

**ORTEC®**

**ICS™**

**Integrated Cryocooling System**

**User Manual**

**Advanced Measurement Technology, Inc.**  
**(“AMT”)**

**WARRANTY**

AMT warrants that the items will be delivered free from defects in material or workmanship. AMT makes no other warranties, express or implied, and specifically NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

AMT’s exclusive liability is limited to repairing or replacing at AMT’s option, items found by AMT to be defective in workmanship or materials within one year from the date of delivery with the exception of the cryocooler, internal controller, and active noise cancellation, which are warranted for two years. AMT’s liability on any claim of any kind, including negligence, loss, or damages arising out of, connected with, or from the performance or breach thereof, or from the manufacture, sale, delivery, resale, repair, or use of any item or services covered by this agreement or purchase order, shall in no case exceed the price allocable to the item or service furnished or any part thereof that gives rise to the claim. In the event AMT fails to manufacture or deliver items called for in this agreement or purchase order, AMT’s exclusive liability and buyer’s exclusive remedy shall be release of the buyer from the obligation to pay the purchase price. In no event shall AMT be liable for special or consequential damages.

**Quality Control**

Before being approved for shipment, each AMT instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

**Repair Service**

If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, AMT must be informed, either in writing, by telephone [(865) 482-4411] or by facsimile transmission [(865) 483-2133], of the nature of the fault of the instrument being returned and of the model, serial, and revision (“Rev” on rear panel) numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. The AMT standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped PREPAID via Air Parcel Post or United Parcel Service to the designated AMT repair center. The address label and the package should include the Return Authorization Number assigned. Instruments being returned that are damaged in transit due to inadequate packing will be repaired at the sender’s expense, and it will be the sender’s responsibility to make claim with the shipper. Instruments not in warranty should follow the same procedure and AMT will provide a quotation.

**Damage in Transit**

Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify AMT of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment, if necessary.

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## ADDITIONAL WARRANTY AND SAFETY NOTICES

There are no serviceable parts in the ICS. Opening the enclosure or performing operations other than those described in this manual may void your warranty.

Using this equipment in a manner not specified in this manual may impair the protection the equipment provides.

## SAFETY INSTRUCTIONS AND SYMBOLS

This manual contains up to three levels of safety instructions that must be observed in order to avoid personal injury and/or damage to equipment or other property. These are:

**DANGER** Indicates a hazard that could result in death or serious bodily harm if the safety instruction is not observed.

**WARNING** Indicates a hazard that could result in bodily harm if the safety instruction is not observed.

**CAUTION** Indicates a hazard that could result in property damage if the safety instruction is not observed.

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

In addition, the following symbol might appear on the product:



**ATTENTION – Consult the manual in all cases where this symbol is marked in order to determine the nature of the potential hazards and any actions that must be taken to avoid them**



**DANGER – Hazardous voltage**



**Protective earth (ground) terminal**

Please read all safety instructions carefully and make sure you understand them fully before attempting to use this product.

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# ORTEC® ICS™

## INTEGRATED CRYOCOOLING SYSTEM

### 1. INTRODUCTION

The ICS™ is a highly reliable, maintenance-free, electromechanically cooled cryostat delivering superior performance for ORTEC high-purity germanium (HPGe) detectors. The industry-proven AMETEK Sunpower® CryoTel® cryocooler has a service life of >200,000 hours for unmatched operational reliability.

ICS incorporates ANC™ (Active Noise Cancellation) technology, and is designed to virtually eliminate vibrational and audible noise levels. This provides resolution performance comparable to liquid nitrogen cooled systems in all operational orientations, making it the choice for users seeking premium resolution and versatility in a broad array of HPGe applications.

The vacuum-hardened cryostat eliminates the need to thermally cycle the detector in the event of a partial warm-up.

### 2. INSPECTION FOR SHIPPING DAMAGE

If a shipping carton(s) arrives with externally visible damage, **do not unpack it**. Notify the carrier and make arrangements to file a damage claim. **In all cases of shipping damage, it is the customer's responsibility to file a damage claim.**

If, during unpacking, you find concealed damage, **notify the carrier and file a claim**. Preserve packing materials, waybills, and other such documentation to establish claims.

Contact the ORTEC Global Service Center, 1-800-251-9750 or (865) 482-4411, for further instructions. Outside the USA, contact your local ORTEC representative.

### 3. OPERATING CAUTIONS AND NOTES

#### 3.1. HANDLING AND MOVING THE ICS

#### WARNING

Because of its weight, the ICS is rated by OSHA as a two-person lift. In addition, **it is significantly nose-heavy**. Keep this in mind when lifting and positioning the unit.

