MAINTENANCE and INSTALLATION MANUAL

CHC–15 Crystal Holder
GC–15 Glass Cell

IPN 623800 Rev. D

INFICON

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GC–15 Glass Cell

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INFICON Instruments for Intelligent Control®

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WARNING

All standard safety procedures associated with the safe handling of electrical equipment must be observed. Always disconnect power when working inside the controller. Only properly trained personnel should attempt to service the instrument.

Warranty

INFICON warrants the product to be free of functional defects in material and workmanship and that it will perform in accordance with its published specification for a period of (twelve) 12 months.

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1.1.1 CH-15 CRYSTAL HOLDER

Material:	CPVC
O-Ring:	Viton® Size: 2-019
Temperature Range:	-25°C to 95°C
Connector:	SMB

1.1.2 GC-15 GLASS CELL

Material:	Pyrex Glass
O-Ring:	Viton® Size: 2-116
Approx. Volume of Water:	45 mL
Temperature Range:	20°C to 300°C

1.2 ORDERING INFORMATION

Part Number	**Description**
623204	CHC-15 with GC-15 Kit
623201	CHC-15 Crystal Holder (CPVC)
623202	GC-15 Glass Cell
803339	Stopper
803252	Glass Cell O-Ring
889095	Pogo Contacts
803251	Crystal Holder O-Ring
603216-2	Cable 2’ SMB – SMB Plug
803338	Clamp – Pinch, Stainless #28

2 CRYSTAL HOLDER DESCRIPTION

The CHC-15 Crystal Holder is designed to mate with a ChemGlass O-ring Joint P/N CG-124-04 or equivalent. This allows the user to create his own experimental cell around the O-ring Joint.

Figure 1 shows a INFICON CHC-15 Crystal Holder. It has a cavity for a 1-inch diameter crystal. Inside the cavity there are two Pogo® pins providing connections to the crystal's front and rear electrodes. Note the locations of the Pogo® pins. These pins are internally connected to the SMB connector. Also note the location of the index hole that identifies the crystal orientation.

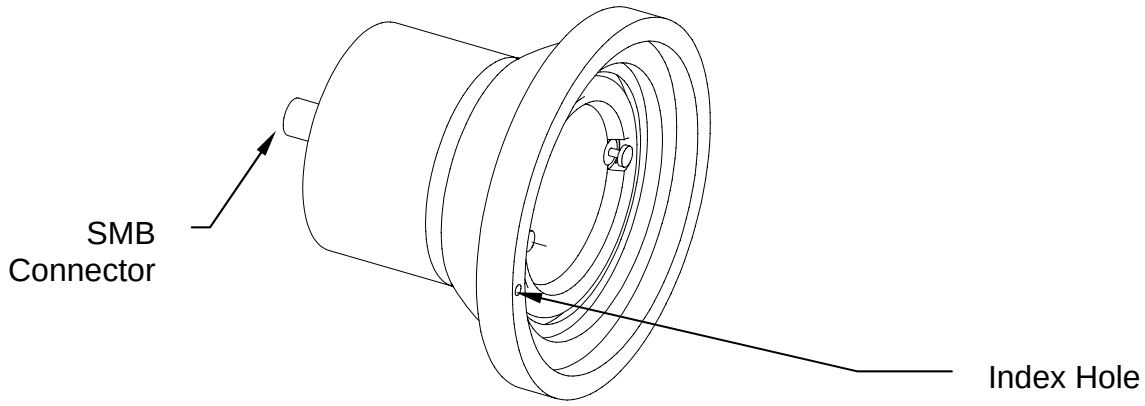


Figure 1 CHC-15 Crystal Holder

2.1.1 HOW TO INSTALL A CRYSTAL IN A INFICON CRYSTAL HOLDER

Since the crystals have to be changed periodically, this is an important step with which to become thoroughly familiar:

