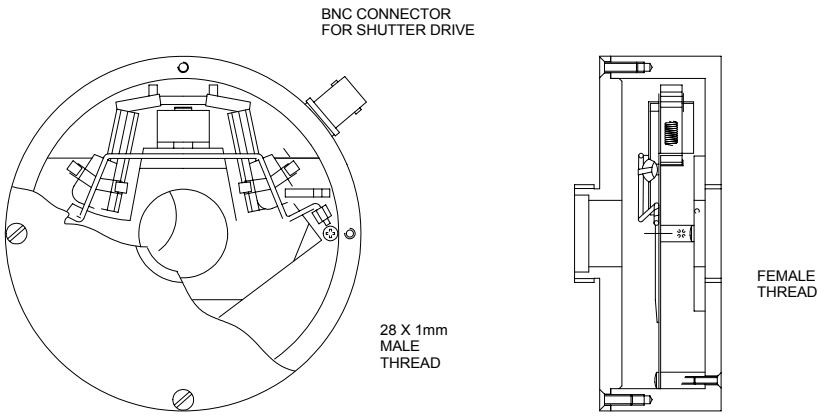


Figure 18: 22.900.109 Shutter for CP200 and HR-Series Spectrometers
MAN 0105

Screw the shutter onto the 28 mm (M-28) threaded adapter on the entrance slit of the spectrometer.

Connect the 32617 BNC-to-9-pin connector cable to the BNC connector on the shutter and to the 9-pin connector on the branch of the 35872 cable to the detector head.

For all other monochromators contact the Jobin Yvon Customer Service Department for assistance in shutter selection and installation.

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APPENDIX F: TRIGGERING WITH THE IGA-3000 DETECTION SYSTEM AND SPECTRAMAX FOR WINDOWS

The Spectrum ONE IGA-3000 Detection System has both input and output TTL trigger functions. One hardware input trigger can be configured in the software. Note: the fastest triggering rate possible is 50 Hz for experiments using a mechanical shutter. For experiments without a shutter, the fastest triggering rate compatible with the controller is 3KHz. Two hardware triggers are available as BNC receptacles on the back of the controller: one for input and one for output.

To enable triggering using SpectraMax for Windows, the following procedure can be used:

1. Open the Experiment Acquisition window.
2. Click on the box labeled "Trigger" as shown in Figure 1.

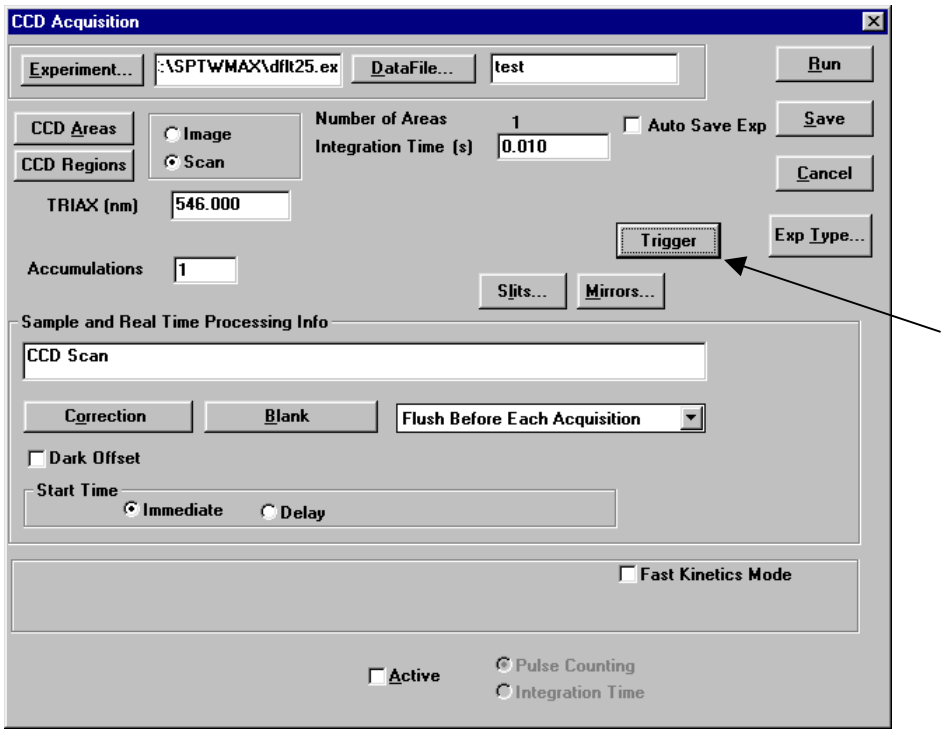


Figure 1. Trigger functionality can be selected in the Acquisition window by clicking on the "Trigger" box.

3. A Trigger Setup window will appear, as shown in Figure 2.
4. Click on the "Enable" button to activate Input Trigger, select one of the options listed below.
5. Click on the "OK" button to close the Trigger Setup window.

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6. Verify the other experimental parameters, then run the experiment.