When lifting or moving the ICS:

- **Do not place any load on the detector housing or cryostat** (i.e., do not use the detector/cryostat assembly as a contact point with any other surface). Compressing, denting, or bending any part of this assembly may damage the detector element or breach the cryostat vacuum, **and will void your warranty**.
- **Do not attempt to lift the ICS by the detector housing or cryostat**. This may damage the detector element or breach the cryostat vacuum, **and will void your warranty**.

### 3.2. ELECTRICAL CAUTIONS

If the mains power cord is damaged, contact ORTEC for servicing information. *Do not replace the cord.*

### 3.3. BERYLLIUM WINDOWS AND INTERNAL CRYOSTAT PRESSURE

#### DANGER

Inhaling beryllium dust can lead to a chronic lung disorder called berylliosis. Beryllium has also been listed as a carcinogen, based principally on animal tests. If a beryllium window should implode, contact our ORTEC Global Service Center or your ORTEC representative for shipping instructions to return the detector for repair. In the event that some beryllium pieces fall out of the detector, take care to avoid breathing any dust or powder that may form. Wearing protective gloves and/or using tweezers, pick up pieces in a manner so as not to generate any dust. Dispose of the pieces according to local or national regulation.

Some ORTEC detectors have beryllium windows, which are especially fragile and can sometimes be ruptured by a light touch. *Rupture of a beryllium window causes severe system damage, and in some circumstances can cause personal injury and other health effects.* Therefore, do not touch or allow objects to contact a beryllium window. ORTEC ships a removable plastic endcap cover with our beryllium-window detectors. Keep this cover on the endcap when the detector is not in use or if the window is damaged.

If a beryllium window should rupture under normal circumstances, it will implode and personnel will typically not be exposed to flying fragments and possible injury. Cover the detector window with its the protective plastic cover and tape the cover down so that none of the beryllium pieces can fall out.

*A more dangerous situation may result if the beryllium window ruptures outward due to a pressure build-up in the cryostat.* This can happen if the cryostat develops a leak while cold and then warms up. If a cold cryostat shows evidence of poor vacuum, place the protective plastic cover over the beryllium window and secure it with the plastic set screw(s) or with tape. Symptoms of a poor vacuum include an unusually cold cryostat or endcap; moisture condensation or "sweating"; or, in extreme cases, an outward bulge in the window on warmup.

If the window has a hole or crack, cover the defect with tape, then affix the protective plastic cover.

In all cases, disconnect the system from the MCB or other external electronics. Then, before turning off the ICS power and warming up the cryostat or taking any additional action, contact our Global Service Center or your ORTEC representative.

### 3.4. DETECTOR WARMUP FOR REPOSITIONING OR SHIPPING

Once the ICS is cooled, you can power off the ICS for a brief period (e.g., 10–20 minutes) without significantly warming the detector. When the cryocooler is restarted, the unit typically returns to ready status within a few minutes. The cryocooler can be restarted at any time without harming the detector element, regardless of whether the detector is warm, partially cooled, or cooled to operating temperature.

Allow the ICS to warm for 24 hours before enclosing it in packing materials.

**CAUTION** *Do not enclose the ICS in packing materials or a shipping case while it is cold.* This could allow condensation to form on the cryostat and enter the enclosure and connectors, potentially damaging the electronics.

## 4. SYSTEM OVERVIEW

### 4.1. CONTENTS OF THE SHIPPING CARTON<sup>1</sup>

When you receive the ICS, its shipping carton(s) will contain the following components at minimum:

- ICS integrated detector/cryocooler.
- Region-specific ac/dc power adapter and cord.
- Detector cable kit.
- This ICS user manual; the Photon Detector Manual containing performance and testing information for your detector type; and the Quality Assurance Detector Sheet (QADS) specific to your detector, listing the detector type, composition, size, test results, cooling time, and recommended bias voltage.

Options will typically be packaged separately and will include their own instructions.

### 4.2. THE ICS

Figure 1 and Figure 2 illustrate the ICS main features.