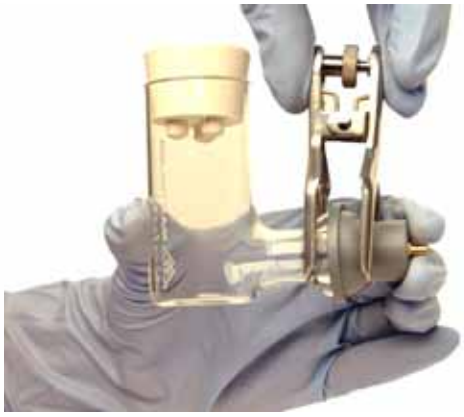
1. Identify the Front and Rear Sides of the crystal. See Section 2.2.1.
2. Clean & Dry the Crystal Holder cavity.
3. Place the CHC-15 between your index finger and your middle finger with the Index pin of the CHC-15 at the 3 O'clock line (Refer to Picture 1).
4. Then insert the Crystal with the Front Side (Sensing Electrode) exposed. The "Wrap-around Extended Electrode" MUST be in the 60º region as in Figure 4 below.
3. Place the O-Ring (provided with the glass joint) over the Crystal.
4. Fit the glass joint on top of the o-ring. Make sure it is centered on the CHC-15.
5. Secure the assembly with a clamp (ChemGlass P/N CG-150-05) as shown in Picture 4.
6. Tilt the cell when filling with liquid, so air isn't trapped at the crystal surface. Fill with enough liquid to cover the crystal completely.

