

# Isco 3700ZR Sampler

## Manual Set



Assembly #60-2744-045  
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Revision B, October 19, 2006



This set of manuals support the Isco 3700ZR Refrigerated Sampler. The manual set is comprised of the following parts:

### **Part 1**

## **Isco 3700ZR Refrigerated Sampler Manual**

Part 1 provides an overview of the entire system to include general installation instructions and a brief description of the major system components.

### **Part 2**

## **3700R/3740 Refrigerated Sampler Manual**

Part 2 provides detailed operating instructions for the sampler controller. This manual includes instructions for programming the sampler controller to collect and distribute liquid samples. The manual also includes service related information for the controller.

### **Part 3**

## **Bebco 2002 Operation & Maintenance Manual**

Part 3 provides detailed instructions for the operation of the Bebco Purge Controller. This manual also provides servicing information for this unit.

### **Part 4**

## **Marvel Refrigerator Manual**

Part 4 provides instructions for the installation and operation of the Marvel Refrigerator. Servicing instructions for the refrigerator can also be found in this manual.



# Isco 3700ZR Sampler

## Assembly Instructions



Manual Body, Part #69-2743-072  
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Revision A, October 19, 2006



# 3700ZR Refrigerated Sampler

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# 3700ZR Refrigerated Sampler

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## *Section 1 Manual Overview and Illustrations*

### 1.1 Introduction

The Isco 3700ZR Refrigerated Sampler is designed for use in hazardous locations where the presence of flammable or explosive vapors could result in a fire or explosion were a standard sampler to be employed. The 3700ZR is rated for use in Class I Div. 1 Group C & D Hazardous Locations (or comparable atmospheres).

The 3700ZR consists of three components combined to make the hazardous location sampler. The components used to accomplish this are:

- An Isco 3700 Sampler Controller
- A Bebcu Purge System to house the Isco Controller
- A Refrigerator designed specifically for hazardous locations

### 1.2 Composition of the Manual

This manual set consists of four parts.

- The first part is an overview of the 3700ZR Refrigerated Sampler with a brief description of its unique features, consisting of pictures and descriptions of the various components and interconnections. Note that not all features described in the component manuals (Sections 2, 3, and 4) apply to this model.
- The second part is an Isco 3700 Controller/Refrigerator Manual.
- The third part is a manual for the Bebcu Purge System.
- The fourth part is the manual for the Refrigerator.

Teledyne Isco recommends that you study each section individually to gain a thorough understanding of how the unit is put together and how it is connected to the sample and discharge lines.

### 1.3 Programming Exception

The 3700ZR uses a standard 3700 Sampler Controller with an unmodified sample program installed in software. However, please note that the 3700ZR is offered only with 1, 2, or 8 sample bottles. Other bottle options will appear on screen when programming. *Important - Make sure you select the number that matches the number of bottles in your sampler.* Selecting a greater number will result in excess sample being pumped into the refrigerator interior. This will not cause physical harm to the sampler or refrigerator, but it will make a mess.

