



CATALOG 2022

# Mid-IR, Near-IR and UV-Vis Accessories and Supplies

PIKE Technologies specializes in spectroscopic accessories for all sampling techniques.

# About PIKE

## PIKE LEGACY

In 1989, Phil and Irene Brierley had a dream. They envisioned an enterprise that would specialize in imaginative design and manufacture of custom spectroscopic accessories. They wanted to integrate new technology that would make the life of a spectroscopist easier and more efficient—all at an outstanding value. Together, Phil and Irene founded PIKE Technologies.

Throughout the years, Phil and his team created a comprehensive line of sampling accessories. Phil passed away in 1999, but his legacy lives on.

## OUR TECHNOLOGY

At PIKE Technologies, we manufacture a wide range of spectroscopic accessories and sampling solutions:

- ▶ Attenuated total reflectance (ATR)
- ▶ Diffuse reflectance
- ▶ Specular reflectance
- ▶ Integrating spheres
- ▶ Polarization
- ▶ IR microscope and objectives
- ▶ Beam condensers
- ▶ Remote sensing
- ▶ Transmission

### HEATING AND AUTOMATION:

Many of our products include heating and automation options to further enhance productivity. Our proprietary software, AutoPRO and TempPRO, will make your routine measurements easy, consistent and reliable.

### RESEARCH AND DEVELOPMENT

We also offer design and consulting services for development of specialized and custom products for a wide range of spectroscopy applications.

## CONTACT US

As you review our catalog, know that our team is always available to help you choose the best accessory for your application and answer any technical questions you may have.

608.274.2721 | [info@piketech.com](mailto:info@piketech.com) | [piketech.com/contact-us](http://piketech.com/contact-us)

We look forward to serving you.

- Team PIKE

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# Sampling Kits



If you are not sure where to start, check out PIKE Technologies' sampling kits. You will immediately find everything you need for the most basic FTIR experiments, and you will be able to collect your first spectrum in less than 30 minutes from the time the kit arrives. The kits are carefully designed to include all necessary components. They eliminate guesswork and assure that you have everything you need for immediate productivity.

# Premium Sampling Kit

## AT A GLANCE

- ▶ Complete kit for transmission FTIR sampling
- ▶ Make KBr pellets with Pixie, a compact hydraulic press
- ▶ Make mulls for solid samples
- ▶ Run liquid samples for qualitative and quantitative analysis

All the tools you need for easy preparation of transmission measurements of liquids and solids.

The Premium kit includes Pixie, a small bench top hydraulic press for the easy preparation of 7-mm KBr pellets, and Nujol™/Fluorolube® for mull making – another popular method for preparation of solid samples. For liquid analysis, a complete demountable cell with a set of spacers ranging from 15 microns to 1 mm is provided. Viscous liquids can be measured directly as a thin film between the KBr windows. Also included are PIKE's most popular sample holders: the universal holder with a 20-mm aperture, KBr pellet holders and PIKE disposable/storage cardboard cards for pellets and polymer films.

| PART NUMBER                         | DESCRIPTION   |
|-------------------------------------|---|
| 162-1010                            | Premium Transmission Sampling Kit                         |
| <b>Included Parts and Materials</b> |   |
| 160-8010                            | KBr Powder, 100 g   |
| 161-0510                            | Fluorolube, 1 oz  |
| 161-0500                            | Nujol, 1 oz   |
| 042-3035                            | Spatula, spoon  |
| 042-3050                            | Spatula, flat   |
| 161-5030                            | Mortar and Pestle, 35 mm                                  |
| 181-1400                            | Pixie Hydraulic Pellet Press                              |
| 161-1010                            | 7-mm Die Set  |
| 161-1011                            | 7-mm Collar   |
| 161-1018                            | KBr Pellet Holder   |
| 161-6000                            | Finger Cots (12 ea.)                                      |
| 162-1100                            | Demountable Liquid Cell Assembly                          |
| 160-1010                            | KBr Window, 32 x 3 mm (6 ea.)                             |
| 160-1015                            | KBr Window, 32 x 3 mm, drilled (6 ea.)                    |
| 162-1290                            | Teflon Spacers, assortment                                |
| 161-0521                            | Syringe, 2 mL (2 ea.)                                     |
| 162-3610                            | Press-On Demountable Liquid Cell Holder for 32-mm windows |
| 162-5600                            | Universal Sample Holder*                                  |
| 162-5300                            | Magnetic Film Holder for 13-mm pellets and film samples   |
| 162-5400                            | Film Sampling Card, 20-mm clear aperture (10 ea.)*        |

**Note:** Cell holders marked "\*" fit all standard slide mounts, but due to their height may not allow for a complete sample compartment door closure on some smaller spectrometers. Please consult PIKE Technologies before placing an order.





# Standard Sampling Kit

## AT A GLANCE

- ▶ Complete kit for transmission FTIR sampling
- ▶ Make KBr pellets and mulls for solid samples
- ▶ Run liquid samples for qualitative and quantitative analysis
- ▶ Convenient padded carrying and storage case

Everything you need to run liquid and solid samples by transmission IR spectroscopy.

This general-purpose kit contains tools and materials for liquid and solid sampling. A complete demountable cell with a set of spacers ranging from 15 microns to 1 mm is provided for measurements of liquid samples. Viscous liquids can be measured directly as a thin film between the KBr windows.

The kit includes a hand-operated press for the preparation of 7-mm KBr pellets and Nujol™/Fluorolube® for mull making – another popular method for preparation of solid samples. Also included are PIKE's most popular sample holders: the universal holder with a 20-mm aperture, KBr pellet holders and PIKE disposable/storage cardboard cards for pellets and polymer films.

| PART NUMBER                         | DESCRIPTION   |
|-------------------------------------|---|
| 162-1000                            | Standard Transmission Sampling Kit                        |
| <b>Included Parts and Materials</b> |   |
| 160-8010                            | KBr Powder, 100 g   |
| 161-0510                            | Fluorolube, 1 oz  |
| 161-0500                            | Nujol, 1 oz   |
| 042-3035                            | Spatula, spoon  |
| 042-3050                            | Spatula, flat   |
| 161-5035                            | Mortar and Pestle, 35 mm                                  |
| 161-1027                            | PIKE Hand Press for KBr pellets                           |
| 161-1010                            | 7-mm Die Set  |
| 161-1018                            | KBr Pellet Holder   |
| 161-6000                            | Finger Cots (12 ea.)                                      |
| 162-1100                            | Demountable Liquid Cell Assembly                          |
| 160-1010                            | KBr Window, 32 x 3 mm (6 ea.)                             |
| 160-1015                            | KBr Window, 32 x 3 mm, drilled (6 ea.)                    |
| 162-1290                            | Teflon Spacers, assortment                                |
| 161-0521                            | Syringe, 2 mL (2 ea.)                                     |
| 162-3610                            | Press-On Demountable Liquid Cell Holder for 32-mm windows |
| 162-5600                            | Universal Sample Holder*                                  |
| 162-5300                            | Magnetic Film Holder for 13-mm pellets and film samples   |
| 162-5400                            | Film Sampling Card, 20-mm clear aperture (10 ea.)*        |

**Notes:** Cell holders marked "\*" fit all standard slide mounts, but due to their height may not allow for a complete sample compartment door closure on some smaller spectrometers. Please consult PIKE Technologies before placing an order.



# Comprehensive Sampling Kit

## AT A GLANCE

- ▶ Complete sampling kit for analysis of solids, liquids and gas samples by transmission
- ▶ Make KBr pellets and mulls for solid samples
- ▶ Run qualitative and quantitative analysis of liquid samples
- ▶ Identify and quantify gas samples
- ▶ Convenient padded carrying and storage case

## Complete gas, liquid and solid sampling tools.

The Comprehensive Transmission Sampling Kit includes a 100-mm pathlength gas cell, in addition to all the sample preparation and mounting tools described in the Standard Transmission Sampling Kit.

The gas cell body is made of glass and features stopcocks, all necessary gaskets, two KBr windows and slide-mounted cell holder. It is designed for gas measurements at ambient temperature and normal atmospheric pressure.

| PART NUMBER                         | DESCRIPTION   |
|-------------------------------------|---|
| 162-2000                            | Comprehensive Transmission Sampling Kit                   |
| <b>Included Parts and Materials</b> |   |
| 160-8010                            | KBr Powder, 100 g   |
| 161-0510                            | Fluorolube®, 1 oz   |
| 161-0500                            | Nujol™, 1 oz  |
| 042-3035                            | Spatula, spoon  |
| 042-3050                            | Spatula, flat   |
| 161-5035                            | Mortar and Pestle, 35 mm                                  |
| 161-1027                            | PIKE Hand Press for KBr pellets                           |
| 161-1010                            | 7-mm Die Set  |
| 161-1018                            | KBr Pellet Holder   |
| 161-6000                            | Finger Cots (12 ea.)                                      |
| 162-5300                            | Magnetic Film Holder for 13-mm pellets and film samples   |
| 162-1100                            | Demountable Liquid Cell Assembly                          |
| 160-1010                            | KBr Window, 32 x 3 mm (6 ea.)                             |
| 160-1015                            | KBr Window, 32 x 3 mm, drilled (6 ea.)                    |
| 162-1290                            | Teflon® Spacers, assortment                               |
| 161-0521                            | Syringe, 2 mL (2 ea.)                                     |
| 162-3610                            | Press-On Demountable Liquid Cell Holder for 32-mm windows |
| 162-5600                            | Universal Sample Holder*                                  |
| 162-2200                            | Gas Cell, 100-mm pathlength, 38-mm diameter               |
| 160-1320                            | KBr Window, 38 x 6 mm (2 ea.)                             |
| 162-5400                            | Film Sampling Card, 20-mm clear aperture (10 ea.)*        |

**Notes:** Cell holders marked "\*" fit all standard slide mounts, but due to their height may not allow for a complete sample compartment door closure on some smaller spectrometers. Please consult PIKE Technologies



# Educational Sampling Kit

## AT A GLANCE

- ▶ Basic sampling kit for transmission FTIR sampling
- ▶ Perform qualitative and quantitative analysis
- ▶ Economical analysis of solids, liquids and gases
- ▶ Convenient padded carrying and storage case

The Educational Sampling Kit contains all necessary tools for the analysis of gas, liquid and solid samples.

This kit is designed as a low-cost alternative for busy teaching laboratories. It includes 100-mm gas cell with straight, septa tubes, a bolt press for making KBr pellets and a 35-mm mortar and pestle.

A complete demountable cell with a set of spacers ranging from 15 microns to 1 mm is provided for measurements of liquid samples. Viscous liquids can be measured directly as a thin film between the KBr windows.

| PART NUMBER                         | DESCRIPTION   |
|-------------------------------------|---|
| 162-3000                            | Educational Transmission Sampling Kit                     |
| <b>Included Parts and Materials</b> |   |
| 160-8010                            | KBr Powder, 100 g   |
| 162-1100                            | Demountable Liquid Cell Assembly                          |
| 161-0510                            | Fluorolube®, 1 oz   |
| 161-0500                            | Nujol™, 1 oz  |
| 160-1010                            | KBr Window, 32 x 3 mm (6 ea.)                             |
| 160-1015                            | KBr Window, 32 x 3 mm, drilled (6 ea.)                    |
| 042-3035                            | Spatula, spoon  |
| 042-3050                            | Spatula, flat   |
| 162-1290                            | Teflon® Spacers, assortment                               |
| 161-0521                            | Syringe, 2 mL (2 ea.)                                     |
| 161-5035                            | Mortar and Pestle, 35 mm                                  |
| 162-3610                            | Press-On Demountable Liquid Cell Holder for 32-mm windows |
| 161-2500                            | Bolt Press for KBr pellets                                |
| 161-2511                            | Wrench Set for bolt press (2 ea.)                         |
| 162-2100                            | Gas Cell, 100-mm pathlength, 25-mm diameter               |
| 160-1133                            | KBr Window, 25 x 4 mm (2 ea.)                             |
| 161-6000                            | Finger Cots (12 ea.)                                      |
| 162-5300                            | Magnetic Film Holder for 13-mm pellets and film samples   |
| 162-5400                            | Film Sampling Card, 20-mm clear aperture (10 ea.)*        |

**Notes:** Cell holders marked "\*" fit all standard slide mounts, but due to their height may not allow for a complete sample compartment door closure on some smaller spectrometers. Please consult PIKE Technologies before placing an order.



# Valu-Line Sampling Kit

## AT A GLANCE

- ▶ Excellent starter kit for routine applications, research or teaching
- ▶ Combination of widely used accessories: HATR, EasiDiff, 30Spec
- ▶ Complete set of auxiliary sample preparation tools for immediate productivity
- ▶ Pre-aligned, fixed-position optical designs offering reproducible, high-quality data

| PART NUMBER   | DESCRIPTION   |
|---|---|
| 050-10XX  | Valu-Line Sampling Kit  |
| <b>Included Accessories</b>   |   |
|   | HATR – combined trough and flat plate ATR, including 45-degree ZnSe crystal trough and flat plate, volatiles cover, powder press and sample clamp               |
|   | EasiDiff – diffuse reflection accessory with two micro and two macro sample cups, EasiPrep sample preparation kit, alignment mirror, mortar and pestle, and KBr |
|   | 30Spec – specular reflection accessory with set of three masks for control of sampling spot size  |
| <b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Add -GE, -KR, -SI or -AM to the part number to substitute the following HATR crystal plates: Germanium, KRS-5, Silicon or AMTIR. |   |

High-performance set of FTIR accessories addressing all solid and liquid sampling needs.

The number of available FTIR accessories can be overwhelming. Sometimes, it is not easy to decide which accessory will do the job. A solution to this problem is PIKE Technologies' Valu-Line Accessory Kit. This kit combines frequently used and practical set of FTIR sampling accessories.

### HATR - MULTIPLE REFLECTION HORIZONTAL ATR

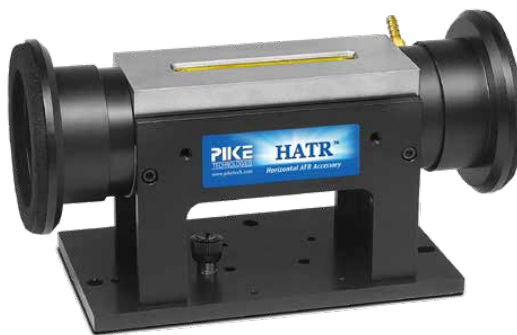
Designed to analyze liquid and semi-liquid samples, pastes, gels, films, soft powders and multiple solid materials. This accessory comes with trough and flat crystal plates to accommodate all types of samples. The HATR is carefully designed to provide excellent results with minimum effort.

### EASIDIFF - DIFFUSE REFLECTION ACCESSORY

An ideal accessory for the analysis of powders and intractable solids. With a set of convenient tools for solid sample preparation, this compact, high-performance accessory provides outstanding collection efficiency.

### 30SPEC - SPECULAR REFLECTION ACCESSORY

A great accessory for the analysis of thin organic films deposited on reflective surfaces and a myriad of surface coatings and surface treatments. The 30Spec comes with a set of three masks which allow for the isolation of small, predetermined spots on larger samples, and the analysis of small samples.



# Ultima Sampling Kit

## AT A GLANCE

- ▶ Analysis kit for liquids, solids, powders, polymers and thin films
- ▶ Complete kit for ATR, diffuse reflection, and specular reflection sampling techniques
- ▶ High-performance accessories eliminate tedious pellet making

High-performance, single reflection ATR and backup accessories to do-it-all.

Single reflection ATR measurements have become quite popular for two main reasons – simplified sample preparation and ease of use relative to traditional FTIR measurements. The single reflection ATR is capable of analyzing a wide variety of samples – including rigid solids and hard powders which are difficult to achieve with a multi-reflection ATR.

Other samples still need to be analyzed by other methods, especially poor absorbers, some powders and films. For this reason, the Ultima kit includes a high-performance ATR, and basic diffuse and specular reflection accessories. This combination of accessories offers a complete range of sampling devices used in FTIR.



| PART NUMBER                 | DESCRIPTION   |
|-----------------------------|---|
| 050-20XX-DI                 | Ultima Sampling Kit with Diamond ATR  |
| 050-20XX                    | Ultima Sampling Kit with ZnSe ATR   |
| <b>Included Accessories</b> |   |
|                             | MIRacle – single reflection ATR with diamond/ ZnSe crystal or ZnSe crystal plate, universal configuration for solid and liquid analysis   |
|                             | EasiDiff – diffuse reflection accessory with sampling tools, two micro and two macro sample cups, EasiPrep sample preparation kit, alignment mirror, mortar and pestle, and KBr |
|                             | 30Spec – specular reflection accessory with set of three masks for control of sampling spot size  |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Add -GE or -SI to part number 050-20XX to substitute Germanium or Silicon MIRacle crystal plates. The MIRacle includes a high pressure clamp.

## MIRACLE – SINGLE REFLECTION ATR

The MIRacle™ ATR is a high-performance FTIR sampling tool for solid, liquid, or polymer samples. This ATR offers a flexible platform to address a wide range of applications. The patented optical design of the accessory offers the highest energy throughput and maximum sensitivity.

## EASIDIFF – DIFFUSE REFLECTION ACCESSORY

The EasiDiff is ideal for the analysis of powders and intractable solids. With a set of convenient tools for solid sample preparation, this compact, high-performance accessory provides outstanding collection efficiency.

## 30SPEC – SPECULAR REFLECTION ACCESSORY

A great accessory for the analysis of thin organic films deposited on reflective surfaces and a myriad of surface coatings and surface treatments. The 30Spec comes with a set of three masks which allow for the isolation of small and large samples.

# Favorites Sampling Kit

## AT A GLANCE

- ▶ High performance kit for liquids, solids, powders, polymers and thin films
- ▶ Complete kit for diamond ATR, diffuse reflection, and specular reflection sampling techniques
- ▶ High-performance accessories eliminate tedious pellet making

The Favorites Sampling Kit combine the most popular IR accessories across three sampling techniques: ATR, diffuse reflection and specular reflection.

The IRIS ATR is the cornerstone accessory of this kit. With its monolithic diamond ATR element, this accessory will provide robustness and allow you to measure many types of samples including solids, liquids, and films. Given the short pathlength of a single reflection ATR, however, there will be samples that may benefit from the sensitivity of diffuse and specular reflection measurements especially poor absorbers, some powders and films.



| PART NUMBER   | DESCRIPTION   |
|---|---|
| 050-21XX  | Favorites Sampling Kit  |
| <b>Included Accessories</b>   |   |
|   | IRIS – single reflection diamond ATR  |
|   | EasiDiff – diffuse reflection accessory with sampling tools, two micro and two macro sample cups, EasiPrep sample preparation kit, alignment mirror, mortar and pestle, and KBr |
|   | 30Spec – specular reflection accessory with set of three masks for control of sampling spot size  |
| <b>Note:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. |   |

### IRIS – SINGLE REFLECTION DIAMOND ATR

The IRIS ATR is a high-performance FTIR sampling. The hardness diamond allows for the most rigid samples without damage. The diamond's pH tolerance of 1-14 and its unique PTFE seal between the diamond and the plate housing provides a platform to analyze strong organic solvents and acid to basic samples.

### EASIDIFF - DIFFUSE REFLECTION ACCESSORY

The EasiDiff is ideal for the analysis of powders and intractable solids. With a set of convenient tools for solid sample preparation, this compact, high-performance accessory provides outstanding collection efficiency.

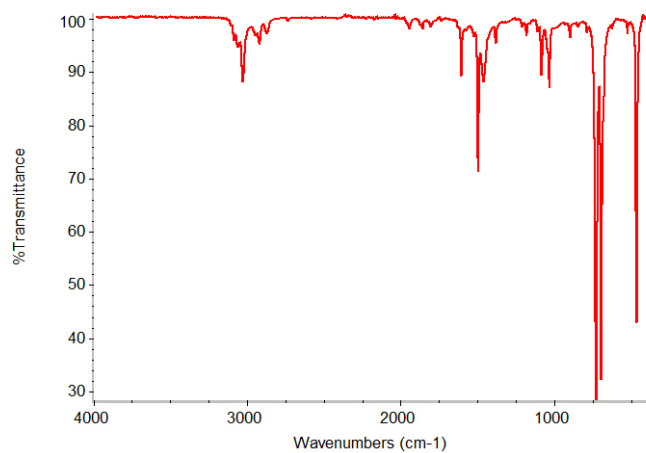
### 30SPEC - SPECULAR REFLECTION ACCESSORY

A great accessory for the analysis of thin organic films deposited on reflective surfaces and a myriad of surface coatings and surface treatments. The 30Spec comes with set of three masks which allow for the isolation of small d large samples.

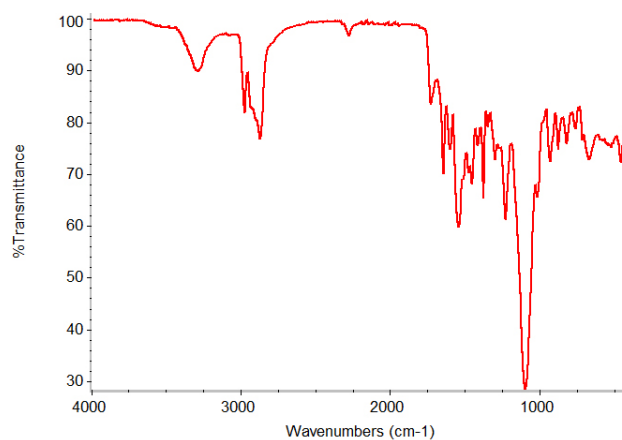


## THE IRIS DIAMOND ATR

IRIS is a robust and reliable diamond ATR for IR analysis of most all samples in the lab. Whether it is a rigid polymer, strong organic solvent, powder and more, IRIS has it covered.



Toluene spectrum, showing absorbance bands across the full spectral range to  $400\text{ cm}^{-1}$ .

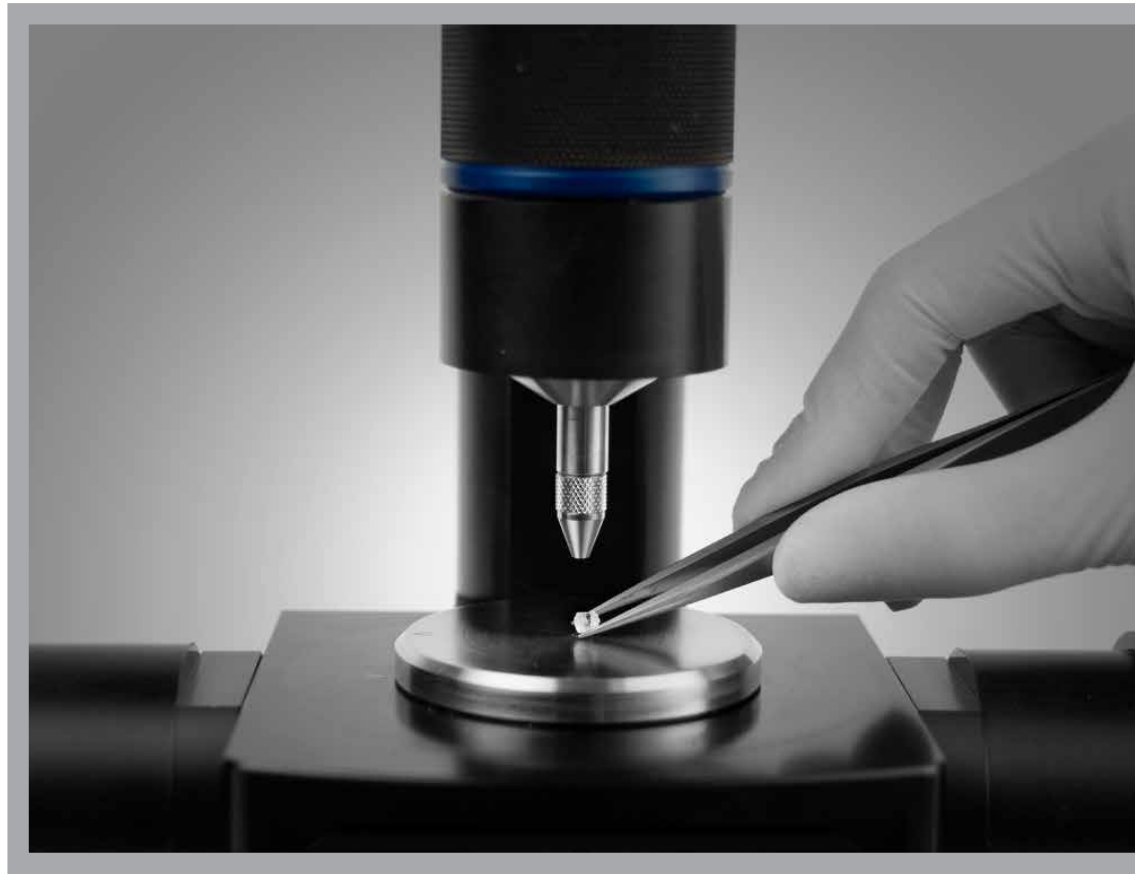


Polyurethane spectrum, showing unreacted isocyanate monomer at  $2280\text{ cm}^{-1}$ . Usable spectral results can be obtained across this diamond phonon band region.





# Attenuated Total Reflection (ATR)



ATR products successfully replace constant-path transmission cells and salt plates used for analysis of liquid and semi-liquid materials. Horizontal ATR accessories are used to analyze films, pastes, solids and fine powders. Thanks to the reproducible effective pathlength, ATR is well suited for both qualitative and quantitative applications. Several temperature control options are available.

# IRIS

## AT A GLANCE

- ▶ High-performance monolithic diamond ATR
- ▶ Full spectral range for mid- and far-IR measurements
- ▶ Precision optics and design for high energy throughput
- ▶ Optional Ge ATR crystal for high refractive index samples
- ▶ Additional sampling tools — Flow-Through Attachment and Liquids Retainer



Generate high-quality spectra with the IRIS Diamond ATR. Measure a wide range of sample types, including powders, gels, liquids and solids. Ideal for research, QA/QC and sample identification.

## PERFORMANCE AND DESIGN

### ADVANTAGES OF DIAMOND

The mechanical properties and chemical compatibility of diamond make it an ideal ATR element for nearly all samples. With the diamond's Knoop hardness, 5-10 times greater than other common ATR elements, the IRIS diamond ATR may be used to measure extremely hard samples without concern of damage to the accessory.

The pH tolerance of diamond spans 1-14, adding to this ATR element's versatility to handle samples ranging from strong bases to strong acids, and everything in between. A unique feature of the IRIS, is the PTFE seal between the diamond and the ATR stainless steel plate housing. Unlike many commercial accessories where the ATR crystal is sealed with epoxy, the PTFE seal of the IRIS will stand up to long-term exposure to organic and caustic samples.

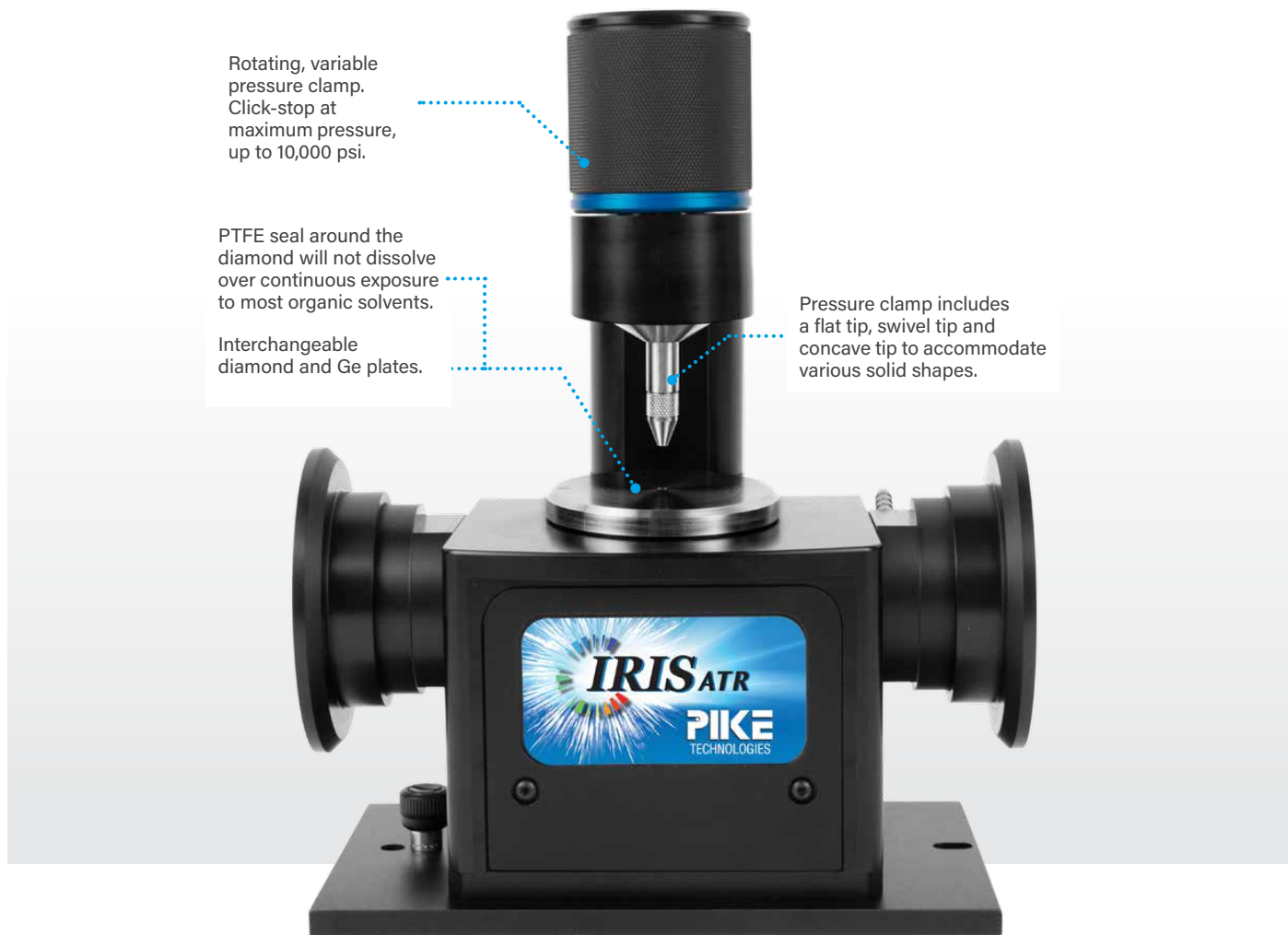
Two monolithic diamond plate models are offered for IRIS. The standard performance diamond plate has a range from 4000–400  $\text{cm}^{-1}$ , and for those wishing to make measurements into the far-IR, an extended-range diamond plate with a cutoff of 30  $\text{cm}^{-1}$  is available. For measurements solidly in the mid-IR range, the standard performance plate is most popular and is recommended.

### BENEFITS OF GERMANIUM

To provide users with the added flexibility, IRIS may be configured with a Ge ATR plate for measuring samples with a high refractive index such as carbon black-filled samples and inorganic materials (e.g. oxides, aluminas, titania and minerals). The Ge element offers an expanded transmission range, 4000–450  $\text{cm}^{-1}$ . Swapping the ATR plates is easy, and efficient.

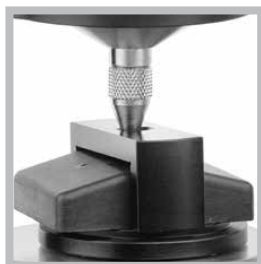
### PRECISION OPTICS - OPTIMAL PERFORMANCE

By using the precision diamond-turned mirrors in its efficient optical design, IRIS is a high energy throughput ATR accessory. This allows for quick measurements to be made, generally less than one minute to complete. Adding to the accessories robustness and reliability is the mechanical construction of the ATR crystal plate, which uses a strong metal brace underneath the ATR element to prevent microscopic movements of the ATR crystal. These features in combination with a small monolithic diamond (1.8 mm diameter) produces high quality spectra across the full mid-IR region including the diamond phonon bands region, inherent to all diamonds.



## IRIS SAMPLING TOOLS

The Liquids Retainer with Volatiles Cover (left) offers a trough configuration while reducing the amount of evaporation when taking IR measurements of highly volatile liquid samples. The Flow-Through Attachment (right) allows for handling samples that pose a hazard, and are degraded from ambient exposure.



### DIGITAL FORCE ADAPTER

The high-pressure clamp may be mated with the Digital Force Adapter, which is ideal for applications that require controlled and reproducible pressure. The magnitude of applied force is displayed on an external easy-to-read LCD readout.

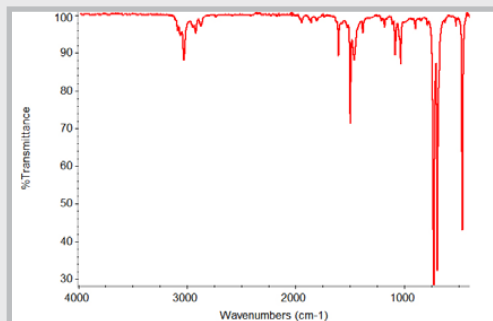


### SPECIFICATIONS

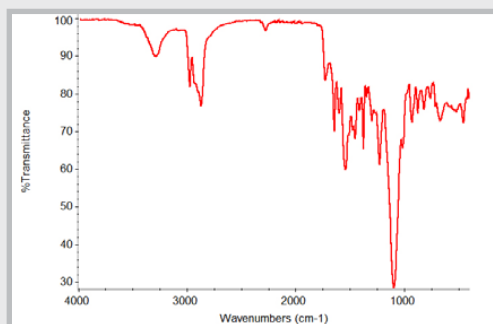
|   |  |
|---|--|
| <b>ATR Crystal Choices</b>                | Monolithic diamond or Ge   |
| <b>Spectral Range, Diamond</b>            | 4000 to 400 $\text{cm}^{-1}$   |
| <b>Spectral Range, Diamond Ext. Range</b> | 4000 to 30 $\text{cm}^{-1}$  |
| <b>Spectral Range, Ge</b>                 | 4000 to 450 $\text{cm}^{-1}$   |
| <b>Crystal Plate Mounting</b>             | User-changeable plates   |
| <b>Crystal Plate Housing</b>              | Stainless steel  |
| <b>Angle Of Incidence</b>                 | 45 degrees, nominal  |
| <b>Diamond Surface Diameter</b>           | 1.8 mm   |
| <b>Digital Force Adapter (option)</b>     | Load cell sensor for precise and reproducible pressure control. Attaches directly to High-Pressure IRIS clamps. Digital readout. |
| <b>Press Clamp</b>                        | Rotating, continuous variable pressure; click-stop at maximum pressure.  |
| <b>Maximum Pressure</b>                   | 10,000 psi   |
| <b>Sample Access</b>                      | 47 mm, ATR crystal to pressure mount   |
| <b>Accessory Dimensions (W X D X H)</b>   | 102 x 97 x 91 mm (excludes FTIR baseplate and mount)   |
| <b>FTIR Compatibility</b>                 | Most, specify model and type   |

## IRIS APPLICATION

The IRIS is a robust and reliable diamond ATR that allows for IR analysis of most all samples in the lab. Whether it is a rigid polymer, strong organic solvent, powder and more—IRIS has it covered.



**Toluene spectrum**, showing absorbance bands across the full spectral range to 400  $\text{cm}^{-1}$ .



**Polyurethane spectrum**, showing unreacted isocyanate monomer at 2280  $\text{cm}^{-1}$ . Usable spectral results can be obtained across this diamond phonon band region.

| PART NUMBER   | DESCRIPTION  |
|---|--|
| <b>Base Optics (required)</b>   |  |
| 027-18XX  | IRIS<br><b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Base includes purge tubes, purge kit, and selected spectrometer base mount.   |
| <b>Crystal Plates (must select 1 or more)</b>                               |  |
| 027-2100  | Diamond Crystal Plate  |
| 027-2110  | Diamond Crystal Plate, Extended Range  |
| 027-2120  | Ge Crystal Plate<br><b>Notes:</b> Crystal plates are pre-aligned. Plate housing is stainless steel. Contact PIKE for Hastelloy options.  |
| <b>Clamp and Clamp Accessories (required for solid or powdered samples)</b> |  |
| 027-3025  | High-Pressure Clamp  |
| 027-3027  | High-Pressure Confined Space Clamp   |
| 076-6029  | Digital Force Adapter  |
| 025-3095  | Flat Tip for High-Pressure Clamp   |
| 025-3093  | Swivel Tip for High-Pressure Clamp   |
| 025-3092  | Concave Tip for High-Pressure Clamp  |
| 025-3099  | Tip Assortment for High-Pressure Clamp<br><b>Notes:</b> The High-Pressure Clamp is required for analysis of solids, powders and use of Liquids Retainer, Flow-Through Attachment or the Digital Force Adapter. Pressure clamp includes a flat tip, a swivel tip and a concave tip. |
| <b>Optional Sampling Tools</b>  |  |
| 026-5013  | Liquids Retainer and Volatiles Cover Set   |
| 026-5010  | Liquids Retainer   |
| 026-5012  | Flow-Through Attachment, 100 $\mu\text{L}$<br><b>Notes:</b> Flow-Through Attachment and Liquids Retainer require High-Pressure Clamp.  |



# MIRacle

## AT A GLANCE

- ▶ Highest IR throughput ATR
- ▶ Complete flexibility
- ▶ Fully configurable
- ▶ Pinned-in-place, changeable crystal plates
- ▶ Optional specular reflection plate
- ▶ Temperature control, flow-through attachment and sealed clamp

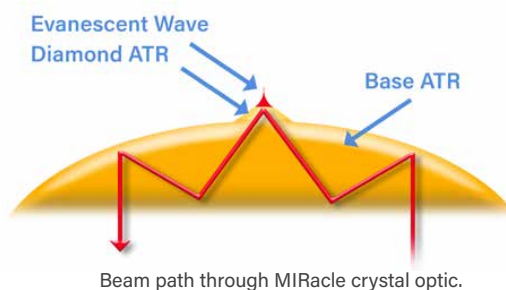


TEMPERATURE CONTROL  
OPTIONS AVAILABLE

The MIRacle™ ATR is a high-performance FTIR sampling tool for solid, liquid, or polymer samples. With options for interchangeable single, 3- or 9-reflection crystal plates, and for heating or cooling, the MIRacle offers a flexible platform to address a wide range of FTIR sampling applications.

## MIRACLE OPTICAL DESIGN

In the patented MIRacle optical design, the ATR crystal focuses the IR beam and also provides the ATR sampling interface. This technology delivers the greatest energy throughput for a commercially-available, small area ATR, that saves considerable data collection time and produces high quality spectra.

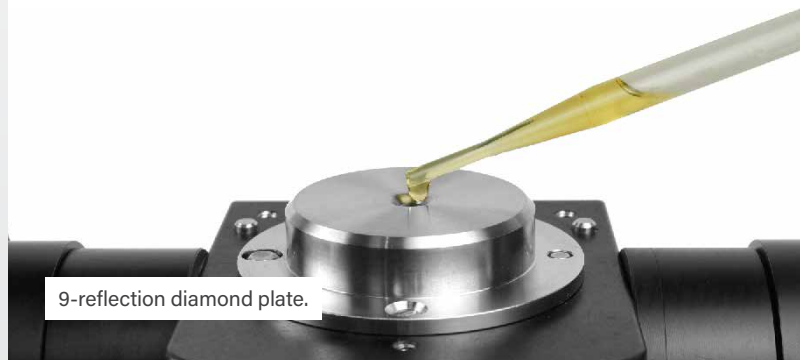


## ATR PLATES

The MIRacle is one of our most configurable ATR accessories. The crystal plates are pinned in place and easily changeable within seconds with no alignment required. With this flexibility, you can change the crystal type to precisely match your sampling requirements.

