WARRANTY

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

ORTEC’s exclusive liability is limited to repairing or replacing at ORTEC’s option, items found by ORTEC to be defective in workmanship or materials within one year from the date of delivery. ORTEC’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 ORTEC fails to manufacture or deliver items called for in this agreement or purchase order, ORTEC’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 ORTEC be liable for special or consequential damages.

Quality Control

Before being approved for shipment, each ORTEC 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, ORTEC 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 ORTEC 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 ORTEC 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 ORTEC 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 ORTEC of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment, if necessary.
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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 may appear on the product:

ATTENTION – Refer to Manual

DANGER – High Voltage

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

SAFETY WARNINGS AND CLEANING INSTRUCTIONS

DANGER Opening the cover of this instrument is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.

WARNING Using this instrument in a manner not specified by the manufacturer may impair the protection provided by the instrument.

Cleaning Instructions

To clean the instrument exterior:

- Unplug the instrument from the ac power supply.
- Remove loose dust on the outside of the instrument with a lint-free cloth.
- Remove remaining dirt with a lint-free cloth dampened in a general-purpose detergent and water solution. Do not use abrasive cleaners.

CAUTION To prevent moisture inside of the instrument during external cleaning, use only enough liquid to dampen the cloth or applicator.

- Allow the instrument to dry completely before reconnecting it to the power source.
1. DESCRIPTION

The ORTEC CryoSecure™ Compressor Power Controller type is designed to protect low-temperature solid-state detectors from damage following a mains power failure. The CryoSecure controls the sequence of events to safely return the detector to a normal operating temperature if the detector has not had time to warm to a temperature at which it will be damaged if cooling is restarted. The CryoSecure is intended to be used with a cryogenic cooling system such as the ORTEC EC-III™.

Designed for international use, the CryoSecure can accommodate input voltages of 100 V ac to 240 V ac at 47 to 63 Hz. A rear-panel connector block incorporates a fuse holder and the input power connector. The CryoSecure uses an international standard IEC power connector to permit the use of power cords and plugs that meet local electrical standards. Output to the compressor is provided via a mating connector on the rear panel and is controlled by a solid-state relay. Maximum output to the compressor is limited to 600 W. No power conditioning or conversion is performed.

The CryoSecure incorporates a microprocessor-controlled circuit to detect a mains power failure, measure the duration of the power failure, and determine an appropriate control response based upon user settings. During the power failure, a sealed, rechargeable, 6-V lead-acid battery supplies power to the CryoSecure for continued operation (nominally 10 hours). Indicators are conveniently located on the front panel allowing the user to monitor the status of the controller: AC POWER indicates the CryoSecure is operating from ac mains and is charging the internal backup battery, MAINS FAIL indicates when mains power has been interrupted, HOLDING indicates the controller has entered the hold mode, WARMING indicates the controller has entered the warm mode, and BIAS OFF indicates the detector bias voltage has been interrupted or shutdown. A front-panel, twoposition rocker switch turns power on and off, and a push-button INITIALIZE switch allows the user to select the sequence of operation.

The Bias Shutdown signal from the detector is passed through the CryoSecure via a rear-panel BNC connector before continuing to the bias supply. This connection allows the CryoSecure to prevent bias voltage from being applied to the detector until the detector has been adequately cooled. The control unit also contains a solid-state relay to control power to the compressor.

NOTE

The internal timers switches are set at the factory for a specific system including a detector and an EC-III cooler. The CryoSecure cannot be switched from one detector system to another without assistance from ORTEC service personnel.
2. SPECIFICATIONS

2.1. PERFORMANCE

INPUT AC VOLTAGE The CryoSecure can accommodate input voltages of 100 V ac to 240 V ac at 47 to 63 Hz.

INPUT CURRENT Typically 7.5 A rms when connected to a 600-W compressor.

CIRCUIT PROTECTION The input ac power line is protected with a 10-A fuse incorporated into the AC POWER input connector on the rear panel.

2.2. CONTROLS AND INDICATORS

POWER Front-panel rocker switch turns power on/off.

INITIALIZE Front-panel push-button switch begins system operation, and allows the user to manually cycle through the operating sequences.

LED INDICATORS
- AC POWER—mains power on/ battery recharging.
- MAINS FAIL—mains power failure
- HOLDING—system holding after an mains power failure.
- WARMING—detector warming.
- BIAS OFF—bias hold off.

HOLD TIME Internal printed wiring board (PWB)-mounted rotary switches (qty. 2) allow the user to set amount of time the CryoSecure waits before entering the warming state after a mains power failure.

WARMING TIME Internal PWB-mounted rotary switches (qty. 2) allow the user to set amount of time the CryoSecure waits before restarting the compressor after a mains power failure.