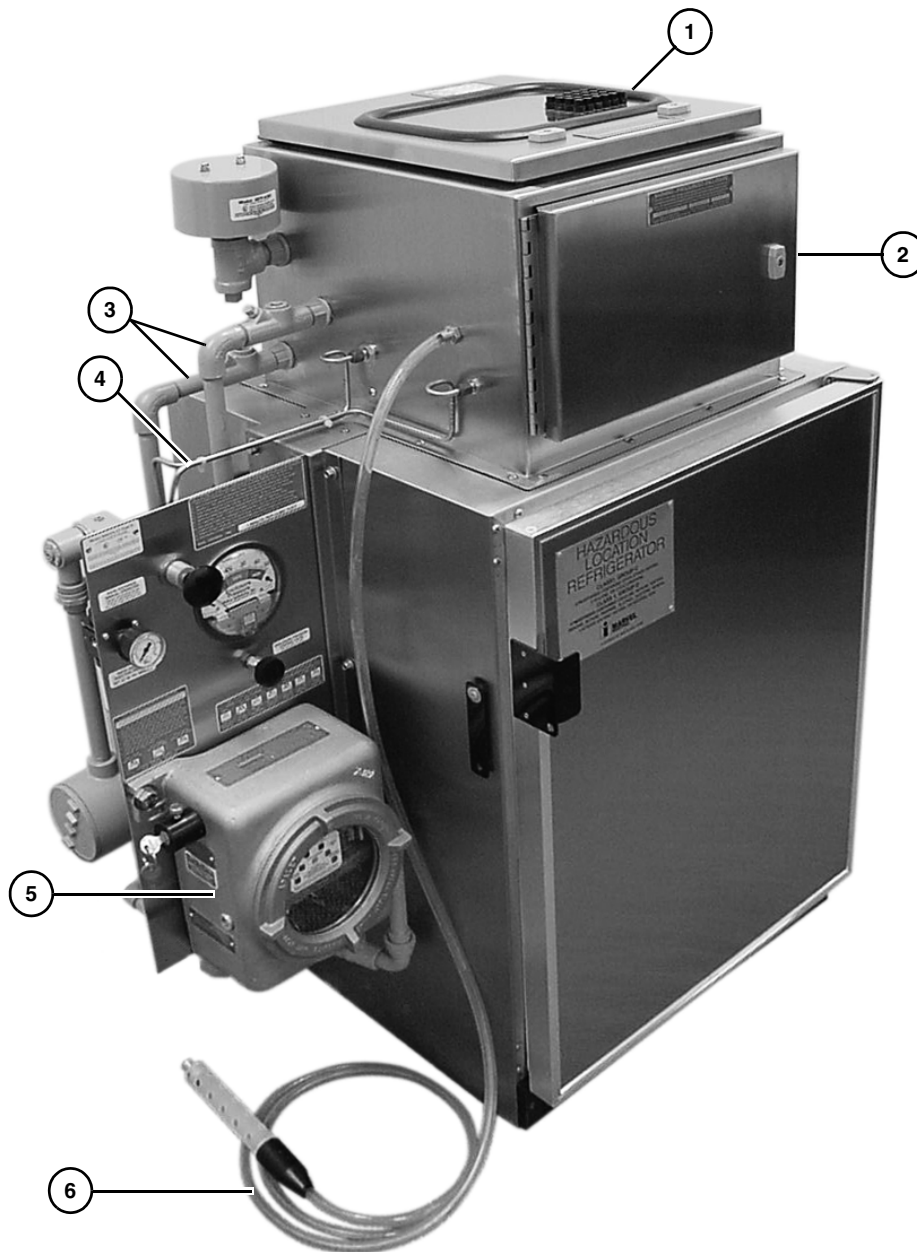


Figure 1-1 View of the 3700ZR Refrigerated Sampler

- 1 Top access door with remote keypad actuators
  - 2 Front access door
  - 3 Electrical supply conduits
  - 4 Purge air lines
  - 5 Purge system
  - 6 Sample suction line and strainer
-

## 1.4 Installation Requirements

The 3700ZR Refrigerated Sampler is intended for indoor use in locations where atmospheres have been designated Class I, Division 1, Gas Groups C and D (or comparable).

The 3700ZR refrigeration system relies on air convection to remove heat from the condenser coil on the back of the refrigerator. It is important that adequate clearance (at least 1½ inches) be provided between the condenser and the nearest wall to allow for adequate circulation of cooling air. The condenser should also be protected from any damage or abuse.

The location of the 3700ZR must have 120 VAC, 60 Hz electrical power from a dedicated circuit. The location must also have a compressed (4 SCFM at 80-120 psig, minimum) clean air supply.



### **WARNING**

**Electrical connections must be performed by a qualified electrician.**

Electrical connections to the 3700ZR are made through special hazardous location conduit fittings. After completing the electrical connections, these fittings must be potted with epoxy resin. When the 3700ZR is shipped from the factory these fittings are tagged to indicate that the potting has not yet been poured.

## 1.5 General Description of the Unit

The 3700ZR Refrigerated Sampler consists of a stainless steel refrigerator rated for use in Class I Div. 1 Group C & D Hazardous Locations with an Isco 3700 Sampler Controller mounted on top of the refrigerator inside a sealed, purged enclosure. The UL-listed 3700 Controller is rated for use in ordinary locations and must be enclosed in a safe environment.

The purge system, mounted on the left side of the refrigerator, provides and maintains a safe operating environment inside the purged enclosure housing the 3700 Controller. The purge system first flushes any hazardous gases present with clean air pumped from outside the hazardous environment in a process called *rapid purge*. A rapid purge forces clean air at a higher pressure through the purged housing and out the protection vent. This air exchange takes five minutes. After the initial purge, the purge system then maintains the safe environment by keeping the enclosure filled with clean air at a pressure slightly higher than atmospheric. This higher pressure prevents the infiltration of any hazardous gases.

