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# Crystal 12<sup>TM</sup>

## Sensor

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IPN 074-398-P1





O P E R A T I N G M A N U A L

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# Crystal12™

## Sensor

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IPN 074-398-P1A



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Part # (see Title Page) 074-

Aspect	Very Dissatisfied	Dissatisfied	No Opinion	Satisfied	Very Satisfied	Importance (ranked from 1 to 5, where 1 is low and 5 is high)
Found everything I needed	VD	D	NO	S	VS	
Easy to read	VD	D	NO	S	VS	
Easy to use	VD	D	NO	S	VS	
Relevant to my work	VD	D	NO	S	VS	
Accurate information	VD	D	NO	S	VS	
Well-written	VD	D	NO	S	VS	
Well-organized	VD	D	NO	S	VS	
Technical Enough	VD	D	NO	S	VS	
Helped me solve problems	VD	D	NO	S	VS	

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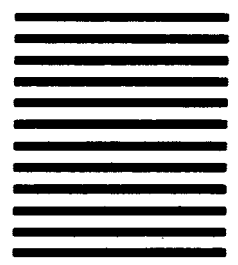
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# Table Of Contents

## Chapter 1

### Sensor Specifications

1.1	Specifications for Crystal12 Sensor 750-667-G1 . . . . .	1-1
1.1.1	Installation Requirements . . . . .	1-2
1.1.1.1	Feedthrough . . . . .	1-2
1.1.1.2	Other . . . . .	1-2
1.1.1.3	Utilities . . . . .	1-2
1.1.2	Materials . . . . .	1-3
1.1.3	Unpacking Instructions . . . . .	1-3
1.1.4	Inventory . . . . .	1-4
1.1.4.1	Standard . . . . .	1-4
1.1.4.2	Options . . . . .	1-4
1.2	Using this Manual . . . . .	1-12
1.2.1	Symbols and their Definitions . . . . .	1-12
1.3	How to Contact Customer Support . . . . .	1-13
1.3.1	Returning Your Crystal12 Sensor to INFICON . . . . .	1-13

## Chapter 2

### Sensor Installation

2.1	Crystals in the Crystal12 Sensor . . . . .	2-1
2.1.1	Handle the Crystal with Care . . . . .	2-1
2.1.2	Replacing Crystals . . . . .	2-1
2.2	Pre-installation Sensor Check . . . . .	2-2
2.2.1	Cygnus Deposition Controller . . . . .	2-3
2.3	General Guidelines for Crystal12 Sensor . . . . .	2-3
2.3.1	Crystal Sensor Installation . . . . .	2-5
2.4	Crystal12 Sensor Installation when used with Cygnus . . . . .	2-7
2.4.1	Changing Crystal Sensor Type and Programming the Relay Outputs . . . . .	2-7
2.4.2	Wiring the Relay Outputs with Relay I/O Boards 760-162-G1 or 760-162-G1/G2 . . . . .	2-9
2.5	Crystal12 Operation when used with a Cygnus . . . . .	2-11
2.5.1	Initialization . . . . .	2-11
2.5.2	Crystal Switching . . . . .	2-11
2.6	Crystal12 Sensor Requirement when Not Installed with a Cygnus . . . . .	2-12

## Chapter 3

### Installation of the Solenoid Valve Assembly

3.1	Installation with 1" Bolts . . . . .	3-1
3.2	Installation with 2 3/4" Feedthrough . . . . .	3-2
3.3	Electrical and Pneumatic Connections . . . . .	3-3
3.3.1	Electrical . . . . .	3-3
3.3.2	Pneumatic Solenoid Tube Connections . . . . .	3-3

## Chapter 4

### Maintenance

4.1	General Precautions . . . . .	4-1
4.1.1	Maintain the Temperature of the Crystal . . . . .	4-1
4.1.2	Use the Optimum Crystal Type . . . . .	4-1
4.1.3	Crystal Concerns when Opening the Chamber . . . . .	4-1
4.2	Crystal Seat Maintenance . . . . .	4-2
4.3	Alignment Instruction for Crystal12 Sensor (IPN 750-667) . . . . .	4-2
4.3.1	Required Equipment . . . . .	4-2
4.3.2	Procedure . . . . .	4-3
4.3.3	Replacing the Bellows Assembly (750-286-P2) . . . . .	4-6
4.3.3.1	Equipment required: . . . . .	4-6
4.3.3.2	Procedure . . . . .	4-6
4.3.4	Replacing the Electrical Connection Assembly . . . . .	4-7
4.3.4.1	Equipment Required . . . . .	4-7
4.3.4.2	Procedure . . . . .	4-7
4.4	Cygnus Status and Error Messages . . . . .	4-8
4.5	Troubleshooting the Crystal12 Sensor . . . . .	4-8

## Chapter 5

### Feedthrough Outline Drawings

# Chapter 1

## Sensor Specifications

### 1.1 Specifications for Crystal12 Sensor 750-667-G1

The Crystal12 sensor is a twelve crystal quartz crystal deposition monitor transducer. When the monitor crystal being used fails, a new crystal is advanced into position, fully replacing the failed crystal's function. The mechanism used for providing this motion is pneumatically powered. The logic for automatic operation of this transducer is provided with the Cygnus™ Deposition Controller. See [Figure 1-1](#) and [Table 1-1](#).

Figure 1-1 Crystal12 Sensor



Table 1-1 Sensor Specification

Maximum bakeout temp with no water	130 °C
Maximum operating isothermal environment temperature with minimum water flow	300 °C
Size (maximum envelope)	4.0" (102 mm) dia. x 3.3" (84 mm) high 4.75" (121 mm) dia. x 3.46" (88 mm) with optional mounting posts installed
Water, air and coax length	Standard 30" (762 mm)
Crystal exchange	Front-loading
Mounting	Six #4-40 tapped holes on the back of the sensor body, six #4-40 tapped holes on outside circumference. Three #6-32 tapped holes with optional mounting kit.

## 1.1.1 Installation Requirements

### 1.1.1.1 Feedthrough

- ◆ Qty (1) 2-3/4" ConFlat® with two coaxial feedthroughs, two pass water, one air IPN 002-080, See [Figure 5-2 on page 5-2](#) or,
- ◆ Qty (1) 1" bolt with 1 coaxial feedthrough, two pass water, one air IPN 750-030-G1, see [Figure 5-1 on page 5-1](#).

### 1.1.1.2 Other

- ◆ User to provide mounting structure adequate to support weight of Crystal12 and designed to facilitate removal and replacement with minimal change in exact position. An optional mounting post kit, IPN 750-670-G1, may be purchased for this purpose.



### CAUTION

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**Do not mount the Crystal12 unsupported.**

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- ◆ User to provide vacuum-tight braze joints or connectors for the water and air tubes.
- ◆ Valve assembly for air, IPN 750-420-G1 (not provided), with a 0.022" restrictor orifice installed by the user. (Orifice included with Crystal12 accessory kit.) See [Table 1-3 on page 1-4](#).
- ◆ XIU or Oscillator designed to interface with the Cygnus controller.

### 1.1.1.3 Utilities

- ◆ Minimum water flow 150-200 cc/min, 30 °C max (Do not allow water to freeze). Coolant should not contain chlorides as stress corrosion cracking may occur.
- ◆ Regulated air supply 80-90 PSIG (5.5 bar - 6.2 bar) [550 kPa - 620 kPa]
- ◆ 2 meter maximum length of 1/8" tubing between bellows assembly and the control valve.



### CAUTION

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**Do not allow water tubes to freeze. This may happen if the tubes pass through a cryogenic shroud and the fluid's flow is interrupted.**

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## 1.1.2 Materials

Table 1-2 Materials

Plate, Material Shield, Mechanical Parts, Body and Carousel	304 type stainless steel
Springs, Electrical Contacts	Au plated Be-Cu, Au Plate 302 stainless steel
Water and air tubes	S-304, 0.125" (3.2 mm) O.D. x .016" (0.4 mm) Wall Thickness x 30" Long (762 mm) Seamless Stainless Steel Tubing
Connector	Stainless steel
Insulators	Teflon®, Peek®
Cable	Teflon insulated copper plated steel
Crystal	0.550" (13.97 mm) Diameter

## 1.1.3 Unpacking Instructions

The Crystal12 sensor and accessories are packaged in a single cardboard carton with rigid foam inserts.

Carefully remove the packaged accessories before removing the sensor.

The unit in the shipped condition has been aligned at the factory, no further alignment is required.

During shipment, units may vibrate slightly out of position. This does not mean alignment is required. The unit will return to the centered position the first time it is pneumatically activated.

## 1.1.4 Inventory

### 1.1.4.1 Standard

In addition to the basic transducer, the complete shipping package includes an accessory kit (IPN 750-268-G3) which consists of the following:

Table 1-3 Contents of Accessory Kit

Qty	IPN	Description
X	750-268-G3	Accessory Kit, Crystal12 Sensor
1	750-254-G2	Assembly, Alignment Tool
1	074-5000	CD, Thin Film Manuals
2	008-010-G10	Sensor Crystal 6 MHz (10 crystals per package)
1	059-189	CC-1010-0225 Orifice 0.0225" diameter
2	070-201	#4 Split Lock Washer, Stainless Steel
2	084-032	#4-40x0.375" Long Socket Head Cap Screw, Stainless Steel
2	084-039	#4-40x0.500" Long Socket Head Cap Screw, Stainless Steel
2	084-084	#4-40x0.688" Long Socket Head Cap Screw, Stainless Steel
1	070-828	Hex Wrench 1/16" SC9-3
1	070-829	Hex Wrench 3/32" SC9-5
1	070-1175	Hex Wrench 5/64" SC9-4
1	750-037-G1	Spring Tube Bender Kit
1	750-191-G1	Molybdenum Disulfide in Alcohol

### 1.1.4.2 Options

Table 1-4 Options

Qty	IPN	Description
1	750-670-G1	Mounting Post Kit
1	750-420-G1	3-Way Solenoid Valve Assembly



