



The #1 Thin-Film Vacuum Coating Source

2017/2018

Contents

About Us	3
Crystals Buying Guide	5
Phillip Technologies and Colnatec	6
About Our Packaging	7
Material Selection Guide	8
AT Cut Crystals	9
Inficon Type	10
Balzers Type	11
Ulvac Type	12
1" Diameter for Liquid Monitoring Applications	13
"Keyhole" Pattern	14
RC Crystals	15
Inficon Type	20
Ulvac Type	21
Balzers Type	22
Specialty High Temperature Crystals	23
Inficon Type HT Crystals	23
SuperQuartz Crystals by Colnatec	24
Hardware and Accessories	25
Eon-ID™ Monitor w/ Integrated Display	26
Phoenix™ SingleFilm Thickness Sensor	28
Phoenix System PC	29
Eon-LTTM PC-Based Monitor	31
Tempe™ System	33
Universal Oscillator (OSC100)	35

About Us

Background

Formerly known as Tangidyne, Phillip Technologies has been in operation since 2004 with the mission to provide the world's best quality crystals, at competitive prices, and with reliable service. Phillip Technologies has over twenty years of combined knowledge in thin-film and quartz-crystal technology, and with this amalgamation of knowledge and our use of cutting edge production methods, we are proud to call ourselves leaders in the Film Thickness Monitoring industry.

Sales & Marketing

As a force in the global crystal marketplace, our company, utilizes efficient software and sales mapping systems to keep customer requests accurate and timely. We pride ourselves on our fast lead-times and in many cases same-day turnaround. More importantly we track all orders from start to finish so no detail is missed.

Facilities & Equipment

Not only do we offer revolutionary and proprietary crystals but also produce industry standard components to the most exacting specifications. We pride ourselves on maintaining a safe, orderly, and efficient production facility. All components are produced, inspected and sealed in a class 1,000 cleanroom environment prior to delivery to the customer's facility. Furthermore, all products are provided with full traceability documents to ensure only the highest quality is delivered.

Engineering

We are the only Crystal Manufacturer in the world with ongoing product research & development. Furthermore, we are the only company in the world authorized to offer the RC™ and HT™ line of crystal sensors designed to work at temperatures ranging from 250-300°C and 300-450°C. We also produce a wide range of custom crystals designs for universities and R&D groups worldwide.

Company Culture

In addition to utilizing efficient and innovative production methods, we believe the health and welfare of our employees is the greatest force in producing high quality components you can trust. In summary: our customers process' is also our process, and we will always strive to ensure your supply chain and production team are served with the highest level of integrity.

Factory and Headquarters Location

2003 Perimeter Road | Suite E
Greenville | South Carolina 29605-5276 | USA

Leadership

President Phillip Grimshaw (Phillip@PhillipTech.com)

Chief Technical Officer Scott Grimshaw (Scott@PhillipTech.com)

Production Abilities

Monthly capacity

100,000 pieces per month

Lead-Times

100 pieces — 1 day ARO

500 pieces — 1 day ARO

1,000-2,000 pieces — 1 day ARO

3,000-5,000 pieces — 3 day ARO

5,000-10,000 pieces — 3-5 days ARO

10,000+ pieces — 7-10 days ARO

Employees

QC Inspectors — 3

Managers — 2

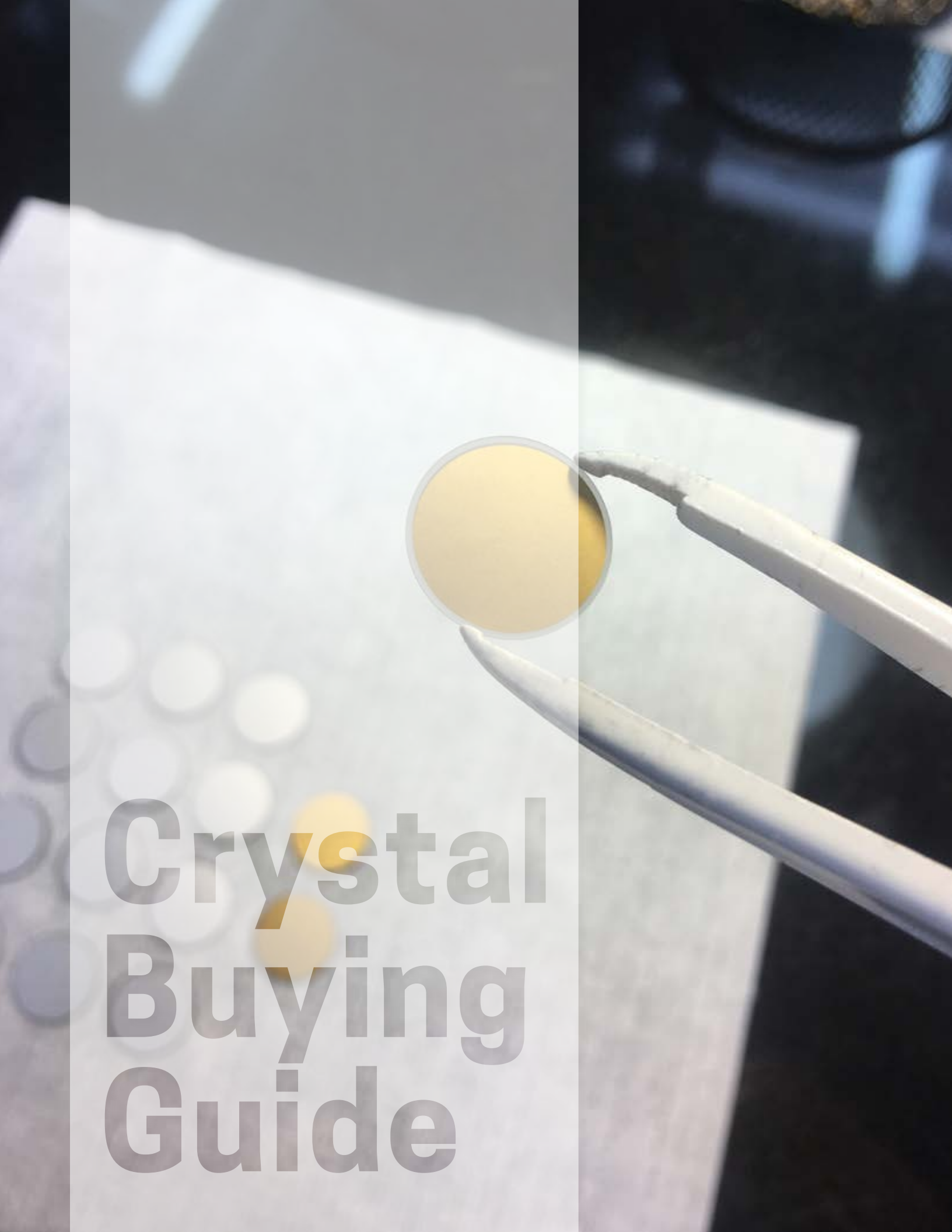
Operators — 5

Material Handlers — 2

Technical Support Staff — 2

Total factory size

6,000 Ft²



Crystal Buying Guide

Phillip Technologies and Colnatec

Working Together to Provide Excellence in Thin-Film Metrology

Proudly work together to bring our customers the most innovative film-thickness measuring technologies. Since 2013 both companies have operated independently to provide two things: stellar service, and high quality systems & components.

Phillip Technologies represents the consumables side of the business, providing everything quartz crystal related, while Colnatec's work centers exclusively on the design and manufacture of monitoring system hardware and software.