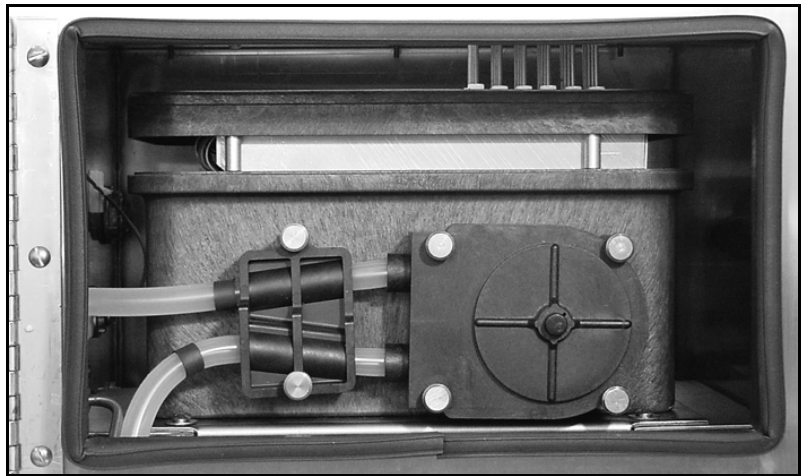
The purge system also supplies power to the UL-listed Isco 913 High Capacity Power Pack located inside the enclosure to provide low voltage DC to operate the 3700 Controller. In the event that safe pressure is lost inside the continuously purged enclosure, electrical power to the Power Pack and 3700 Controller is automatically disconnected by the purge system. The refrigerator will continue to operate to keep the samples cool.

Some of the main features of the system include:

- Keyed operation
- Large front and top access doors requiring tool entry
- Operation of sampler with doors closed
- Moisture detector
- Sample Connections through bulkhead fittings
- Purge Controller status indication by LED status indicators. (See the Bebcu Manual, Part 3)
- Input connection available from remote flow meter and output for alarm signals

### 1.5.1 Purge System

The purge system mounted on the left side of the refrigerator controls the air flow to the purged enclosure and power to the sampler. The purge system has gauges to indicate safe pressure level, purge pressure level, and incoming air pressure. The EPCU has LEDs to indicate system status that can be viewed through the round porthole on the cover. Electrical connections between the purge system and the purged enclosure are made through special hazardous location conduit fittings. Air is supplied to the purged enclosure through  $\frac{1}{4}$ " OD stainless steel lines.



*Figure 1-2 View of the Sampler Controller Showing the Raised Control Panel*

The sampler control panel is raised above the control box to allow purge air to circulate through the control box.

Note that the purge system does not control AC power to the refrigerator itself, which is designed for operation in hazardous locations. In the event of purge system malfunction or shutdown, due to loss of safe pressure, power to the sampler will be disconnected, but the refrigerator will continue to run.

For detailed operation of the purge system, refer to part 3 of this manual.

### 1.5.2 Key Operation

For security reasons, operation of the system is controlled by a key located on the EPCU (Electrical Power Control Unit). In the OFF position the electronic control is completely disabled. In the ON position the EPCU is fully functional. The key can be removed in the ON position by pulling up on the knob on top of the key switch. In the BYPASS mode, power continues to be supplied to the sampler controller when safe operating pressure is lost and when safe operating pressure is returned, the EPCU bypasses the initial purging operation. Note that the BYPASS mode can only be achieved after the system has been initially pressurized. There are two labels affixed just below the key-switch. The lower label tells the status of the EPCU in all three key positions, clockwise from the left — OFF, ON, and BYPASS.

**⚠ WARNING**

**Never operate the system in bypass mode unless the conditions are known to be safe.**



Figure 1-3 The control box for the EPCU, showing the key switch and LEDs

**1.5.3 Flow Meter/Alarm  
Entry**

Located on the back left side of the purged enclosure is a large conduit fitting that allows incoming signals from a flow meter for flow pacing and/or output to an alarm. The optional alarm function provides a signal when a sample is missed. Note that this conduit fitting is of a special type designed for use in hazardous locations, and after wiring, must be filled with an epoxy potting compound to ensure the integrity of the pressurized enclosure.

---



*Figure 1-4 Rear view of 3700ZR showing condenser and conduit fitting*

- 1 Special conduit fitting
  - 2 Static condenser coil
  - 3 Sealed thermostat
-

#### 1.5.4 Moisture Detector

Located on top of the refrigerator inside the purged enclosure in front of the peristaltic pump is a moisture detector. It is typical of peristaltic pumps that after numerous cycles, the tubing will split, and may leak inside the purged enclosure.

