

Isco 701 pH/ Temperature Module

Instruction Manual



Part #60-9003-065
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Foreword

This instruction manual is designed to help you gain a thorough understanding of the operation of the equipment. Isco recommends that you read this manual completely before placing the equipment in service.

Although Isco designs reliability into all equipment, there is always the possibility of a malfunction. This manual may help in diagnosing and repairing the malfunction.

If the problem persists, call or email the Isco Customer Service Department for assistance. Contact information is provided below. Simple difficulties can often be diagnosed over the phone. If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by the Customer Service Department, including the use of the **Return Authorization Number** specified. **Be sure to include a note describing the malfunction.** This will aid in the prompt repair and return of the equipment.

Isco welcomes suggestions that would improve the information presented in this manual or enhance the operation of the equipment itself.

Contact Information

Phone:	(800) 228-4373	(USA, Canada, Mexico)
	(402) 464-0231	(Outside North America)
Repair Service:	(800) 775-2965	(Analytical and Process Monitoring Instruments)
	(800) 228-4373	(Samplers and Flow Meters)
Fax:	(402) 465-3022	
Email address:	info@isco.com	
Website:	www.isco.com	
Return equipment to:	4700 Superior Street, Lincoln, NE 68504-1398	
Other correspondence:	P.O. Box 82531, Lincoln, NE 68501-2531	

701 pH/Temperature Module

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701 pH/Temperature Module

Section 1 Programming and Installation

1.1 Introduction

The 701 pH/Temperature Module is one of Isco's interchangeable modules for the 6700 Series Samplers. The module uses a pH probe with an internal temperature sensor to measure the acidity or alkalinity and the temperature of a liquid.

You can install the module only on a 6700 Series controller. The pH probe can be used in nearly any installation where it can be mounted and retrieved for periodic maintenance and calibration.

 **WARNING**

The module has not been approved for use in hazardous locations as defined by the National Electrical Code. Before installing any device in a dangerous location review the safety precautions in the sampler manual. Check applicable guidelines, codes, and regulations of federal, state, city, and county agencies.

1.2 Installing the Module

To install the module:

1. Turn the sampler off.
2. Remove the connector cap in the module bay and move it aside.
3. Slide the module into the bay.
4. Push the module to be sure the connector is firmly seated.

To remove the module turn the sampler off. Depress the silver button and pull the module from the bay. Replace the connector cap in the module bay.

1.3 Installation Checklist

1. Install the module then turn the sampler on.
2. Program the sampler and calibrate the module's pH reading.
3. Install the probe.
4. Connect the probe's cable to the module.
5. Setup the sampler. See Chapter 3 of the sampler manual.
6. Run the program.

1.4 Calibrating the pH Module

The pH module uses a two-part calibration for the pH probe using commercially prepared calibrated buffer solutions. For accurate readings you must clean and recalibrate the probe on a regular basis. How often depends on the operating conditions.

Flow streams with a high grease content will coat the sensing surfaces of the probe quickly, clogging them and slowing the response time or stopping it altogether.

Calibrating the module can be done with two or three points. With two point calibration (pH 4 and 7, pH 4 and 10, or pH 7 and 10) the module creates a linear relationship from pH 0 to 14 through these two points. With three point calibration (pH 4, 7, and 10) the module creates a linear relationship from pH 0 to 7 through pH 4 and 7 and creates another linear relationship from pH 7 to 14 using calibration points pH 7 and 10.

1.5 Programming Notes

When a module is installed, the sampler adds the necessary screens for programming. These screens appear in Figures 1-1 and 1-2.

<input checked="" type="checkbox"/> Note

An * (asterisk) appears next to the reading if the module was unable to take a reading. If an * appears, the reading displayed is the last available reading.

You must have the module installed before turning the controller on. When the controller is turned on it looks for a module. If the module is installed after the controller is turned on you will not be able to program the sampler for use with the module. For more information see Chapter 2, Programming, in the sampler manual.

1.6 Programmed Enable

When a pH/Temperature Module is installed, additional enable options are available. The options will be pH, TEMPERATURE, or pH and TEMPERATURE. For more information about programming, see Sampler Enable in Chapter 5 of the sampler manual.