Launched in 2009, Colnatec has established new industry standards in the design, development, and manufacturing of innovative, high-performance sensors and electronic instrumentation used in multiple, diverse areas:

- Atomic Layer Deposition (ALD)
- Solar cell manufacturing (CIGS)
- Mobile display (OLED)
- Optical Coatings (PVD)
- Food packaging (R2R)
- High speed electrical devices (MBE)
- Architectural glass (In-Line)
- Semiconductor wafer processing (CVD)

Through the use of patented and patent-pending technologies, researchers, manufacturers, and system-builders are able to increase the conversion efficiency of photovoltaic films, reduce production and run times and costs, and improve overall performance; it's ultimately about achieving higher yield.

Holder of numerous patents Colnatec received the [Department of Energy SBIR Phase I and II awards](#) for a self-cleaning process control sensor to be used in manufacturing [CIGS solar cells](#). This sensor extends crystal life indefinitely and enables solar cell manufacturers to achieve cell and module efficiencies well beyond the status quo. Colnatec is also one of about eight winners of the Arizona Commerce Authority Innovation Challenge Grant Program for promoting innovation in the technology sector.



About Our Crystals

We package all of our quartz crystals in clean room compatible packaging, or discs, that holds 4 or 10 crystals, depending on the crystal type ordered. Careful attention to the design ensures that the center of the crystal, where the actual measurement occurs (within a radius of 3 mm from the center), is not touched or contaminated by the plastic.

Packaging Materials Used

We only use pharmaceutical grade Virgin PETG plastic for the package top, and hand cleaned polystyrene for the base. This difference in plastics is necessary due to the buildup of static charge between two motional pieces of PETG. Some manufacturers use anti-static PETG, but this contains a polymer agent that will eventually leach onto the crystal surface contaminating the products. Furthermore, some packaging manufacturers will compensate for poor production methods by using a mold release (like silicone and other aerosol based compounds), that can severely contaminate the crystal in long and short term storage.

Packaging without Contamination

Contamination of the crystal electrodes can result in adverse product performance and degrade specifications. Usually this appears as a wet mark on the crystal, or in extreme cases the crystal will completely turn into a darker shade of its original color. In other cases, as with silver and alloy, the crystal can appear to turn yellowish and give the false impression of oxidation. In other words, our packages were designed from the ground up with the same exacting standards as the crystals themselves.

Cleanroom Compatible Packaging

Additionally, our package materials are cleanroom compatible due to their non-outgassing and chemically inert nature. Our engineering team also chose pharmaceutical grade plastic due to its low particle generation characteristics. Moreover, all packages are hand cleaned prior to being filled with crystals in our class 1,000 cleanroom.

Bulk Packaging Options

In addition to the 10 piece crystal discs, we bulk package quantities of 50 pieces (5 discs) in clear, cleanroom compatible containers for easy storage and transport. These containers are made with the same pharmaceutical grade PETG used with the crystal disc and are a great way to stack and safely store large quantities in your inventory. The bulk box is also an extremely reliable method of protecting the crystals from moisture and physical damage during their time with the shipping carrier en route to the customer.



Material Selection Guide

Material Properties

Different electrode materials are good for different applications.
See what choice you should make for your process.



Gold is best suited for low stress coatings, metallization, and organic coatings



Silver is best suited for medium stress coatings and low stress optical films



Alloy is best suited for high stress coatings and dielectrics, refractory metals, CIGS and OLED

Something Missing?

We can also apply custom electrodes with the material of your choice.
Contact our sales department today for details*.

**Some restrictions apply.*



AT Crystals

OEM Quality at a Discount Price

Our AT Cut replacement quartz monitor crystals are an excellent choice to enhance your process and help you maintain a lean consumables budget. We sell a wide range of replacement crystals for most commercially popular film thickness monitoring systems. Furthermore, we stock nearly all our crystal offerings for fast delivery to ensure no downtime in your production or laboratory environment. Our crystals are manufactured to the original manufacturer's (OEM) specifications. In most cases we exceed these OEM specifications and quality controls to provide you with replacement consumables you can thoroughly trust.

Inficon Type

AT Cut

Temperature Range

20-100°C

Gold



Alloy



Silver



Description:

Replacement quartz crystal sensor for use in thin film deposition monitors and controllers including Inficon, Maxtek, Sigma Instruments, and Sycon instruments.

Physical Specification:

- ① Material: Single Crystal Alpha Quartz, Unswept, Electronic Grade ($Q > 1E6$)
- ② Dimensions: 0.550" $\pm$.000/.002" OD
- ③ Contour: 2.5 - 3.0 diopter (212 - 177 mm radius of curvature) plano convex
- ④ Finish: 7 microns rms roughness plano and contour sides
- ⑤ No chips, scratches or etch marks within a 13.95 mm diameter clear aperture
- ⑥ Electrodes: "Inficon" pattern back, fully coated crystal face

Electrical Specifications:

- ① Available Frequency: 5 and 6 MHz, fundamental series resonance
- ② Resistance: $< 10^* - 15$ Ohms, plated **alloy only*
- ③ Contact Resistance: < 10 Ohms edge to edge on pattern side
- ④ Spurious Modes: First Anharmonic > 150 KHz above fundamental

Ordering Information:

PART NUMBER	ITEM DESCRIPTION
TAN05IG	5 MHz Inficon pattern gold quartz crystal
TAN05IA	5 MHz Inficon pattern alloy quartz crystal
TAN05IS	5 MHz Inficon pattern silver quartz crystal
TAN06IG	6 MHz Inficon pattern gold quartz crystal
TAN06IA	6 MHz Inficon pattern alloy quartz crystal
TAN06IS	6 MHz Inficon pattern silver quartz crystal

Balzers Type

AT Cut

Temperature Range

20-100°C

Gold



Alloy



Silver



Description:

Quartz sensor for use in thin film deposition monitors and controllers, including Balzers, and Evatec instruments.

Physical Specification:

- ① Material: Single Crystal Alpha Quartz, Unswept, Electronic Grade ($Q > 1E6$)
- ② Dimensions: 0.550" $\pm$.000/.002" OD
- ③ Contour: 2.5 - 3.0 diopter (212 - 177 mm radius of curvature) plano convex
- ④ Finish: 7 microns rms roughness plano and contour sides
- ⑤ No chips, scratches or etch marks within a 13.95 mm diameter clear aperture
- ⑥ Electrodes: "Balzers" pattern back, fully coated crystal face

Electrical Specifications:

- ① Available Frequencies: 5 MHz, fundamental series resonance
- ② Resistance: $< 10^* - 15$ Ohms, plated **alloy only*
- ③ Contact Resistance: < 10 Ohms edge to edge on pattern side
- ④ Spurious Modes: First Anharmonic > 150 KHz above fundamental

Ordering Information:

PART NUMBER	ITEM DESCRIPTION
TAN05BG	5 MHz Balzers pattern gold quartz crystal
TAN05BA	5 MHz Balzers pattern alloy quartz crystal
TAN05BS	5 MHz Balzers pattern silver quartz crystal

Ulvac Type

AT Cut

Temperature Range

20-100°C

Gold



Alloy



Silver



Description:

Quartz sensor for use in Ulvac and Sloan instruments.