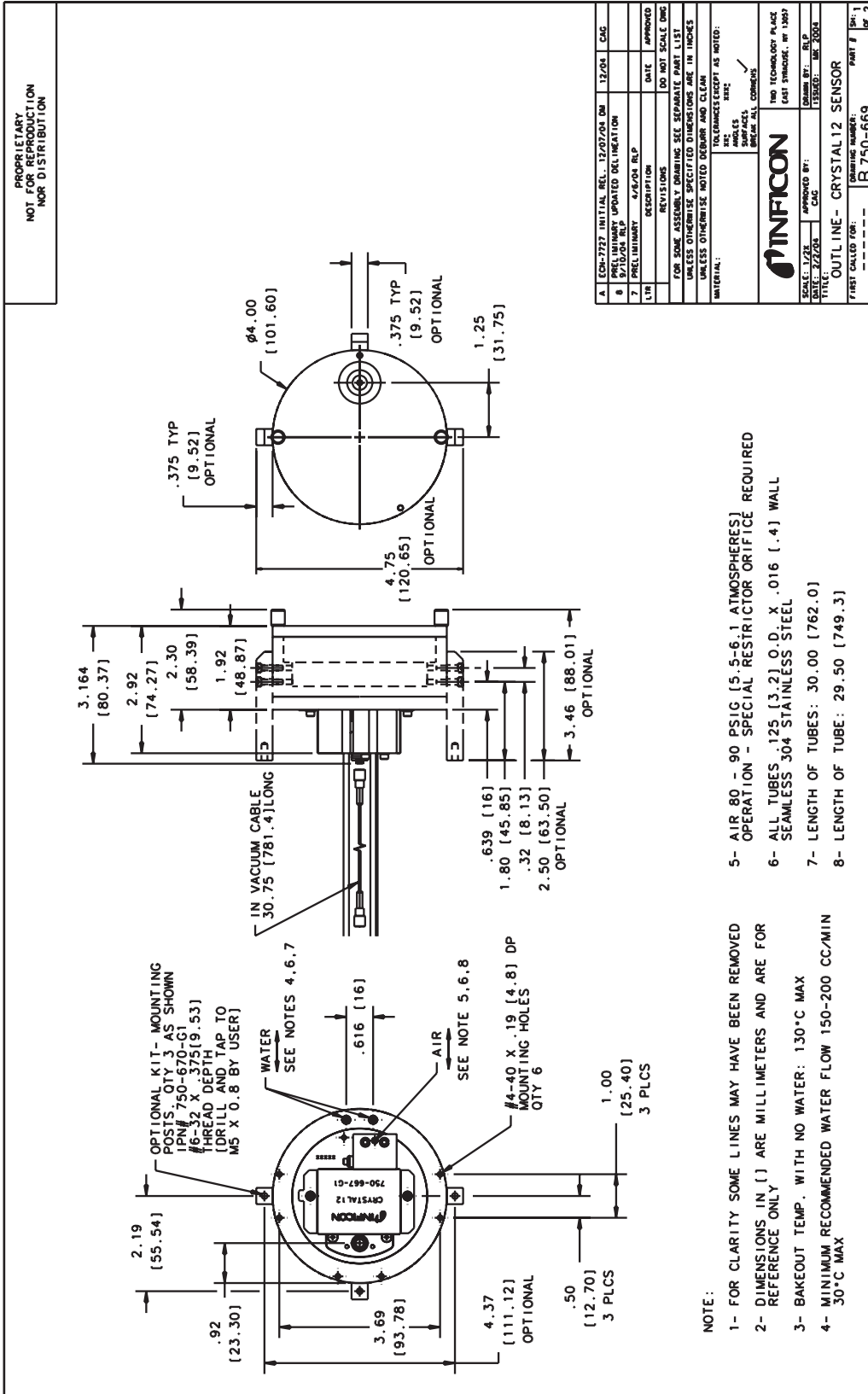


Figure 1-2 Outline of Crystal12 Sensor - Page 1 of 2

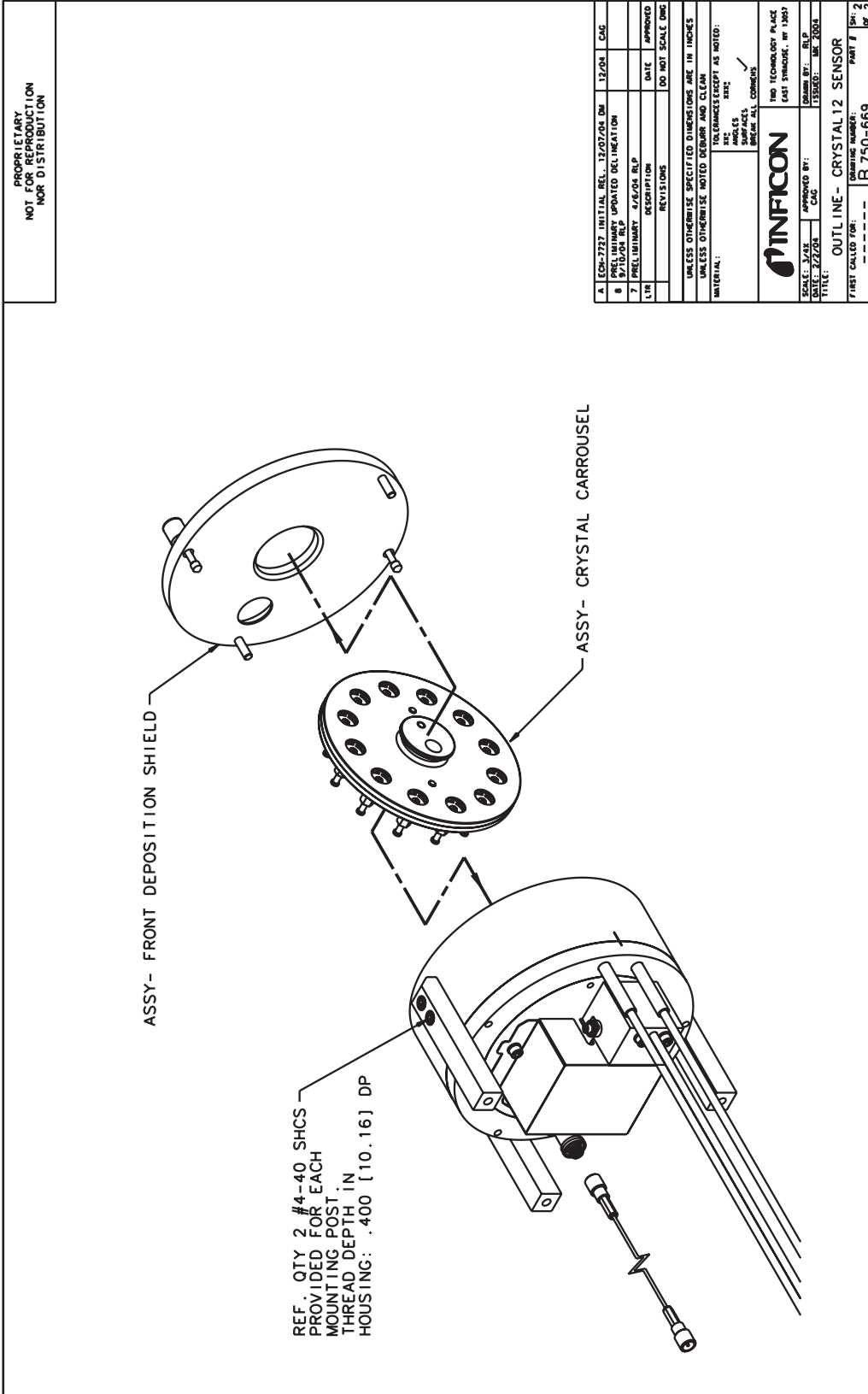


Figure 1-3 Outline of Crystal12 Sensor - Page 2 of 2

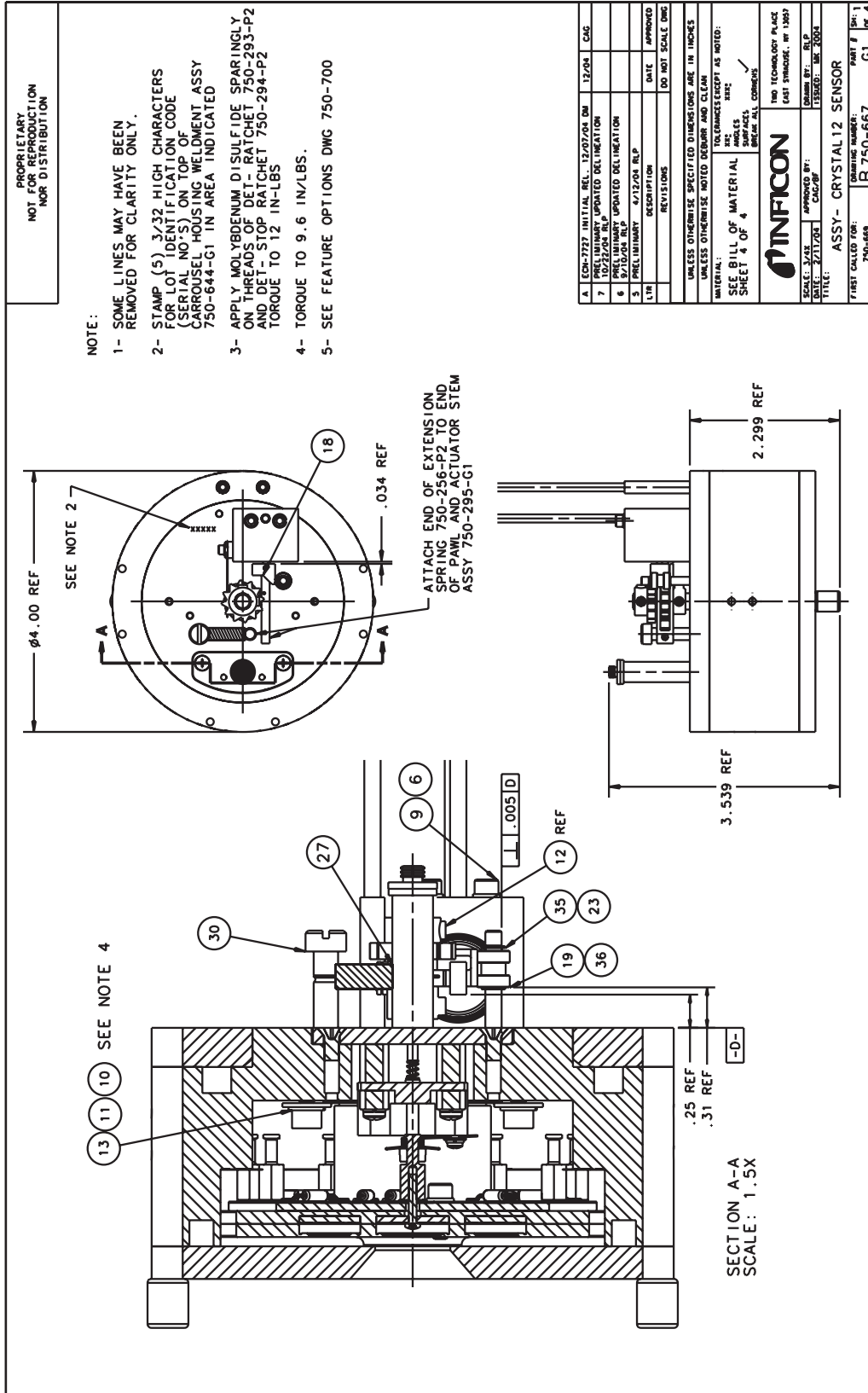


Figure 1-4 Assembly Crystal12 Sensor - Page 1 of 4

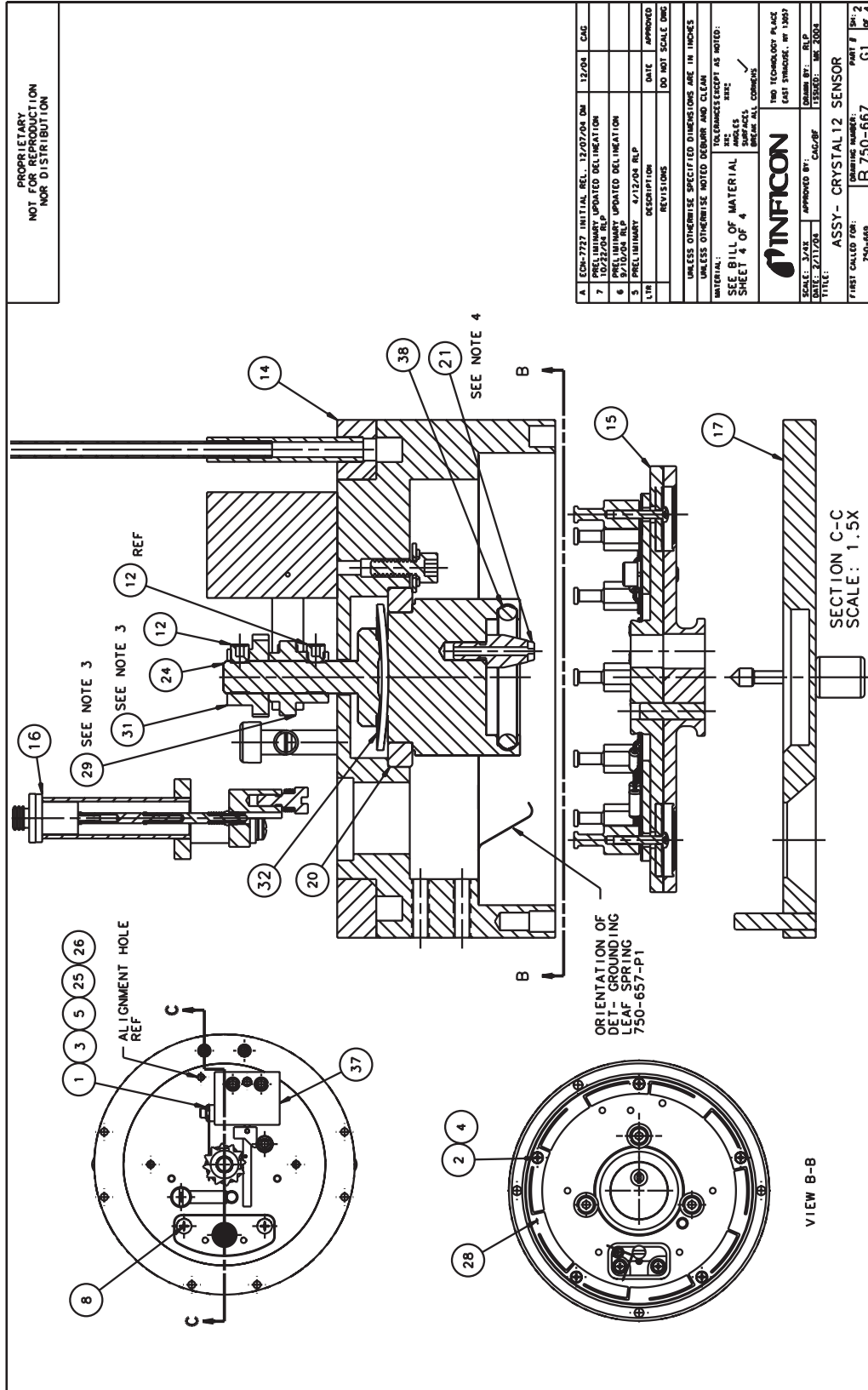


Figure 1-5 Assembly Crystal12 Sensor - Page 2 of 4

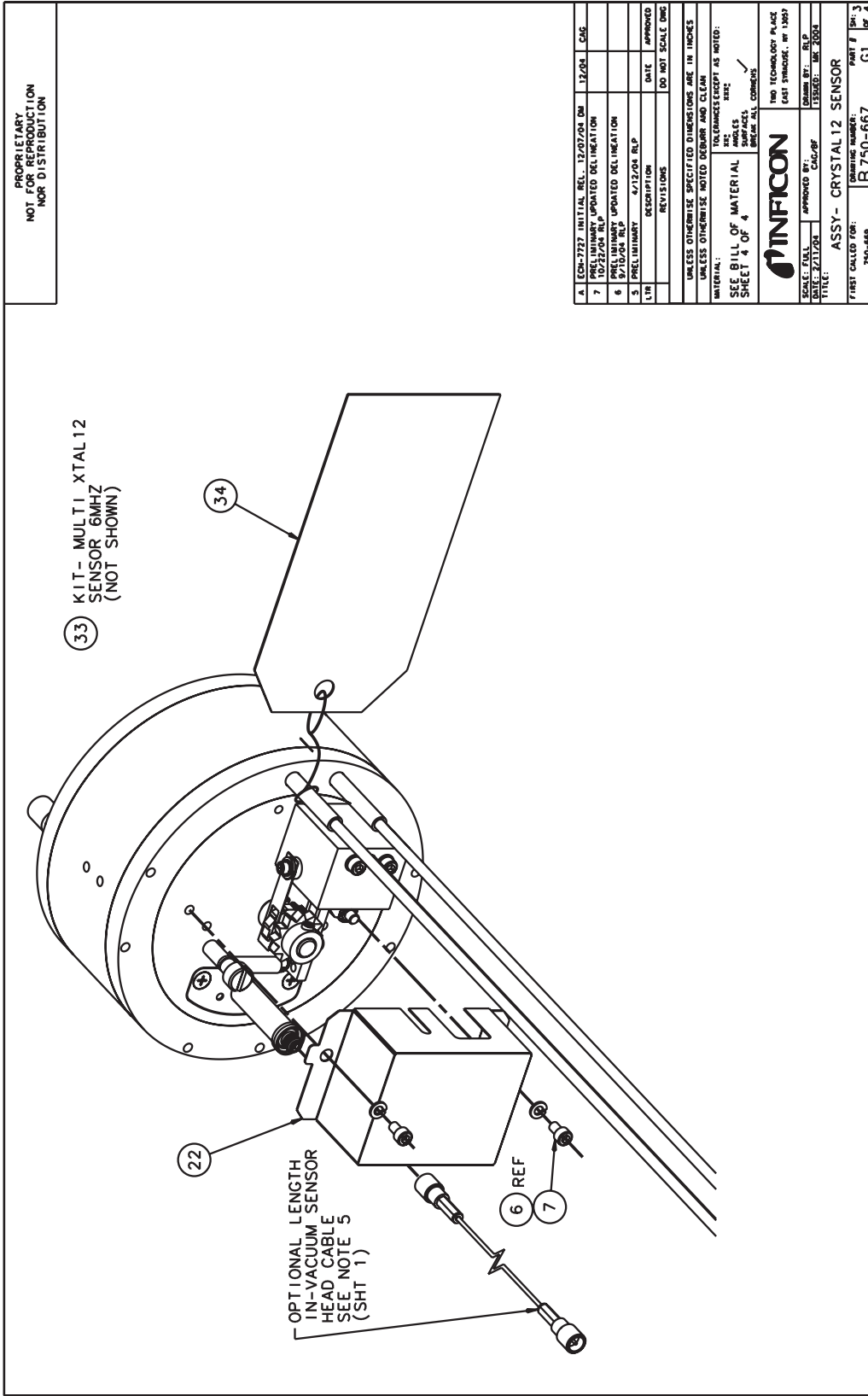
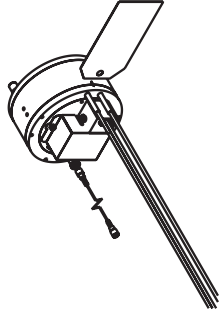


Figure 1-6 Assembly Crystal12 Sensor - Page 3 of 4

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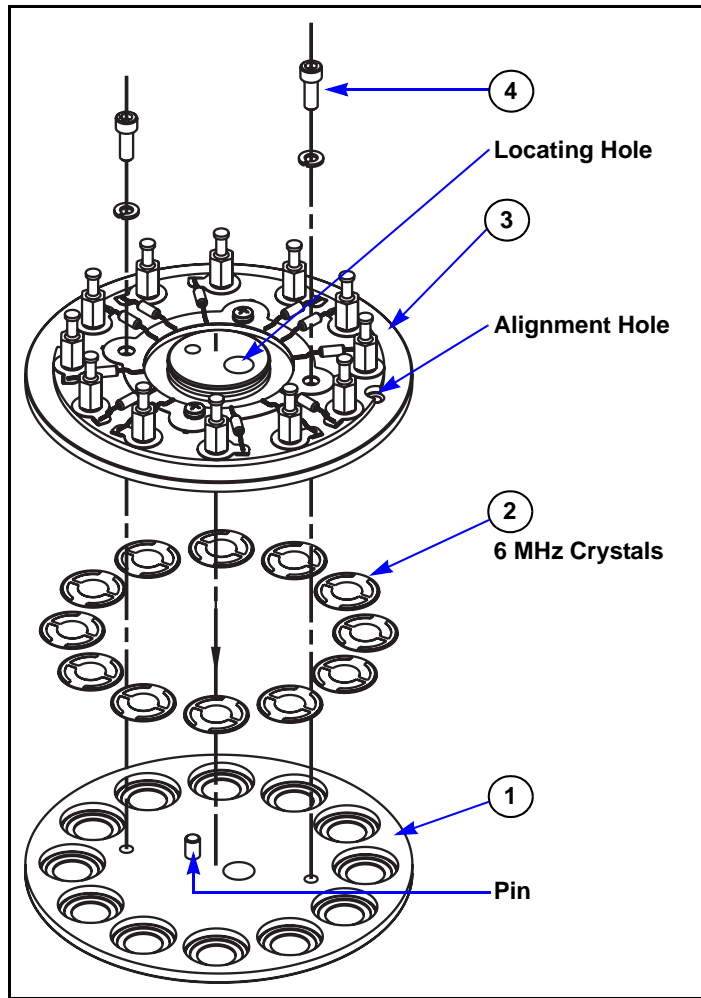


Item	Qty	Part #	Name
1	1	082-032	#2 INTERNAL LOCK WASHER SS
2	5	070-170	#2 SPLIT LOCK WASHER SS
3	1	082-022	#2 WASHER PLAIN SS
4	5	082-045	#2-56 X .187 LG PHIL PAN HD SCR SS
5	1	082-024	#2-56 X .250 LG HEX SOC HD CAP SCR SS
6	4	070-201	#4 SPLIT LOCK WASHER SS
7	2	084-044	#4-40 X .187 LG SOC HD CAP SCR SS
8	2	084-048	#4-40 X .250 LG PHIL FLAT HD SCREW SS
9	2	084-093	#4-40 X 1.125 LG SOC HD CAP SCR SS
10	3	086-041	#6 FLAT WASHER SS
11	3	086-038	#6 SPLIT LOCK WASHER SS
12	4	086-084-P2	#6-32 X .125 LG SOC SET SCR SS HARDENED NI PLATED
13	3	086-036	#6-32 X 3/8 SOC HD CAP SCR SS
14	1	750-644-G1	ASSY- CARROUSEL HOUSING WELDMENT
15	1	750-652-G1	ASSY- CRYSTAL CARROUSEL
16	1	750-649-G1	ASSY- ELECTRICAL CONNECTION
17	1	750-658-G1	ASSY- FRONT DEPOSITION SHIELD
18	1	750-295-G1	ASSY- PAWL AND ACTUATOR STEM
19	2	070-779	BALL BEARING .250 OD X .125 BORE #A. 7Y55-P2512 NO LUB
20	1	070-1268	BEARING 1.375 OD X 1.000 ID X .187 THK SS
21	1	750-660-P1	DET- #6-32 LOCATION SCREW
22	1	750-276-P3	DET- ACTUATOR COVER
23	1	750-258-P2	DET- BEARING SHAFT
24	1	750-647-P1	DET- CARROUSEL SPINDLE BODY
25	1	750-291-P1	DET- DETENT
26	1	750-292-P2	DET- DETENT SPACER
27	1	750-256-P2	DET- EXTENSION SPRING
28	1	750-657-P1	DET- GROUNDING LEAF SPRING
29	1	750-293-P2	DET- RATCHET
30	1	750-252-P2	DET- SPRING POST
31	1	750-294-P2	DET- STOP RATCHET
32	1	070-1254	E-RING BOWED #51310075H5TB TRUARC
33	1	750-268-G3	KIT- MULTI XTAL12 SENSOR 6MHZ
34	1	750-299-P1	OPERATING PRESSURE TAG
35	2	070-398	RETAINING RING TRUARC 5103-12H
36	1	070-867	SHAFT SPACER .125 ID X .187 OD X .094 THK SS PIC B4-10
37	1	750-286-P2	SPEC- BELLOWS ASSY
38	1	750-626-P1	SPEC- SPRING X213841

A	CON-7222	INITIAL REL. 12/07/04 DM	12/04	CAG
7		PRELIMINARY UPDATED DELINEATION		
6		PRELIMINARY UPDATED DELINEATION		
5		PRELIMINARY 4/12/04 RLP		
4		DESCRIPTION	DATE	APPROVED
3		REVISIONS		DO NOT SCALE DIMS
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES				
MATERIAL: TOLERANCES EXCEPT AS NOTED:				
SEE BILL OF MATERIAL				
SHEET 4 OF 4				
IND TECHNOLOGY PLACE EAST SYDNEY, NT 13657				
SCALE: 1/16" = 1" / 1/32" = 1" / 1/16" = 1" / 8" = 1"				
DRAWN BY: RLP				
CHECKED BY: JMB/RLP				
APPROVED BY: CAG/CBF				
ASSY - CRYSTAL 12 SENSOR				
FIRST CALLED FOR: 750-669				
DRAWING NUMBER: B 750-667				
PART # SH-4				
G1 of 4				

Figure 1-7 Assembly Crystal12 Sensor - Page 4 of 4

Figure 1-8 Crystal Carousel



## 1.2 Using this Manual

Please take a moment to read the following.

### 1.2.1 Symbols and their Definitions

**NOTE:** Notes provide additional information about the current topic.

**HINT:** Hints provide insight into product usage.



---

#### **CAUTION**

**This caution paragraph cautions against actions which may bring about a malfunction or the loss of data.**

---



---

#### **WARNING**

**This warning paragraph warns of actions that may result in physical injury to the user.**

---



---

#### **WARNING - Risk Of Electric Shock**

**This warning paragraph warns of potentially lethal voltages.**

---