The single reflection diamond/ZnSe is the most popular MIRacle ATR plate, and is an ideal universal ATR element that can accommodate samples across the pH spectrum and extremely hard samples. Table 1 summarizes the various MIRacle ATR crystal characteristics and typical applications for each.

For applications requiring enhanced spectral sensitivity for measuring minor components, the MIRacle may be configured with multiple reflection ATR plates. The 3-reflection diamond/ZnSe crystal plates are available in flat and trough style, and 9-reflection diamond/ZnSe is offered in trough style only.



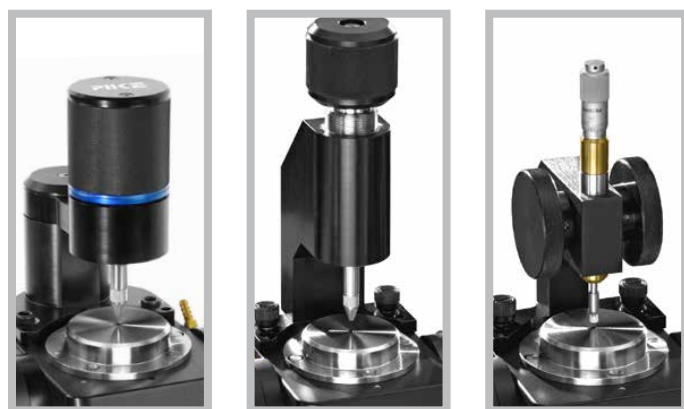
9-reflection diamond plate.

**TABLE 1: MIRACLE CRYSTAL PLATE SPECIFICATIONS**

| MIRacle Crystal Plate  | Application                                 | Hardness (kg/mm <sup>2</sup> ) | Cutoff Spectral Range (cm <sup>-1</sup> ) | Refractive Index @ 1000 cm <sup>-1</sup> | Depth of Penetration @ 45° (μ) | pH Range of Sample |
|--|---|--------------------------------|---|--|--------------------------------|--------------------|
| Diamond/ZnSe   | Ideal for hard samples, acids or alkaline   | 5700                           | 525                                       | 2.4                                      | 2.0                            | 1-14               |
| Diamond/KRS-5  | When you need full mid-IR spectral range    | 5700                           | 250                                       | 2.4                                      | 2.0                            | 1-14               |
| Ge   | General purpose and carbon filled or rubber | 550                            | 575                                       | 4.0                                      | 0.66                           | 1-14               |
| Si   | Excellent for far-IR spectral measurement   | 1150                           | 8900-1500, 475-40                         | 3.4                                      | 0.85                           | 1-12               |
| ZnSe   | General purpose ATR crystal                 | 120                            | 520                                       | 2.4                                      | 2.0                            | 5-9                |
| Note: crystal plates are covered by PIKE Technologies' patent numbers 5,965,889 and 6,128,075 or are manufactured under license of 5,200,609, 5,552,604 and 5,703,366. |   |                                |   |  |                                |                    |

**PRESS CLAMP OPTIONS**

Recommended for most applications, the high-pressure clamps are calibrated to deliver over 10,000 psi of pressure when used with the single reflection crystal plates, and have a slip-clutch mechanism to prevent excessive pressure from being applied to the crystal. All clamps include three tips to accommodate hard, soft and pellet-shaped samples.



High-Pressure Clamp for routine sampling.

Confined Space Clamp for limited area in sample compartment.

Micrometer Clamp for low pressure.

| MIRacle Clamp Pressure    | Max Force (lbf) | Crystal Diameter (mm) | Pressure (psi) |
|---------------------------|-----------------|-----------------------|----------------|
| High-Pressure Clamps      | 40              | 1.8                   | 10,141         |
|                           |                 | 6.0                   | 913            |
| Micrometer Pressure Clamp | 8               | 1.8                   | 2,028          |
|                           |                 | 6.0                   | 183            |

**DIGITAL FORCE ADAPTER**

The high-pressure clamp may be mated with the Digital Force Adapter (DFA), which attaches directly to the clamping assembly. The DFA's embedded load cell exhibits high linearity, reproducibility, and exceptional accuracy. The magnitude of applied force is displayed on an external easy-to-read LCD readout.



**SEALED CLAMP**

The Sealed Sample Chamber for the MIRacle Single Reflection ATR accessory attaches to dedicated single reflection diamond, ZnSe or Ge crystal ATR plates allowing the complete assembly to be moved from the spectrometer to a protective environment for sample handling. Once the sample has been loaded onto the ATR crystal, the sealed clamp may be engaged, shielding the sample from the external environment. Typical applications include studies of toxic or chemically aggressive solids and powders.

The chamber is made of stainless steel and is sealed against the crystal plate with a chemically resistant O-ring. The chamber contains an internal, spring-loaded anvil that compresses the sample against the ATR crystal at a preset, clutch-controlled setting.




Sealed Sample Chamber.

## TEMPERATURE CONTROL

The MIRacle can be configured with temperature-controlled ATR plates. For resistively heated plates, the temperature controller has a touch-screen panel, and is ready to use with PIKE TempPRO software. This program offers a graphical user interface for easy profile set up, and initiates data collection as a function of time and temperature when used with most commercial spectrometers. The liquid jacketed plates require user-provided liquid circulator.

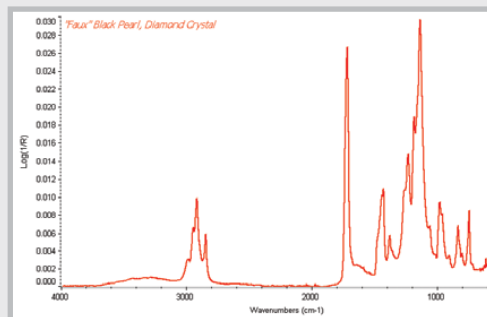


### SPECIFICATIONS

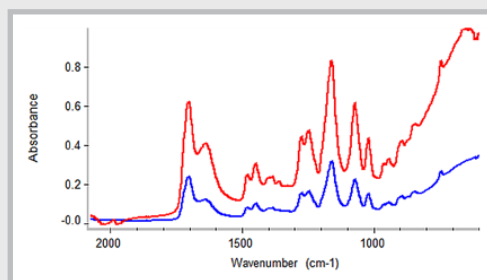
|   |   |
|---|---|
| <b>ATR Crystal Choices</b>              | Diamond/ZnSe, Diamond/KRS-5, Ge, ZnSe, Si   |
| <b>Crystal Plate Mounting</b>           | User-changeable plates  |
| <b>Crystal Plate Housing</b>            | Stainless steel or Hastelloy  |
| <b>Angle Of Incidence</b>               | 45 degrees, nominal   |
| <b>Crystal Dimensions (surface)</b>     | 1.8 mm single reflection<br>6.0 mm 3- and 9-reflection  |
| <b>Pressure Device</b>                  | Rotating, continuously variable pressure; click-stop at maximum (high-pressure clamp)   |
| <b>Digital Force Adapter (option)</b>   | Load cell sensor for precise and reproducible pressure control. Attaches directly to high-pressure MIRacle clamps. Digital readout. Not for use with heated plates. |
| <b>Maximum Pressure</b>                 | 10,000 psi  |
| <b>Sample Access</b>                    | 55 mm, ATR crystal to pressure mount  |
| <b>Heating Options</b>                  | Ambient to 60 or 130 °C maximum   |
| <b>Accuracy</b>                         | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C   |
| <b>Sensor Type</b>                      | 3 wire Pt RTD (low drift, high stability)   |
| <b>Temperature Control</b>              | Touch-panel display with USB interface. PIKE TempPRO software for PC control with unlimited ramps and automated data collection.                                    |
|   |    |
| <b>Input</b>                            | 100-240 VAC, auto setting, external power supply  |
| <b>Output</b>                           | 1.3A/24 VDC 30 W maximum  |
| <b>Specular Reflection Option</b>       | Optional, 45 degree nominal angle of incidence  |
| <b>Purge Sealing</b>                    | Purge tubes and purge line connector included   |
| <b>Accessory Dimensions (W X D X H)</b> | 104 x 103 x 210 mm (excludes FTIR baseplate and mount)  |
| <b>FTIR Compatibility</b>               | Most, specify model and type  |

## MIRACLE APPLICATION

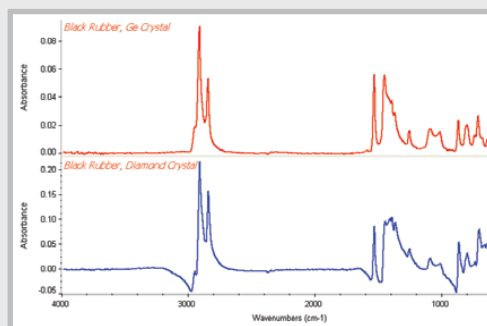
The MIRacle ATR is a universal sampling accessory. With its wide range of plates available, including single and multiple reflection, this accessory can accommodate most all samples.



**Faux black pearl spectrum**, collected using MIRacle diamond ATR crystal. Diamond is the most robust of all ATR elements, and is ideal for hard samples.



**Hydrogel spectrum**, collected using the 3-reflection diamond/ZnSe crystal (red) and single reflection diamond/ZnSe (blue). Multiple reflection ATR crystals increase sensitivity for liquid and pliable solids.



**Black rubber spectrum**, collected using a single reflection Ge crystal (red) and a single reflection diamond crystal (blue).

The spectrum run on the Ge crystal plate exhibits a normal baseline and symmetric absorbance bands, while the spectrum run on the diamond crystal plate has a baseline shifted and asymmetric absorbance bands.

For high refractive index samples such as carbon-filled rubber and some inorganic samples, Ge crystal is best.



| PART NUMBER  | DESCRIPTION   |
|--|---|
| <b>Base Optics (required)</b>                                    |   |
| 025-18XX   | MIRacle<br><b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Base includes purge tubes, purge kit, and selected spectrometer base mount.   |
| <b>Crystal Plates (must select 1 or more)</b>                    |   |
| 025-2108   | Diamond/ZnSe Performance Crystal Plate  |
| 025-2107   | Diamond/ZnSe HS Performance Crystal Plate   |
| 025-2028   | Diamond/KRS-5 Performance Crystal Plate   |
| 025-2027   | Diamond/KRS-5 HS Performance Crystal Plate  |
| 025-2018   | ZnSe Performance Crystal Plate  |
| 025-2058   | Ge Performance Crystal Plate  |
| 025-2098   | Si Performance Crystal Plate  |
| 025-2118   | 3-Reflection Diamond/ZnSe Performance Crystal Plate   |
| 025-2120   | 3-Reflection Diamond/ZnSe Performance Crystal Plate, Trough   |
| 025-2038   | 3-Reflection ZnSe Performance Crystal Plate   |
| 025-2218   | 9-Reflection Diamond/ZnSe Performance Crystal Plate, Trough   |
| 025-2208   | Specular Reflection Performance Plate<br><b>Notes:</b> Crystal plates are pre-aligned. Plate housing is stainless steel. Contact PIKE for more Hastelloy (HS) options.  |
| <b>Pressure Clamps (required for solid and powdered samples)</b> |   |
| 025-3025   | Performance High-Pressure Clamp   |
| 076-6025   | Digital Force Adapter for High-Pressure Clamp   |
| 025-3029   | Performance Micrometric, Low-Pressure Clamp   |
| 025-3027   | Performance High-Pressure Confined Space Clamp  |
| 076-6028   | Digital Force Adapter for High-Pressure Confined Space Clamp<br><b>Notes:</b> The High-Pressure Clamp is recommended for general applications. Pressure clamps include a flat tip, a swivel tip and a concave tip. The Digital Force Adapter requires High-Pressure Clamp, P/N 025-3025 or 025-3027 (sold separately), and may not be used at temperatures above ambient. |

| PART NUMBER   | DESCRIPTION  |
|---|--|
| <b>Sampling Options</b>   |  |
| 025-4018  | Heated ZnSe Performance Crystal Plate  |
| 025-4058  | Heated Ge Performance Crystal Plate  |
| 025-4108  | Heated Diamond/ZnSe Performance Crystal Plate (60 °C max.)   |
| 025-2104  | Liquid Jacketed Diamond/ZnSe Performance Crystal Plate (60 °C max.)  |
| 025-2014  | Liquid Jacketed ZnSe Performance Crystal Plate   |
| 025-2054  | Liquid Jacketed Ge Performance Crystal Plate   |
| 025-2094  | Liquid Jacketed Si Performance Crystal Plate   |
| 026-5014  | Flow-Through Attachment, 100 µL  |
| 026-5013  | Liquids Retainer and Volatiles Cover Set   |
| 076-1610  | Digital Temperature Control Module   |
| 007-0207  | PIKE TempPRO Software<br><b>Note:</b> For heated diamond/ZnSe crystal plate, the maximum crystal temperature is 60 °C . The maximum temperature for ZnSe heated plate is 130 °C . Germanium become optically opaque at 90 °C. Temperature controller is required for heated crystal plates. If PC control is desired, TempPRO software must be purchased (sold separately). Liquid jacketed crystal plates require customer-provided circulator. |
| <b>Sealed High-Pressure Clamp (must select the sealed clamp and at least one crystal ATR plate)</b> |  |
| 025-6020  | Sealed High-Pressure Clamp   |
| 025-6108  | Diamond/ZnSe Sealed Clamp Performance Plate  |
| 025-6018  | ZnSe Sealed Clamp Performance Plate  |
| 025-6058  | Ge Sealed Clamp Performance Plate  |
| <b>Replacement Parts</b>  |  |
| 025-3099  | Tip Assortment for High-Pressure Clamp   |
| 025-3095  | Flat Tip for High-Pressure Clamp   |
| 025-3093  | Swivel Tip for High-Pressure Clamp   |
| 025-3092  | Concave Tip for High-Pressure Clamp  |
| 025-3053  | MIRacle Micrometer Clamp Tip Assortment  |
| 025-3052  | Flat Tip for Micrometric Clamp   |
| 025-3061  | Swivel Tip for Micrometric Clamp   |
| 025-3054  | Concave Tip for Micrometric Clamp  |
| 025-3094  | 7.8 mm ATR Pressure Tip for High-Pressure Clamp  |
| 025-3096  | 7.8 mm ATR Pressure Tip for Micrometer Clamp<br><b>Notes:</b> Please contact us for items not described in this list. Reconditioning service for used MIRacle crystal plates is available.   |

# GladiATR

## AT A GLANCE

- ▶ Diamond crystal design
- ▶ High energy throughput design
- ▶ Full spectral range for analysis in the mid-IR and far-IR regions
- ▶ Temperature control options, sub-ambient up to 300 °C
- ▶ Optional Ge crystal plate



TEMPERATURE CONTROL  
OPTIONS AVAILABLE

The GladiATR is a durable diamond ATR which is widely used in research and general testing laboratories. Its rugged design makes it ideal for use in environments where large numbers of samples are measured, while its configurability offers the flexibility to accommodate a variety of samples.

### DIAMOND ATR ELEMENT

The GladiATR diamond crystal is a monolithic design which will not scratch or fracture even at extreme pressures. This design permits analysis of hard, intractable objects such as coated metal wires, polymer pellets and geological samples without damage to the ATR crystal. The diamond crystal is brazed into the stainless steel or Hastelloy plate, which makes the GladiATR compatible with pressure up to 30,000 psi.

### HIGH ENERGY THROUGHPUT

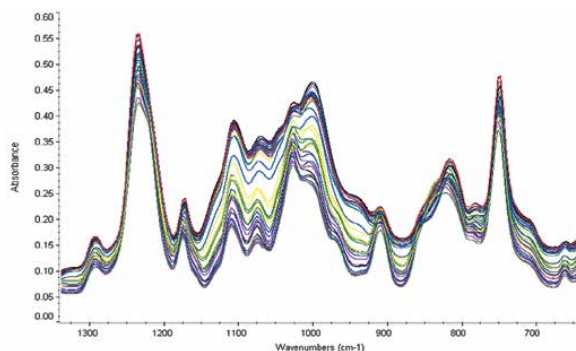
The energy throughput of the GladiATR is exceptional. This significantly improves spectral quality and reduces sampling time. This high-performance ATR is designed and manufactured using all reflecting optics providing full spectral range in the mid-IR and far-IR spectral regions.

### GE CRYSTAL PLATE

An optional Ge crystal plate is available for analysis of high refractive index samples, and offers an extended spectral range from 5000–450  $\text{cm}^{-1}$ . Crystal plates are easily changeable.


### TEMPERATURE CONTROL

Temperature-controlled crystal plates are available for thermal studies. The resistively heated diamond plate has a range from ambient to 300 °C. The temperature controller has a touch-screen panel and is ready to use with PIKE TempPRO software. This program offers a graphical user interface for easy profile set up, and initiates data collection as a function of time and temperature when used with most commercial spectrometers. For sub-ambient studies, liquid jacketed plates are an option, which requires user-provided liquid circulator. The liquid jacketed/heated GladiATR diamond plate blends the benefits of both resistive heating and liquid jacketing.



ATR/FTIR spectra from cure of thermoset epoxy using the heated diamond crystal plate on the GladiATR.

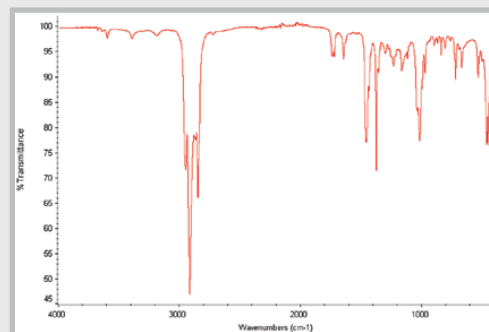
## SPECIFICATION

|  |  |
|--|--|
| <b>ATR Crystal Choices</b>                 | Diamond, Ge  |
| <b>Crystal Plate Mounting</b>              | User changeable plates   |
| <b>Crystal Type</b>                        | Monolithic   |
| <b>Diamond Mounting</b>                    | Brazed   |
| <b>Crystal Plate Housing</b>               | Stainless steel  |
| <b>Angle Of Incidence</b>                  | 45 degrees, nominal  |
| <b>Crystal Dimensions</b><br>(surface)     | 3.0 mm diameter  |
| <b>Optics</b>                              | All reflective   |
| <b>Pressure Device</b>                     | Rotating, continuously variable pressure; click stop at maximum  |
| <b>Digital Force Adapter</b><br>(option)   | Load cell sensor for precise and reproducible pressure control. Attaches directly to GladiATR clamp. Digital readout. For ambient temperature measurements only. |
| <b>Maximum Pressure</b>                    | 30,000 psi   |
| <b>Sample Access</b>                       | 80 mm, ATR crystal to pressure mount   |
| <b>Spectral Range, Diamond</b>             | 4000 to 30 $\text{cm}^{-1}$ (IR optics dependent)  |
| <b>Spectral Range, Ge</b>                  | 4000 to 450 $\text{cm}^{-1}$   |
| <b>Heating Options</b>                     | Diamond, 300 °C maximum<br>Ge, 130 °C maximum  |
| <b>Accuracy</b>                            | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C  |
| <b>Sensor Type</b>                         | 3 wire Pt RTD (low drift, high stability)  |
| <b>Temperature Control</b>                 | Touch-panel display with USB interface. PIKE TempPRO software for PC control with unlimited ramps and automated data collection.                                 |
|  |   |
| <b>Input</b>                               | 100–240 VAC, auto setting, external power supply   |
| <b>Output</b>                              | 4A/24 VDC, 100 W maximum. 6A/24 VDC, 150 W max. (300 °C version)   |
| <b>Cooling Options</b>                     | Liquid jacketed crystal plates available   |
| <b>Specular Reflection Option</b>          | Optional, 45 degree nominal angle of incidence   |
| <b>Purge Sealing</b>                       | Purge tubes and purge line connector included  |
| <b>Accessory Dimensions</b><br>(W X D X H) | 140 x 205 x 340 mm<br>(excludes FTIR baseplate and mount)  |
| <b>FTIR Compatibility</b>                  | Most, specify model and type   |

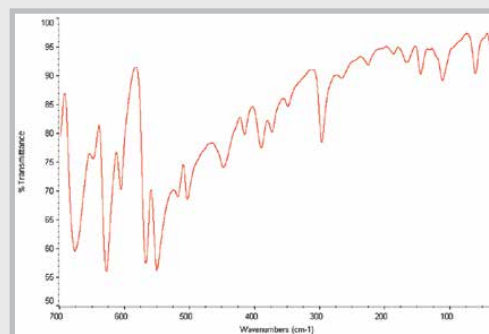


## APPLICATION

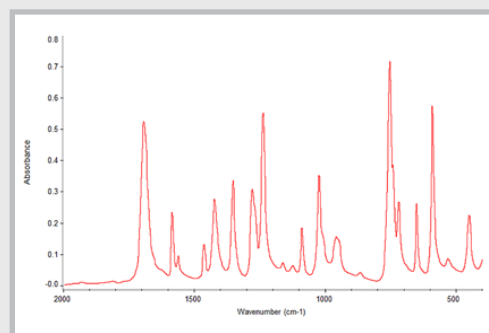
The GladiATR is a robust ATR accessory that may be configured with a full spectral range diamond or an extended-range Ge crystal. Measurements may also be made at sub-ambient temperatures using the liquid jacketed plates and up to 300 °C using the resistively heated diamond plate.



**Polymer pellet spectrum** collected using GladiATR with diamond crystal. Spectral range in the mid-IR is 4000–400  $\text{cm}^{-1}$ .



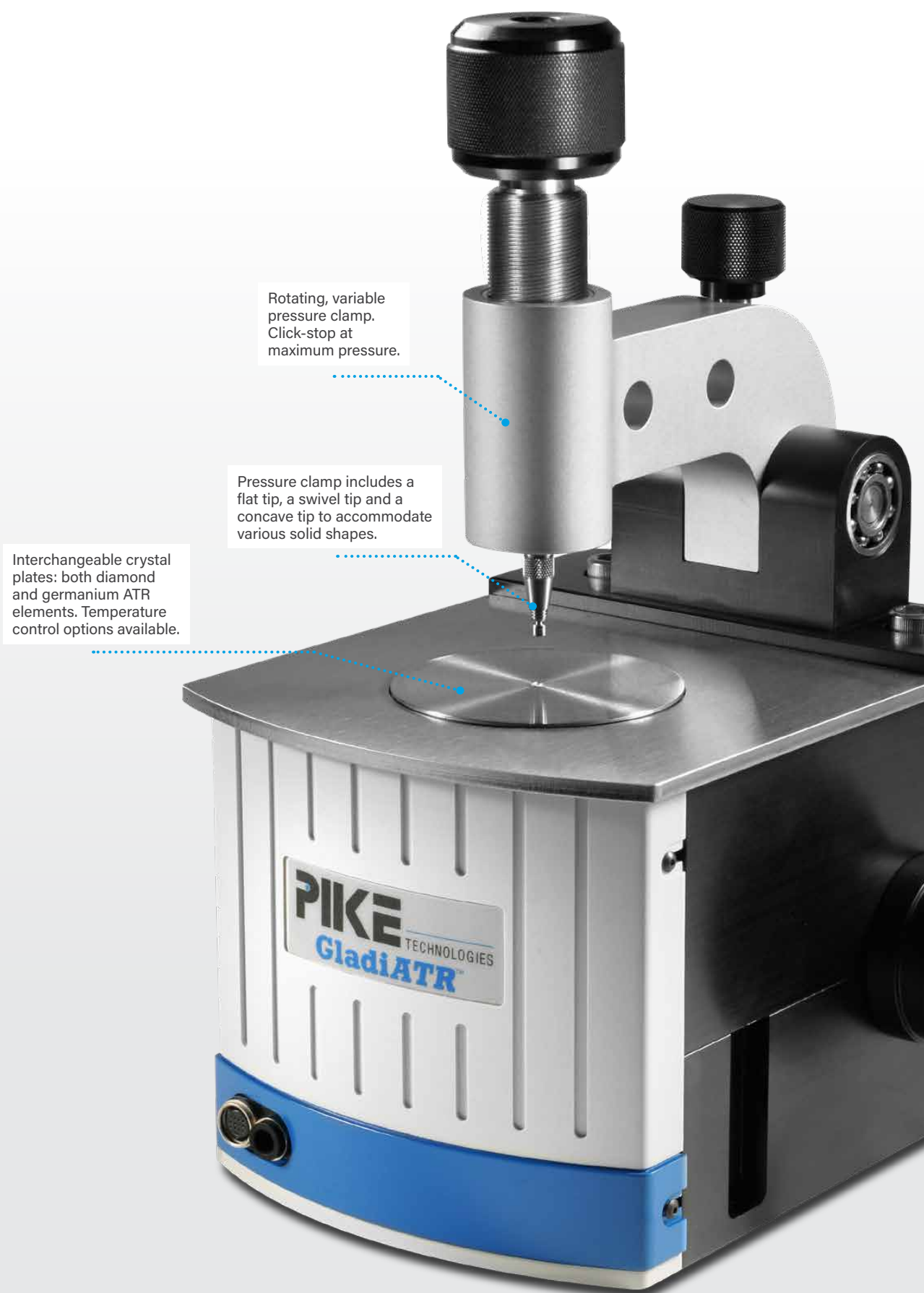
**Sulfathiazole spectrum** collected using GladiATR with diamond crystal plate and far-IR optics in an FTIR instrument.



**Bromoacetophenone spectrum** collected using GladiATR with extended range Ge crystal plate.

| PART NUMBER   | DESCRIPTION  |
|---|--|
| <b>Base Optics (<i>must select</i>)</b>   |  |
| 026-18XX  | GladiATR with heating capability up to 300 °C<br><br><b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. All GladiATRs include purge tubes, purge kit, and selected spectrometer base mount. Crystal plates must be selected from the table below. High-Pressure Clamp, Digital Force Adapter and Liquids Retainer/Volatiles Cover are optional and need to be ordered separately, if required. |
| <b>GladiATR Stainless Top (<i>must select one</i>)</b>  |  |
| 026-2001  | GladiATR Standard Stainless Top<br><br><b>Note:</b> Stainless top is not required for temperature controlled plates.   |
| <b>Crystal Plates for GladiATR (<i>must select one or more</i>)</b>                               |  |
| 026-2100  | Diamond Crystal Plate  |
| 026-2050  | Ge Crystal Plate   |
| 026-2200  | Specular Reflection Plate<br><br><b>Notes:</b> GladiATR crystal plates are pre-aligned and pinned-in-place. Changing crystal plates is easy and fast to optimize sampling results. Plate housing is stainless steel; contact us for Hastelloy options. Reconditioning service is available.  |
| <b>Pressure Clamp for GladiATR, All Models (<i>must select for solid or powdered samples</i>)</b> |  |
| 026-3020  | High-Pressure Clamp  |
| 076-6026  | Digital Force Adapter for High-Pressure Clamp<br><br><b>Notes:</b> The High-Pressure Clamp is required for analysis of solids, powders and use of Liquids Retainer, Flow-Through Attachment and/or Digital Force Adapter (Digital Force Adapter may be used when measuring samples at ambient temperature only). Pressure clamp includes a flat tip, a swivel tip and a concave tip.   |

| PART NUMBER   | DESCRIPTION  |
|---|--|
| <b>GladiATR Temperature Controlled Crystal Plates</b> |  |
| 026-4102  | Heated Diamond Crystal Plate, 300 °C   |
| 026-4119  | Liquid Jacketed/Heated Diamond Crystal Plate   |
| 026-4115  | Liquid Jacketed Diamond Crystal Plate  |
| 026-4121  | Heated Ge Crystal Plate, 130 °C  |
| 026-4131  | Liquid Jacketed Ge Crystal Plate, 130 °C   |
| 076-1610  | Digital Temperature Control Module   |
| 007-0207  | PIKE TempPRO Software<br><br><b>Notes:</b> Ge becomes optically opaque at 150 °C; maximum operating temperature for this crystal is 130 °C. Temperature controller is required for heated crystal plates. If PC control is desired, TempPRO software must be purchased (sold separately). Liquid jacketed crystal plates require customer-provided circulator. |
| <b>GladiATR Sampling Options</b>                      |  |
| 025-3099  | Tip Assortment for High-Pressure Clamp   |
| 025-3095  | Flat Tip for High-Pressure Clamp   |
| 025-3093  | Swivel Tip for High-Pressure Clamp   |
| 025-3092  | Concave Tip for High-Pressure Clamp  |
| 026-5014  | Flow-Through Attachment, 300 °C, 100 µL  |
| 026-5013  | Liquids Retainer and Volatiles Cover Set   |
| 026-5015  | Liquids Retainer and Volatiles Cover Set, 300 °C<br><br><b>Note:</b> Flow-Through Attachment and Liquids Retainer are compatible with all crystal plate offerings (require High-Pressure Clamp).   |



Rotating, variable pressure clamp. Click-stop at maximum pressure.

Pressure clamp includes a flat tip, a swivel tip and a concave tip to accommodate various solid shapes.

Interchangeable crystal plates: both diamond and germanium ATR elements. Temperature control options available.

**PIKE** TECHNOLOGIES  
**GladiATR**

# GladiATR Vision

## AT A GLANCE

- ▶ View through diamond crystal
- ▶ 110X magnification
- ▶ USB image capture, document sample image
- ▶ Diamond crystal design—scratch and fracture resistant
- ▶ Full spectral range for mid-IR and far-IR analysis
- ▶ Optional heated, viewing crystal plate



TEMPERATURE CONTROL  
OPTIONS AVAILABLE



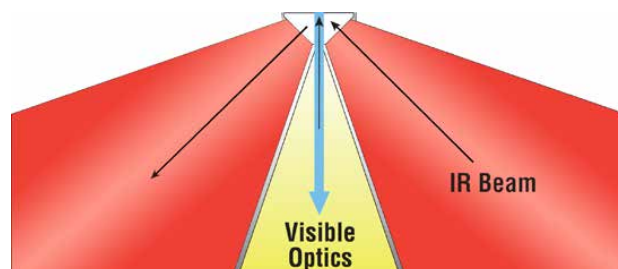
The GladiATR Vision™ diamond ATR is a novel sampling tool that couples small area infrared analysis with simultaneous viewing.

Samples are placed face down and positioned on the diamond crystal while its image is projected in real-time on the LCD screen. Finding and optimizing the sample placement for specific analysis areas is easy and fast. Analysis of thick or non-transparent samples is simple because viewing is through the diamond crystal.

## WHAT YOU SEE IS WHAT YOU SAMPLE

The GladiATR Vision accessory utilizes an innovative optical design with IR beam and visible optical image converging at the sample position—ensuring that “what you see is what you sample.”

The viewing specular reflection plate transforms the GladiATR Vision into a 45° specular reflection accessory, uniquely allowing the sampling spot, such as a defect, to be easily located. With the small spot size of 3 mm, you can be confident of your sampling point.



Diamond crystal plate of the GladiATR Vision accessory. IR beam and visible illumination meet at the sample position.

## POWERFUL MAGNIFICATION

The 110X magnification enables the positioning of relatively small samples—as small as 50 microns—into the center of the diamond crystal for optimized analysis. Visible image is displayed on an LED screen and can also be viewed on the computer.




## WIDE SPECTRAL RANGE AND IR-CAPABILITIES

The GladiATR Vision optical design is all reflective, preserving the full spectral range inherent to diamond, 4000-400  $\text{cm}^{-1}$ . For FTIR spectrometers equipped with far-IR optics, the spectral range is extended to less than 50  $\text{cm}^{-1}$ .

## TEMPERATURE CONTROL

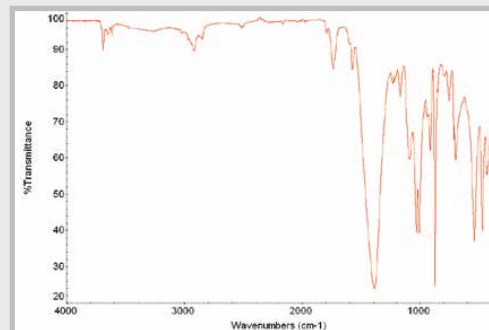
Temperature controlled crystal plates are available for thermal studies. The resistively heated diamond plate has a temperature range from ambient to 210 °C. The Digital Temperature Controller offers touch-screen operation, and may be used with TempPRO software. Data collection may be initiated as a function of time or temperature with most FTIR spectrometers. For applications requiring sub-ambient temperatures, liquid jacketed plates are available.

## SPECIFICATIONS

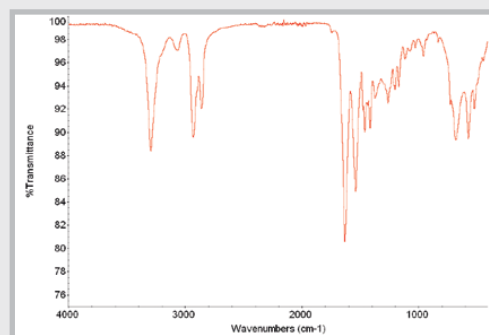
|   |  |
|---|--|
| <b>ATR Crystal Choices</b>  | Diamond, Ge (non-viewing)  |
| <b>Crystal Plate Mounting</b>   | User changeable plates   |
| <b>Crystal Type</b>   | Monolithic   |
| <b>Diamond Mounting</b>   | Brazed   |
| <b>Crystal Plate Housing</b>  | Stainless steel  |
| <b>Angle Of Incidence</b>   | 45 degrees, nominal  |
| <b>Crystal Dimensions (surface)</b>   | 3.0 mm diameter  |
| <b>Optics</b>   | All reflective   |
| <b>Pressure Device</b>  | Rotating, continuously variable pressure; click stop at maximum  |
| <b>Digital Force Adapter (option)</b>   | Load cell sensor for precise and reproducible pressure control. Attaches directly to GladiATR clamp. Digital readout. For ambient temperature measurements only. |
| <b>Maximum Pressure</b>   | 30,000 psi   |
| <b>Sample Access</b>  | 80 mm, ATR crystal to pressure mount   |
| <b>Spectral Range, Diamond</b>  | 4000 to 30 $\text{cm}^{-1}$ (IR optics dependent)  |
| <b>Viewing</b>  | Integrated 4" LCD  |
| <b>Magnification</b>  | 110X magnification   |
| <b>View Area</b>  | 770 x 590 microns  |
| <b>Optional Image Save</b>  | USB image capture  |
| <b>Viewing Mode</b>   | Through diamond crystal  |
| <b>Input Power Supply</b>   | 100–240 V, auto setting, external  |
| <b>Output</b>   | 1.5A/12 VDC, 18 W maximum  |
| <b>Heating Options</b>  | Diamond, 210 °C maximum<br>Ge, 130 °C maximum  |
| <b>Accuracy</b>   | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C  |
| <b>Sensor Type</b>  | 3 wire Pt RTD (low drift, high stability)  |
| <b>Temperature Control</b>  | Touch-panel display with USB interface. PIKE TempPRO software for PC control with unlimited ramps and automated data collection.                                 |
|    |  |
| <b>Input</b>  | 100–240 VAC, auto setting, external power supply   |
| <b>Output</b>   | 4A/24 VDC 100 W maximum  |
| <b>Specular Reflection Option</b>   | Viewing, 45 degree nominal angle of incidence  |
| <b>Purge Sealing</b>  | Purge tubes and purge line connector included  |
| <b>Accessory Dimensions (W X D X H)</b>   | 140 x 225 x 340 mm (excludes FTIR baseplate and mount)   |
| <b>FTIR Compatibility</b>   | Most, specify model and type   |

## APPLICATION

The GladiATR Vision diamond ATR integrates a camera positioned underneath the diamond ATR crystal. This allows you to see the FTIR measuring area. Temperature control options available.



**Print-on-paper spectrum** run on GladiATR Vision with diamond crystal. Image of the analysis area is shown above. Spectral range is 4000–400  $\text{cm}^{-1}$  with standard FTIR optics.



**200-micron compressed fiber spectrum** collected with the GladiATR Vision with diamond crystal.

| PART NUMBER   | DESCRIPTION   |
|---|---|
| <b>Base Optics (<i>must select one</i>)</b>   |   |
| 026-19XX  | GladiATR Vision Base Optics<br><br><b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. GladiATR Vision Base Optics versions include purge tubes, illumination power supply, purge kit and spectrometer base mount. USB interface software included enables image capture on your PC.                 |
| <b>GladiATR Stainless Top (<i>must select one</i>)</b>  |   |
| 026-2004  | GladiATR Vision Stainless Top<br><br><b>Note:</b> Stainless top is not required for temperature controlled plates.  |
| <b>Crystal Plates for GladiATR Vision (<i>must select one or more</i>)</b>                        |   |
| 026-2102  | GladiATR Vision Diamond Crystal Plate   |
| 026-2050  | Ge Crystal Plate (non-viewing)  |
| 026-2202  | Specular Reflection Plate (viewing)<br><br><b>Notes:</b> GladiATR Crystal Plates are pinned-in-place. Changing crystal plates is easy and fast to optimize sampling results. Only the GladiATR Vision Diamond Crystal Plate and viewing Specular Reflection Plate are compatible with sample viewing.   |
| <b>High-Pressure Clamp for GladiATR Vision (<i>must select for solid or powdered samples</i>)</b> |   |
| 026-3020  | High-Pressure Clamp   |
| 076-6026  | Digital Force Adapter for High-Pressure Clamp<br><br><b>Notes:</b> The High-Pressure Clamp is required for analysis of solids, powders and for use of liquids retainer and/or Digital Force Adapter (Digital Force Adapter may be used with samples at ambient temperature only). Pressure clamp includes a flat tip, a swivel tip and a concave tip. |

| PART NUMBER   | DESCRIPTION  |
|---|--|
| <b>GladiATR Vision Temperature Controlled Crystal Plate</b> |  |
| 026-4101  | Heated Diamond Crystal Plate, 210 °C (viewing)   |
| 026-4121  | Heated Ge Crystal Plate, 130 °C (non-viewing)  |
| 026-4129  | Liquid Jacketed Diamond Crystal Plate, 210 °C max (viewing)  |
| 076-1610  | Digital Temperature Control Module   |
| 007-0207  | PIKE TempPRO Software<br><br><b>Notes:</b> For heated diamond crystal plates, maximum crystal temperature is 210 °C. Ge becomes optically opaque at 150 °C. Maximum recommended temperature for this crystal is 130 °C. Temperature controller is required for heated crystal plates. If PC control is desired, TempPRO software must be purchased (sold separately from Temperature Control Module). Liquid jacketed crystal plates require customer-provided circulator. |
| <b>GladiATR Vision Sampling Options</b>                     |  |
| 026-5014  | Flow-Through Attachment, 100 µL  |
| 026-5013  | Liquids Retainer and Volatiles Cover Set   |
| 026-3051  | Volatiles Cover  |
| 026-5010  | Liquids Retainer<br><br><b>Note:</b> Flow-Through Attachment and Liquids Retainer are compatible with all crystal offerings (High-Pressure Clamp required).  |





Rotating, continuous variable pressure clamp. Click-stop at maximum pressure.

View-through diamond crystal makes it easy to find sample point.

Image is projected in real-time on an integrated 4" LCD screen.

# GladiATR Illuminate

## AT A GLANCE

- ▶ UV/Vis light introduced from under the diamond ATR prism
- ▶ Diamond crystal design – will not scratch or fracture
- ▶ Full spectral range for the analysis in the mid-IR and far-IR regions
- ▶ Temperature-controlled options available
- ▶ Compatible with most FTIR spectrometers



TEMPERATURE CONTROL  
OPTIONS AVAILABLE

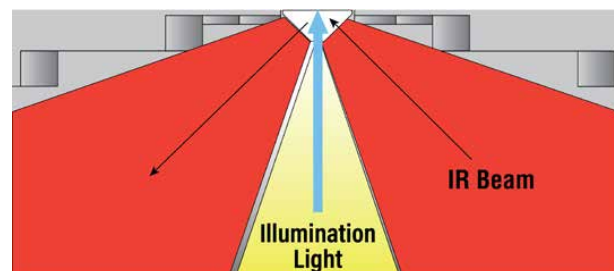


The GladiATR Illuminate is an ATR accessory designed for the analysis of photocuring or the solidification of liquid resins upon exposure to light.