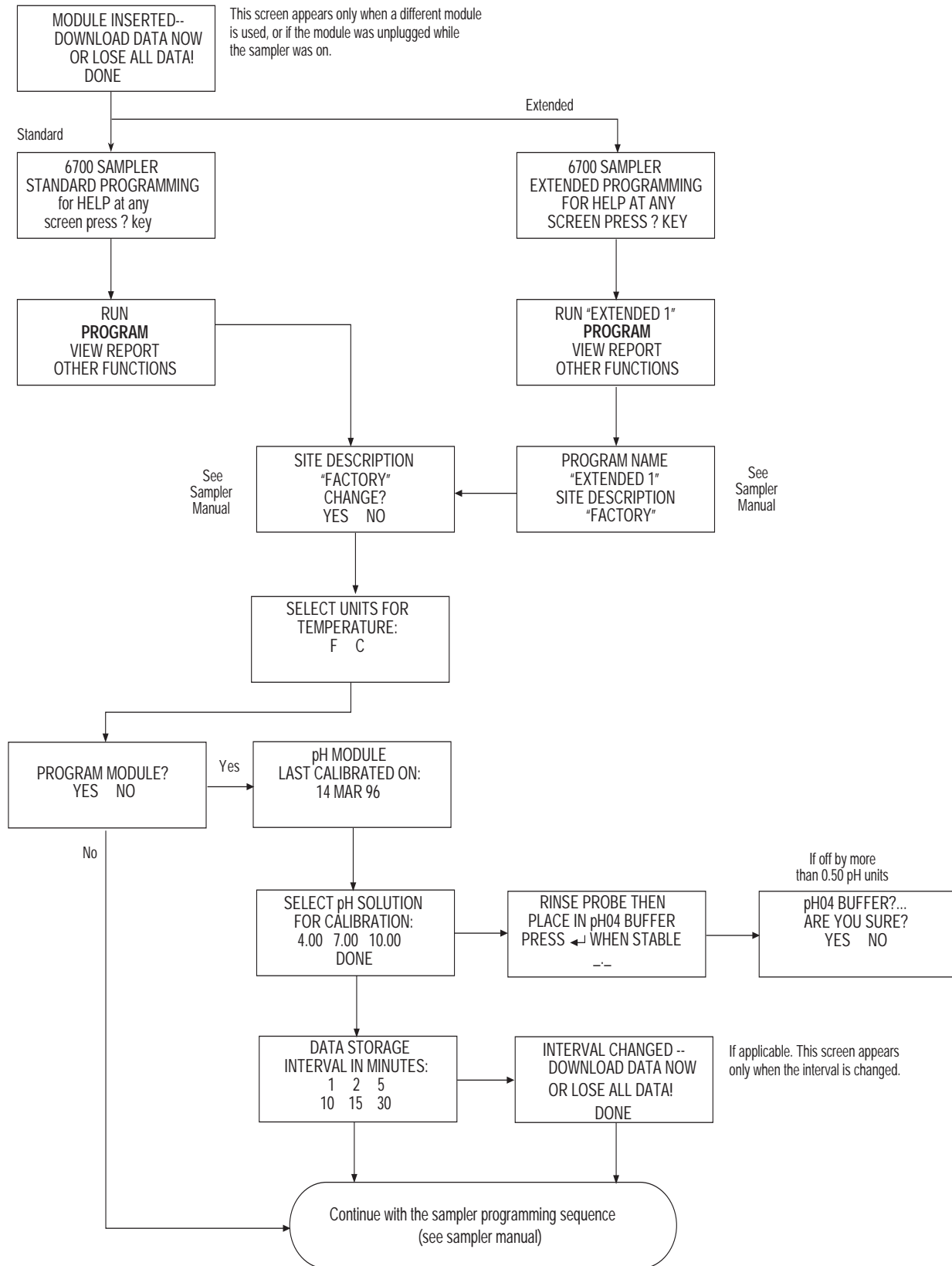


Figure 1-1 Programming the sampler to use the 701 Module

701 pH/Temperature Module
 Section 1 Programming and Installation

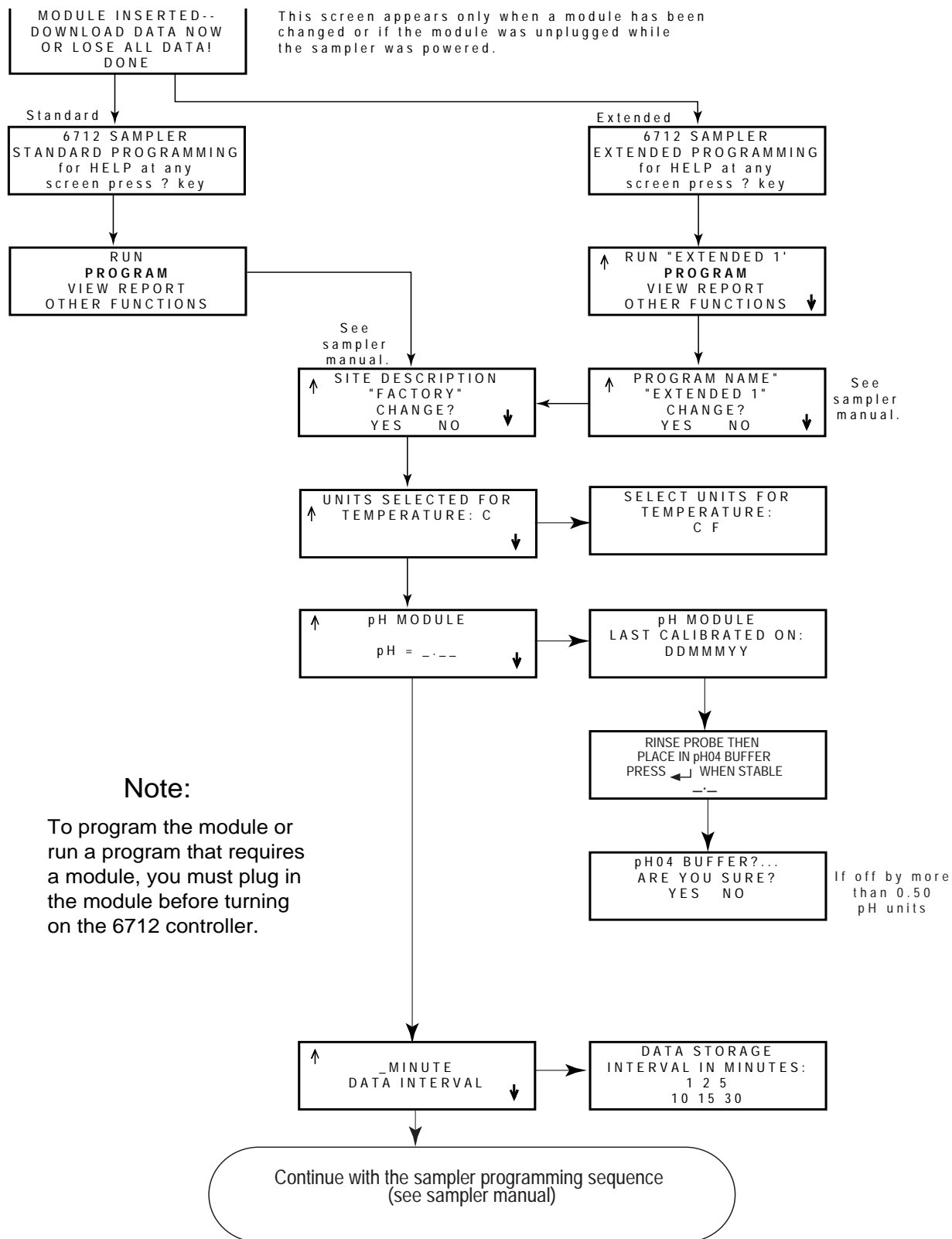


Figure 1-2 Quick View: Programming the sampler to use the 701 Module

1.7 Installation Guidelines

Note

Remember to unscrew the rubber guard cap from the sensing end of the probe after you install it, or the probe will be unable to sense the flow stream.

The guard cap is to protect the probe during shipment and storage and to keep the glass membrane and liquid junction from drying out. If you remove the probe from the stream for any reason, clean it and replace the cap after filling with 4.0 buffer solution. Never store the probe dry or without the cap in place.

Always mount the probe in an easily-accessible location. The probe will need cleaning, calibration, and eventual replacement.

1.7.1 Stream Conditions

Install the probe only in streams that have continuous flow.

For proper operation, there must also be enough flow or liquid to submerge the sensing end of the probe completely.

If flow in the stream is intermittent (dry for periods of time), the pH probe sensing bulb will dry out and its response time will become slow. This will be a problem in situations where pH changes rapidly. If the probe remains dry long enough, it will be ruined. Never let the sensing end of the probe dry out.

Installation in streams with high grease content may result in poor performance and require frequent maintenance.

The pH Probe will operate satisfactorily mounted either horizontally or vertically in the stream. However, horizontal mounting is more secure, and presents less of a trap for debris.

1.7.2 Vertical Mounting

If you mount the pH probe vertically, mount it securely. Never suspend the probe by its cable, particularly over streams that run at high levels and high velocities, or streams that carry debris which could damage the sensor.