Assembly Illustration Shown with GC-15 Glass Cell

Picture 1

Picture 2

Picture 3



Picture 4

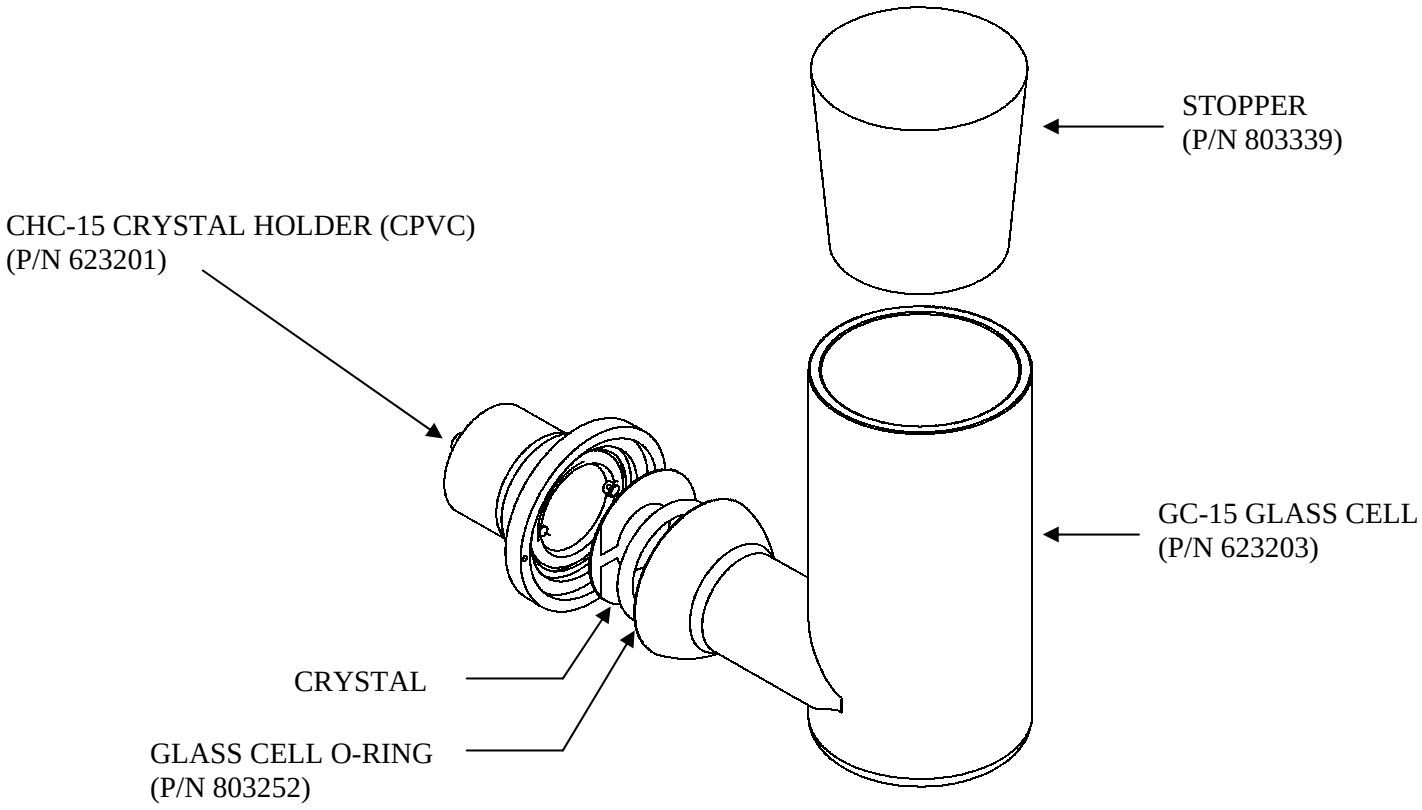


Figure 2 CHC-15 & GC Installation & Part Identification

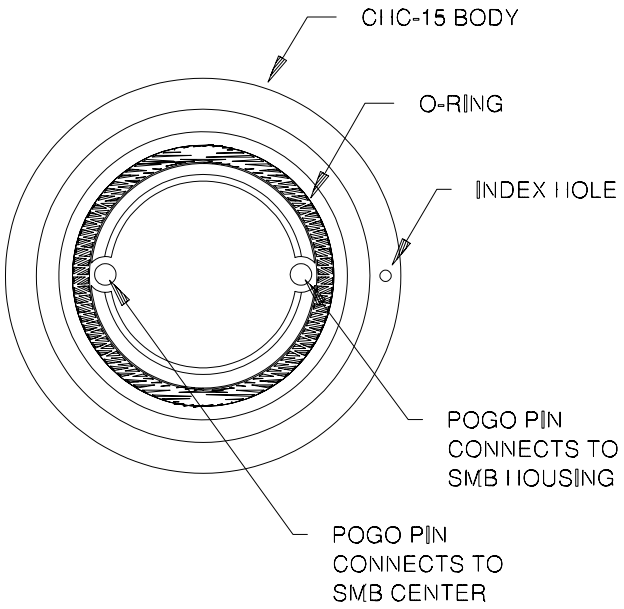


Figure 3 CHC-15 Parts Identifications

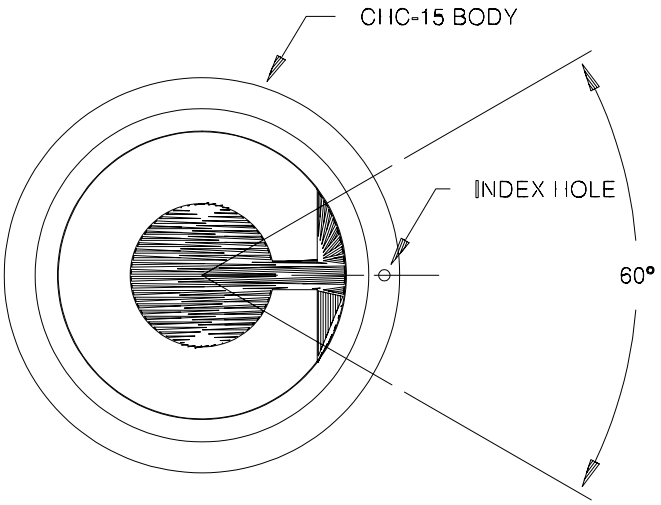


Figure 4 Crystal Installation

2.1.2 HOLDER CARE AND HANDLING

With a robust design, INFICON crystal holder requires little care. However, the crystal holder is in direct contact with the sensor crystal and your experiment environment. Thus, care must be taken to ensure its cleanliness eliminating any contaminants that may react with the crystal or the experiment media. The following guidelines are recommended for general handling of the holders.