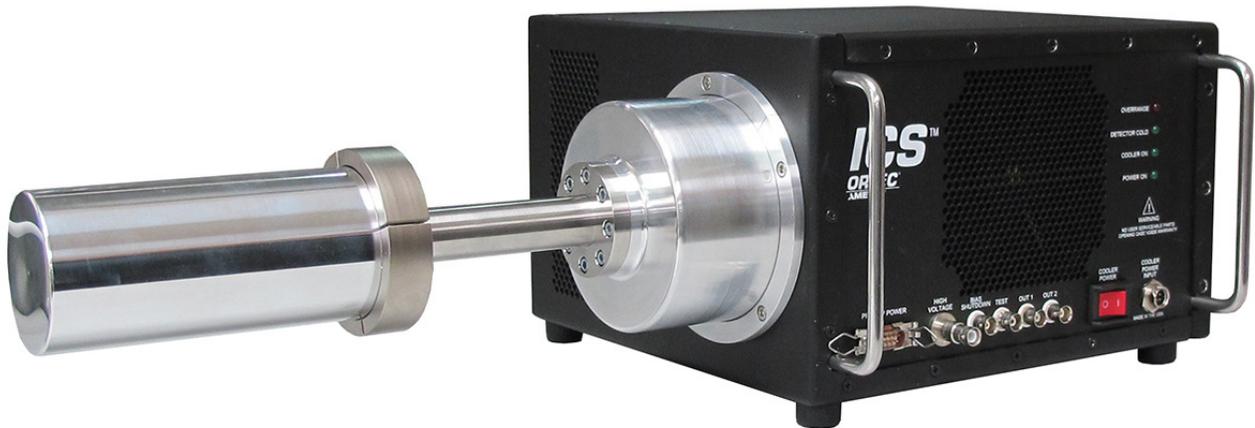


Figure 1. ICS Detector Panel.

<sup>1</sup> All system components and specifications subject to change without notice.



Figure 2. Connector Panel.

#### 4.2.1. Connectors and Indicators

##### 4.2.1.1. CONNECTORS

- **PREAMP POWER** 9-pin D connector; provides  $\pm 24$  V and  $\pm 12$  V for preamplifier power.

**NOTE** Power must be applied to this connection in order for the detector temperature to be monitored. The SYSTEM COLD light will remain illuminated regardless of the temperature state of the detector unless preamplifier power is applied.

- **HV** SHV connector connects to detector bias (high-voltage) input on MCB or NIM amplifier.
- **SHUTDOWN** BNC turns off the bias supply voltage when the detector is warm. Software-selectable ORTEC or TTL mode (SMART-1® detectors auto-select the SMART shutdown mode). In ORTEC mode, the detector's Bias Shutdown cable must be connected to this input or the high voltage will not turn on.<sup>2</sup>
- **OUT1, OUT2** BNCs provide preamplifier output signals of either polarity.
- **TEST** BNC connector connects to pulser output.
- **INHIBIT** Fifth BNC only on ICS units with transistor reset preamplifier.

##### 4.2.1.2. POWER

- **ON/OFF** Rocker switch turns cryocooler and control electronics on/off.
- **POWER IN** Power cable from ac/dc adapter secures with bayonet-mounted collet to prevent unintended power interruption (do not overtighten).

<sup>2</sup> HV Shutdown out is converted to Temperature Readout for SMART-1 detectors.

**4.2.1.3. INDICATORS**

- **OVER RANGE** Red LED illuminates when a very high count rate causes preamp overrange.
- **SYSTEM COLD** Green LED illuminates when the detector is at operating temperature.
- **CRYOCOOLER ON** Green LED illuminates when the cryocooler is operating.
- **POWER** Green LED illuminates when system power is applied to the ICS.

**4.3. COOLING THE DETECTOR**

To begin the cooling cycle:

- 1) Place the ICS assembly in its intended operating location and orientation.
- 2) Make sure the power switch is in the OFF position (position 'O') before connecting the power module to the ICS power connector, then connect the power cord to the power module.
- 3) Connect the power cord to the mains, then turn the power switch ON (position 'I').
- 4) The POWER LED will illuminate, followed by the CRYOCOOLER ON LED approximately 1 minute later.

**NOTE** If the POWER LED illuminates but the CRYOCOOLER ON LED does not, contact our Global Service Center for assistance.

The cooling time will depend on the detector size and type, and is listed on the QADS for your detector. Before attempting to apply high voltage to the detector, it is extremely important to fully cool it according to the recommended time on the QADS **and** connect the SHUTDOWN (bias shutdown) cable between the ICS and MCB or NIM electronics. This will prevent the premature application of bias to the detector and any resulting damage that may void your warranty.

- 5) When the ICS has cooled for the specified period and the SYSTEM COLD LED illuminates, the detector is fully cooled and ready for use.