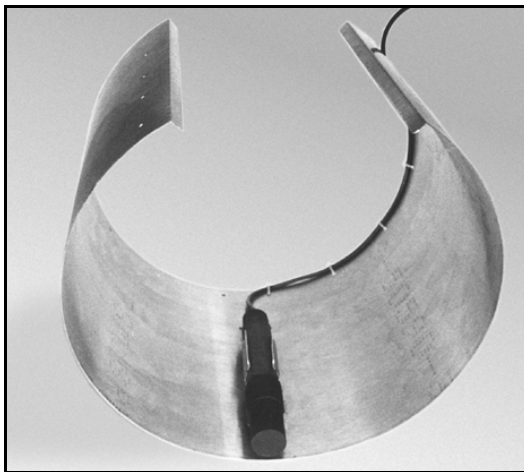
1.7.3 Horizontal Mounting

For horizontal mounting, the probe fastens to a sensor carrier that snap-fits to an Isco mounting ring. The mounting rings fit various diameters of round pipes. They are held in place by the outward force of spring pressure in the smaller sizes and by a screw arrangement in the larger sizes. After mounting the probe in the ring or strap, route the cable out of the stream so it will not trap debris that could clog the sewer. Isco recommends mounting the probe facing upstream, as there is a stop on the sensor carrier that is not effective when the probe is facing down stream.

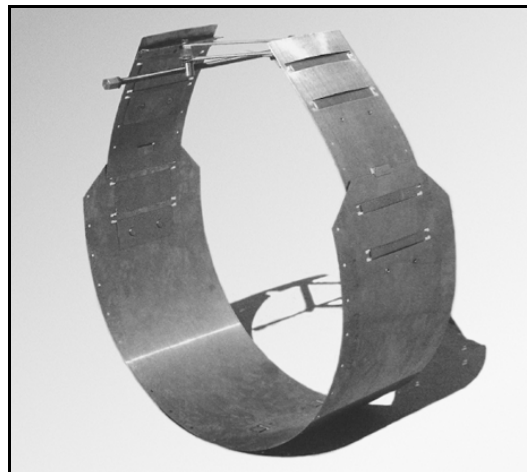
1.7.4 Installation in Round Pipes

Isco offers three systems for installing a pH probe in round pipes:

- Isco Spring Rings for pipe diameters of 15 inches or less
- Scissors Rings for pipe diameters from 18 to 72 inches
- Street Level Installation System



**Spring Ring
(6 to 15 inches)**



**Scissors Ring
(18 to 72 inches)**

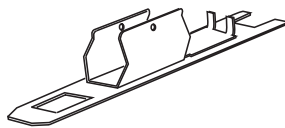
Figure 1-3 Isco Mounting Rings

1.8 Spring Rings

Stainless steel spring rings simplify probe installation in 6 to 15 inch round pipes. Isco offers five diameter sizes: 6, 8, 10, 12, and 15 inches (150, 200, 250, 300, and 380 mm). A typical spring ring is shown in Figure 1-3.

This self-expanding device compresses to slide into a pipe. When released, the ring secures itself against the wall with an inherent outward force.

1.8.1 Preparing the Spring Ring



pH Probe Carrier

First, attach the probe to the carrier assembly. Then fit the carrier onto the mounting tabs of the ring, making sure the tabs completely engage the slots in the carrier. This method of attaching the probe to the ring allows for easy removal in case service is needed later.

Route the cable away from the carrier and along the spring ring's edge with holes. Secure the cable in position by placing plastic ties through the holes and then locking them around the cable. To prevent debris from collecting, attach the cable so that it offers as little resistance to the flow as possible. Avoid loops or slack sections. Attach it neatly and closely to the spring ring.

1.8.2 Installing the Spring Ring

After the probe and carrier have been attached to the spring ring, the actual installation procedure is fairly simple. First, lower the spring ring assembly into the area of the pipe. Next, grasp the spring ring and compress it into a tight circle. Then push the ring up into the pipe the desired distance.

When you have the ring where you want it, release the ring, allowing it to expand outwardly. It may be necessary to rotate the ring to position the pH probe in the bottom center of the pipe. This completes the installation procedures.

Under conditions of high velocity (greater than five feet per second or 1.5 meters per second), the spring ring may not have sufficient outward force to keep it tight against the pipe. The flow could lift the ring off the bottom of the pipe, or even carry it downstream.

This problem is more prevalent in the larger diameter pipes (10, 12, and 15 inch) and in pipes with a smooth inside surface. If any of these conditions are present, or if movement of the spring ring is detected or suspected, you must anchor the ring in place. You can do this by shooting studs through the ring into the pipe or by other appropriate means. In some cases, it may be sufficient to increase the outward force of the ring by bending it into a less-round shape.

1.9 Scissors Rings

The adjustable Scissors Ring is available for pipes 18 inches (457 mm) in diameter and larger. The Scissors Ring is sold in sets assembled from seven basic parts: base section, a scissors mechanism, four different sized extensions, and a hardware kit. This device mounts Isco pH probe carriers, flow probes, and other parameter probes in closed cylindrical, process or sewer pipes. The assembled rings can fit pipe diameters from 18" to 72". Ring sections are .040" thick 1/2 hard 301 stainless steel sheet. All other parts are also stainless steel, except for the plastic cable ties in the hardware kit.

The scissors mechanism provides approximately 11 1/2" of adjustment, used to tighten the ring assembly. Each extension, 1, 2, 3, and 4, adds 7.5", 20", 30", or 40", respectively, to the circumference of the ring. Used alone, the base section fits an 18" diameter pipe. The 7.5" (the smallest) extension is used to take up or remove slack in larger pipe sizes where variations in circumference can occur. Refer to Table 1-1 for the recommended configurations for various pipe diameters. The scissors mechanism will work best if the respective assembly is installed to allow the scissors to expand approximately in the middle of the adjustment.

Table 1-1 Recommended Scissors Ring Configurations

Diameter	Parts (all configurations include the Scissors Assembly)
18"	Base Section
21", 24"	Base + (2) 7.5" Extensions
30"	Base + (2) 20" Extensions
36"	Base + (2) 20" Extensions + (2) 7.5" Extensions
42"	Base + (2) 30" Extensions + (2) 7.5" Extensions
48"	Base + (2) 40" Extensions + (2) 7.5" Extensions
60"	Base + (4) 30" Extensions + (2) 7.5" Extensions
72"	Base + (4) 40" Extensions + (2) 7.5" Extensions

1.9.1 Assembling the Scissors Ring

 **CAUTION**

Use gloves and eye protection when assembling and installing the rings. Though deburred, the edges of the stainless steel can cut if improperly handled.

When assembling the ring sections, make sure the tongue sections are correctly inserted into the slotted sections. Note the accompanying diagram. A flat blade screwdriver may help slide the tongue sections through the slots and over the securing buttons. In large pipes, you may find it useful to assemble the base and extensions above ground, without connecting into a circle, before entering the manhole. Then you can pass it down the manhole. Do not drop it; a large assembly could be badly bent.

The three sets of mounting tabs on the base section are for mounting the Isco flow and parameter probes. The pH probe is first attached to a carrier and then will slide onto any set of tabs. Make sure both tabs properly and completely engage the slots of the carrier.

 **Note**

There are countersunk holes on the base section near the mounting tabs for the probes. These holes are for mounting the Isco Probe Extension.