Physical Specification:

- ① Material: Single Crystal Alpha Quartz, Unswept, Electronic Grade (Q>1E6)
- ② Dimensions: 0.490" +.000/.003" OD
- ③ Contour: 2.5 - 3.0 diopter (212 - 177 mm radius of curvature) plano convex
- ④ Finish: 7 microns rms roughness plano and contour sides
- ⑤ No chips, scratches or etch marks within a 13.95 mm diameter clear aperture
- ⑥ Electrodes: "Ulvac" pattern both sides

Electrical Specifications:

- ① Available Frequencies: 5 and 6 MHz, fundamental series resonance
- ② Resistance: <10*-15 Ohms, plated *alloy only
- ③ Contact Resistance: <10 Ohms edge to edge on pattern side
- ④ Spurious Modes: First Anharmonic >150 KHz above fundamental

Ordering Information:

PART NUMBER	ITEM DESCRIPTION
TAN05SG	5 MHz Ulvac pattern gold quartz crystal
TAN05SA	5 MHz Ulvac pattern alloy quartz crystal
TAN05SS	5 MHz Ulvac pattern silver quartz crystal'
TAN06SG	6 MHz Ulvac pattern gold quartz crystal
TAN06SA	6 MHz Ulvac pattern alloy quartz crystal
TAN06SS	6 MHz Ulvac pattern silver quartz crystal

1" Diameter for Liquid Monitoring Applications

AT Cut

Temperature Range

20-100°C

Gold



Alloy



Silver



Description:

1" diameter polished Quartz sensor for use in Maxtek PM 700 series RQCM, and SRS QCM200 Quartz Crystal Microbalance

Physical Specification:

- ① Material: Single Crystal Alpha Quartz, Unswept, Electronic Grade (Q>1E6)
- ② Dimensions: 1.00" +.000/-.002" OD (25.4mm)
- ③ Contour: plano-plano
- ④ Finish: Optical polish*, both sides **also available in unpolished version.*
- ⑤ No chips, scratches or etch marks within a 13.95 mm diameter clear aperture
- ⑥ Electrodes: "Maxtek/SRS" patterned gold

Electrical Specifications:

- ① Available Frequencies: 5, 6, and 9 MHz, fundamental series resonance
- ② Resistance: <10*-15 Ohms, plated **alloy only*
- ③ Contact Resistance: <10 Ohms edge to edge on pattern side
- ④ Spurious Modes: First Anharmonic >150 KHz above fundamental

Ordering Information:

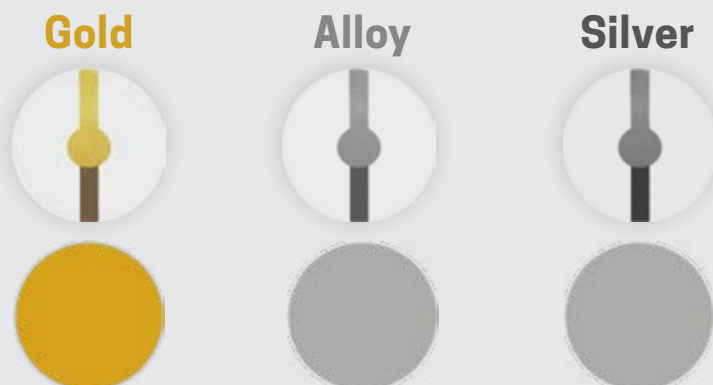
PART NUMBER	ITEM DESCRIPTION
TAN05GLP	5 MHz 1" Maxtek/SRS pattern gold quartz crystal
TAN05SLP	5 MHz 1" Maxtek/SRS pattern silver quartz crystal
TAN05ALP	5 MHz 1" Maxtek/SRS pattern alloy quartz crystal
TAN06GLP	6 MHz 1" Maxtek/SRS pattern gold quartz crystal
TAN06SLP	6 MHz 1" Maxtek/SRS pattern silver quartz crystal
TAN06ALP	6 MHz 1" Maxtek/SRS pattern alloy quartz crystal
TAN09GLP	9 MHz 1" Maxtek/SRS pattern gold quartz crystal
TAN09SLP	9 MHz 1" Maxtek/SRS pattern silver quartz crystal
TAN09ALP	9 MHz 1" Maxtek/SRS pattern alloy quartz crystal

“Keyhole” Pattern

AT Cut

Temperature Range

20-100°C



Description:

14 mm diameter polished Quartz sensor with “keyhole” electrodes for use in custom mounting devices commonly found in R&D applications. Designed for electrical contacts to clip or solder to each each of the electrodes contacts.

Physical Specification:

- ① Material: Single Crystal Alpha Quartz, Unswept, Electronic Grade ($Q > 1E6$)
- ② Dimensions: 0.550” +.000/.002” OD
- ③ Contour: 2.5 - 3.0 diopter (212 - 177 mm radius of curvature) plano convex
- ④ Finish: Optical polish*, both sides **also available in unpolished version.*
- ⑤ No chips, scratches or etch marks within a 13.95 mm diameter clear aperture
- ⑥ Electrodes: “keyhole” pattern

Electrical Specifications:

- ① Available Frequencies: 5, 6, 9, and 10 MHz, fundamental series resonance
- ② Resistance: <10*-15 Ohms, plated **alloy only*
- ③ Contact Resistance: <10 Ohms edge to edge on pattern side
- ④ Spurious Modes: First Anharmonic >150 KHz above fundamental

Ordering Information:

PART #	ITEM DESCRIPTION	PART #	ITEM DESCRIPTION
TAN05KGP	5 MHz 14mm Keyhole pattern polished gold quartz crystal	TAN09KGP	9 MHz 14mm Keyhole pattern polished gold quartz crystal
TAN05KSP	5 MHz 14mm Keyhole pattern polished silver quartz crystal	TAN09KSP	9 MHz 14mm Keyhole pattern polished alloy quartz crystal
TAN05KAP	5 MHz 14mm Keyhole pattern polished alloy quartz crystal	TAN09KAP	9 MHz 14mm Keyhole pattern polished alloy quartz crystal
TAN06KGP	6 MHz 14mm Keyhole pattern polished gold quartz crystal	TAN10KGP	10 MHz 14mm Keyhole pattern polished gold quartz crystal
TAN06KSP	6 MHz 14mm Keyhole pattern polished silver quartz crystal	TAN10KSP	10 MHz 14mm Keyhole pattern polished silver quartz crystal
TAN06KAP	6 MHz 14mm Keyhole pattern polished alloy quartz crystal	TAN10KAP	10 MHz 14mm Keyhole pattern polished alloy quartz crystal



RC Crystals

The most accurate QCMs in the World

A film thickness monitor measures the change in resonance frequency of an oscillating quartz crystal while a thin film coating is collecting on its surface. As the coating builds up the resonance frequency decreases in a very predictable fashion. If the density of the deposited film is known, the thickness of the film can be calculated in real-time. A film thickness monitor works on the underlying assumption that any change in the resonance frequency is solely a result of film build-up. Unfortunately, it does not always work out this way...

Conventional AT Crystal

The following illustration demonstrates how a traditional AT crystal performs during e-beam and thermal evaporation and the effects of radiant heat on crystal performance.

1. Predeposition

Source power is applied to condition and melt the evaporant

Water-cooled sensor head is stable at 10-20°C

Source shutter is closed while material heats during the pre-deposition stage.

2. Deposition phase

Sensor head and crystal are exposed to radiating heat from source and deposition vapor

Shutter opens beginning deposition process.