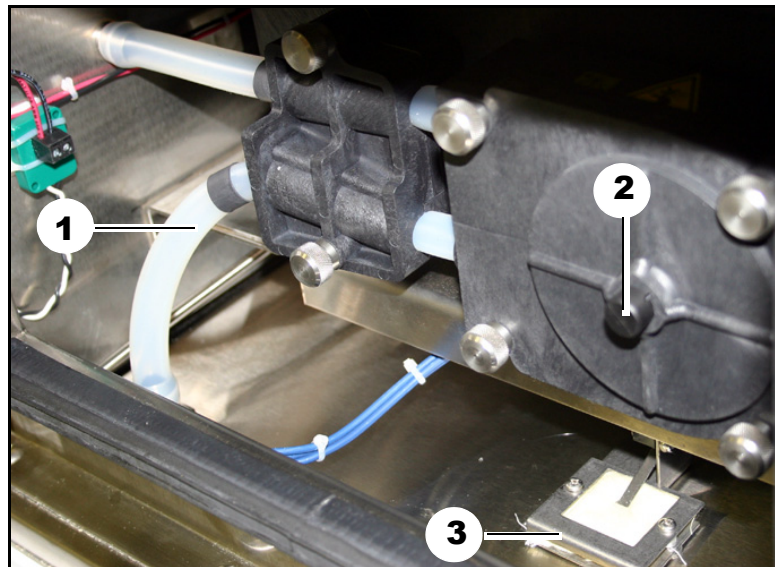
Note that the sampler is programmed to keep track of the number of pump counts and will issue a warning to change the pump tubing when the tubing is approaching end-of-life.

Note also that the moisture detector contains a bag that absorbs moisture triggering the sensor. This bag is a consumable item and must be replaced once it has been wetted. Replacement bags are included with the 3700ZR. Bags that have been wetted can be dried out and reused.

When moisture is present, the bag swells up, lifting the switch and shutting the system down.

Removing the bag will disable the moisture detector but will not affect the operation of the 3700ZR.

---



*Figure 1-5 Inside pressurized enclosure, showing front of pump and moisture sensor*

- 1 Pump tubing
  - 2 Sampler pump
  - 3 Moisture detector
-

*Removal and replacment*

1. Lift the holding tab (switch).
2. Install the moisture detector bag with the seamed edge facing outward.

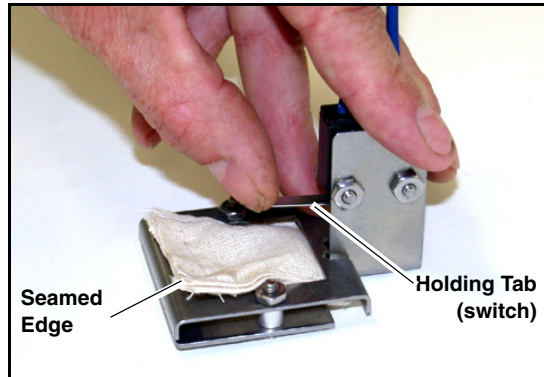


Figure 1-6 Installing the moisture detector

3. Tuck the corners and edges under the bracket and smooth out.

### 1.5.5 Suction Line

The suction line tube comes into the purged enclosure through a bulkhead fitting located on the left hand side of the purged enclosure. Only  $\frac{3}{8}$ " ID suction line can be used.

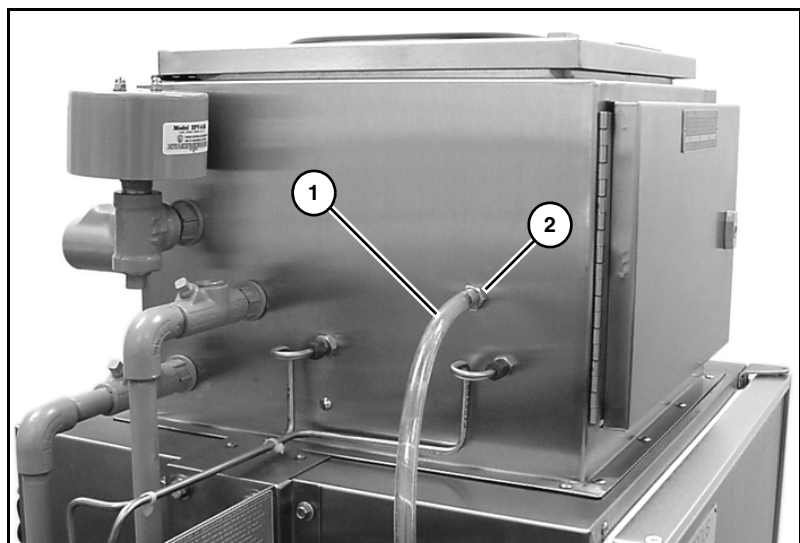


Figure 1-7 View of left side showing the sampler suction line and bulkhead connector