The hardware kit provides plastic cable ties to secure the cable along the back of the ring. It also includes flat head bolts and nuts you can use to bolt sections of the ring assembly together. This is recommended when installing the ring into the larger pipe sizes, while significant flow exists. The ring can thrash around during installation, before you can tighten the scissors mechanism, if there is high flow. Bolting the tongue sections together can greatly increase safety and prevent the assembly from being torn apart.

1.9.2 Installing the Scissors Ring

Fit the assembled scissors ring into the pipe and push it upstream the desired distance. It may be necessary to rotate the ring to position the probe in the bottom center of the pipe. Once in position, secure the assembly in place by gently tightening the supplied scissors mechanism with a $5/8$ " socket wrench or other suitable tool. Do not overtighten the mechanism; it is designed to flex somewhat to provide a positive lock once moderately tightened. Route the cable out of the pipe so that it does not collect debris or disturb the flow.

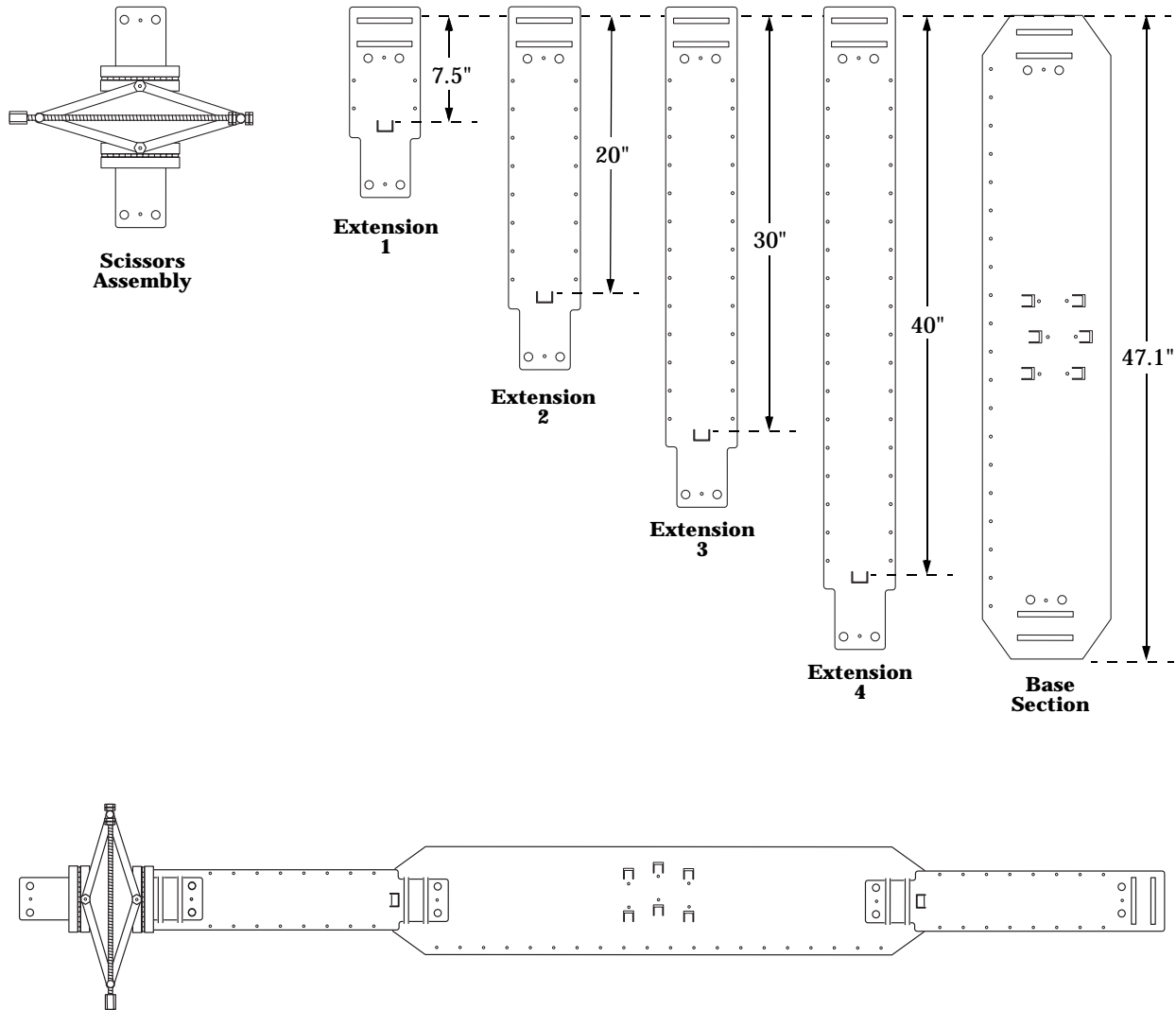


Figure 1-4 Scissors Ring Parts

1.10 Street Level Installation System

The Street Level Installation System provides a way to install the probe in a round pipe without entering a manhole. This system uses multi-section poles and expansion rings that fit 6, 8, 10, 12, and 15 inch round pipes in manholes as deep as 15 feet. The system includes an instruction manual. Contact the factory or your representative for details.

1.11 Other Installation Methods

Isco's mounting hardware can be installed or adapted for use in many channels. The paragraphs below list additional pH probe installation methods.

1.11.1 Rectangular, Trapezoidal, and Earthen Channels

The Sensor Mounting Plate may be used to mount the pH probe in these channels. The stainless steel plate has tabs to mount up to three sensors. It is secured in concrete channels by driving studs into the channel bottom and bolting the plate to the studs. In an earthen channel, the plate can be held in place by driving in stakes.

1.11.2 U-Channels

It is possible to mount the pH probe and carrier in a U-channel with a scissors ring base section. Attach the base section to the channel wall with studs fired from a power-activated stud gun.

1.12 Maintenance

1.12.1 Storage and Maintenance of pH Probe

Whenever the pH probe is in storage or out of solution, you must be careful to keep the glass sensor bulb wet. Always store the probe with the rubber cover screwed completely over the threaded end of the sensor. Exposure to air causes the glass membrane to dry out. This makes it very slow to respond in solution. Prolonged or repeated dehydration of the bulb may ruin the probe completely.

The pH sensitive glass can become "conditioned" to its environment, especially when it is continuously exposed to high pH (10 and above) solutions. The glass does have a memory and will respond slowly when exposed to a lower pH solution after having been in a high pH solution for any significant period of time.

Storage of a pH probe in a 4.0 buffer solution is recommended as this has a "regenerative" effect on the glass and does not put a memory on it. Tap water will work if 4.0 buffer solution is not available. Deionized water is good for quick rinses to clean the element, but not for prolonged storage of an electrode. Continuous exposure of the ion-sensitive membrane to a wetted, but non-ionic solution will improperly "condition" the membrane.

The reference electrode is also adversely affected when allowed to dry out. Salt crystals from the electrolyte or precipitates of the solution measured will form salt "bridges" either within or on the surfaces of the liquid junction, causing the reference to be less conductive and resulting in a higher reference impedance.