3. Sensor head & Crystal

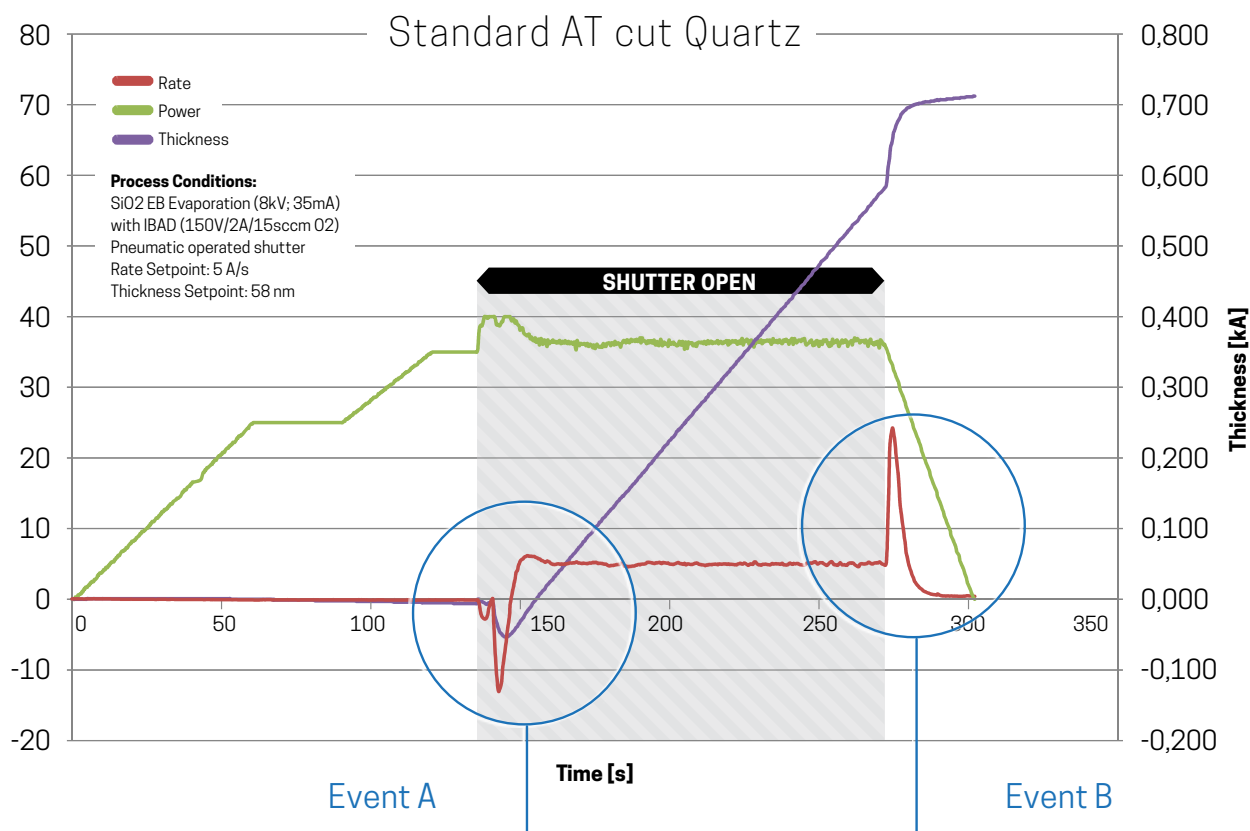
Despite being watercooled, extreme radiant heat makes contact with the crystal causing frequency disturbances which cause rate fluctuations.

4. Response of Monitoring System

The result of this radiant heat is seen in the process data below. Pay particular attention to the follow events.

Event A: after the shutter opens, the radiation from the source reaches the crystal, the crystal expands, and the frequency rises. This is interpreted by the monitor as negative rate or thickness.

Event B: as the shutter closes, radiation stops and the crystal frequency suddenly decreases because the crystal contracts, leading to a false thickness change. This frequency decrease registers as a rate or thickness increase.

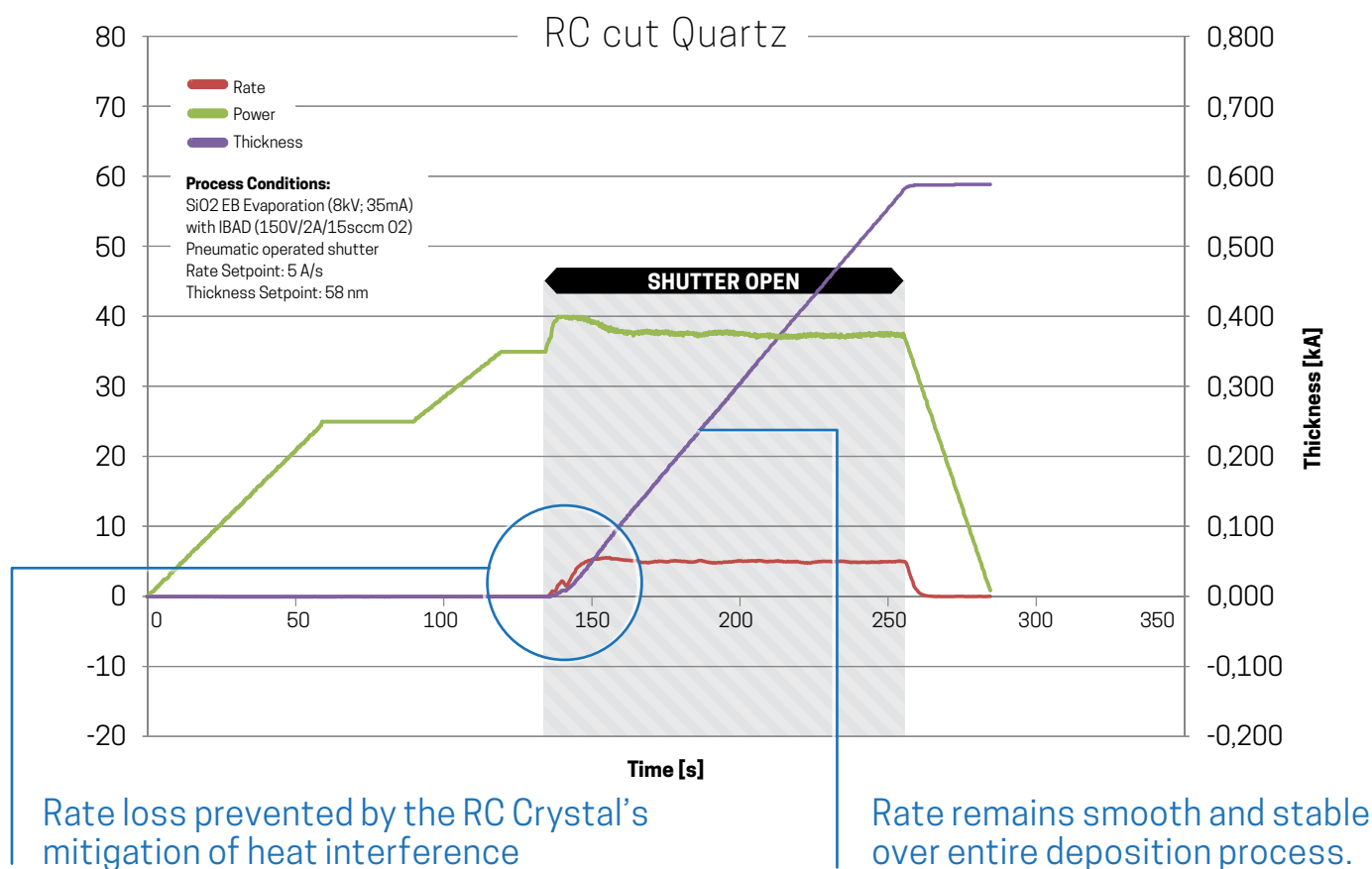


How RC Crystals solve This Problem

Invented by our CTO, Scott Grimshaw, the RC crystal's thermal radiation resistance enables the most accurate measurements possible in thin film deposition. RC crystals mitigate the aforementioned issues because this recently invented design is insensitive to frequency

shifts caused by source radiation or film stress. This shift prevention is accomplished by adjusting the stress coefficients of the quartz plate using advanced fabrication methods. The RC crystal will not show a rate spike when the deposition source shutter is opened (Event A). Typically, this

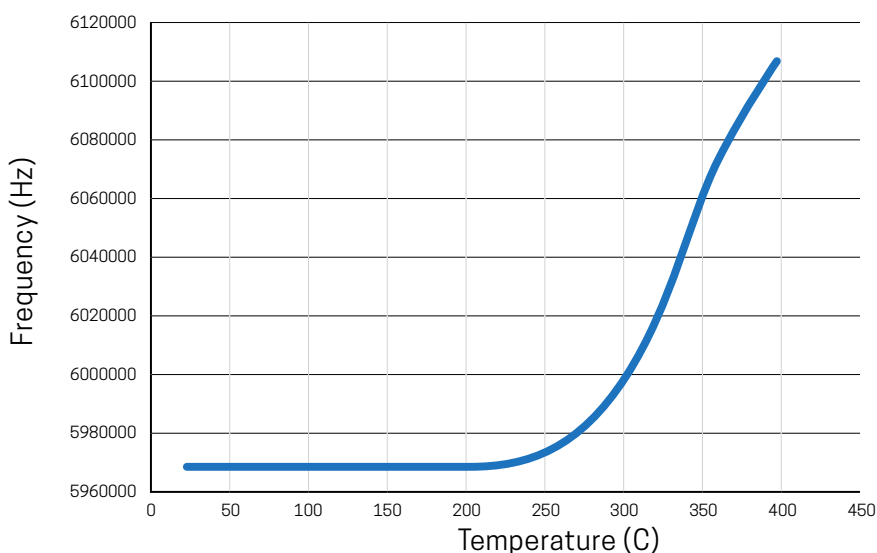
action causes a frequency shift of up to 100 Hz, which translates for films such as aluminum, to rate changes of 50 Angstroms. Further, the noise associated with the intense energy of impinging atoms in sputtering is dramatically reduced, owing to the stress insensitivity of the crystal.