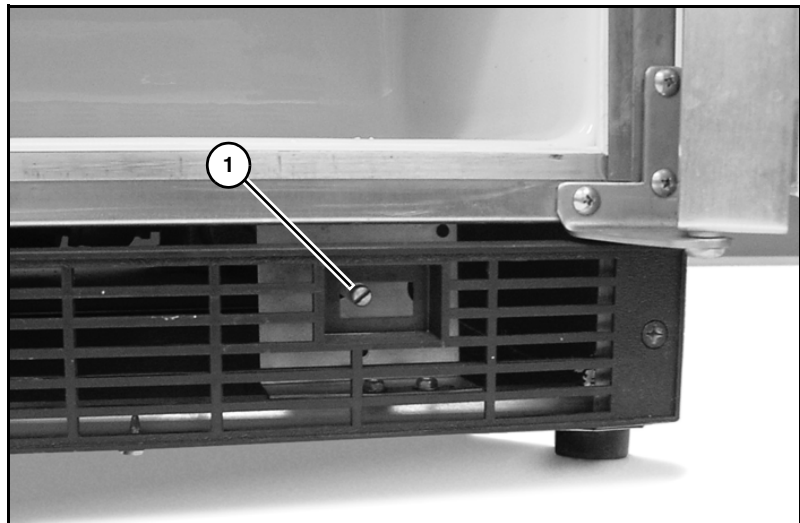
- 1 Suction Line
- 2 Bulkhead connector



### 1.5.6 Thermostat

The refrigerator's thermostat is located in an explosion proof housing beneath the refrigerator. Adjustment of this control is by insertion of a flat-bladed screwdriver into the slotted shaft.

Turning the shaft clockwise makes the refrigerator run cooler, while turning it counterclockwise makes the refrigerator run warmer. Avoid making large adjustments to this control. Make slight changes and allow adequate time for the new temperature to be reached before changing it again. The sampler will be shipped with the thermostat in the normal position. However, there are no markings on the refrigerator to indicate the thermostat position. The normal position can be found by rotating the shaft all the way clockwise, noting the end position, then rotating the shaft all the way counterclockwise and noting that end position. Center the shaft by rotating it halfway between the two end positions.



*Figure 1-8 Location of refrigerator temperature adjustment control*

1 Adjustment shaft

### 1.5.7 Access Doors

The purged enclosure has two large access doors, one located on the front for maintenance of the pump and one on the top for service of the controller and power pack. Both doors require a tool (large hex key) to open. Behind the doors, both openings are lined with gaskets to seal the enclosure and reduce air consumption. The general principle behind the use of the purge system is to keep any flammable or explosive vapor out of the enclosure where the sampler is mounted so that an arc caused by the motor brushes or broken wire cannot ignite the flammable gases present in the hazardous location. The slight positive pressure applied to the enclosure prevents infiltration of such gases and the seals on the doors ensure that the unit will not leak when the doors are closed. When a door is opened, safe pressure is lost and the purge system disables the power to the sampler, unless the system key switch is in the BYPASS mode.

The top door features a large Lexan window for viewing the 3700 Controller display for sampler status and programming. Also embedded in the window are the remote actuators, which allow operation and programming of the sampler with the door closed and latched. A label containing the keypad legend is conveniently placed above the window for reference purposes, because the keypad actuators obscure the view of the keypad.



*Figure 1-9 View of the purged enclosure and the access doors*

- 1 Keypad legend
- 2 Actuators
- 3 Top access door
- 4 Front access door

### 1.5.8 Programming the Sampler

Programming is done by pressing the buttons that extend through the plastic window in the top access door of the purge unit. Extensions below these buttons press keypad switches on top of the sampler controller. Since the sampler keypad is obscured by the actuators mounted in the window, a legend for the keypad is provided above the window on the right hand side of the top access door. The sampler can also be programmed by direct access to the keypad when the top door is open and the purge system in BYPASS. Note however, that the hazardous location *must* be safe for you to do this.

### 1.5.9 Internal Power Connections

The power supply for the sampler controller is a high-capacity Isco 913 Power Pack. The 120 VAC input for the power pack is controlled by the EPCU. Main power to the power pack is disconnected by the EPCU whenever the air pressure inside the purged enclosure drops below the safe limit, unless the purge system is in the BYPASS mode.



*Figure 1-10 Detail of cabinet interior showing the plug-in for the power pack*

## 1.6 Technical Specifications, Controls, and Connectors

The technical specifications, controls, and connectors of the 3700ZR are listed below in Table 1-1.