This condition will typically worsen until the unit no longer functions. Soaking the reference electrode in a 4.0 pH solution, or tap water if the buffer is not readily available, may bring the reference back to life. Boiling the electrode in 4.0 buffer solution or tap water could revive the electrode in more severe situations. If none of these works, replace the probe.

1.12.2 Probe Life

All pH probes are consumable items, meaning that they will eventually fail and have to be replaced.

During the working life of the probe you will have to clean and recalibrate it periodically. Grease and debris will interfere with

the probe's ability to measure pH accurately. Grease will coat the end of the probe. Grease is an insulator, keeping the ions from reaching the glass membrane and porous liquid junction, thus failing to create a voltage potential.

The pH probe has reached the end of usable life when you can no longer calibrate the probe (after cleaning) to 4 and 7. Another indication of end of life is when the probe eventually calibrates satisfactorily, but takes too long to stabilize (more than 10 minutes).

Such a probe could not possibly respond to a situation of rapidly-changing pH. If your situation requires faster response, you might consider end-of-life to have occurred when stabilization time reaches five or seven minutes.

1.12.3 Flash Memory and Software Upgrades

The module has Flash memory to store its software. With Flash technology, you can upgrade your module's software without sending it back to the factory or replacing the chip. Simply connect a computer to the sampler with the module installed and run the Flash update program.

 Note

When updating the Flash memory the module must be attached to the sampler and power must be supplied to the sampler.

1.12.4 Repairing the Module

The module has no user-serviceable parts. Its case is completely sealed to protect the internal components. To repair the unit, the case must be broken open and replaced. If you think your module requires repair, contact Isco's Technical Service Department for information on returning it to the factory.

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701 pH/Temperature Module

Section 2 The pH Probe

2.1 Function of the Probe

The pH probe measures the acidity or alkalinity of an aqueous solution by determining the relative quantity of dissociated hydrogen ions, H⁺ (actually H₃O⁺) in the solution. A larger quantity of H⁺ ions indicates acidity, while a smaller quantity of H⁺ ions indicates alkalinity. The H in pH stands for Hydrogen and the p stands for power.

The normal scale for pH runs from 0 to 14, with 0 being most acidic and 14 being most alkaline. Distilled water at 25° C is neutral at 7, based on the fact that the dissociation constant (number of H⁺ and OH⁻ [hydroxyl] ions present) for pure water at 25° C is 10⁻⁷.

A dissociation constant is a number that indicates the amount of ionic dissociation occurring for a given substance after it is dissolved in aqueous solution. Dissociation constants vary widely for substances depending on the nature of the chemical bonds within the substance.

Each number on the pH scale between 7 and 0 equals a tenfold increase in H⁺ ion concentration. Each number between 7 and 14 equals a tenfold decrease of H⁺ ion concentration. The measurement of wastewater pH is commonly made to monitor the effect of treatment chemicals added to raise or lower the pH.

Water that has been used for various industrial processes may deviate substantially from 7. Chemicals are often added to the water to bring the pH close to that of neutral water, which is 7.

For example, if the effluent has a concentration of heavy metal ions, they must be removed before discharge. Raising the pH of solutions containing transition-metal ions will cause them to precipitate, which can be removed as sludge. The resultant solution will be high in pH and will require acid to neutralize it.

The pH probe is intended for use in applications where there are sulfide and/or metal ion concentrations. It is recommended for applications where poisoning ion concentrations are greater than 100 parts per billion.

2.2 How the pH Probe Works

The pH probe is a combination of two electrochemical half-cells. Together they provide a low-voltage signal that corresponds to the hydrogen-ion concentration of a solution.

If you look at the pH probe, you will see a glass bulb on one end. This is called the ***glass mono electrode***. The glass is of a special composition sensitive only to hydrogen ions. This electrode is exposed to the solution to be measured. The specific sensitivity to hydrogen ions prevents interference from other ions that may be present in the solution.

The glass membrane produces an electrical potential proportional to hydrogen ion activity. The other electrode, called the **reference electrode**, completes the circuit between the glass electrode and the solution.

The two electrodes can be separate, or built into a single housing. The Isco pH probe combines both electrodes in a single housing and also contains an amplifier to reduce the extremely high impedance of the circuit. This improves the reaction of the probe to stray capacitance and reduces interference caused by electrical noise in the vicinity.

Like any other chemical reaction, pH measurement is affected significantly by temperature. Consequently, temperature compensation is provided. The Isco pH probe has a built-in temperature sensor that is exposed for faster response.

When the ion selective electrode and the reference electrode are connected to a high impedance voltmeter and submerged in solution, ions move to the surface of the membrane. The electrical charge on the ions creates a potential difference across the barrier between the solution and the membrane. This voltage difference is proportional to the activity of the ion in solution.

The potential translates into a reading of pH. With the module, the voltage is sent first to a preamplifier inside the probe to reduce the impedance of the circuit and improve the signal to noise ratio, and then on to the module.

701 pH/Temperature Module

Appendix A Technical Specifications

The following tables contain technical data for the Isco 701 pH/Temperature Module and Probe, including weight, physical dimensions, materials, and operational specifications.

Table A-1 Technical Specifications for the 701 pH/Temperature Module

General Notes: 1. All weights may vary ± 0.2 lb (± 0.1 kg). 2. All lengths may vary $\pm 1/4$ inch (± 0.64 cm).	
Module Weight:	1.1 lbs (0.5 kg)
Sensor Weight:	0.9 lbs (0.4 kg)
Module Dimensions:	4.9 x 5.7 x 2.0 inches (12.4 x 14.5 x 5.1 cm)
Module Material:	Polystyrene
Operational Temperature:	32°F to 120°F (0°C to 49°C)
Storage Temperature:	0°F to 140°F (-18°C to 60°C)
Module Enclosure:	NEMA 4X and 6, IP67
Power:	Provided by sampler.
Memory:	Nonvolatile programmable Flash. Can be field updated through the sampler.
Readings:	Programmable through the sampler at 1, 2, 5, 10, 15, and 30 minute intervals.
pH Resolution:	0.1 pH unit
pH Amplifier Accuracy:	± 0.1 pH units from 0 to 11.9 pH. ± 0.2 pH units from 12.0 to 14.0 pH
Temperature Resolution:	0.20°F (0.10°C)
Range:	0 to 14 pH units

Table A-2 Technical Specifications for the pH/Temperature Probe

Sensor Dimensions:	1.2 inches in diameter, 6 inches long (3.0 cm in diameter, 15.2 cm long)
Cable Length:	25 feet (7.6 m)
Probe material:	Stainless Steel
Cable Material:	PVC
pH Range:	0 to 14 pH units
Liquid Junction Configuration:	Annular
Element Type:	Silver-Silver Chloride (Ag-AgCl)
Liquid Junction Material:	Porous Teflon [®]
Reference Electrolyte:	Double Junction – Inner Chamber: KCL-AgCl – Outer Chamber: KNO3
Temperature Range:	32°F to 176°F (0°C to 80°C)

Teflon is a registered trademark of DuPont de Nemours, E.I., & Co., Inc.

