

Operating Manual

Crystal12[®]

Sensor



INFICON

Two Technology Place

East Syracuse, NY 13057-9714

1 Trademarks, Disclaimer, Copyright

Trademarks

The trademarks of the products mentioned in this manual are held by the companies that produce them.

INFICON® and Crystal12® are trademarks of INFICON Inc.

ConFlat® is a registered trademark of Varian Corporation.

Teflon® is a registered trademark of Dupont.

Scotch-Brite™ is a trademark of 3M.

SWAGELOK® and CAJON® are registered trademarks of Swagelok, Co.

Inconel® is a registered trademark of International Nickel Co.

Microdot® is a registered trademark of Microdot Corp.

All other brand and product names are trademarks or registered trademarks of their respective companies.

Disclaimer

The information contained in this Manual is believed to be accurate and reliable. However, INFICON assumes no responsibility for its use and shall not be liable for any special, incidental, or consequential damages related to the use of this product.

Due to our continuing program of product improvements, specifications are subject to change without notice.

Copyrights

©2026 All rights reserved. Reproduction or adaptation of any part of this document without permission is unlawful.

2 Warranty

WARRANTY AND LIABILITY - LIMITATION: Seller warrants the products manufactured by it, or by an affiliated company and sold by it, to be, for the period of warranty coverage specified below, free from defects of materials or workmanship under normal proper use and service. The period of warranty coverage is specified for the respective products in the respective Seller instruction manuals for those products but shall not be less than one (1) year from the date of shipment thereof by Seller. Seller's liability under this warranty is limited to such of the above products or parts thereof as are returned, transportation prepaid, to Seller's plant, not later than thirty (30) days after the expiration of the period of warranty coverage in respect thereof and are found by Seller's examination to have failed to function properly because of defective workmanship or materials and not because of improper installation or misuse and is limited to, at Seller's election, either (a) repairing and returning the product or part thereof, or (b) furnishing a replacement product or part thereof, transportation prepaid by Seller in either case. In the event Buyer discovers or learns that a product does not conform to warranty, Buyer shall immediately notify Seller in writing of such non-conformity, specifying in reasonable detail the nature of such non-conformity. If Seller is not provided with such written notification, Seller shall not be liable for any further damages which could have been avoided if Seller had been provided with immediate written notification.

THIS WARRANTY IS MADE AND ACCEPTED IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WHETHER OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE OR OTHERWISE, AS BUYER'S EXCLUSIVE REMEDY FOR ANY DEFECTS IN THE PRODUCTS TO BE SOLD HEREUNDER. All other obligations and liabilities of Seller, whether in contract or tort (including negligence) or otherwise, are expressly EXCLUDED. In no event shall Seller be liable for any costs, expenses or damages, whether direct or indirect, special, incidental, consequential, or other, on any claim of any defective product, in excess of the price paid by Buyer for the product plus return transportation charges prepaid.

No warranty is made by Seller of any Seller product which has been installed, used or operated contrary to Seller's written instruction manual or which has been subjected to misuse, negligence or accident or has been repaired or altered by anyone other than Seller or which has been used in a manner or for a purpose for which the Seller product was not designed nor against any defects due to plans or instructions supplied to Seller by or for Buyer.

This manual is intended for private use by INFICON Inc. and its customers. Contact INFICON before reproducing its contents.

Table of Contents

1	Trademarks, Disclaimer, Copyright	3
2	Warranty	4
3	Introduction and Specifications	7
3.1	Specifications for Crystal12 Sensor XL12-100000 or XL12-100000-CN	7
3.2	Definition of Notes, Cautions, and Warnings	7
3.3	How to Contact Customer Support	8
3.3.1	Returning Sensor to INFICON	8
3.4	Unpacking and Inspection	9
3.4.1	Accessory Kit	9
3.5	Specifications	10
3.5.1	Materials	10
3.5.2	Installation Requirements	10
3.6	List of Supplied Drawings	12
4	Sensor Installation	15
4.1	Crystals in the Crystal12 Sensor	15
4.1.1	Handle the Crystal with Care	15
4.1.2	Replacing Crystals	16
4.2	Pre-Installation Sensor Check	18
4.2.1	Cygnus 2 Deposition Controller	18
4.3	General Guidelines for Crystal12 Sensor	19
4.3.1	Crystal Sensor Installation	20
4.4	Crystal12 Sensor Installation When Used with Cygnus 2	22
4.4.1	Changing Crystal Sensor Type and Programming the Relay Outputs	22
4.4.2	Wiring the Relay Outputs with Relay I/O Boards	23
4.5	Crystal12 Operation When Used with Cygnus 2	25
4.5.1	Initialization	25
4.5.2	Crystal Switching	26
4.6	Crystal12 Sensor Requirement when Not Installed with Cygnus 2	27
5	Installation of the Solenoid Valve Assembly	28
5.1	Introduction	28
5.1.1	Orifice Installation	28
5.2	Installation with a 2.54 cm (1 in.) Bolt Feedthrough	29
5.3	Installation with 2 3/4 in. Feedthrough	31
5.4	Electrical and Pneumatic Connections	32
5.4.1	Electrical Connections	32
5.4.2	Pneumatic Connections	32
5.4.3	Solenoid Valve Drawings	32

6 Maintenance	34
6.1 General Precautions	34
6.1.1 Maintain the Temperature of the Crystal	34
6.1.2 Use the Optimum Crystal Type	34
6.1.3 Crystal Concerns when Opening the Chamber	34
6.2 Crystal Seat Maintenance	34
6.3 Alignment Instruction for Crystal12 Sensor XL12-100000 or XL12-100000-CN	35
6.3.1 Required Equipment	35
6.3.2 Procedure	36
6.4 Replacing the Bellows Assembly (750-286-P2)	39
6.4.1 Required Equipment	40
6.4.2 Procedure	40
6.5 Replacing the Electrical Connection Assembly	43
6.5.1 Required Equipment	43
6.5.2 Procedure	43
6.6 Cygnus 2 Status and Error Messages	44
6.7 Symptom, Cause, Remedy Chart	45
7 Feedthrough Outline Drawings	48

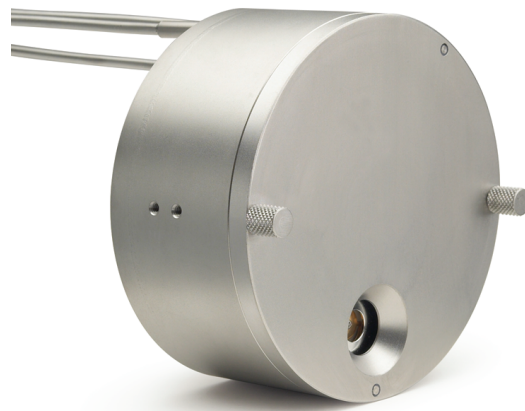
3 Introduction and Specifications



These instructions do not provide for every contingency that may arise in connection to the installation, operation, or maintenance of this equipment. Should you require further assistance, please contact INFICON.

3.1 Specifications for Crystal12 Sensor XL12-100000 or XL12-100000-CN

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[®] 2 Deposition Controller.



3.2 Definition of Notes, Cautions, and Warnings

Before using this manual, please take a moment to understand the Notes, Cautions, and Warnings used throughout. They provide pertinent information that is useful in achieving maximum instrument efficiency while ensuring personal safety.



Notes provide additional information about the current topic.



⚠ CAUTION

This is a Caution paragraph. It cautions against actions that may cause an instrument malfunction or the loss of data.

**⚠ WARNING**

This is a General Warning paragraph. It warns against actions that may cause bodily injury.

3.3 How to Contact Customer Support

If you need assistance with your sensor, please read this operating manual before contacting customer support. If you cannot 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 the third image in List of Supplied Drawings [▶ 12].
- A description of your problem.
- An explanation of any corrective action you may have already attempted.
- The exact wording of any error messages 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 www.inficon.com.

3.3.1 Returning 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 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.

3.4 Unpacking and Inspection

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.

3.4.1 Accessory Kit

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

Quantity	Part Number	Description
X	750-268-G3	Accessory kit, Crystal12 sensor
1	750-254-G2	Assembly, alignment tool
1	074-5000	Thin Film manuals CD
1	008-010-G10	Assembly, sensor crystal 6 MHz (10 crystals per package)
1	059-0189	CC-1010-0225 orifice 0.559 mm (0.022 in.) diameter
2	070-0201	#4 split lock washer, stainless steel
2	084-032	#4-40 x 9.5 mm (0.375 in.) long socket head cap screw, stainless steel
2	084-039	#4-40 x 12.7 mm (0.500 in.) long socket head cap screw, stainless steel
2	084-084	#4-40 x 17.48 mm (0.688 in.) long socket head cap screw, stainless steel
1	070-0828	Hex wrench 1.59 mm (1/16 in.) SC9-3
1	070-0829	Hex wrench 2.38 mm (3/32 in.) SC9-5
1	070-1175	Hex wrench 1.98 mm (5/64 in.) SC9-4
1	750-037-G1	Spring tube bender kit
1	750-191-G1	Molybdenum disulfide in alcohol

Optional

Quantity	Part Number	Description
1	750-670-G1	Mounting post kit
1	750-420-G1	3-way solenoid valve assembly

3.5 Specifications

Maximum bakeout temperature with no water	130°C
Maximum operating isothermal environment temperature with minimum water flow	400°C
Size (maximum envelope)	9.7 cm (3.8 in.) diameter by 5.1 cm (2.0 in.) high
Water tubes, air tube, and in-vacuum cable length	76.2 cm (30 in.) tubes, 3.175 mm (1/8 in.) OD seamless stainless steel, 0.406 mm (0.016 in.) wall thickness. Includes 78.1 cm (30.75 in.) in-vacuum cable
Crystal exchange	Front loading, extraction tool required Crystal holder extraction tool (PN 750-279-P1) included
Mounting	Six #4-40 tapped holes on the back of the sensor body
Crystal	14 mm (0.550 in.) diameter

3.5.1 Materials

Plate, material shield, mechanical parts, body and carousel	304 stainless steel
Springs, electrical contacts	Au plated Be-Cu, Au plated Inconel, 302 stainless steel
Water and air tubes.	S-304, 0.125 in. (3.2 mm) O.D. x .016 in. (0.4 mm) wall thickness x 30 in. long (762 mm) Seamless stainless steel tubing
Electrical connector	Stainless steel
Insulators	Teflon®, Peek®
Cable	Teflon insulated copper

3.5.2 Installation Requirements

Feedthrough

- 2.54 cm (1 in.) bolt feedthrough with one coaxial, two pass water, and one air (PN 750-030-G1-CN)
- CF40 (2-3/4 in. ConFlat®) feedthrough with two coaxial, two pass water, and one air (PN 002-080-CN)

Other

- The user is to provide a mounting structure adequate to support the weight of Crystal12 and designed to facilitate the removal and replacement of the instrument with a minimal change in the exact position. An optional mounting post kit, PN 750-670-G1, may be purchased for this purpose.



CAUTION

Do not mount Crystal12 unsupported.

- user provided vacuum-tight braze joints or connectors for the water and air tubes
- valve assembly for air, PN 750-420-G1 (not provided, see Introduction) with a 0.559 mm (0.022 in.) restrictor orifice installed by the user. (Orifice included with Crystal12 accessory kit)
- XIU or oscillator to match specific controller/monitor

Utilities

- The minimum water flow is 150 to 200 cm/min, 30°C maximum (do not allow the water to freeze). The coolant should not contain chlorides as stress corrosion cracking may occur.
- A regulated air supply 80-90 PSIG (5.5 bar - 6.2 bar) [550 kPa - 620 kPa].
- A two meter maximum length of 1/8 in. tubing between bellows assembly and the control valve.



CAUTION

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

3.6 List of Supplied Drawings

PROPRIETARY
NOT FOR REPRODUCTION
NOR DISTRIBUTION

2.19 [55.54]
 .92 [23.30]
 3.69 [93.78]
 4.37 [111.12] OPTIONAL
 .50 [12.70] 3 PLCS
 1.00 [25.40] 3 PLCS
 .616 [16]
 #4-40 X .19 [4.8] DP MOUNTING HOLES QTY 6
 AIR SEE NOTE 5, 6, 8
 WATER SEE NOTES 4, 6, 7
 OPTIONAL KIT- MOUNTING POSTS, QTY 3 AS SHOWN IPN# 750-670-G1 #6-32 X .375 [9.53] THREAD DEPTH (DRILL AND TAP TO M5 X 0.8 BY USER)
 3.164 [80.37]
 2.92 [74.27]
 2.30 [58.39]
 1.92 [48.87]
 .375 TYP [9.52] OPTIONAL
 IN VACUUM CABLE 30.75 [781.4] LONG
 .639 [16]
 1.80 [45.85]
 .32 [8.13]
 2.50 [63.50] OPTIONAL
 3.46 [88.01] OPTIONAL
 .375 TYP [9.52] OPTIONAL
 Ø4.00 [101.60]
 4.75 [120.65] OPTIONAL
 1.25 [31.75]