The GladiATR Illuminate uses a liquid light guide to introduce UV/VIS light to the sample. The light is projected from underneath the diamond ATR element, allowing you to monitor solidification in real-time by tracking changes in chemical functionality. By observing this process, reaction kinetics may be determined, and resin formulations optimized. Applications include evaluating dental coatings and sealants, medical adhesives, photoresists, and 3D printing.

## MECHANICAL AND OPTICAL DESIGN

Conventional photochemical setups irradiate samples from top-down, while IR measurements presented are being taken from the bottom-up. This disparity results in a difference in light intensity throughout the depth of the sample due to absorption and sample thickness nonuniformity, and limits the accuracy of analysis and mitigates characterization of opaque resins. The GladiATR Illuminate overcomes these challenges by illuminating from beneath the sample. This accessory design feature aligns the absorption cross section of the sample with the evanescent wave of the IR beam for characterization. To maximize the light introduced to the ATR crystal and sample, an optical lens is incorporated at the light guide tip.



Diamond crystal plate of the GladiATR Illuminate accessory; IR beam and illumination meet at the sample position.

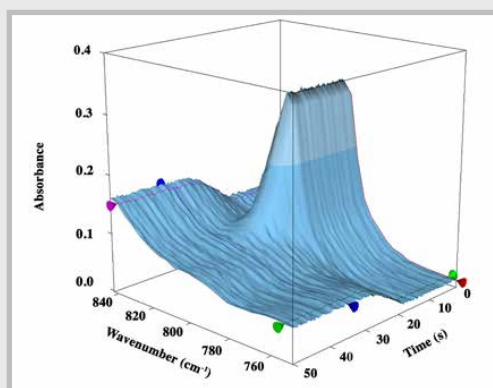
The GladiATR Illuminate optical design is all reflective, preserving the full spectral range inherent to diamond. For standard mid-IR FTIR spectrometers, the spectral range available with the GladiATR Illuminate is 4000–400  $\text{cm}^{-1}$ . For FTIR spectrometers equipped with far-IR optics, the spectral range is extended to less than 50  $\text{cm}^{-1}$ .

## TEMPERATURE CONTROL

Temperature controlled crystal plates are available for thermal studies. The resistively heated diamond plate has a temperature range from ambient to 210 °C. The Digital Temperature Controller offers touch-screen operation, and may be used with TempPRO software. Data collection may be initiated as a function of time or temperature with most FTIR spectrometers. For applications requiring sub-ambient temperatures, liquid jacketed plates are available.




## APPLICATION

The GladiATR Illuminate diamond ATR is an innovative accessory for monitoring photocuring reactions.



Acrylate photopolymerization spectrum, using 405 nm light. Waterfall plot showing the band change over time. Irradiation began at 19 seconds.

## SPECIFICATIONS

|   |   |
|---|---|
| <b>ATR Crystal Choices</b>              | Diamond   |
| <b>Crystal Plate Mounting</b>           | User changeable plates  |
| <b>Crystal Type</b>                     | Monolithic  |
| <b>Diamond Mounting</b>                 | Brazed  |
| <b>Crystal Plate Housing</b>            | Stainless steel   |
| <b>Angle Of Incidence</b>               | 45 degrees, nominal   |
| <b>Crystal Dimensions</b>               | 3.0 mm diameter   |
| <b>Optics</b>                           | All reflective  |
| <b>Pressure Device</b>                  | Rotating, continuously variable pressure; click stop at maximum   |
| <b>Digital Force Adapter (option)</b>   | Load cell sensor for precise and reproducible pressure control. Attaches directly to GladiATR clamp. Digital readout.   |
| <b>Maximum Pressure</b>                 | 30,000 psi  |
| <b>Sample Access</b>                    | 80 mm, ATR crystal to pressure mount  |
| <b>Spectral Range, Diamond</b>          | 4000 to 30 $\text{cm}^{-1}$ (IR optics dependent)   |
| <b>Liquid Light Guides</b>              | Core: 3 mm; Length: 1.2 m   |
| <b>Heating Options</b>                  | Diamond, 210 °C maximum   |
| <b>Accuracy</b>                         | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C   |
| <b>Sensor Type</b>                      | 3 wire Pt RTD (low drift, high stability)   |
| <b>Temperature Control</b>              | Touch-panel display. PIKE TempPRO software for PC control with unlimited ramps and automated data collection.   |
|   |    |
| <b>Input</b>                            | 100–240 VAC, auto setting, external power supply  |
| <b>Output</b>                           | 4A/24 VDC 100 W maximum   |
| <b>Accessory Dimensions (W X D X H)</b> | 140 x 225 x 340 mm (excludes FTIR baseplate and mount)  |
| <b>FTIR Compatibility</b>               | Most, specify model and type  |

| PART NUMBER  | DESCRIPTION  |
|--|--|
| <b>Base Optics</b>   |  |
| 026-16XX   | GladiATR Illuminate Base Optics<br><b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. GladiATR Illuminate Base Optics include purge tubes, purge kit and spectrometer base mount. Liquid light guide sold separately.  |
| <b>GladiATR Stainless Top (must select one)</b>  |  |
| 026-2001   | GladiATR Stainless Top<br><b>Note:</b> Stainless top is not required for temperature controlled plates.  |
| <b>Crystal Plates for GladiATR and Temperature Controller (must select one or more)</b>        |  |
| 026-2103   | Illuminate Diamond Crystal Plate   |
| 026-4123   | Illuminate Heated Diamond Crystal Plate, 210 °C  |
| 026-4125   | Illuminate Liquid Jacketed Diamond Crystal Plate, 210 °C   |
| 076-1610   | Digital Temperature Control Module   |
| 007-0207   | PIKE TempPRO Software<br><b>Notes:</b> GladiATR Crystal Plates are pinned-in-place. Changing crystal plates is easy and fast to optimize sampling results. Temperature controller is required for heated crystal plates. If PC control is desired, TempPRO software must be purchased separately. Liquid jacketed crystal plates require customer-provided circulator. |
| <b>High-Pressure Clamp for GladiATR Illuminate (must select for solid or powdered samples)</b> |  |
| 026-3020   | High-Pressure Clamp  |
| 076-6026   | Digital Force Adapter for High-Pressure Clamp<br><b>Notes:</b> The High-Pressure Clamp is required for analysis of solids, powders and for use of liquids retainer and/or Digital Force Adapter (Digital Force Adapter may be used with samples at ambient temperature only). Pressure clamp includes a flat tip, a swivel tip and a concave tip.                      |
| <b>GladiATR Illuminate Liquid Light Guides</b>   |  |
| 162-4920   | Liquid Light Guide 340-800 nm  |
| 162-4922   | Liquid Light Guide 420-2000 nm<br><b>Notes:</b> Liquid light guides are 1.2 m long, and have a 3 mm core. Contact us for alternative lengths or light guides themselves.   |
| <b>GladiATR Sampling Options</b>   |  |
| 026-5014   | Flow-Through Attachment, 100 $\mu\text{L}$   |
| 026-5013   | Liquids Retainer and Volatiles Cover Set   |
| 026-3051   | Volatiles Cover  |
| 026-5010   | Liquids Retainer<br><b>Note:</b> Flow-Through Attachment and Liquids Retainer are compatible with all crystal offerings (High-Pressure Clamp required).  |

# ATR Sampling Tools

## IRIS, MIRACLE AND GLADIATR

### LIQUIDS RETAINER AND VOLATILES COVER

The Liquids Retainer with Volatiles Cover offers a trough configuration while reducing the amount of evaporation when taking IR measurements of highly volatile liquid samples.

### FLOW-THROUGH ATTACHMENT

The Flow-Through Attachment allows for handling samples that pose a hazard and are degraded from ambient exposure.

### DIGITAL FORCE ADAPTER FOR HIGH-PRESSURE CLAMP

The Digital Force Adapter attaches directly to the clamping assembly to precisely measure the applied force by using an embedded load cell that exhibits high linearity and exceptional accuracy. The magnitude of applied force is displayed on an external easy-to-read LCD readout. The digital clamp is ideal for applications that require controlled and reproducible pressure. This option may not be used with temperature-controlled plates.



| PART NUMBER  | DESCRIPTION  |
|--|--|
| Sampling Tools   |  |
| 026-5014   | Flow-Through Attachment, 100 µL (300 °C max.)          |
| 026-5013   | Liquids Retainer and Volatiles Cover Set (210 °C max.) |
| 026-5015   | Liquids Retainer and Volatiles Cover Set (300 °C max.) |
| <b>Notes:</b> For temperature-controlled options, see respective product page. Flow-Through Attachment and Liquids Retainer require High-Pressure Clamp. |  |
| Specular Reflection Performance Plates   |  |
| 025-2208   | MIRacle  |
| 026-2200   | GladiATR   |
| Digital Force Adapter for High-Pressure Clamp  |  |
| 076-6025   | MIRacle  |
| 076-6026   | GladiATR   |
| 076-6027   | IRIS   |
| <b>Note:</b> Digital Force Adapter requires High-Pressure Clamp.   |  |

## GLADIATR AND MIRACLE

### SPECULAR REFLECTION PLATE

The GladiATR and MIRacle may be converted from an ATR accessory to a specular reflection accessory by using the Specular Reflection Plate. The angle of incidence is 45 degrees, and the plate is easily interchangeable with ATR plates.

### TEMPERATURE CONTROL OPTIONS

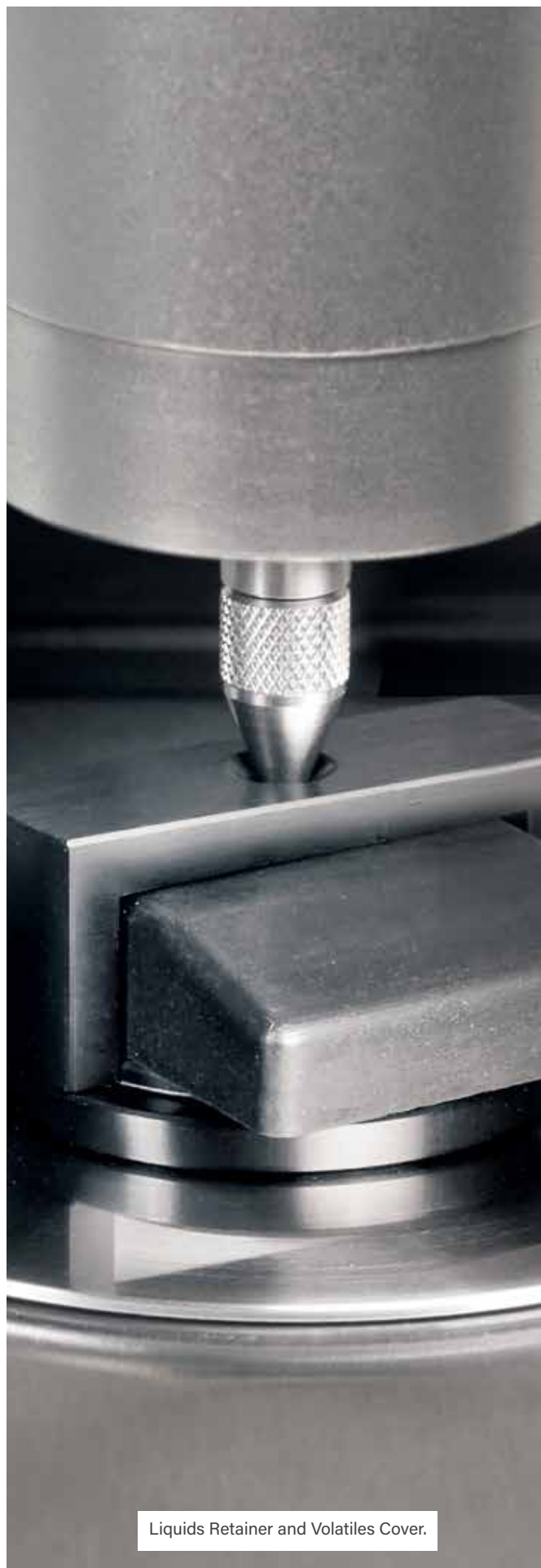
The GladiATR and MIRacle can be configured with liquid jacketed plates and resistively heated crystal plates with temperature control module. The PIKE controller has a touch-panel interface with USB port and is ready for use with PIKE TempPRO software. TempPRO provides a graphical user interface for temperature control and kinetics measurements. The liquid jacketed plates require user-provided liquid circulator.



MIRacle temperature-controlled ATR plate.



Flow-Through Attachment.



Liquids Retainer and Volatiles Cover.

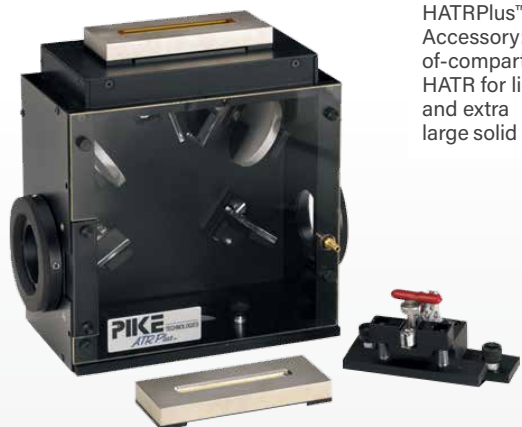
# HATR

## AT A GLANCE

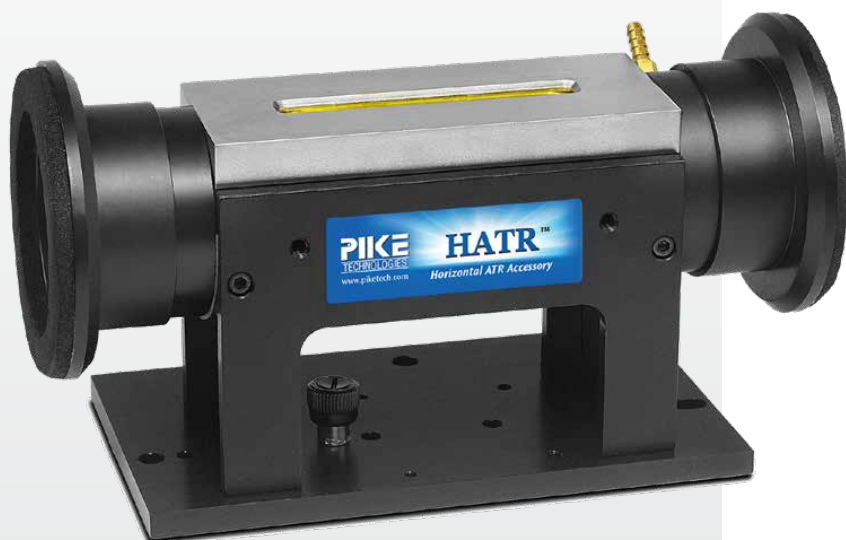
- ▶ Excellent energy throughput
- ▶ Up to 20 internal reflections
- ▶ Interchangeable crystal plates
- ▶ Trough, flat and flow-through plates
- ▶ ZnSe, KRS-5, Ge, AMTIR or Si ATR elements



TEMPERATURE CONTROL  
OPTIONS AVAILABLE



HATRPlus™  
Accessory: out-of-compartment  
HATR for liquid  
and extra  
large solid samples.



Horizontal Attenuated Total Reflection (HATR) accessories are multiple reflection ATRs. These are ideal for the IR measurement of liquids, semi-solids, solids and films when additional sensitivity is required.

HATRs feature a constant and reproducible effective pathlength and are well suited for both qualitative and quantitative applications. Typically, sampling is achieved by placing the sample onto the HATR crystal, often eliminating sample preparation. To optimize spectral measurements, a selection of crystal materials, plate formats and temperature control options are available.

## HATR AND HATRPLUS

HATR products are available in two base optic configurations. The HATR is an in-compartment design for samples that fit into the FTIR sample compartment. The HATRPlus is an out-of-compartment design where the sampling surface extends above the FTIR cover, thereby permitting analysis of very large samples. Applications using the HATRPlus include coatings on large manufactured components, layered composition analysis on large objects, and skin analysis in the health and personal care industries.

Both HATRs are high-performance accessories, carefully designed to provide excellent results with minimum effort. They are easily installed in the sample compartment, locking into position on the sample compartment baseplate. Stable alignment provides excellent analytical precision.

## HATR CRYSTAL PLATES

There are several high-quality crystal materials covering a full spectrum of applications. The most popular crystals are 4-mm thick and generate 10 reflections on the sample (45° face angle). The 2-mm thick crystals (Ge, ZnSe) result in 20 reflections. Trough and sealed flat crystal plates are sealed using metallic gaskets, eliminating premature failure and the risk of cross-contamination associated with inferior, epoxy-bonded systems.

All ATR plates are pin-mounted to the HATR base with no alignment required. Crystal plate changeover is rapid, allowing a wide range of samples to be analyzed with maximum convenience. The HATRs have been optimized for maximum optical throughput and excellent quality spectra can be obtained from demanding samples.

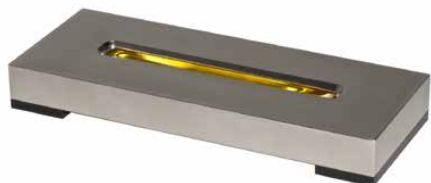
## FLAT PLATE

The flat plate is used for the analysis of solid materials, including polymer and film samples. The crystal is mounted slightly above the surface of the metal plate, which helps to achieve good crystal/sample contact when the flat plate press is used. The ZnSe and Ge 45-degree flat plates are available in a sealed version, which is ideal for sampling of oils and other types of low surface tension, non-volatile liquids.



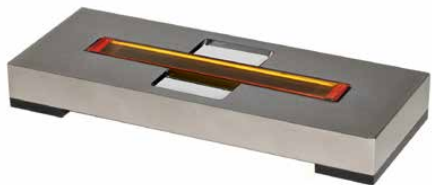
## TROUGH PLATE

The trough plate is designed for easy sampling, with a large, recessed crystal to accommodate the sample – generally a liquid, powder, or paste. Typically, only a thin layer of the sample needs to be applied onto the crystal surface. For fast evaporating samples, a volatiles cover should be used to cover the sampling area. By using the optional powder press, soft powders often produce quality spectra when analyzed by HATR, assuming that they can be put in intimate contact with the crystal.



## RCPLATE™

The RCPlate is designed for special applications, such as measurements of coatings, mono-molecular layers, or bio-films deposited directly upon the HATR crystal. The plate allows easy removal and reinsertion of the ATR crystal.



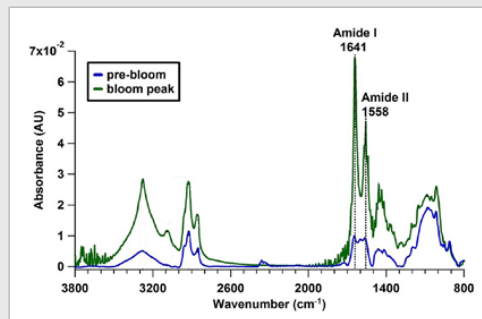
## FLOW-THROUGH CELL

Flow-through cells are a versatile option for the dynamic laboratory. The ATR crystal is sealed in with O-rings, which allows for user-changeable crystals. The sample may be introduced by syringe or through tubing connected to a 1/16-inch compression fitting. Flow-through cells may be configured for temperature control and with PTFE coating.

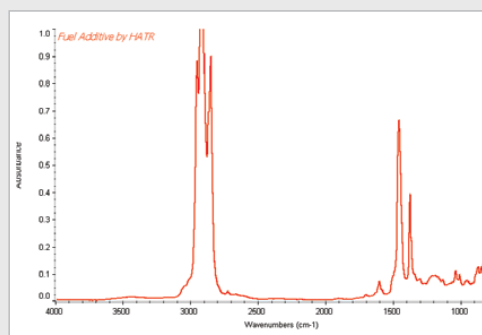


## APPLICATION

The HATR is an ideal accessory when requiring added sensitivity. Flat, trough and flow cells make it possible to fully configure this accessory to meet your sampling requirements.



Dehydrated sea water spectra, collected before and after phytoplankton bloom using the ZnSe 20-reflection HATR trough plate.



Fuel additive spectrum, collected using a trough plate with ZnSe crystal.

## PHOTOCATALYTIC FLOW-THROUGH CELL

PIKE offers a flow-through cell with a quartz window, integrated into the cell lid for photocatalytic studies. Due to UV-induced degradation of ZnSe caused by the external source probe, we recommend using an AMTIR crystal.



## TEMPERATURE CONTROL

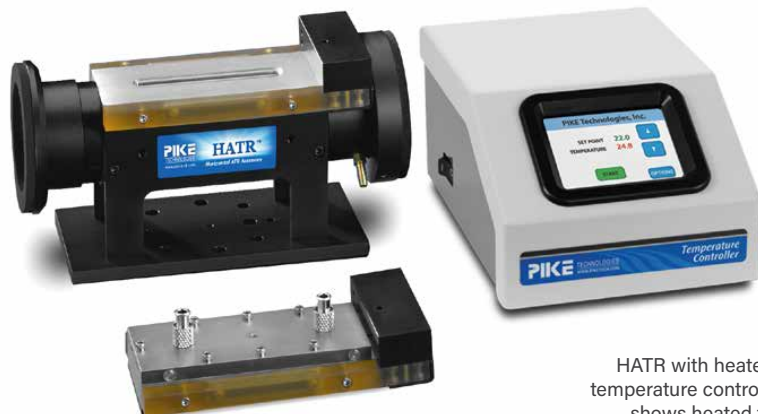
Resistive heating and liquid jacketed plates are available for thermal studies. The maximum temperature is 120 °C for all crystal types. The Digital Temperature Controller offers touch-screen operation, and may be used with TempPRO software. Ramps and hold times are easily programmed through TempPRO software. Data collection may be initiated as a function of time or temperature with most FTIR spectrometers.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
|             | Complete HATR Systems   |
| 022-10XX    | HATR Trough Plate System with 45° ZnSe Crystal Includes Trough Plate, Volatiles Cover and Powder Press  |
| 022-11XX    | HATR Flat Plate System with 45° ZnSe Crystal Includes Flat Plate and HATR Pressure Clamp  |
| 022-12XX    | HATR Combined Trough and Flat Plate System with 45° ZnSe Crystals Includes Trough Plate, Flat Plate, Volatiles Cover, Powder Press and Pressure Clamp |
| 024-11XX    | HATRPlus Flat Plate System with 45° ZnSe Crystal Includes Flat Plate and HATR Pressure Clamp  |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. HATR and HATRPlus systems may be purchased with other crystal plates; just add -Ge for germanium, -KR for KRS-5, -AM for AMTIR, or -Si for silicon to the part number. Additional plates can be added to an order for any system above. Other configurations may be selected from the options below.

### RESISTIVELY HEATED PLATES SPECIFICATIONS

|                            |  |
|----------------------------|--|
| <b>Temperature Range</b>   | Ambient to 120 °C  |
| <b>Accuracy</b>            | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C  |
| <b>Sensor Type</b>         | 3 wire Pt RTD (low drift, high stability)  |
| <b>Temperature Control</b> | Touch-panel display with USB interface. PIKE TempPRO software for PC control with unlimited ramps and automated data collection. |
| <b>Input</b>               | 100-240 VDC, auto setting, external power supply   |



HATR with heated trough plate and temperature control module—foreground shows heated flow-through cell.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
|             | Configurable HATR Systems - HATR Base Optics  |
| 022-19XX    | HATR Platform Optics Assembly   |
| 024-19XX    | HATRPlus Platform Optics Assembly   |
|             | <b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. HATR and HATRPlus Platform Optics Assemblies include purge tubes, purge kit and spectrometer base mount. |
|             | Pressure Clamp for HATR and HATRPlus  |
| 022-3050    | HATR (pivoting) Pressure Clamp  |
| 022-3054    | HATR High-Pressure Clamp  |
| 024-3050    | HATRPlus (pivoting) Pressure Clamp  |
| 024-3053    | HATRPlus High-Pressure Clamp  |

**Notes:** The pressure clamp is required for solids, films, coatings and powdered samples. Maximum force for (pivoting) Pressure Clamp and High-Pressure Clamp is 13 lbf and 30 lbf, respectively.

### Crystal Plates 45° (must select 1 or more)

| ZnSe        |              |
|-------------|--------------|
| 022-2010-45 | Trough       |
| 022-2020-45 | Flat         |
| 022-2024-45 | Sealed Flat  |
| 022-2012-45 | Trough, 2 mm |
| 022-2022-45 | Flat, 2 mm   |
| Ge          |              |
| 022-2050-45 | Trough       |
| 022-2060-45 | Flat         |
| 022-2064-45 | Sealed Flat  |
| 022-2052-45 | Trough, 2 mm |
| 022-2062-45 | Flat, 2 mm   |
| KRS-5       |              |
| 022-2030-45 | Trough       |
| 022-2040-45 | Flat         |
| AMTIR       |              |
| 022-2070-45 | Trough       |
| 022-2080-45 | Flat         |
| Si          |              |
| 022-2090-45 | Trough       |
| 022-2100-45 | Flat         |

**Notes:** Crystal Plates are pre-aligned and pinned-in-place. For most HATR crystal plates, 60 degree face angle is also available. Where not noted, crystals are 4-mm thick and generate 10 reflections on the sample (45° cut). 2-mm thick crystals result in 20 reflections (45° cut). If you need a crystal not listed here, please contact us. Reconditioning service is available.



| PART NUMBER | DESCRIPTION                        |
|-------------|------------------------------------|
|             | Heated Crystal Trough Plates 45°   |
| 022-5110    | ZnSe                               |
| 022-5120    | AMTIR                              |
| 022-5130    | KRS-5                              |
| 022-5140    | Si                                 |
| 022-5150    | Ge                                 |
|             | Heated Flow-Through Cells 45°      |
| 022-5210    | ZnSe                               |
| 022-5212    | ZnSe, 2 mm                         |
| 022-5220    | AMTIR                              |
| 022-5230    | KRS-5                              |
| 022-5240    | Si                                 |
| 022-5250    | Ge                                 |
| 022-5252    | Ge, 2 mm                           |
| 022-5225    | AMTIR with UV Port                 |
| 076-1610    | Digital Temperature Control Module |
| 007-0207    | PIKE TempPRO Software              |

**Notes:** Temperature is adjustable from ambient to 120 °C for heated trough plates and flow-through cells. Ge becomes opaque near 100 °C. Resistance heated plates require selection of a PIKE Technologies Temperature Control Module. PIKE TempPRO software (sold separately) can be used for graphical setup and automated data collection for thermal experiments. PTFE-coated flow-through cells available – contact us for more information.

|          | Flow-Through Cells 45° |
|----------|------------------------|
| 022-4010 | ZnSe                   |
| 022-4012 | ZnSe, 2 mm             |
| 022-4020 | AMTIR                  |
| 022-4030 | KRS-5                  |
| 022-4040 | Si                     |
| 022-4050 | Ge                     |
| 022-4052 | Ge, 2 mm               |
| 022-5228 | AMTIR with UV Port     |

**Notes:** HATR flow-through cells include Luer-Lok® fittings for easy connection with a syringe. A set of 1/16" Swagelok® fittings are also included. Cell volume is 500 µL. PTFE-coated flow-through cells available – contact us for more information.

|          | Liquid Jacketed Crystal Plates 45° |
|----------|------------------------------------|
| 022-5310 | ZnSe                               |
| 022-5320 | AMTIR                              |
| 022-5330 | KRS-5                              |
| 022-5340 | Si                                 |
| 022-5350 | Ge                                 |

**Notes:** Liquid jacketed crystal plates require customer-provided liquid circulator. Liquid jacketed crystal plates enable heating to 120 °C and cooling. Ge becomes opaque near 100 °C.

| PART NUMBER | DESCRIPTION                                      |
|-------------|--|
|             | Liquid Jacketed, Flow-Through Crystal Plates 45° |
| 022-5410    | ZnSe   |
| 022-5412    | ZnSe, 2 mm                                       |
| 022-5420    | AMTIR  |
| 022-5430    | KRS-5  |
| 022-5440    | Si   |
| 022-5450    | Ge   |
| 022-5452    | Ge, 2 mm   |

**Notes:** Liquid jacketed flow-through crystal plates require customer-provided liquid circulator to enable heating to 120 °C and cooling. HATR flow cells include Luer-Lok fittings for easy connection with a syringe and 1/16" Swagelok fittings. PTFE coated flow-through cells available – contact us for more information.

|          | HATR RC Plate                             |
|----------|---|
| 022-2300 | RCPlate for HATR (for 45° crystals, 4 mm) |

**Note:** Requires a selection of HATR Crystal – see below

|          | Replacement Parts                    |
|----------|--------------------------------------|
| 022-3051 | HATR Volatiles Cover                 |
| 022-3052 | HATR Powder Press                    |
|          | Crystal Traps 45° 80 x 10 x 4 or 2mm |
| 160-5554 | ZnSe, 4 mm                           |
| 160-5559 | ZnSe, 2 mm                           |
| 160-5555 | KRS-5, 4 mm                          |
| 160-5556 | Ge, 4 mm                             |
| 160-5560 | Ge, 2 mm                             |
| 160-5557 | AMTIR, 4 mm                          |
| 160-5558 | Si, 4 mm                             |
| 160-5561 | ZnSe, 4 mm                           |
| 160-5562 | Ge, 4 mm                             |

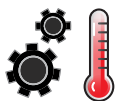
|          | Flow Cell Parts                          |
|----------|--|
| 022-3032 | Spacer, 2 mm                             |
| 022-3033 | Spacer, 4 mm                             |
| 022-3040 | Viton O-Ring, upper (6 ea.)              |
| 022-3045 | Viton O-Ring, lower (6 ea.)              |
| 022-3041 | Perfluoroelastomer O-Ring, upper (1 ea.) |
| 022-3046 | Perfluoroelastomer O-Ring, lower (1 ea.) |

**Notes:** Reconditioning service for used HATR crystal plates is available. Contact PIKE Technologies for items not described in this list.

# ATRMMax II

## AT A GLANCE

- ▶ Selectable angle of incidence from 25° to 65° in one-degree increments
- ▶ 0.5 to 10-micron depth of penetration
- ▶ 3 to 12 reflections of IR beam
- ▶ Flat and trough crystal plates for solids, films, powders and liquid samples
- ▶ Automated option with electronic control module and AutoPRO™ software
- ▶ Sealed and purgeable optical design to eliminate water vapor and carbon dioxide interferences



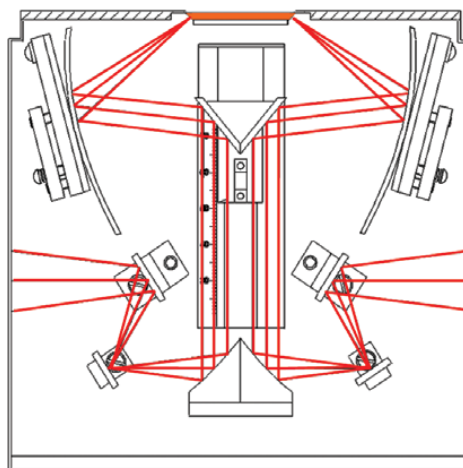
AUTOMATION OPTION  
TEMPERATURE CONTROL



The ATRMax II is a high throughput, variable angle horizontal ATR accessory. Its adjustable angle of incidence allows for easy optimization of spectral measurements and execution of depth profiling studies.

## VARIABLE ANGLE

The ATRMax II design employs a unique optical layout (U.S. patent 5,105,196) which enables samples to be analyzed over a range of incident angles, 25° to 65°, providing experimental control over the depth of penetration of an IR beam into the sample and the number of beam reflections in the ATR crystal.



Proprietary beam path within the ATRMax II FTIR sampling accessory.

## ATR CRYSTALS

The ATR crystals for the ATRMax II are of trapezoidal shape and 56-mm long, 10-mm wide and 4-mm thick. Standard bevel angles at each end of the crystal are available in 30-, 45-, and 60-degree versions, and are available in ZnSe, Ge, AMTIR and KRS-5. Coupling the variable angle of incidence of the ATRMax II with the different crystal face angles, the number of reflections may be changed from 3 to 12.

### FLAT PLATES

Flat crystal plates are used for the analysis of coatings, films and non-particulate solids. Typical applications include depth profiling studies and optimization of ATR spectral data. A sample clamp is required to provide intimate contact between the sample and crystal surface.

### TROUGH PLATES

The trough crystal plate is recommended for use with liquids, pastes and powdered samples. Typical applications include the analysis of oils, detergents, and other liquid samples.

## FLOW THROUGH CELLS

A variety of flow-through cells that feature removable crystals are available. This enables replacement of the crystals and facilitates cleaning of "sticky" samples. Flow cells may be configured for ambient measurements and heating and liquid jacketed temperature control. With the liquid jacketed version, samples may be measured at heated or cooled temperatures using a liquid circulator. PTFE coating of the cell is an option.

## HEATED CRYSTAL PLATES

Optional resistively heated crystal plates are available for the ATRMax II trough, flat and flow-through cell versions. These heated crystal plates are driven using the PIKE Technologies' temperature control module. PIKE TempPRO software is available for graphical temperature profile set up, and interfaces with most FTIR software packages for data collection.



## SPECIAL APPLICATIONS

The RCPlate is designed for special applications, such as measurements of coatings, mono-molecular layers, or bio-films deposited directly upon the ATRMax crystal. The plate allows easy removal and reinsertion of the ATR crystal.



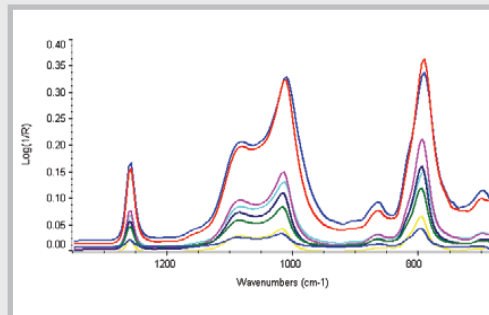
## AUTOMATION

The Automated ATRMax II model offers motorized control of the accessory's angle selector through AutoPRO software. With automation, the collection of spectra from multiple angles of incidence may be streamlined by programming and executing the experiment through the computer. Advantages of the automated ATRMax II system include:

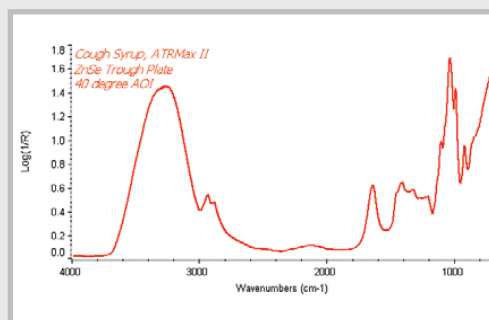
- ▶ Computer controlled precision, accuracy and repeatability
- ▶ Synchronization of mirror position changes with collection of sample spectra
- ▶ Full integration of the AutoPRO software with most FTIR spectrometer programs
- ▶ Tailor-made, predefined experiments

## APPLICATION

With a variety of ATR crystal materials, crystal face angles, and plate options (through, flat and flow cell), the ATRMax II offers the flexibility to optimize spectral measurements.



**Silicon release agent spectra** for depth profiling investigation collected at angles ranging from 25 to 65 degrees using a Ge flat plate.



**Cough syrup spectrum** collected using the ZnSe trough plate and a 40-degree angle of incidence.

## RESISTIVELY HEATED PLATES SPECIFICATIONS

|                            |  |
|----------------------------|--|
| <b>Temperature Range</b>   | Ambient to 120 °C  |
| <b>Accuracy</b>            | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C  |
| <b>Sensor Type</b>         | 3 wire Pt RTD (low drift, high stability)  |
| <b>Temperature Control</b> | Touch-panel display with USB interface. PIKE TempPRO software for PC control with unlimited ramps and automated data collection. |
| <b>Input</b>               | 100–240 VDC, auto setting, external power supply   |



| PART NUMBER | DESCRIPTION  |
|-------------|--|
|             | Complete ATRMax II Systems   |
| 023-10XX    | ATRMax II Trough Plate System with 45° ZnSe<br>Includes Trough Plate, Volatiles Cover and Powder Press   |
| 023-11XX    | ATRMax II Flat Plate System with 45° ZnSe<br>Includes Flat Plate and Pressure Clamp  |
| 023-12XX    | ATRMax II Combined Trough and Flat Plate System with 45° ZnSe<br>Includes Trough Plate, Flat Plate, Volatiles Cover, Powder Press and Pressure Clamp |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. ATRMax II Systems may be purchased with plates other than ZnSe. Just add -Ge for germanium, -KR for KRS-5, -AM for AMTIR, or -Si for Silicon. Additional plates can be added to an order for any system. Other configurations may be selected from the options below.

| ATRMax II Base Optics ( <i>must select</i> ) |                               |
|--|-------------------------------|
| 023-19XX                                     | ATRMax II Variable Angle HATR |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. ATRMax II Base Optics includes purge tubes, purge kit and spectrometer base mount.

| Plates for ATRMax II ( <i>must select 1 or more</i> ) |              |
|---|--------------|
|   | Flat Plate   |
| 023-2031  | ZnSe, 30°    |
| 023-2011  | ZnSe, 45°    |
| 023-2051  | ZnSe, 60°    |
| 023-2033  | Ge, 30°      |
| 023-2013  | Ge, 45°      |
| 023-2053  | Ge, 60°      |
| 023-2032  | KRS-5, 30°   |
| 023-2012  | KRS-5, 45°   |
| 023-2052  | KRS-5, 60°   |
| 023-2045  | Si, 45°      |
| 023-2047  | AMTIR, 45°   |
|   | Trough Plate |
| 023-2021  | ZnSe, 30°    |
| 023-2001  | ZnSe, 45°    |
| 023-2041  | ZnSe, 60°    |
| 023-2023  | Ge, 30°      |
| 023-2003  | Ge, 45°      |
| 023-2043  | Ge, 60°      |
| 023-2022  | KRS-5, 30°   |
| 023-2002  | KRS-5, 45°   |
| 023-2042  | KRS-5, 60°   |
| 023-2044  | Si, 45°      |
| 023-2046  | AMTIR, 45°   |

**Notes:** ATRMax plates are pre-aligned and pinned-in-place. Changing plates to optimize sampling results is easy and fast. If you need a plate not listed here, please contact us.

| PART NUMBER                | DESCRIPTION   |
|----------------------------|---|
|                            | Pressure Clamp for ATRMax II  |
| 023-3050                   | ATRMax Pressure Clamp   |
|                            | <b>Note:</b> The pressure clamp is required for solids, films, coatings and powdered samples. |
| ATRMax II Sampling Options |   |
| 023-2800                   | Automated Upgrade for ATRMax II   |
| 023-2850                   | Automated Option for ATRMax II  |
| 023-2300                   | RCPlate for ATRMax II   |
| 023-4000                   | ATRMax Flow Cell Assembly<br>(order crystal separately)                                       |
| 023-4100                   | ATRMax Liquid-Jacketed Flow-Through Cell Assembly<br>(order crystal separately)               |
| 023-4200                   | ATRMax Heated Flow-Through Cell Assembly<br>(order crystal separately)                        |
| 023-4300                   | ATRMax Heated Trough Plate Assembly<br>(order crystal separately)                             |
| 023-4400                   | ATRMax Heated Flat Plate Assembly<br>(order crystal separately)                               |
| 013-4200                   | ATR Variable Angle Heating Conversion Plate   |
| 076-1610                   | Digital Temperature Control Module  |
| 007-0207                   | PIKE TempPRO Software   |

**Notes:** Automated option includes PIKE AutoPRO software and controller. The ATR Variable Angle Heating Conversion Plate must be selected with temperature controlled plates. Resistively heated plates require selection of the Temperature Control Module. Maximum temperature is 120 °C. PIKE TempPRO software (sold separately) can be used for graphical setup and automated data collection with most FTIR spectrometers for thermal experiments.

| Trapezoid Crystals for ATRMax II, 56 x 10 x 4 mm |            |
|--|------------|
| 160-5563   | ZnSe, 45°  |
| 160-5571   | ZnSe, 60°  |
| 160-5569   | Ge, 30°    |
| 160-5565   | Ge, 45°    |
| 160-5573   | Ge, 60°    |
| 160-5570   | Si, 30°    |
| 160-5567   | Si, 45°    |
| 160-5575   | Si, 60°    |
| 160-5566   | AMTIR, 45° |
| 160-5574   | AMTIR, 60° |

**Note:** Please contact PIKE Technologies for crystals not on this list.

| ATRMax II Replacement Parts |                           |
|-----------------------------|---------------------------|
| 023-3051                    | ATRMax II Volatiles Cover |
| 023-3052                    | ATRMax II Powder Press    |

**Notes:** Please contact PIKE Technologies for items not described in this list. Reconditioning service for used ATRMax plates is available.