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701 pH/Temperature Module

Appendix B Accessories

Accessories and replacement parts can be purchased by contacting Isco's Customer Service Department.

Table B-1 Accessories

pH Module w/Single Junction Probe (includes module, probe, pH 4, 7, and 10 buffers, rinse, and manual)	68-6700-051
pH Module w/Double Junction Probe (includes module, probe, pH 4, 7, and 10 buffers, rinse and manual)	68-6700-052
Single Junction pH /Temp Sensor (includes module, probe, pH 4, 7, and 10 buffers, rinse and manual)	68-6700-053
Double Junction pH/Temp Sensor (includes module, probe, pH 4, 7, and 10 buffers, rinse and manual)	68-6700-054
pH/Temp Probe (<i>Single Junction</i>)	60-9004-125
pH/Temp Probe (<i>Double Junction</i>)	60-9004-126
pH Module Manual	60-9003-065
pH Probe Mount Assembly	60-3208-001
Electrode Rinse Solution	479-0010-00
pH 4 Buffer	479-0001-04
pH 7 Buffer	479-0001-07
pH 10 Buffer	479-0001-10
Sensor Probe Mounting Ring 6" Dia	68-3200-007
Sensor Probe Mounting Ring 8" Dia	68-3200-008
Sensor Probe Mounting Ring 10" Dia	68-3200-009
Sensor Probe Mounting Ring 12" Dia	68-3200-010
Sensor Probe Mounting Ring 12" Dia	68-3200-011
Extension Kit For 18"-26" Pipe	68-3000-042
Extension Kit For 26"-38" Pipe	68-3000-043
Extension Kit For 38"-44" Pipe	68-3000-044
Extension Kit For 44"-48" Pipe	68-3000-045
Extension Kit For 60" Pipe	68-3000-046
Extension Kit For 72" Pipe	68-3000-047
Extension Kit For 18"-60" Pipe	68-3000-048
Base Button Assembly	60-3004-171
Adjustment Mechanism Assembly	60-3004-170
7.5" Mounting Ring Extensions, Quantity 2	68-3003-038
20" Mounting Ring Extensions, Quantity 2	68-3003-039

Table B-1 Accessories (Continued)

30" Mounting Ring Extensions, Quantity 2	68-3003-040
40" Mounting Ring Extensions, Quantity 2	68-3003-041
Probe Extension	68-3200-012

701 pH/Temperature Module

Appendix C Material Safety Data

ORION MATERIAL SAFETY DATA SHEET

SHEET 1 OF 2

Orion Research Incorporated
 THE SCHRAFFT CENTER
 529 MAIN STREET, BOSTON, MA 02129 USA
 TELEPHONE 617-242-3900

I. PRODUCT IDENTIFICATION

PRODUCT NAME perpHect Buffer 4	CATALOG NO. 910410, 910425, 910450	EFFECTIVE DATE 06/01/91
HAZARDOUS SHIPMENT LABELLING: DOT None	LATA None	
PREPARED BY <i>Thomas J. Fitzgerald</i>	TITLE Quality Assurance Chemist	
APPROVED BY <i>Lynn O'Rourke</i>	TITLE Director Regulatory Matters	

II. HAZARDOUS INGREDIENTS (IDENTITY INFORMATION)

HAZARDOUS COMPONENTS* SPECIFIC CHEMICAL IDENTITY: COMMON NAME(S)	CAS NO.	%	OSHA PEL	ACGIH TLV	LD 50 mg/Kg
Potassium Hydrogen Phthalate (KHP)	877-24-7	1.01	None	None	None listed.
Amaranth Red Dye (C ₂₀ H ₁₁ N ₂ O ₁₀ S ₃ Na ₃)	915-67-3	0.005	None	None	1,000 (IPR-MUS)
** De-ionized Water (H ₂ O)	7732-18-5	98.985	None	None	190,000 (IPR-MUS)

III. PHYSICAL DATA

BOILING POINT 760 mm Hg 100°C	FREEZING POINT 0°C
SPECIFIC GRAVITY (H ₂ O = 1) 1.0	VAPOR PRESSURE @ NA °
pH @ 25 °C 4.01	SOLUBILITY IN WATER, % BY WT. @ Miscible
VOLATILES, % BY WT. N A	EVAPORATION RATE (BUTYL ACETATE = 1) N A
VAPOR DENSITY (AIR = 1) N A	
APPEARANCE AND ODOR Light Red, Odorless Liquid	

IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (TEST METHOD) Not Flammable	AUTOIGNITION TEMPERATURE N A
FLAMMABLE LIMITS IN AIR, % BY VOLUME:	LOWER UPPER N A N A
EXTINGUISHING MEDIA Water, CO ₂ , Dry Chemical, Foam or Spray	
SPECIAL FIRE-FIGHTING PROCEDURES None	
UNUSUAL FIRE AND EXPLOSION HAZARDS None	

* Chemicals which are not classified as hazardous per U.S. OSHA guidelines (29CFR Parts 1915.2 or 1916.2) or the Massachusetts Substance List (105CMR670.000 Appendix A) will not necessarily be listed on this form even though one or more may be a constituent of this product.

Liability is expressly disclaimed for any loss or injury arising out of the use of this information or the use of any materials designated. Safe use of the materials is the responsibility of the user.

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Rev. A

* NA = Not Available/Not Applicable
 * * Non-hazardous Component

ORION MATERIAL SAFETY DATA SHEET

SHEET 2 OF 2

PRODUCT NAME: perpHect Buffer 4

CATALOG NO.: 910410, 910425,
910450

V. REACTIVITY DATA

STABILITY:		CONDITIONS TO AVOID	
UNSTABLE <input type="checkbox"/>	STABLE <input checked="" type="checkbox"/>	None	
INCOMPATIBILITY (MATERIALS TO AVOID)		Nitric Acid	
HAZARDOUS DECOMPOSITION PRODUCTS		None	
HAZARDOUS POLYMERIZATION:		CONDITION TO AVOID	
MAY OCCUR	WILL NOT OCCUR <input checked="" type="checkbox"/>	None	

VI. HEALTH HAZARD DATA

ROUTE(S) OF ENTRY:	INHALATION?	SKIN?	INGESTION?
	No	Yes	Yes
HEALTH HAZARDS (ACUTE AND CHRONIC)			
Acute: Low hazard because of low concentration of salts.		Chronic: Possible skin irritant for prolonged exposure.	
CARCINOGENICITY:	NTP?	IARC MONOGRAPHS?	OSHA REGULATED?
	(Suspect)	(Animal Positive)	(Not Found)
SIGNS AND SYMPTOMS OF EXPOSURE			
Irritation or redness of the skin.			
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE			
Possible aggravation of skin diseases.			
EMERGENCY AND FIRST AID PROCEDURES			
Wash contact area with water. If ingested, give large amounts of water and consult physician.			