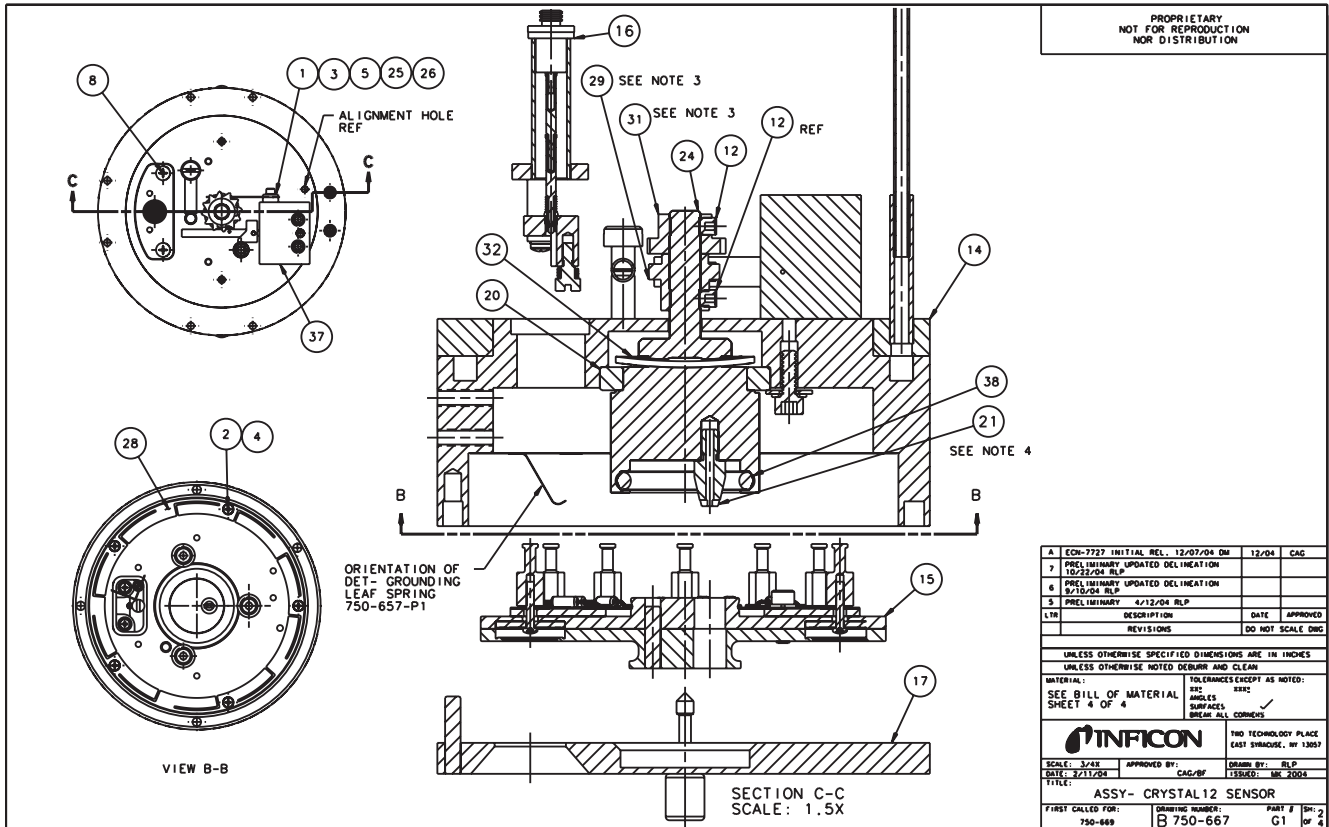
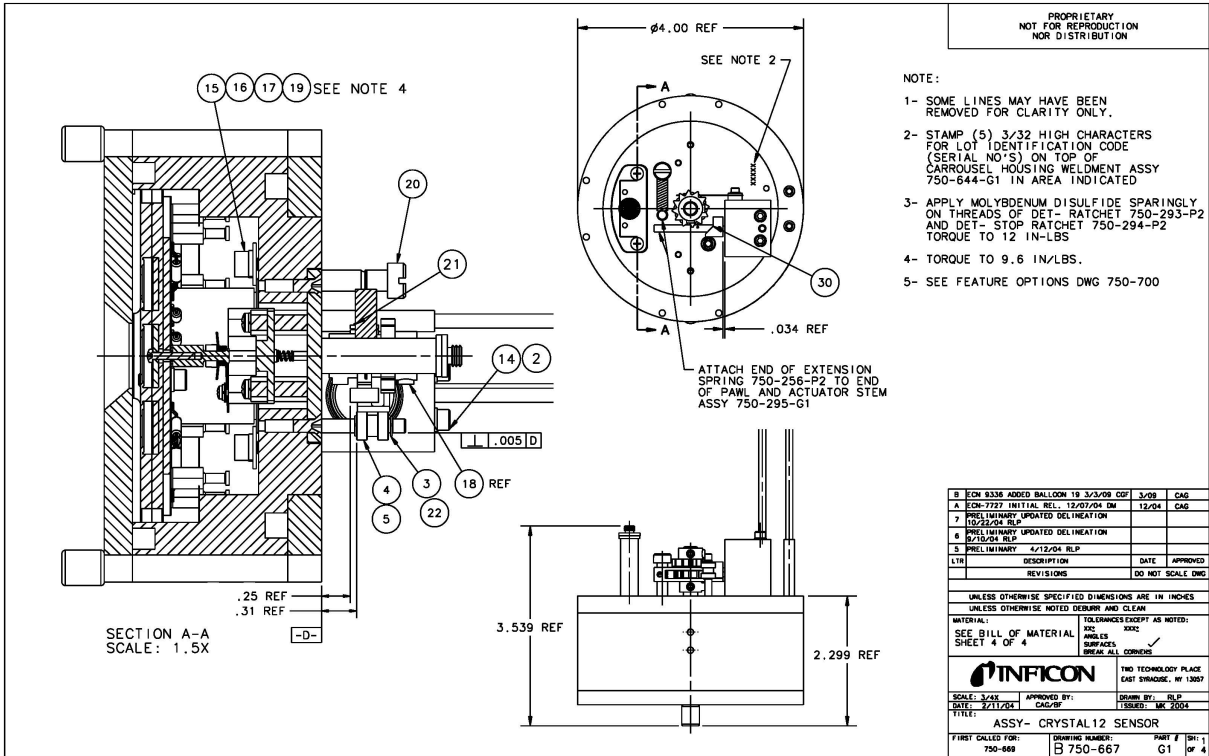
NOTE:
 1- FOR CLARITY SOME LINES MAY HAVE BEEN REMOVED
 2- DIMENSIONS IN [] ARE MILLIMETERS AND ARE FOR REFERENCE ONLY
 3- BAKEOUT TEMP. WITH NO WATER: 130°C MAX
 4- MINIMUM RECOMMENDED WATER FLOW 150-200 CC/MIN 30°C MAX
 5- AIR 80 - 90 PSIG [5.5-6.1 ATMOSPHERES] OPERATION - SPECIAL RESTRICTOR ORIFICE REQUIRED
 6- ALL TUBES .125 [3.2] O.D. X .016 [.4] WALL SEAMLESS 304 STAINLESS STEEL
 7- LENGTH OF TUBES: 30.00 [762.0]
 8- LENGTH OF TUBE: 29.50 [749.3]

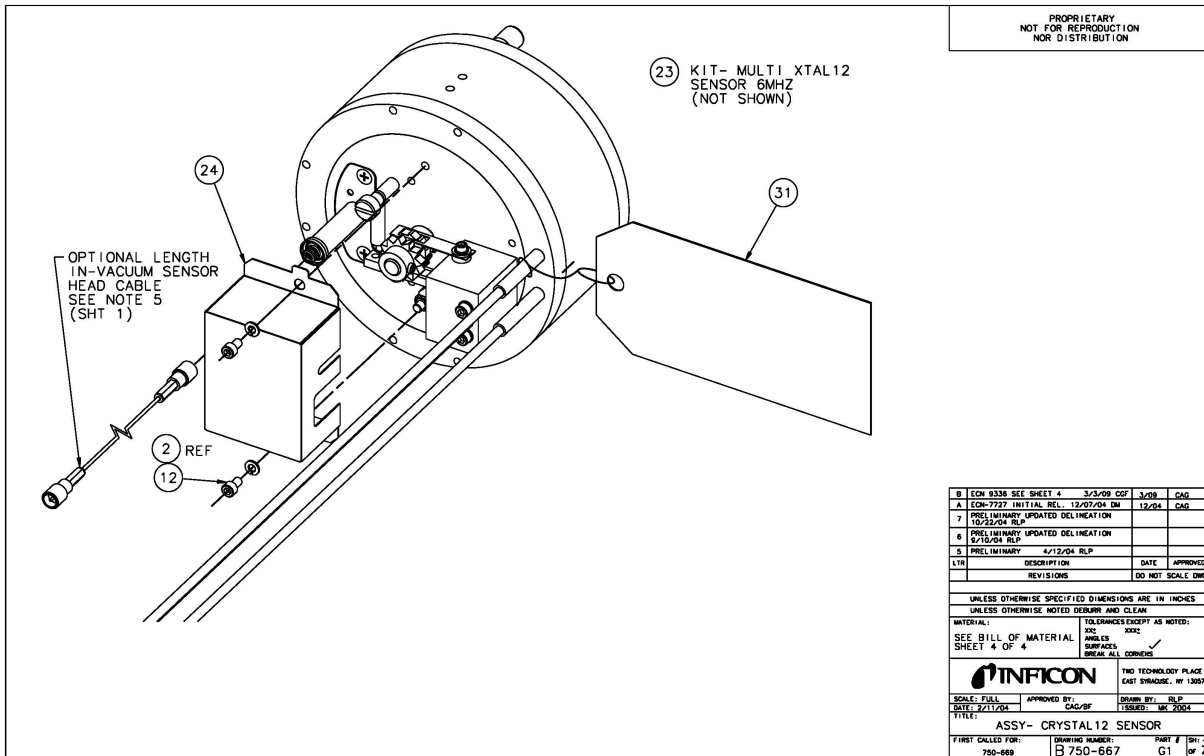
A	CON-7727 INITIAL REL. 12/07/04 DM	12/04	CAG
B	PRELIMINARY UPDATED DELINEATION		
7	PRELIMINARY 6/8/04 RLP		
LTN	DESCRIPTION	DATE	APPROVED
	REVISIONS		DO NOT SCALE DIMS
FOR SOME ASSEMBLY DRAWING SEE SEPARATE PART LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES			
UNLESS OTHERWISE NOTED DEBURR AND CLEAN			
MATERIAL:		TOLERANCES EXCEPT AS NOTED:	
	FRA	ANGLES	DEB
	SURFACES	BREAK ALL CORNERS	
INFICON		TNO TECHNOLOGY PLACE EAST SYRACUSE, NY 13053	
SCALE: 1/2" = 1"	APPROVED BY: CAG	DATE: 3/2/04	DESIGN BY: RLP ISSUED: MC 2004
TITLE: OUTLINE- CRYSTAL 12 SENSOR			
FIRST CALLED FOR:	DRAWING NUMBER: B 750-669	PART #	SH: 1 OF 2

PROPRIETARY
NOT FOR REPRODUCTION
NOR DISTRIBUTION

REF. QTY 2 #4-40 SHCS PROVIDED FOR EACH MOUNTING POST. THREAD DEPTH IN HOUSING: .400 [10.16] DP
 ASSY- FRONT DEPOSITION SHIELD
 ASSY- CRYSTAL CARROUSEL

A	CON-7727 INITIAL REL. 12/07/04 DM	12/04	CAG
B	PRELIMINARY UPDATED DELINEATION		
7	PRELIMINARY 6/8/04 RLP		
LTN	DESCRIPTION	DATE	APPROVED
	REVISIONS		DO NOT SCALE DIMS
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES			
UNLESS OTHERWISE NOTED DEBURR AND CLEAN			
MATERIAL:		TOLERANCES EXCEPT AS NOTED:	
	FRA	ANGLES	DEB
	SURFACES	BREAK ALL CORNERS	
INFICON		TNO TECHNOLOGY PLACE EAST SYRACUSE, NY 13053	
SCALE: 3/4" = 1"	APPROVED BY: CAG	DATE: 3/2/04	DESIGN BY: RLP ISSUED: MC 2004
TITLE: OUTLINE- CRYSTAL 12 SENSOR			
FIRST CALLED FOR:	DRAWING NUMBER: B 750-669	PART #	SH: 2 OF 2





PROPRIETARY
NOT FOR REPRODUCTION
NOR DISTRIBUTION

B	ECH 8336	SEE SHEET 4	3/3/09	CSF	3/09	CAG
A	ECH-7227	INITIAL REL.	12/07/04	DM	12/04	CAG
7	PRELIMINARY UPDATED DELINEATION					
6	PRELIMINARY UPDATED DELINEATION					
5	PRELIMINARY	4/12/04	RLP			
LTN	DESCRIPTION		DATE	APPROVED		
	REVISIONS			DO NOT SCALE DIMS		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE NOTED DEBURR AND CLEAN

MATERIAL: TOLERANCES EXCEPT AS NOTED:
DIM: .001
ANGLES: XXXX
SURFACES: ✓
BREAK ALL CORNERS

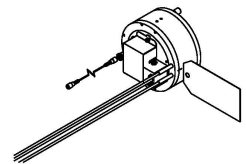
INFICON TNO TECHNOLOGY PLACE
EAST BRIDGE, NY 13057

SCALE: FULL APPROVED BY: CAG/SP DRAWN BY: RLP
DATE: 3/11/04 ISSUED: MK 2004

TITLE: ASSY- CRYSTAL 12 SENSOR

FIRST CALLED FOR: DRAWING NUMBER: PART # BR: 3
750-889 B 750-667 G1 OF 4

Item	Qty	Part #	Name
1	10	070-0170	WASHER 2 SPLIT LOCK SS
2	4	070-0201	WASHER 4 SPLIT LOCK SS
3	2	070-0398	RETAINING RING TRUARC 5103-12H
4	2	070-0779	BALL BEARING .250 OD .125 BORE
5	1	070-0867	STANDOFF RD .187 OD .125 ID .094
6	1	070-1254	E-RING BOWED 51310075HSTB TRUARC
7	1	070-1268	BEARING 1.375 OD 1.00 ID .187 T
8	1	082-022	WASHER 2 FLAT SS
9	1	082-024	SCREW 2-56 x .250 LG HEX SOC HD
10	1	082-032	WASHER 2 INTERNAL LOCK SS
11	10	082-045	SCREW 2-56 x .187 LG PHIL PAN HD
12	2	084-044	SCREW 4-40 x .188 LG SOC HD CAP
13	2	084-048	SCREW 4-40 x .250 LG PHIL FLAT H
14	2	084-093	SCREW 4-40 x 1.125 LG SOC HD CAP
15	3	086-036	SCREW 6-32 x .375 LG SOC HD CAP
16	3	086-038	WASHER 6 SPLIT LOCK SS
17	3	086-041	WASHER 6 FLAT SS
18	4	086-084-P2	SCREW 6-32 x .125 LG SOC SET STL
19	3	086-143	WASHER 6 FLAT SS NAS 620
20	1	750-252-P2	SPRING POST
21	1	750-256-P2	EXTENSION SPRING
22	1	750-258-P2	BEARING SHAFT
23	1	750-268-G3	MULTI XTAL 12 SENSOR 6 MHZ
24	1	750-276-P3	ACTUATOR COVER
25	1	750-286-P2	BELLOWS ASSY
26	1	750-291-P1	DETENT
27	1	750-292-P2	DETENT SPACER
28	1	750-293-P2	RATCHET
29	1	750-294-P2	STOP RATCHET
30	1	750-295-G1	PAWL AND ACTUATOR STEM
31	1	750-299-P1	OPERATING PRESSURE TAG
32	1	750-626-P1	SPRING X213841
33	1	750-644-G1	CARROUSEL HOUSING
34	1	750-647-P1	CARROUSEL SPINDLE BODY
35	1	750-649-G1	ELECTRICAL CONNECTION
36	1	750-652-G1	CRYSTAL CAROUSEL
37	1	750-657-P1	GROUNDING LEAF SPRING
38	1	750-658-G1	FRONT DEPOSITION SHIELD
39	1	750-660-P1	6-32 LOCATION SCREW



PROPRIETARY
NOT FOR REPRODUCTION
NOR DISTRIBUTION

B	ECH 8336	082-045 AND 070-170 WERE A QUANTITY OF 10 AND ADDED 086-143	3/3/09	CSF	3/09	CAG
A	ECH-7227	INITIAL REL.	12/07/04	DM	12/04	CAG
7	PRELIMINARY UPDATED DELINEATION					
6	PRELIMINARY UPDATED DELINEATION					
5	PRELIMINARY	4/12/04	RLP			
LTN	DESCRIPTION		DATE	APPROVED		
	REVISIONS			DO NOT SCALE DIMS		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE NOTED DEBURR AND CLEAN

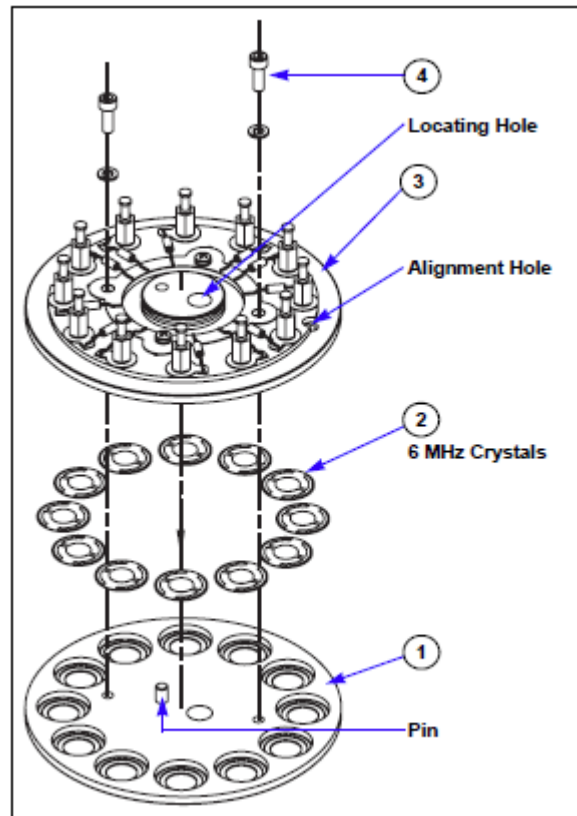
MATERIAL: TOLERANCES EXCEPT AS NOTED:
DIM: .001
ANGLES: XXXX
SURFACES: ✓
BREAK ALL CORNERS

INFICON TNO TECHNOLOGY PLACE
EAST BRIDGE, NY 13057

SCALE: 1/2X APPROVED BY: CAG/SP DRAWN BY: RLP
DATE: 3/11/04 ISSUED: MK 2004

TITLE: ASSY- CRYSTAL 12 SENSOR

FIRST CALLED FOR: DRAWING NUMBER: PART # BR: 4
750-889 B 750-667 G1 OF 4



4 Sensor Installation

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



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 become contaminated, clean them thoroughly using a suitable solvent to avoid outgassing and excessive peeling of the deposition material from the sensor's surfaces.