Additional Benefit: Compatible with High Temperature Processes

In addition to rate-spike prevention, RC Crystals also can stably operate up to 300°C, which makes them perfect for high temperature applications requiring intense heat, such as ALD, CVD, OVPD, and high temperature PVD. The graph below illustrates the temperature versus frequency turning curve (F vs T) for an RC Crystal.

RC Crystal: Frequency vs Temperature Curve





Inficon Type

RC

Temperature Range

20-300°C

Gold



Alloy



Silver



Description:

Replacement quartz crystal sensor with enhanced high temperature and “rate-spike” resistance. For use in thin film deposition monitors and controllers, including Inficon, Maxtek, Sigma Instruments, and Sycon instruments.

Physical Specification:

- ① Material: Single Crystal Alpha Quartz, Unswept, Electronic Grade (Q>1E6)
- ② Dimensions: 0.550” +.000/.002” OD
- ③ Contour: 2.5-3 diopter (212-177 mm radius of curvature) plano convex
- ④ Finish: 7 microns rms roughness plano and contour sides
- ⑤ No chips, scratches or etch marks within a 13.95 mm diameter clear aperture
- ⑥ Electrodes: “Inficon” pattern back, fully coated crystal face.

Electrical Specifications:

- ① Available Frequencies: 5 and 6 MHz, fundamental series resonance
- ② Resistance: <40 Ohms, plated
- ③ Contact Resistance: <10 Ohms edge to edge on pattern side
- ④ Spurious Modes: First Anharmonic >150 KHz above fundamental

Ordering Information:

PART NUMBER	ITEM DESCRIPTION
TAN05RCIG	5 MHz RC Inficon pattern gold quartz crystal
TAN05RCIA	5 MHz RC Inficon pattern alloy quartz crystal
TAN05RCIS	5 MHz RC Inficon pattern silver quartz crystal
TAN06RCG	6 MHz RC Inficon pattern gold quartz crystal
TAN06RCA	6 MHz RC Inficon pattern alloy quartz crystal
TAN06RCS	6 MHz RC Inficon pattern silver quartz crystal

Ulvac Type RC

Temperature Range
20-300°C

Gold



Alloy



Silver



Description:

Quartz sensor with enhanced high temperature and “rate-spike” resistance.
For use in Ulvac and Sloan instruments.

Physical Specification:

- ① Material: Single Crystal Alpha Quartz, Unswept, Electronic Grade (Q>1E6)
- ② Dimensions: 0.490”+.000/.003” OD
- ③ Contour: 2.5-3 diopter (212-177 mm radius of curvature) plano convex
- ④ Finish: 7 microns rms roughness plano and contour sides
- ⑤ No chips, scratches or etch marks within a 13.95 mm diameter clear aperture
- ⑥ Electrodes: “Ulvac” pattern both sides

Electrical Specifications:

- ① Available Frequencies: 5 MHz, fundamental series resonance
- ② Resistance: <40 Ohms, plated
- ③ Contact Resistance: <10 Ohms edge to edge on pattern side
- ④ Spurious Modes: First Anharmonic >150 KHz above fundamental

Ordering Information:

PART NUMBER	ITEM DESCRIPTION
TAN05RCSG	5 MHz RC Ulvac pattern gold quartz crystal
TAN05RCSA	5 MHz RC Ulvac pattern alloy quartz crystal
TAN05RCSS	5 MHz RC Ulvac pattern silver quartz crystal

Balzers Type

RC

Temperature Range

20-300°C

Gold



Alloy



Silver



Description:

Quartz sensor with enhanced high temperature and “rate-spike” resistance.
For use in thin film deposition monitors and controllers, including Balzers, and Evatec instruments.

Physical Specification:

- ① Material: Single Crystal Alpha Quartz, Unswept, Electronic Grade (Q>1E6)
- ② Dimensions: 0.550” +. 000/.002” OD
- ③ Contour: 2.5-3 diopter (212-177 mm radius of curvature) plano convex
- ④ Finish: 7 microns rms roughness plano and contour sides
- ⑤ No chips, scratches or etch marks within a 13.95 mm diameter clear aperture
- ⑥ Electrodes: “Balzers” pattern back, fully coated crystal face

Electrical Specifications:

- ① Available Frequencies: 5 MHz, fundamental series resonance
- ② Resistance: <40 Ohms, plated
- ③ Contact Resistance: <10 Ohms edge to edge on pattern side
- ④ Spurious Modes: First Anharmonic >150 KHz above fundamental

Ordering Information:

PART NUMBER	ITEM DESCRIPTION
TAN05RCBG	5 MHz RC Balzers pattern gold quartz crystal
TAN05RCBA	5 MHz RC Balzers pattern alloy quartz crystal
TAN05RCBS	5 MHz RC Balzers pattern silver quartz crystal

Inficon Type

HT

Temperature Range

250-400°C

Gold



Alloy



Silver



Description:

For processes that operate at temperatures above 100°C, standard quartz crystals are extremely noisy. This noise prevents accurate and stable film thickness measurements. To solve this problem, Colnatec has invented monitor crystals that operate stably above 100°C, are stress-insensitive, and can operate in plasmas. High temperature HT crystals can maintain operating efficiency at temperatures up to 400°C. The HT is ideal for processes requiring intense heat, such as ALD, CVD, OVPD, high temperature PVD, and thin film furnace processes such as selenization and indiffusion.

As an added benefit, the HT crystals can disregard the rate spike caused by temperature variances. This usually occurs when the deposition source shutter is opened or the crystal is exposed to plasmas. Typically, this action causes a frequency shift of up to 100 Hz, which translates to rate changes of 50 angstroms or more for films such as aluminum. Further, the noise associated with the intense energy of impinging atoms in sputtering is dramatically reduced, owing to the stress-insensitivity of the crystal. These are very real advantages in the measurement of

nanometer films used in the manufacture of OLEDs, precision optical interference films, or next-generation electronic devices (e.g., solar cells).

Although it can be used effectively in place of standard AT-cut quartz in all commercially available film thickness monitors and controllers, HT crystals are ideally suited to Colnatec high temperature sensor heads. They are available in 5 or 6 MHz versions, with gold or aluminum electrodes, sized in 14mm and 12.5mm diameters.

Ordering Information:

PART NUMBER	ITEM DESCRIPTION
TAN06HTIG	6 MHz HT Inficon Gold
TAN06HTIA	6 MHz HT Inficon Alloy
TAN06HTIS	6 MHz HT Inficon Silver

SuperQuartz by Colnatec

Sold exclusively through
Phillip Technologies

Temperature Range

400°C and Higher!