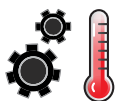
ATRMax II with flow cell plate.



# ReactorMAX

## AT A GLANCE

- ▶ Temperature control up to 215 °C
- ▶ Sealed sample chamber for pressures up to 55 bar
- ▶ Optional in-chamber stirrer
- ▶ Automated angle of incidence selection
- ▶ 0.5 to 10-micron depth of penetration
- ▶ Multiple reflection ATR from 3 to 9 reflections



AUTOMATION OPTION  
TEMPERATURE CONTROL



ReactorMAX is a research-grade, variable angle ATR, designed for demanding applications that require high temperature and pressure. With automated control of the variable angle, spectral data may be easily optimized.

## TEMPERATURE-CONTROLLED PRESSURE VESSEL

The ReactorMAX is equipped with a temperature-controlled pressure vessel that may be heated up to 215 °C and operated up to 55 bar. Optional stirring is available. The material of the pressure vessel is Hastelloy, capable of withstanding extremely harsh chemicals under pressure/temperature conditions. Integrated into the bottom of the vessel is a multiple reflection AMTIR ATR crystal.

## ATR ELEMENT

With a pH tolerance between 1-9, AMTIR offers a robust ATR crystal for a wide range of applications. ReactorMAX ATR element is a trapezoidal shape and 56-mm long, 10-mm wide and 4-mm thick. Standard bevel angles at each end of the AMTIR crystal are available in 45- and 60-degree versions. Coupling the variable angle of incidence of the ReactorMAX with the variable crystal face angles, one can select effective angle of incidence ranging from 35 to 65 degrees and the range in number of reflections from 3 to 9. Contact PIKE for other ATR crystal material options.

## AUTOMATION

The control of angle selection, temperature and stirring speed is automated and integrated into PIKE software. Automation streamlines experimental protocols; the entire experiment can be programmed and executed by the computer. Advantages of the automated features include:

- ▶ Computer controlled precision, accuracy and repeatability
- ▶ Synchronization of mirror position changes with collection of sample spectra
- ▶ Full integration of the PIKE Technologies software with most FTIR spectrometer programs for data collection
- ▶ Tailor-made, predefined experiments
- ▶ "Hands-free" operation

## SPECIFICATIONS

|                                      |   |
|--------------------------------------|---|
| <b>Max. Operating Pressure</b>       | 55 bar  |
| <b>Max. Operating Temperature</b>    | 215 °C  |
| <b>Spectral Range</b>                | 4000 - 800 $\text{cm}^{-1}$   |
| <b>Pathlength Range</b>              | 5 - 20 $\mu\text{m}$ with sample refractive index approx. 1.3 - 1.6 |
| <b>Reaction Chamber Construction</b> | Hastelloy C276  |
| <b>Sealing O-rings</b>               | Kalrez  |
| <b>Dimensions (W X D X H)</b>        | 229 x 152 x 610 mm  |
| <b>Total Weight</b>                  | 15.65 kg  |

Note: Contact PIKE Technologies for other crystal options.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 023-13XX    | ReactorMAX with Stirring<br>Includes base optics, reactor vessel with stirring, 45-degree AMTIR ATR crystal, controller, cabling, and software. |
| 023-14XX    | ReactorMAX<br>Includes base optics, reactor vessel, 45-degree AMTIR ATR crystal, controller, cabling, and software.                             |

**Notes:** replace XX with your spectrometer's Instrument Code listed in the back of the catalog.

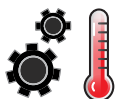
| Replacement Parts |  |
|-------------------|--|
| 160-5566          | Crystal 45°, Trap. 56 x 10 x 4 mm, AMTIR |
| 160-5574          | Crystal 60°, Trap. 56 x 10 x 4 mm, AMTIR |



# VeeMAX III

## AT A GLANCE

- ▶ 0.4 to 46-micron depth of penetration
- ▶ High throughput for excellent quality spectra
- ▶ Integrated position for manual or automated polarizer
- ▶ Can be used as a variable angle of incidence specular reflection accessory
- ▶ Configurable for monolayer studies and spectroelectrochemistry
- ▶ Sealed and purgeable optical design to eliminate water vapor and carbon dioxide interferences

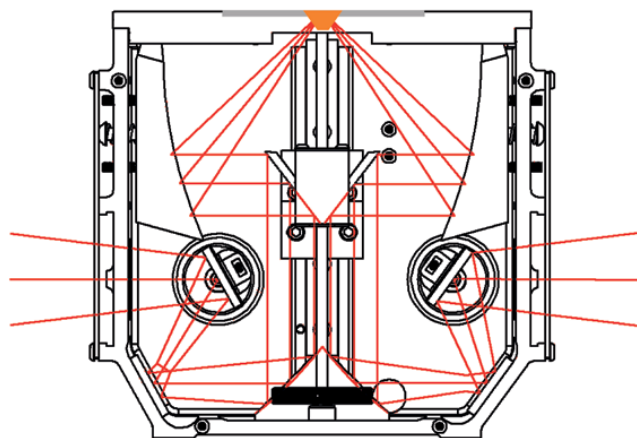


AUTOMATION OPTION  
TEMPERATURE CONTROL



The VeeMAX III with ATR offers continuous variable angle of incidence and a variety of crystal plates to selectively control the depth of penetration of the IR beam into the sample. ATR applications include the study of layered samples, coatings, release agents, monolayers on silicon and spectroelectrochemistry.

The VeeMAX III with ATR accessory provides exceptionally high throughput (over 50% with 45 degree ZnSe crystal) to minimize sampling time and enable detection of low concentration components in samples of complex composition. The crystal flat plates offered for the VeeMAX are ideal for solid and layered samples and are designed for use with the optional pressure clamp. The combination of large crystal diameter (20 mm) and slip-clutch pressure clamp provides sample-to-crystal contact without altering layered sample composition. The optional liquids retainer may be added to the crystal plate for analysis of liquid samples.



VeeMAX III with ATR optical layout.

## TEMPERATURE CONTROL

Temperature controlled crystal flat plates are available for thermal studies. The maximum temperature is 130 °C for all crystal types. PIKE Technologies' temperature controller allows unlimited ramps to be easily programmed using PIKE TempPRO software. Data collection as a function of time or temperature may be prescribed for most FTIR spectrometers.



Heated crystal plate.



## AUTOMATED VEEMAX

Motorized control of angle of incidence via personal computer is available for the accessory. The Automated VeeMAX III is ideal for depth profiling studies as it greatly speeds and improves the precision and reproducibility of the data collection process. AutoPRO software interfaces with most FTIR software packages for automated data collection.

## MONOLAYERS APPLICATIONS

Monolayers and ultra-thin films absorbed on silicon or gold substrate are easily sampled using the VeeMAX when equipped with a high refractive index ATR crystal. Compared to specular reflection sampling for monolayer analysis, an increase in sensitivity of up to 1–2 orders of magnitude may be realized via ATR sampling. For these applications, the VeeMAX III accessory is configured to include a high-angle Ge flat plate (60 or 65 degrees), the high-pressure clamp with a 7.8-mm pressure tip, and a polarizer.

## SPECTROELECTROCHEMICAL CELLS

The Jackfish Electrochemical Cells (SEC) are fully compatible with the VeeMAX, and offer a complete solution for spectroelectrochemical experiments via ATR-SEIRAS technique. The Jackfish cells, designed for organic and aqueous environments, may be configured for use with VeeMAX ATR face-angled crystals, or micromachined silicon ATR wafers.



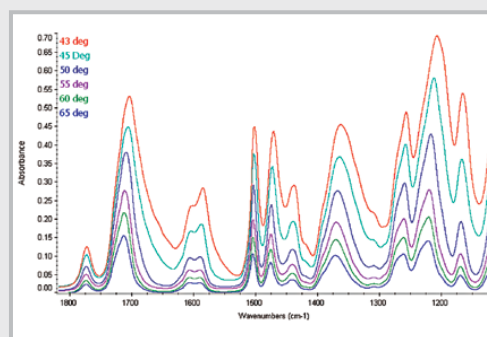
The Jackfish J2 spectroelectrochemical cell.

In addition to the Jackfish SEC, PIKE offers a customizable electrochemical cell for the VeeMAX. The PIKE electrochemistry cell is equipped with a precision micrometer for electrode positioning, and is ideal for external reflection experiments.

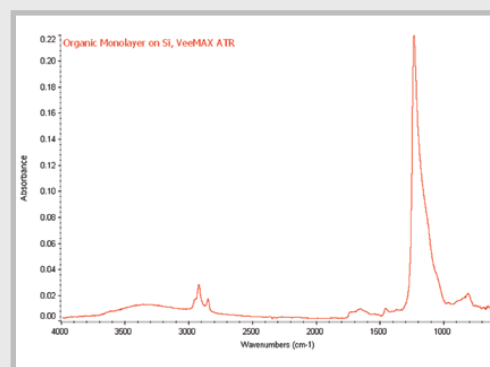


PIKE spectroelectrochemical cell.

## APPLICATION



Depth profiling spectra of layered polymer film, collected using ZnSe crystal at angles of incidence from 43 to 65 degrees. IR absorbance band at  $1591\text{ cm}^{-1}$  clearly increases relative to other bands as we probe deeper into the sample.




Monomolecular layer on silicon spectrum, collected with VeeMAX III with 60 degree Ge crystal, pressure clamp with 7.8-mm tip and p-polarization.



Automated VeeMAX III with polarizer option for automated depth profiling studies. Angle of incidence and polarization angle can be set independently.

## SPECIFICATIONS

|   |   |
|---|---|
| <b>ATR Crystal Choice</b>               | ZnSe, Ge, Si, ZnS   |
| <b>Crystal Plate Mounting</b>           | User-changeable plates  |
| <b>Crystal Plate Housing</b>            | Stainless Steel   |
| <b>Crystal Dimension (surface)</b>      | 20-mm diameter  |
| <b>Optics</b>                           | All reflective  |
| <b>Pressure Device</b>                  | Rotating, continuous variable pressure; click stop at maximum   |
| <b>Heating Options</b>                  | 130 °C  |
| <b>Accuracy</b>                         | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C   |
| <b>Sensor Type</b>                      | 3 wire Pt RTD (low drift, high stability)   |
| <b>Temperature Control</b>              | Touch-panel display with USB interface.<br>PIKE TempPRO software for PC control with unlimited ramps and automated data collection. |
|   |    |
| <b>Input</b>                            | 100–240 VAC, auto setting, external power supply  |
| <b>Output</b>                           | 24 VDC/50 W maximum   |
| <b>Purge Sealing</b>                    | Purge tubes and purge barb included   |
| <b>Accessory Dimensions (W X D X H)</b> | 177 x 92 x 162 mm (excludes clamp height and baseplate)   |
| <b>Jackfish Spectroelectrochemical</b>  |   |
| J1 Vessel Volume                        | 20 mL   |
| J2 Vessel Volume                        | 10 mL   |
| <b>Jackfish Spectroelectrochemical</b>  |   |
| Vessel Material                         | Polytetrafluoroethylene or PEEK   |
| <b>Spectroelectrochemical</b>           |   |
| Vessel Volume                           | 7.5 mL  |
| Vessel Dimensions                       | 25 mm tall, 25 mm dia tapering to 19 mm   |
| <b>Spectroelectrochemical</b>           |   |
| Vessel Material                         | Polytetrafluoroethylene or PEEK   |
| <b>FTIR Compatibility</b>               | Most, specify model and type  |

| PART NUMBER  | DESCRIPTION  |
|--|--|
| 013-11XX   | VeeMAX III Variable Angle Specular Reflectance Accessory Includes specular reflectance masks (2, 5/8 and 3/8"), gold substrate alignment mirror, purge tubes, purge kit and spectrometer base mount. |
| 013-12XX   | Automated VeeMAX III Includes controller, cabling, sample masks (2", 5/8" and 3/8"), gold substrate alignment mirror, FTIR base mount, and purge tubes   |
| <p><b>Note:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Automated VeeMAX III includes PIKE Technologies AutoPRO software and controller.</p>  |  |
| <p><b>Crystal Plates for VeeMAX III ATR (must select 1 or more for ATR)</b></p>  |  |
| 013-4021   | Flat Plate, ZnSe, 45°  |
| 013-4031   | Flat Plate, ZnSe, 60°  |
| 013-4041   | Flat Plate, Ge, 45°  |
| 013-4051   | Flat Plate, Ge, 60°  |
| 013-4061   | Flat Plate, Ge, 65°  |
| 013-4081   | Flat Plate, Si, 45°  |
| 013-4071   | Flat Plate, Si, 60°  |
| 013-4091   | Flat Plate, ZnS, 45°   |
| 013-4096   | Flat Plate, ZnS, 60°   |
| 013-3401   | Liquids Retainer for VeeMAX III ATR crystals   |
| 013-3501   | VeeMAX III ATR Flow Cell   |
| <p><b>Notes:</b> VeeMAX III Crystal Plates are pre-aligned and pinned-in-place. Changing crystal plates is easy and fast to optimize sampling results. ZnS crystal plate is excellent for deepest penetration of IR beam. If you need a crystal not listed here, please contact us. Flow cell and Liquids Retainer require High-Pressure Clamp. Reconditioning service for used VeeMAX crystal plates is available. Optional Crystal Plates for Heated VeeMAX III ATR.</p> |  |
| <p><b>Pressure Clamp for VeeMAX III (must select for solids, films or powder analysis)</b></p>   |  |
| 013-3101   | VeeMAX III ATR Pressure Clamp  |
| 025-3094   | 7.8-mm ATR Pressure Tip  |
| <p><b>Notes:</b> The pressure clamp is required for solids, films, coatings and powdered samples. The pressure clamp is supplied with 20-mm tip for solid samples. The 7.8-mm pressure tip is required for monolayers on silicon or small samples.</p>   |  |

| PART NUMBER  | DESCRIPTION                                  |
|--|--|
| <b>Heated Plates</b>   |  |
| 013-4121   | Heated Flat Plate, ZnSe, 45°                 |
| 013-4131   | Heated Flat Plate, ZnSe, 60°                 |
| 013-4141   | Heated Flat Plate, Ge, 45°                   |
| 013-4151   | Heated Flat Plate, Ge, 60°                   |
| 013-4161   | Heated Flat Plate, Ge, 65°                   |
| 013-4171   | Heated Flat Plate, Si, 60°                   |
| 013-4181   | Heated Flat Plate, Si, 45°                   |
| 013-4191   | Heated Flat Plate, ZnS, 45°                  |
| 013-4196   | Heated Flat Plate, ZnS, 60°                  |
| 076-1610   | Digital Temperature Control Module           |
| 007-0207   | PIKE TempPRO Software                        |
| <p><b>Notes:</b> Heated VeeMAX III crystal plates may be heated to 130 °C. Temperature control module selection is required for heated crystal plates. If PC control is desired TempPRO software must be purchased separately.</p>   |  |
| <b>VeeMAX III Sampling Options</b>   |  |
| 090-1000   | Manual Polarizer, ZnSe                       |
| 090-1200   | Manual Polarizer, KRS-5                      |
| 090-3000   | Precision Manual Polarizer, ZnSe             |
| 090-3200   | Precision Manual Polarizer, KRS-5            |
| 090-5000   | Precision Automated Polarizer, ZnSe, USB     |
| 090-5100   | Precision Automated Polarizer, KRS-5, USB    |
| 007-0300   | PIKECalc Software                            |
| <p><b>Notes:</b> PIKECalc software provides easy calculations of depth of penetration, effective angle of incidence and critical angle for ATR measurements. Other polarizer options are found in the polarization section of this catalog. Automated VeeMAX III and automated polarizer interface simultaneously.</p> |  |
| <b>Replacement Parts</b>   |  |
| 013-4010   | Mask Set for VeeMAX                          |
| 300-0002   | Gold Substrate Alignment Mirror, 1.25 x 3.0" |

| PART NUMBER   | DESCRIPTION                                   |
|---|---|
| <b>Spectroelectrochemical Configuration</b>   |   |
| 162-4709  | Jackfish SEC Cell J1F                         |
| 162-4714  | Jackfish SEC Cell J1W                         |
| 162-4719  | Jackfish SEC Combination Cell J1              |
| 162-4701  | Jackfish SEC Cell J2F                         |
| 162-4702  | Jackfish SEC Cell J2W                         |
| 162-4703  | Jackfish SEC Combination Cell J2              |
| 162-4814  | J1W, J2W Universal ATR Si elements (2)        |
| 162-4816  | J1W, J2W ATR-SEIRAS Optimized Si elements (2) |
| 160-5546  | ZnSe Crystal, 45°                             |
| 160-5550  | ZnSe Crystal, 60°                             |
| 160-5547  | Ge Crystal, 45°                               |
| 160-5551  | Ge Crystal, 60°                               |
| 160-5548  | Si Crystal, 45°                               |
| 160-5552  | Si Crystal, 60°                               |
| 160-5549  | ZnS Crystal, 45°                              |
| 160-5553  | ZnS Crystal, 60°                              |
| 160-5527  | CaF <sub>2</sub> Crystal, 60°                 |
| 160-1144  | CaF <sub>2</sub> Flat Window, 20-mm diameter  |
| 160-1304  | ZnSe Flat Window, 20-mm diameter              |
| 013-3300  | Electrochemical Cell, PTFE                    |
| 013-3370  | Electrochemical Cell, PEEK                    |
| 013-3402  | Heated Electrochemical Cell, PTFE             |
| 013-3320  | Flat Window Holder, Delrin™                   |
| 013-3345  | 45° Crystal Holder, Delrin                    |
| 013-3360  | 60° Crystal Holder, Delrin                    |
| 013-3374  | 45° Crystal Holder, PEEK                      |
| 013-3376  | 60° Crystal Holder, PEEK                      |
| 013-3445  | Heated 45° Crystal Holder                     |
| 013-3460  | Heated 60° Crystal Holder                     |
| <p><b>Notes:</b> The Jackfish SEC requires selection of the cell and a ATR crystal; for a full selection of Jackfish options including electrodes, see the Jackfish product datasheet. The PIKE electrochemical configuration requires electrochemical cell, crystal or window holder and VeeMAX III accessory. Must select one or more crystal or flat window. Choose a crystal holder to match the crystal angle. A flat window or CaF<sub>2</sub> crystal are used for specular reflectance sampling. Other window types for specular reflectance measurements may be found in our listing of transmission windows, 20 mm x 2 mm. The heated electrochemical cell requires the selection of a Digital Temperature Control Module. If PC control is desired TempPRO software must be purchased separately. Electrodes for the PIKE electrochemical cell are supplied by the end-user.</p> |   |

# Jackfish Electrochemical Cells

## AT A GLANCE

- ▶ Cells construction materials compatible with organic solvents and acidic/basic media
- ▶ Reliable electrical contact with metal thin-film electrode
- ▶ Easy installation on the VeeMAX III ATR accessory
- ▶ Two ATR crystal geometries available to accommodate VeeMAX ATR crystals or ATR Si wafers

Jackfish spectroelectrochemical cells (SEC) are designed for surface-sensitive FTIR spectroelectrochemistry using the attenuated total reflectance surface-enhanced infrared spectroscopy (ATR-SEIRAS) technique.

The Jackfish cells enable fundamental studies of the electrified metal-solution interface and have applications in molecular self-assembly, interfacial sensing, and next-generation energy solutions. High-quality IR spectra can be obtained from sub-monolayer amounts of adsorbed molecules. By controlling the electrical potential applied to the metal thin film electrode on the ATR crystal surface, the user can perform vibrational characterization of potential-dependent changes at the interface.

## THE JACKFISH DESIGN

### CELL DESIGN

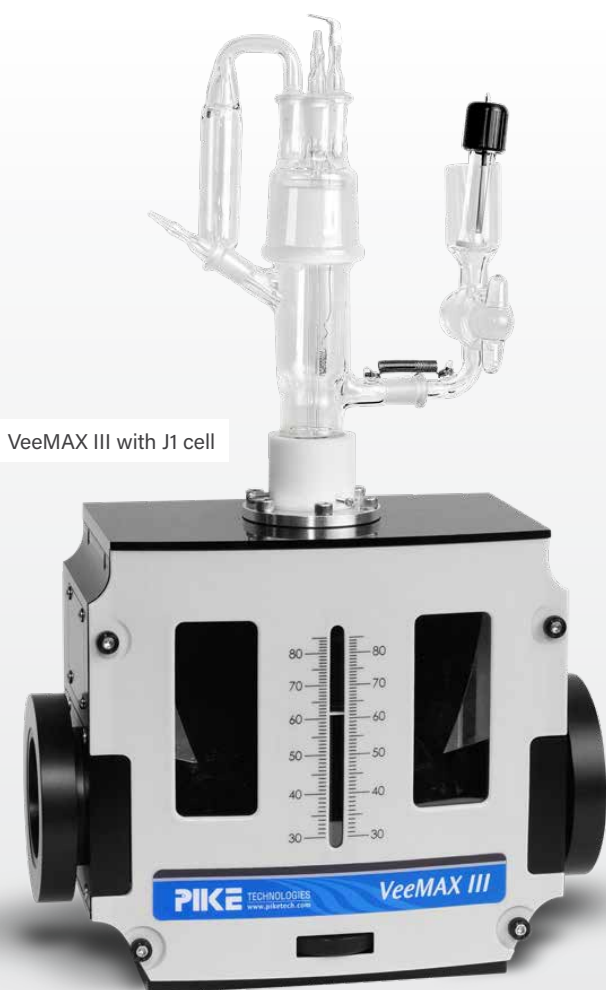
Two cell models are available, J1 and J2. Both are fully compatible with the PIKE VeeMAX III variable angle ATR sampling accessory, and are constructed from highly chemical-resistant polyether ether ketone (PEEK) and glass for a broad range of aqueous or organic solution conditions.

#### J1

The J1 uses ground glass joints designed for use with aqueous electrolytes and offers a reference arm separated with a stopcock, which acts as a salt bridge preventing migration of the reference electrode filling solution into the cell body. There are three ports at the top of the cell and side ports for a reference electrode arm and a short bubbler. Typical uses of the ports are to support the counter electrode, and to accommodate glass bubblers and an exhaust gas trap. The long glass bubbler allows sparging of the solution volume with inert gas to remove atmospheric oxygen, enabling high-quality electrochemistry and ensuring stability of the thin film electrode. The short gas bubbler is used to create an inert atmosphere above the electrolyte. The minimum cell volume for the J1 is 20 mL.

#### J2

The J2 offers a simple sealed design compatible with volatile solvents, where the electrodes are inserted directly into the cell in close proximity to the working electrode, reducing the impedance to the reference electrode. With a compression-style fitting, the J2 accepts reference electrodes having diameters between 5 and 7 mm. The completely sealed design can be used with Schlenk techniques or in a glovebox. The minimum cell volume for the J2 is 10 mL.



The Jackfish cell designs make connecting with the metal thin film electrode easy. The PEEK reservoir has embedded spring-loaded pins, which contact the metal thin film electrode outside of the solution. This innovative design maintains superior electrical contact over long experiments without degrading the thin film electrode.

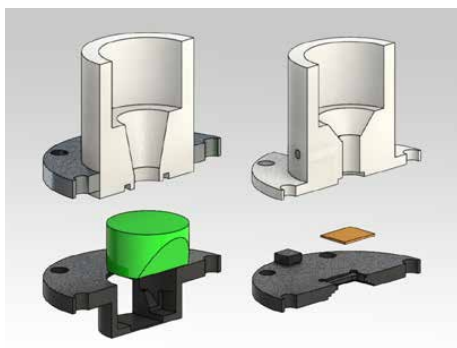


The Jackfish J2 model

### ATR ELEMENTS

Two ATR element geometries are available for maximum flexibility. The J1F and J2F models are designed around the PIKE face-angled crystals (FAC). In a previous study investigating the adsorption of a pyridine derivative, the spectral response was two times stronger when using a Si 60 degree FAC compared to a Si hemisphere with an angle of incidence of 65 degrees. The FAC exhibited higher energy throughput and lower spectral noise above the long-wavelength cutoff.

The J1W and J2W models accommodate an IRUBIS GmbH microgrooved Si ATR wafer. The shorter pathlength (relative to a FAC or hemisphere), of the beam through the wafer mitigates losses due to Si phonon absorption, allowing the user complete access to the fingerprint and far-IR spectral regions. Additionally, wafers are inexpensive and can be recycled or disposed. Two wafer designs are available. The ATR-SEIRAS optimized wafer has an angle of incidence of 55 degrees, and is typically used for direct thin film deposit onto the Si wafer. The universal wafer has an angle of incidence of 35 degrees and provides a robust and strongly enhancing surfaces for hybrid films formed by electrodepositing metal island layers on conductive metal oxide films.

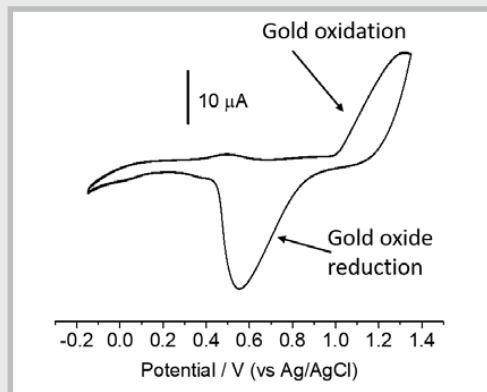


Left: Jackfish model J1F/J2F.  
Right: Jackfish model J1W/J2W.

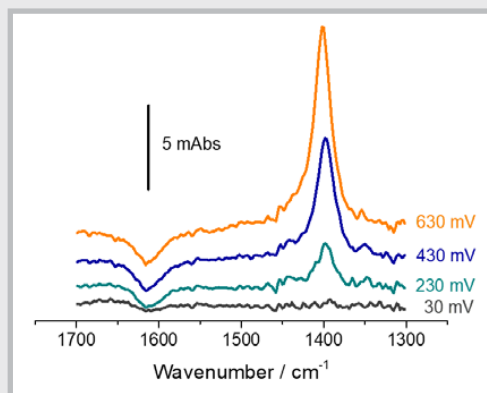
## APPLICATION

Attenuated total reflection surface enhanced infrared spectroscopy (ATR-SEIRAS) has emerged as an alternative to external reflection based IR spectroelectrochemistry, and has been shown to be a powerful, highly surface-sensitive tool for the analysis of molecules present at electrode surfaces.

The ATR-SEIRAS method has seen increasing popularity in small molecule catalysis, particularly adept at elucidating mechanistic details concerning  $\text{CO}_2$  electroreduction.



A typical CV of gold electropolishing using acetate buffer, using 100 mM acetate at pH 3.6 and a 20 mV/sec scan rate and Ag/AgCl reference electrode.



Potential dependence of symmetric  $\text{COO}^-$  stretching of adsorbed acetate on clean gold surface after electropolishing procedure. Absorbance spectrum for 630 mV, 430 mV, 230 mV, and 30 mV (vs Ag/AgCl) are all referenced to -100 mV (vs Ag/AgCl).

## BACKGROUND

Jackfish SEC was founded in 2018 in Saskatoon, Canada by electrochemists at the University of Saskatchewan. The team has spent 10 years designing, innovating and testing spectroelectrochemical cells for attenuated total reflectance surface-enhanced infrared spectroscopy (ATR-SEIRAS). A decade of experiment-based design improvements has led to an innovative and commercially available ATR-SEIRAS cell design. Jackfish SEC is dedicated to making advanced infrared spectroelectrochemical technology easily accessible to new users with off-the-shelf solutions that allow you to easily equip your laboratory with ATR-SEIRAS capabilities.

## SELECTED REFERENCES

**Optimization of a Commercial Variable Angle Accessory for Entry Level Users of Electrochemical Attenuated Total Reflection Surface Enhanced Infrared Absorption Spectroscopy (ATR-SEIRAS).** Applied Spectroscopy. 2019; 73(12), 1394-1402.

**Hybrid Gold–Conductive Metal Oxide Films for Attenuated Total Reflectance Surface Enhanced Infrared Absorption Spectroscopy.** ACS Applied Nano Materials. 2019; 2, 1274.

**Electrochemical ATR-SEIRAS Using Low-Cost, Micromachined Si Wafers.** Analytical Chemistry. 2017; 89, 11818–11824.

**Surface Enhanced Infrared Studies of 4-Methoxypyridine Adsorption on Gold Film Electrodes.** Langmuir. 2016; 32, 2184-2191.

**Charge Transfer and SEIRAS Studies of 1,4-Benzoquinone Functionalized Mixed Monothiol/Dithiol Self Assembled Monolayers.** Electrochimica Acta. 2011; 56, 4361-4368.

**Surface Enhanced Infrared Absorption Spectroscopy Studies of DMAP Adsorption on Gold Surfaces.** Langmuir. 2009; 25, 2241-2247.

**Electrodeposited Gold Nanodaggers on Conductive Metal Oxide Films Provide Substrates for Dual-Modality Surface Sensitive Vibrational Spectroscopy.** Journal of Physical Chemistry C. 2020; 124, 13356-13364.

**Microsecond Resolved Infrared Spectroelectrochemistry Using Dual Frequency Comb IR Lasers.** Analytical Chemistry. 2020; 92, 6241-6244.

| PART NUMBER  | DESCRIPTION  |
|--|--|
| 162-4709   | Jackfish SEC Cell J1F  |
| 162-4714   | Jackfish SEC Cell J1W  |
| 162-4719   | Jackfish SEC Combination Cell J1   |
| 162-4701   | Jackfish SEC Cell J2F  |
| 162-4702   | Jackfish SEC Cell J2W  |
| 162-4703   | Jackfish SEC Combination Cell J2   |
| 013-11XX   | VeeMAX III Variable Angle Specular Reflectance Accessory Includes specular reflectance masks (2, 5/8" and 3/8"), purge tubes, purge kit and spectrometer base mount. |
| 013-13XX   | VeeMAX III Laser   |
| <p><b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. The VeeMAX III is required for use of the Jackfish SEC Cell. The SEC Combination Cell is compatible with standard VeeMAX face-angled crystals or Si wafer elements. SEC cell base is PEEK; PTFE configurations are available upon request. The J2 models include a Ag/AgCl reference electrode. The VeeMAX III Laser accessory is designed for instruments having a collimated beam.</p> |  |
| <b>Crystal Options (choose at least one)</b>   |  |
| 160-5552   | Si FAC Crystal, 60°  |
| 160-5550   | ZnSe FAC Crystal, 60°  |
| 160-5551   | Ge FAC Crystal, 60°  |
| 162-4814   | J1W, J2W Universal ATR Si elements (2)   |
| 162-4816   | J1W, J2W ATR-SEIRAS Optimized Si elements (2)  |
| <p><b>Notes:</b> The 60° Si crystal is the user preferred option. The J1W and J2W cells are compatible with 162-4814 and 162-4816. See VeeMAX III with ATR for other crystal options.</p>  |  |
| <b>Electrodes</b>  |  |
| 162-4720   | J1 Platinum Counter Electrode  |
| 162-4722   | J1 Gold Counter Electrode  |
| 162-4723   | J1 Ag/AgCl Reference Electrode   |
| 162-4768   | J2 Platinum Counter Electrode  |
| 162-4767   | J2 Gold Counter Electrode  |
| 162-4769   | J2 Ag/AgCl Ref Electrode   |
| <p><b>Note:</b> The Platinum Counter Electrode and Ag/AgCl Reference Electrode are user-preferred options. J2 model includes a Ag/AgCl reference electrode.</p>  |  |
| <b>Replacement Parts and Options</b>   |  |
| 162-4724   | J1F/J2F Lower Viton® O-ring  |
| 162-4725   | J1W/J2W Lower Viton® O-ring  |
| 162-4726   | Upper Viton O-ring   |
| 162-4728   | J1F/J2F Lower Perfluoroelastomer O-ring  |
| 162-4729   | J1W/J2W Lower Perfluoroelastomer O-ring  |
| 162-4730   | Upper Perfluoroelastomer O-ring  |
| 162-4732   | Electroless Deposition Fixture   |
| <p><b>Note:</b> Please contact PIKE Technologies for parts not found here.</p>   |  |



Long bubbler.

Exhaust gas trap.

Counter electrode.

Reference electrode.

Short bubbler.

80

# AutoATR

## AT A GLANCE

- ▶ Complete hardware and software package for automated ATR analysis
- ▶ Up to 24 unique ATR measurements in a single run
- ▶ Spectra comparable to a single reflection ZnSe or diamond ATR
- ▶ Removable and replaceable ATR elements
- ▶ Fully enclosed, purgeable design with front-loading tray
- ▶ In-compartment mounting, compatible with most FTIR spectrometers



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE

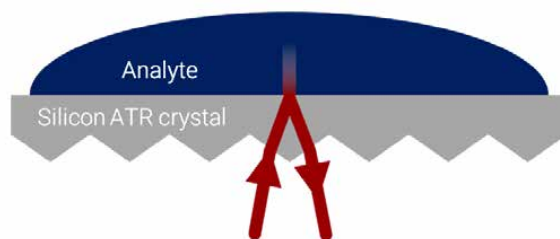
The AutoATR enables 24 unique ATR measurements to be conducted within one run. It is designed for the analysis of liquids, gels, pastes, casted films and more.

## ENHANCED PRODUCTIVITY

Through automated sampling, lab efficiency may be increased. The AutoATR, with its capability of collecting multiple ATR spectra within a single run, makes this accessory ideal for the high-throughput lab conducting routine measurements, and requiring the quick development of IR calibrations. It may also be used in large-scale studies (e.g. biology, medical, pharmaceutical and food).

## SILICON ATR ELEMENT

The ATR crystal is made of 500- $\mu\text{m}$  thick silicon, functionalized with multiple microprisms, which couples the light into the crystal. With its thin profile, the Si wafer offers an ideal multipurpose ATR element. The wafer offers a full spectral range spanning 4000–450  $\text{cm}^{-1}$ , and has an inert sampling surface suitable for use with substances having a pH between 1-12. The resulting absorbance band strength is comparable to those obtained with a standard diamond ATR.



IRUBIS Si ATR crystal.

Each sampling plate consists of up to 24 individual and removable Si ATR elements. The elements allow users to prepare samples while analyzing others. Additionally, the silicon sampling surface may be functionalized outside the microplate, and prepared samples may be stored.

## OPTICAL AND MECHANICAL DESIGN

The AutoATR is designed to fit into the sample compartment of most FTIR spectrometers.

Its X,Y tray moves to a position outside the accessory for easy loading and unloading of samples. The stage is driven by precision motors for speed and reproducibility. The accessory's optics are fully enclosed for easy purging.





## OPTICAL DESIGN

The AutoATR's optical design is based upon a precision ellipsoidal reflector, which has been diamond turned for optimal performance. The efficiency of the AutoATR's optics in combination with the unique Si ATR element results in exceptional throughput and reproducibility. Thus, high-quality spectra may be collected quickly.



AutoATR Si Element.

## AUTOPRO SOFTWARE

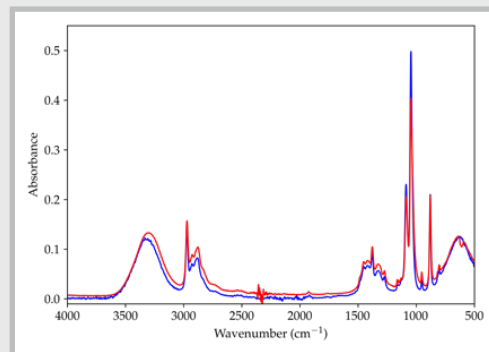
The AutoATR control software, AutoPRO, plays an integral role in its usability and value. Data collection is enabled through communication with most FTIR software programs. It allows for traceability by facilitating multiple users, and importing sample descriptions via a text file.

### SPECIFICATIONS

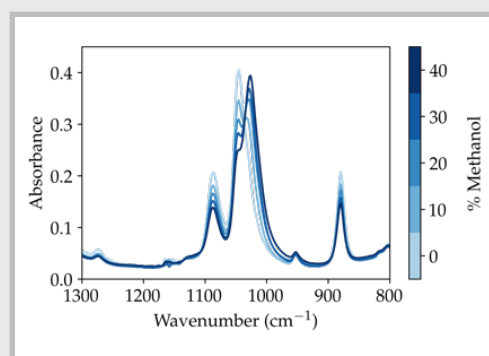
|                                  |  |
|----------------------------------|--|
| <b>Optics</b>                    | Elliptical – 3X beam demagnification           |
| <b>Accuracy</b>                  | +/- 25 $\mu\text{m}$                           |
| <b>Mechanical Specifications</b> |  |
| Repeatability                    | +/- 5 $\mu\text{m}$                            |
| Resolution                       | 1 $\mu\text{m}$                                |
| Minimum Run Time                 | Time is spectrometer and application dependent |
| <b>Computer Interface</b>        | USB  |
| <b>Dimensions (W X D X H)</b>    | 159 x 330 x 172 mm                             |
| <b>Weight</b>                    | 4.5 kg   |

## APPLICATION

The AutoATR allows for up to 24-samples to be collected in a single run. It is suitable for liquids, gels, pastes and casted films. Spectral results are similar to a single reflection diamond ATR.



**Ethanol spectra** collected using the AutoATR (red) and a single reflection diamond ATR (blue).



**Methanol in ethanol (%v/v) spectra**, collected with the AutoATR.

| PART NUMBER   | DESCRIPTION   |
|---|---|
| 047-25XX  | AutoATR<br>Includes AutoPRO software, 24-well ATR plate with ATR elements, purge tubes and spectrometer mount |
| <b>Note:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. |   |
| Replacement Parts and Options   |   |
| 162-4810  | AutoATR 24-well Plate with ATR Elements   |
| 162-4812  | AutoATR 12-well Plate with ATR Elements   |
| 162-4814  | AutoATR Replacement ATR Elements (2 ea.)  |

# JetStream

## AT A GLANCE

- ▶ ATR design for static and flowing liquid measurements
- ▶ Small sample chamber provides efficient sampling
- ▶ ZnSe and Ge crystal options available
- ▶ Suitable for qualitative and quantitative applications
- ▶ Temperature control option up to 200 °C
- ▶ Pressures up to 1500 psi



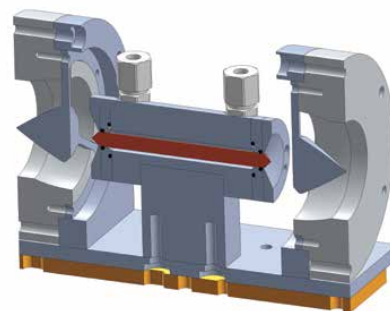
TEMPERATURE CONTROL  
OPTIONS AVAILABLE

A multiple reflection ATR for high pressure measurements where measurement sensitivity is required.

## PERFORMANCE AND DESIGN

The JetStream design revolves around a cylindrical ATR crystal that is encased in a heavy-duty stainless steel body. The maximum pressure rating is 1500 psi and the volume of the sample chamber is 1.3 mL. Samples, introduced through a compression fitting, completely surround the multiple reflection ATR crystal. This provides efficient sampling for excellent reproducibility and sufficient throughput for high sensitivity measurements.