4.1 Crystals in the Crystal12 Sensor

4.1.1 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 results in high rate noise and premature crystal failure.

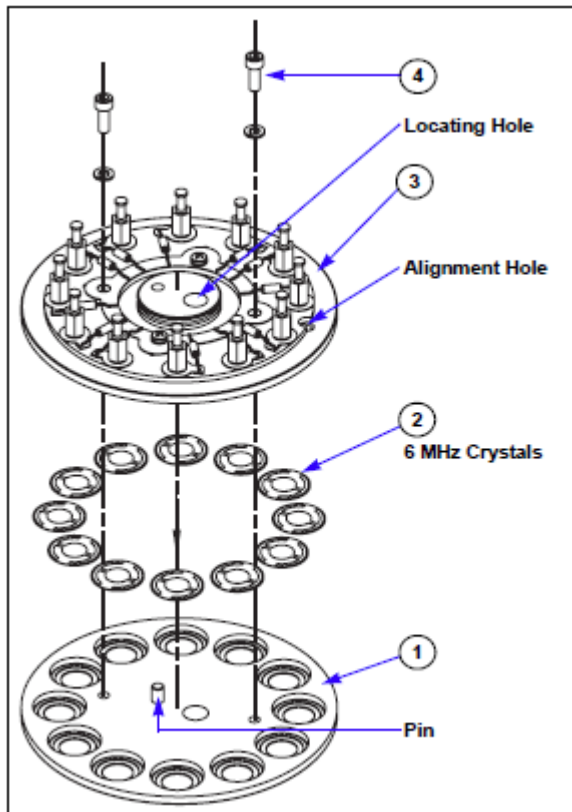
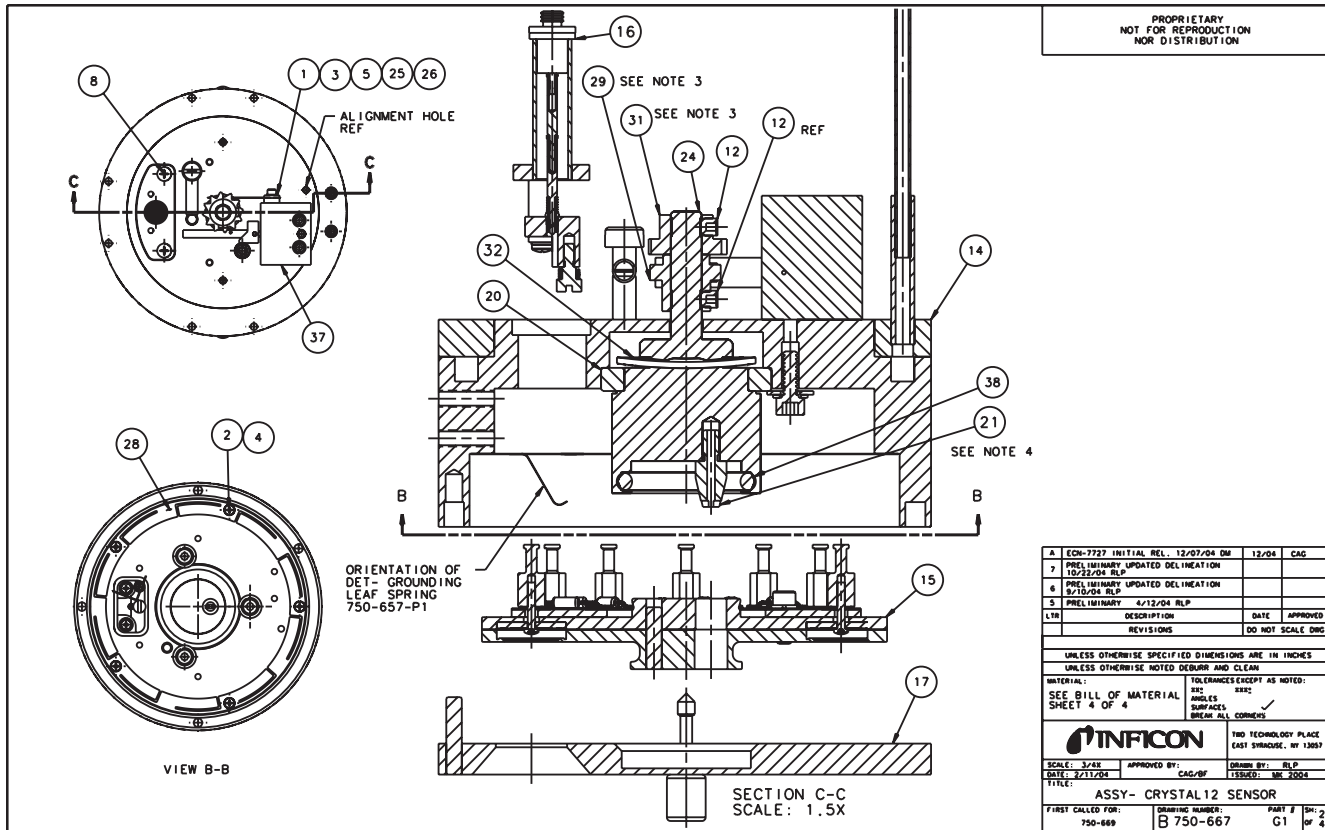


⚠ CAUTION

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.

4.1.2 Replacing Crystals

This section references the figures below.



Replacing crystals in Crystal12 requires the removal of the front deposition shield (item 17). This is accomplished by removing the two captive fasteners that attach the front deposition shield to the carousel housing (item 14).

The crystal carousel (item 15) is removed from the carousel housing by gripping the carousel assembly by the protruding hub and applying pressure using an index finger near the radial edge of the carousel.

Cygnus 2 detects when a carousel is removed and displays a **Carousel Open** 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) that secure the two halves (items 1 and 3) of the assembly.

Exchanging the crystals is accomplished by inverting the plate (item 1) containing the used crystals and installing the new crystals (item 2) in the orientation shown.

Reassemble the crystal carousel assembly by orientating the pin protruding from item 1 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) with the #6-32 location screw (item 21). The carousel assembly should snap into place.

Orient and attach the front deposition shield (item 17) to the carousel housing (item 14) using the two knurled captive fasteners.

The crystal status and **Carousel Open** message on the Cygnus 2 display remains unchanged subsequent to a carousel replacement, until one of the following occurs:

- A **Rotate Sensor** function is initiated via remote communications, or from the front display soft key of the Sensor Information 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 Cygnus 2 detects a crystal position, the **Carousel Open** message is removed and all crystals are labeled as good.

4.2 Pre-Installation Sensor Check

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

4.2.1 Cygnus 2 Deposition Controller

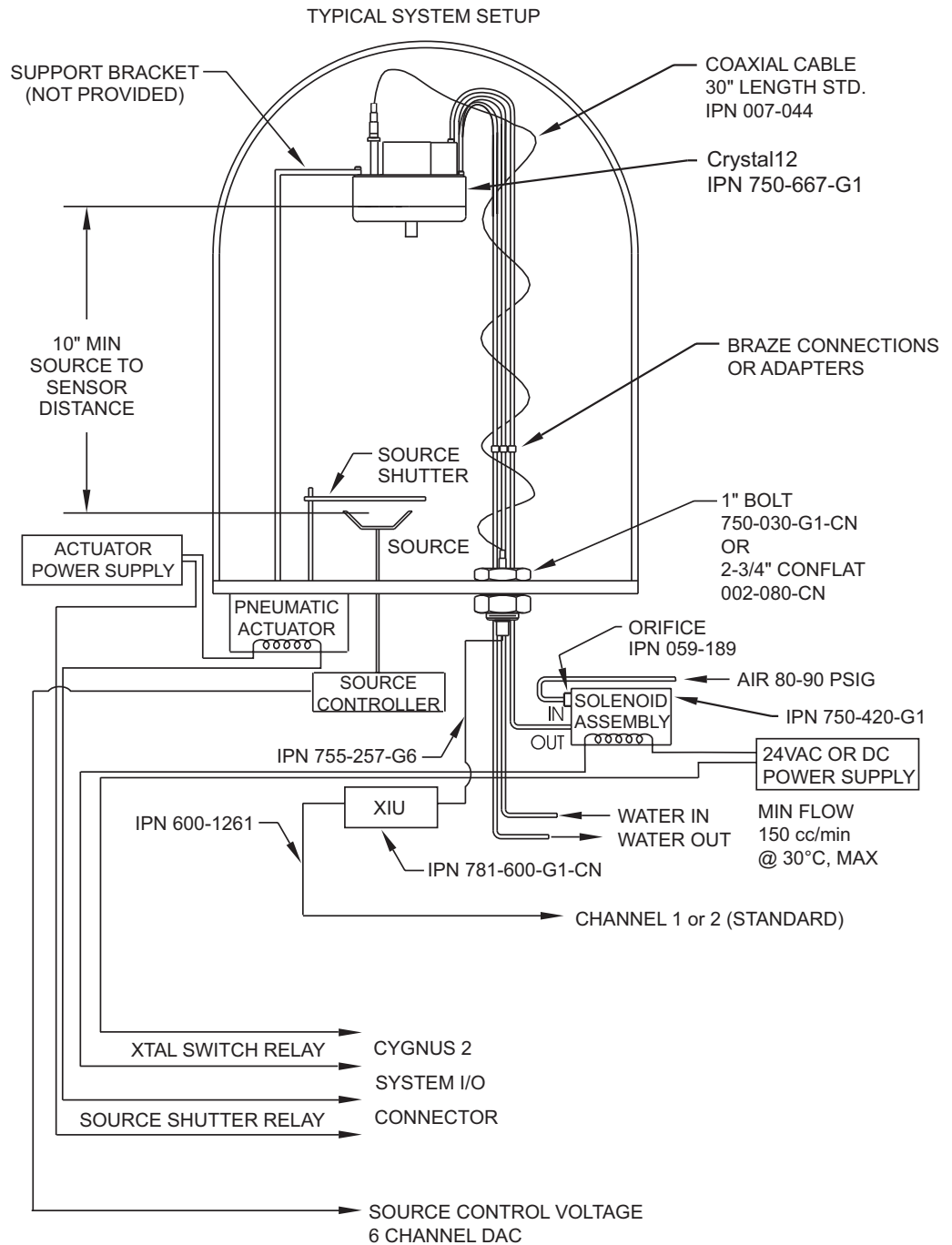
- 1 Connect the in-vacuum cable from the sensor head to the feedthrough or a coax adapter (Microdot/BNC).
- 2 Connect one end of the 15.2 cm (6 in.) XIU cable (PN 755-257-G6) to the BNC connector on the feedthrough.
- 3 Connect the other end of the 15.2 cm (6 in.) XIU cable to the connector of the ModeLock oscillator (XIU) (PN 781-600-G1-CN).
- 4 Connect one end of the XIU cable (PN 600-1261-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.
- 7 Set the power switch **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) may have to be manually advanced by hand to make an electrical contact to correct the failed condition.



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.

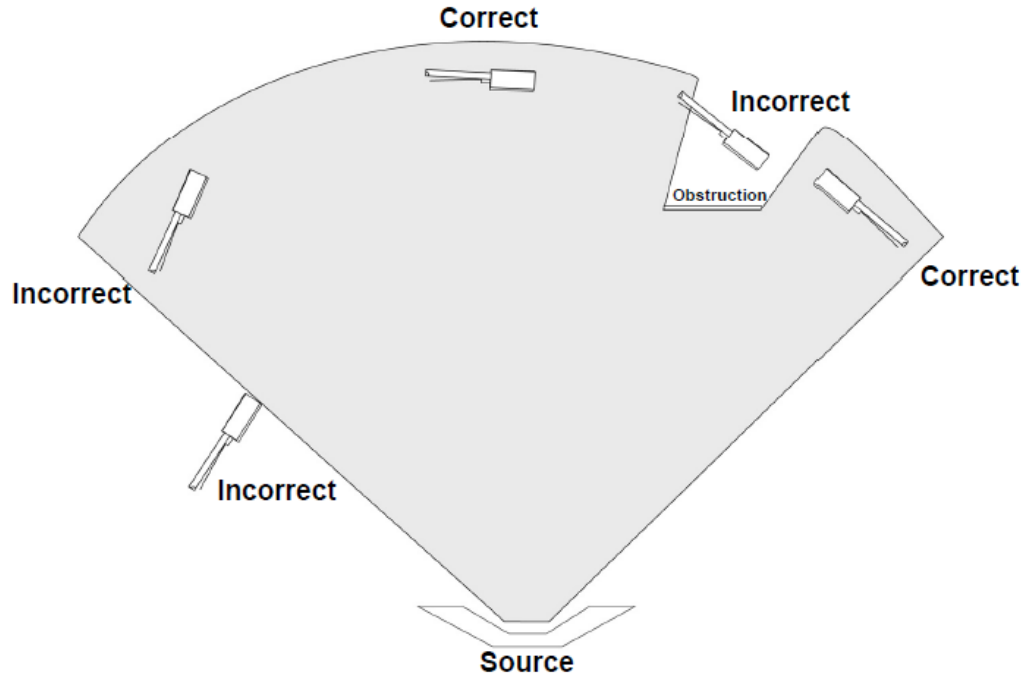
4.3 General Guidelines for Crystal12 Sensor

The figure below 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.



4.3.1 Crystal Sensor Installation

Install the sensor as far as possible from the evaporation source (a minimum of 10 in. or 25.4 cm) while still being in a position to accumulate thickness at a rate proportional to accumulation on the substrate. The figure below shows proper and improper sensor positioning.



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 ensure there are no obstructions blocking a direct path between the sensor and the source.

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

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 (PN 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 the air tubes to the proper length and connect them directly to the feedthrough or use vacuum rated couplings.



⚠ CAUTION

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

After cutting the water and air tubes, verify 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

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

- 4 Verify 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 2 m (80 in.) of 1/8 in. 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 in. is used, the maximum length must be reduced proportional to the additional volume.

4.4 Crystal12 Sensor Installation When Used with Cygnus 2

4.4.1 Changing Crystal Sensor Type and Programming the Relay Outputs

- 1 Select Sensors from the main menu. Then move the cursor to the appropriate sensor number and press Select Sensor.

0.000 $\text{\AA}/\text{s}$ 2.360 $\text{k}\text{\AA}$ 0.00%				READY
Overview	Sensor Number	5		
Sensor	Sensor Type	Generic	# Positions	10
	Switch Out	4	# Pulses	1
	Shutter Out	0	Pulse On	1.0 s
	Auto-Z	No	Pulse Off	1.0 s
	Recorder Settings			
	Output	11		
	Function	Rate		
	Range	100		
Sensor		Carousel Open 4		Crystal Fail 2
02/05/2011 13:40				

- 2 Select Sensor Type = Xtal12.