- Always keep the holder clean and dry when not in use.
- Always use clean room grade gloves while handling the holder and its components.
- Never handle the holder with bare hands as human skin oils may deposit on it and react with your experiment.
- Always rinse the holder generously with deionized water and thoroughly blow dry using filtered air after each experiment. This is especially important if the holder has been exposed to oxidizing acids.
- Always act fast in the event that liquids or chemicals have entered the crystal cavity in the holder. Immediately clean the holder using the following procedure.
    - Remove the crystal to expose the crystal cavity.
    - Remove both Pogo® contact pins from their sockets. Use a pair of tweezers (or gloved fingernail), grab the Pogo® head firmly and pull it straight out of its socket.
    - Rinse the holder, the crystal cavity and the Pogo® sockets generously with deionized water to remove all traces of chemicals and thoroughly blow-dry the whole holder using filtered air. Ensure all liquids that may have been trapped inside the sockets are removed.
    - Generously rinse the Pogo® contact pins with deionized water, occasionally squeeze the pins to push out any liquids that may have been trapped inside the pins. Thoroughly blow-dry the pins using filtered air.
    - Install the Pogo® pins back into their sockets. Use the tip of a pair of tweezers and push down on each Pogo® pins to verify their deflection.
- It is always a good idea to inspect the O-ring and test the travel of the Pogo contacts whenever the crystal is being replaced.
- Check the general appearance of the O-ring. It should be free of any deposits or defects when viewed with the naked eye. Inspect it from the side for low spots or insufficient height above the center ring.
- Gently depress the pogo pins. Make sure that they move freely and that travel is not restricted. They should depress to a level well below the surface of the O-ring, at least by an amount equal to the thickness of the crystal. When extended they should extend well above the surface of the O-ring. Again, at least by an amount equal to the crystal thickness.

2.2 1 INCH DIAMETER CRYSTALS

INFICON pioneered the standard AT-cut, 5 MHz, 1-inch diameter crystals for use in liquid applications. The AT-cut quartz is chosen for its superior mechanical and piezoelectric properties, and the angle of cut can be adjusted to obtain a zero temperature coefficient at a desired operating temperature. The 1 inch diameter was chosen to allow enough distance between the active area of the crystal and the mounting o-ring. This improves the overall stability of the crystal by reducing the frequency changes due to mounting stress.

2.2.1 ELECTRODE CONFIGURATION

Figure 5 below shows INFICON's 1" crystal electrode patterns. The left figure shows the ½ inch diameter front electrode (also called sensing electrode) with an extended electrode that wraps around the edge of the crystal and extends into a semicircle shown in the top half of the right figure. The lower half of the right figure shows the ¼ inch diameter rear electrode (also called contact electrode).

This configuration enables both electrical contacts to be made on the backside of the crystal allowing measurement in conductive liquids.

The oversized front electrode (½ inch in diameter as oppose to the ¼ inch diameter rear electrode) was chosen to ensure a more consistence deposition across the active area of the crystal. The exposed area of the front electrode is 0.212 in^2 (137 mm^2), but the active oscillation region (displacement area) is limited to the overlapping area of the front and rear electrodes (0.053 in^2 or 34.19 mm^2).