The compact cell design employs a pair of transfer optics to direct the infrared beam to one end of an IR transmitting ATR crystal. A similar pair of optics directs the beam emitted from the other end of the ATR crystal to the spectrometer detector.



Optical diagram of the JetStream ATR.

## THE ATR ELEMENT

The ATR crystal for the JetStream accessory is a Ge or ZnSe cylinder, 82 mm in length and 6.4 mm in diameter. To optimize accessory performance, crystal geometry has been carefully chosen. The design of the JetStream provides 12 reflections of the IR beam along the crystal surface.

## HEATING OPTIONS

Heating up to 200 °C may be realized with the heated JetStream base. The Digital Temperature Controller offers touch-screen operation, and may be used with TempPRO software. Ramps and hold times are easily programmed through TempPRO software. Data collection may be initiated as a function of time or temperature with most FTIR spectrometers.



## SPECIFICATIONS

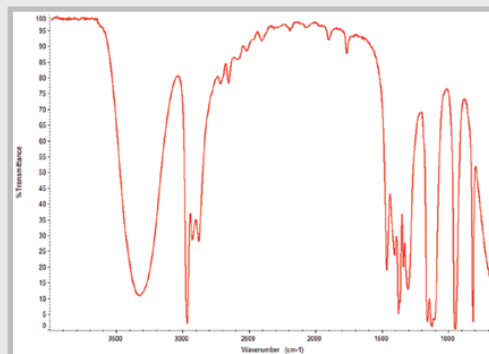
|  |  |
|--|--|
| <b>Cell Body</b>                           | 316 Stainless Steel  |
| <b>ATR Crystals</b>                        | ZnSe or Ge   |
| <b>Crystal Size</b><br>(L X Dia)           | 82 mm x 6.4 mm   |
| <b>Crystal Face Angle</b>                  | 45°  |
| <b>Number Of Reflections</b>               | 12   |
| <b>Cell Volume</b>                         | 1.3 mL   |
| <b>Liquid Connectors</b>                   | 316 Stainless Steel Swagelok®  |
| <b>Maximum Pressure</b>                    | 1500 psi   |
| <b>Heating Options</b>                     | Ambient to 200 °C maximum  |
| <b>Accuracy</b>                            | +/- 0.5° up to 100 °C  |
| <b>Sensor Type</b>                         | +/- 0.5% of set point > 100 °C<br>3 wire Pt RTD (low drift, high stability)  |
| <b>Temperature Control</b>                 | Touch-panel display with USB interface. PIKE TempPRO software for PC control with unlimited ramps and automated data collection. |
| <b>Input</b>                               | 100–240 VAC, auto setting, external power supply   |
| <b>Output</b>                              | 3 A/24 VDC/75 W maximum  |
| <b>Accessory Dimensions</b><br>(W X D X H) | 153 x 100 x 108 mm<br>(excludes FTIR baseplate and mount)  |
| <b>FTIR Compatibility</b>                  | Most, specify model and type   |



Heated JetStream accessory.

## APPLICATION

The JetStream is ideal for applications requiring additional sensitivity offered by a multiple reflection ATR and requires high pressure operation. Temperature control is available.



Isopropanol spectrum collected using the JetStream with ZnSe crystal.

| PART NUMBER | DESCRIPTION  |
|-------------|--|
|             | Base Optics ( <i>must select one</i> )   |
| 020-19XX    | JetStream ATR Base Optics Assembly   |
| 020-18XX    | Heated JetStream ATR Base Optics Assembly  |
|             | <b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Choose a temperature controller below for the Heated JetStream. ¼ inch compression fittings are supplied. Contact us for other fitting sizes. |
|             | ATR Crystals for JetStream ( <i>must select one or more</i> )  |
| 160-5578    | ZnSe Rod   |
| 160-5579    | Ge Rod   |
|             | <b>Note:</b> Ge becomes opaque near 100 °C.  |
|             | Temperature Controller for JetStream   |
| 076-1610    | Digital Temperature Control Module   |
| 007-0207    | PIKE TempPRO Software  |
|             | <b>Notes:</b> PIKE TempPRO software (sold separately) can be used for graphical setup and automated data collection for thermal experiments. TempPRO is compatible with most FTIR spectrometers.   |
|             | Replacement Parts  |
| 020-3040    | EPDM Crystal O-Rings, 120 °C max (2 ea.)   |
| 020-3041    | EPDM Housing O-Rings, 120 °C max (2 ea.)   |
| 020-3045    | Perfluoroelastomer Crystal O-Rings (2 ea.)   |
| 020-3046    | Perfluoroelastomer Housing O-Rings (2 ea.)   |

# Classic VATR

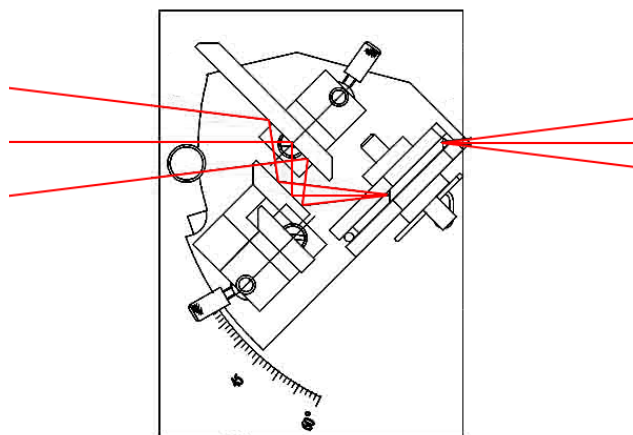
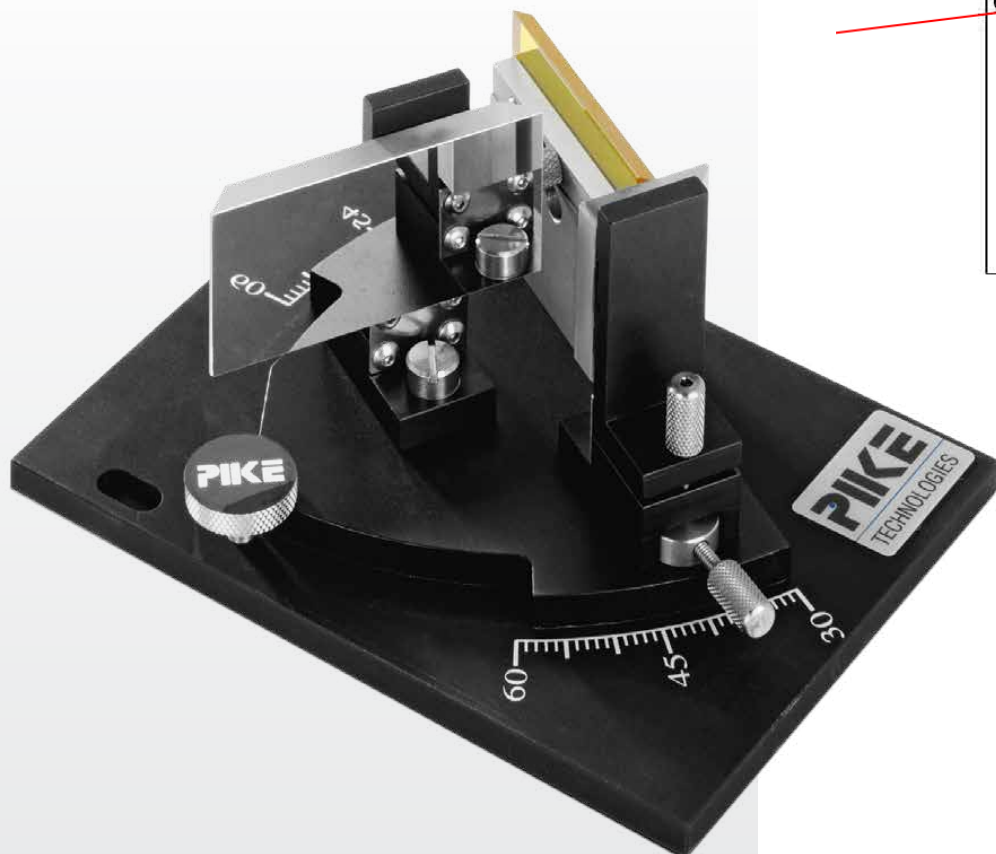
## FEATURES

- ▶ 30 to 60-degree variable angle of incidence
- ▶ Full control over the number of reflections and depth of penetration
- ▶ Unique mechanism for fine-tuning mirror positions and precise, repeatable alignment
- ▶ High energy throughput
- ▶ Stainless steel, easy-to-remove crystal mounts and anvils
- ▶ Economical introduction to ATR techniques

Variable Angle ATR for analysis of solids, films and coatings. VATR is an excellent, low-cost tool for teaching the principles of internal reflection spectroscopy, and for basic research.

The Variable Angle ATR is a traditional in-compartment accessory with the ATR crystal mounted vertically with respect to the spectrometer baseplate. Its optical layout is based on an optimized Gilby configuration and allows continuous adjustment of the incident beam angle between 30 to 60 degrees.

This accessory is suitable for the analysis of solids, films and coatings, but it cannot be used for working with liquids. For enhanced sensitivity the sample may be mounted on both sides of the crystal. A unique mirror adjustment mechanism that utilizes mirror placement and proportional pivoting allows precise and repeatable alignment. PIKE Technologies' Variable Angle ATR offers flexibility when the frequent replacement of ATR crystals is required.



VATR optical layout.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 021-19XX    | VATR Variable Angle, Vertical ATR   |
|             | <b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. VATR Base Optics includes plate for mounting in FTIR spectrometer slide mount. |

Crystal Options for VATR (*must select 1 or more*)

| P/N 50 mm | P/N 25 mm | Description              |
|-----------|-----------|--------------------------|
| 160-5528  | 160-5530  | KRS-5, 45° Parallelogram |
| 160-5529  | 160-5531  | KRS-5, 60° Parallelogram |
| 160-5532  | 160-5533  | ZnSe, 45° Parallelogram  |
| 160-5543  | 160-5540  | ZnSe, 60° Parallelogram  |
| 160-5541  | 160-5538  | Ge, 30° Parallelogram    |
| 160-5534  | 160-5536  | Ge, 45° Parallelogram    |
| 160-5535  | 160-5537  | Ge, 60° Parallelogram    |
| 160-5544  | 160-5539  | Si, 45° Parallelogram    |

**Notes:** VATR crystals are available in lengths of 25 and 50 mm. All are 3-mm thick and 10-mm wide. Select crystal length and type based upon desired sample absorbance and spectral range.

| PART NUMBER | DESCRIPTION  |
|-------------|--|
|             | Crystal Holder and Clamp for VATR ( <i>must select 1 or more</i> ) |
| 021-5050    | 50-mm VATR Crystal Holder and Clamp                                |
| 021-5020    | 25-mm VATR Crystal Holder, Clamp and Mirror                        |

**Note:** The pressure clamp is selected for the ATR crystal length.

VATR Replacement Parts

|          |                                     |
|----------|-------------------------------------|
| 021-5040 | 25-mm VATR Crystal Holder and Clamp |
| 021-5030 | Set of 25-mm and 50-mm Pads         |

**Note:** Please contact PIKE Technologies for items not described in this list.



VATR with KRS-5 crystal.

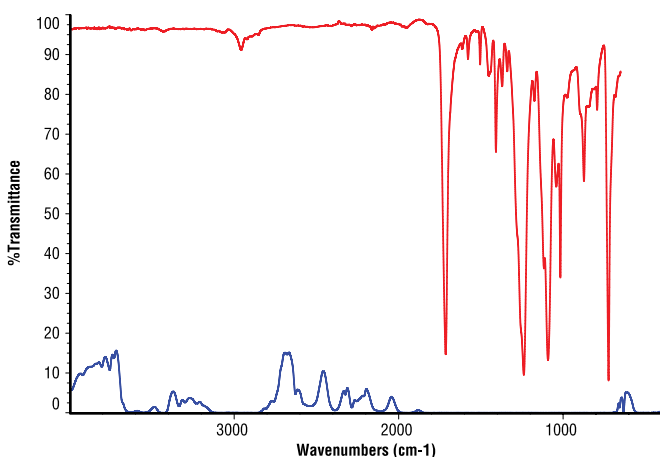
# ATR

## Theory and Applications

Attenuated Total Reflectance (ATR) is the most widely used FTIR sampling tool. ATR generally allows qualitative or quantitative analysis of samples with little to no sample preparation, which greatly speeds sample analysis.

The main benefit of ATR sampling comes from the very thin sampling pathlength and depth of penetration of the IR beam into the sample. This is in contrast to traditional FTIR sampling by transmission where the sample must be diluted with IR transparent salt, pressed into a pellet or pressed to a thin film, prior to analysis to prevent totally absorbing bands in the infrared spectrum.

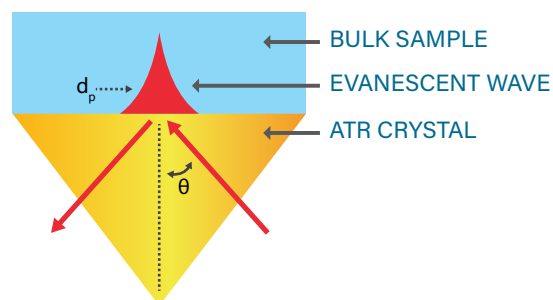
A comparison of transmission versus ATR sampling results of a thick polymer sample is shown below where the sample is too thick for high-quality transmission analysis (blue spectrum). In transmission spectroscopy, the IR beam passes through the sample and the effective pathlength is determined by the thickness of the sample and its orientation to the directional plane of the IR beam. In the example below, the sample is too thick for transmission analysis because most of the IR bands are totally absorbing. However, simply placing the thick sample on the ATR diamond crystal (e.g. IRIS, MIRacle, GladiATR) and applying pressure generates a nearly perfect result (red spectrum) – identified by a library search as a polybutylene terephthalate. The total analysis time for the thick polymer by ATR was less than 1 minute.



ATR and transmission spectra of a thick polymer sample.

### HOW ATR WORKS

With ATR sampling the IR beam is directed into a crystal of relatively higher refractive index. The IR beam reflects from the internal surface of the crystal and creates an evanescent wave, which projects orthogonally into the sample in intimate contact with the ATR crystal. Some of the energy of the evanescent wave is absorbed by the sample and the reflected radiation is returned to the detector. This ATR phenomenon is shown graphically in the following representation of a single reflection ATR.



Single Reflection ATR

While the analysis of samples by ATR is easy, it is interesting and useful to be aware of each of the following experimental factors and how they affect the final spectrum:

- ▶ Refractive indices of the ATR crystal and the sample
- ▶ Angle of incidence of the IR beam
- ▶ Critical angle
- ▶ Depth of penetration
- ▶ Wavelength of the IR beam
- ▶ Effective pathlength
- ▶ Number of reflections
- ▶ Quality of the sample contact with ATR crystal
- ▶ ATR crystal characteristics

### CRITICAL ANGLE

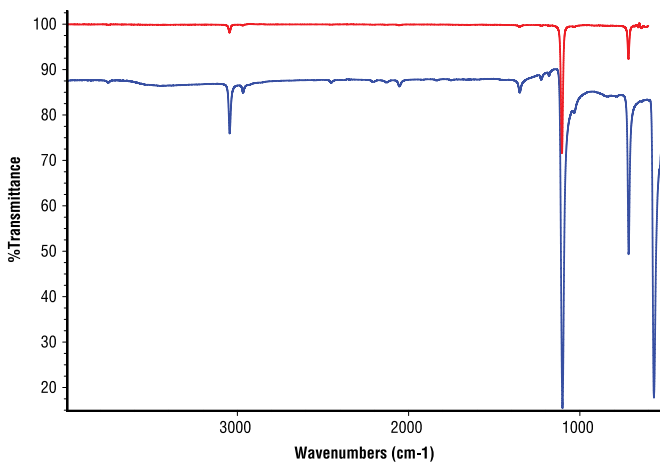
The refractive indices of the crystal and sample are important considerations in the ATR sampling technique by virtue of the following equation:

$$\theta_c = \sin^{-1}\left(\frac{n_2}{n_1}\right)$$

where  $\theta_c$  is the critical angle,  $n_2$  is the refractive index of the sample and  $n_1$  is the refractive index of the crystal.

When the angle of incidence exceeds the critical angle, a purely ATR spectral result is observed. If the critical angle is not met, a combined ATR and external reflectance result is observed. This occurs if the angle of incidence of the IR beam is too low, if the refractive index of the crystal is too

low, if the refractive index of the sample is too high or a combination of these three factors. In most cases this problem is not observed; however, an example of this is shown in the following spectral data. The sample is a high refractive index liquid ( $n_1=1.8$ ) run on a 45-degree accessory using diamond and Ge crystal plates. The spectrum run on the Ge crystal plate exhibits a normal baseline and symmetric absorbance bands—critical angle is met. The spectrum run on the diamond crystal plate has a baseline shifted and asymmetric absorbance bands due to non-adherence to the critical angle requirements for this set of analysis parameters.



Spectra of high refractive index liquid collected using Ge (red) and diamond (blue) ATR crystals.

Another way to correct the spectral artifacts in the high refractive index sample spectrum would be to increase the angle of incidence in the ATR accessory to a value above the critical angle. Adjustment or selection of the angle of incidence is available in several of the PIKE Technologies ATR accessories.

### DEPTH OF PENETRATION

Further useful consideration for ATR analysis is the depth of penetration ( $d_p$ ) of the IR beam into the sample. Technically, this is defined as the distance required for the electric field amplitude to fall to  $e^{-1}$  of its value at the surface and is defined as:

$$d_p = \frac{\lambda_1}{2\pi\sqrt{\sin^2\theta - n_{21}^2}} \quad \text{and} \quad n_{21} = n_2/n_1$$

where  $\lambda$  is the wavelength of light,  $\lambda_1 = \lambda/n_1$ , and  $\theta$  is the angle of incidence of the IR beam relative to a perpendicular from the surface of the crystal. Typical depth of penetration in ATR ranges from about 0.5 microns up to about 5 microns depending upon these experimental conditions. Shown in the graphical representation of the ATR phenomenon, the strength of the evanescent wave decays rapidly as we progress from the surface of the ATR crystal.

### EFFECTIVE PENETRATION

To compare the sample absorbance of the ATR measurement with that of a transmission measurement, we need to calculate the volume of the evanescent wave, known as the effective penetration of the IR beam. The effective penetration ( $d_e$ ), is unique for parallel polarization ( $d_{e\parallel}$ ) and perpendicular polarization ( $d_{e\perp}$ ) and these are defined by:

$$d_{e\perp} = \frac{n_{21}\lambda_1 \cos\theta}{\pi(1 - n_{21}^2)\sqrt{\sin^2\theta - n_{21}^2}}$$

$$d_{e\parallel} = \frac{n_{21}\lambda_1 \cos\theta (2\sin^2\theta - n_{21}^2)}{\pi(1 - n_{21}^2)[(1 + n_{21}^2)\sin^2\theta - n_{21}^2]\sqrt{\sin^2\theta - n_{21}^2}}$$

The effective penetration for an unpolarized IR beam is the average of the parallel and perpendicular penetration.

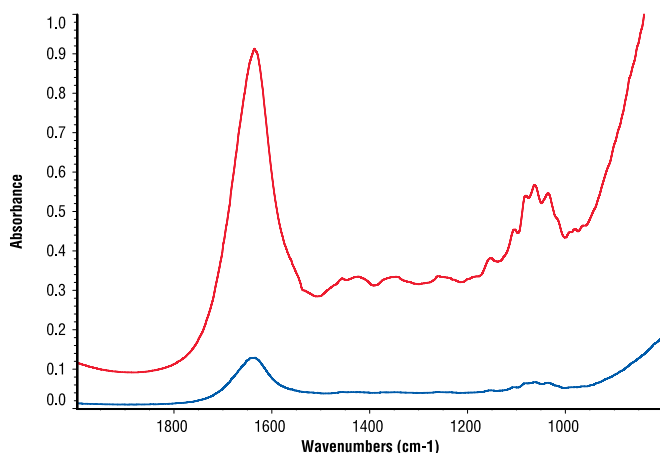
$$d_e = \frac{(d_{e\perp} + d_{e\parallel})}{2}$$

### MULTIPLE REFLECTION ATR

Generally, a single reflection ATR is ideal for qualitative analysis, "what is my sample?" When we need to look at minor components of a sample for qualitative or quantitative analysis, then we need to increase the effective pathlength (EPL) by increasing the number of reflections ( $N$ ) within the ATR crystal. The effective pathlength in ATR is defined by the following equation, where  $N$  = number of reflections on the sample.

$$EPL = N \times d_e$$

An example of the benefit of increased number of reflections is shown in the following spectral data for the analysis of carbohydrate content in a soft drink sample. The red spectrum is collected using a 10-reflection HATR accessory. The blue spectrum is run using a single-reflection ATR using an identical scaling factor. Clearly the minor carbohydrate bands are more readily apparent in the multi-reflection ATR accessory.



Soft drink sample using 10-reflection (red) and 1-reflection (blue) ATR.

**TABLE 1: PATHLENGTHS AND PENETRATION DEPTH (IN MICRONS), AND ATR CRYSTALS AT VARIOUS ANGLES OF INCIDENCE (IN DEGREES) AND NUMBERS OF REFLECTIONS.**

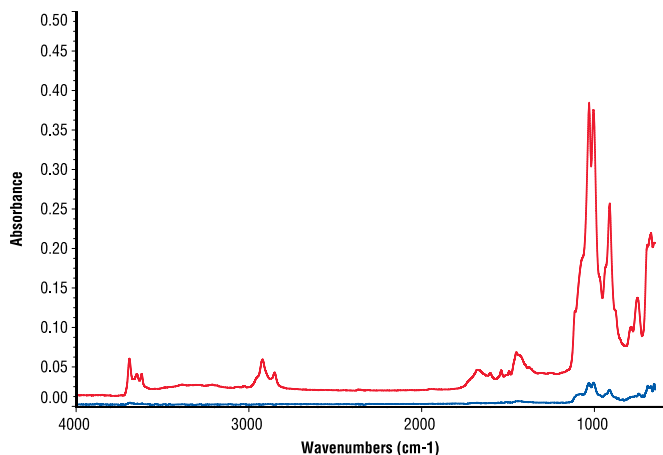
| ATR Sampling for $n_2 = 1.5$<br>$\lambda = 1000 \text{ cm}^{-1}$ |    | ZnSe, Diamond<br>$n_1 = 2.4$<br>$\theta_c = 38.7^\circ$ |       |       | AMTIR<br>$n_1 = 2.5$<br>$\theta_c = 36.9^\circ$ |       |       | Ge<br>$n_1 = 4.0$<br>$\theta_c = 22.0^\circ$ |       |       |
|--|----|---|-------|-------|---|-------|-------|--|-------|-------|
| $\theta$   | N  | $d_p$   | $d_e$ | EPL   | $d_p$   | $d_e$ | EPL   | $d_p$  | $d_e$ | EPL   |
| 45   | 1  | 2.00  | 4.36  | 4.36  | 1.70  | 3.38  | 3.38  | 0.66   | 0.61  | 0.61  |
| 45   | 3  | 2.00  | 4.36  | 13.08 | 1.70  | 3.38  | 10.15 | 0.66   | 0.61  | 1.84  |
| 45   | 10 | 2.00  | 4.36  | 43.60 | 1.70  | 3.38  | 33.84 | 0.66   | 0.61  | 6.14  |
| 30   | 1  | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   | 1.2  | 1.59  | 1.59  |
| 30   | 3  | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   | 1.2  | 1.59  | 4.76  |
| 30   | 10 | N/A   | N/A   | N/A   | N/A   | N/A   | N/A   | 1.2  | 1.59  | 15.85 |
| 60   | 1  | 1.11  | 1.53  | 1.53  | 1.02  | 1.30  | 1.30  | 0.51   | 0.32  | 0.32  |
| 60   | 3  | 1.11  | 1.53  | 4.59  | 1.02  | 1.30  | 3.91  | 0.51   | 0.32  | 0.97  |
| 60   | 10 | 1.11  | 1.53  | 15.32 | 1.02  | 1.30  | 13.03 | 0.51   | 0.32  | 3.23  |

Note: N/A indicates critical angle is violated.

For your convenience we have calculated theoretical values of depth of penetration, effective penetration, and effective pathlength for typical combinations of crystal materials, angles of incidence, and number of reflections (Table 1).

### SAMPLE CONTACT WITH ATR ELEMENT

With the thin penetration of the evanescent wave into the sample, intimate contact must be made between the sample and the surface of the ATR crystal. For liquid or pliable samples, quality of sample contact with the ATR crystal is generally not a problem. For rigid, irregular-shaped or porous samples, high pressure sufficient to deform the sample will increase the extent of sample contact and thereby increase sample absorbance. This is shown in the following spectral data collected for a porous foam polymer using a MIRacle ATR with ZnSe crystal.



Porous foam sample with high pressure (red) and low pressure (blue).

The blue spectrum was collected with low pressure applied to the foam sample, whereas the red spectrum is produced with high pressure. The ATR absorbance using high pressure is about 10 times greater than with low pressure—all other sampling factors are identical. For rigid, crystalline, or hard, irregular surface samples we recommend a single reflection diamond ATR because it is easy to apply high pressure onto the small crystal (1.8 mm diameter) with the high-pressure clamp, producing over 10,000 psi.

### ATR CRYSTAL PROPERTIES

The selection of the ATR crystal characteristics should be matched to the type of samples we run. Selection can be made to control depth of penetration of the IR beam, for hardness to prevent crystal damage, for desired spectral range and for acceptable pH range for acid or caustic samples. No individual crystal type will match all applications, so PIKE Technologies offers a broad range of choices for ATR. Table 2 will give you some guidelines for selection of your ATR crystal.

**TABLE 2: ATR CRYSTAL CHARACTERISTICS FOR FTIR SAMPLING.**

| Crystal   | $n_1$ | $d_p$<br>microns | Solubility<br>g/100 g | pH<br>Range | Hardness<br>kgf/mm <sup>2</sup> |
|-----------|-------|------------------|-----------------------|-------------|---------------------------------|
| AMTIR     | 2.50  | 1.70             | Insoluble             | 1-9         | 170                             |
| Diamond   | 2.40  | 2.01             | Insoluble             | 1-14        | 5,700                           |
| Germanium | 4.00  | 0.66             | Insoluble             | 1-14        | 550                             |
| KRS-5     | 2.37  | 2.13             | 0.05                  | 5-8         | 40                              |
| Silicon   | 3.40  | 0.85             | Insoluble             | 1-12        | 1,150                           |
| ZnS       | 2.20  | 3.86             | Insoluble             | 5-9         | 240                             |
| ZnSe      | 2.40  | 2.01             | Insoluble             | 5-9         | 120                             |

Note:  $d_p$ , for  $n_2 = 1.5$ .  $\lambda = 1000 \text{ cm}^{-1}$ , 45 degree angle of incidence.







# Diffuse Reflection



Diffuse reflectance is a highly sensitive technique for the analysis of powdered and solid samples. Typically, a sample is ground with KBr into a fine powder and run without making pellets. Some samples can be run directly without dilution, especially if one is looking for minor components. Diffuse reflectance sampling is ideally suited for automation and PIKE offers configurations for high-capacity sampling.

# EasiDiff

## AT A GLANCE

- ▶ Pre-aligned optical components for reproducible, high-quality data
- ▶ Micrometer-controlled sample positioning and focusing
- ▶ High-energy throughput providing nanogram sensitivity
- ▶ Precision slide for repeatable sample introduction and efficient collection of background and sample spectra
- ▶ Unique Sample Preparation and Loading Kit included

The EasiDiff is an economical, high-quality diffuse reflection accessory designed to analyze a wide variety of solid samples. It is often used for analysis of pharmaceuticals, illicit drugs, inorganic solids and minerals, and powdered chemicals.

The EasiDiff reduces the time required to produce an infrared spectrum compared to KBr pellet techniques. Typically, a small amount of sample (about 1%) is mixed with KBr powder and the spectrum is collected.

## FAST AND EFFICIENT DESIGN

The EasiDiff employs an elegant, high-performance optical design for maximum energy throughput and ease of operation. Optical components critical to achieving this performance are permanently aligned. Focusing is achieved by bringing the sample (not the collection mirror) to the optimum position with a micrometer. A dual-position sample holder permits background and sample collection in a simple, two-step process.

A special version of the EasiDiff with gold-coated optics for NIR measurements is also available.

### SAMPLING CUPS

Two standard sampling cups offer 0.18 and 0.03 cm<sup>3</sup> capacities. The required approximate weight of the sample/KBr mixture is 450 mg for the large cup and 80 mg for the small one.

### ABRASION KIT

The Abrasion Sampling Kit (optional) consists of a sample collector tool and a set of silicon carbide and diamond disks. Sampling is performed by abrading the surface of the investigated substance with a selected disk. The disk is placed in the accessory and a diffuse reflection spectrum of the material is collected.

The abrasion technique is advantageous when the sample is intractable, too large to bring into the lab, or its shape may prevent the sample from fitting firmly onto the sampling platform of a traditional IR accessory.



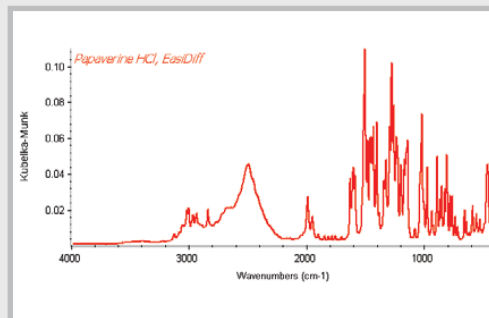
Abrasion Sampling Kit.

## SPECIFICATIONS

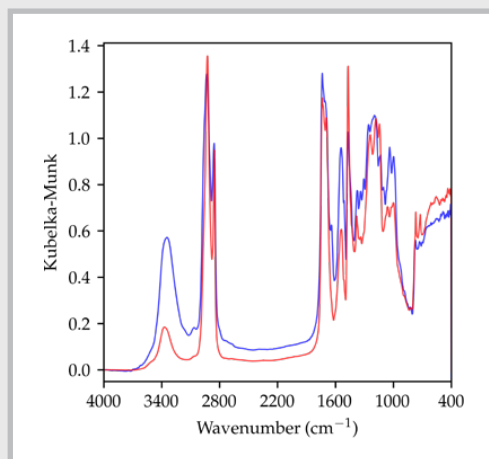
|                               |  |
|-------------------------------|--|
| <b>Optical Design</b>         | All reflection                                     |
| <b>Dimensions (W X D X H)</b> | 96 x 110 x 154 mm<br>(excluding baseplate)         |
| <b>Sample Focus</b>           | Micrometer   |
| <b>Sample Positions</b>       | 2 positions, slide stops for background and sample |
| <b>Sample Cup Dimensions</b>  |  |
| Micro                         | 6 mm ID x 1.6 mm deep                              |
| Macro                         | 10 mm ID x 2.3 mm deep                             |
| <b>Sample Cup Volume</b>      |  |
| Micro                         | 0.03 cm <sup>3</sup>                               |
| Macro                         | 0.18 cm <sup>3</sup>                               |

## APPLICATION

For powders and diffusely scattering solids, diffuse reflection is a convenient infrared sampling technique, and offers high sensitivity. For intractable samples, the abrasion method provides a simple solution for analyzing solids and coatings—example shown below.



**Papaverine hydrochloride (1% in KBr powder) spectrum** collected using the EasiDiff diffuse reflection accessory.



**Polymer spectra** of the outer cover of two golf balls brands using the abrasion method.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 042-10XX    | EasiDiff Accessory with Sample Preparation Kit Includes 2 micro sample cups, 2 macro sample cups, EasiPrep Sample Preparation Kit, alignment mirror, 35-mm mortar with pestle and KBr powder (100 g)          |
| 042-50XX    | EasiDiff Accessory, NIR Version with Gold-Coated Optics Includes 2 micro sample cups, 2 macro sample cups, EasiPrep Sample Preparation Kit, alignment mirror, 35-mm mortar with pestle and KBr powder (100 g) |

**Note:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog.

## Option

|          |   |
|----------|---|
| 042-3010 | Abrasion Sampling Kit Includes sample collector tool and stainless steel sample post, 25 diamond abrasive disks and 75 silicon carbide abrasive disks |
|----------|---|

## Replacement Parts and Supplies

|          |   |
|----------|---|
| 042-2010 | Micro Sample Cup (2 ea.)                  |
| 042-2020 | Macro Sample Cup (2 ea.)                  |
| 042-2025 | EasiDiff Sample Slide                     |
| 160-8010 | KBr Powder (100 g)                        |
| 042-3020 | Abrasion Disks, silicon carbide (100 ea.) |
| 042-3025 | Abrasion Disks, diamond (50 ea.)          |
| 042-3030 | Sample Cup Holder and Base                |
| 042-3040 | Sample Preparation Kit                    |
| 042-3080 | Alignment Mirror, aluminum, specular      |
| 042-3082 | Alignment Mirror, gold, specular          |
| 042-3084 | Alignment Mirror, gold, diffuse           |
| 042-3060 | Flat Sample Post                          |

**Note:** Please contact PIKE Technologies for items not described in this list.

# DiffusIR

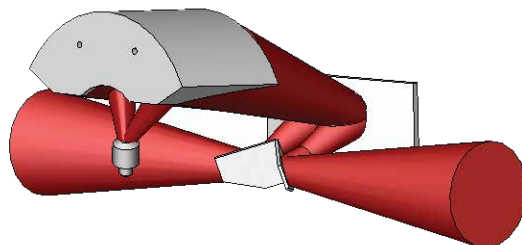
## AT A GLANCE

- ▶ Large and efficient optics for maximum sensitivity and detection limits
- ▶ Micrometer-controlled sample focus to optimize results for every sample
- ▶ Optional environmental chambers for heating, cooling, high-vacuum and high-pressure applications
- ▶ Quick release feature of environmental chambers for easy insertion and removal of sealed chambers
- ▶ TempPRO software option for macro control of data collection at user specified temperatures or times
- ▶ Sealed and purgeable optical design to eliminate water vapor and carbon dioxide interference

The DiffusIR™ is a research-grade diffuse reflection accessory with an efficient optical design accommodating the optional environmental chambers. These specialized chambers can be used to study thermodynamic properties of materials, to determine reaction mechanisms, to perform catalytic studies and much more.

## DESIGN

The heart of the DiffusIR is a unique monolithic ellipsoidal reflector permanently fixed in place—eliminating the need for repositioning the focus optics for sample placement. The DiffusIR optical design is optimized to efficiently collect diffuse radiation generated from the sample and minimize the effects of the specular radiation component. The optical components are enclosed and equipped with purge tubes for the elimination of water and CO<sub>2</sub> interferences.



Optical geometry of the DiffusIR accessory.

With the DiffusIR, sample introduction is performed using an integral 2-position slide – enabling background and sample spectra to be collected without loss of purge. The sample height can be optimized by using the micrometer sample focusing adjustment. In this manner the sensitivity of the accessory is maximized without sacrificing precision.

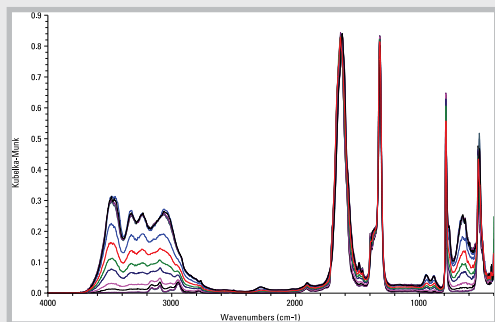
The DiffusIR comes with a Sample Preparation and Loading Kit and a Sample Abrasion Kit for the analysis of intractable samples.



Low temperature chamber shown with connections.

## APPLICATION

The DiffusIR offers a highly sensitive, research-grade accessory for the analysis of powders and other diffusely scattering samples. When equipped with an environmental chamber, influence of gas flow and thermal conditions on the sample may be investigated.



**Thermal transformation of hydrated inorganic compound spectra**, measured using the DiffusIR with environmental chamber. Spectra automatically collected between 80 and 160 °C at 5° increments using PIKE TempPRO software.

### TEMPERATURE/GAS FLOW STUDIES

Advanced temperature studies of materials in controlled environments can be done using the PIKE environmental chambers. Chambers for the DiffusIR can be operated at temperatures ranging from -150 to 1000 °C and at pressures up to 1500 psi. The chambers allow for gas flow to monitor the effects of gas on catalysts and other powdered samples. The optional chambers are easily inserted into the DiffusIR and secured using push-lock pins.

Coupling the environmental chambers with the PIKE Temperature Control Module and TempPRO™ software provides the ability to graphically set up the experiment with unlimited ramps and initiate data collection at specified time or temperature intervals when used with most FTIR instruments.

### OPTIONAL GOLD-COATED OPTICS

A special version of the DiffusIR with gold-coated optics is available for maximum mid-IR performance and for NIR diffuse reflection sampling. The DiffusIR and its options are compatible with most FTIR spectrometers.

### SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Optical Design</b>         | 3X ellipsoidal  |
| <b>Angle Of Incidence</b>     | 30 degrees, nominal   |
| <b>Dimensions (W X D X H)</b> | 180 x 230 x 130 mm (excluding purge tubes and baseplate)              |
| <b>Sample Focus</b>           | Micrometer  |
| <b>Sample Positions</b>       | 2 positions, slide stops for background and sample with no purge loss |
| <b>Sample Cups</b>            | Micro: 6 mm ID x 1.6 mm deep<br>Macro: 10 mm ID x 2.3 mm deep         |
| <b>Purge</b>                  | Standard purge tubes and purge connection                             |

### ENVIRONMENTAL CHAMBER SPECIFICATIONS

|  |   |
|--|---|
| <b>Temperature Range, HTV</b>  | Ambient to 1000 °C  |
| <b>Temperature Range, LTV</b>  | -150 to 500 °C  |
| <b>Accuracy</b>  | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C   |
| <b>Heating Rate, Maximum</b>   | 20°C/min  |
| <b>Temperature Control</b>   | Digital, Touch-panel display  |
| <b>Kinetic Setup</b>   | Unlimited temperature ramps   |
| <b>Requires Digital Temperature Control Module And PIKE TempPRO Software</b> | Individual ramp rate and hold time settings<br>Graphical display of experiment settings<br>Trigger data collection at specified USB interface |
| <b>Sensor</b>  | K Type<br>RTD Type, Pt100 (for LTV)   |
| <b>Input</b>   | 100-240 VAC (for both versions)   |
| <b>Output</b>  | 28VDC/84 W max. (1000 °C version)<br>54 VDC/84 W max. (LTV version)   |
| <b>Vacuum Achievable</b>   | 1 x 10 <sup>-6</sup> Torr (13 x 10 <sup>-4</sup> Pa)  |
| <b>Window Size</b>   | 32 x 3 mm disk (vacuum) 32 mm ZnSe dome (pressure)  |
| <b>Leak Rate</b>   | < 6.0 x 10 <sup>-11</sup> Pa m <sup>3</sup> /s  |
| <b>Pressure Maximum</b>  | 1500 psi, with High-Pressure Adapter (available in HTV versions only)<br>14.7 psi (1 atmosphere) using KBr window                             |
| <b>Sample Cup Size</b>   | 5 mm ID x 2 mm deep   |
| <b>Sample Cup Design</b>   | Porous ceramic compatible with powders and gas flow   |
| <b>Cooling Ports</b>   | Quick-Fit, 6 mm ID  |
| <b>Gas/Vacuum Ports</b>  | 1/8" Swagelok®  |

Environmental chamber for the DiffusIR.



| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 041-10XX    | DiffusIR Accessory<br>Includes Sample Preparation Kit with 2 micro and 2 macro sample cups, sample loading tools, Abrasion Sampling Kit, SiC and diamond sampling disks, alignment mirror, 35-mm mortar with pestle and KBr powder (100 g)                         |
| 041-60XX    | DiffusIR Accessory with Gold-Coated Optics<br>Includes Sample Preparation Kit with 2 micro and 2 macro sample cups, sample loading tools, Abrasion Sampling Kit, SiC and diamond sampling disks, alignment mirror, 35-mm mortar with pestle and KBr powder (100 g) |

**Note:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog.

| DiffusIR Options |   |
|------------------|---|
| 162-4200         | DiffusIR Environmental Chamber, HTV, ambient to 1000 °C |
| 162-4180         | High-Pressure Adapter Dome for Chambers, HTV            |
| 162-4140         | DiffusIR Environmental Chamber, LTV, -150 to 500 °C     |

**Notes:** HTV and LTV chambers require the selection of a temperature control module. DiffusIR Chambers include front plate accommodating environmental chamber (easily changeable with standard DiffusIR front plate), Pin-Loc chamber insertion for easy sample exchange, KBr window, ceramic sampling cups compatible with vacuum and reaction formats, ports and 2 shut-off valves for vacuum operation and ports for connection of water cooling. The 1000 °C HTV chambers may be fitted with the high-pressure adapter and are easily switchable from standard vacuum to high-pressure operation. The LTV chamber is not compatible with simultaneous pressurization and low temperature operation. Operation of the LTV at sub-ambient temperatures requires part number 162-4165 Liquid Nitrogen-Cooled System and Temperature Control Module and rotary pump for vacuum insulation. All chambers require a liquid circulator to reduce heat transfer to the outer housing and to preserve the life of the chamber heaters.