0.000 $\text{\AA}/\text{s}$ 2.360 $\text{k}\text{\AA}$ 0.00%				READY
Overview	Sensor Number	5		
Sensor	Sensor Type	Generic	# Positions	10
	Switch Out	4	# Pulses	1
	Shutter Out	0	Pulse On	1.0 s
	Auto-Z	No	Pulse Off	1.0 s
	Recorder Settings			
	Output	11		
	Function	Rate		
	Range	100		
Sensor		Carousel Open 4		Crystal Fail 2
02/05/2011 13:40				

- 3 If Sensor Type = XTAL12, the Switch Out(put) field becomes selectable. Select the relay output number to be used to activate the crystal switch.

Overview	Sensor #	1	2	3	4	5	6		
Sensor Type		Single	XtalTwo	XtalSix	Xtal12	Generic	Single		
Switch Out		0	1	2	3	4	0		
Shutter Out		0	0	0	0	0	0		
Auto-Z		No	No	No	No	No	No		
Recorder Output		7	8	9	10	11	0		
Function Range		Thick 100	Rate 100	Thick 100	Rate 100	Rate 100	Rate 100		
# Positions		1	1	1	1	10	1		
# Pulses		1	1	1	1	1	1		
Pulse On s		1.0	1.0	1.0	1.0	1.0	1.0		
Pulse Off s		1.0	1.0	1.0	1.0	1.0	1.0		
Sensor			Carousel Open 4				Crystal Fail 2		
02/05/2011 11:33									
Select Sensor									

4.4.2 Wiring the Relay Outputs with Relay I/O Boards

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).

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.

Relay #	Pins	TTL	Pin
I/O Board #1			
1	7,6	1	15
2	9,8	2	14
3	11,10	3	13
4	13,12	4	12
5	5,4	5	11
6	3,2	6	10
7	1,14	7	9
8	15,16	8	8
		9	7
		10	6
		11	5
		12	4
		13	3
		14	2
		GND	1
I/O Board #2			
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

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

4.5 Crystal12 Operation When Used with Cygnus 2

4.5.1 Initialization

An automatic **Rotate Sensor** function occurs when Cygnus 2 is first powered on, assuming a channel's crystal **Sensor Type** is configured as a Crystal12.



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

Whenever a **Rotate Sensor** function is initiated, Cygnus 2 will advance the Crystal12 carousel until it locates Position 1. After Position 1 is located, the **Rotate Sensor** function begins cataloging the crystals at each position as either good or failed.

- Because Position 1 is unique, the Crystal12 always ends on Position 1
- A **Rotate Sensor** 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 Crystal12 is manually moved there is no guarantee of correct position detection.

- Example 1: If Crystal12 head were moved manually from Position 2 to Position 5, Cygnus 2 would not detect the difference. When a switch is done, Cygnus 2 would advance Crystal12 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 2 assumes Crystal12 remains on that position until a **Crystal Switch** or a **Rotate Head** function is initiated

4.5.2 Crystal Switching

Crystal12 requires one pneumatic pulse to change position. Upon a crystal switch, the **Crystal Switch Output** relay closes for one second and then opens. One second after the relay is opened, the crystal switch function is considered complete.

Cygnus 2 then looks for the appropriate crystal position.

After completion of the crystal switch, there is a short delay of about five 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 2 Channel** is in **Deposit**, Crystal12 advances to the next "good" crystal, skipping the failed crystals.

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

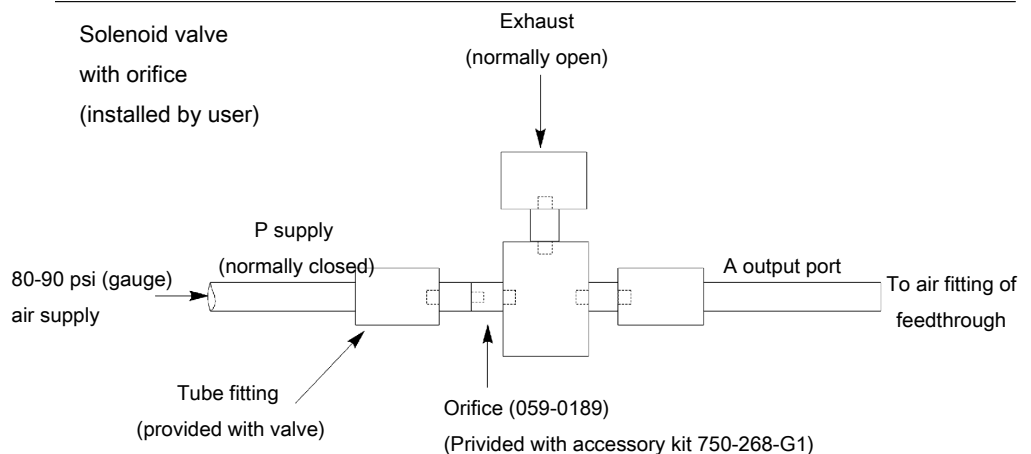
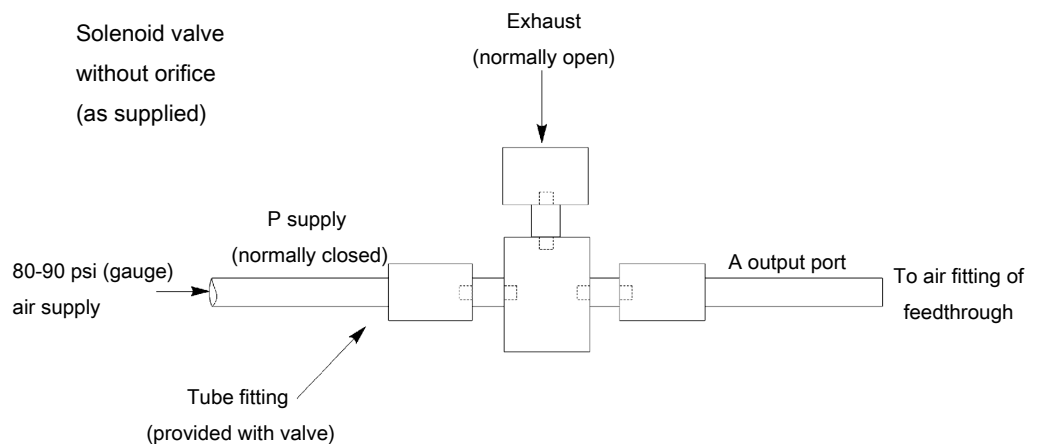
If a **Start** command is given to the **Channel** and Crystal12 is currently on a failed crystal the instrument will automatically crystal switch to the next known good crystal before entering **Deposit**.

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.

4.6 Crystal12 Sensor Requirement when Not Installed with Cygnus 2

The Crystal12 can be manually operated with other **Deposition Controllers**. However, the user must 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 the figure below 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 General Guidelines for Crystal12 Sensor [▶ 19] 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.

5 Installation of the Solenoid Valve Assembly

5.1 Introduction

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 in. and the (recommended) 2 3/4 in. feedthroughs. However, if the assembly is to be used with the 2 3/4 in. feedthrough, you will need to modify the valve bracket as follows.

For the following steps, use the image below. (DWG. 750-420-G1)

PROPRIETARY
 NOT FOR REPRODUCTION
 NOR DISTRIBUTION

NOTES:

1. TEST FOR FUNCTION AT 21 VAC MINIMUM AND 100 PSIG AIR
2. POLARIZATION OF HOOK UP WIRES NOT REQUIRED
3. REMOVE FITTING FROM EXHAUST PORT OF VALVE FOR USE ON FEEDTHRU
4. STRAIN RELIEVE INTERFACE CABLE TO SOLENOID VALVE BODY
5. INDIVIDUALLY BAG AND LABEL WITH IPN: 750-420-G1 NAME: SPEC- 3 WAY SOLENOID VALVE ASSEMBLY
6. SOME DRAWING LINES ARE REMOVED FOR CLARITY.
7. SPECIFICATIONS
 - 7.1 ASSY P/N: TM-D12-L1-ASSY
 - 7.2 PRESS (MAX): 100 PSIG
 - 7.3 ELECTRICAL:
 - OPER VOLTAGE 24.0 AC OR DC
 - POWER 2.5 WATTS AT 24 VDC
 - +15%, -10%
 - 7.4 TEMP RANGE: 0 °F TO 122 °F
 - 7.5 WETTED MATERIALS:
 - ANODIZED ALUMINUM
 - ELECTROLESS NICKEL
 - NEOPRENE

ITEM	QTY	IPN	PART DESCRIPTION
1	3	059-0405	#10-32 TO 1/8 TUBE FITTING SMC #KQ2H01-32
2	2	144-055	#M3 SPLIT LOCKWASHER SS MCMASTER-CARR #92148A150
3	2	961522000	#M3 x 6mm PHIL PAN HD SCREW
4	1	206-900 (064-181)	DET - OPERATING PRESSURE LABEL
5	1	750-422-P1	DET - SOLENOID VALVE BRACKET
6	1	035-0030	INTERFACE CABLE BRIDGE & SURGE SUP 26 AWG MOD 2587-7
7	1	750-421-P1	SPEC- 3 WAY SOLENOID VALVE

A	ECH 7019 DWG RELEASE	3/11/03	SS	3/03	CAG
LTR	DESCRIPTION	DATE	APPROVED	DO NOT SCALE DWG	
MATERIAL:		TOLERANCES EXCEPT AS NOTED:			
SEE DWG SPECS AND BOM		FRAZ ANGLES SURFACES BREAK ALL CORNERS			
		TWO TECHNOLOGY PLACE EAST STRAUSS, NY 13057			
SCALE: FULL	APPROVED BY:	RF	CAG	DRAWN BY: SS	
DATE: 3/11/03				ISSUED: M. KATRIS	
TITLE: SPEC- 3 WAY SOLENOID VALVE ASSEMBLY					
FIRST CALLED FOR:	DRAWING NUMBER:	PART #	SH: 1		
	B 750-420	G1	PF 1		

- 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.

5.1.1 Orifice Installation

In order for the CrystalSix Sensor to operate properly, a 0.559 mm (0.022 in.) diameter orifice (PN 059-0189 provided in the accessory kit, PN 750-268-G1) must be installed between the air supply and port P of the solenoid valve assembly. This is accomplished by the following procedure.

- 1 Unthread the tube fitting attached to the normally closed (N.C.) P Supply port of the 3-way solenoid valve.

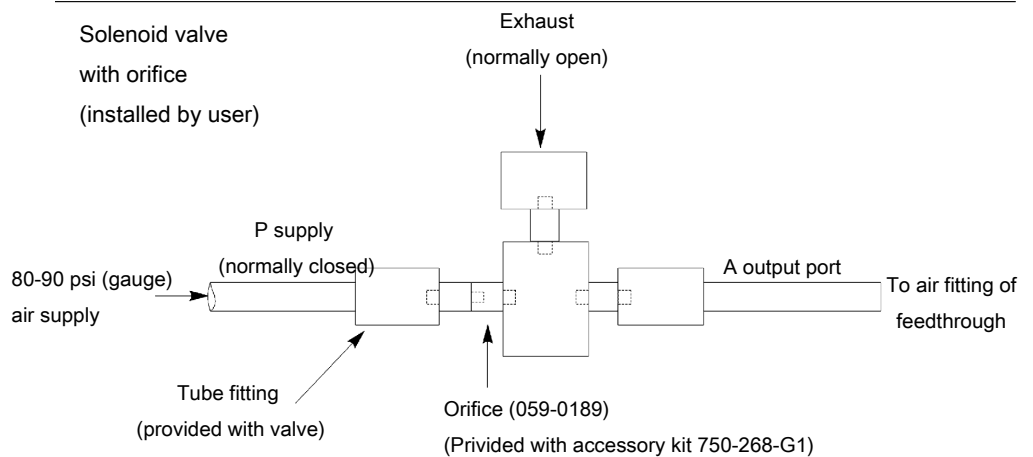
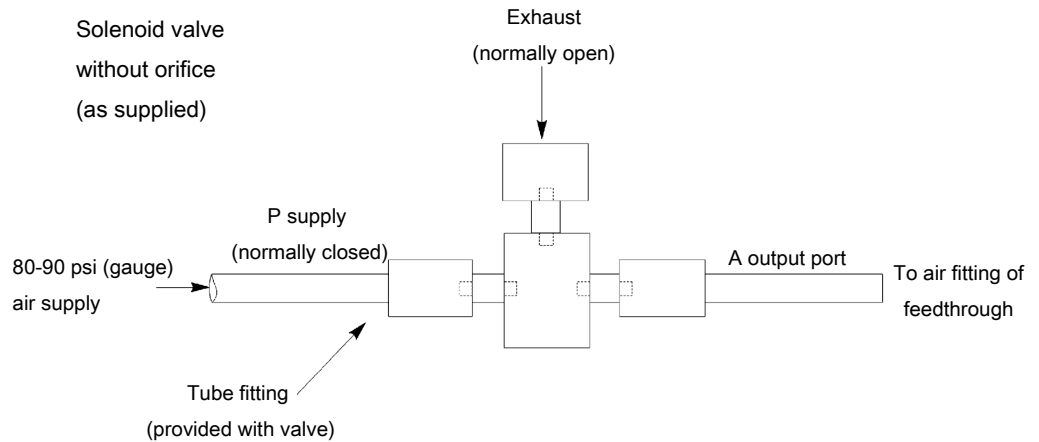
28 / 50

074-398-P1B Crystal12 Sensor Operating Manual

- 2 Install the orifice by threading it into the normally closed (N.C.) port of the 3-way solenoid valve.
- 3 Thread the tube fitting previously removed into the orifice.



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.



5.2 Installation with a 2.54 cm (1 in.) Bolt Feedthrough

When installing the solenoid valve assembly with a CrystalSix Sensor, a 2.54 cm (1 in.) bolt equipped with three pass tubes (two water and one air) and a single coaxial feedthrough (PN 750-030-G1-CN) is required.

Most INFICON 2.54 cm (1 in.) bolt feedthroughs with air tubes are equipped with a fitting adapter (PN 007-133). This adapter provides an easy way to attach a quick disconnect fitting (included with the PN 750-420-G1 solenoid valve) to the feedthrough air tube. The fitting adapter is available INFICON for feedthroughs not equipped with this adapter.

Follow the steps below:

- 1 Ensure the O-ring is in the groove on the bolt.
- 2 Insert the 2.54 cm (1 in.) bolt such that the hexagonal shaped end of the bolt is on the vacuum side of the chamber.
- 3 Add the solenoid valve bracket to the bolt threads.
- 4 Add the washer.
- 5 Add the feedthrough nut.
- 6 Tighten the feedthrough nut.
- 7 Remove the quick disconnect air fitting from the exhaust port of the solenoid valve and thread it into the fitting adapter (PN 007-133) installed on the feedthrough air tube.
- 8 Connect the 3.175 mm (1/8 in.) air tube from the **A** port of the solenoid valve to the quick disconnect fitting installed in step 7.



CAUTION

Use of more than 2 m (80 in.) of 3.175 mm (1/8 in.) tubing between the valve and the bellows may cause a switch failure because of the time required to bleed out sufficient air during de-pressurization. If tubing greater than 3.175 mm (1/8 in.) is used, the maximum length must be reduced proportional to the additional volume.