Gold



Description:

For processes that operate at temperatures above 100°C, standard quartz crystals are extremely noisy. This noise prevents accurate and stable film thickness measurements. To solve this problem, Colnatec has invented monitor crystals that operate stably above 100°C, are stress-insensitive, and can operate in plasmas. The most vigorous of these, SuperQuartz (SQ™), maintains operating efficiency at temperatures of 500°C+. The SuperQuartz is ideal for processes requiring intense heat, such as ALD, CVD, OVPD, high temperature PVD, and thin film furnace processes such as selenization and indiffusion.

As an added benefit, SuperQuartz crystals are able to disregard the rate spike caused by temperature variances. This usually occurs when the deposition source shutter is opened or the crystal is exposed to plasmas. Typically, this action causes a frequency shift of up to 100 Hz, which translates to rate changes of 50 angstroms or more for films such as aluminum. Further, the noise associated with the intense energy of impinging atoms in sputtering is dramatically reduced, owing to the stress-insensitivity of the crystal. These are very real advantages in the measurement of

nanometer films used in the manufacture of OLEDs, precision optical interference films, or next-generation electronic devices (e.g., solar cells).

Although it can be used effectively in place of standard AT-cut quartz in all commercially available film thickness monitors and controllers, the SQ™ crystal is ideally used in Colnatec high temperature sensor heads. SuperQuartz is available in a 6 MHz version, with gold electrodes, sized in 14mm diameter.

Ordering Information:

PART NUMBER	ITEM DESCRIPTION
TAN06SQG	6 MHz, Inficon Pattern, Gold, SuperQuartz Crystals. Sold 1 Crystal per pack

The RC Crystal offers very real advantages in the measurement of nanometer films used in the manufacture of OLED, precision optical interference films, or next generation electronic devices. RC crystals can be used in place of standard AT-cut quartz in all commercially available film thickness monitors and controllers. In some, very rare, cases the only modification needed is replacement of the user's existing crystal oscillator with a Colnatec OSC100 oscillator.



Hardware and Accessories

Eon-ID™ Monitor w/ Integrated Display

Comprehensive, Versatile Film Thickness Monitor

All-inclusive, versatile, affordable thin film deposition monitoring solution

Drawing from its extensive background in the design and manufacture of cutting-edge thin film technology, Colnatec introduces a new film thickness monitor that packages an ultra-high resolution deposition measurement system into a compact, rackmountable enclosure.



With its integrated display, intuitive GUI, and durable architecture, Eon-ID™ film thickness monitor is the only product of its kind that works right out of the box.

Eon-ID™ offers an all-inclusive design that adapts easily to a variety of settings- ranging from industrial to laboratory to clean room to research environments.

With its temperature monitoring capability, touchscreen display, and sturdy industry-ready design, Eon-ID™ presents an all-in-one solution that will probably be the last thin film QCM monitor you'll ever need!

Features

- Integrated touchscreen display for process programming and monitoring - easier than using a smartphone!
- Connectivity includes RS-232
- Rackmount capable (1 or 2 Eon-IDs per slot)
- Dual sensor for expanded capability
- Advanced technology that increases reliability and durability in industrial environments
- Features built in temperature monitoring

Applications

- Atomic Layer Deposition (ALD)
- Chemical Vapor Deposition (CVD)
- Molecular Beam Epitaxy (MBE)
- CIGS (thin film solar)
- OLED (display & lighting)
- Multi-Layer Optical Thin Film Deposition
- Roll-to-roll coating

MEASUREMENT

Frequency Resolution	0.001 Hz @ 6 MHz (1 sample per second)
Sample Rate	100 Hz - 10 Hz (10 ms - 100 ms)
Display Update Rate	10 Hz - 1 Hz (10 ms - 100 ms)
Sensor Crystal Frequency	6 MHz

DISPLAY

Thickness	Auto ranging: -999 to 9999.9 kÅ
Rate	Auto ranging -999 to 9999.9 Å
Crystal Health	00 to 100%
Screen	7" LCD-TFT display graphics; 800 x 480 VGA resolution; resistive touch

COMMUNICATIONS

RS-232 Communication Compatibility	Yes
RS-232 Baud Rate	115200 Baud
Communications Protocol	RS-232 standard (See "RS232 Commands" in the Eon-ID manual)

SOFTWARE

Thickness	Auto ranging: -999 to 9999.9 kÅ
Rate	Auto ranging -999 to 9999.9 Å
Power	00.00 to 100%
Crystal Health	00 to 100%
User Labeled Process (full touchscreen with alphanumeric entry)	Yes
User Labeled Films (full touchscreen with alphanumeric entry)	Yes
Shutter Delay	Yes
Software Control Loops	PID
Data Logging	Yes
User Language	English

ELECTRONICS

Temperature	2x TC Type K
Relay Output Setup	Outputs can be triggered according to user-defined conditions
Sensor Head Input(s)	High resolution inputs, accurate up to .001 Hz (2) BNC
Thermocouple Input(s)	K-type thermocouple inputs; accurate to +/-0.25°C (2)
Display with Graphics	7" LCD-TFT display graphics; 800 x 480 VGA resolution; resistive touch (touchscreen)

DB9

Relays*

2x Relays 2x SPST (programmable)
*Max 2A@30VDC

Eon-ID™ Monitor	10" L X 8.25" W X 5.25" H
Rackmount Dimension	Standard 19" 3U high rack; 1 or 2 Eon-IDs per slot

DIMENSIONS

Eon-ID™ Monitor	10" L X 8.25" W X 5.25" H
Rackmount Dimension	Standard 19" 3U high rack; 1 or 2 Eon-IDs per slot

POWER SUPPLY

24 volt power (supplied)

ORDERING INFORMATION

Eon-ID™	Thin film monitor/controller with integrated touchscreen and temperature measurement
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Phoenix™ SingleFilm Thickness Sensor

Conventional Sensor with Embedded Thermocouple

Redefining the Conventional

Temperature-fluctuation can be considered the most significant contributor to frequency drift in quartz crystals. Traditional sensor heads address this problem with water cooling. While many manufacturers advise that crystal temperature be kept at “around 20°C”, their products are incapable of actually measuring temperature.

Real-world application has shown that a standard water-cooled sensor can experience a 20° C flux within as few as 10 minutes during high-rate deposition. In an industry of nanometer measurements, this level of variance can easily result in considerable inaccuracy.

Dissatisfied with the level of precision available on the market, Colnatec undertook to design a sensor head

that adds a new level of control to the thin film deposition process. As a result, the Phoenix™ sensor head is capable of not only measuring temperature but of withstanding temperatures higher than any other sensor head. This allows for monitoring processes up to 500°C (e.g., ALD, CVD, etc.).

When the Phoenix™ is combined with Colnatec’s Eon-LT™ monitor (or controller), temperature and frequency are automatically graphed alongside the corresponding rate and thickness values on a personal computer, allowing for real-time correction and accuracy up to .001 Hz.

The Phoenix™ is optimized for Colnatec’s RC™ crystals that are uniquely immune to radiation spikes and film stress caused by shutter openings, film condensation, and source radiation.



The system is ideal for ALD systems when used with HT crystals, reducing ex-situ metrology sampling and scrapped runs due to real-time control of process and/or reactor conditions. In addition, the Phoenix™ achieves greater accuracy in film deposition per wafer, leading to increased process yield and improved film quality.

DIMENSIONS

Length	4” to 30” depending on customer requirements
Cross Section	Able to be passed through a 2.75” ConFlat™ port

ORDERING INFORMATION

Phoenix™	Standard sensor with embedded thermocouple
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Features

- Temperature measuring quartz crystal sensor head, single versions
- Embedded type K thermocouple
- Designed for 14 mm diameter crystals, up to 10 MHz operation
- Available with 2.75 Conflat™ or 1” bolt feed through as stock configuration. Length 30” (75 mm). Custom sizes, flanges, and bends available. Also available with compression fittings to allow infinite length adjustability
- Standard SMA air side connection for crystal measurement. Compatible with the Eon-ID, Eon-LT™, or other film thickness monitors and controllers

Applications

- Atomic Layer Deposition (ALD)
- Chemical Vapor Deposition (CVD)
- Molecular Beam Epitaxy (MBE)
- CIGS (thin film solar)
- OLED (display & lighting)
- Multi-Layer Optical Thin Film Deposition

Phoenix System PC

Film Thickness Monitoring System with Temp. Measurement

The New Standard in Measurement

Colnatec has built its reputation on understanding and answering the need for high- quality, competitively-priced film thickness measurement equipment. In line with this philosophy, Phoenix™ System PC features exclusive, cutting- edge technology and elegant design.