## 1.3 How to Contact Customer Support

If you need assistance with your sensor, please read this Operating Manual before contacting Customer Support. If you can not find the answer in this manual, decide whether:

- ◆ Your sensor functions, but it does not work for your application — request Application Assistance.
- ◆ Your sensor functions, but you need to know how to use it — request Technical Support.
- ◆ Your sensor does not function (it's broken) — request Repair Services.
- ◆ You need to order parts — request Order Services.

When you contact Customer Support, please have the following information readily available:

- ◆ The Lot Identification Code for your sensor. For the location of the Lot Identification Code, refer to [Figure 1-4 on page 1-7](#).
- ◆ A description of your problem.
- ◆ An explanation of any corrective action that you may have already attempted.
- ◆ The exact wording of any error messages that you have received.

To contact Customer Support, refer to the contact list located at the front of this manual. Or, contact your sales office. Or, see the [www.inficon.com](http://www.inficon.com) website.

### 1.3.1 Returning Your Crystal12 Sensor to INFICON

Do not return any component of your sensor to INFICON without first speaking with a Customer Support Representative. You must obtain a Return Material Authorization (RMA) number from the Customer Support Representative.

If you deliver a package to INFICON without an RMA number, your package will be held and you will be contacted. This will result in delays in servicing your sensor.

Prior to being given an RMA number, you will be required to complete a Declaration Of Contamination (DOC) form if your sensor has been exposed to process materials. DOC forms must be approved by INFICON before an RMA number is issued. INFICON may require that the sensor be sent to a designated decontamination facility, not to the factory. Failure to follow these procedures will delay the repair of your sensor.

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## Chapter 2

# Sensor Installation

Successful operation of any crystal sensor depends on proper placement, compatibility of its construction with its operating environment and connection to proper utilities.

**NOTE:** The sensor head, water tubes, cable, etc. should be clean and grease free when installed in the vacuum chamber. These parts should be handled while wearing clean nylon gloves. If parts do become contaminated, clean them thoroughly using a suitable solvent to avoid outgassing and excessive peeling of deposition material from the sensor's surfaces.

## 2.1 Crystals in the Crystal12 Sensor

### 2.1.1 Handle the Crystal with Care

Always use clean nylon lab gloves and clean nylon or Teflon tweezers when handling the crystal. Handle the crystals only by their edges. Anything that comes in contact with the crystal surfaces may leave contamination, which may lead to poor film adhesion. Poor film adhesion will result in high rate noise and premature crystal failure.



#### CAUTION

**Do not use metal tweezers to handle crystals. Metal tweezers may chip the edge of the crystal and lead to short life, erratic resonance, or both.**

### 2.1.2 Replacing Crystals

Replacing crystals in the Crystal12 requires removal of the front deposition shield (item 17, [Figure 1-5 on page 1-8](#)). This is accomplished by removing the two captive fasteners that attach the front deposition shield to the carousel housing (item 14, [Figure 1-5 on page 1-8](#)).