BIAS OFF TIME Internal PWB-mounted rotary switch allows the user to set amount of time the CryoSecure waits after restarting the compressor, before allowing the detector bias voltage to be applied.

DEEP DISCHARGE PROTECTION In the event of a long-term power failure, or if the ac mains are turned off for an extended period of time, an internal relay will disconnect the internal circuitry from the internal backup battery before the battery discharges. When ac power is restored, the system will resume normal operation and the battery will be recharged.

2.3. INPUTS

AC LINE IN Rear-panel, international-standard IEC power connector, type CEE-22, accepts power cables wired according to local electrical standards. A power cable is shipped with the CryoSecure.

BIAS SHUTDOWN Rear-panel BNC connector accepts Bias Shutdown signal from detector. During normal operation, this signal is passed through a relay contact to allow bias voltage to be applied to the detector. During a holding, warming, or bias-off (cooling) state, the Bias Shutdown signal is interrupted, preventing bias from being applied to the detector.

2.4. OUTPUTS

COMPRESSOR Rear-panel, type NEMA 5-15R AC, provides ac mains voltage to the compressor. A solid state switch in series controls on/off operation of the compressor.

BIAS SHUTDOWN Rear-panel BNC connector provides Bias Shutdown signal to the Bias Supply High Voltage Shutdown.

2.5. ELECTRICAL AND MECHANICAL

WEIGHT Net 2.6 kg (5.8 lb); shipping 3.2 kg (7.0 lb).

DIMENSIONS 21.5 cm (8.4 in.) wide, 26 cm (10.2 in.) deep, and 10.2 cm. (4.0 in.) high. Aluminum enclosure.

DANGER Isolate the controller from the mains power supply before removing the cover.
3. INSTALLATION AND STARTUP

3.1. SWITCHING ON
The battery is connected to the control logic by a self-holding relay which is kept in the OFF state during storage and shipping (see Section 5.2 for storage and shipping preparation). When mains power is first applied, the relay is switched on, and will remain on during operation. While mains power is on, the battery is continuously charging.

3.2. THE POWER-ON (“SAFE”) STATE
Following this first switch-on, the CryoSecure enters a safe state, with the compressor and bias voltage both held off. The HOLDING, WARMING, and BIAS OFF LEDs all flash to indicate this state.

The system will return to this safe state if the mains power input is still off at the end of the warming period.

To begin system operation, press and hold the INITIALIZE button for more than 5 seconds. The system will then enter the warming state (see Section 4.1.3). Release the INITIALIZE button when the LEDs indicate the change to the warming state.

3.3. INSTALLATION IN A “WARM” SYSTEM
If the CryoSecure is installed in a system with the detector at room temperature, it is inconvenient to have to wait for the warming period to elapse before cooling begins. In this case, the system can be forced from the warming state directly to the cooling state. To do this, proceed as in Section 3.2, then press and hold the INITIALIZE button for an additional 5 seconds. The WARMING LED will then go out and the compressor will start. Note that, as for a power failure in normal operation, the detector bias supply will be held off until the end of the cooling period.

3.4. INSTALLATION IN A “COLD” SYSTEM
If the CryoSecure is installed quickly enough in a system with the detector already at working temperature (i.e., so that the detector has not had time to warm to a dangerous state), it can be forced into the normal working state (bypassing the warming and cooling states) by pressing and holding the INITIALIZE button for 5 seconds when in the cooling (bias-off) state.

4. OPERATING INSTRUCTIONS

4.1. OPERATIONAL STATES

4.1.1. Normal Operation
During normal operation, the compressor is running and the detector bias voltage can be applied. The AC POWER indicator is lit; all other indicators are off.

4.1.2. AC Mains Power Failure—the Holding State
When the CryoSecure detects a mains power failure, the system enters the holding state. During this state, the AC POWER and WARMING indicators are off, and the MAINS FAIL, HOLDING, and BIAS OFF indicators are lit.

The CryoSecure will remain in this state until either mains power is restored or the holding time period (as set on the internal switches) expires. If mains power is restored within the holding time period, the system will return to the normal state. If the holding time is exceeded but the mains power still off, the system will enter the warming state. The holding time is set by the factory so the detector will not have time to warm to a temperature at which damage will occur if cooling restarts.

4.1.3. The Warming State
In the warming state, the HOLDING LED is off and the WARMING and BIAS OFF LEDs are lit. The AC POWER LED is initially off and the MAINS FAIL LED is lit. The duration of the warming period is set at the factory with internal switches. If the mains supply is restored during the warming period, the AC POWER LED lights and the MAINS FAIL LED turns off.