- 9 Attach the **P** port of the solenoid valve to a source of air. The air supply must be 80 psi (gauge) {95 psi (absolute)} (6.5 bar (absolute)) [653 kPa (absolute)] (minimum) to 90 psi (gauge) {105 psi (absolute)} (7.2 bar (absolute)) [722 kPa (absolute)] (maximum).



WARNING

Do not exceed 100 psi (gauge) {115 psi (absolute)} (7.9 bar (absolute)) [791 kPa (absolute)].

Connection to excessive pressure may result in personal injury or equipment damage.



CAUTION

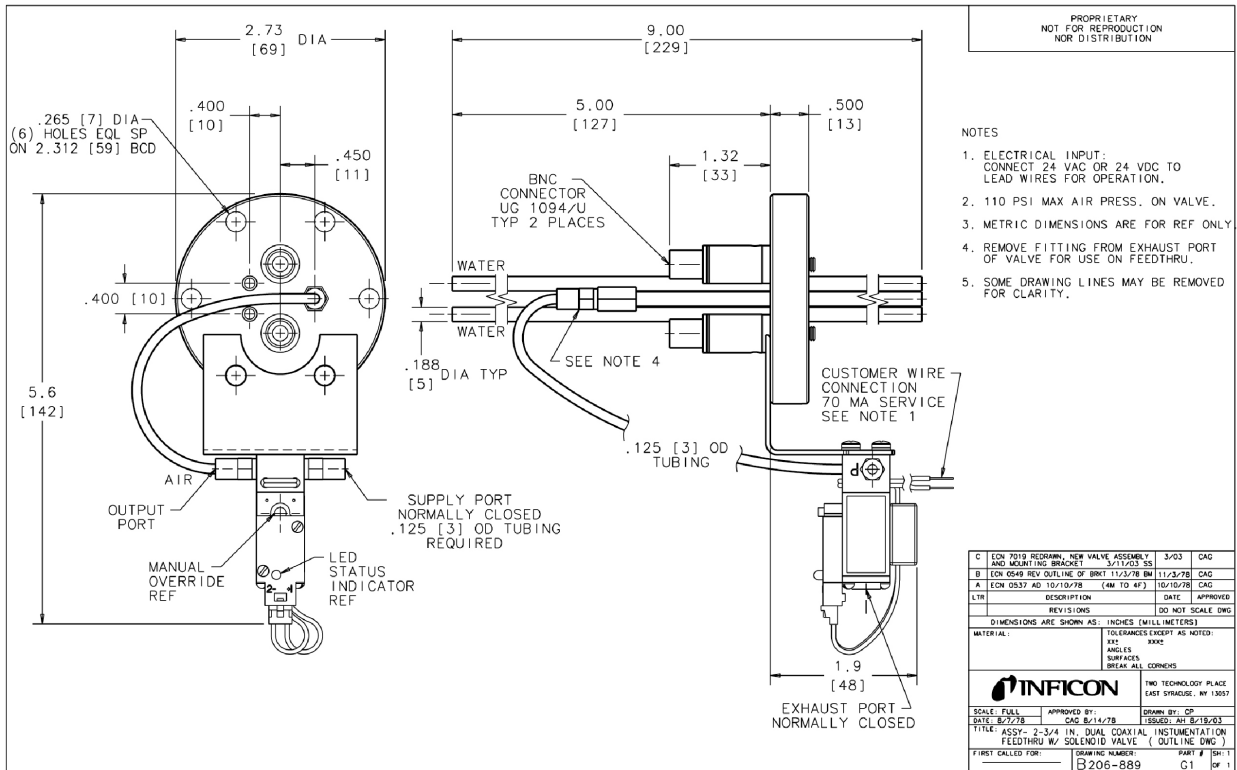
Maximum temperature for the solenoid valve assembly is 105°C for bakeout and operation.

- 10 Make electrical connections to the solenoid valve.

5.3 Installation with 2 3/4 in. Feedthrough

Installation of the solenoid valve requires a 2 3/4 in. feedthrough inclusive of two coaxial feedthroughs (IPN 002-080-CN). 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 shown below.



- 3 Tighten the feedthrough bolts.
- 4 Install the air fitting to the female thread adapter.
- 5 Connect the 3.175 mm (1/8 in.) air tube from the valve output (A) to the feedthrough fitting.
- 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 the orifice (PN 059-0189) has been installed into this NC valve port.



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

5.4 Electrical and Pneumatic Connections

5.4.1 Electrical Connections

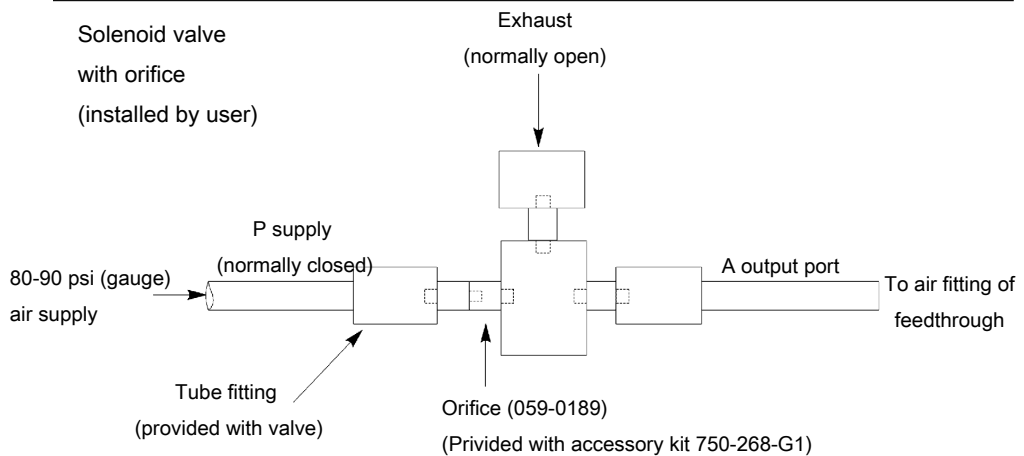
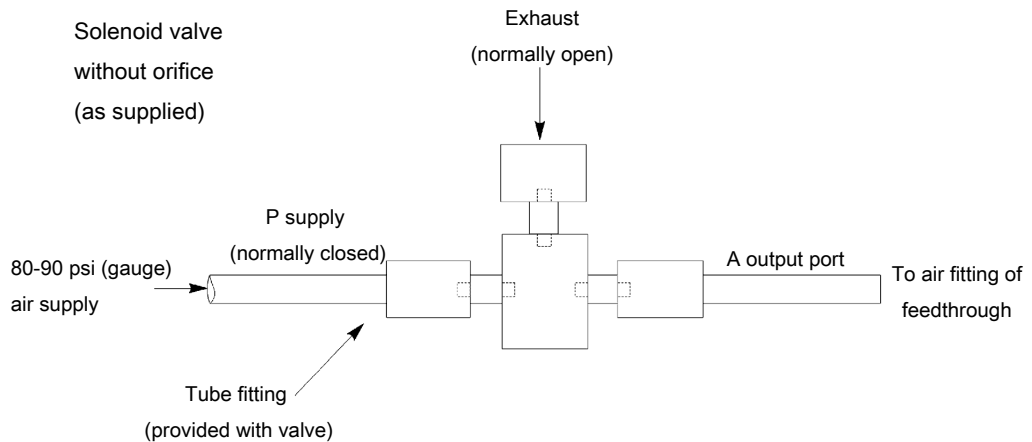
To complete installation of the assembly, make electrical connections where indicated in the CF40 (2-3/4 in. ConFlat) Dual Coaxial Feedthrough and Solenoid Valve figure in section 3.4 to either 24 V(ac) • V(dc). Current required is approximately 70 mA.



⚠ CAUTION

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

5.4.2 Pneumatic Connections



5.4.3 Solenoid Valve Drawings

The following Solenoid Valve Outline Drawings provide dimensions and other relevant data necessary for planning equipment configurations.

Solenoid Valve (PN 750-420-G1)

PROPRIETARY NOT FOR REPRODUCTION NOR DISTRIBUTION

NOTES:

- TEST FOR FUNCTION AT 21 VAC MINIMUM AND 100 PSIG AIR
- POLARIZATION OF HOOK UP WIRES NOT REQUIRED
- REMOVE FITTING FROM EXHAUST PORT OF VALVE FOR USE ON FEEDTHRU
- STRAIN RELIEVE INTERFACE CABLE TO SOLENOID VALVE BODY
- INDIVIDUALLY BAG AND LABEL WITH IPN: 750-420-G1 NAME: SPEC- 3 WAY SOLENOID VALVE ASSEMBLY
- SOME DRAWING LINES ARE REMOVED FOR CLARITY.
- SPECIFICATIONS
 - 7.1 ASSY P/N: TM-D12-L1-ASSY
 - 7.2 PRESS (MAX): 100 PSIG
 - 7.3 ELECTRICAL:
 - OPER VOLTAGE: 24.0 AC OR DC
 - POWER: 2.5 WATTS AT 24 VDC
 - +15%, -10%
 - 7.4 TEMP RANGE: 0 °F TO 122 °F
 - 7.5 WETTED MATERIALS:
 - ANODIZED ALUMINUM
 - ELECTROLESS NICKEL
 - NEOPRENE

ITEM	QTY	IPN	PART DESCRIPTION
1	3	059-0405	#10-32 TO 1/8 TUBE FITTING SMC #K02H01-32
2	2	144-055	#M3 SPLIT LOCKWASHER SS MCMASTER-CARR #92148A150
3	2	961522000	#M3 x 6mm PHIL PAN HD SCREW
4	1	206-900 (064-181)	DEL- OPERATING PRESSURE LABEL
5	1	750-422-P1	DEL- SOLENOID VALVE BRACKET
6	1	035-0030	INTERFACE CABLE BRIDGE & SURGE SUP 26 AWG MOD 2587-7
7	1	750-421-P1	SPEC- 3 WAY SOLENOID VALVE

A	ECN 7019 DWG RELEASE	3/11/03 SS	3/03	CAG
LTB	DESCRIPTION	DATE	APPROVED	
	REVISIONS			DO NOT SCALE DWG

MATERIAL:		TOLERANCES EXCEPT AS NOTED:	
SEE DWG SPECS AND BOM		XXX	ANGLES
		XXXX	SURFACES
		BREAK ALL	CORNERS

SCALE: FULL APPROVED BY: RF CAG DRAWN BY: SS
DATE: 3/11/03 ISSUED: M. KATRIS

TITLE: SPEC- 3 WAY SOLENOID VALVE ASSEMBLY
FIRST CALLED FOR: B 750-420 PART # G1 SH: 1 OF 1

CF40 (2-3/4 in. ConFlat) Dual Coaxial Feedthrough and Solenoid Valve (Drawing PN 206-889)

PROPRIETARY NOT FOR REPRODUCTION NOR DISTRIBUTION

NOTES:

- ELECTRICAL INPUT: CONNECT 24 VAC OR 24 VDC TO LEAD WIRES FOR OPERATION.
- 110 PSI MAX AIR PRESS. ON VALVE.
- METRIC DIMENSIONS ARE FOR REF ONLY.
- REMOVE FITTING FROM EXHAUST PORT OF VALVE FOR USE ON FEEDTHRU.
- SOME DRAWING LINES MAY BE REMOVED FOR CLARITY.

C	ECN 7019 REDRAWN, NEW VALVE ASSEMBLY AND MOUNTING BRACKET	3/03	CAG
B	ECN 0549 REV OUTLINE OF BRKT 11/23/78 BM	11/23/78	CAG
A	ECN 0537 AD 10/10/78 (4M TO 4F)	10/10/78	CAG
LTB	DESCRIPTION	DATE	APPROVED
	REVISIONS		DO NOT SCALE DWG

MATERIAL:		TOLERANCES EXCEPT AS NOTED:	
SEE DWG SPECS AND BOM		XXX	ANGLES
		XXXX	SURFACES
		BREAK ALL	CORNERS

SCALE: FULL APPROVED BY: RF CAG DRAWN BY: CP
DATE: 8/27/78 ISSUED: AF 8/19/03

TITLE: ASSY- 2-3/4 IN. DUAL COAXIAL INSTRUMENTATION FEEDTHRU W/ SOLENOID VALVE (OUTLINE DWG)
FIRST CALLED FOR: B 206-889 PART # G1 SH: 1 OF 1

6 Maintenance

6.1 General Precautions

6.1.1 Maintain the Temperature of the Crystal

Periodically measure the water flow rate through the crystal sensor to verify 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 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.

6.1.2 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 alloy electrodes. Gold is preferred for other applications.

6.1.3 Crystal Concerns when Opening the Chamber

Thick deposits of some materials, such as SiO₂, 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.

6.2 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**

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.

6.3 Alignment Instruction for Crystal12 Sensor XL12-100000 or XL12-100000-CN

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.



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 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.