The crystal carousel (item 15, [Figure 1-5 on page 1-8](#)) is removed from the carousel housing by gripping the carousel assembly by the protruding hub and applying pressure using your index finger near the radial edge of the carousel.

The Cygnus detects when a carousel is removed and displays a "Carousel Change-Out" message. When a carousel change-out occurs, all crystals are identified as failed with a message displayed on the channel pages. Crystal

position 12 is displayed as the assumed current position until the change-out is complete and a rotate head or crystal switch function is performed. At the end of the rotate head function, the sensor will be at position number 1.

Replacement of the twelve monitor crystals requires the removal of the two fasteners (item 4, [Figure 1-8 on page 1-11](#)) that secure the two halves (items 1 and 3) of the assembly.

Exchanging the crystals is accomplished by inverting the plate (item 1, [Figure 1-8 on page 1-11](#)) containing the used crystals and installing the new crystals (item 2) in the orientation shown in [Figure 1-8 on page 1-11](#).

Reassemble the crystal carousel assembly by orientating the pin protruding from item 1 (refer to [Figure 1-8 on page 1-11](#)) with the hole provided in item 3, then securing the two halves with fasteners (item 4).

To install the carousel assembly into the Crystal12 sensor, grasp the carousel assembly by the protruding hub and orient the locating hole of the carousel assembly (item 15, [Figure 1-5 on page 1-8](#)) with the #6-32 location screw (item 21, [Figure 1-5 on page 1-8](#)). The carousel assembly should snap into place.

Orient and attach the front deposition shield (item 17, [Figure 1-5 on page 1-8](#)) to the carousel housing (item 14, [Figure 1-5 on page 1-8](#)) using the two knurled captive fasteners.

The crystal status and "Carousel Change-Out" message on the Cygnus display will remain unchanged subsequent to a carousel replacement until one of the following occurs.

- ◆ A "Rotate Head" function is initiated via remote communications, or from the front display soft key of either the ALL CHANNELS MAINTENANCE display or the individual CHANNEL SENSOR MAINTENANCE display. This is the preferred method because it ensures the correct position is detected while providing an accurate accounting of good and failed crystals.
- ◆ A crystal switch function via the front display "soft key", hand held controller or remote communication is initiated.
- ◆ The user manually rotates the carousel to make electrical contact.

When the Cygnus detects a crystal position, the "Carousel Change-Out" message is removed and all crystals are labeled as good.

## **2.2 Pre-installation Sensor Check**

Prior to installing the sensor in the vacuum system, you should make certain it is in proper working condition by following the procedure outlined below.

### 2.2.1 Cygnus Deposition Controller

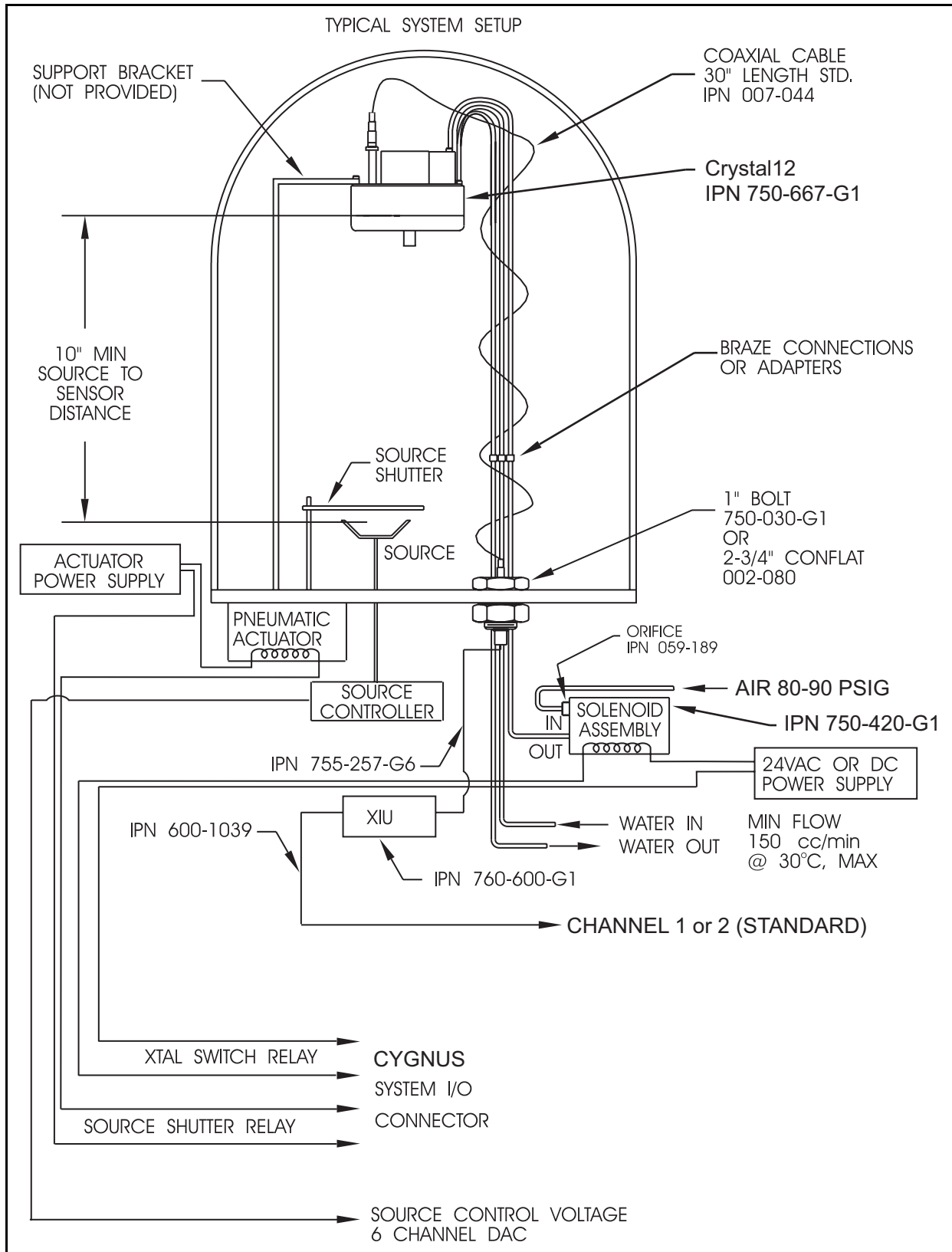
- 1 Connect the in-vacuum sensor head cable to the feedthrough or a coax adapter (Microdot/BNC).
- 2 Connect one end of the 6" XIU cable (IPN 755-257-G6) to the BNC connector of the feedthrough.
- 3 Connect the other end of the 6" XIU cable to the connector of the XIU (IPN 760-600-G1).
- 4 Connect one end of the XIU cable (IPN 600-1039-Gxx) to the mating connector of the XIU.
- 5 Connect the other end of the XIU cable to a sensor channel at the rear of the controller.
- 6 Connect power to the controller and set the power switch to ON. The instrument will power up in the ALL CHANNELS display.
  - ♦ If the RATE field corresponding to the sensor channel selected in the previous step is displayed in normal video and is actively being updated, you can assume the sensor is in proper working order and may be installed.
  - ♦ If the RATE field is displayed in inverse video, a failed crystal condition exists for the specific channel. The carousel assembly (item 15, [Figure 1-5 on page 1-8](#)) may have to be manually advanced by hand to make an electrical contact to correct the failed condition.

**NOTE:** The carousel assembly may also be advanced by temporarily connecting a regulated air supply (80-90 PSIG (5.5 bar - 6.2 bar) [550 kPa - 620 kPa]) to the tube of the bellows assembly (item 37, [Figure 1-5 on page 1-8](#)).

### 2.3 General Guidelines for Crystal12 Sensor

[Figure 2-1](#) shows the typical installation of an INFICON water-cooled crystal sensor in the vacuum process chamber. Refer to Chapter 3 for information regarding the installation of the solenoid valve assembly (750-420-G1) used to pneumatically index the sensor. Use the illustration and the following guidelines to install your sensor(s) for optimum performance and convenience.

Figure 2-1 Typical Crystal12 Installation for Cygnus

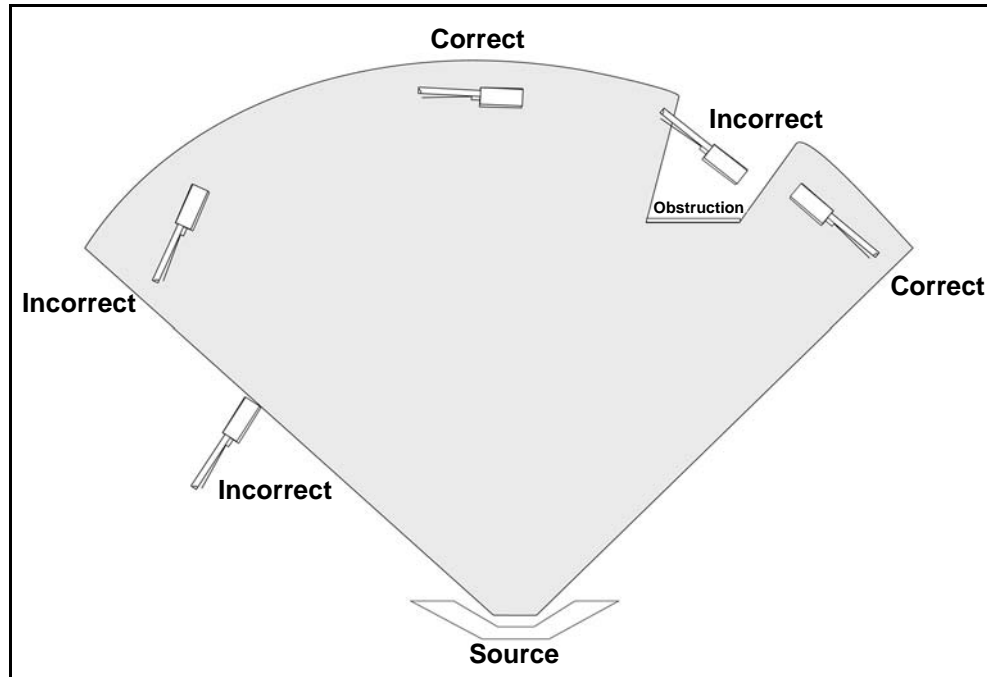


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### 2.3.1 Crystal Sensor Installation

Generally, install the sensor as far as possible from the evaporation source (a minimum of 10" or 25.4 cm) while still being in a position to accumulate thickness at a rate proportional to accumulation on the substrate. Figure 2-2 shows proper and improper sensor positioning.

Figure 2-2 Sensor Installation Guidelines



To guard against spattering, use a source shutter to shield the sensor during the initial soak periods. If the crystal is hit with even a minute particle of molten material, it may be damaged and stop oscillating. Even in cases when it does not completely stop oscillating, it may immediately become unstable, or shortly after deposition begins instability may occur.

Plan the installation to insure that there are no obstructions blocking a direct path between the sensor and the source.

Install sensors in such a manner that the center axis of the crystal is aimed directly at the source to be monitored. Verify that the angle of the sensor location (with reference to the source) is well within the evaporant stream.

Attach the sensor with a mounting bracket anchored to the deposition chamber. With the bracket in place, temporarily position and attach the sensor head as outlined in the general guidelines above. Next, temporarily install the feedthrough. You may now form, measure, and mark the sensor's tubes (use the bending tool (IPN 750-036) to form tubes in the system).

Build the Sensor/Feedthrough Assembly. Remove the sensor and the feedthrough, cut the water cooling tubes and air tubes to the proper length and connect them directly to the feedthrough or use vacuum rated couplings.



### CAUTION

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**To prevent damage to the feedthrough or sensor during welding or brazing, insure that at least one inch of water tube is left between the sensor and the feedthrough.**

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After cutting the water and air tubes, verify that they are clear of metal particles by forcing compressed air through the tubing. Heliarc welding is recommended (torch brazing may also be acceptable) for connecting the sensor to the feedthrough water tube.

Vacuum rated connectors such as CAJON® are recommended for use between the sensor and the feedthrough to speed maintenance. If brazing adapters are to be used, attach them to the sensor water-cooling tubes prior to connection to the feedthrough. Make connections as follows:

- 1 Clean the water tube and adapter surfaces with solvent if necessary.
- 2 Apply brazing flux to surfaces being joined.
- 3 Braze the connections using a flame temperature appropriate for the brazing material being used.



### CAUTION

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**Excessive application of brazing material, or excessive heat due to brazing, may result in blockage of the water tube.**

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- 4 Verify that each joint is not blocked by blowing compressed air through the cooling tubes.
- 5 Thoroughly clean the braze joint and helium leak test before installing the sensor and feedthrough into the process chamber.

Once all water and air tube connections are fabricated, install the sensor and feedthrough assembly into the process system and secure all retaining hardware. Shield the coax cable from heat radiating from the evaporant source or the substrate heater. You can do this very simply, if your process allows, by wrapping aluminum foil around the cable and water tubes. Connect the external water tubes from the feedthrough to your water supply system and flow controller. We recommend using detachable couples (Swagelok® or equivalent) for external water tube connections. Apply water pressure to verify flow and tightness.