VII. PRECAUTIONS (SAFE HANDLING AND USE)

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash down drain with water if local law allows.
WASTE DISPOSAL METHOD
Consult with and observe all federal, state, and local laws when disposing of this product.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
Suitable for general storage. This product is not regulated under SARA Title III.
OTHER PRECAUTIONS
Not affected by Cal. Prop 65. NFPA Rating: Scale (0-4) Health 1, Fire 0, Reactivity 1, Specific - None.

VIII. CONTROL MEASURES

RESPIRATORY PROTECTION (SPECIFY TYPE)			
None			
VENTILATION	LOCAL EXHAUST	No	SPECIAL
	MECHANICAL (GENERAL)	No	OTHER
PROTECTIVE GLOVES		EYE PROTECTION	
Yes (any type)		Safety Glasses	
OTHER PROTECTIVE CLOTHING OR EQUIPMENT			
No			
WORK/HYGIENIC PRACTICES			
No eating or drinking while working with this product.			

ORION MATERIAL SAFETY DATA SHEET

SHEET 1 OF 2

Orion Research Incorporated
THE SCHRAFFT CENTER
529 MAIN STREET, BOSTON, MA 02129 USA
TELEPHONE 617-242-3900

I. PRODUCT IDENTIFICATION

PRODUCT NAME pHfect Buffer 7	CATALOG NO. 910710, 910725, 910750	EFFECTIVE DATE 06/01/91
HAZARDOUS SHIPMENT LABELLING: DOT None	IATA None	
PREPARED BY <i>[Signature]</i>	TITLE Quality Assurance Chemist	
APPROVED BY <i>[Signature]</i>	TITLE Director Regulatory Matters	

II. HAZARDOUS INGREDIENTS (IDENTITY INFORMATION)

HAZARDOUS COMPONENTS* SPECIFIC CHEMICAL IDENTIFY; COMMON NAME(S)	CAS NO.	%	OSHA PEL	ACGIH TLV	LD 50 mg/kg
Potassium Phosphate (KH ₂ PO ₄)	7778-77-0	0.284	None	None	None Listed
Sodium Phosphate (Na ₂ HPO ₄)	7558-79-4	0.413	None	None	298 (IVN-DOG)
Sodium Chromate (Na ₂ CrO ₄)	7775-11-3	0.013	50 ug/mg3	50 ug/m3	57 (IRR-RAT)
Potassium Dichromate (K ₂ CrO ₇)	778-50-9	0.003	50 ug /m3	50 ug/m3	37 (INR-RAT)
** De-ionized Water (H ₂ O)	7732-18-5	99.287	None	None	190,000 (ORL-DOG)

III. PHYSICAL DATA

BOILING POINT 760 mm Hg 100°C	FREEZING POINT 0°C
SPECIFIC GRAVITY (H ₂ O = 1) 1.0	VAPOR PRESSURE @ NA
pH @ °C 25 7.00	SOLUBILITY IN WATER, % BY WT. @ Miscible
VOLATILES, % BY WT. NA	EVAPORATION RATE (BUTYL, ACETATE = 1) NA
VAPOR DENSITY (AIR = 1) NA	
APPEARANCE AND ODOR Light Yellow, Odorless Liquid	

IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (TEST METHOD) Not Flammable	AUTOIGNITION TEMPERATURE NA
FLAMMABLE LIMITS IN AIR, % BY VOLUME: EXTINGUISHING MEDIA Water, CO ₂ , Dry Chemical, Foam or Spray	LOWER NA UPPER NA
SPECIAL FIRE-FIGHTING PROCEDURES None	
UNUSUAL FIRE AND EXPLOSION HAZARDS None	

* Chemicals which are not classified as hazardous per U.S. OSHA guidelines (29CFR Parts 1915.2 or 1915.2) or the Massachusetts Substance List (105CMR670.000 Appendix A) will not necessarily be listed on this form even though one or more may be a constituent of this product.

Liability is expressly disclaimed for any loss or injury arising out of the use of this information or the use of any materials designated. Safe use of the materials is the responsibility of the user.

Document No. 205569-001
Rev. A

• NA = Not Available/Not Applicable
• • Non-hazardous Component

ORION MATERIAL SAFETY DATA SHEET

SHEET 2 OF 2

PRODUCT NAME: perHect Buffer 7

CATALOG NO.: 910710, 910725,
910750

V. REACTIVITY DATA

STABILITY: UNSTABLE <input type="checkbox"/> STABLE <input checked="" type="checkbox"/>	CONDITIONS TO AVOID
INCOMPATIBILITY (MATERIALS TO AVOID)	Magnesium and Sodium metals
HAZARDOUS DECOMPOSITION PRODUCTS	Possible evolution of fumes from phosphates if heated.
HAZARDOUS POLYMERIZATION: MAY OCCUR <input type="checkbox"/> WILL NOT OCCUR <input checked="" type="checkbox"/>	CONDITION TO AVOID None

VI. HEALTH HAZARD DATA

ROUTE(S) OF ENTRY:	INHALATION? No	SKIN? No	INGESTION? Yes
HEALTH HAZARDS (ACUTE AND CHRONIC)	Low Hazard for both acute and chronic because of low concentration of salts.		
CARCINOGENICITY:	NTP? Not Found	IARC MONOGRAPHS? Not Found	OSHA REGULATED? Not Found
SIGNS AND SYMPTOMS OF EXPOSURE	Irritation of skin.		
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE	Possible aggravation of skin diseases.		
EMERGENCY AND FIRST AID PROCEDURES	Wash off contact area with water. If ingested, give large amounts of water and contact a physician.		

VII. PRECAUTIONS (SAFE HANDLING AND USE)

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Wash down drain with water if local law allows.
WASTE DISPOSAL METHOD
Consult with and observe all federal, state and local laws when disposing of this product.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING
SARA Title III: Releases of Na_2HPO_4 are subject to reporting under Sec. 302 of Title III.
OTHER PRECAUTIONS
NEPA Rating: Scale (0-4) Fire 0, Health 0, Reactivity 0, Specific - None. Not affected by CAI Proposition 65 .

VIII. CONTROL MEASURES

RESPIRATORY PROTECTION (SPECIFY TYPE)			
VENTILATION	LOCAL EXHAUST	No	SPECIAL
	MECHANICAL (GENERAL)	No	OTHER
PROTECTIVE GLOVES	No	EYE PROTECTION	Safety Glasses
OTHER PROTECTIVE CLOTHING OR EQUIPMENT	No		
WORK/HYGIENIC PRACTICES	No eating or drinking while working with this product.		