With Phoenix™ System PC, users can take advantage of temperature measurement technology to reduce the effects of temperature on the crystal and improve process stability.

In many high-temperature applications, sensors will often fail due to their low temperature rating. The Phoenix™ sensor head is capable of not only measuring temperature

but of operating in temperatures higher than any other sensor head on the market. This allows for monitoring processes up to 500°C (e.g., ALD, CVD, etc.).

Although the system is capable of accepting any 14 mm diameter crystal up to 10MHz, it is optimized for the RC Crystal, which is uniquely immune to radiation spikes and film stress caused by shutter openings, film condensation, and source radiation.

With higher frequency resolution and temperature measurement Phoenix™ System PC outperforms any comparable technology. This remarkable set of features enables more efficient process control at highly competitive prices.



Features

- Temperature measurement for greater accuracy
- Sensor available in different lengths and with different flanges for flexibility
- New, easy-to-learn interface that conveniently installs on your PC
- Dual channels for expanded capability
- Standard SMA air side connection for crystal measurement
- Accepts all crystals crystals within 4-10 MHz, 1-200 Ω
- Industry Standard RS232 communication protocol

Applications

- Atomic Layer Deposition (ALD)
- Chemical Vapor Deposition (CVD)
- Molecular Beam Epitaxy (MBE)
- CIGS (thin film solar)
- OLED (display & lighting)
- Multi-Layer Optical Thin Film Deposition

MEASUREMENT

Frequency Resolution	0.001 HZ @ 6 MHz (1 Sample per Second)
Sample Rate	0.5 Hz to 100 Hz
Display Update Rate	0.5 Hz to 100 Hz (Depending on sampling rate)
Sensor Crystal Frequency	5, 6, 7, 8, 9, 10 MHz

COMMUNICATIONS

Standard	RS232
	USB (Process Programming)
Optional	Ethernet
Creating Programs	All settings can be programmed using the touchscreen and embedded keypad. Keyboard can be connected via the USB port. CactusProg™ software can be used on a PC to create layers and can be transferred using a USB flash drive.
Capabilities	Unlimited Layer and Process programs

DIMENSIONS

Length	4" to 30" depending on customer requirements
Cross Section	Able to be passed through a 2.75" ConFlat port

STANDARD HARDWARE

Sensor	2x BNC Connections (External Oscillator Required)
Temperature	2x type K TC
Sources	2x 0-5 VDC source controls
Relays (non-programmable)	2x SPST NO for abort & thickness set-point
Input (programmable)	8x isolated 5V inputs
Output (programmable)	8x 5A SPST relays
Remote Power	Front panel FOB connector for manual power control
Expandable sensor card (1 incl., expandable to 2)	x2 sensors, 2x sources, 2x relays, 2x Type K TC
Expandable I/O card (1 incl., expandable to 2)	Input: 8x isolated 5 VDC inputs
	Output: 8x 5A SPST relays
Input setup	Inputs can trigger events depending on user selected conditions
Output Setup	Outputs can be triggered depending on user selected conditions
DAC Recorder	Either or both source outputs can be used as recorder outputs

ORDERING INFORMATION

Phoenix™	Standard sensor with embedded thermocouple
Eon-LTC™	Temperature measurement & source control
Eon-LTM™	Temperature measuring film thickness monitor

Eon-LTTM PC-Based Monitor

Film Thickness Monitor with Temperature Measurement

Basic Design with Same Degree of Excellence

Designed with the same level of dependability and precision of Eon™ system, the EonLT™ PC-based film thickness monitor provides a basic feature-set for users who do not require process or temperature control. The EonLT™ offers the same innovative monitoring capability of the Eon™, yet the technology has been streamlined to provide a more compact, low-cost unit. Like the Eon™, the Eon-LT™ is a temperature measuring film thickness monitor which surpasses conventional monitors that are blind to thermal changes of the crystal. The combination of frequency and temperature measurement allows unprecedented accuracy in real-time

Why measure temperature?

The frequency change of a crystal by process heating can easily be equal to the frequency change caused by coating. In normal operation there

is a built-in 10% error in most rate measurements. In the worst case, the error rate can reach 100% - calling into question the entire purpose of the measurement process. While Eon-LT™ is compatible with industry standard

crystal sensors, the unit was also specifically created to be paired with Colnatec's Phoenix™ in combination with AT™, HT™, RC™, or SuperQuartz (SQ™) 6 MHz crystals for achieving a degree of precision never before imagined in the world of thin film.



Features

- Temperature measuring quartz oscillator
- Communicates with latest, intuitive Eon™ software
- Real time graphing of temperature and frequency alongside corresponding rate and thickness values
- Shutter on/off support (relays)
- All connecting cables, software, and instruction manual included

Applications

- Atomic Layer Deposition (ALD)
- Chemical Vapor Deposition (CVD)
- Molecular Beam Epitaxy (MBE)
- CIGS (thin film solar)
- OLED (display & lighting)
- Multi-Layer Optical Thin Film Deposition

MEASUREMENT

Frequency Resolution	0.001 HZ @ 6 MHz (1 Sample per Second)
Sample Rate	100 Hz to 10 Hz
Display Update Rate	10 Hz - 1 Hz
Sensor Crystal Frequency	6 MHz

ELECTRONICS

Temperature	2x type K TC
Sources	2x 0-5 VDC source controls
Relays (non-programmable)	2x SPST NO for abort & thickness setpoint
Remote Power	Front panel FOB connector for manual power control
Input setup	Inputs can trigger events depending on user selected conditions
Output Setup	Outputs can be triggered depending on user selected conditions
LED(s)	Dual status
Communication Protocol	Communication status Power-up status RS-232
DAC Recorder	Either or both source outputs can be used as recorder outputs

DIMENSIONS

4.5" x 2.5" x 1"	
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ORDERING INFORMATION

Eon-LT™	PC-interactive thin film monitor
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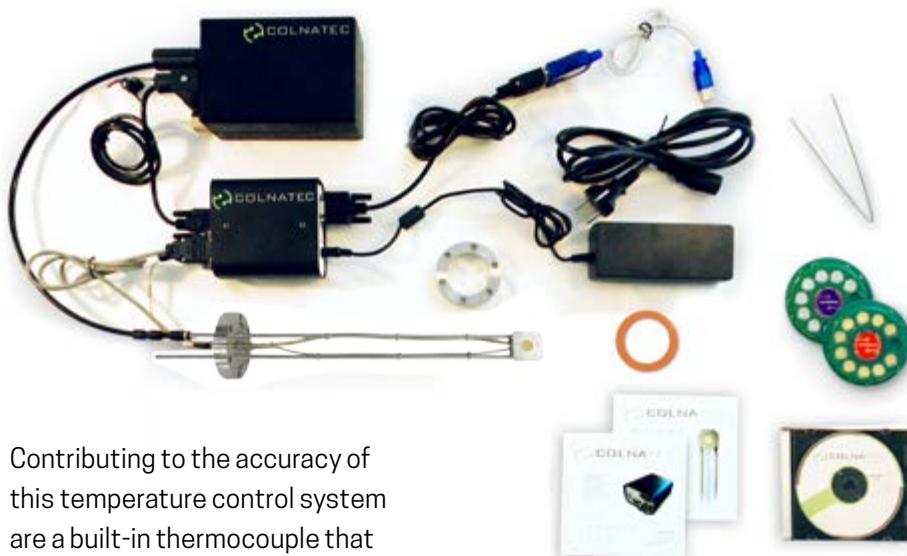
Tempe™ System

Thin Film Measurement with Temperature & Deposition Control

Self-Heating Sensor for Thin Film Measurement and Control

Tempe™ System is designed for thin film coating process control in high-temperature environments. With a heater built into the sensor, the Tempe™ system can achieve and maintain any temperature within a range of 40-500°C. This can be useful in a variety of circumstances.