Because of geometric factors, variations in surface temperature, and differences in electrical potential, the crystal and substrates often do not receive the same amount of material. If you want the thickness indication on the controller to represent the thickness on the substrates, calibration is required to determine the tooling. Consult your controller's manual for the proper procedure for obtaining the tooling factor.



### CAUTION

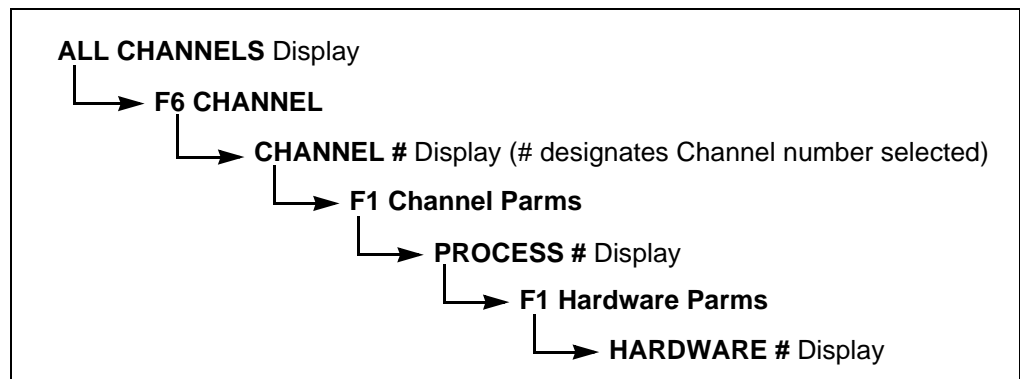
Use of more than 80" (2 meters) of 1/8" tubing between the valve and the bellows may cause a switcher failure because of the time required to bleed out sufficient air during de-pressurization. If tubing greater than 1/8" is used, the maximum length must be reduced proportional to the additional volume.

## 2.4 Crystal12 Sensor Installation when used with Cygnus

### 2.4.1 Changing Crystal Sensor Type and Programming the Relay Outputs

- 1 Display the Hardware # Display (see [Figure 2-3](#)).

Figure 2-3 Display Tree for HARDWARE # Display.



- Select Sensor Type: 1 (Single); 2 (CrystalTwo); 6 (CrystalSix); 12 (Crystal12). See [Figure 2-4](#).

Figure 2-4 Selecting Sensor Type Example

HARDWARE 2		PROCESS PARMs
DAC Settings		
Source Voltage Range	3	
DAC Rate Range	0	
Substrate Shutter		
Output	0	
Output Type	0	
Sensor		
Shutter Output	0	
Shutter Output Type	0	
Type	<input type="text" value="1"/>	
Crucible		
Number of Crucibles	1	
		CHANNEL

- If a Sensor Type 2, 6 or 12 is selected, a Switch Output field appears. Select the relay output number to be used to activate the crystal switch. See [Figure 2-5](#).

Figure 2-5 Selecting the Output Number Example

HARDWARE 2		PROCESS PARMs
DAC Settings		
Source Voltage Range	3	
DAC Rate Range	0	
Substrate Shutter		
Output	0	
Output Type	0	
Sensor		
Shutter Output	0	
Shutter Output Type	0	
Type	12	
Switch Output	<input type="text" value="1"/>	
Crucible		
Number of Crucibles	1	
		CHANNEL

## 2.4.2 Wiring the Relay Outputs with Relay I/O Boards 760-162-G1 or 760-162-G1/G2

On the relay connector, connect the leads of the solenoid valve across the one side of a 24 volt supply and one side of a relay (1-8, 1-16, or 1-24; whichever was programmed). See [Table 2-1](#).

Table 2-1 +24 V(dc) Pin Connections

Pin	Function
1	Return
2	Return
3	Return
4	Not Connected
5	Not Connected
6	+24 Volts
7	+24 Volts
8	+24 Volts
9	Not Connected



### CAUTION

**Both the isolated 24 V(dc) supply and the RS-232C remote communications port use a 9-pin D-sub connector. Care must be taken not to inadvertently connect the RS-232C remote communications cable to the 24-volt supply connector. Also, care must be taken not to inadvertently connect the 24 V(dc) supply cable to the RS-232C remote communications connector.**

Connect a jumper between the second side of the 24 volt supply and the second side of the selected relay. See [Table 2-2](#).

Table 2-2 Input/Relay Pin Connections

Relay #	Pins	TTL Input #	Pin	Relay	Pins	TTL Input #	Pin
<b>I/O Board #1</b>				<b>I/O Board #3</b>			
1	7, 6	1	15	17	7, 6	25	9
2	9, 8	2	14	18	9, 8	26	10
3	11, 10	3	13	19	11, 10	27	11
4	13, 12	4	12	20	13, 12	28	12
5	5, 4	5	11	21	5, 4	29	13
6	3, 2	6	10	22	3, 2	30	14
7	1, 14	7	9	23	1, 14	31	15
8	15, 16	8	8	24	15, 16	32	1
		9	7			33	2
		10	6			34	3
		11	5			35	4
		12	4			36	5
		13	3			37	6
		14	2			38	7
		GND	1			GND	8
<b>I/O Board #2</b>							
9	7, 6	15	15				
10	9, 8	16	14				
11	11, 10	17	13				
12	13, 12	18	12				
13	5, 4	19	11				
14	3, 2	20	10				
15	1, 14	21	9				
16	15, 16	22	8				
		23	7				
		24	6				
		25	5				
		26	4				
		27	3				
		28	2				
		GND	1				

## 2.5 Crystal12 Operation when used with a Cygnus

### 2.5.1 Initialization

An automatic Rotate Head function occurs when the Cygnus is first powered on, assuming that a channel's crystal Sensor Type is configured as a Crystal12.

**HINT:** It is important to perform a Rotate Head function after a carousel change-out, or after changing the crystal sensor type.

Whenever a Rotate Head function is initiated, the Cygnus will advance the Crystal 12 carousel until it locates Position 1. After Position 1 is located, the Rotate Head function begins cataloging the crystals at each position as either good or failed.

- ◆ Because Position 1 is unique, the Crystal 12 always ends on Position 1.
- ◆ A Rotate Head function could require as many as 11 pulses to initially find position 1 and an additional 12 pulses to catalog the crystals (total maximum number of pulses for initialization is 23).
- ◆ A Rotate Head function can only be done when the Channel is in READY or STOP state.

A Crystal Switch will also identify a crystal in the new position as either "good" or "failed".

Because only Position 1 is uniquely identified, if the Crystal 12 is manually moved we do not guarantee correct position detection.

- ◆ Example 1. If the Crystal 12 head were moved manually from Position 2 to Position 5, Cygnus would not detect the difference. When a switch is done, Cygnus would advance the Crystal 12 to Position 6, and assume it was Position 3 as these two positions are not uniquely identified.
- ◆ Example 2. Once a position is reached, Cygnus assumes the Crystal 12 remains on that position until a Crystal Switch or a Rotate Head function is initiated.

### 2.5.2 Crystal Switching

A Crystal 12 requires one pneumatic pulse to change position. Upon a crystal switch, the Crystal Switch Output relay will close for one second and then open. One second after the relay is opened, the crystal switch function is considered complete. Cygnus then looks for the appropriate crystal position.

After completion of the crystal switch, there is a short delay of about 5 seconds before the crystal frequency information is used. This delay insures good frequency reading by allowing time for the crystal to come to thermal equilibrium after being exposed to the material source.

If a crystal switch is initiated while the Cygnus Channel is in Deposit, the Crystal12 will advance to the next "good" crystal, skipping the failed crystals.

If a crystal switch is initiated and the Channel is not in Deposit, the Crystal12 will advance to the next position regardless of the status (good or failed) of the crystal in this position.

If a Start command is given to the Channel and the Crystal12 is currently on a failed crystal the instrument will automatically crystal switch to the next known good crystal before entering Deposit.

If the last known good crystal fails while in Deposit, the Channel will go into Time Power, Idle Ramp, or Stop, depending on the value of the Channel's "CRYSTAL FAIL OPTION" parameter.

## **2.6 Crystal12 Sensor Requirement when Not Installed with a Cygnus**

The Crystal12 can be manually operated with other Deposition Controllers. The user must, however, be aware of the functional requirements for operation. These include, but are not limited to:

- 1** The three-way solenoid valve assembly must be energized and de-energized once per crystal position. Twelve pulses complete one revolution.
- 2** The electrical pulse applied to the solenoid valve must be at least one second in duration during both the pressurization (energized) and de-pressurization (de-energized) phase.
- 3** A 24 volt AC or DC supply is required to energize the solenoid assembly. Consult [Figure 3-1 on page 3-3](#) for wiring assignments.
- 4** The user should provide some means of determining the quantity of "good" crystals when initially loaded, and quantity of good crystals remaining at any time.
- 5** Follow the guidelines shown in [section 2.3 on page 2-3](#) for installation.
- 6** You will need to keep track of the total thickness as a manually generated sum of the deposit accumulated at each crystal position.

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## Chapter 3

# Installation of the Solenoid Valve Assembly

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The solenoid valve assembly (IPN 750-420-G1) and the feedthrough should be installed at the same time. The same valve assembly is used for both the 1" and the (recommended) 2 3/4" feedthroughs. However, if the assembly is to be used with the 2 3/4" feedthrough, you will need to modify the valve bracket as follows.

For the following steps, see [Figure 3-2 on page 3-4](#). (DWG. 750-420-G1)

- 1 Align the score line on the valve assembly bracket (item 5) over the edge of a table or other square edge.
- 2 Using pliers, grasp the part of the bracket extending over the edge and push down. The bracket will break along the score line. Use a file to smooth any rough edges which occur along the break.

**NOTE:** In order for the Crystal12 sensor to operate properly, a .022" diameter orifice (IPN 059-189 provided in Kit 750-268) must be installed in line between the air supply and the solenoid valve assembly. This is accomplished by the following procedure. See [Figure 3-1 on page 3-3](#).

- 3 Unthread the tube fitting attached to the normally closed (N.C.) P Supply port of the 3-way solenoid valve.
- 4 Install the orifice by threading it into the normally closed (N.C.) port of the 3-way solenoid valve.
- 5 Thread the tube fitting previously removed into the orifice.

**NOTE:** Do not install the orifice into the normally open output port. This will require a longer time interval for depressurization of the bellows assembly and may lead to an apparent sensor failure.

### 3.1 Installation with 1" Bolts

Installation of the solenoid valve assembly for the Crystal12 sensor requires one 1" bolt feedthrough (IPN 750-030-G1, see [Figure 5-1 on page 5-1](#)).

Follow these steps:

- 1 Ensure that the o-ring is in place on the bolt. Insert the 1" bolt such that the hexagonal shaped end of the bolt is on the vacuum side of the chamber.
- 2 Add the Bracket.
- 3 Add the Washer.
- 4 Add the Nut.
- 5 Tighten the feedthrough nut.

- 6 Add the air fitting to the tube which has the female thread adapter installed.
- 7 Connect 1/8" diameter tubing from the valve output (A) to the feedthrough fitting.



### CAUTION

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**Use of more than 80" (2 meters) of 1/8" tubing between the valve with the orifice and the bellows may cause a switcher failure because of the time required to bleed out sufficient air during de-pressurization. If tubing greater than 1/8" in diameter is used, the maximum length must be reduced proportional to the additional volume.**

---

- 8 Attach the valve's supply (normally closed (NC) port) to the 80-90 PSIG (5.5 bar - 6.2 bar) [550 kPa - 620 kPa] source of air. Verify that the orifice (IPN 059-189) has been installed into this NC valve port. (See Figure 3-1b of [Figure 3-1 on page 3-3.](#))

## 3.2 Installation with 2 3/4" Feedthrough

Installation of the solenoid valve requires a 2 3/4" feedthrough inclusive of two coaxial feedthroughs (IPN 002-080, see [Figure 5-2 on page 5-2](#)). The second coaxial feedthrough is not used, and should be protected from damage as a result of process material. Follow the steps below:

- 1 Install the Feedthrough.
- 2 Add the valve bracket (modified) to the desired location as illustrated in [Figure 3-3 on page 3-5](#).
- 3 Tighten the feedthrough bolts.
- 4 Install the air fitting to the female thread adapter.
- 5 Connect 1/8" diameter tubing from the valve output (A) to the feedthrough fitting. See the *CAUTION* in [section 3.1](#) above.
- 6 Attach the valve's supply (P) (normally closed (NC) port) to the 80-90 PSIG (5.5 bar - 6.2 bar) [550 kPa - 620 kPa] source of air. Verify that the orifice (IPN 059-189) has been installed into this NC valve port. (See Figure 3-1b of [Figure 3-1 on page 3-3.](#))

**NOTE:** Maximum temperature for the solenoid valve assembly is 105 °C for bakeout and operation.



### 3.3 Electrical and Pneumatic Connections

#### 3.3.1 Electrical

To complete installation of the assembly, make electrical connections where indicated in [Figure 3-3 on page 3-5](#) to either 24 V(ac) or V(dc). Current required is approximately 70 mA.