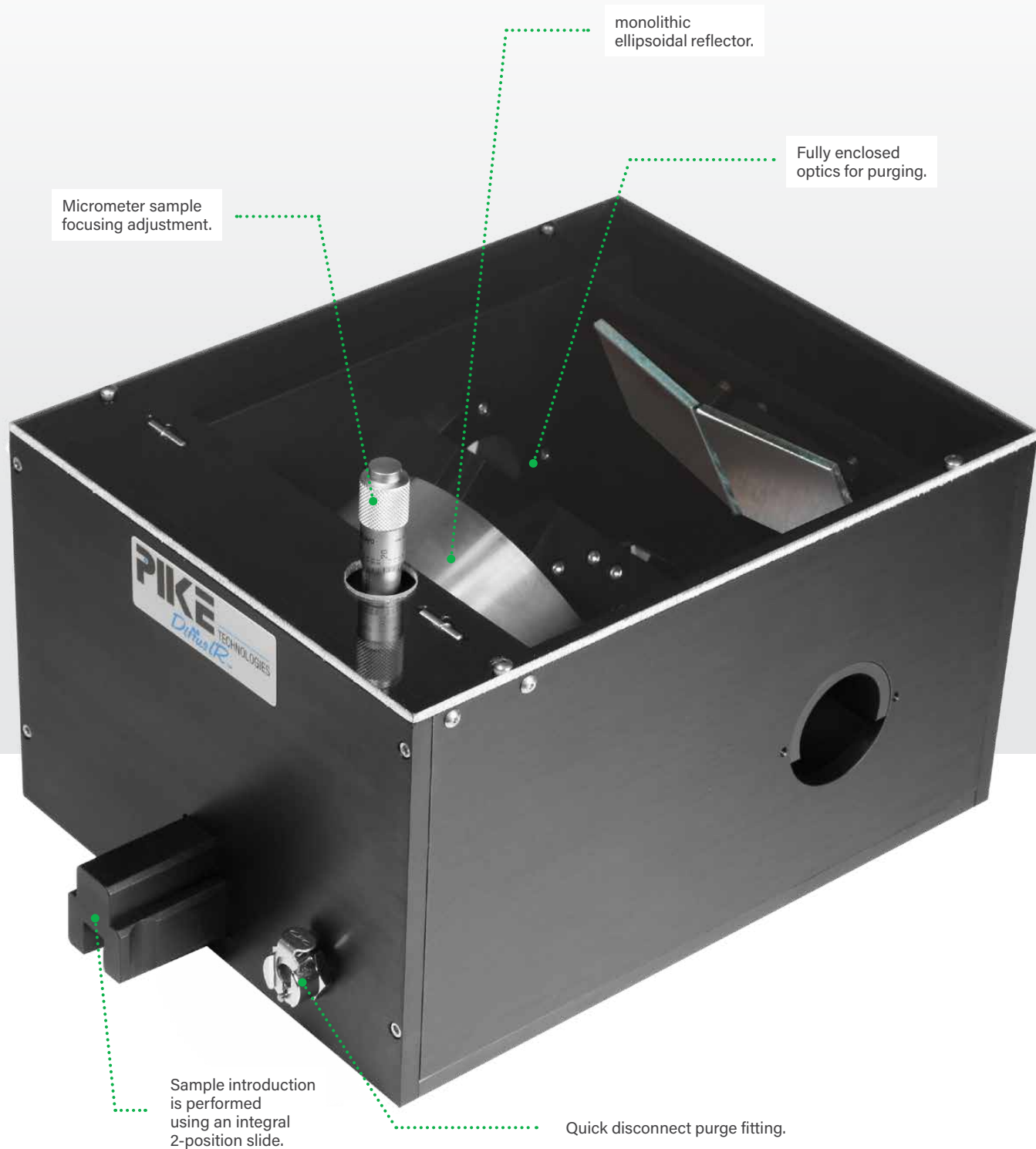
| Temperature Control Modules |   |
|-----------------------------|---|
| 076-2550                    | Digital Temperature Control Module  |
| 007-0207                    | PIKE TempPRO Software   |
| 162-4165                    | Liquid Nitrogen-Cooled System and Temperature Control Module DiffusIR Environmental Chamber, LTV, -150 to 500 °C, 115 V |
| 162-4166                    | Liquid Nitrogen-Cooled System and Temperature Control Module DiffusIR Environmental Chamber, LTV, -150 to 500 °C, 220 V |

**Notes:** Digital Temperature Control Module with TempPRO software (sold separately) provides a graphical user interface for setting experiment parameters and data collection. Please contact PIKE for PC compatibility. The Temperature Control Modules for the HTV and LTV chambers are not interchangeable.

| Replacement Parts and Supplies |  |
|--------------------------------|--|
| 170-1100                       | Liquid Recirculator                                    |
| 042-2010                       | Sample Cup, micro, 6 mm diameter, 1.6 mm deep (2 ea.)  |
| 042-2020                       | Sample Cup, macro, 10 mm diameter, 2.3 mm deep (2 ea.) |
| 042-3030                       | Sample Cup Holder and Base                             |
| 160-8010                       | KBr Powder (100 g)                                     |
| 042-3040                       | Sample Preparation Kit                                 |
| 042-3010                       | Abrasion Sampling Kit                                  |
| 042-3020                       | Abrasion Disks, silicon carbide (100 ea.)              |
| 042-3025                       | Abrasion Disks, diamond (50 ea.)                       |
| 042-3060                       | Flat Sample Post                                       |
| 042-3080                       | Alignment Mirror, aluminum                             |
| 042-3082                       | Alignment Mirror, gold                                 |
| 162-4298                       | Rotary Pump for vacuum insulation, 115V                |
| 162-4299                       | Rotary Pump for vacuum insulation, 230V                |
| 160-1132                       | Disk, KBr, 32 x 3 mm                                   |
| 160-1113                       | Disk, ZnSe, 32 x 3 mm                                  |
| 160-1231                       | Disk, ZnSe, 32 x 3 mm, with anti-reflective coating    |
| 160-5049                       | Disk, SiO <sub>2</sub> , 32 x 3 mm                     |
| 160-5125                       | Disk, SiO <sub>2</sub> , 32 x 3 mm, low OH             |
| 160-1159                       | Disk, Si, 32 x 3 mm                                    |
| 162-4210                       | O-Ring for DiffusIR Chamber (10 ea.)                   |
| 162-4215                       | O-Ring for DiffusIR Chamber cooling line (10 ea.)      |
| 162-4251                       | Ceramic Cup for DiffusIR Chamber, porous               |
| 162-4270                       | Alignment Mirror for DiffusIR Chamber                  |

**Note:** Please contact PIKE Technologies for items not described in this list.





# UpIR

## AT A GLANCE

- ▶ Upward-looking optics provide fast and easy analysis of samples placed face down on the sample port
- ▶ Out-of-compartment design for analysis of large samples
- ▶ Analysis of powders, ground solid samples and coatings on metallic surfaces
- ▶ High optical throughput and exceptional signal-to-noise ratio
- ▶ Pre-aligned, fixed-position optical components for reproducible, high-quality data
- ▶ Optional gold-coated optics version for highest performance mid-IR and NIR applications

The UpIR is an innovative FTIR accessory developed to support a wide range of diffuse reflection applications.

## MID-IR ANALYSIS FOR BOTH SMALL AND LARGE SAMPLES

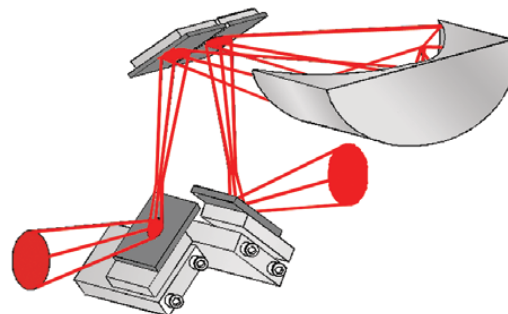
To make measurements, simply place large, solid samples face down onto the top plate of the accessory. Powders can be placed into a suitable sampling cup at the top of the UpIR. A mask set is included for the analysis of small solids such as gems and precious stones.

This design is uniquely suitable for mid-IR analysis of coatings on metallic surfaces of large or small samples. For this application, analysis is rapid and easy because no sample preparation or cleanup is required. Since the sampling area of the UpIR is above the plane of the FTIR instrument, even large samples that do not fit into the sample compartment can be analyzed with this accessory.

The accessory is equipped with purge tubes for the elimination of CO<sub>2</sub> and water interferences from infrared spectra.

### THE OPTICAL GEOMETRY OF THE UPIR

The accessory is equipped with an upward-looking, high-performance ellipsoidal mirror. The sampling stage provides a sampling port with inserts for diffuse reflection or specular reflection measurements.



Optical geometry of the UpIR accessory.

All mirrors, including the ellipsoidal collection mirror, are permanently mounted. The position of the sampling stage is controlled with an adjustable micrometer to achieve the best possible throughput.

### OPTIONAL GOLD-COATED OPTICS

The gold-coated optics version of the UpIR provides the highest throughput in the mid-IR spectral region and is recommended for NIR sampling.



## SPECIFICATIONS

|                                  |   |
|----------------------------------|---|
| <b>Optical Design</b>            | All reflection  |
| <b>Dimensions</b><br>(W X D X H) | 154 x 197 x 228 mm<br>(excluding purge tubes and baseplate) |
| <b>Sample Focus</b>              | Micrometer  |
| <b>Purge</b>                     | Standard purge tubes and purge connection                   |

## SAMPLING INSERTS

The UpIR accessory includes a solids sampling plate for flat samples, a ZnSe-windowed sampling cup for powders or other particulate samples, and a 4-piece mask set (aperture diameters of 10, 7, 5, and 3 mm) suitable for measuring small solids such as gemstones.



ZnSe-windowed sampling cup.

4-piece mask set.

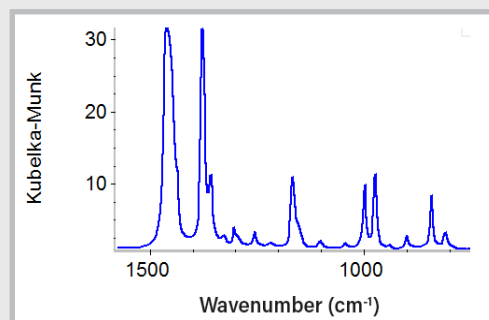
For NIR sampling of solids, powders or tablets, the sapphire-windowed sampling cup is recommended. In the NIR spectral region samples can be analyzed while contained in a glass vial; the optional 21-mm glass vial holder is recommended.



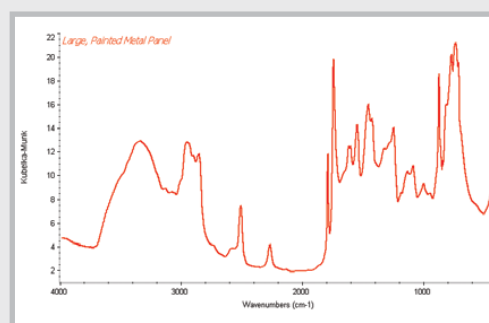
Glass vial holder and ZnSe powder cup.

## APPLICATION

For diffuse reflection measurements, the UpIR is ideal for large samples due to its tall height, and with the mask set can also accommodate small samples.



3-Ply face mask spectrum, non-destructive IR measurement using the UpIR.



Large painted metal panel spectrum collected using the UpIR.

| PART NUMBER  | DESCRIPTION                                    |
|--|--|
| 044-10XX   | UpIR   |
| 044-60XX   | UpIR with Gold-Coated Optics                   |
| <p><b>Notes:</b> Includes solids sampling insert and powders sampling insert with ZnSe window, mask set, gold mirror, purge tubes, purge kit and spectrometer baseplate. Replace <b>XX</b> with your spectrometer's Instrument Code listed in the back of the catalog.</p> |  |
| UpIR Options   |  |
| 044-3030   | Solids Sampling Insert                         |
| 044-3010   | Glass Vial Holder, 21 mm                       |
| 044-3020   | Sample Vials, 21 x 70 mm (200 ea.)             |
| 044-3050   | UpIR Mask Set, 3, 5, 7 and 10 mm               |
| 044-3040   | Powders Sampling Cup (order window separately) |
| 160-1155   | Window, ZnSe, 25 x 2 mm                        |
| 160-1307   | Window, Ge, 25 x 2 mm                          |
| 160-5000   | Window, Sapphire, 25 x 2 mm                    |
| 048-3000   | Diffuse Gold Reference                         |

# AutoDiff II

## AT A GLANCE

- ▶ Automated diffuse reflection accessory for unattended analysis of up to 60 samples
- ▶ High-performance optical design collects maximum amount of energy and provides high-quality spectra
- ▶ Easily programmable for automated sample collection
- ▶ Removable sample tray to speed sample loading and unloading



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE



The AutoDiff II is a high-performance, automated diffuse reflection accessory developed to analyze multiple samples with minimal user intervention. This programmable accessory can be fully automated to save time and increase productivity.

Typical applications include powdered pharmaceutical samples, high-throughput forensic sampling, kidney stone analysis, soils analysis and analysis of many other powdered samples where speed and efficiency are important. Spectral quality and reproducibility are excellent with the AutoDiff II.

## DESIGN

The design employs an automated R-theta sampling stage providing diffuse reflection analysis with greatly reduced operator intervention and increased sample throughput. The optical design of the AutoDiff II utilizes a high-efficiency fixed ellipsoidal reflector to collect the maximum amount of diffusely reflected energy from the sample. Other optical components important to achieving this high performance are aligned and permanently located. The accessory is baseplate-mounted in the FTIR spectrometer sample compartment and can be purged independently or it can use the spectrometer's purge.

The AutoDiff II fully automates diffuse reflection FTIR spectroscopy. The sample tray contains positions for 60 samples, plus a center position for a background sample, which usually consists of pure KBr powder. The sample plate is marked into six areas, labeled from A to F. Each area has ten sample positions marked from 1 through 10. This sample position numbering scheme is also used within the software for describing and positioning the samples.

Gold-coated optics version of the AutoDiff II is available for highest performance mid-IR analysis and for automated NIR diffuse reflection sampling.

## AUTOPRO SOFTWARE

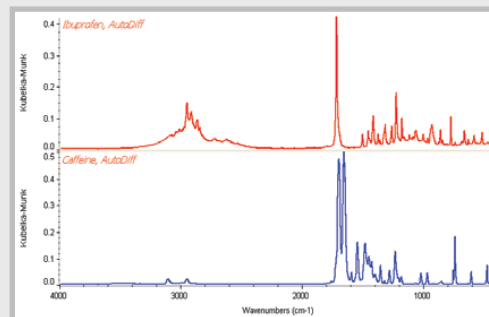
The AutoDiff II is controlled by PIKE AutoPRO software which incorporates multi-operator sample submission. The system is extremely flexible and the graphical user interface is intuitive and simple. Additional features include integrating sample information into the spectral data file and file name, and several background collection options such as collecting a background between intervals of sample data collection to minimize atmospheric contributions in the IR spectra. The AutoPRO software integrates easily with most commercially-available FTIR software packages.

## SPECIFICATIONS

|                                  |  |
|----------------------------------|--|
| <b>Optical Design</b>            | 3X beam demagnification  |
| <b>Angle Of Incidence</b>        | 30°  |
| <b>Accuracy</b>                  | +/- 25 µm  |
| <b>Mechanical Specifications</b> |  |
| Repeatability                    | +/- 5 µm   |
| Resolution                       | 1 µm   |
| Minimum Run Time                 | 60 Samples - 60s<br>(without data collection)                                      |
| <b>Computer Interface</b>        | USB  |
| <b>Samples Focus</b>             | Z-direction adjustment   |
| <b>Sample Positions</b>          | 60 cup positions per sampling tray   |
| <b>Sample Cups</b>               | Macro cups, 10 mm ID x 2.3 mm deep<br>(micro cups optional, 6 mm ID x 1.6 mm deep) |
| <b>Purge</b>                     | Standard purge tubes and purge connections   |
| <b>Power Requirements</b>        | 100-240 Volts AC; 50/60 Hz   |
| <b>Weight</b>                    | 8.2 kg   |
| <b>Dimensions (W X D X H)</b>    | 219 x 290 x 333 mm<br>(excluding purge tubes and baseplate)                        |
| <b>Stage Motion</b>              | R-Theta  |

## APPLICATION

To increase productivity and laboratory throughput, the diffuse reflection sampling is easily adapted to automated sampling. Popular applications include pharmaceutical, soil, and kidney stone analysis.



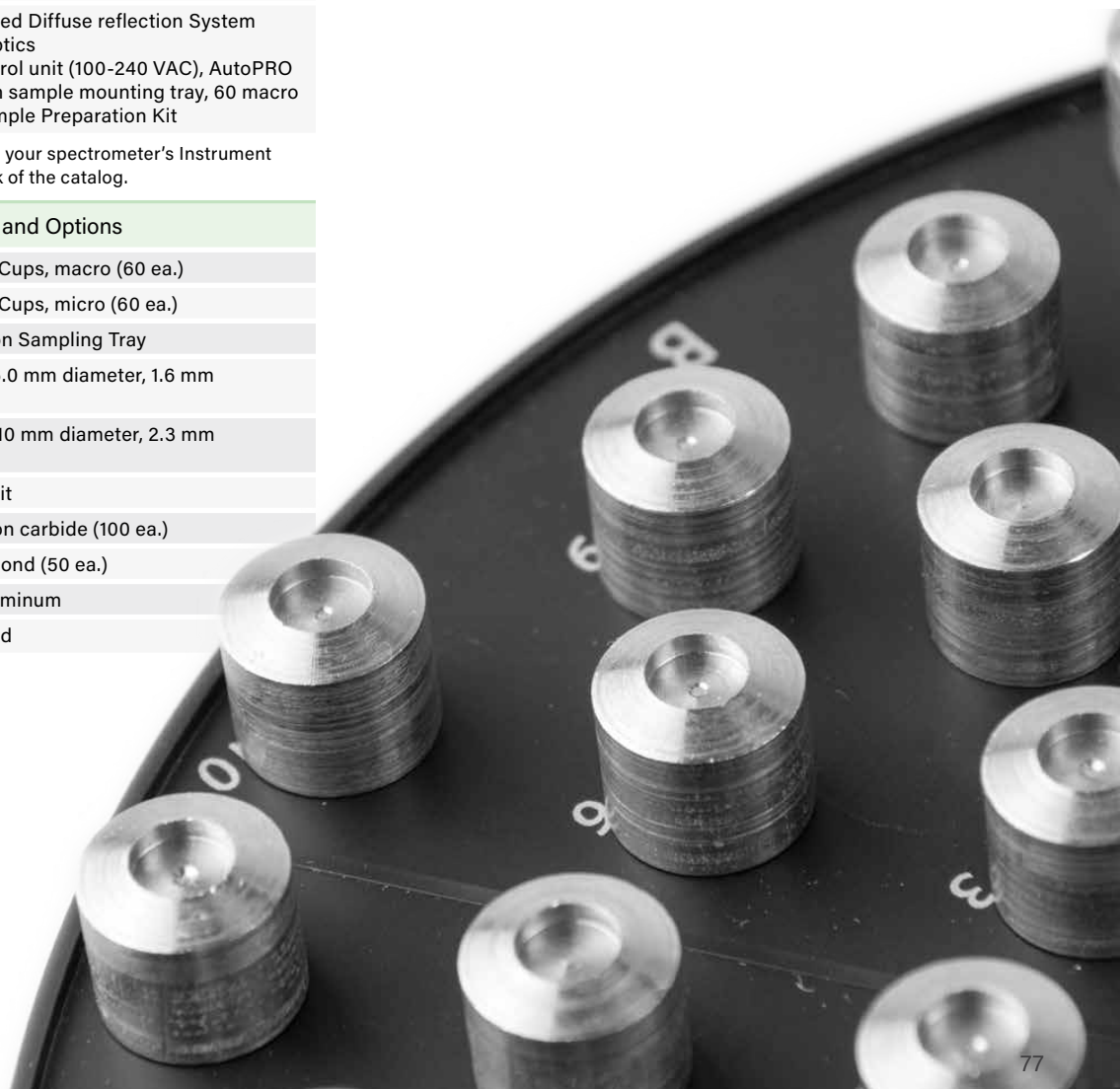
Ibuprofen and Caffeine spectra collected using the AutoDiff II accessory.

| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 043-29XX    | AutoDiff II – Automated Diffuse reflection System<br>Includes motion control unit (100-240 VAC), AutoPRO software 60-position sample mounting tray, 60 macro sample cups and Sample Preparation Kit                          |
| 043-79XX    | AutoDiff II – Automated Diffuse reflection System with Gold-Coated Optics<br>Includes motion control unit (100-240 VAC), AutoPRO software, 60-position sample mounting tray, 60 macro sample cups and Sample Preparation Kit |

**Note:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog.

## Replacement Parts and Options

|          |   |
|----------|---|
| 043-3090 | AutoDiff II Sampling Cups, macro (60 ea.)               |
| 043-3085 | AutoDiff II Sampling Cups, micro (60 ea.)               |
| 043-0902 | AutoDiff II 60-Position Sampling Tray                   |
| 042-2010 | Sample Cup, micro, 6.0 mm diameter, 1.6 mm deep (2 ea.) |
| 042-2020 | Sample Cup, macro, 10 mm diameter, 2.3 mm deep (2 ea.)  |
| 042-3010 | Abrasion Sampling Kit                                   |
| 042-3020 | Abrasion Disks, silicon carbide (100 ea.)               |
| 042-3025 | Abrasion Disks, diamond (50 ea.)                        |
| 042-3080 | Alignment Mirror, aluminum                              |
| 042-3082 | Alignment Mirror, gold                                  |



# XY Autosampler

## AT A GLANCE

- ▶ Automated analysis with standard 24-, 48-, or 96-well plates. Special configurations available.
- ▶ Diffuse reflection of powdered samples or specular reflection sampling for reaction residues
- ▶ Gold-coated optics version for highest performance mid-IR and NIR sampling
- ▶ Optional transmission sampling with integrated DTGS or InGaAs detector and transmission sampling plate
- ▶ Fully enclosed, purgeable design with front-loading tray
- ▶ In-compartment mounting, compatible with most FTIR spectrometers



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE

The XY Autosampler is designed around standard 24-, 48- or 96-well microplate architectures – ideal for high-efficiency sample loading and FTIR reflection analysis. Through automation, you will save time and improve consistency across measurements.

Applications include high throughput analysis of liquid residues and chemical reactions, powdered samples, and automated diffuse reflection analysis. Also, when configured with a custom sample tray, the XY may be easily converted into a precision mapping stage for IR measurements.

## DESIGN

The loading tray moves to a position outside of the accessory for easy loading and unloading of samples while conserving the purge. This also permits interface to a robot/autoloader.

### XY AUTOSAMPLER FEATURES

The XY Autosampler features an X, Y stage with both axes driven by high-precision motors for speed and reproducibility. USB and DC power are the only external connections required for this accessory. The transmission option requires a spectrometer external IR detector port. Programming and control of the XY Autosampler is done through PIKE Technologies' AutoPRO software, which can be integrated easily with most FTIR software packages. With AutoPRO, custom mapping profiles to suit needs are easily generated, and data collection protocols can be saved and imported for later use.

### OPTICAL DESIGN

The optical layout of the XY Autosampler is based upon a precision ellipsoidal reflector, which condenses the beam onto the sample with a power of approximately 3 times with an Angle of Incidence (AOI) striking the sample at 30°. The size of the spot illuminated at the sample is approximately 2 mm which is ideal for up to 96-well configurations.

The accessory is compatible with most FTIR spectrometers. The XY Autosampler is available with standard aluminum optics or with gold-coated optical components for highest performance in mid-IR and optimized NIR sampling.



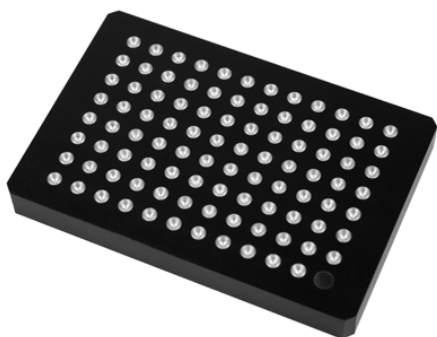
## SPECIFICATIONS

|                                  |  |
|----------------------------------|--|
| <b>Optics</b>                    | Elliptical – 3X beam demagnification           |
| <b>Angle Of Incidence</b>        | 30°  |
| <b>Mechanical Specifications</b> |  |
| Repeatability                    | +/- 5 µm                                       |
| Accuracy                         | +/- 25 µm                                      |
| Resolution                       | 1 µm   |
| Minimum Run Time                 | Time is spectrometer and application dependent |
| <b>Computer Interface</b>        | USB  |
| <b>Purge</b>                     | Standard purge tubes and purge connections     |
| <b>Power Requirements</b>        | 100–240 Volts AC; 50/60 Hz                     |
| <b>Dimensions (W X D X H)</b>    | 159 x 336 x 141 mm (including micrometer)      |
| <b>Weight</b>                    | 4.5 kg   |

## SAMPLING PLATES

The 96-well diffuse reflection plate features 96 polished cavities for placement of powder samples and small solids. For sampling convenience, an option 24-well plate for disposable cups is available for reflection measurements.

Please contact PIKE Technologies if you require specialized sampling plate configurations or a custom plate for mapping the sample



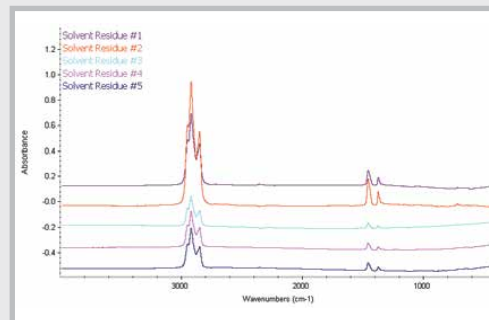
96-well diffuse reflection sampling plate.



96-well silicon transmission sampling plate.

## APPLICATION

The XY Autosampler offers a flexible platform to automated diffuse/specular IR measurements. It may be configured to increase lab productivity by running several samples within a run, and also may be used as a precision mapping stage.



High-quality FTIR spectra of solvent residues collected with the XY Autosampler.

| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 047-21XX    | XY Autosampler – Diffuse reflection  |
| 047-61XX    | XY Autosampler – Diffuse reflection with Gold-Coated Optics  |
| 047-22XX    | XY Autosampler – Diffuse reflection/Transmission with integrated DTGS detector                           |
| 047-62XX    | XY Autosampler – Diffuse reflection/Transmission with Gold-Coated Optics with integrated DTGS detector   |
| 047-23XX    | XY Autosampler – Diffuse reflection/Transmission with integrated InGaAs detector                         |
| 047-63XX    | XY Autosampler – Diffuse reflection/Transmission with Gold-Coated Optics with integrated InGaAs detector |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. All XY Autosamplers include PIKE AutoPRO software and a 96-well diffuse reflection sampling plate. Diffuse reflection/Transmission versions include a 96-well plate for diffuse reflection and a 96-well plate for transmission. For other options please contact PIKE Technologies. For transmission option, your spectrometer must be capable of interfacing with an external detector. A glass-bottom well plate is recommended for NIR transmission measurements.

## Options

|          |   |
|----------|---|
| 073-9110 | 96-Well Diffuse reflection Sampling Plate                     |
| 073-9130 | 96-Well Si Transmission Sampling Plate                        |
| 073-9160 | 24-Well Diffuse reflection Sampling Plate for Disposable Cups |
| 162-1920 | Disposable Cups (50 ea.)                                      |

# Sample Prep Kit

## AT A GLANCE

- ▶ Convenient sample preparation tools for diffuse reflection measurements
- ▶ Micro and macro sampling cups
- ▶ Sampling cup holder to enhance loading reproducibility

The Sample Preparation and Loading Kit makes the handling of powder samples for diffuse reflection sampling easy.

This kit includes a round mounting base and a matching tray with an opening which accommodates sampling cups. The cup is placed in the assembly and overfilled with sample, and then excess powder is leveled-off with a spatula. The overflow is retained on the tray and can be easily returned to the sample container or disposed.

Two standard sampling cups offer 0.18 and 0.03 cm<sup>3</sup> capacities (10-mm diameter, 2.3-mm deep and 6.0-mm diameter, 1.6-mm deep). The required approximate weight of the sample/KBr mixture is 450 mg for the large cup and 80 mg for the small one.

| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 042-3040    | Sample Preparation and Loading Kit<br>Includes 2 micro and 2 macro cups, alignment mirror, sampling cup holder and base, 2 spatulas, brush |
| 042-2010    | Sample Cup, micro, 6-mm diameter, 1.6-mm deep (2 ea.)  |
| 042-2020    | Sample Cup, macro, 10-mm diameter, 2.3-mm deep (2 ea.)   |
| 042-3030    | Delrin® Sampling Cup Holder and Base   |
| 042-3080    | Alignment Mirror, aluminum, specular   |
| 042-3082    | Alignment Mirror, gold, specular   |
| 042-3084    | Alignment Mirror, gold, diffuse  |
| 042-3070    | Camel Hair Brush   |
| 042-3035    | Spatula, spoon   |
| 042-3050    | Spatula, flat  |
| 160-8010    | KBr Powder (100 g)   |
| 161-5050    | Agate Mortar & Pestle 50mm   |

**Note:** The Sample Preparation and Loading Kit is included with EasiDiff, DiffusIR and AutoDiff diffuse reflection accessories.





# Abrasion Sampling Kit

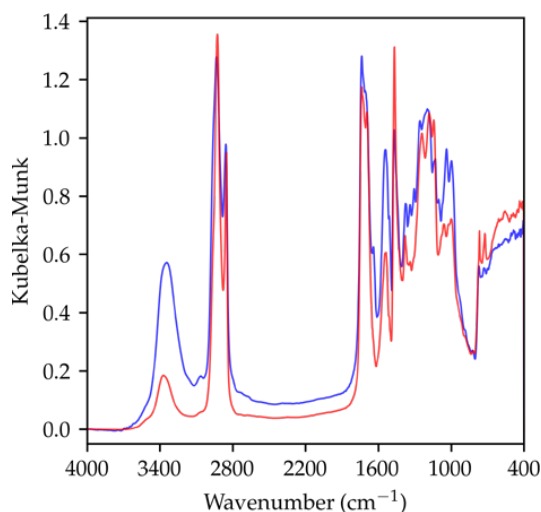
## AT A GLANCE

- ▶ Convenient set of tools for collection of difficult solid samples
- ▶ Rigid construction, diamond and silicon carbide disks
- ▶ Sampling post fits the EasiDiff, DiffusIR and AutoDiff accessories

The abrasion method for diffuse reflection sampling is particularly useful for the analysis of large painted surfaces (e.g. car panels) and other awkward objects, which makes measuring by traditional techniques difficult.

The Abrasion Sampling Kit consists of a sample collector tool with a set of silicon carbide and diamond disks. Sampling is performed by abrading the surface of the investigated substance with a selected disk. The disk is placed in the accessory and a diffuse reflection spectrum of the material is collected.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 042-3010    | Abrasion Sampling Kit<br>Includes sample collector tool with stainless steel flat sample post, 75 SiC disks and 25 diamond abrasion disks |
| 042-3020    | Abrasion Disks, silicon carbide (100 ea.)   |
| 042-3025    | Abrasion Disks, diamond (50 ea.)  |
| 042-3060    | Flat Sample Post  |



Spectra of polymer outer cover of two brands of golf balls.



Brushing a silicon carbide (SiC) disk against a golf ball.

# Diffuse Reflection

## Theory and Applications

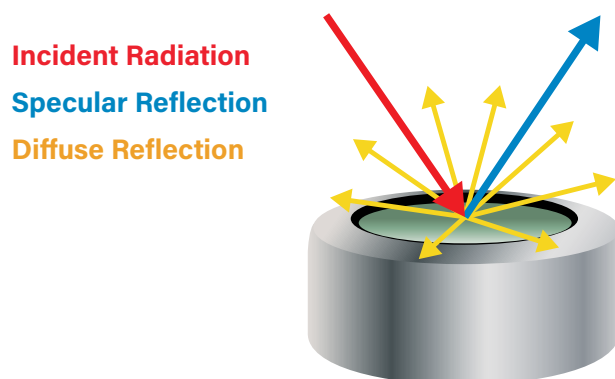
Diffuse reflection is an excellent sampling technique for powdered or crystalline materials in the mid-IR and NIR spectral ranges. It can also be used for analysis of intractable solid samples. As with transmission analysis in the mid-infrared, often samples to be analyzed by diffuse reflection are generally ground and mixed with an IR transparent salt such as potassium bromide (KBr) prior to sampling.

Diffuse reflection sampling offers an excellent alternative to transmission of KBr pellets as it eliminates the time-consuming process of pressing pellets. This technique can also be used to study the effects of temperature and gas flow for the analysis of catalysts and other diffusely scattering samples by configuring the accessory with a heating or cooling environmental chamber.

One of the greatest additional benefits of diffuse reflection sampling is that it is ideally amenable to automation. Methods can be developed with a manual version diffuse reflection accessory and then moved to automation to increase sample throughput. PIKE Technologies offers several diffuse reflection accessory configurations: basic, advanced with heat chamber capabilities, upward directed IR beam for easy sampling access and fully automated for maximum sampling efficiency.

### HOW DIFFUSE REFLECTION WORKS

Diffuse reflection relies upon the focused projection of the spectrometer beam into the sample where it is reflected, scattered and transmitted through the sample material. The back reflected, diffusely scattered light (some of which is absorbed by the sample) is then collected by the accessory and directed to the detector optics. Only the part of the beam that is scattered within a sample and returned to the surface is considered diffuse reflection.

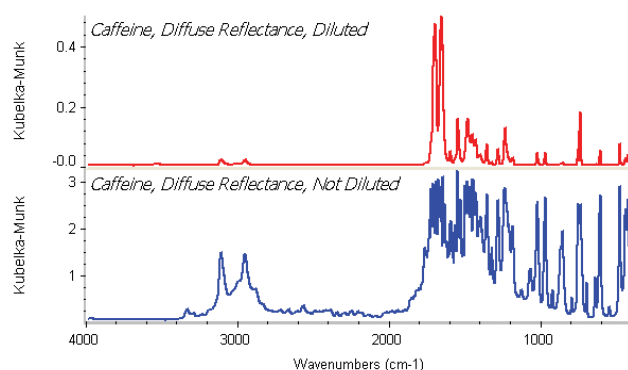


### FACTORS THAT INFLUENCE SPECTRAL QUALITY

Some powders may be analyzed by diffuse reflection as neat samples (coal samples, soil samples, diffuse coatings on a reflective base). Usually, the sample must be ground and mixed with a non-absorbing matrix such as KBr. The sample to matrix ratio is generally between 1 to 5% (by weight). Diluting ensures a deeper penetration of the incident beam into the sample which increases the contribution of the scattered component in the spectrum and minimizes the specular reflection component.

The specular reflection component in diffuse reflection spectra causes changes in band shapes, their relative intensity, and, in some cases, it is responsible for complete band inversions (Restrahlen bands). Dilution of the sample with a non-absorbing matrix minimizes these effects. Particle size and sample loading mechanics also play an important role.

This is shown below in the spectral data for caffeine, where the upper spectrum is diluted to about 2% by weight in KBr and demonstrates very high quality with sharp, well-defined absorbance bands. The lower spectrum is of undiluted caffeine measured by diffuse reflection and shows derivative-shaped bands in the 1700  $\text{cm}^{-1}$  and 1500  $\text{cm}^{-1}$  region of the data. The upper spectrum of diluted caffeine is clearly of higher spectral quality than that of the undiluted caffeine.



Diffuse reflection spectra showing greatly improved results from sample dilution.

Other factors related to high spectral quality for diffuse reflection sampling are listed below.

- ▶ Particle Size – reducing the size of the sample particles reduces the contribution of reflection from the surface. Smaller particles improve the quality of spectra (narrow bandwidths and better relative intensity). The recommended size of the sample/matrix particles is 50 microns or less (comparable to the consistency

of the finely ground flour). This fine powder is easily achieved by using the PIKE Technologies ShakIR ball mill.

- ▶ Refractive Index – effects result in specular reflection contributions (spectra of highly reflecting samples will be more distorted by the specular reflection component). This effect can be significantly reduced by sample dilution.
- ▶ Homogeneity – samples prepared for diffuse reflection measurements should be uniformly and well mixed. Non-homogenous samples will lack reproducibility and will be difficult to quantify. An ideal way to mix samples for diffuse reflection is by using the PIKE Technologies ShakIR.
- ▶ Packing – the required sample depth is governed by the amount of sample scattering. The minimum necessary depth is about 1.5 mm. The sample should be loosely but evenly packed in the cup to maximize IR beam penetration and minimize spectral distortions.

## THE KUBELKA-MUNK EQUATION

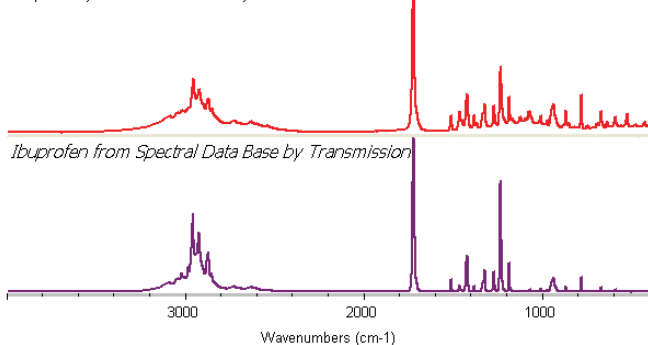
Even with all these sample preparation practices, the raw diffuse reflection spectra will appear different from its transmission equivalent (stronger than expected absorption from weak IR bands). A Kubelka-Munk conversion can be applied to a diffuse reflection spectrum to compensate for these differences. This conversion is available in most FTIR software packages.

The Kubelka-Munk equation is expressed as

$$f(R) = \frac{(1-R)^2}{2R} = \frac{k}{s}$$

where  $R$  is the absolute reflectance of the sampled layer,  $k$  is the molar absorption coefficient and  $s$  is the scattering coefficient.