If the process requires a heated substrate in a cold chamber, the Tempe™ sensor is capable of mimicking the temperature of the substrate. The sensor is also capable of initiating a high-temp, self-cleaning “bake cycle” that can extend crystal life and reduce interruptions due to crystal failure in a continuous process environment.



Contributing to the accuracy of this temperature control system are a built-in thermocouple that conveys temperature data to the Eon™ controller - which makes real-time adjustments to the heater - and the Mirage™ air-cooling unit, which automatically delivers super-cooled compressed air into the sensor in response to the fluctuating temperature changes of the sensor.

The accuracy of Tempe™ system during depositions between 200-350°C is further enhanced by Colnatec's High Temperature™ (HT) crystal, ideal for ALD, CVD, MBE, CIGS, solar cell fabrication, OLED, and a variety of other thin film processes.

Features

- Temperature controlled sensor head, complete with heater, air-cooling lines,
- and embedded TC (optional shutter if required)
- KF or ConFlat vacuum flange with connectors for heater,
- TC, crystal control, air lines for cooling, and optional shutter
- Freestanding PC-based film thickness monitor/controller with integrated temperature measurement and heater control. Continuously reports rate, thickness, and crystal temperature data in real-time
- Mirage™ Air-Cooling System capable of supplying cold air up to 28°C (50°F) below the supply air temperature
- Tempe™ System includes all connecting cables, remote oscillator, easy-to-use PC software, quick-start guides, and instruction manual

Applications

- Atomic Layer Deposition (ALD)
- Chemical Vapor Deposition (CVD)
- Molecular Beam Epitaxy (MBE)
- CIGS (thin film solar)
- OLED (display & lighting)
- Multi-Layer Optical Thin Film Deposition
- OLED (display & lighting)
- Multi-Layer Optical Thin Film Deposition

MEASUREMENT

Frequency Resolution	0.001 Hz @ 6 MHz (1 sample per second)
Sample Rate	100 Hz - 10 Hz (10 ms - 100 ms)
Display Update Rate	10 Hz - 1 Hz (10 ms - 100 ms)
Sensor Crystal Frequency	6 MHz

ELECTRONICS

Temperature	2x TC Type K
LED(s)	Dual status
DB9	2x relays SPST (programmable) N.O.
DB37	Heater control connector
Source Power Supply Signal	0-5v DC source controls (2)
Sensor Head Input(s)	High resolution inputs, accurate up to .001 Hz (2) BNC
Thermocouple Input(s)	Type K thermocouple inputs; resolution 0.1°C (2)

SOFTWARE

Thickness	Auto ranging: -999 to 9999.9 kÅ
Rate	Auto ranging -999 to 9999.9 Å
Power	00.00 to 100%
Crystal Health	00 to 100%
Number of Processes	100,000+
Number of Layers	100,000+
Manual Power Control	Yes
User Labeled Process	Yes
User Labeled Films	Yes
Shutter Delay	Yes
Software Control Loops	PID
Data Logging	Yes
User Language	English

COMMUNICATIONS

RS-232 Communication Compatibility	Yes
RS-232 Baud Rate	115200 Baud
Communication Protocol	Communication status Power-up status RS232 (Communications manual available online)

SENSOR

Sensor Communications	2x BNC connections
Temperature	Type K TC (2)
Source Power Supply Signal	0-5v DC source controls (2)
Heater Composition	Aluminum nitride with tungsten traces
Power Cable Composition	Silica ceramic braided nickel wire
Sensor Composition	- Body: 304 SS (stainless steel) - Insulators: Alumina - Contact springs: Inconel - Screws: 304 SS (stainless steel)
Vacuum Rating	1X10E-8 Torr 1.32 E-11 atm 1.33 E-6 Pa

DIMENSIONS

Tempe™ Sensor	- Head: 0.56" X 1.18" x 1.18" - Body length: 4" to 30" depending on customer requirements - Head width: Can be passed through a KF or ConFlat port with an inner diameter larger than 1.377" (35 mm)
Eon™ Controller	4.5" X 2.5" X 1.75"
Mirage™ Air-Cooling System	6" X 5.5" X 4.25"

POWER

24 volt power (supplied)

ORDERING INFORMATION

Tempe™ System	PC-Interactive thin film measurement system with temperature and deposition control
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Universal Oscillator (OSC100)

Competitively Priced Replacement with Greater Stability



Inexpensive Alternative to Brand Replacement Oscillators

Has the oscillator that drives your quartz crystal stopped working? Is the guy who assembled your system nowhere to be found? Or maybe he's trying to over-charge you for a simple, yet critical, replacement part. Colnatec can help.

Colnatec has designed a nearly universal oscillator to replace many of the existing OEM oscillators. This option is less costly and much faster than acquiring a refurbished unit or sending one in for repair.

Not only does the Colnatec oscillator meet the same specifications of the OEM parts, it has been improved to provide lower noise susceptibility.

Since the creation of the original crystal oscillators, technology has drastically changed. Electronics today are faster and more reasonably priced. Colnatec has taken advantage of recent breakthroughs in technology to deliver higher quality products at competitive prices.

Features

- Low-noise technology
- Replaces existing parts
- Capable of higher drive voltages

Benefits

- Less noise, provides more reliability
- 1:1 replacement for existing oscillators (see complete list)
- Suitable for blank crystals

Specifications

- 50 OHM input and output
- Compatible with 5-10 MHz crystals
- 5 VDC drive
- Isolated drive

Compatibility List

COMPATIBLE WITH:

Inficon

- IQM-233 Thin Film Deposition Controller PCI-Express Card
- SQC-310 Thin Film Deposition Controller
- SQM-160 Thin Film Deposition Monitor
- STM-2XM 2-Channel Rate/Thickness Monitor

Inficon

- IC-6000 Thin Film Deposition Controller
- XTC Thin Film Deposition Controller
- XTM Thin Film Deposition Monitor

Maxtec

- MDC-260 FILM DEPOSITION CONTROLLER
- MCD-360 FILM DEPOSITION CONTROLLER
- MDC-360C FILM DEPOSITION CONTROLLER
- MDC-361C FILM DEPOSITION CONTROLLER
- MDC-370 FILM DEPOSITION CONTROLLER

Sycon Instruments

- STM-1 Thin Film Deposition Monitor
- STM-100/MF Thin Film Deposition Monitor
- STC-2000A Thin Film Deposition Controller
- STC-2002 Thin Film Deposition Controller

Sigma

- All

Telemark

- All

INCOMPATIBLE WITH:

Inficon

- Cygnus 2 Thin Film Deposition Controller
- Guardian EIES Controller
- IC6 Thin Film Deposition Controller
- STM-2 USB Thin Film Rate/Thickness Monitor
- XTC/3 Thin Film Deposition Controller

Inficon

- Cygnus Thin Film Deposition Controller
- IC/5 Thin Film Deposition Controller
- Q-pod Thin Film Deposition Monitor
- XTC/2 & XTC/C Thin Film Deposition Controllers
- XTM/2 Thin Film Deposition Monitor
- IC/4 & IC/4 Plus Thin Film Deposition Controllers

Leybold

- Sentinel III EIES Controller

Maxtek

- RQCM – Quartz Crystal Microbalance Research System