6.3.1 Required Equipment

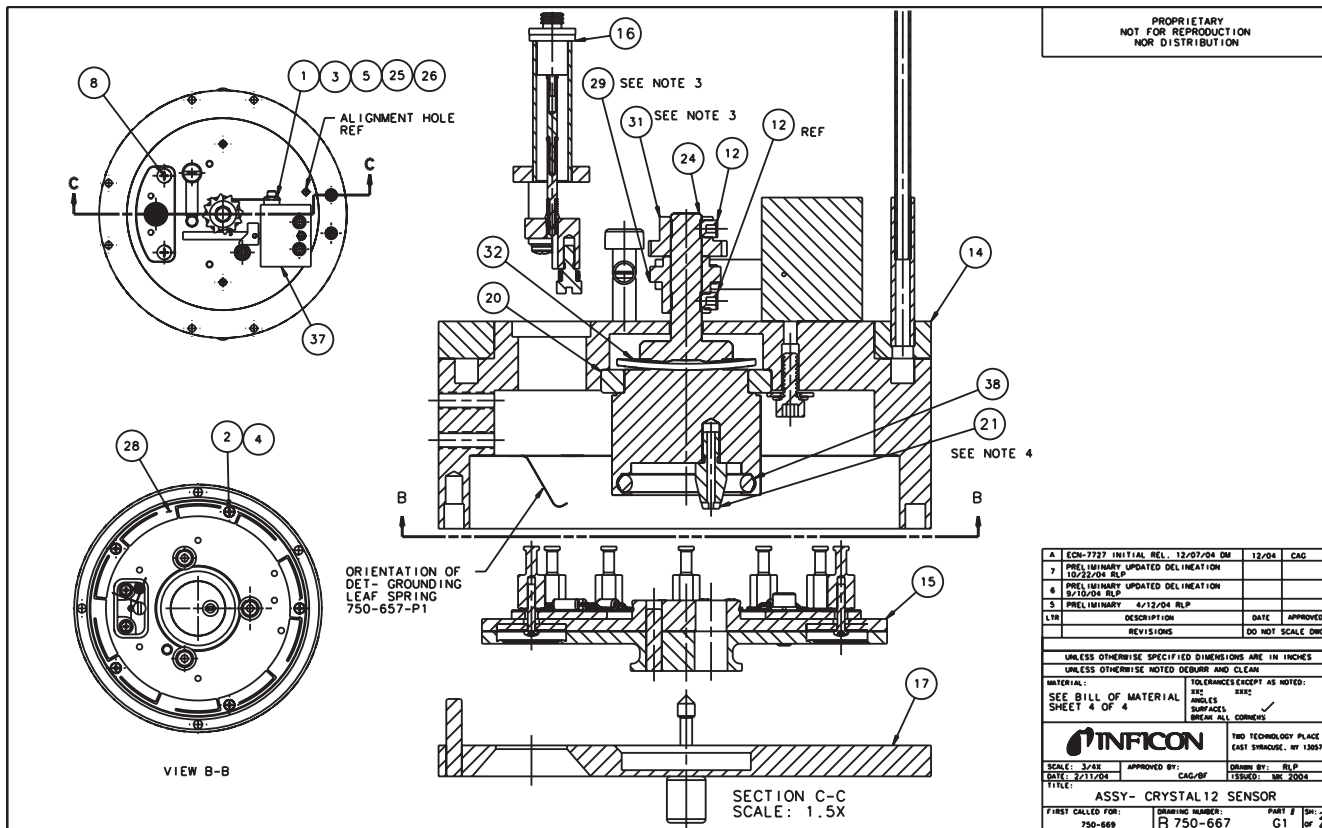
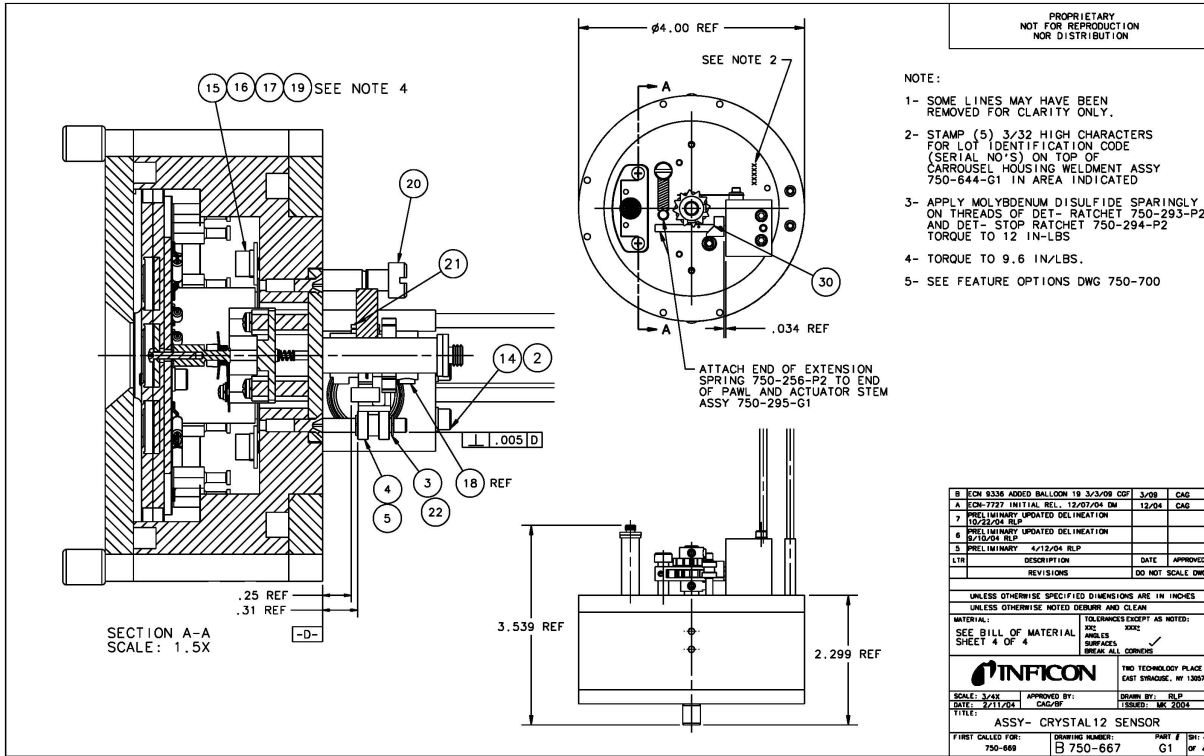
- 5/64 in. Allen wrench (included in 750-268 kit)
- 1/16 in. Allen wrench (included in 750-268 kit)
- 3/32 in. Allen wrench (included in 750-268 kit)
- Alignment tool assembly 750-254-G2 (included in 750-268 kit)
- Regulated air supply 80-90 PSIG (5.5 bar - 6.2 bar) [550 kPa - 620 kPa]

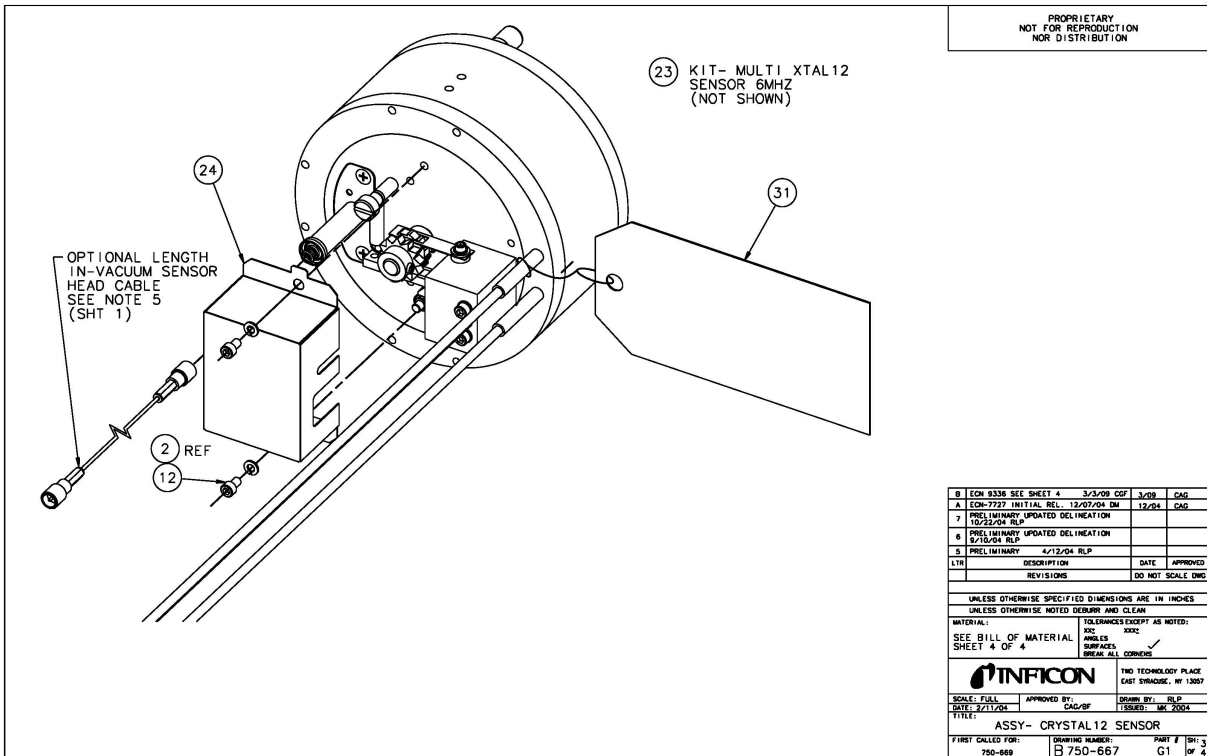


75 PSIG (5.2 bar) [520 kPa] is for alignment purposes only.

6.3.2 Procedure

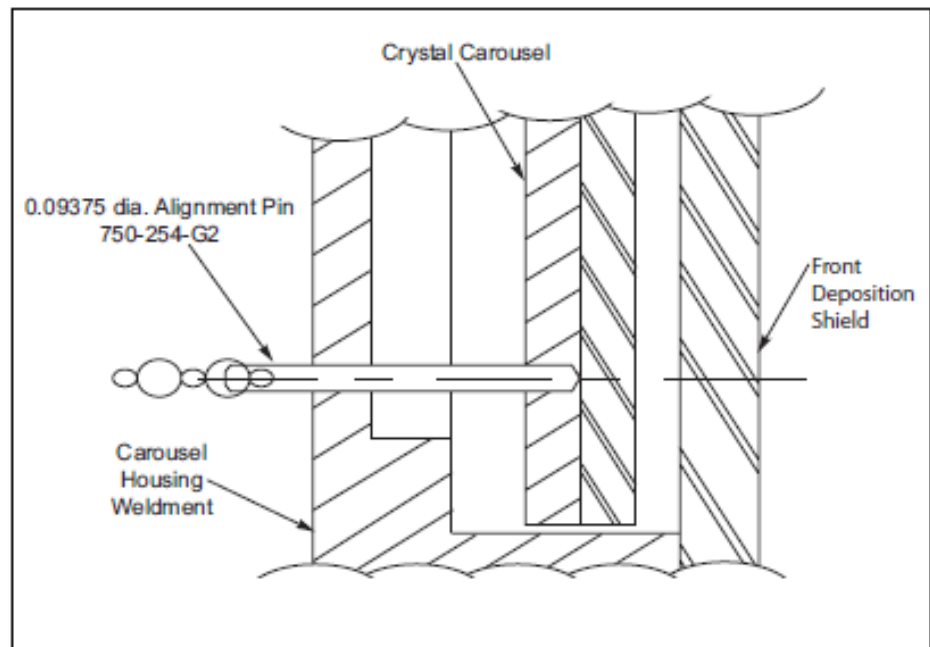
Reference the figures below for this procedure.





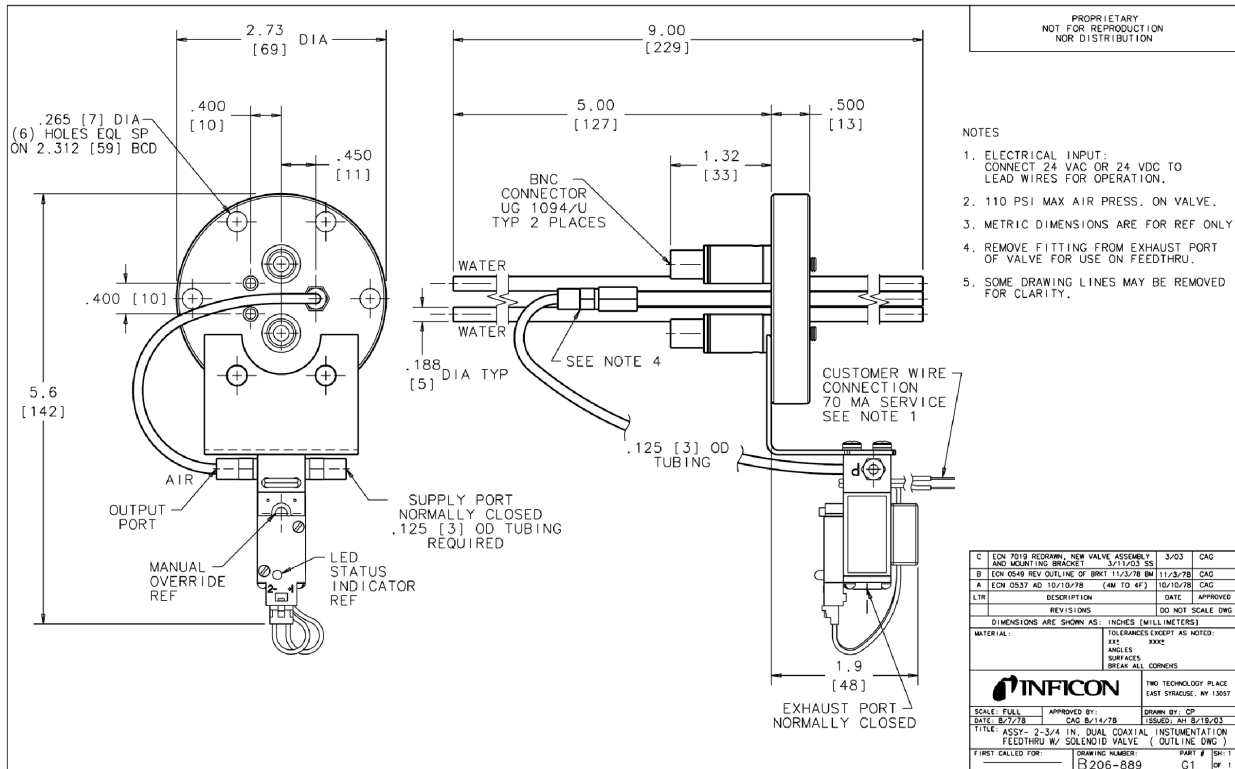
With the required equipment, proceed as follows:

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

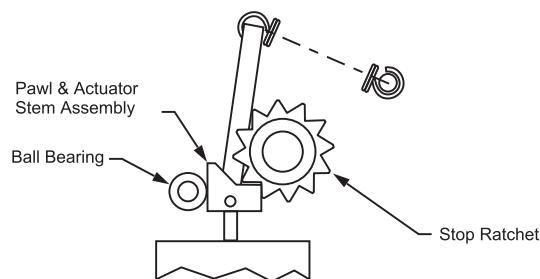


- 3 Remove the actuator cover (item 22) and its related hardware (items 6 and 7).

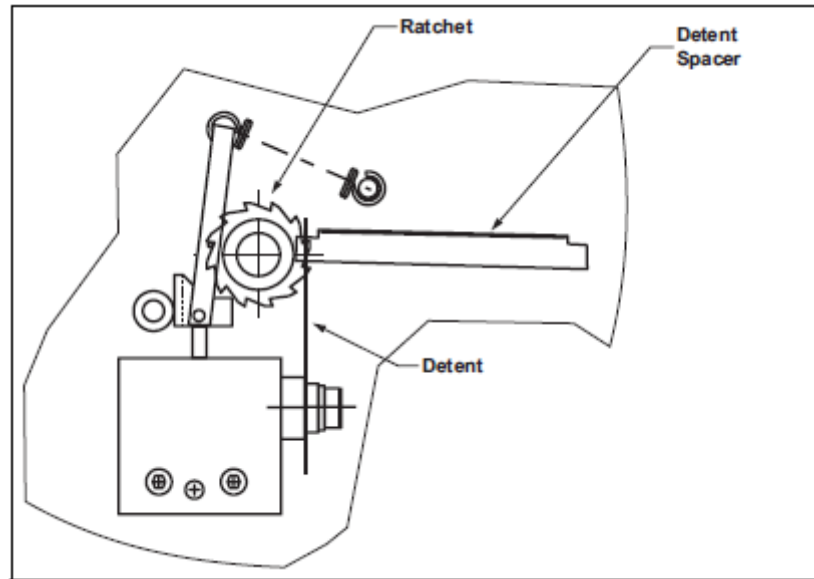
- 4 Loosen the set screws (two set screws per item) of the ratchet (item 29) and the stop ratchet (item 31).
- 5 Loosen the #2 fastener (item 5) that attaches the detent (item 25) to the bellows assembly (item 37). Do NOT remove detent.
- 6 Actuate the bellows assembly by applying 24 volts to the leads of the solenoid valve of the solenoid valve assembly. Consult the figure below for wiring assignments. The air pressure must be sustained.



- 7 Rotate the ratchet (item 29) counterclockwise until one tooth contacts the pin of the pawl and actuator stem assembly (item 18). Secure the ratchet to the 0.25" diameter shaft of the carousel spindle body (item 24) utilizing the #6-32 x 0.125" long socket set screw (item 12). Torque the #6-32 x 0.125" long socket set screws (item 12) to 12 in-lbs.
- 8 Rotate the stop ratchet (item 31) clockwise until it contacts the stem of the pawl and actuator stem assembly (item 18) as shown below. Secure the stop ratchet to the 0.25" diameter shaft of the carousel spindle body (item 24) utilizing the #6-32 x 0.125" long socket set screws (item 12). Torque the #6-32 x 0.125" long socket set screws (item 12) to 12 in-lbs.