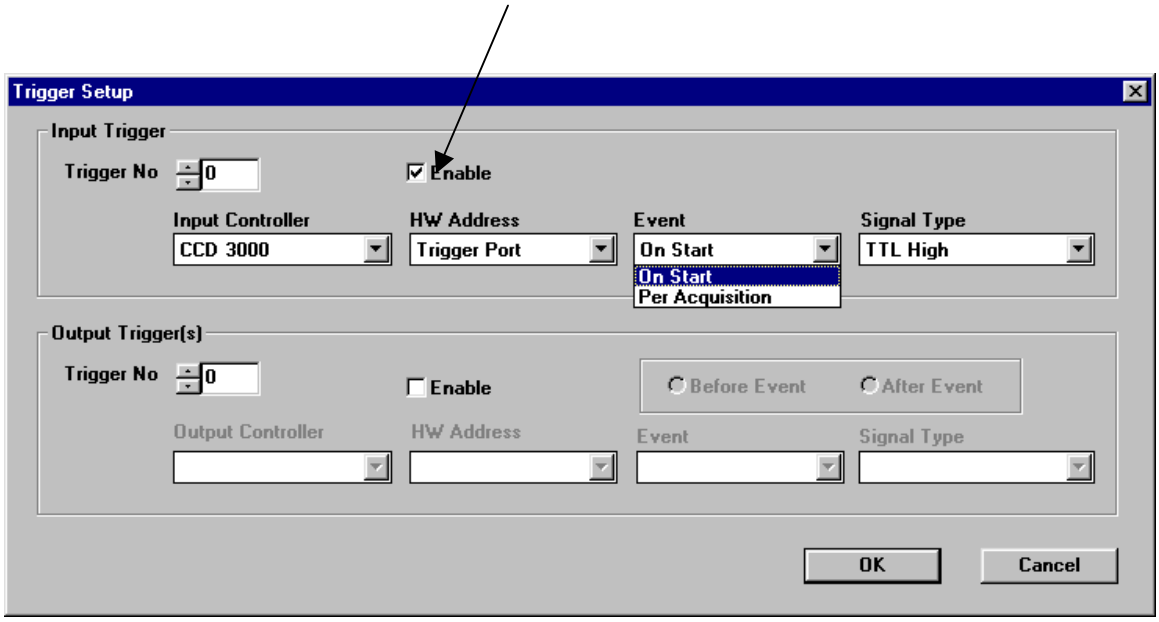


Figure 2. The Trigger Setup window allows the user to activate TTL trigger inputs and outputs. Here, the Input Trigger function is enabled.

- Input Trigger Parameters
    - Input Trigger On Start—The experiment will start as soon as the IGA controller receives a TTL high signal. If the controller receives multiple input triggers, only the first one will have any effect on the experiment.
    - Input Trigger Per Acquisition—In a multiple acquisition experiment (such as an experiment where Multiple Accumulations or Blast Mode is selected), sometimes it is desirable to wait for a trigger to start each acquisition. In this case each acquisition will start only after the IGA controller receives a TTL high signal.

- Output Trigger Parameters—The TTL output from the Trigger Out BNC port on the IGA controller will stay high for the duration of the software-specified integration time.

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SERVICE POLICY:

If you need assistance in resolving a problem with your instrument, contact our Customer Service Department directly, or if outside the United States, through our representative or affiliate covering your location.

Often it is possible to correct, reduce, or localize the problem through discussion with our Customer Service Engineers.

All instruments are covered by a warranty. The warranty statement is printed on the inside back cover of this manual. Service for out-of-warranty instruments is also available, for a fee. Contact Jobin Yvon or your local representative for details and cost estimates.

If your problem relates to software, please verify your computer's operation by running any diagnostic routines that were provided with it. If there is a support diskette provided, refer to the manual for that diskette, and follow the troubleshooting procedures. Be ready to provide version numbers for the operating system that you are using, as well as the software version and firmware version of any controller or interface options in your system. The software version can be determined by reading the version from the welcome panel that is displayed when the software is loaded. Or select the software name at the right end of the menu bar and click on “About” to view the same panel. Also knowing the memory type and allocation, and other computer hardware configuration data from the PC's CMOS Setup utility may be useful.

In the United States, customers may contact the Customer Service department directly:

- By phone at (732) 494-8660 ext. 185
- The Service fax numbers are: (732) 549-9309 for the Optical Spectroscopy Division (OSD), 549-2571 for the Raman Group and 549-5157 for the Fluorescence Group
- E-mail us at Systems@jyhoriba.com
- Or you may write to:

  Jobin Yvon, Inc.
  Customer Service (Specify OSD, Raman or Fluorescence)
  3880 Park Avenue
  Edison, N.J. 08820 U.S.A.

From other locations worldwide, contact the representative or affiliate for your location.

If an instrument or component must be returned, the method described on the following page should be followed to expedite servicing and reduce your downtime.

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Return Authorization:

All instruments and components returned to the factory must be accompanied by a Return Authorization Number issued by our Customer Service Department.
To issue a Return Authorization number, we require:

- The model and serial number of the instrument
- A list of items and/or components to be returned
- A description of the problem, including operating settings
- The instrument user's name, mailing address, telephone, and fax numbers
- The shipping address for shipment of the instrument to you after service
- Your Purchase Order number and billing information for non-warranty services
- Our original Sales Order number, if known
- Your Customer Account number, if known
- Any special instructions

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