The system will remain in the warming state, with the compressor power off and the detector bias supply held off, until the end of the warming period. At the end of the warming period, the system will enter the cooling state. The warming period is set at the factory so that the detector can warm to a safe temperature before cooling recommences.

If the mains power supply is still off when the warming period expires, the system will enter the “safe” power-on state, described in Section 3.2.
4.1.4. The Cooling State

In the cooling state, the AC POWER and BIAS OFF LEDs are lit while the MAINS FAIL, HOLDING, and WARMING LEDs are off. The compressor power is reapplied, but the detector bias supply is held off.

The system will remain in the cooling state for the period set on the internal BIAS OFF TIME switch, after which the BIAS OFF LED will go out and the detector bias voltage can be reapplied. The system will then return to normal operation (see Section 4.1.1).

The cooling period (bias-off time) is set to a value long enough for the detector to be cooled to a temperature where it is safe to re-apply the bias voltage.

If the mains supply fails during the cooling period, the CryoSecure will return to the start of the warming state.

4.2. SETTING THE HOLDING TIME

The holding time, which is the time the CryoSecure waits after a mains failure before going into the warming state, is set with the two rotary selector switches mounted along the top edge of the controller PWB, labeled HOLD HI and HOLD LO.

The switches are BCD-type selectors, each with settings from 0 to 9. The number set on the switches corresponds to the holding time, with each unit of the number set representing 5 minutes. The following table gives examples of some possible settings:

<table>
<thead>
<tr>
<th>HOLD HI</th>
<th>HOLD LO</th>
<th>Time(min)</th>
<th>Time(h:min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>5</td>
<td>0:05</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>50</td>
<td>0:50</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>175</td>
<td>2:55</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>495</td>
<td>8:15</td>
</tr>
</tbody>
</table>

**DANGER** Isolate the controller from the mains power supply before removing the cover.

4.3. SETTING THE WARMING TIME

The warming time, which is the time the CryoSecure waits after a mains power failure before restarting the compressor, is set with the two rotary selector switches mounted along the top edge of the controller PWB, labeled WARM HI and WARM LO.

The switches are BCD-type selectors, each with settings from 0 to 9. The number set on the switches corresponds to the warming time, with each unit of the number set representing 1 hour. The following table gives examples of some possible settings:

<table>
<thead>
<tr>
<th>WARM HI</th>
<th>WARM LO</th>
<th>Time (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>99</td>
</tr>
</tbody>
</table>

4.4. SETTING THE COOLING (BIAS-OFF) TIME

The cooling, or bias-off, time is the time the CryoSecure waits after restarting the compressor before allowing the detector bias voltage to be reapplied. It is set with the rotary selector switch mounted along the top edge of the controller PWB, labeled BIAS OFF.

The switch is a hexadecimal-type selector with settings from 0 to F. The number set on the switches corresponds to the holding time, with each unit of the number set representing 2 hours. The following table give a list of the possible settings:

<table>
<thead>
<tr>
<th>Switch Setting</th>
<th>Time (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td>A</td>
<td>20</td>
</tr>
<tr>
<td>B</td>
<td>22</td>
</tr>
<tr>
<td>C</td>
<td>24</td>
</tr>
<tr>
<td>D</td>
<td>26</td>
</tr>
<tr>
<td>E</td>
<td>28</td>
</tr>
<tr>
<td>F</td>
<td>30</td>
</tr>
</tbody>
</table>

4.5. DEEP DISCHARGE PROTECTION

In the event of a long-term power failure or if the mains is switched off for a long period, the battery, normally charged to 6.75 V, will eventually discharge to 5.25 V. When this voltage is reached, a self-holding relay will de-energize, disconnecting the battery. The CryoSecure will then be in the shipping/storage-preparation state described in Section 5.2. The battery will reconnect automatically when mains power is restored, and the system will go into the “safe” state described in Section 3.2.
5. CALIBRATION AND MAINTENANCE

5.1. TEST MODE
If the jumper link marked W3 on the PWB is removed, the system will run in a test mode in which the timers will run at 60 times the normal rate. For example, a period set to 3 hours will actually elapse in 3 minutes. This is useful for checking system operation.

**WARNING** Remember to reinstall W3 after testing.

5.2. STORAGE AND SHIPPING

**DANGER** Isolate the controller from the mains power supply before removing the cover.

With the CryoSecure disconnected from the mains supply, remove the top cover and locate the sealed, rechargeable, lead-acid battery (to the left of the unit as viewed from the front). Disconnect the red lead to the battery, wait 10 seconds, then re-connect it. The battery will now be isolated from the control circuitry until mains power is re-applied.