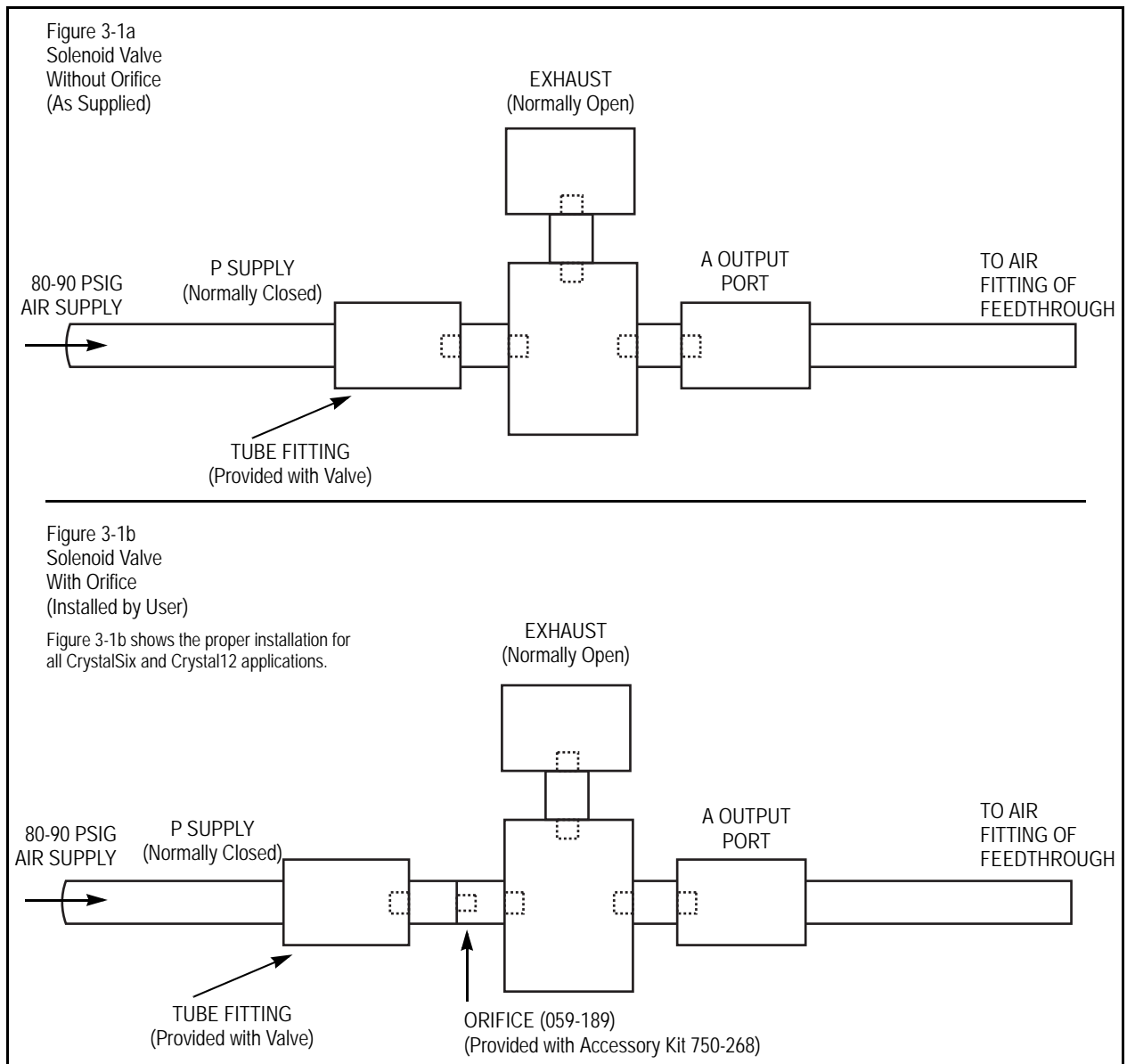


#### CAUTION

**Maximum applied voltage must not exceed 26 V(ac)**

#### 3.3.2 Pneumatic Solenoid Tube Connections

Figure 3-1 Pneumatic Solenoid Tube Connections



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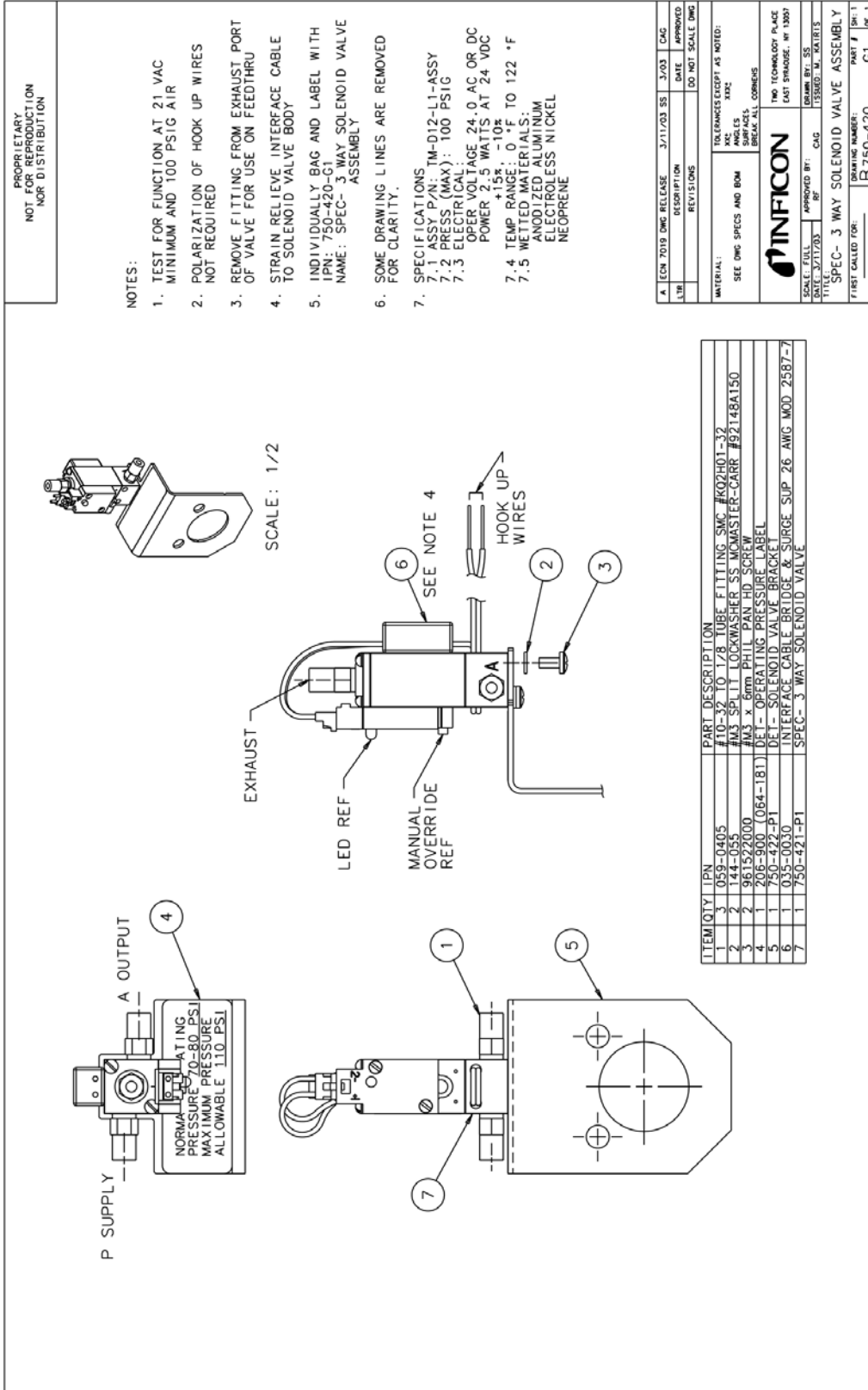


Figure 3-2 Solenoid Valve Assembly

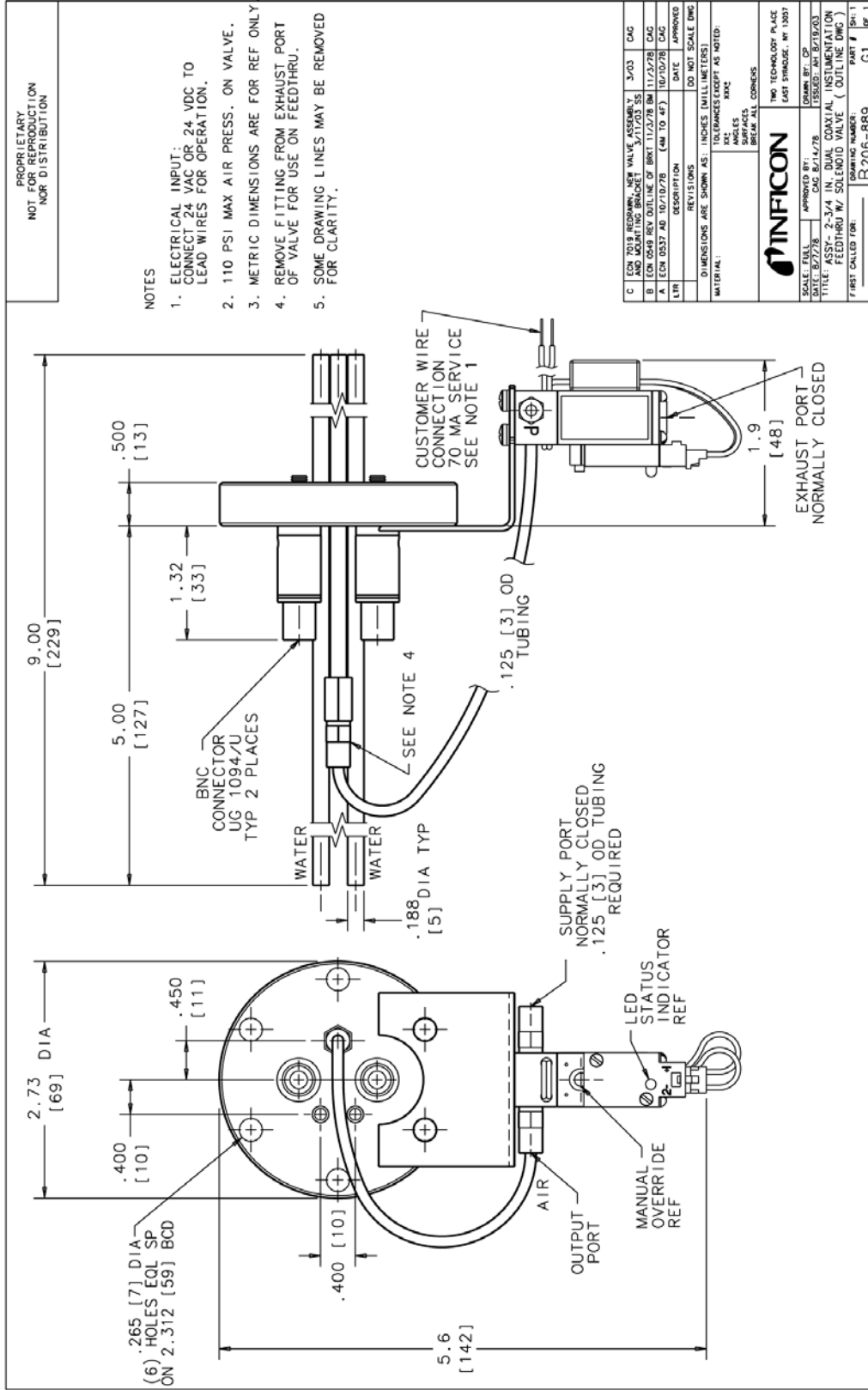


Figure 3-3 2 3/4" Dual Coaxial Feedthrough & Valve Assembly

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## **Chapter 4**

# **Maintenance**

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### **4.1 General Precautions**

#### **4.1.1 Maintain the Temperature of the Crystal**

Periodically measure the water flow rate through the crystal sensor to verify that it meets or exceeds the value specified in chapter one. Depending upon the condition of the cooling water used, the addition of an inline water filtering cartridge system may be necessary to prevent flow obstructions. Many coating systems use parallel water supply taps that provide high total flows. An obstruction or closed valve in the pipe that supplies water to the sensor head would not result in a noticeable reduction of total flow. The best test is to directly monitor the flow leaving the sensor.

The crystal requires sufficient water cooling to sustain proper operational and temperature stability. Ideally, a constant heat load is balanced by a constant flow of water at a constant temperature. INFICON quartz crystals are designed to provide the best possible stability under normal operating conditions. No crystal can completely eliminate the effects of varying heat loads. Sources of heat variation include radiated energy emanating from the evaporant source and from substrate heaters.

#### **4.1.2 Use the Optimum Crystal Type**

Certain materials, especially dielectrics, may not adhere strongly to the crystal surface and may cause erratic readings. For many dielectrics, adhesion is improved by using crystals with silver coated electrodes. Gold is preferred for other applications.

#### **4.1.3 Crystal Concerns when Opening the Chamber**

Thick deposits of some materials, such as SiO<sub>2</sub>, Si and Ni will normally peel off the crystal when it is exposed to air, due to changes in film stress caused by gas absorption. When peeling material is observed, replace the crystal.