*Ibuprofen, Diffuse Reflectance, Kubelka-Munk Converted*



Diffuse reflection spectra of ibuprofen with Kubelka-Munk conversion compared to a transmission spectrum.

The spectra shown above demonstrate this spectral conversion for ibuprofen collected by diffuse reflection. The sample was diluted to about 1% by weight in KBr and mixed using the ShakIR. The Kubelka-Munk converted spectrum for ibuprofen shows excellent comparison with the transmission spectrum and is easily identified using library search of a transmission spectral database.

The Kubelka-Munk equation creates a linear relationship for spectral intensity relative to sample concentration (it assumes infinite sample dilution in a non-absorbing matrix, a constant scattering coefficient and an “infinitely thick” sample layer). These conditions can be achieved for highly diluted, small particle samples (the scattering coefficient is a function of sample size and packing) and a sample layer of at least 1.5 mm. With proper sample preparation, diffuse reflection spectroscopy can provide ppm sensitivity and high-quality results.

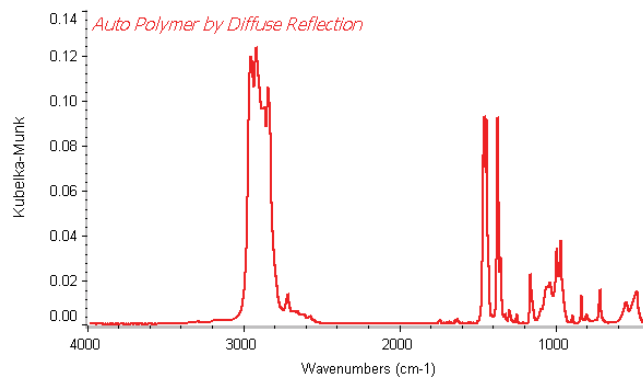
## PLASTIC BUMPERS AND TOUGH SAMPLES

Sometimes it is necessary to analyze a sample which simply does not fit in a spectrometer’s sample compartment – the analysis of polymer-based automotive components or painted panels are typical examples.

A special diffuse reflection technique allows quick and simple analysis of such samples in a relatively non-destructive manner. A small amount of the sample can be collected by abrasion on a diamond or silicon carbide abrasion disk and analyzed immediately with the help of a diffuse reflection accessory.

The figure below shows the diffuse reflection spectrum of an automotive body component. The PIKE Abrasion Sampling Kit with diamond sampling disk was rubbed across the large automotive component which collects some of the polymer material into the web of the sampling disk. Spectra were co-added for 1 minute and ratioed to the diamond disk background spectrum. The resulting spectrum is of excellent quality and is identified as a polypropylene copolymer.

Diffuse reflection can also be used for the analysis of liquid samples. In this application a small amount of the sample is dispensed directly onto the KBr powder and analyzed.



Diffuse reflection spectrum using diamond abrasion disk.

## POWDERS

For the analysis of powders the following procedure is recommended:

- ▶ Place about 200–400 mg of KBr into the ShakIR ball mill vial with a stainless steel ball and grind for 30 seconds
- ▶ Fill the background diffuse cup with this KBr
- ▶ Remove excess KBr with a flat edge – the KBr should be loosely packed
- ▶ Add 1 to 5 mg of the sample to the remaining KBr in the ShakIR vial and mix for 30 seconds
- ▶ Fill the sample diffuse cup with this mixed sample/KBr

- ▶ Remove excess sample with a flat edge – the sample should be loosely packed
- ▶ Place the background and sample diffuse cups into the sample holder
- ▶ Slide the sample holder into the accessory
- ▶ Position the KBr cup in the beam and collect a background
- ▶ Move the holder to the sample position and collect a sample spectrum (the ratio of these two spectra will produce a spectrum of the sample)
- ▶ Convert the raw diffuse reflection spectrum to Kubelka-Munk

Under ideal conditions the transmission of the strongest band in the spectrum should be in the 50% range. If the resulting bands are too intense or distorted, further dilute the sample and make sure that all other measurement affecting factors (particle size, homogeneity and packing) are within required limits.

### **SUMMARY**

Diffuse reflection accessories make the analysis of a wide range of solid samples easier, faster and more efficient. Advanced options for diffuse reflection provide the ability to heat and cool the sample and monitor a reaction process. Automation versions of diffuse reflectance accessories provide the ability to greatly increase sample throughput.





# Specular Reflection



Specular reflection sampling represents a very important technique useful for the measurement of thin films on reflective substrates, the analysis of bulk materials and the measurement of mono-molecular layers on a substrate material. Often this technique provides a means of sample analysis with no sample preparation—keeping the sample intact for subsequent measurements.

# VeeMAX III

## AT A GLANCE

- ▶ Selectable angle of incidence – from 30 to 80 degrees in 1-degree increments
- ▶ Automated option for automated high-precision experiments
- ▶ Measurement of thin films and monolayers to relatively thick films
- ▶ Optimize spectral results with selectable angle of incidence
- ▶ Integrated position for IR polarizer – essential for monolayer analysis and study of polymer orientation
- ▶ Optional single reflection ATR crystals



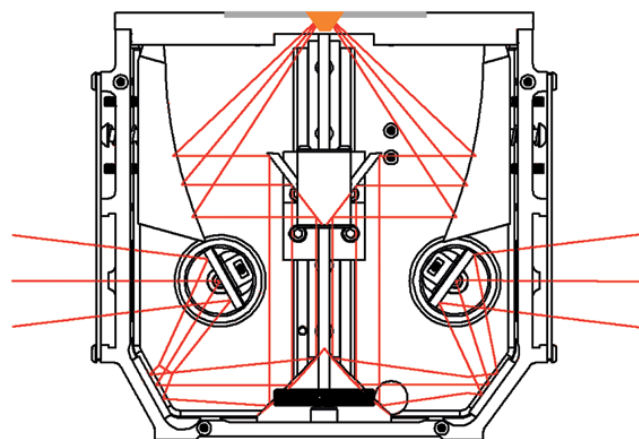
FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE



The VeeMAX III is a variable angle, high-performance, research-grade specular reflection accessory. The unique variable angle optical design (U.S. Patent No. 5,106,196) makes it a key accessory to analyze a wide range of samples.

Typical VeeMAX III applications include depth profiling, analysis of monolayers and ultra-thin films, determination of polymer orientation and spectroelectrochemistry. From monolayers to relatively thick films, all experiments may be optimized by varying the angle of incidence from 30 to 80 degrees. Changing the angle is as easy as turning the angle selector on the front panel of the accessory.

To make measurements, the sample is placed face down on the sampling surface. Designed for unrestricted access to the sampling area, large samples may be readily analyzed. Masks with 2", 5/8" and 3/8" apertures are provided to suit different sample geometries. Thanks to the optical design of this accessory and the quality of the diamond-turned optics, excellent throughput is realized even at high angles of incidence.



VeeMAX III with ATR optical layout.

Another important design feature of the VeeMAX III is its enclosed optics for purging, which eliminates the need to purge the entire sample compartment. This significantly decreases sampling time. It is furnished with two internal polarizer mounts allowing the PIKE polarizer to be inserted into the accessory on either the source or detector side of the spectrometer. The polarizer setting dial is easily accessed without breaking the purge when changing polarizer orientation.

## VERSATILE ATR OPTIONS

The VeeMAX III accessory may be fitted with an ATR flat plate, allowing for variable angle ATR experiments. Please see the ATR section of our catalog for complete configuration options.



## AUTOMATION

An optional automated version of the VeeMAX III accessory is available. It features a precision motor with USB interface and PIKE Technologies AutoPRO software. Operation of the VeeMAX III can be integrated with the spectrometer software of most FTIR instruments, which allows the operator to precisely and reliably control a wide range of angles of incidence and data collection simultaneously. Automated sampling decreases operator and measurement error, and increases workflow productivity.



Automated VeeMAX III with polarizer option. Angle of incidence and polarization angle can be set independently.

## SPECTROELECTROCHEMICAL CELLS

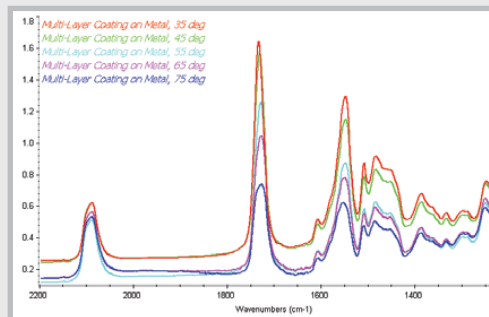
A spectroelectrochemical cell options for the VeeMAX III is also available. The PIKE cell, for applications requiring customization, allows for external reflection experiments using a flat IR window or  $\text{CaF}_2$  prism or for ATR-SEIRAS experiments. The PIKE electrochemistry cell is equipped with a precision micrometer for electrode positioning. Alternatively, PIKE offers an out-of-the-box cell for the popular ATR-SEIRAS measurements. ATR-SEIRAS has emerged as an alternative to external reflection based IR spectroelectrochemistry, and has been shown to be a powerful tool. To learn more, See the Jackfish cell in the ATR section.



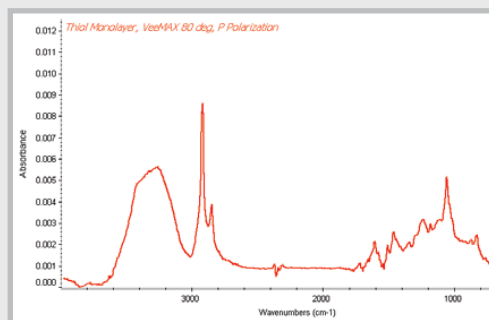
The Jackfish J2 Electrochemical Cell

## APPLICATIONS

Through the unique variable angle design, the VeeMAX III angle of incidence feature provides a versatile accessory to optimize the measurement. Manual and automated options available.



Multi-layered coating on metal substrate spectra, measured using the VeeMAX III.



Thiol monolayer spectrum, measured using the VeeMAX III set at 80 degrees angle of incidence, ZnSe polarizer and MCT detector.

## SPECIFICATIONS

|                                 |  |
|---------------------------------|--|
| <b>Optics</b>                   | All reflective                         |
| <b>Angle of Incidence Range</b> | 30 to 80 degrees                       |
| <b>Sample Masks</b>             | 2", 5/8" and 3/8"                      |
| <b>Purge Sealing</b>            | Purge tubes and purge barb included    |
| <b>Dimensions (W x D x H)</b>   | 177 x 92 x 162 mm (excludes baseplate) |
| <b>FTIR Compatibility</b>       | Most, specify model and type           |

| PART NUMBER                 | DESCRIPTION   |
|-----------------------------|---|
| 013-11XX                    | VeeMAX III<br>Includes sample masks (2", 5/8" and 3/8"), gold substrate alignment mirror, FTIR base mount, and purge tubes  |
| 013-12XX                    | Automated VeeMAX III<br>Includes controller, cabling, sample masks (2", 5/8" and 3/8"), gold substrate alignment mirror, FTIR base mount, and purge tubes             |
|                             | <b>Note:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog.   |
| VeeMAX III Sampling Options |   |
| 090-1000                    | Manual Polarizer, ZnSe  |
| 090-1200                    | Manual Polarizer, KRS-5   |
| 090-3000                    | Precision Manual Polarizer, ZnSe  |
| 090-3200                    | Precision Manual Polarizer, KRS-5   |
| 090-5000                    | Precision Automated USB Polarizer, ZnSe   |
| 090-5100                    | Precision Automated USB Polarizer, KRS-5  |
|                             | <b>Note:</b> Automated version includes PIKE Technologies AutoPRO software and controller. More polarizer options are found in the polarizer section of this catalog. |

| PART NUMBER                           | DESCRIPTION   |
|---------------------------------------|---|
| VeeMAX III Replacement Parts          |   |
| 013-4010                              | Specular Mask Set   |
| 300-0002                              | Gold Substrate Alignment Mirror, 1.25 x 3.0"  |
|                                       | <b>Note:</b> Please contact PIKE Technologies for items not described in this list.   |
| Spectroelectrochemical Configurations |   |
| 013-3300                              | Electrochemical Cell - PTFE   |
| 013-3370                              | Electrochemical Cell - PEEK   |
| 160-5527                              | Prism, CaF <sub>2</sub> , 60 degree   |
| 013-3360                              | Crystal Holder, 60 degree   |
| 160-1144                              | Flat Window, CaF <sub>2</sub> , 20 x 2 mm   |
| 160-1304                              | Flat Window, ZnSe, 20 x 2 mm  |
| 013-3320                              | Flat Window Holder  |
|                                       | <b>Notes:</b> The electrochemical configuration requires Electrochemical Cell and VeeMAX III Specular Reflection accessory. Must select one or more windows. Choose appropriate window holder. More window types for Specular Reflection measurements may be found in our listing of transmission windows, 20 x 2 mm. Electrodes supplied by the end-user. See VeeMAX III with ATR and Jackfish cell product sheets for full ATR crystal and configuration options. |



Automated VeeMAX III programmed with the PIKE Technologies AutoPRO software.



Automated VeeMAX III with polarizer option.

# 10Spec

## AT A GLANCE

- ▶ Measure sample reflectance
- ▶ Fixed 10-degree angle of incidence
- ▶ Sample illumination using collimated beam
- ▶ Sampling mask sizes of 2", 5/8" and 3/8"
- ▶ Purge cover and purge tubes for removal of atmospheric interferences
- ▶ Extended Height 10Spec to accommodate large samples

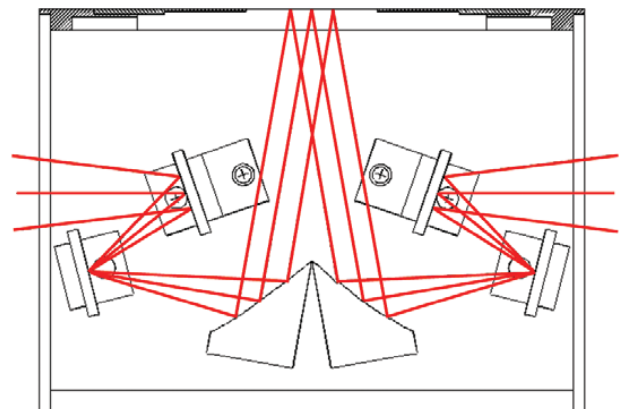
The PIKE Technologies 10Spec is an optimized specular reflectance accessory designed to make high-performance measurements of sample reflectivity.

The 10Spec produces a collimated beam to illuminate the sample area such that the reflectivity measurement is made at a uniform 10-degree angle of incidence and not an average of angles produced by a focused beam accessory design. At a near-normal angle, the polarization effects on reflectivity are minimized. The optics are enclosed to allow for purging.

The 10Spec is recommended to measure the reflectivity of glass. However, it may also be used to measure near-normal reflectivity of a wide variety of surfaces including military devices, reflecting optics, anti-reflective (AR) coated surfaces, and other reflecting and non-reflecting materials.



Extended Height 10Spec.



Beam path within the 10Spec specular reflectance accessory.



## THE 10SPEC MODELS

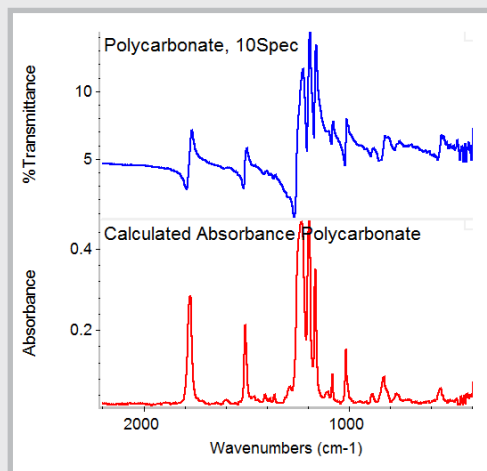
The 10Spec is available in two versions. The standard version is 118-mm tall whereas the Extended Height 10Spec is 205-mm tall, which positions the sample above the top of the FTIR instrument. The Extended Height 10Spec is designed to accommodate samples that are too large to fit within the confinements of the sample compartment.

## SPECIFICATIONS

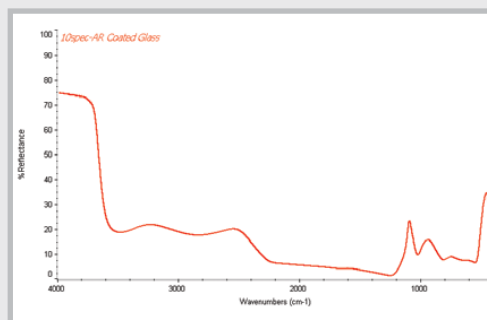
|                               |  |
|-------------------------------|--|
| <b>Optics</b>                 | All reflective                         |
| <b>Angle of Incidence</b>     | 10 degrees                             |
| <b>Sample Masks</b>           | 2", 5/8" and 3/8"                      |
| <b>Purge Sealing</b>          | Purge tubes and purge barb included    |
| <b>Dimensions (W x D x H)</b> |  |
| Standard                      | 159 x 90 x 118 mm (excludes baseplate) |
| Extended Height               | 159 x 90 x 205 mm (excludes baseplate) |
| <b>FTIR Compatibility</b>     | Most, specify model and type           |

## APPLICATIONS

Near-normal specular reflection sampling is useful for the measurement of thin films on reflective substrates and the analysis of bulk materials. Often this technique offers a non-destructive testing method.



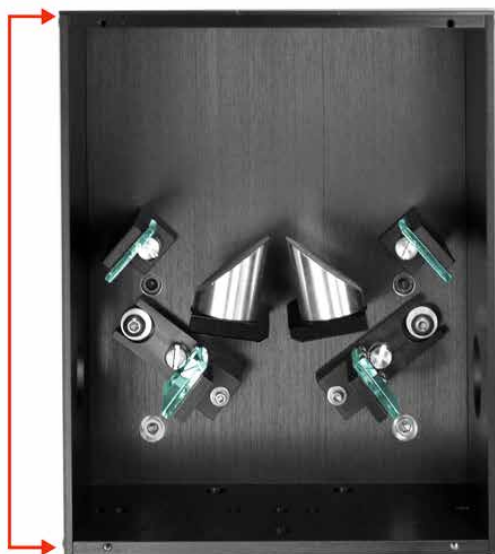
Polycarbonate spectra, collected with the 10Spec before (blue) and after Kramers-Kronig transformation.



Glass spectrum, measuring the sample's reflectivity.

| PART NUMBER   | DESCRIPTION  |
|---|--|
| 010-10XX  | 10Spec - 10 Degree Specular Reflection Accessory<br>Includes 3 sample masks (2", 5/8" and 3/8"), gold substrate alignment mirror and FTIR base mount |
| 010-11XX  | Extended Height 10Spec Accessory<br>Includes 3 sample masks (2", 5/8" and 3/8"), gold substrate alignment mirror and FTIR base mount                 |
| <b>Note:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. |  |
| <b>10Spec Replacement Parts and Sampling Options</b>  |  |
| 010-3010  | Specular Mask Set  |
| 300-0002  | Gold Substrate Alignment Mirror, 1.25 x 3.0"   |

205 mm



Extended Height 10Spec.

118 mm



Standard 10Spec.

# 30Spec and 45Spec

## AT A GLANCE

- ▶ Measurement of thick films and film thickness
- ▶ Fixed angle of incidence, 30° or 45°
- ▶ Sample masks to define sampling area
- ▶ Slide-mount design for easy installation of accessory

The 30Spec and 45Spec are ideal for the measurement of relatively thick films by specular reflection.

Samples are simply laid across the top of the accessory and the spectrum of the film is measured quickly. The 30Spec and the 45Spec include sample masks of  $\frac{3}{8}$ ",  $\frac{1}{4}$ " and  $\frac{3}{16}$ " to define specific sampling areas. These accessories are slide-mounted and are compatible with most FTIR instruments.

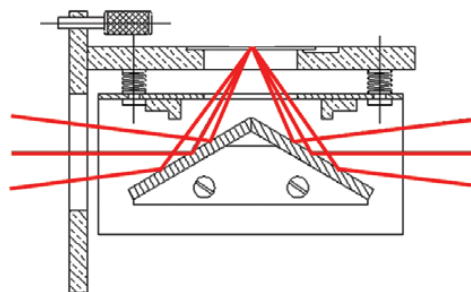
The 30Spec and 45Spec provide high-quality FTIR spectra for identification of coatings and can also be used to measure coating thickness. IR throughput is high using these accessories due to their relatively simple optical design.



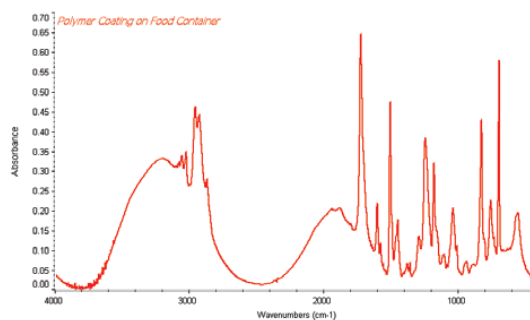
| PART NUMBER  | DESCRIPTION  |
|--|--|
| 011-1000   | 30Spec - 30° Specular Reflection Accessory                             |
| 011-4500   | 45Spec - 45° Specular Reflection Accessory                             |
| <b>Included Parts</b>  |  |
| Sample Masks ( $\frac{3}{8}$ ", $\frac{1}{4}$ ", and $\frac{3}{16}$ "), alignment mirror and slide-mount |  |
| <b>Replacement Parts</b>   |  |
| 011-2010   | Sample Masks ( $\frac{3}{8}$ ", $\frac{1}{4}$ ", and $\frac{3}{16}$ ") |
| 300-0039   | Aluminum Substrate Alignment Mirror                                    |

## SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Optics</b>                 | All reflective  |
| <b>Angle of Incidence</b>     | 30 degrees or 45 degrees                              |
| <b>Sample Masks</b>           | $\frac{3}{8}$ ", $\frac{1}{4}$ " and $\frac{3}{16}$ " |
| <b>Dimensions (W x D x H)</b> | 51 x 96 x 77 mm                                       |
| <b>Mount</b>                  | 2 x 3" slide mount                                    |



Optical geometry for the 30Spec and 45Spec.



FTIR spectrum of polymer coating on a food container collected using the PIKE 30Spec.

# 80Spec

## AT A GLANCE

- ▶ Measurement of thin films and mono-molecular layers
- ▶ Fixed 80-degree angle of incidence
- ▶ Gold-coated reflective optics for highest throughput grazing angle analysis
- ▶ Integrated polarizer mounts
- ▶ Baseplate mount design for stable operation and collection of high-quality spectra

The 80Spec is ideal for the measurement of relatively thin films and mono-molecular layers by specular reflection.

Samples are simply placed face down across the top of the accessory and the spectrum is collected.

The 80Spec is available in two versions. The most popular version includes three sample masks to define smaller areas on a sample, and is recommended for smaller samples or for measurement of variations in thin film coatings. The basic configuration features a flat sampling surface with fixed sampling port (2 3/8" x 3/4"). This version is ideal for analysis of larger, uniform samples.

Generally, the measurement of ultra-thin film samples—especially monolayers—is significantly enhanced by using p-polarized light, with the electric field vector perpendicular to the sample surface. The 80Spec includes polarizer mounts on both incoming and outgoing beams for positioning optional manual or automated IR polarizers.

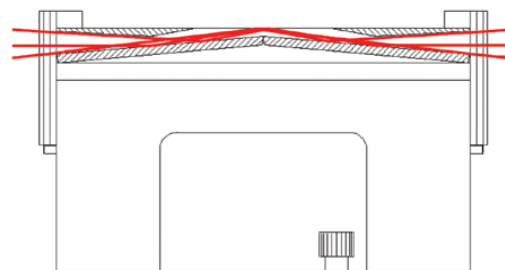


| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 012-11XX    | 80Spec – 80° Specular Reflection Accessory with Sample Masks (2", 5/8" and 3/8")<br>Includes a gold substrate alignment mirror, dual polarizer mount and FTIR base mount |
| 012-10XX    | 80Spec – 80° Specular Reflection Accessory<br>Includes a gold substrate alignment mirror, dual polarizer mount and FTIR base mount                                       |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. For compact-size spectrometers, only one polarizer mount may be included due to sample compartment width restriction.

| Replacement Parts and Options |  |
|-------------------------------|--|
| 010-3010                      | Specular Mask Set                            |
| 300-0002                      | Gold Substrate Alignment Mirror, 1.25 x 3.0" |
| 090-1000                      | Manual Polarizer, ZnSe                       |
| 090-1200                      | Manual Polarizer, KRS-5                      |
| 090-3000                      | Precision Manual Polarizer, ZnSe             |
| 090-3200                      | Precision Manual Polarizer, KRS-5            |
| 090-5000                      | Precision Automated USB Polarizer, ZnSe      |
| 090-5100                      | Precision Automated USB Polarizer, KRS-5     |

**Note:** For more polarizer options see the polarizer section of this catalog.



Beam path within the 80Spec specular reflection accessory.



FTIR spectrum of an ultra-thin film on a reflective substrate using p-polarized IR beam.

# AGA Accessory

## AT A GLANCE

- ▶ Quantitative measurement of small areas of thin films and mono-molecular layers
- ▶ Fixed 80-degree angle of incidence
- ▶ Measurement of lubricants on hard disks
- ▶ Sampling dimensions selectable from 1/2, 3/8, 1/4, 3/16 and 1/8 inch diameter
- ▶ Mount for optional polarizer
- ▶ Spectral range 10,000–500 cm<sup>-1</sup>

| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

|          |   |
|----------|---|
| 015-10XX | AGA - Grazing Angle Specular Reflection Accessory<br>Includes 5 selectable spot sizes of 1/2", 3/8", 1/4", 3/16" and 1/8", gold substrate alignment mirror, polarizer mount and FTIR base mount |
|----------|---|

**Note:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog.

### Replacement Parts and Sampling Options

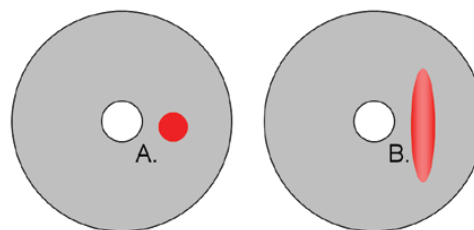
|          |  |
|----------|--|
| 300-0002 | Gold Substrate Alignment Mirror, 1.25 x 3.0" |
| 090-1000 | Manual Polarizer, ZnSe                       |
| 090-1200 | Manual Polarizer, KRS-5                      |

**Note:** For more polarizer options see the polarizer section of this catalog.

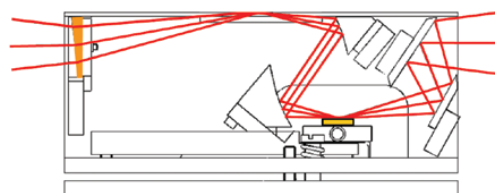
The Advanced Grazing Angle (AGA) specular reflection accessory is a tool designed for quantitative measurement of spatially defined areas of thin films on reflective substrates.

Traditional grazing angle accessories produce an elliptical and non-uniform spot size on the sample area. This causes problems when quantitative analyses are to be performed on small sample areas. To overcome this design deficiency, the AGA accessory focuses the beam from the spectrometer onto the pin mirror. The portion of the beam that is reflected from this mirror is imaged at unit magnification onto the sample, striking it at 80 degrees. Thus, the beam at the sample position is uniform and circular in dimension.

The selectable slide-mounted pin mirrors range from 1/2" to 1/8" diameter. The AGA allows excellent quantitative results for the defined sample area.



Sampling image on a hard disk surface produced by (A) the spatially resolved AGA and (B) a traditional grazing angle accessory.



Beam path within the AGA - Grazing Angle Specular Reflection Accessory.



FTIR spectrum of an 18-angstrom thick lubricant on a hard disk measured in 15 seconds using an MCT detector.



# Absolute Reflection Accessory

## AT A GLANCE

- ▶ Measurement of absolute reflectance of optical surfaces, windows and metallic surfaces
- ▶ Fixed 12-degree angle of incidence
- ▶ Performance evaluation of optical elements
- ▶ Evaluation of test plates in medical, industrial and military applications

The Absolute Reflection Accessory (ARA) is designed for making high precision specular reflection measurements.

Unlike traditional relative measurements where reflectance is a function of the background reference, the ARA does not require a background reflection standard due to its unique V/W optical arrangement.

When using relative reflection accessories, the sample reflectance is measured and calculated typically against a gold mirror that has a 94–99% reflectance in the infrared region. With the ARA, however, the reference mirror is integrated into both the background and sample measurements. In the V position, the beam reflects from the reference mirror in the background spectrum. In the W position, it reflects from the sample twice and the same reference mirror once at 12 degrees in the sample position. The absolute reflectance of a sample is calculated as the square root of the measured value at a given wavenumber or wavelength.

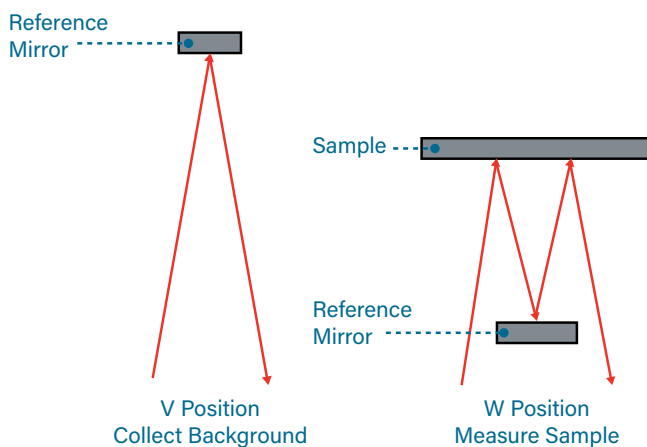


| PART NUMBER   | DESCRIPTION   |
|---|---|
| 014-10XX  | Absolute Reflectance Accessory<br>Includes V / W sample holder, gold substrate mirror and FTIR base mount |
| <b>Note:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. |   |
| Replacement Parts and Sampling Options  |   |
| 300-0061  | Gold Substrate Alignment Mirror, 2 x 3"   |

## SPECIFICATIONS

|                               |                                     |
|-------------------------------|-------------------------------------|
| <b>Optics</b>                 | All reflective                      |
| <b>Angle of Incidence</b>     | 12 degrees                          |
| <b>Optical Configuration</b>  | V / W                               |
| <b>Purge Sealing</b>          | Purge tubes and purge barb included |
| <b>Dimensions (W x D x H)</b> | 165 x 241 x 146 mm                  |
| <b>Sample Holder Opening</b>  | Oval, 40 mm (W) x 22 mm (H)         |
| <b>FTIR Compatibility</b>     | Most, specify model and type        |

The background and sample positions are easily selected by rotating the sample holder 180 degrees. With the ARA spring-loaded mount, sample loading and unloading is easy.



Beam path for V and W positions for the ARA.

# Specular Reflection

## Theory and Applications

Specular reflection sampling in the infrared is a useful technique for measuring thin films on reflective substrates, analyzing of bulk materials and measuring of mono-molecular layers on a reflective substrate. Often this technique provides a means of sample analysis with no sample preparation—keeping the sample intact for subsequent measurements.

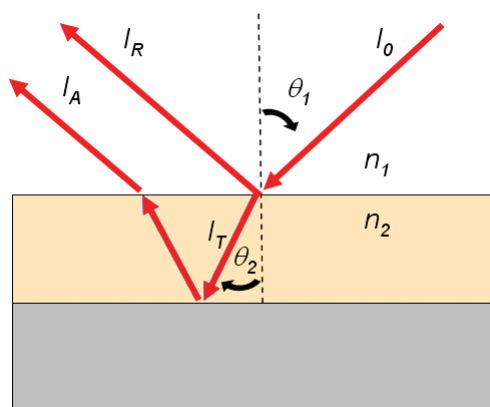
The basics of the sampling technique involve measurement of the reflected energy from a sample surface at a given angle of incidence. The electromagnetic and physical phenomena that occur at and near the surface are dependent upon the angle of incidence of the illuminating beam, refractive index and thickness of the sample and other sample and experimental conditions. A discussion of all of the physical parameters and considerations surrounding the specular reflection sampling technique is beyond the scope of this overview. We will present this technique from an applications-oriented perspective.

### TYPES OF SPECULAR REFLECTION EXPERIMENTS

- ▶ Reflection-absorption of relatively thin films on reflective substrates measured at near-normal angle of incidence.
- ▶ Specular reflection measurements of relatively thick samples measured at near-normal angle of incidence.
- ▶ Grazing angle reflection-absorption of ultra-thin films or monolayers deposited on surfaces measured at a high angle of incidence.

### REFLECTION-ABSORPTION MEASUREMENTS

In the case of a relatively thin film on a reflective substrate, the specular reflection experiment may be thought of as similar to a “double-pass transmission” measurement and can be represented as:



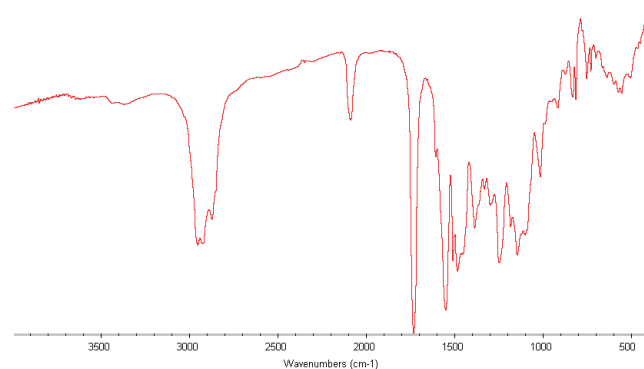
Beam path for reflection-absorption of a relatively thin film measured by specular reflection.

The incident FTIR beam represented by  $I_0$  illuminates the thin film of a given refractive index ( $n_2$ ) and at an angle of incidence ( $\theta_1$ ). Some of the incident beam is reflected from the sample surface, represented by  $I_R$  at the incident angle  $\theta_1$  and is also known as the specular component. Some of the incident beam is transmitted into the sample represented by  $I_T$  at an angle of  $\theta_2$  – calculated from Snell's Law.

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

At the reflective substrate, the beam reflects back to the surface of the thin film. When the beam exits the thin film it has geometrically passed through the film twice and is now represented as  $I_A$ . Infrared energy is absorbed at characteristic wavelengths as this beam passes through the thin film and its spectrum is recorded.

The specular reflection spectra produced from relatively thin films on reflective substrates measured at near-normal angle of incidence are typically of high quality and very similar to spectra obtained from a transmission measurement. This result is expected as the intensity of  $I_A$  is high relative to the specular component ( $I_R$ ).

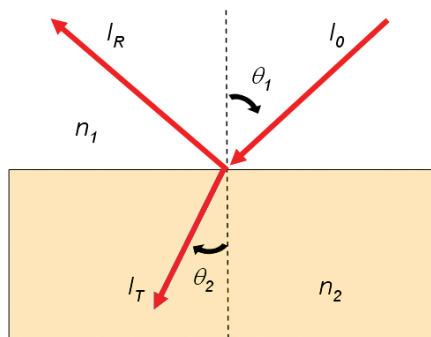


Spectrum of thin film coating on a metal surface measured at 30 degrees angle of incidence using the VeeMAX III specular reflection accessory.

### REFLECTION MEASUREMENTS—THICK SAMPLES

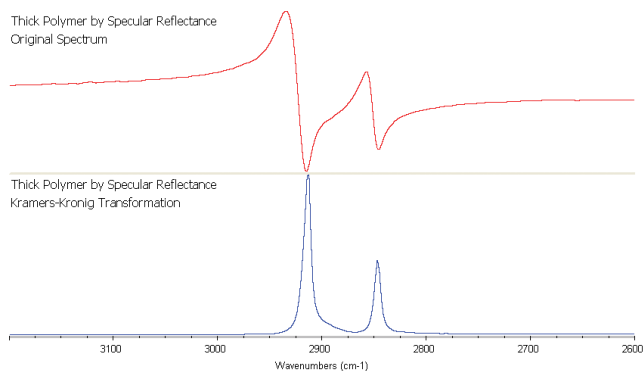
For relatively thick samples, the specular reflection experiment produces results which require additional considerations as the specular component of the total reflected radiation is relatively high.

Again, the incident FTIR beam represented by  $I_0$  illuminates the sample of a given refractive index ( $n_2$ ) and at an angle of incidence  $\theta_1$ . Some of the incident beam is reflected from the sample surface, represented by  $I_R$  at the incident angle  $\theta_1$ . Some of the incident beam is transmitted into the sample represented by  $I_T$  at an angle of  $\theta_2$ . As predicted by Fresnel equations, the percent of reflected versus transmitted light increases with higher angles of incidence of the illuminating beam. Furthermore, the refractive index of the sample, surface roughness, and sample absorption coefficient at a given wavelength all contribute to the intensity of the reflected beam.



Beam path for relatively thick sample, measured by specular reflection.

At wavelengths where the sample exhibits a strong IR absorption, the reflectivity of the sample increases. The super-position of the extinction coefficient spectrum with the refractive index dispersion results in a spectrum with derivative-shaped bands. This specular reflection spectrum can be transformed using the Kramers-Kronig conversion to a transmission-like spectrum as shown in the example below.

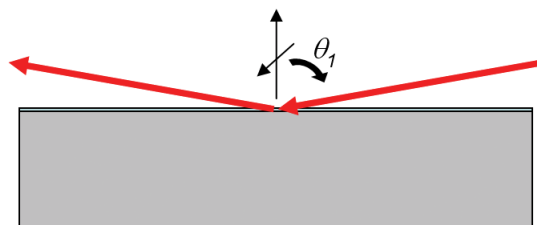


Spectrum (upper - original) of a relatively thick polymer sample measured at 30 degrees angle of incidence using the VeeMAX III; the lower spectrum has been transformed using the Kramers-Kronig software algorithm and is very similar to a transmission spectrum of the polymer polyethylene.

### GRAZING ANGLE MEASUREMENTS— ULTRA-THIN FILMS AND MONOLAYERS

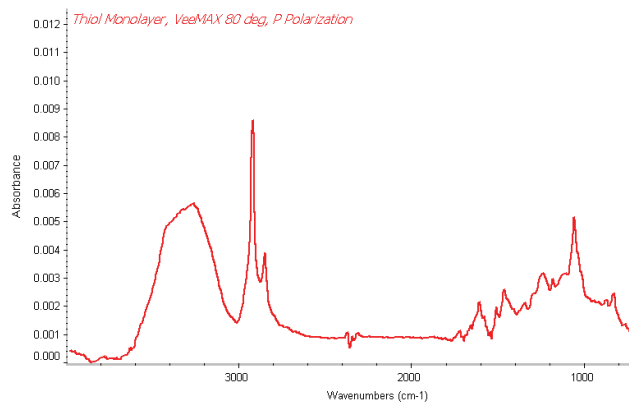
Our third application of specular reflection is the measurement of relatively thin films and mono-molecular layers at grazing angle of incidence. At high angles of incidence, between 60 and 85 degrees, the electromagnetic field in the plane of the incident and reflected radiation is greatly increased relative

to a near-normal angle of incidence. The perpendicular component of the electromagnetic field of the reflecting radiation is not enhanced.



Beam path for a relatively thick sample measured by specular reflection.

Because of the orientation of the electromagnetic field at the surface for grazing angle measurements, the use of an IR polarizer greatly improves the sampling result. By collecting the spectrum at grazing angle of incidence with p-polarization, we only examine the enhanced portion of the electromagnetic field at the sample surface, thereby producing a stronger absorbance spectrum.



Grazing angle specular reflection analysis of a thiol mono-molecular layer deposited on a gold-surfaced mirror using the PIKE VeeMAX III at 80 degrees and p-polarization; the FTIR was equipped with an MCT detector.

### SUMMARY

Specular reflection is a valuable FTIR sampling technique for the analysis of thin films on reflective substrates, for relatively thick films on reflective materials and for bulk materials where no sample preparation is preferred. PIKE Technologies offers a complete line of specular reflection accessories to perform these analyses.