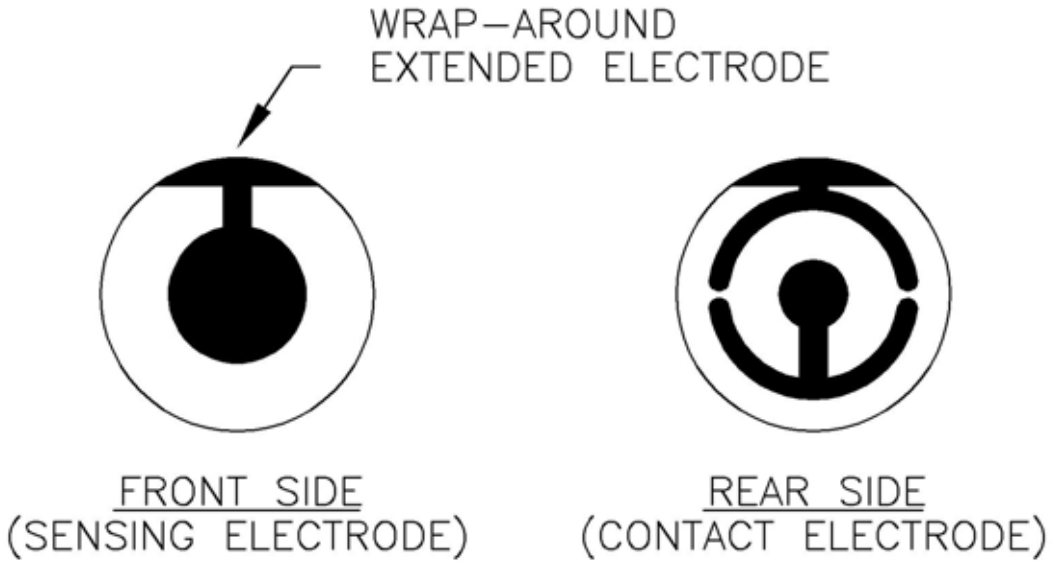


Figure 5 1-Inch Diameter Crystals – Electrode Configuration

The figure below shows a INFICON 1" diameter as seen from the front side.

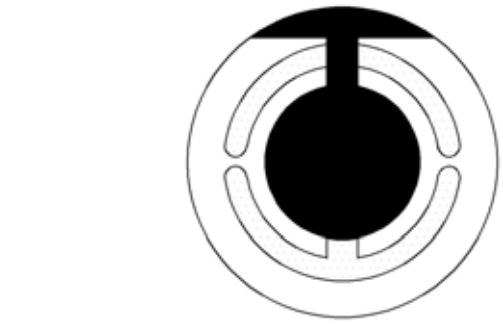


Figure 6. 1" Crystal - as Seen From The Front Side

2.2.2 CRYSTAL PARAMETERS

Polished one-inch diameter crystals that are commonly available for liquid work have the typical values as listed below.

Type	Frequency Range (MHz)	Electrode Material	Resistance (ohms)	Q Factor
5 MHz	4.976 – 5.020	Gold	~10	120,000
9 MHz	8.976 – 9.036	Gold	~7	55,000

2.2.3 CRYSTAL SURFACE FINISH

Studies have shown that electrode surface roughness can cause large apparent mass loadings due to the liquid that is trapped within pores at the crystal surface [1]. INFICON's crystals are optically polished to 50 Å average surface roughness to minimize this effect. Polished crystals are required to obtain good agreement between theory and measurement during liquid immersion experiments. Polished crystals are also required to obtain measurements reproducibility from crystal to crystal[2].

Non-polished crystals (R_a=1.8 microns) are also available at reduced costs for applications that do not require the accuracy and reproducibility of the polished crystals.

2.2.4 CRYSTAL ELECTRODE MATERIALS

INFICON's crystals are available in a variety of electrode materials including Gold, Platinum, Aluminum, Silver, Titanium, etc. INFICON also offers Gold electrode crystals with an additional SiO2 outer layer to create a hydrophilic surface needed for some biological applications.

2.2.5 CRYSTAL THICKNESS

INFICON AT cut, 1-inch diameter crystals are plano-plano. Their physical thickness is determined by a frequency constant and their final frequency. The frequency constant for an AT cut crystal is 1.668E5 Hz × cm or 65.5 kHz × in. Therefore, the crystal thicknesses for various frequencies are as follows.

5 MHz AT cut thickness = 333 microns (0.013 inch)

6 MHz AT cut thickness = 227 microns (0.0109 inch)

9 MHz AT cut thickness = 185 microns (0.007 inch)

Footnotes

[1] Martin, Stephen, et. al., "Effect of Surface Roughness on the Response of Thickness-Shear Mode Resonators in Liquids", Anal. Chem., 65 (**1993**) 2910.

[2] Sullivan, C. K. and Guilbault, G.G. "Commercial Quartz Crystal Microbalances- theory and applications", Biosensors and Bioelectronics 14 (**1999**) 663-670.