## 4.2 Crystal Seat Maintenance

In dielectric and organic material coating applications, the surface where the crystal contacts the crystal seat may require periodic cleaning. Since most dielectrics are insulators, any buildup due to blow-by will eventually cause erratic or poor electrical contact between the crystal and the sensor body. This buildup will also cause a reduction in thermal transfer from the crystal to the sensor body. Both of these will result in noisy operation and early crystal failure.

Cleaning may be accomplished by gently buffing the crystal seating surface with a white Scotch-Brite™ pad followed by an ultrasonic bath in soap solution followed by thorough rinsing in deionized water and drying or by ultrasonic cleaning and rinsing only.



### CAUTION

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**The crystal seating surface is machined to a very fine finish (16 micro inches rms). This high quality finish is essential to provide good electrical and thermal contact with the crystal. Applying excessive force during cleaning or using overly abrasive cleaning materials may damage this finish and reduce sensor performance.**

---

## 4.3 Alignment Instruction for Crystal12 Sensor (IPN 750-667)

During shipment, units may vibrate slightly out of position. This does not mean realignment is required. The unit will return to the centered position the first time it is pneumatically activated.

The unit shipped to you has been aligned at the factory, no further alignment is required.

**NOTE:** Realignment is only required if the unit has been disassembled for any reason, such as evaporant material removal, or any electrical problem that may occur, or if the ratchet (item 29, [Figure 1-5 on page 1-8](#)) is loosened, or removed. This procedure is critical and must be carefully followed.

The unit, when properly aligned, will index the crystal to a position that is closely centered within the aperture provided in the front deposition shield. The unit must be aligned if this condition does not exist.

### 4.3.1 Required Equipment

- ◆ 5/64" allen wrench (Included in 750-268 Kit)
- ◆ 1/16" allen wrench (Included in 750-268 Kit)
- ◆ 3/32" allen wrench (Included in 750-268 Kit)

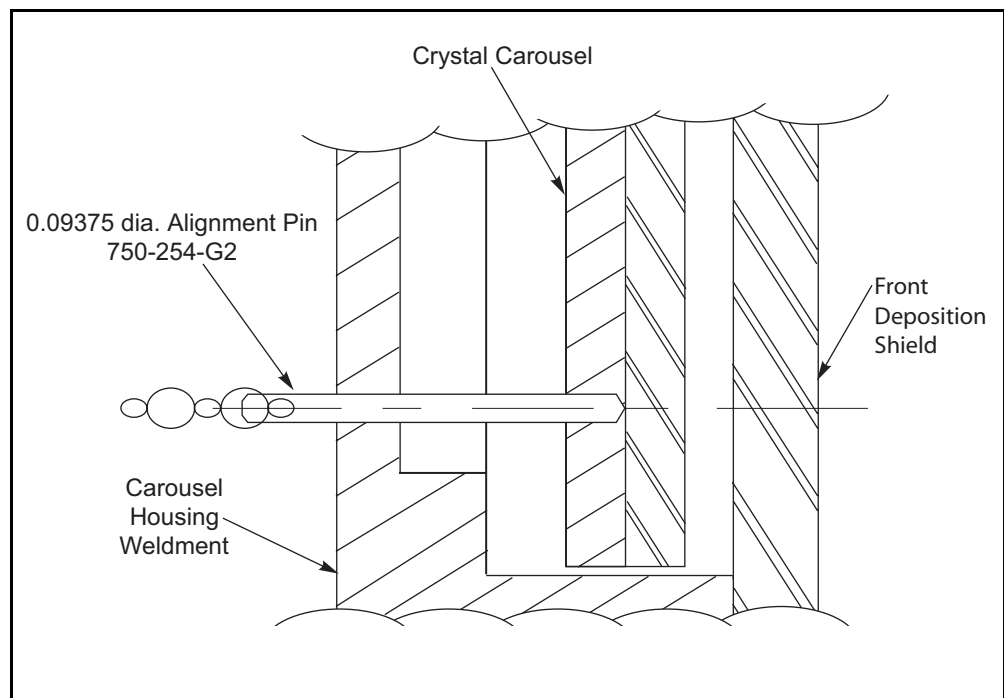
- ◆ Alignment tool assembly 750-254-G2 (Included in 750-268 kit)
  - ◆ Regulated air supply 80-90 PSIG (5.5 bar - 6.2 bar) [550 kPa - 620 kPa]
- NOTE:** 75 PSIG (5.2 bar) [520 kPa] is for alignment purposes only.

### 4.3.2 Procedure

With the required equipment at hand, proceed as follows:

- 1 Temporarily connect an air supply to the bellows assembly (item 37, [Figure 1-5 on page 1-8](#)) supply tube. Regulate the air pressure to 75 PSIG (5.2 bar) [520 kPa].
- 2 Insert the 0.09375" diameter alignment pin (of the 750-254-G2 assembly) in the alignment hole (if not already installed) as shown in [Figure 4-1](#). The crystal carousel may need to be rotated to achieve the alignment condition shown in [Figure 4-1](#).

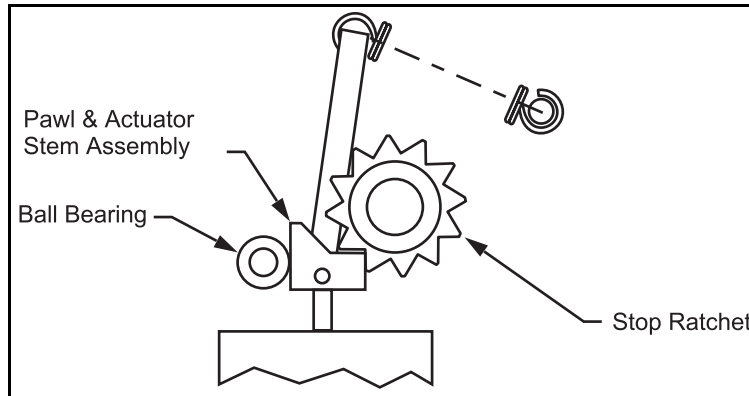
Figure 4-1 Alignment Pin Installation



- 3 Remove the actuator cover (item 22, [Figure 1-6 on page 1-9](#)) and its related hardware (items 6 and 7, [Figure 1-6 on page 1-9](#)).
- 4 Loosen the set screws (two set screws per item) of the ratchet (item 29, [Figure 1-5 on page 1-8](#)) and the stop ratchet (item 31, [Figure 1-5 on page 1-8](#)).
- 5 Loosen the #2 fastener (item 5, [Figure 1-5 on page 1-8](#)) that attaches the detent (item 25, [Figure 1-5 on page 1-8](#)) to the bellows assembly item 37, [Figure 1-5 on page 1-8](#)). Do NOT remove detent.

- 6 Actuate the bellows assembly by applying 24 volts to the leads of the solenoid valve of the solenoid valve assembly. Consult [Figure 3-3 on page 3-5](#) for wiring assignments. The air pressure must be sustained.
- 7 Rotate the ratchet (item 29, [Figure 1-5 on page 1-8](#)) counterclockwise until one tooth contacts the pin of the pawl and actuator stem assembly (item 18, [Figure 1-4 on page 1-7](#)). Secure the ratchet to the 0.25" diameter shaft of the carousel spindle body (item 24, [Figure 1-5 on page 1-8](#)) utilizing the #6-32 x 0.125" long socket set screw (item 12, [Figure 1-4 on page 1-7](#)).
- 8 Rotate the stop ratchet (item 31, [Figure 1-5 on page 1-8](#)) clockwise until it contacts the stem of the pawl and actuator stem assembly (item 18, [Figure 1-4 on page 1-7](#)) as shown in [Figure 4-2](#). Secure the stop ratchet to the 0.25" diameter shaft of the carousel spindle body (item 24, [Figure 1-5 on page 1-8](#)) utilizing the #6-32 x 0.125 long socket set screws (item 12, [Figure 1-5 on page 1-8](#)).

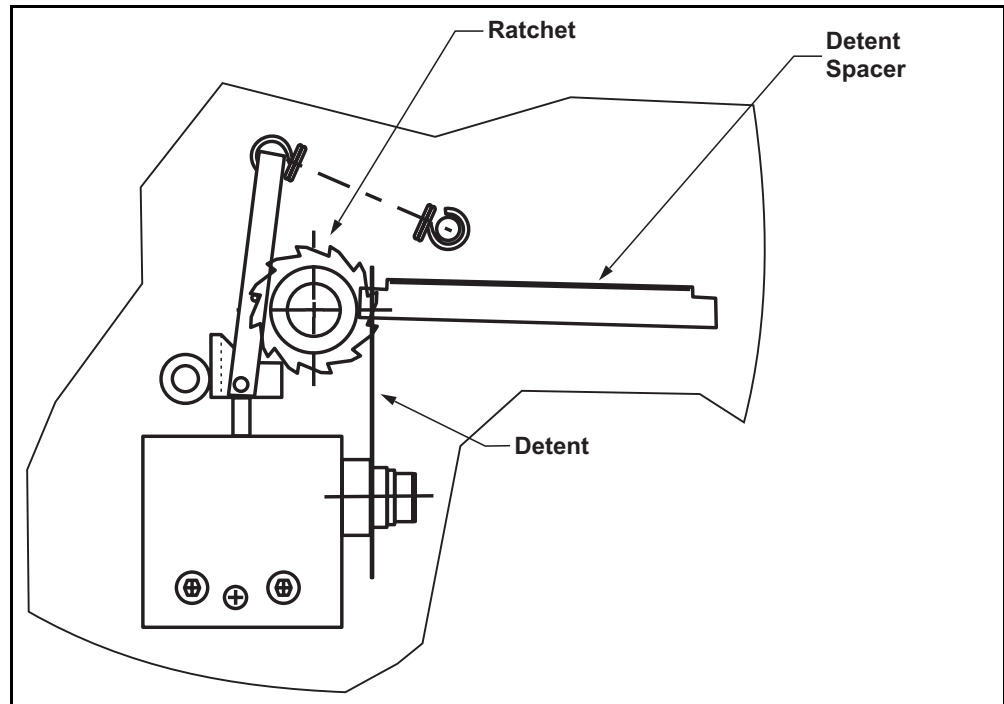
Figure 4-2 Setting the Stop Ratchet



- 9 Position the detent spacing tool (of the 750-254-G2 assembly) between the detent (item 25, [Figure 1-5 on page 1-8](#)) and ratchet (item 29, [Figure 1-5 on page 1-8](#)) as shown in [Figure 4-3](#). Pull the detent against the detent spacing tool and subsequently against the tooth of the ratchet. Tighten the #2 fastener (item 5, [Figure 1-5 on page 1-8](#)) to secure the detent to the bellows assembly.



Figure 4-3 Setting the Detent



- 10** Remove the detent spacing tool.
- 11** Release air pressure from the bellows assembly (item 37, [Figure 1-5 on page 1-8](#)).
- 12** Remove the 0.09375" diameter alignment pin of the 750-254-G2 alignment tool assembly from the hole.
- 13** Press the crystal switch button on the handheld controller or the instrument front panel. The sensor will advance to the next crystal position. Each crystal should be centered in the aperture. Make certain the detent drops in to engage each tooth of the ratchet (item 29, [Figure 1-5 on page 1-8](#)) on each pulse.
- 14** Secure the actuator cover (item 22, [Figure 1-6 on page 1-9](#)) to the carousel housing weldment (item 14, [Figure 1-5 on page 1-8](#)) using two #4-40 x 0.187" long socket head cap screws (items 6 and 7, [Figure 1-6 on page 1-9](#)).
- 15** Install the front deposition shield (item 17, [Figure 1-5 on page 1-8](#)) by first orienting the pins in the front deposition shield to coincide with the locating holes in the carousel housing weldment (item 14, [Figure 1-5 on page 1-8](#)), then secure the front deposition shield by tightening the two knurled captive screws.
- 16** Regulate the air supply to 80-90 PSIG (5.5 bar - 6.2 bar) [550 kPa - 620 kPa] for operation.

The Crystal12 Sensor is now aligned.

### 4.3.3 Replacing the Bellows Assembly (750-286-P2)

Replace the bellows assembly with INFICON part number 750-286-P2. This will require the removal of the used bellows assembly and reattachment of the replacement bellows assembly to the feedthrough airline (refer to [section 1.1.1, Installation Requirements, on page 1-2](#)).