- 9 Position the detent spacing tool (of the 750-254-G2 assembly) between the detent (item 25) and ratchet (item 29) as shown below. Pull the detent against the detent spacing tool and subsequently against the tooth of the ratchet. Tighten the #2 fastener (item 5) to 2.5 in-lbs to secure the detent to the bellows assembly.



- 10 Remove the detent spacing tool.
 - 11 Release air pressure from the bellows assembly (item 37).
 - 12 Remove the 0.09375 in. 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) on each pulse.
 - 14 Secure the actuator cover (item 22) to the carousel housing weldment (item 14) using two #4-40 x 0.187 in. long socket head cap screws (items 6 and 7).
 - 15 Install the front deposition shield (item 17) by first orienting the pins in the front deposition shield to coincide with the locating holes in the carousel housing weldment (item 14), 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.

6.4 Replacing the Bellows Assembly (750-286-P2)

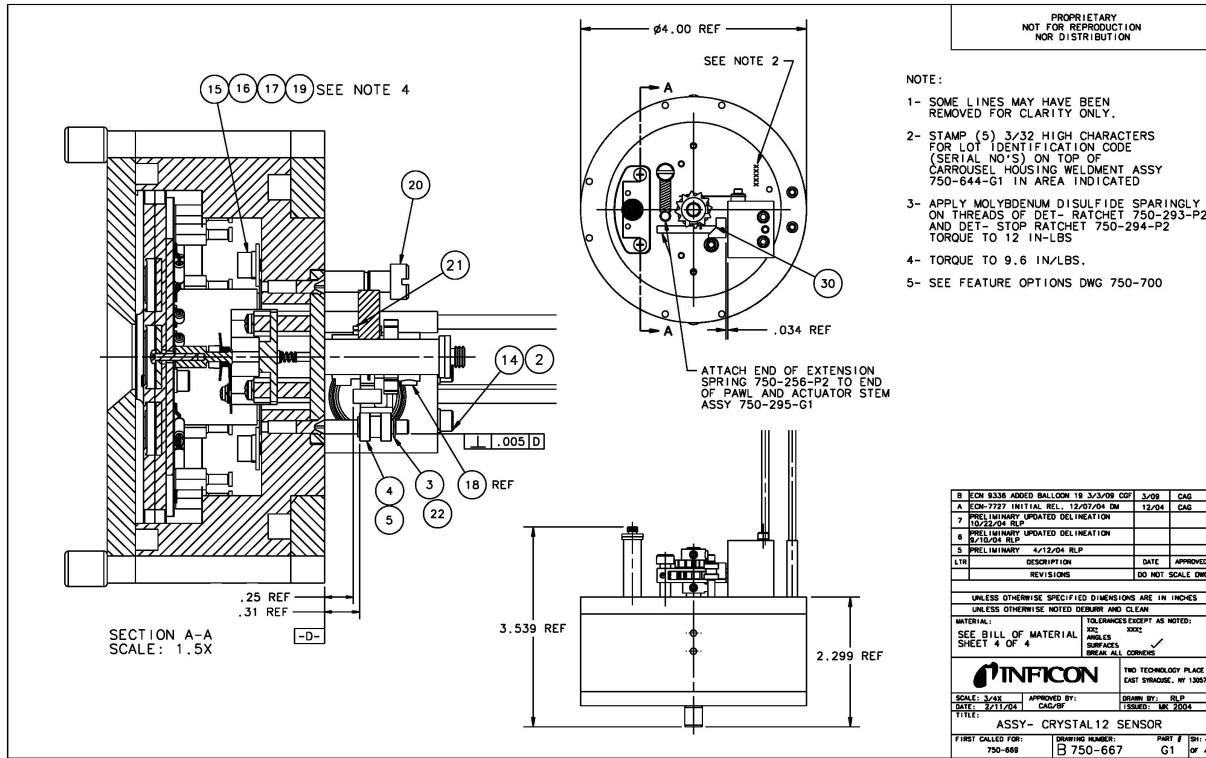
Replace the bellows assembly with INFICON part number 750-286-P2. This will require the removal of the used bellows assembly and reattachment of the replacement bellows assembly to the feedthrough airline (refer to Installation Requirements [▶ 10]).

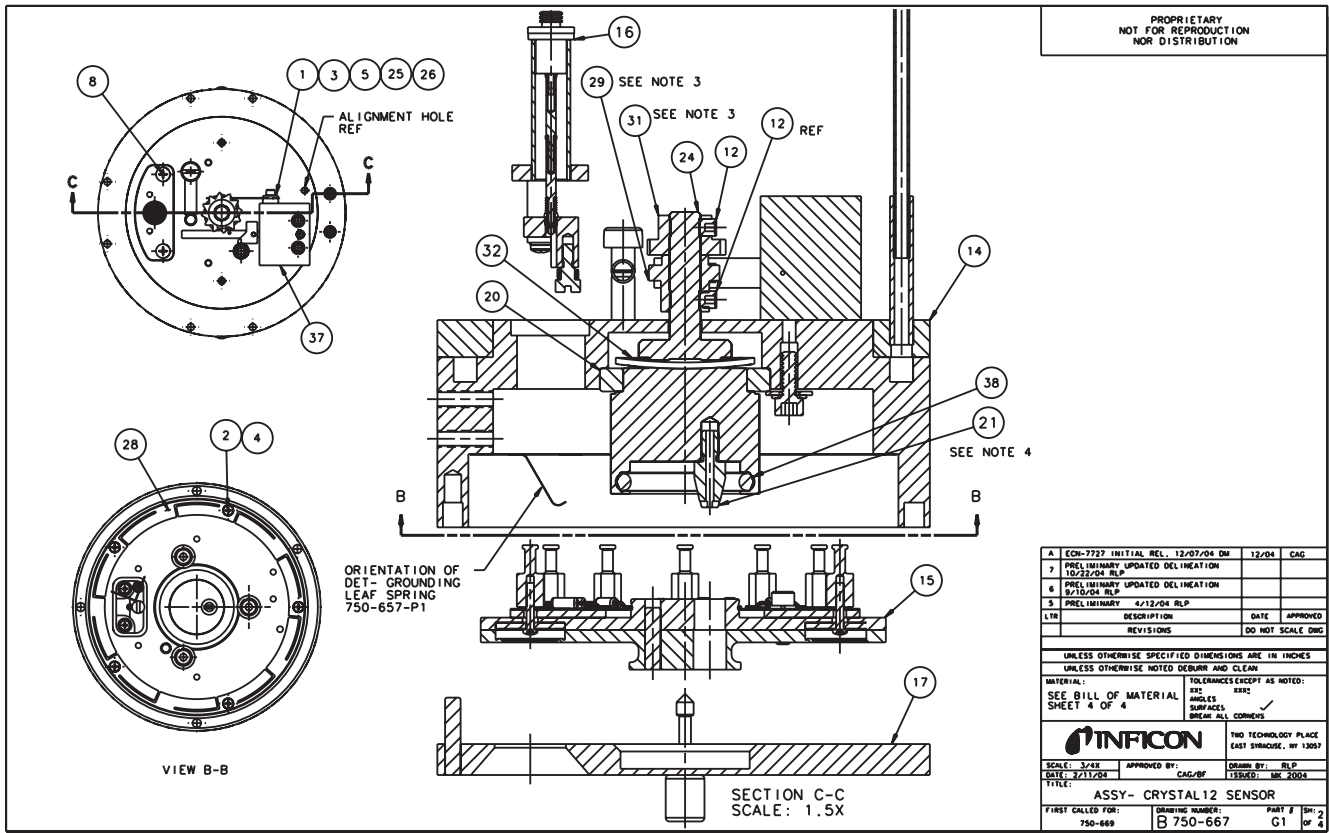
6.4.1 Required Equipment

- 1/16 in. Allen wrench (included in 750-268 kit)
- 3/32 in. Allen wrench (included in 750-268 kit)

6.4.2 Procedure

Reference the figures below for this procedure.





PROPRIETARY
NOT FOR REPRODUCTION
NOR DISTRIBUTION

A	EOM-7227 INITIAL REL. 12/07/04 DM	12/04	CAG
7	PRELIMINARY UPDATED DELINEATION 10/22/04 RLP		
6	PRELIMINARY UPDATED DELINEATION 8/10/04 RLP		
5	PRELIMINARY 4/12/04 RLP		
LTR	DESCRIPTION	DATE	APPROVED
	REVISIONS	DO NOT SCALE DIMS	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE NOTED DEBURR AND CLEAN

MATERIAL: SEE BILL OF MATERIAL SHEET 4 OF 4

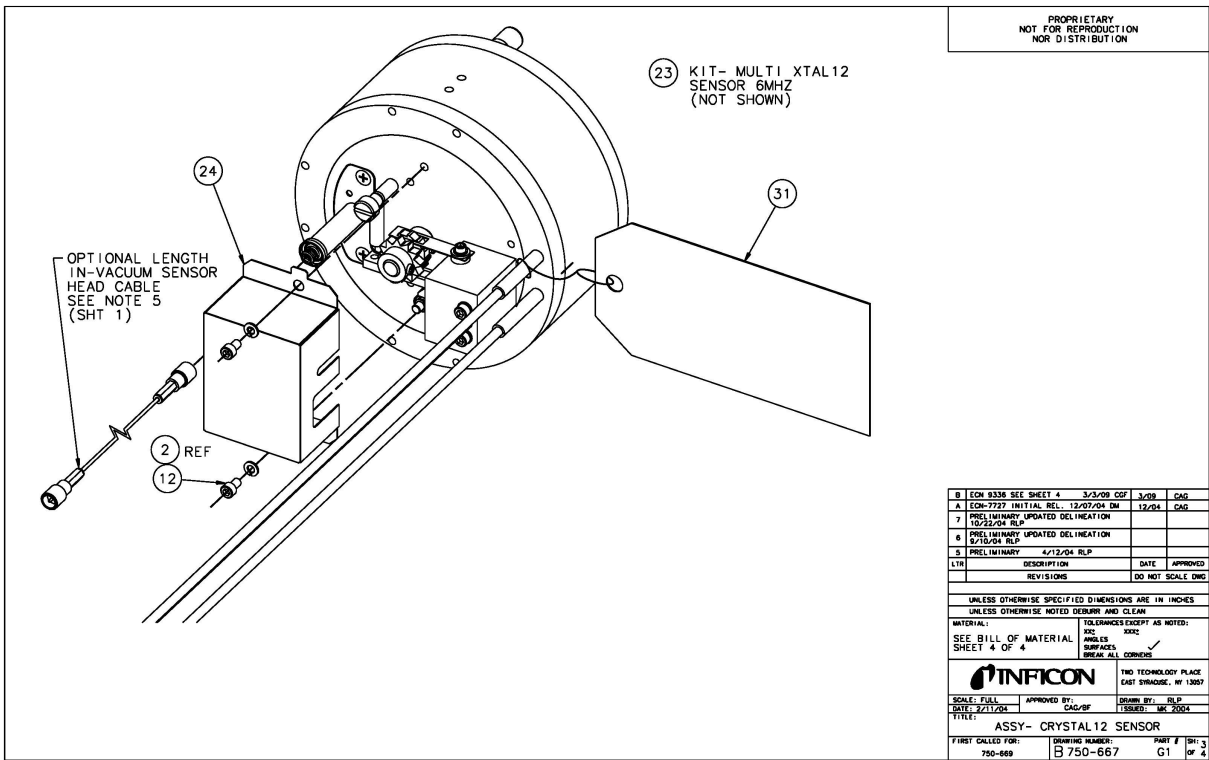
TOLERANCES EXCEPT AS NOTED:
HOLE SIZE ✓
ANGLES ✓
SURFACES ✓
BREAK ALL CORNERS ✓

INFICON TWO TECHNOLOGY PLACE
EAST SYRACUSE, NY 13057

SCALE: 3/4X APPROVED BY: RLP
DATE: 2/11/04 CAG/DF DRAWN BY: RLP
ISSUED: MK 2004

TITLE: ASSY - CRYSTAL 12 SENSOR

FIRST CALLED FOR: 750-669 DRAWING NUMBER: B 750-667 PART # SH: 2 OF 4



PROPRIETARY
NOT FOR REPRODUCTION
NOR DISTRIBUTION

B	EOM 9336 SEC SHEET 4	3/3/09 CCF	3/09	CAG
A	EOM-7227 INITIAL REL. 12/07/04 DM	12/04	CAG	
7	PRELIMINARY UPDATED DELINEATION 10/22/04 RLP			
6	PRELIMINARY UPDATED DELINEATION 8/10/04 RLP			
5	PRELIMINARY 4/12/04 RLP			
LTR	DESCRIPTION	DATE	APPROVED	
	REVISIONS	DO NOT SCALE DIMS		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE NOTED DEBURR AND CLEAN

MATERIAL: SEE BILL OF MATERIAL SHEET 4 OF 4

TOLERANCES EXCEPT AS NOTED:
HOLE SIZE ✓
ANGLES ✓
SURFACES ✓
BREAK ALL CORNERS ✓

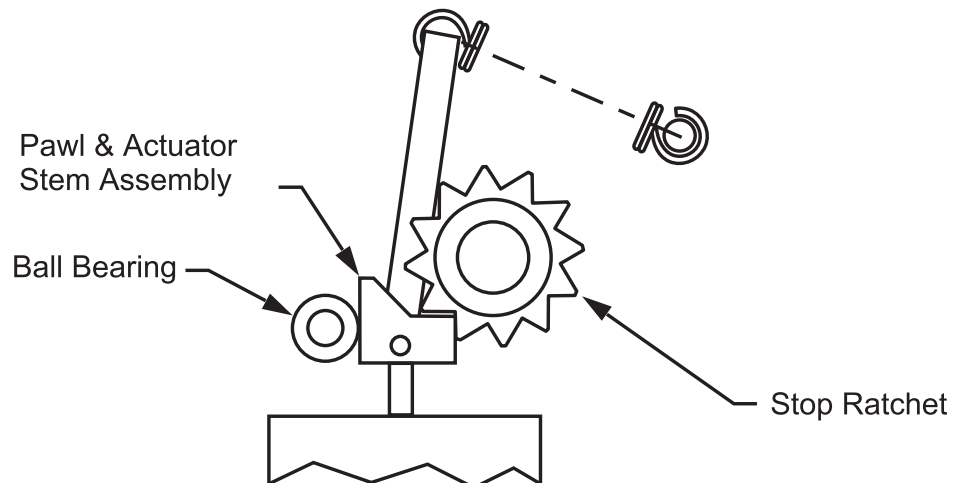
INFICON TWO TECHNOLOGY PLACE
EAST SYRACUSE, NY 13057

SCALE: FULL APPROVED BY: RLP
DATE: 2/11/04 CAG/DF DRAWN BY: RLP
ISSUED: MK 2004

TITLE: ASSY - CRYSTAL 12 SENSOR

FIRST CALLED FOR: 750-669 DRAWING NUMBER: B 750-667 PART # SH: 3 OF 4

- 1 Remove the two #4 fasteners (item 7) that secure the actuator cover (item 22) to carousel housing weldment (item 14).
- 2 Remove the actuator cover. Remove the front deposition shield (item 17) by unthreading the two knurled captive screws.
- 3 Remove the extension spring (item 27) from the pawl and actuator stem assembly (item 18).
- 4 Remove the two #4 fasteners (item 9) that secure the bellows assembly (item 37) to the carousel housing weldment (item 14).
- 5 Carefully remove the bellows assembly. The pawl and actuator stem assembly (item 18) and the detent (item 25) will be removed with the bellows assembly.
- 6 Unthread the pawl and actuator stem assembly (item 18) from the bore of the bellows assembly being replaced (item 37) 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 the first image.
- 7 Remove the detent and related hardware (items 1, 3, 5, 26) 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 in. Allen wrench, loosen the set screws (item 12) that secure the ratchet (item 29) and the stop ratchet (item 31) to the carousel spindle body (item 24).
- 9 Fasten the replacement bellows assembly to the carousel housing weldment (item 14) using the two #4-40 x 1.125 long screws (item 9). 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) as illustrated below). 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) such that it engages the pin of the pawl and actuator stem assembly.
- 12 Position the detent (item 25) so it engages the ratchet (item 29).