ATI ORION MATERIAL SAFETY DATA SHEET

Sheet 1 of 2

Orion Research Incorporated
THE SCHRAFFT CENTER
529 Main Street, Boston, MA 02129 USA
Telephone 617-242-3900

I. PRODUCT IDENTIFICATION

Product Name perpHeat Buffer 10	Catalog No. 911010, 911025	Effective Date 07/20/93
Hazardous Shipment Labelling: DOT None	IATA None	
Prepared By <i>[Signature]</i>	Title Quality Assurance Chemist	
Approved By <i>[Signature]</i>	Title Director Regulatory Matters	

II. HAZARDOUS INGREDIENTS (IDENTIFY INFORMATION)

Hazardous Components* Specific Chemical Identity: Common Name(s)	CAS NO.	%	OSHA PEL	ACGIH TLV	LD 50mg/Kg
Sodium Bicarbonate (NaHCO ₃)	144-55-8	0.209	None	None	4220 (ORL-RAT)
Sodium Carbonate (Na ₂ CO ₃)	497-19-8	0.264	None	None	117 (PR-MUS)
Methylparaben (C ₈ H ₉ O ₃)	99-76-3	0.001	None	None	NA
FD&C Blue (C ₃₇ H ₃₆ N ₂ O ₈ S ₃ *2Na)	384445-9	0.0005	None	None	5.5g 1Kg (SCU-RAT)TD Lo
**Deionized Water (H ₂ O)	7732-18-5	99.526	None	None	190,000 (ORL-DOG)

III. PHYSICAL DATA

Boiling Point 750 mm Hg 100°C	Freezing Point 0°C
Specific Gravity (H ₂ O=1) 1.0	Vapor Pressure @ NA
pH @ 25 °C 10.01	Solubility In Water, % By Wt @ Miscible
Volatiles, % By Wt. NA	Evaporation Rate (BUTYL ACETATE = 1) NA
Vapor Density (AIR = 1) NA	
Appearance and Odor Light blue, odorless liquid	

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point (test Method) Not flammable	Autoignition Temperature NA
Flammable Limits in air, % by volume: Lower Upper	NA NA
Extinguishing Media Water, CO ₂ , Dry chemical, foam or spray	
Special Fire-Fighting Procedures None, non-flammable	
Unusual Fire and Explosion Hazards None	

- * Chemicals which are not classified as hazardous per U.S. OSHA guidelines (29CFR Parts 1915.2 or 1916.2) or the Massachusetts Substance List (105CMR670.000 Appendix A) will not necessarily be listed on this form even though one or more may be a constituent of this product
- * NA Not available/not applicable
- ** Non-hazardous component

Liability is expressly disclaimed for any loss or injury arising out of the use of this information or the use of any materials designated. Safe use of the materials is the responsibility of the user.

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Rev. C

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Form MSDS/1192

ATI ORION MATERIAL SAFETY DATA SHEET

Sheet 2 of 2

PRODUCT NAME: perpHect Buffer 10 Catalog No.: 911010, 911025

V. REACTIVITY DATA

Stability:	Conditions to Avoid		
Unstable	Stable	X	
Incompatibility (Materials to avoid)	NaK alloy, NH ₄ H ₂ PO ₄ , AL, P ₂ O ₅ , H ₂ SO ₄		
Hazardous Decomposition Products	CO ₂ Upon heating to decomposition		
Hazardous Polymerization:	Condition to Avoid		
May Occur	Will Not Occur	X	None

VI. HEALTH HAZARD DATA

Route(s) Of Entry:	Inhalation?	Skin?	Ingestion?
	No		Yes
Health Hazards (acute and chronic)	Acute: Non-hazardous due to the low levels of salt present. Chronic: Possible irritation of skin		
Carcinogenicity:	NTP?	IARC Monographs? ***	OSHA regulated?
	Not found	(animal positive)	Not found
Signs and Symptoms of Exposure	Irritation of skin		
Medical Conditions Generally Aggravated By Exposure	Could aggravate diseases of the skin.		
Emergency And First Aid Procedures	Wash off contact area with water. If ingested, give large amounts of water. Contact physician.		

VII. PRECAUTIONS (SAFE HANDLING AND USE)

Steps To Be Taken In Case Material Is Released Or Spilled
Clean up and set aside for waste disposal.
Waste Disposal Method
Consult with and observe all Federal, State and Local laws when disposing of this product.
Precautions To Be Taken In Handling And Storing
Suitable for any general handling and storage.
NFPA Rating: Scale (0-4) Fire 0, Health 1, Ractivity 0, Specific - None. Not affected by CAL Proposition 65

VIII. CONTROL MEASURES

Respiratory Protection (specify type)	None		
Ventilation	Local Exhaust	Special	No
	No		
Ventilation	Mechanical (General)	Other	No
	No		
Protective Gloves	Yes	Eye Protection	Safety glasses
Other Protective Clothing Or Equipment	No		
Work/Hygienic Practices	No eating or drinking while working with this product		

One Year Limited Warranty *

Factory Service

Isco instruments covered by this warranty have a one-year limited warranty covering parts and labor.

Any instrument that fails during the warranty period, due to faulty parts or workmanship, will be repaired at the factory at no charge to the customer. Isco's exclusive liability is limited to repair or replacement of defective instruments. Isco is not liable for consequential damages.

Isco will pay surface transportation charges both ways within the 48 contiguous United States if the instrument proves to be defective within 30 days of shipment. Throughout the remainder of the warranty period, the customer will pay to return the instrument to Isco, and Isco will pay surface transportation to return the repaired instrument to the customer. Isco will not pay air freight or customer's packing and crating charges.

The warranty for any instrument is the one in effect on date of shipment. Warranty period

begins on the shipping date, unless Isco agrees in writing to a different date.

Excluded from this warranty are normal wear; expendable items such as charts, ribbon, tubing, and glassware; and damage due to corrosion, misuse, accident, or lack of proper maintenance. This warranty does not cover Isco on-line Process Analyzers and certain Isco SFE instruments, which are covered under different warranty terms, nor does it cover products not sold under the Isco trademark or for which any other warranty is specifically stated in sales literature.

This warranty is expressly in lieu of all other warranties and obligations and Isco specifically disclaims any warranty of merchantability or fitness for a particular purpose. Any changes in this warranty must be in writing and signed by a corporate officer.

The warrantor is Isco, Inc. 4700 Superior, Lincoln, NE 68504. U.S.A.

* This warranty applies to USA customers. Customers in other countries should contact their Isco dealer for warranty service.

Before returning any instrument for repair, please call, fax, or e-mail the Isco service department for instructions. Many problems can often be diagnosed and corrected over the phone, or by e-mail, without returning the instrument to the factory.

Instruments needing factory repair should be packed carefully, preferably in the original carton, and shipped to the attention of the service department. Small, non-fragile items can be sent by insured parcel post. **PLEASE BE SURE TO ENCLOSE A NOTE EXPLAINING THE DEFECT.**

Return instruments to: Isco, Inc. - Attention Repair Service
4700 Superior Street
Lincoln NE 68504 USA

Mailing address: Isco, Inc.
PO Box 82531
Lincoln NE 68501 USA

Phone: Repair service: (800)775-2965 (lab instruments)
(800)228-4373 (samplers & flowmeters)
Sales & General Information (800)228-4373 (USA & Canada)

Fax: (402) 465-3001

Email: service@isco.com