#### 4.3.3.1 Equipment required:

- ◆ 1/16" Allen wrench (Included in 750-268 kit)
- ◆ 3/32" Allen wrench (Included in 750-268 kit)

#### 4.3.3.2 Procedure

- 1 Remove the two #4 fasteners (item 7, [Figure 1-6 on page 1-9](#)) that secure the actuator cover (item 22, [Figure 1-6 on page 1-9](#)) to carousel housing weldment (item 14, [Figure 1-5 on page 1-8](#)).
- 2 Remove the actuator cover. Remove the front deposition shield (item 17, [Figure 1-5 on page 1-8](#)) by unthreading the two knurled captive screws.
- 3 Remove the extension spring (item 27, [Figure 1-4 on page 1-7](#)) from the pawl and actuator stem assembly (item 18, [Figure 1-4 on page 1-7](#)).
- 4 Remove the two #4 fasteners (item 9, [Figure 1-4 on page 1-7](#)) that secure the bellows assembly (item 37, [Figure 1-5 on page 1-8](#)) to the carousel housing weldment (item 14, [Figure 1-5 on page 1-8](#)).
- 5 Carefully remove the bellows assembly. The pawl and actuator stem assembly (item 18, [Figure 1-4 on page 1-7](#)) and the detent (item 25, [Figure 1-5 on page 1-8](#)) will be removed with the bellows assembly.
- 6 Unthread the Pawl and Actuator stem assembly (item 18, [Figure 1-4 on page 1-7](#)) from the bore of the Bellows assembly being replaced (item 37, [Figure 1-5 on page 1-8](#)) and install it into the replacement Bellows Assembly. Continue to thread the Pawl and Actuator assembly until the shoulder of the Actuator stem is approximately 0.034" away from the bellows assembly. This distance specification is for reference only — the actuator stem position may need to be adjusted to obtain the desired condition as illustrated in [Figure 1-4 on page 1-7](#).
- 7 Remove the Detent and related hardware (items 1, 3, 5, 26, [Figure 1-5 on page 1-8](#)) from the bellows assembly and attach them to the replacement bellows assembly. Do not tighten the fastener. Discard the used Bellows Assembly.
- 8 Using the 1/16" allen wrench, loosen the set screws (item 12, [Figure 1-4 on page 1-7](#)) that secure the ratchet (item 29, [Figure 1-5 on page 1-8](#)) and the stop ratchet (item 31, [Figure 1-5 on page 1-8](#)) to the carousel spindle body (item 24, [Figure 1-5 on page 1-8](#)).

- 9 Fasten the replacement bellows assembly to the carousel housing weldment (item 14, [Figure 1-5 on page 1-8](#)) utilizing the two #4-40 x 1.125 long screws (item 9, [Figure 1-4 on page 1-7](#)). Do not tighten the screws. Position the Bellows assembly in such a fashion as to allow the actuator stem to come in contact with the ball bearings (item 19, [Figure 1-4 on page 1-7](#)) as illustrated in [Figure 4-2 on page 4-4](#)). Tighten the screws.
- 10 Attach the loop of the Extension spring to the hole provided in the Pawl of the Pawl and Actuator assembly.
- 11 Position the Ratchet (item 29, [Figure 1-5 on page 1-8](#)) such that it engages the pin of the Pawl and Actuator Stem Assembly.
- 12 Position the detent (item 25, [Figure 1-5 on page 1-8](#)) so that it engages the Ratchet (item 29, [Figure 1-5 on page 1-8](#)).

The unit is now ready to be aligned, refer to [section 4.3 on page 4-2](#) for alignment instructions.

#### **4.3.4 Replacing the Electrical Connection Assembly**

Replace the electrical connection assembly with INFICON part number 750-649-G1.

**NOTE:** Contact INFICON for pricing and availability of new and refurbished assemblies.

The recommended replacement interval for the electrical connection assembly is two years, based upon five revolutions per week of the carousel.

##### **4.3.4.1 Equipment Required**

- ◆ 3/32" Allen wrench
- ◆ #1 Phillips screw driver

##### **4.3.4.2 Procedure**

Reference [Figure 1-5 on page 1-8](#) and [Figure 1-6 on page 1-9](#).

- 1 Remove the #4 fasteners (item 7) that secure the actuator cover (item 22) to the carousel housing weldment (item 14).
- 2 Remove the actuator cover.
- 3 Unthread the in-vacuum sensor head cable from the electrical connector.
- 4 Remove the two #4 Phillips flat head screws (item 8) that secure the electrical connector assembly (item 16) to the carousel housing weldment.
- 5 Remove the electrical connector assembly and install the replacement assembly utilizing the two #4 Phillips flat head screws.
- 6 Re-attach the in-vacuum head cable to the electrical connector.
- 7 Reinstall the actuator cover.

## 4.4 Cygnus Status and Error Messages

### CAROUSEL CHANGE-OUT

The crystal carousel assembly has been removed from a Crystal12 sensor.

### SWITCH IN PROGRESS

The manual state can not be exited while a crystal switch is in progress.

### XTAL SWITCH ERROR

This message indicates a CrystalSix or Crystal12 sensor switcher failure. The instrument did not detect the proper position after having attempted to rotate the sensor head.

### XTAL SWITCHING

Indicates a crystal switch is in progress.

## 4.5 Troubleshooting the Crystal12 Sensor

Table 4-1 Troubleshooting

Symptom	Cause	Remedy
Crystal fail signal on front panel of unit will not disappear even though crystal can be seen through deposition shield aperture.	Damaged Crystal.	Replace crystal.
	Loss of electrical signal.	Check for electrical continuity between feedthrough and torsion spring of the electrical connection assembly. Check for electrical continuity between contact post and leaf spring of individual crystal positions.
Unit will not advance when crystal switch key is pressed. Xtal Switch Error message displayed	Loss of pneumatic supply, or pressure is insufficient for proper operation.	Establish air supply and regulate to 80-90 PSIG (5.5 bar - 6.2 bar) [550 kPa - 620 kPa] for operation.
	Operation has been impaired as a result of peeling of the material accumulated on the face of the aperture plate.	Remove accumulated material.
	Absence of orifice in airline.	Check for orifice, see <a href="#">Chapter 3</a> .
	Grounding leaf springs which contact carousel may be damaged.	Replace grounding leaf spring.

Table 4-1 Troubleshooting (continued)

Symptom	Cause	Remedy
Crystal not centered in aperture.	Improper alignment.	Realign per alignment instructions in <a href="#">Chapter 4</a> .
	0.0225" diameter orifice not installed inline to the supply side of the solenoid valve assembly.	Install orifice where shown on <a href="#">Figure 3-1</a> on page 3-3.
Large jumps of thickness reading during deposition	Mode hopping due to damaged crystal.	Replace crystal.
	Crystal near the end of its life.	Replace crystal.
	Scratches or foreign particles on the crystal holder seating surface.	Clean, polish the crystal seating surface of the crystal carousel. Refer to <a href="#">section 4.2</a> on page 4-2.
	Insufficient crystal cooling.	Check water flow and temperature. Refer to <a href="#">section 1.1.1.3</a> on page 1-2.
Crystal ceases to oscillate during deposition before it reaches its "normal life.	Crystal is being hit by small droplets of molten material from the evaporation source.	Move the sensor further away from the evaporant source.
	Damaged crystal.	Change crystal.
	Deposition material built-up on edge of the crystal carousel aperture plate and touching the crystal, partially masking full crystal area.	Clean the crystal carousel aperture plate.
Crystal does not oscillate or oscillates intermittently (both in vacuum and in air).	Defective or damaged crystal.	Replace crystal.
	Existence of electrical short or poor electrical contacts.	Check for electrical continuity and short in sensor cable, electrical connection assembly, feedthroughs, and crystal carousel.
	Insufficient crystal cooling.	Check water flow and temperature. Refer to <a href="#">section 1.1.1.3</a> on page 1-2.

074-398-P1A

Table 4-1 Troubleshooting (continued)

Symptom	Cause	Remedy
Crystal oscillates in vacuum but stops oscillation after open to air.	Crystal was near the end of its life; opening to air causes film oxidation, which increases film stress.	Replace crystal
	Excessive moisture accumulation on the crystal.	Turn off cooling water to sensor before opening it to air; flow hot water through the sensor when the chamber is open.
Thermal instability: large changes in thickness reading during source warm-up (usually causes thickness reading to decrease) and after the termination of deposition (usually causes thickness reading to increase)	Crystal not properly seated.	Check and clean crystal seating surface of the crystal carousel. Refer to <a href="#">section 4.2 on page 4-2</a> .
	Excessive heat input to the crystal.	If heat is due to radiation from the evaporation source, move sensor further away from source and use sputtering crystals for better thermal stability.
	No cooling water.	Check cooling water flow rate. Flow rate should be a minimum of 150-200 cc/min @ 30 °C max.
Poor thickness reproducibility	Erratic source emission characteristics.	Move sensor to a different location; check the evaporation source for proper operating conditions; insure relatively constant pool height and avoid tunneling into the melt.
	Material does not adhere to the crystal.	Check the cleanliness of the crystal surface; evaporate an intermediate layer of proper material on the crystal to improve adhesion.
Carousel Change-Out and Xtal Fail messages remain after installing carousel.	Open circuit.	Initiate a Crystal Switch or Rotate Head function.

Table 4-1 Troubleshooting (continued)

Symptom	Cause	Remedy
While in Ready or Stop, initiating a Crystal Switch function causes unit to index more than once.	Resistor is open at bypassed position(s).	Repair resistor at bypassed position of 750-652-G1 (item 15 of <a href="#">Figure 1-5 on page 1-8</a> ). Or, contact INFICON.
Unit indexes twelve times and displays Xtal Switch Error, Xtal Fail, and Carousel Change-Out message.	Loss of electrical signal	Check for electrical continuity and isolation.
	Resistor #1 is open / shorted.	
	No carousel installed	Install carousel
	Torsion spring of electrical connection assembly broken.	Replace electrical connection assembly. Refer to <a href="#">section 4.3.4 on page 4-7</a>

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## Chapter 5 Feedthrough Outline Drawings

The following Feedthrough Outline Drawings provide dimensions and other pertinent data necessary for planning equipment configurations.

Figure 5-1 1" Crystal feedthrough w/airtube (IPN 750-030-G1)  
(contains one coaxial, two water tubes and one air tube)

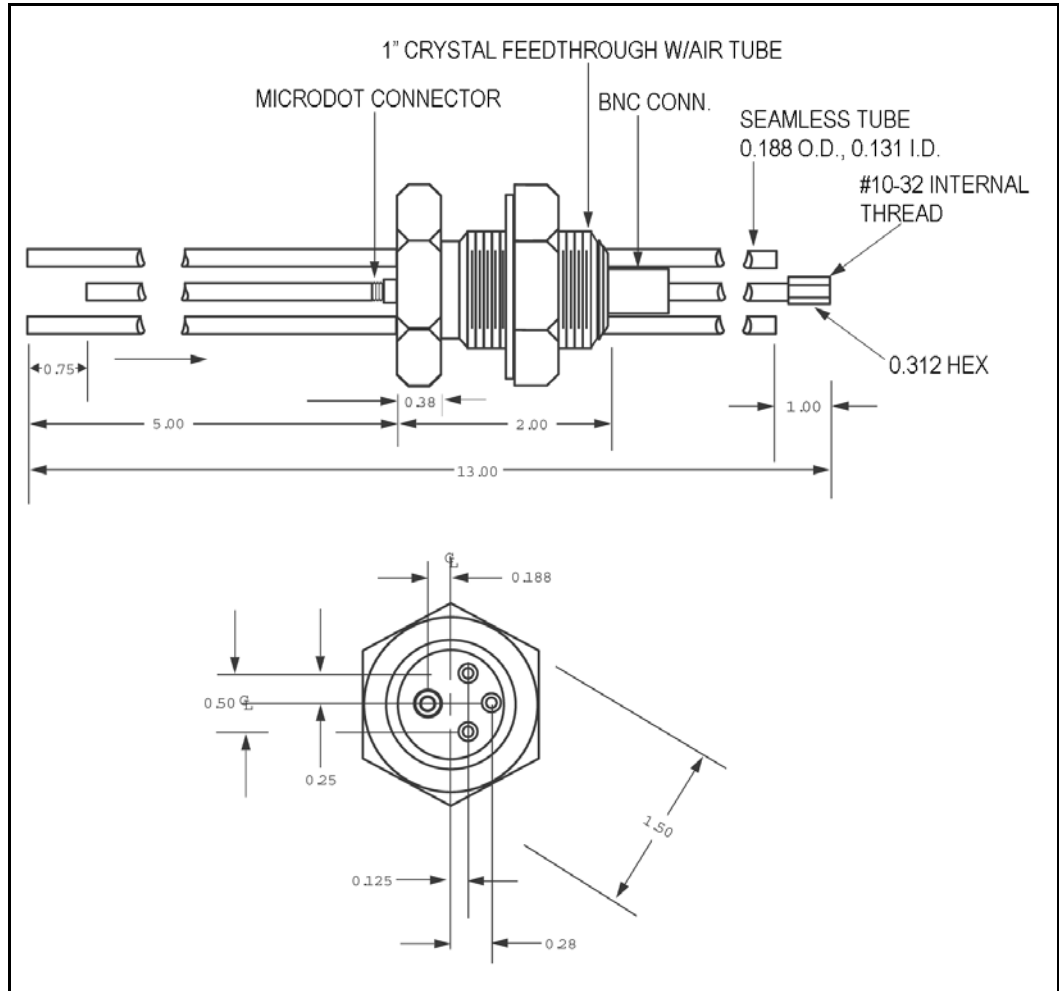


Figure 5-2 Standard 2 3/4" CONFLAT® flange (002-080)  
 (contains two coxials, two water tubes and one air tube)