**4.3.1. Changing the Orientation of the ICS During Operation**

Before changing the orientation of the ICS, switch power OFF then restore power when the unit is in its new position.

**4.4. DETECTOR TESTING**

See the accompanying Photon Detector Manual, which contains testing information specific to the detector mounted on your ICS.

**4.5. DETECTOR PERFORMANCE MEASUREMENTS**

See the accompanying Photon Detector Manual, which contains performance information specific to the detector mounted on your ICS.

## 5. INSTALLATION NOTES

The ICS can be mounted on a stand (with or without a lead shield) or on the ISO-CART II, or can be placed on a benchtop.<sup>3</sup> The two vented panels must have at least 13 mm (0.5 in.) of ventilation space. You may remove the rubber feet, if you wish.

### 5.1. MOUNTING IN A SHIELD

Installing the ICS under a shield is easiest with two people and a step-stool. The stand and mounting hardware are available separately from ORTEC, and the stand's instructions will describe how to mount the ICS and raise it to the desired height. Regardless of stand or shield type, we strongly recommend the following best practices:

- 1) The shield and ICS must be positioned so the ICS is easily disconnected from the mains electrical supply.
- 2) When moving the ICS from place to place or raising the detector into the shield, guide the detector cables to protect the connectors and ensure the wires are not kinked or pulled.
- 3) To avoid ground loops when using a split center plug, make sure the detector base plate does not touch the top of the plug.
- 4) When using a split-center shield plug, do not place the plug on the ICS unit. A dedicated stand for the ICS is available from ORTEC that provides support for the plug.

## 6. SPECIFICATIONS

### 6.1. DETECTOR

**Detector** Internal, coaxial HPGe detector. See the detector's accompanying QADS for information on the detector type and polarity, cooldown time, and recommended bias voltage. Hardened cryostat (no molecular sieve). Consult us on compatible ORTEC detector types, as well as compatibility with other manufacturers' detectors.

**Compatible Endcap Windows** Aluminum, carbon fiber, beryllium.

**Resolution** Refer to the QADS for your specific detector.

### 6.2. CRYOCOOLER

**Cryocooler** All-attitude AMETEK Sunpower CryoTel mechanical cryocooler with ANC (active noise cancellation). Mean time to failure >200,000 hours. Full 2-year warranty.

**Auxiliary Cooling** Internal fan (vented).

**Audible Noise** <60 dB [A] at 1m fully operational below 30°C ambient.

### 6.3. CONNECTORS, SWITCHES, AND INDICATORS

See Section 4.2.1.

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<sup>3</sup> Call for compatibility with other lifts and support mechanisms.

#### 6.4. ELECTRICAL AND MECHANICAL

**Dimensions** See the chart and diagrams in Section 6.5.

**Weight** 40 lb (18 kg) excluding the detector.

**Environmental** Temperature range: -5°C to +40°C. Humidity: non-condensing.

**Maximum Storage Temperature** +50°C.

**Electrical Supply** 100–240 V ac (50/60 Hz) auto ranging.

**UPS/Battery Backup** ICS is compatible with commercial batteries and universal power supplies (UPS). ORTEC offers an optional UPS.

**Power Usage** 70 W typical, 130 W maximum.

6.5. DIMENSIONS

| Endcap Model (dia. mm)                       |            |               | -70   | -76          | -83          | -95          | -108          |
|--|------------|---------------|---|--------------|--------------|--------------|---------------|
| % Efficiencies available in this endcap size |            |               | 0-35  | 25-45        | 25-65        | 60-110       | 120-150       |
| Dim.   | Unit       | Tol.          |   |              |              |              |               |
| A  | mm<br>(in) | 0.3<br>(0.01) | 70<br>(2.75)  | 76<br>(3.0)  | 83<br>(3.25) | 95<br>(3.75) | 108<br>(4.25) |
| BB   | mm<br>(in) | 0.3<br>(0.01) | 85<br>(3.4)   | 92<br>(3.6)  | 98<br>(3.9)  | 111<br>(4.4) | 124<br>(4.9)  |
| CC   | mm<br>(in) | 5<br>(0.2)    | 145<br>(5.7)  | 158<br>(6.2) | 158<br>(6.2) | 158<br>(6.2) | 183<br>(7.2)  |
| ICS-LL                                       | mm         | 3             | Choose from 051, 064, 076, 089, 102, 114, 127, 140, 152, 165, 178, 191, 203, 216, 229, 241, 254, 267, 279, 292, or 305<br>[Note: 102 mm (4 in.) is typical length.] |              |              |              |               |