**Table 1-1 Technical Specifications for the 3700ZR**

<b>Physical Specifications</b>	
Physical Size	Height: 48.5 inches (123 cm) Width: 36 inches (99 cm) Depth: 30 inches (76 cm)
Dry weight	236 lb. (107 kg)
Operational temperature range	32°F to 120°F (0°C to 49°C)
Control box	Corrosion resistant
Temperature set point accuracy	±1.8°F (1°C) at 39°F (4°C)
Pulldown time from 75°F (24°C) to 39°F (4°C)	30 minutes, typical
Recovery time, door open 1 minute with unit operating at 39°F (4°C), 75°F (24°C) ambient	10 minutes typical
<b>Power Specifications</b>	
Sampler controller power requirement	12 VDC, AC Power converter. Sampler standby current 10 mA, maximum.
Supply voltage	120 V, 60 Hz
Current: Running	3.3 amp, typical 120 volts
Starting	12 amp, typical 120 volts
Controller internal 3V lithium battery capacity	5 years, minimum (maintains internal logic and program settings).
<b>Pump and Tubing Specifications</b>	
Suction tubing (intake)	3 to 99 foot (1 – 30.2 m) lengths of $\frac{3}{8}$ " ID vinyl or $\frac{3}{8}$ " ID Teflon® lined
Suction lift	26 feet (7.9 m) maximum
Pumping rate (at 3 feet of head)	$\frac{3}{8}$ " ID suction tubing: 3500 ml/minute
Line transport velocity (at 3 feet of head)	$\frac{3}{8}$ " ID suction tubing: 2.9 ft/sec
<b>Clock Specifications</b>	
Real-time clock accuracy	1 minute per month, typical
<b>Sample Specifications</b>	
Sample volume accuracy	With the liquid detector enabled and automatic compensation for head: typically the greater of ±10% or ±20 ml, over a head range of 1 to 12 feet and a sampler supply voltage of 10 to 13 volts.
Sample volume repeatability	±10 ml, typical
Sample frequency	Selectable from one minute to 99 hours, 59 minutes in one minute increments between consecutive samples, or from one to 9,999 flow pulses in single pulse intervals. As many as 999 nonuniform times may be entered in minute intervals or up to 99 times as specific clock times.

**Table 1-1 Technical Specifications for the 3700ZR (Continued)**

Flow Meter Signal Specifications		
Flow meter signal requirements	5 to 15 volt DC pulse or isolated contact closure of at least 25 milliseconds in duration. (4-20 mA or pulse duration signal may be converted with optional interface unit.)	
Control	Setting	Function
Thermostat	OFF, WARMER, COOLER; 39°F (4°C)	Turns the refrigeration system on/off; selects the sample temperature.
Connector	Type	Function
12 VDC	2-pin female, cable mounted	12 VDC power supply for the sampler
Printer/Alarm	6-pin female, panel mounted	Connects 3700R to laptop computer, or provides alarm output.
Flow Meter	6-pin male, panel mounted	Connects 3700R to external flow meter.
120 VAC	3-wire (2 power, 1 ground) permanently connected to building wiring system	Supplies AC power to the purge system and refrigerator.
Air Supply (Flow Rate)		
Purge (Rapid exchange)	4 SCFM at 80-120 psig	Removes hazardous gas before system start-up.
Safe Pressure	0.2-7.0 SCFH at 80-120 psig	Maintains safe pressure inside purged enclosure.

## 1.7 Service/Maintenance

The following sections describe removal of various components from the unit in the event they need service or replacement.

### 1.7.1 Power Pack Removal

Both the sampler controller and the power pack can be removed through the top access door. To remove the Power Pack, disconnect it from the sampler and from the AC outlet located in the left rear corner of the purged enclosure. Unhook the rubber hold-downs, and lift it out.

### 1.7.2 Sampler Controller Removal

To remove the sampler controller, first remove the Power Pack (as described previously), and the sampler distributor arm (inside the refrigerator; refer to the 3700R manual for more details if necessary). Remove the four screws that hold the equipment mounting platform to the enclosure. Lift the controller and the mounting bracket assembly straight up out of the purged enclosure. Use care to avoid damaging the gasket on the top door or the distributor shaft seal. After removal from the purged enclosure, lay the controller on its top and remove the controller from the mounting bracket by removing the six clips on the bottom. Reassemble in reverse order. Do not over-tighten the u-clips on the bottom of the controller as the controller could be damaged.

**1.7.3 Distributor Shaft Seal Replacement**

Remove the sampler controller as described in the previous section. Remove the four screws holding the seal retainer. Remove the retainer and seal. Place the new seal on top of the refrigerator, align the mounting holes and secure with the retaining plate. Reinstall the controller and power pack.



*Figure 1-11 Controller and Power Pack Access*

**1.7.4 Desiccant**

This controller contains no desiccant. The moisture indicator is a gauge of the amount of moisture coming in with the purge air. No maintenance of the controller is required, but the air coming from the purge system should be dry enough to keep some blue in the indicator.

**1.7.5 Pump Tube**

The pump tube connects to the sample inlet fitting on the wall of the purged enclosure and to a bulkhead fitting entering the refrigerator cabinet. For more information refer to the maintenance section in Section 2 of the 3700R manual.