⇒ The unit is now ready to be aligned, refer to Alignment Instruction for Crystal12 Sensor XL12-100000 or XL12-100000-CN [▶ 35] for alignment instructions.

6.5 Replacing the Electrical Connection Assembly

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



Contact INFICON for pricing and availability of new and refurbished assemblies.

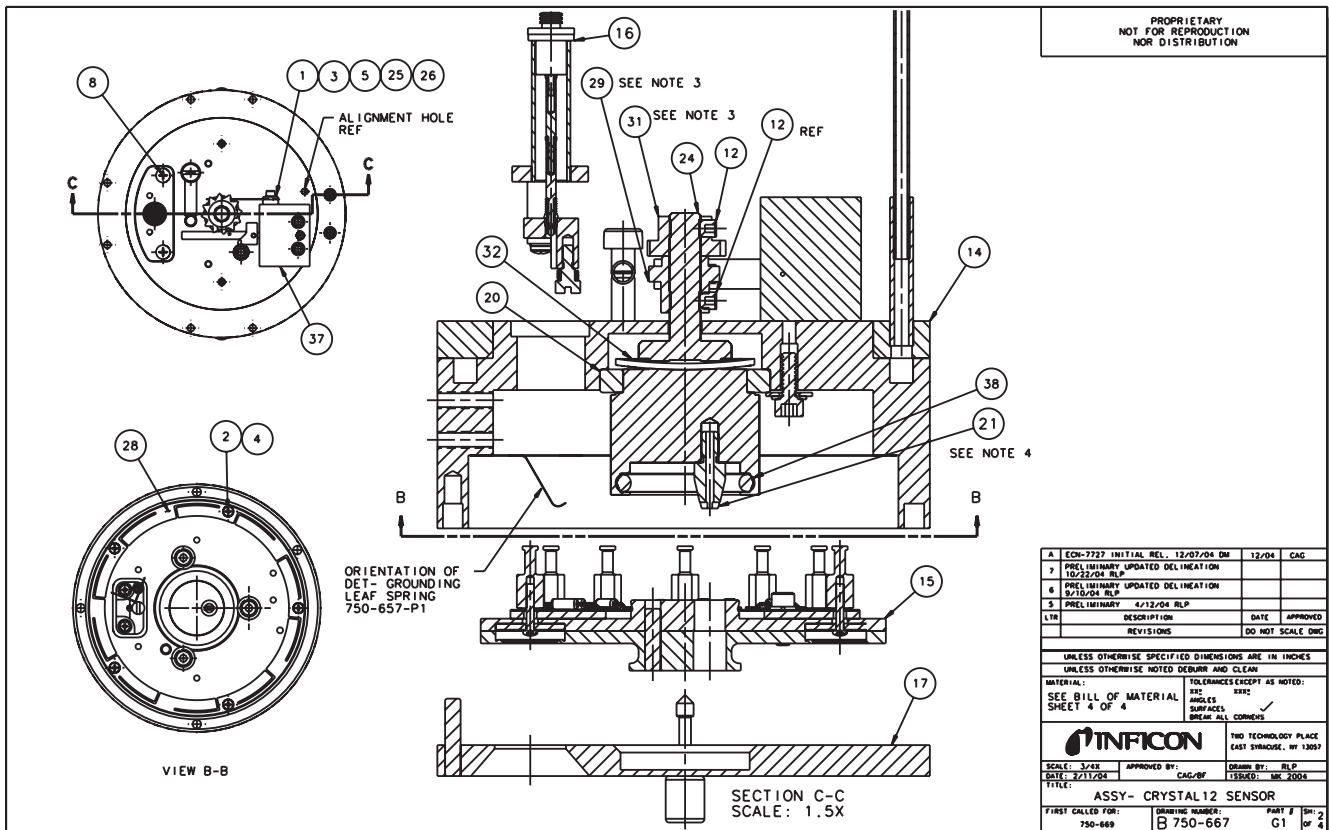
The recommended replacement interval for the electrical connection assembly is two years, based upon five revolutions per week of the carousel.

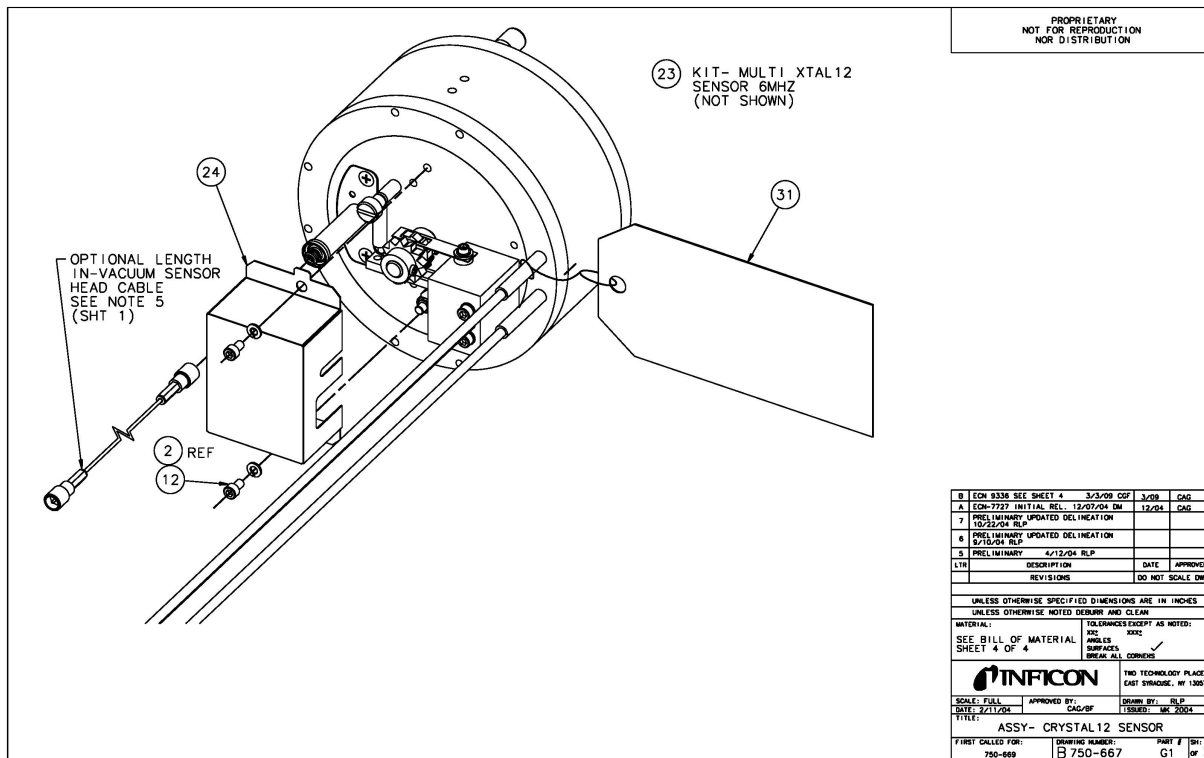
6.5.1 Required Equipment

- 3/32 in. Allen wrench (included in 750-268 kit)
- #1 Phillips head screwdriver

6.5.2 Procedure

Reference the figures below for this procedure.





- 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.

6.6 Cygnus 2 Status and Error Messages

Carousel Open

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

Switch Fail

This message indicates a 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.

6.7 Symptom, Cause, Remedy Chart

Symptom	Cause	Remedy
Crystal fail signal on front panel of unit will not disappear even though the crystal can be seen through the heat shield aperture.	The crystal is damaged.	Replace the crystal.
	The electrical signal was lost.	Check for electrical continuity between the feedthrough and the leaf springs that make contact with the crystal holder in the sensor. If the electrical problem originates in the sensor, see Disassembly Instructions for disassembly instructions.
Unit will not advance when crystal switch key is pressed.	There was a loss of pneumatic supply, or the 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 is impaired as a result of peeling of the material accumulated on the face of the cover.	Remove the accumulated material.
	There is an absence of orifice in the airline.	Check for orifice, see Installation of the Solenoid Valve Assembly [▶ 28].
	The grounding leaf spring, which contact the carousel, may be damaged.	Replace the grounding leaf spring.
The crystal is not centered in the aperture.	There is improper alignment.	Realign per alignment instructions in Maintenance [▶ 34].
	The 0.559 mm (0.022 in.) diameter orifice is not installed in-line to the supply side of the solenoid valve assembly.	Install the orifice where shown on the first figure in Pneumatic Solenoid Tube Connections.
There are large jumps of thickness reading during deposition.	Mode hopping due to damaged or heavily damped crystal.	Replace the crystal.
	The crystal is near the end of its life.	Replace the crystal.
	There are scratches or foreign particles on the crystal holder seating surface.	Clean or polish the crystal seating surface on the crystal holder. Refer to Crystal Seat Maintenance [▶ 34].
	There is insufficient crystal cooling.	Check water flow and temperature. Refer to Installation Requirements [▶ 10].

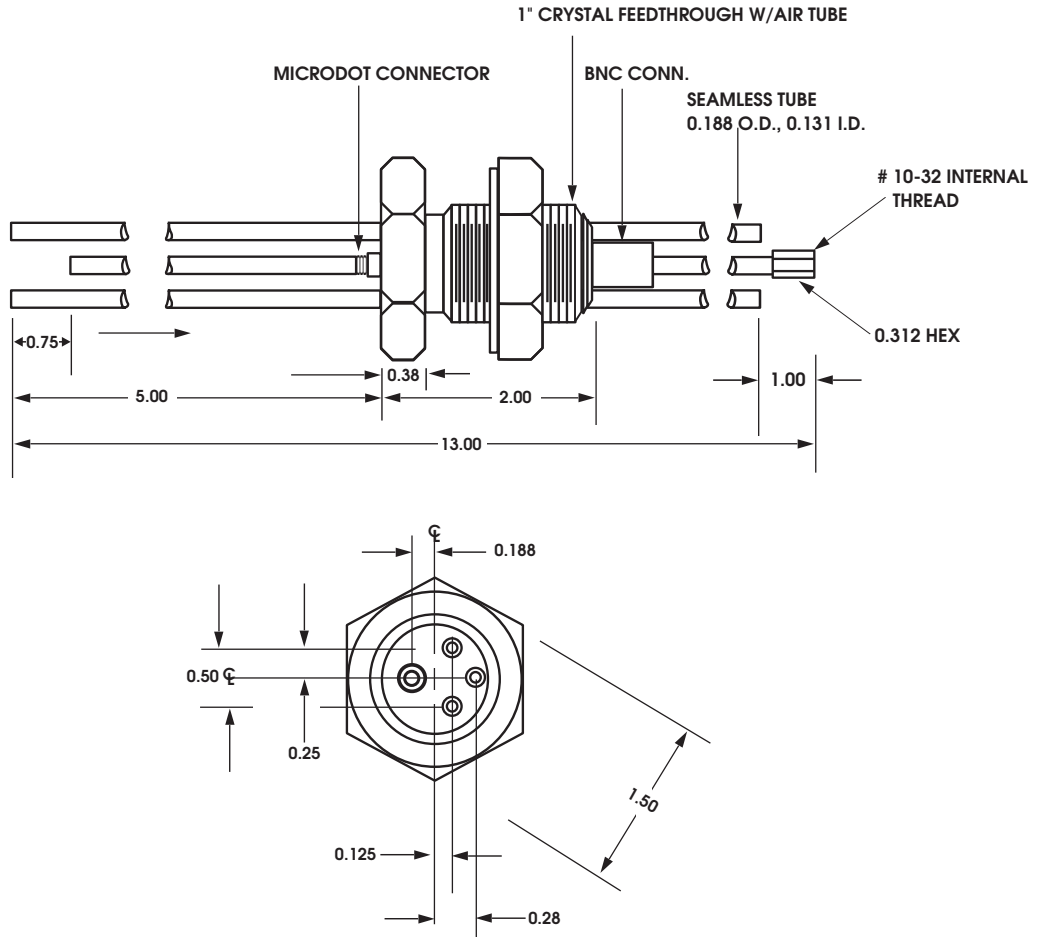
Symptom	Cause	Remedy
The crystal ceases to oscillate during deposition before it reaches its normal life.	The crystal is being hit by small droplets of molten material from the evaporation source.	Use a shutter to shield the sensor during the initial period of evaporation; move the sensor farther away.
	The crystal is damaged.	Replace the crystal.
	Deposition material is built-up on edge of the crystal carousel aperture plate and is touching the crystal, partially masking full crystal area.	Clean the crystal carousel aperture plate.
The crystal does not oscillate or oscillates intermittently (both in vacuum and in air).	The crystal is defective or damaged.	Replace the crystal.
	There is the existence of an electrical short or poor electrical contacts.	Check for electrical continuity and the short in sensor cable, electrical connection assembly, feedthroughs, and crystal carousel.
	There is insufficient crystal cooling.	Check water flow and temperature. Refer to Installation Requirements [▶ 10].
The crystal oscillates in vacuum but stops oscillation after opened to air.	The crystal is near the end of its life; opening to air causes film oxidation, which increases film stress.	Replace the crystal.
	There is excessive moisture accumulation on the crystal.	Turn off the cooling water to the sensor before opening it to air; flow hot water through the sensor when the chamber is open.
Thermal instability: There are large changes in the thickness reading during source warm-up (usually causes the thickness reading to decrease) and after the termination of deposition (usually causes the thickness reading to increase).	The crystal is not properly seated.	Check and clean the crystal seating surface of the crystal holder. Refer to Crystal Seat Maintenance [▶ 34].
	Excessive heat applied to the crystal.	If heat is due to radiation from the evaporation source, move sensor further away from the source and use sputtering crystals for better thermal stability.
	There is no cooling water.	Check cooling water flow rate. Flow rate should be a minimum of 150-200 cc/min at 30 °C max.
Poor thickness reproducibility.	There are erratic source emission characteristics.	Move sensor to a different location; check the evaporation source for proper operating conditions; ensure 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. Use silver or gold coated crystals, as appropriate.

Symptom	Cause	Remedy
Carousel Change-Out and Xtal Fail messages remain after installing carousel.	Open the circuit.	Initiate a Crystal Switch or Rotate Head function.
While in Ready or Stop , initiating a Crystal Switch function causes the unit to index more than once.	The resistor is open at bypassed position(s).	Repair resistor at bypassed position of 750-652-G1 (item 15 of the figure in List of Supplied Drawings [▶ 12]). Or, contact INFICON.
Unit indexes twelve times and displays Xtal Switch Error, Xtal Fail, and Carousel Change-Out message.	There is a loss of electrical signal.	Check for electrical continuity and isolation.
	Resistor #1 is open or shorted.	
	No carousel is installed.	Install the carousel.
	The torsion spring of the electrical assembly is broken.	Replace the electrical connection assembly. Refer to Replacing the Electrical Connection Assembly [▶ 43].

7 Feedthrough Outline Drawings

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

1 in. Crystal feedthrough w/airtube (IPN 750-030-GI-CN) (contains one coaxial, two water tubes and one air tube)





Due to our continuing program of product improvements, specifications are subject to change without notice.
The trademarks mentioned in this document are held by the companies that produce them.