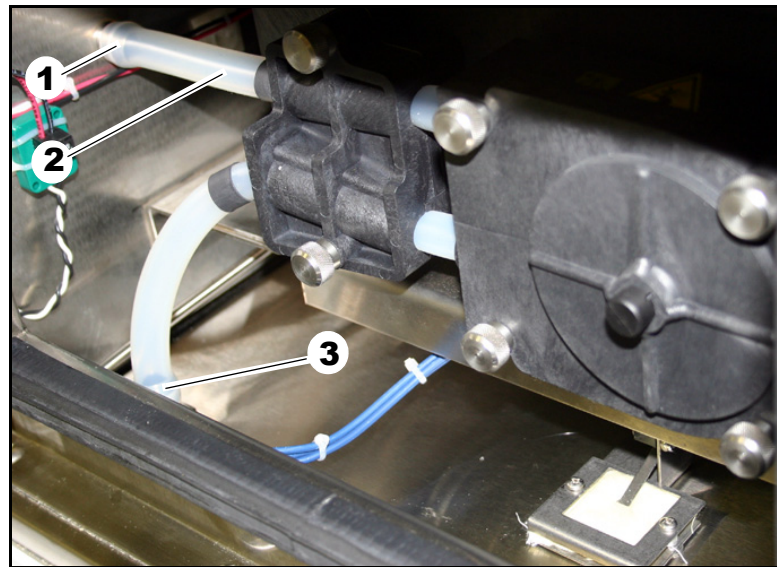


Figure 1-12 Pump Tubing and Bulkhead Fitting

- 1 Bulkhead fitting, sample inlet
- 2 Pump tubing
- 3 Bulkhead fitting, refrigerator

## 1.8 Problem Analysis

If any malfunction should occur in the 3700ZR, it is first necessary to determine which component is the likely cause of the problem. Detailed troubleshooting information is included in each of the component manuals that make up this manual. The three separate systems are the sample controller, the purge system, and the refrigeration system. To help isolate the problem, check and review the following areas.

### **WARNING**

**Do not operate the sampler with the door open unless proven safe conditions exist.**

#### 1.8.1 System

1. Is 120 VAC available at the unit, for both the refrigerator and the purge system?
2. Is air being supplied to the unit at the correct pressure?
3. If either of the above are not correct, fix before proceeding any further.

#### 1.8.2 Sampler Controller/Power Pack

If the purge system appears to be operating properly, troubleshoot the sampler and power pack with the purge system in the BYPASS position IF the hazardous environment is known to be safe. This will permit operation of the unit with the access doors open.

1. Is 12 VDC being supplied to the sampler controller?
2. Are the remote actuators making good physical contact with the switches on the sampler keypad?
3. If the sampler is programmed for flow-paced operation, is a flow pulse being sent from the flow meter?
4. Go to Part 2 of this manual.

### 1.8.3 Purge Control

1. Do the status LEDs inside the purge system indicate proper operation?
2. Is safe pressure being maintained inside the purged enclosure?
3. Are all openings in the purged enclosure sealed?
4. Has the moisture sensor been actuated?
5. Is 120 VAC being supplied to the sampler power pack?
6. Go to Part 3 of this manual.

### 1.8.4 Refrigerator

1. Interior cabinet not cold and refrigerator not running.
2. Interior cabinet too cold, and refrigerator runs for long periods.
3. Go to Part 4 of this manual.

Answering the basic questions outlined in the three preceding sections should point you to the appropriate section of the manual for more detailed troubleshooting information. If problems persist, or you are unable to determine the cause of the problem, please contact Teledyne Isco Customer Service, (800) 228-4373 or (402) 464-0231.

## 1.9 Optional Accessories

There are two optional accessories available for use with the 3700ZR. One is the 4-20 mA Sampler Input Interface used with non-Isco flow meters to provide a signal the sampler can interpret. The other is the Alarm Relay Box, which provides an alarm output signal in the event the 3700ZR misses a sample.

### 1.9.1 4-20 mA Sampler Input Interface

This device is used with non-Isco flow meters that provide output signals of 4-20 mA directly proportional to flow rate. This interface converts the 4-20 mA signals into flow pulses that the 3700ZR can recognize. Note that both the 4-20 mA Sampler Input Interface and the flow meter *must* be installed *outside* the hazardous location, and wired through the conduit fitting on the back of the refrigerator.





Figure 1-13 4-20 mA Sampler Input Interface

### 1.9.2 Alarm Relay Box

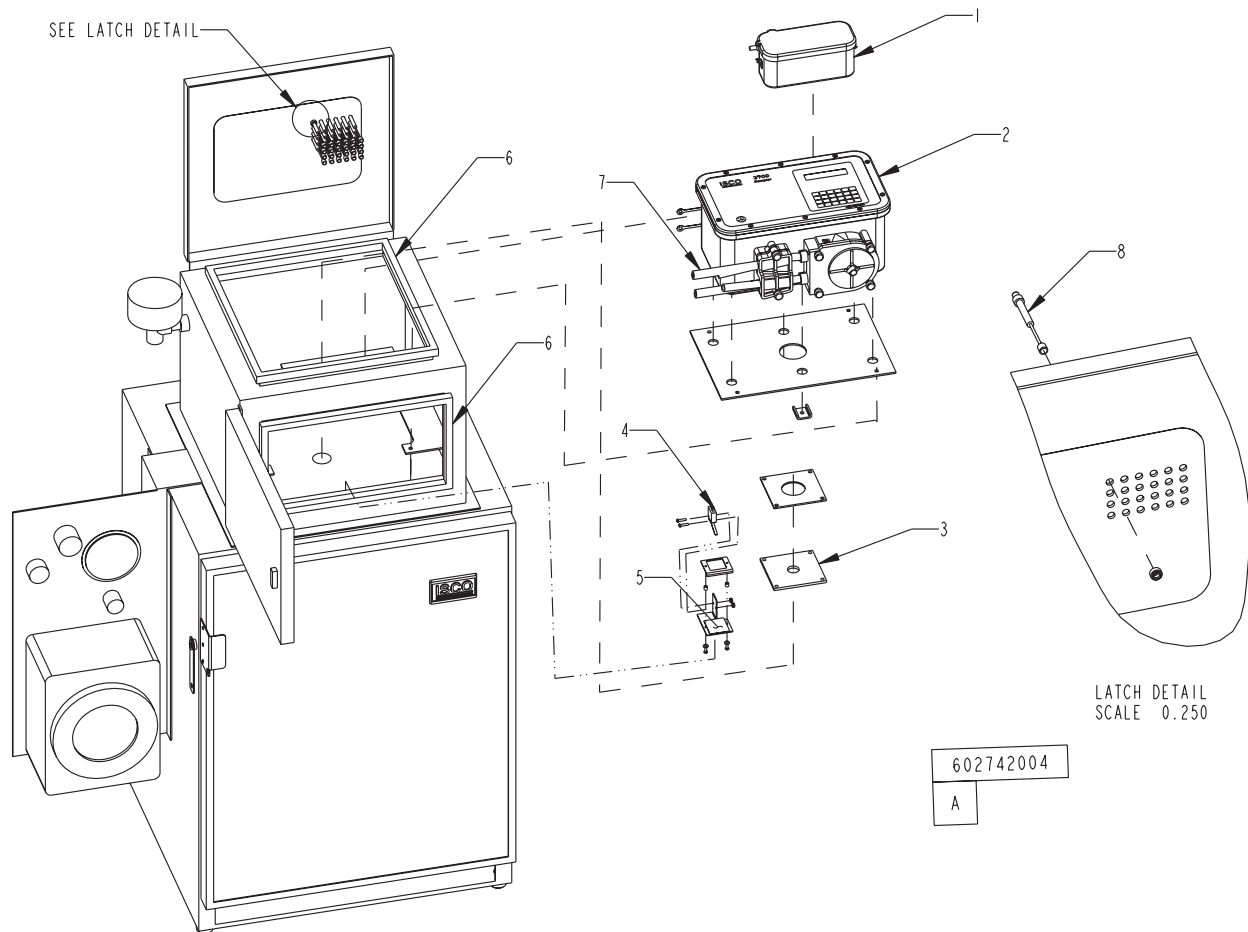
This accessory allows for an alarm output signal in the event the 3700ZR misses a sample. The Alarm Relay Box must be installed outside the hazardous location and wired through the special conduit fitting on the back of the refrigerator. The maximum distance to the alarm relay box is 200 feet.



Figure 1-14 Alarm Relay Box

### 1.10 Replacement Parts

The following illustrated parts breakdown and listing identifies the replacement parts available for the 3700ZR Refrigerated Sampler. Refer to the Replacement Part Listings in Parts 2 through 4 of this manual for parts not depicted below.



602742004

**REPLACEMENT PARTS LIST**

SHEET: 2 OF 2

**TELEDYNE ISCO, INC.**

REV: A DATE: 06251

ITEM NO.	PART NUMBER	DESCRIPTION
1	601684088	913 HIGH CAPACITY POWER PACK
2	605314351	3700ZR CONTROLLER
3	202909017	SEAL, DISTRIBUTOR SHAFT
4	410012005	SWITCH, MICRO SPDT
5	602744051	MOISTURE CARTRIDGE
6	209016317	DOOR GASKET MATERIAL
7	602744038	PUMP, TUBING ASSEMBLY 3700ZR
8	209016379	REMOTE ACTUATOR SAMPLER KEYPAD
9*	602743070	DISCHARGE TUBE 3700ZR 8 BOTTLE
	602743071	DISCHARGE TUBE 3700ZR 2 BOTTLE
	609003264	DISCHARGE TUBE 3700ZR 1 BOTTLE
*		NOT SHOWN

NOTE: 1. For current prices and quotations on parts, contact Isco Service Department.  
 2. This list is subject to change without notice.