# Polarizers



Polarizers may be used to detect oriented samples and for measurement of thin films on reflective substrates. We offer several crystal forms of polarizers and automated versions for transmission, reflection and ATR sampling covering the UV-Vis, NIR, mid-IR and far-IR regions.

# Polarizers

## AT A GLANCE

- ▶ Convenient, slide-mount design for all FTIR spectrometers
- ▶ Compatible with many PIKE Technologies accessories
- ▶ Available in manual and automated versions
- ▶ Elements for NIR, mid-IR and far-IR applications



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE

Polarizers are used for a wide variety of spectroscopy applications. Manual or automated versions are available covering the NIR, mid-IR and far-IR regions.

All polarizers fit into a standard 2 x 3" slide mount and are compatible with FTIR spectrometers. Polarizer elements are 25 mm in diameter and, with mount, have a 20-mm clear aperture.

The polarizers are also compatible with many PIKE Technologies accessories including the 80Spec, VeeMAX, RotatIR and AGA specular reflectance accessories. If you would like to add mounting to any of our accessories, including ATR, please contact us.

### MANUAL POLARIZERS

There are two manual polarizer types available. The manual polarizer has 5-degree scale resolution, and the precision manual polarizer has more precise, 2-degree scale.

### AUTOMATED POLARIZERS

PIKE offers polarizers that are fully computer controlled, making many previously labor-intensive applications easy. Automated polarizers increase reproducibility with accuracy to +/- 0.5 degree. With the automated polarizer an analysis program can be set up through PIKE AutoPRO software to automatically collect all spectra at user-specified polarizer settings. The AutoPRO is compatible with most FTIR instrument software.

In addition, AutoPRO software can simultaneously control the automated polarizer along with multiple PIKE accessories, such as the automated VeeMAX III, and the automated RotatIR.

Precision Manual Polarizer.



Manual Polarizer.

TABLE 1: POLARIZER PROPERTIES.

| Polarizer Type   | Application                | Cutoff, cm <sup>-1</sup> Spectral Range | Transmission Efficiency, K <sub>1</sub> | Undesired Transmission, K <sub>2</sub> | Degree of Polarization, (K <sub>1</sub> -K <sub>2</sub> )/(K <sub>1</sub> +K <sub>2</sub> ) |
|------------------|----------------------------|---|---|--|---|
| ZnSe             | Mid-IR, General Purpose    | 460                                     | 70%                                     | 1.00%                                  | 97%   |
| KRS-5            | Mid-IR, Wide-range         | 200                                     | 75%                                     | 0.25%                                  | 99%   |
| Ge               | Mid-IR, Highest Efficiency | 5500-570                                | 90%                                     | 0.25%                                  | 99%   |
| Polypropylene    | Far-IR, Widest Range       | 500-10                                  | 80%                                     | 4.00%                                  | 93%   |
| CaF <sub>2</sub> | NIR Applications           | 800                                     | 85%                                     | 1.00%                                  | 98%   |
| Glass            | Vis/NIR Broadband          | 20,000-3030                             | 85%                                     | 0.05%                                  | 99%   |
| BaF <sub>2</sub> | Mid-IR                     | 840                                     | 70%                                     | 0.10%                                  | 99%   |

Notes: Efficiency values reported at 1000 cm<sup>-1</sup> for mid-IR, at 3300 cm<sup>-1</sup> for NIR, at 5000 cm<sup>-1</sup> for glass Vis/NIR and 100 cm<sup>-1</sup> for far-IR. All polarizers are holographic, wire grid for maximum performance.

## SPECIFICATIONS

|                                |  |
|--------------------------------|--|
| <b>Element Type</b>            | ZnSe, KRS-5, Ge, CaF <sub>2</sub> , Glass BaF <sub>2</sub> , Polypropylene |
| <b>Element Diameter</b>        | 25 mm  |
| <b>Clear Aperture Diameter</b> | 20 mm  |
| <b>Dimensions (W X D X H)</b>  |  |
| Manual                         | 50 x 86 x 9 mm   |
| Precision Manual               | 50 x 142 x 9 mm  |
| Automated Precision            | 50 x 146 x 55 mm   |
|                                | Note: NIR glass manual polarizers are 17-mm thick                          |



Precision Automated Polarizers, USB.

## PART NUMBER DESCRIPTION

## Manual Polarizers (select based upon spectral range and performance requirements)

|          |  |
|----------|--|
| 090-1000 | Manual Polarizer, ZnSe                       |
| 090-1200 | Manual Polarizer, KRS-5                      |
| 090-1500 | Manual Polarizer, Ge                         |
| 090-1400 | Manual Polarizer, BaF <sub>2</sub>           |
| 090-1650 | Manual Polarizer, Polypropylene              |
| 090-1300 | Manual Polarizer, CaF <sub>2</sub>           |
| 190-2002 | Manual Polarizer, Glass                      |
| 090-3000 | Precision Manual Polarizer, ZnSe             |
| 090-3200 | Precision Manual Polarizer, KRS-5            |
| 090-3500 | Precision Manual Polarizer, Ge               |
| 090-3400 | Precision Manual Polarizer, BaF <sub>2</sub> |
| 090-3650 | Precision Manual Polarizer, Polypropylene    |
| 090-3300 | Precision Manual Polarizer, CaF <sub>2</sub> |
| 190-2000 | Precision Manual Polarizer, Glass            |

**Note:** All manual polarizers are mounted into a 2" x 3" plate for use with the FTIR spectrometer slide sample holder or the appropriate sampling accessory. Contact us for a mount for your PIKE ATR accessory. UV-Vis Polarizers can be found in the UV-Vis section of the catalog.

## Automated Polarizers (select based upon spectral range and performance requirements)

|          |   |
|----------|---|
| 090-5000 | Precision Automated Polarizer, ZnSe             |
| 090-5100 | Precision Automated Polarizer, KRS-5            |
| 090-5400 | Precision Automated Polarizer, Ge               |
| 090-5300 | Precision Automated Polarizer, BaF <sub>2</sub> |
| 090-5550 | Precision Automated Polarizer, Polypropylene    |
| 090-5200 | Precision Automated Polarizer, CaF <sub>2</sub> |
| 190-2005 | Precision Automated Polarizer, Glass            |

**Notes:** All automated polarizers are mounted into a 2 x 3" plate for use with the FTIR spectrometer slide sample holder or the appropriate sampling accessory. The automated polarizers include the PIKE Technologies Motion Control Unit and AutoPRO software for fully automated operation.

# Polarizers

## Theory and Applications

Polarizers are valuable tools used for spectroscopic analysis of sample orientation and for measuring thin films on reflective surfaces. This overview presents basic polarization theory and highlights some useful polarization applications.

### HOW POLARIZERS WORK

For the purposes of discussing polarizers, light is considered an electric field with a magnitude oscillating in time. Light propagating along the z axis can be described as a combination of electric vectors in x and y axis. Linearly polarized light may be thought of as consisting of an x and a y component with different relative magnitudes. For example, if the y component is close to zero, the light is considered fully polarized in the x direction.

Polarizers are devices that split unpolarized light into two orthogonal components; one of the linearly polarized components is transmitted, the other is reflected, redirected or absorbed. The most important features of a good polarizer are brightness, contrast and durability. Brightness and contrast can be described by two main parameters,  $K_1$  and  $K_2$ .

$K_1$  = Transmission efficiency for normally incident polarized light whose electric field vector is perpendicular to the wire direction.

$K_2$  = Transmission efficiency for normally incident polarized light whose electric field vector is parallel to the wire direction.

For a 'perfect polarizer'  $K_1 = 1$ , which means full transmission of polarized light whose electric field vector is in the preferred direction and  $K_2 = 0$ , which means complete blockage of a beam of polarized light whose electric vector is perpendicular to the former. Other measures of performance deduced from  $K_1$  and  $K_2$  are

$$\text{Degree of polarization} = \frac{(K_1 - K_2)}{(K_1 + K_2)}$$

$$\text{Extinction Ratio} = \frac{K_1}{2K_2}$$

$$\text{Principal transmittance ratio or contrast} = \frac{K_1}{K_2}$$

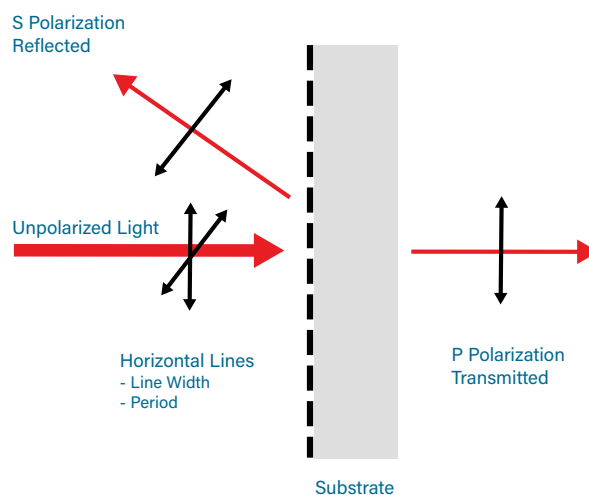
### HOW POLARIZERS ARE MADE

Polarizers may be made from very fine conducting parallel elements or grid placed upon a suitable transparent base material. When the grid spacing is much smaller than the wavelength of light, the light with the electric vector parallel with the grid will be reflected and only the component with perpendicular electric vector will be transmitted (shown graphically on the right).

The overall transmission characteristic of the polarizer depends upon the substrate, but the polarization efficiency depends upon the period, line width and other design parameters of the polarizer.

In the mid-infrared range, the most practical and commonly used polarizers are ruled or holographic wire grid structures. The polarization effect comes from the same principle as the free standing wire grid, except the fine wires are formed on the surface of an infrared transmitting optical window material.

Polarization efficiency depends on smaller grid spacing than the wavelength and on the conductivity of the wires. In the case of a ruled polarizer, the surface of the optical element is created by a diamond needle to form very fine parallel lines, such as 1200 lines/mm, on the surface. The optical element is then placed into a vacuum chamber and this pattern is partially coated with aluminum or other evaporated metallic layer. The spacing between the evaporated thin lines has to be very small, typically a fraction of the wavelength. Ruled polarizers have good performance and are durable at high laser powers, but can only be made on hard, non-granular materials that can be ruled, such as ZnSe.



Graphical representation of the polarization effect.

Holography is another method used to form the fine metallic wire pattern on the surface of the polarizer element. Two coherent laser beams are directed onto the surface of the optical element which is coated with a very thin layer of photo resist. The interference pattern formed at the intersection of the two beams is allowed to expose the photo resist. The lines in between the exposed photo resist are removed and then coated in a vacuum chamber similar to the ruled grating type. The advantage of holographic polarizers is that a wider variety of materials can be used such as the softer KRS-5. Holographic techniques allow more uniform grid patterns because the spacing is produced optically. Light scatter due to imperfections of ruled grooves are also reduced. If the grid spacing is smaller, the polarizer is more efficient. The spacing errors have also much less effect on the efficiency if the grid is much smaller than the wavelength. The trade-off with tighter grid is the reduction of the optical throughput.



These parameters are carefully optimized in the design of the polarizer elements and the right polarizer can be selected for specific experimental conditions.

The maximum transmitted light is affected by the transmission of the materials and the scattering of the ruled and evaporated surfaces. Fresnel losses are determined by the refractive index and the performance of the anti-reflection coating on the element. The maximum transmission compared to a fully depolarized open beam is typically less than 50%. However, FTIR spectrometers produce slightly polarized beams, which in most cases are oriented in the vertical direction in the sample compartment. Thus the apparent transmission of a single polarizer oriented vertically and compared to open beam can be over 50%.

The other critical parameter of polarizers, the contrast, can be measured by crossing two polarizers and recording the throughput signal. For efficient polarizers in a practical spectroscopy setting, such as using a converging infrared beam in the sample compartment of an FTIR spectrometer, it is expected that the light level should be less than 1%. For selected high-performance polarizers it can be better than 0.5%.

Polarizers are usually mounted in a plastic disc and placed in a rotating holder with an angle scale. This way, the angle of the polarizer orientation can be positioned. Motorized polarizers are available with much better angular accuracy and precision. The automated polarizers are also very useful for conducting a series of experiments with different angle settings under complete computer control.

### MONITORING MOLECULAR ORIENTATIONS

One of the main uses of infrared polarizers is to monitor molecular orientation in samples such as films and fibers. During manufacture polymers tend to orient along the axis of the mechanical stretching and this preferred orientation is retained after the material stops flowing. In some cases, polymers are a mixture of crystalline, more polarized, and amorphous, less polarized, forms of the material. In order to study orientation, polarized light is directed on the film or fiber. The polarized light electrical vector coinciding with the dipole of the infrared active moiety increases in absorption intensity, thereby revealing the band assignment and the orientation of the molecular group. Single crystals placed in the focus of polarized light also absorb selectively, depending on the orientation of the crystal.

### POLARIZERS AND ATR

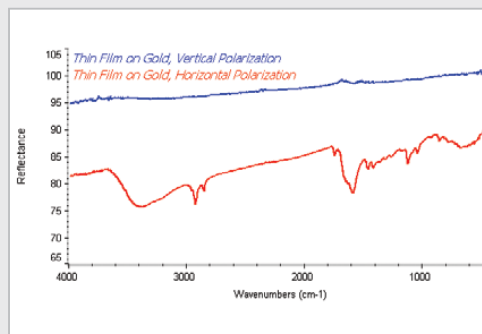
Polarizers can also be used in conjunction with attenuated total reflection (ATR). Even without polarizers, for any ATR that retains the orientation relative to the incoming infrared beam, there could be spectral differences noted when an oriented sample is placed with its direction along the optical axis or perpendicular to it. The phenomenon is related to penetration depth differences for the light components polarized parallel or perpendicular with the reflective surface.

### MONOLAYERS AND THIN FILMS

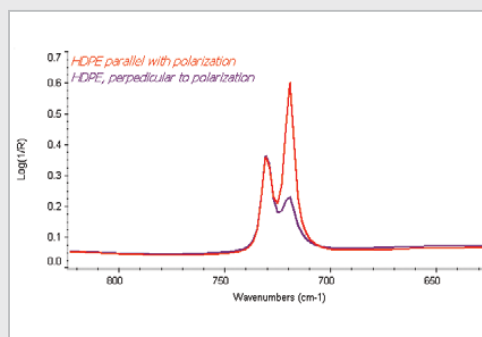
Another important application of polarizers is the enhancement of the signal measuring thin films on polished semiconductors, metallic mirrors and other reflective surfaces. Using grazing angle reflection optics, thin films can be measured. Substantial signal enhancement can be achieved by using polarized light in conjunction with a grazing angle accessory. For example, a thin oily deposit on a gold

## APPLICATIONS

Polarizers are often used to investigate polymer orientation, and monolayers and thin films. PIKE polarizers are mounted on a 2 x 3 inch slide mount, making them easy to integrate into the sampling set up.



Thin oil layer spectra on a gold substrate under horizontal (p or perpendicular) polarization or vertical (s or parallel) polarization



High-density polyethylene spectra with parallel and perpendicular polarization, demonstrating the orientation of this sample.

mirror can be measured with good signal-to-noise ratio by using polarized light with a specular reflection accessory set at 80 degrees. As seen in the applications column, the light polarized such that the electric vector is perpendicular to the metallic mirror surface is enhanced. The spectrum measured with the polarization perpendicular to the surface (electric vector parallel with the surface) is not detected.

### SUMMARY

Polarizers are highly useful spectroscopy sampling tools for the measurement of samples with molecular orientation, for measuring thin films on reflective surfaces and for molecular spectroscopic research.



# Integrating Spheres



Integrating spheres are useful for qualitative and quantitative measurements of sample composition when morphology, particle size, surface roughness or sample flatness varies from sample to sample. PIKE Technologies offers fully integrated accessories for mid-IR and NIR applications.

# Mid-IR IntegratIR

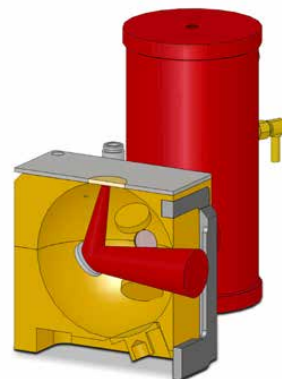
## AT A GLANCE

- ▶ 3-inch sphere. gold-coated, Lambertian scatterer for high-performance measurements
- ▶ 12-degree hemispherical diffuse reflection measurement with specular exclusion port
- ▶ Diffuse transmission station for measurement of highly scattering samples in transmission mode
- ▶ Choice of integrated, high-performance detector MCT or DTGS for ultimate configurability
- ▶ Upward- and downward-looking optical configurations to accommodate a wide range of sample sizes and types
- ▶ In-sample-compartment design to minimize laboratory space requirements

The Mid-IR IntegratIR is an integrating sphere that is often used when studying reflectance properties of solids, analyzing light-scattering and/or highly absorbing samples and collecting spectra difficult to obtain with standard sampling techniques.

## OPTICAL DESIGNS

The Mid-IR IntegratIR™ spheres are available in upward- and downward-looking configurations and are suitable for the measurements of absolute and relative diffuse reflectance of solids, powders and opaque liquids. Each feature a 3-inch diameter highly reflective gold-coated sphere. The accessory mounts in the sample compartment of the FTIR spectrophotometer, and uses a dedicated detector for maximum performance.



Optical diagram of the upward-looking IntegratIR.

The upward- and downward-looking mid-IR spheres feature a 12-degree illumination of the sample, and offer a specular exclusion port for measuring total reflectance (diffuse plus specular) and reflectance of the diffuse component only. For both spheres, the selection of light illumination onto the sample or onto the reference surface is done via a flipper mirror. This allows the background to be collected using either the substitution method or the Taylor method.



Gold-coated Lambertian finish sphere.

## SPECIFICATIONS

|  |   |
|--|---|
| <b>Optical Design</b>                  | Upward- or downward-looking sample spheres  |
| <b>Angle of Incidence</b>              | 12 degrees  |
| <b>Sphere Diameter and Surface</b>     | 76.2 mm (3") gold-coated Lambertian surface   |
| <b>Sample Port Size</b>                | 20 mm   |
| <b>Specular Exclusion Port</b>         | Standard  |
| <b>Sphere Dimensions (W x D x H)</b>   | 159 x 248 x 154 mm (excludes baseplate)   |
| <b>Sample Opening, Downward Sphere</b> | 50.8 x 35.5 x 12.7 mm   |
| <b>Spectral Range, MCT Detectors</b>   | Wide-band: 5000–500 $\text{cm}^{-1}$<br>Mid-band: 5000–650 $\text{cm}^{-1}$<br>Narrow-band: 5000–800 $\text{cm}^{-1}$ |
| <b>Extended DTGS Detector</b>          | 5000–400 $\text{cm}^{-1}$   |
| <b>InGaAs Detector</b>                 | 12,200–3850 $\text{cm}^{-1}$  |

## UPWARD-LOOKING MID-IR INTEGRATING SPHERE

For the upward-looking sphere, reflectance samples are placed directly onto the sample port located on the top of the sphere. This sphere is ideal for large and/or thick solid samples. For powder samples, a ZnSe window plate is available. If preferred, a KBr window can also be used with the sample plate to minimize the reflection loss compared to ZnSe.

## DOWNWARD-LOOKING MID-IR INTEGRATING SPHERE

The downward-looking Mid-IR Integrating Sphere allows the sample to be placed underneath the sphere. This configuration is desirable for measurements of powders and particulate materials because the incidence beam strikes the sample directly, without passing through an IR transparent window.

## DIFFUSE TRANSMITTANCE MEASUREMENTS

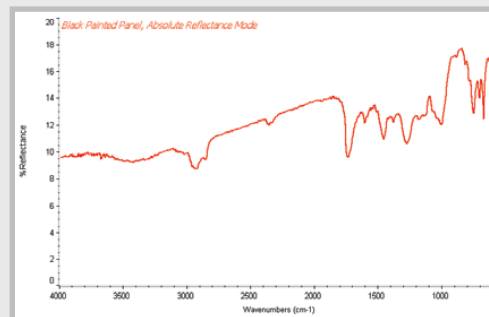
Diffuse transmittance of partially transmitting materials can be measured with either sphere. This is done by placing the sample on a standard 2 x 3" sample holder and sliding it in the mount located in incoming beam port.

## DETECTOR OPTIONS

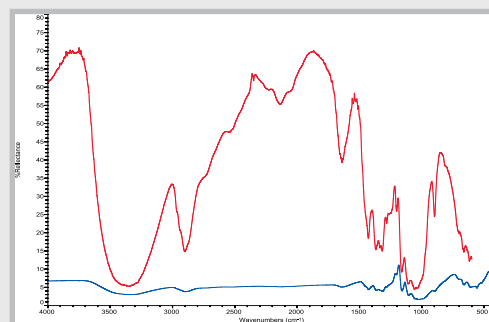
A selection of mercury cadmium telluride (MCT) or deuterated triglycine sulfate (DTGS) detectors is offered with the Integrating Spheres. The wide-band MCT is the commonly configured detector while the less sensitive DTGS is an option for users who require the convenience of a room temperature detector. The MCT detector is approximately 50 times more sensitive compared to the DTGS detector. All detectors are interchangeable. For those FTIR spectrometers with near-IR spectral capabilities, a sensitive InGaAs detector is available.

## APPLICATION

An integrating sphere is ideal for measuring reflectance and transmittance of diffusely scattering material, as the accessory enables the hemispherical collection of scattered IR beam caused by the sample.



Absolute reflectance spectrum of a painted black panel measured using the PIKE Mid-IR Integrating Sphere.



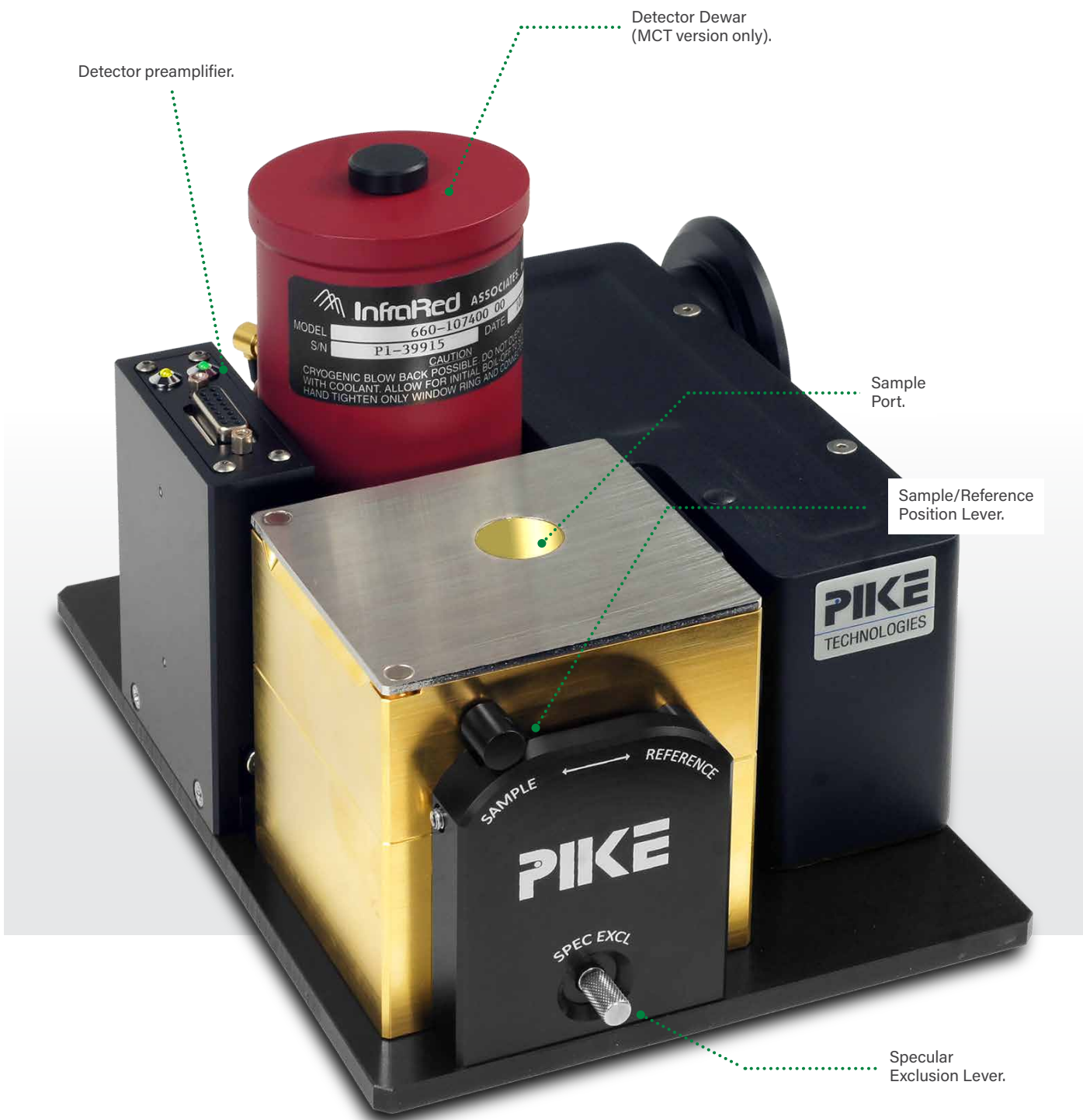
Comparison of transmittance spectra of diffusely scattering paper collected using an Integrating Sphere (red) or without a sphere (blue).



Downward-looking Integrating Sphere.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 048-12XX    | Upward Mid-Infrared IntegratIR Integrating Sphere Accessory<br>Includes sphere, purge enclosure and tubing, diffuse gold reference and sample plate with ZnSe window                  |
| 048-11XX    | Downward Mid-Infrared IntegratIR Integrating Sphere Accessory<br>Includes sphere, purge enclosure and tubing, one diffuse gold reference and powder sample cup                        |
|             | <b>Notes:</b> replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Your FTIR spectrometer must be capable of interfacing with an external detector. |

| PART NUMBER | DESCRIPTION  |
|-------------|--|
|             | Detector Choice for IntegratIR ( <i>must select one</i> )  |
| 048-3350    | Wide-band MCT Detector   |
| 048-3250    | Mid-band MCT Detector  |
| 048-3150    | Narrow-band MCT Detector   |
| 048-3450    | DTGS Detector  |
| 048-3550    | InGaAs Detector  |
|             | <b>Notes:</b> Detector includes preamplifier electronics. MCT detectors require liquid nitrogen for cooling. |
|             | Replacement Parts and Sampling Options   |
| 048-0108    | Sample Plate with 20 x 2 mm ZnSe Window for Upward IntegratIR  |
| 048-0208    | Sample Plate with 20 x 2 mm KBr Window for Upward IntegratIR   |
| 048-3000    | Diffuse Gold Reference for Upward IntegratIR   |
| 048-3001    | Diffuse Gold Reference for Downward IntegratIR   |
| 048-2020    | Powder Sample Cup for Downward IntegratIR  |



Detector preamplifier.

Detector Dewar (MCT version only).

Sample Port.

Sample/Reference Position Lever.

Specular Exclusion Lever.

# External Integrating Sphere

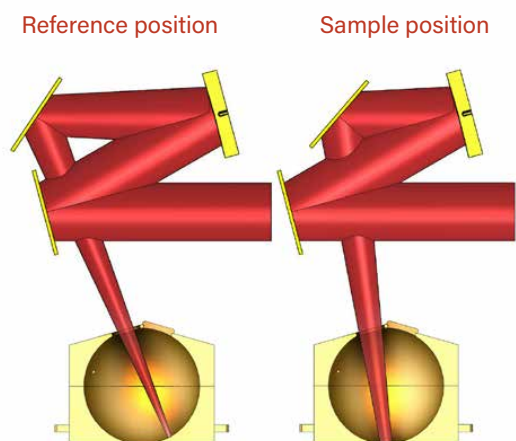
## AT A GLANCE

- ▶ Accommodates large-sized samples
- ▶ 4-inch sphere, gold-coated, Lambertian scatterer for high performance measurements
- ▶ 8-degree hemispherical diffuse reflection measurement with specular exclusion port
- ▶ Manual translation mirror to switch between the reference and sample position
- ▶ Integrated, high-performance MCT detector
- ▶ Utilizes external spectrometer beam to allow for the analysis of oversized samples positioned under the sphere
- ▶ Fully purgeable enclosure

The External Integrating Sphere utilizes the external beam of the spectrometer and is ideal for large samples due to the additional sampling space realized by positioning samples outside the confines of the instrument's sample compartment. It is the preferred sphere for highly precise reflectivity measurements.

## OPTICAL DESIGN

The internal optics of the External Integrating Sphere focus light from the external beam of the spectrometer into a 4-inch gold-plated integrating sphere. A translation mirror is moved manually using the mirror position lever, located on the enclosure of the accessory for precise movement between the sample and reference positions. In the sample position, incident light is 8° from normal. Specular reflection may be excluded by opening a port at the top of the sphere. The detector port is 90° from the sample port.



Optical diagram of the FTIR external beam path for reference and sample positions.

Accurate measurement of both solid- and liquid-phase samples is possible with the 4-inch External Integrating Sphere. By utilizing highly-accurate Taylor methodology for measurement, high-quality components, and sensitive MCT detection, the External Integrating Sphere offers low-noise, highly accurate measurements for a wide range of samples.



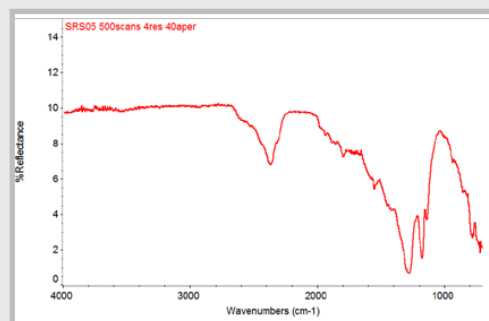


## SPECIFICATIONS

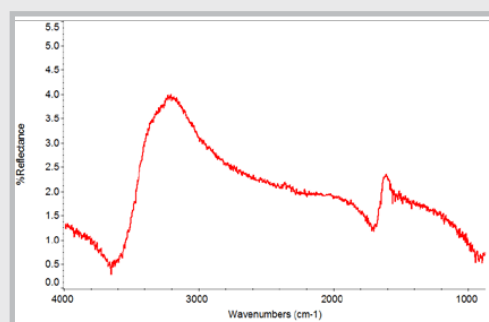
|                                      |   |
|--------------------------------------|---|
| <b>Optical Design</b>                | Downward-looking sample sphere  |
| <b>Angle of Incidence</b>            | 8 degrees   |
| <b>Sphere Diameter and Surface</b>   | 101.6 mm (4") gold-coated Lambertian surface  |
| <b>Sample Port Size</b>              | 20 mm   |
| <b>Specular Exclusion Port</b>       | Standard  |
| <b>Spectral Range, MCT Detectors</b> | Wide-band: 5000–500 $\text{cm}^{-1}$<br>Mid-band: 5000–650 $\text{cm}^{-1}$<br>Narrow-band: 5000–800 $\text{cm}^{-1}$ |
| <b>FTIR Placement</b>                | Right or Left Side  |

## APPLICATION

The External Integrating Sphere offers precision measurements for samples spanning from high to low reflectance. By using the external beam of the spectrometer, this accessory can accommodate small to large samples.



**Reflectivity standard spectrum**, highlighting the quality data for a low-reflectivity sample.



**Water reflectivity spectrum**, collected using the External Integrating Sphere.

| PART NUMBER  | DESCRIPTION  |
|--|--|
| 048-13XXL  | Mid-Infrared External Integrating Sphere Accessory – Left<br>Includes sphere, purge enclosure and tubing.  |
| 048-13XXR  | Mid-Infrared External Integrating Sphere Accessory – Right<br>Includes sphere, purge enclosure and tubing. |
| <p><b>Notes:</b> Replace <b>XX</b> with your spectrometer's Instrument Code listed on page 191. Accessory uses the spectrometer's external beam. Spectrometer must be equipped to accept an external detector.</p> |  |
| <p>Detector (<i>must select one</i>)</p>   |  |
| 048-3360   | Wide-Band MCT Detector for External Sphere   |
| 048-3260   | Mid-Band MCT Detector for External Sphere  |
| 048-3160   | Narrow-Band MCT Detector for External Sphere   |
| <p>Options</p>   |  |
| 048-3000   | Diffuse Gold Reference   |

# NIR IntegratIR

## AT A GLANCE

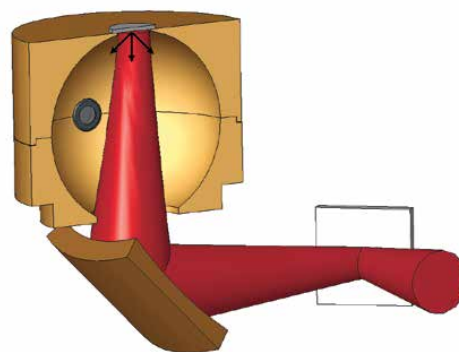
- ▶ Optimized 2-inch gold-coated integrating sphere with high signal-to-noise ratio
- ▶ Fully integrated InGaAs detector for greater sensitivity and faster measurements
- ▶ 10-mm horizontal sampling port for easy sample placement
- ▶ Excellent qualitative and quantitative NIR analysis tool
- ▶ Optional rotating stage for averaging of heterogeneous samples
- ▶ Spectral range 12,200–3850  $\text{cm}^{-1}$
- ▶ In-sample-compartment design

The NIR IntegratIR™ is a near-infrared (NIR) integrating sphere for quantitative and qualitative measurements of a wide variety of solids and paste materials.

The NIR IntegratIR collects reflected energy from a spherical perspective thereby capturing complete and quantitative response from the sample. Using near-infrared chemometrics, qualitative product identification and quantitative analysis may be performed on pharmaceutical, nutraceutical, chemical, polymer, textile, food, agricultural and other samples.

## OPTICAL DESIGN

The NIR IntegratIR accessory features a 2-inch reflective gold-coated integrating sphere and an extended range, high-speed, low-noise indium gallium arsenide (InGaAs) detector, transfer optics and interface electronics. The accessory fits into the sample compartment of most commercial FTIR spectrometers, which are able to interface with an external detector. A 10-mm diameter horizontal sampling port makes the placement of samples onto the accessory easy. An optimized borosilicate window serves as a sampling port at the top of the integrating sphere. The window is bonded and sealed to protect the sphere from corrosive materials and contamination.



Optical diagram of the NIR IntegratIR.

## SAMPLING OPTIONS

High-quality spectra are produced quickly using the NIR IntegratIR, making qualitative and quantitative analysis of a wide variety of sample types efficient and reliable. Sampling of tablets, packaging materials and plastics is easily accomplished by placing the sample directly on the window of the upward-looking sphere. Powders, creams, pastes or liquids containing reflective particles may be placed in disposable flat-bottom vials—eliminating the need for any sample cleanup. The vials may be held in place by a sample-positioning vial holder, resulting in more repeatable measurements.

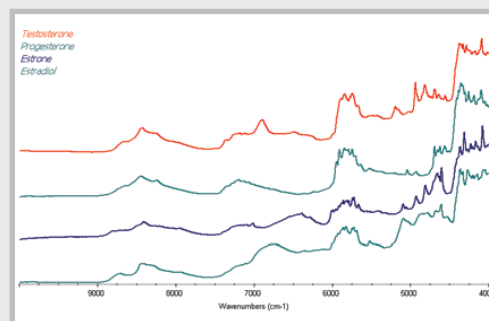
## SPECIFICATIONS

|                                 |   |
|---------------------------------|---|
| <b>Sphere Diameter</b>          | 50.8 mm (2")  |
| <b>Internal Surface</b>         | Lambertian gold   |
| <b>Illumination Angle</b>       | Normal  |
| <b>Input Beam Port Diameter</b> | 18.8 mm   |
| <b>Detector</b>                 | Integrating InGaAs, 2 mm diameter                         |
| <b>Spectral Range</b>           | 12220-3850 cm <sup>-1</sup> ; 0.82-2.6 micron             |
| <b>Sample Port</b>              | 10 mm diameter  |
| <b>Sampling Mode</b>            | Diffuse Reflection  |
| <b>Background Collection</b>    | Substitution  |
| <b>Specular Rejection</b>       | Standard  |
| <b>Automation Options</b>       | Rotating stage, automated tablet analyzer                 |
| <b>Accessory Dimensions</b>     | 167 x 210 x 157 mm<br>(excludes FTIR baseplate and mount) |

For heterogeneous samples, PIKE Technologies offers a rotating stage for the NIR IntegratIR. With this option, one obtains an averaged result to eliminate variations in quantitative results for the chosen sample area.

## APPLICATION

The NIR IntegratIR is great for making quantitative and qualitative measurements of biological, chemical and pharmaceutical products. The NIR spectral region often requires no sample preparation. Samples may often be analyzed through a vial or plastic packaging films.



**Steroids spectra** for quantitative analysis measured through glass vials using the NIR IntegratIR.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 048-60XX    | NIR IntegratIR Integrating Sphere Accessory<br>Includes 2" diffuse gold-coated integrating sphere, InGaAs detector, detector preamplifier, diffuse gold reference, vial holder, and 25 glass vials. |

**Notes:** Replace XX with your spectrometer's Instrument Code listed on page 191. Your spectrometer must be capable of interfacing with an external detector.

| Sampling Options |   |
|------------------|---|
| 048-3000         | Diffuse Gold Reference  |
| 162-5483         | NIST Traceable NIR Reference Standard   |
| 162-5484         | NIST Traceable NIR Reference Standard - Recertification                                 |
| 044-3010         | Glass Vial Holder for 19-mm vials   |
| 048-2999         | Glass Sample Vials, 19 x 65 mm (25 ea.)   |
| 048-0150         | Rotating Stage for Petri dish for heterogeneous samples Includes 100 x 20 mm Petri Dish |
| 048-0151         | Rotating Stage Adapter for 500 mL beaker  |

**Note:** Please contact us for other options. Stage rotates counterclockwise.



Rotating stages available for beakers and Petri dishes.

# Integrating Spheres

## Theory and Applications

Integrating spheres are a useful sampling accessory for the hemispherical collection of scattering light caused by reflection off or transmission through diffuse material.

### WHY USE AN INTEGRATING SPHERE?

The main reasons for using integrating spheres for the measurement of sample reflectance are the following:

- ▶ Efficient measurement of combined diffuse and specular reflectance.
- ▶ Uniform detection of reflectance even when the sample is inhomogeneous.
- ▶ Isotropic detection of reflectance even on samples that reflect in preferred directions.
- ▶ Reduction of polarization effects from the illuminating beam and the sample.
- ▶ Measurement of absolute reflectance (with special integrating spheres).

### MEASURING REFLECTION

Traditional reflectance sampling accessories rely upon a light beam coming from the spectrometer to be focused upon the sample. In order to achieve the best signal-to-noise ratio (SNR), the smaller the focus is, the easier it is to refocus the illuminated sample spot back onto the detector. In order to measure light reflected at a larger angle, optical designs will allow only a small area of the sample to be projected onto the detector. This arrangement serves well if the sample is microscopically homogeneous, but will result in a larger sample position error. When the sample is moved, the focused beam will see a different portion of the sample resulting in measurement-to-measurement differences. This is called insertion error because the spectrum will be slightly different each time the sample is inserted.

Some industrial or natural samples are inhomogeneous either because they are mixtures of different substances or because they have a particle size comparable to the probing beam diameter. If the probing beam could be larger and the reflected light could all be collected, a more representative spectrum could be measured.

Some other samples develop a directional scattering. For example, fibers wound on a mandrel are highly oriented, not just macroscopically as parallel, unidirectional filaments, but also in many cases the molecules of the drawn fibers are oriented within the fiber itself. Such a sample, when placed in a reflectance accessory will generate different results depending on the angle from which the detector is

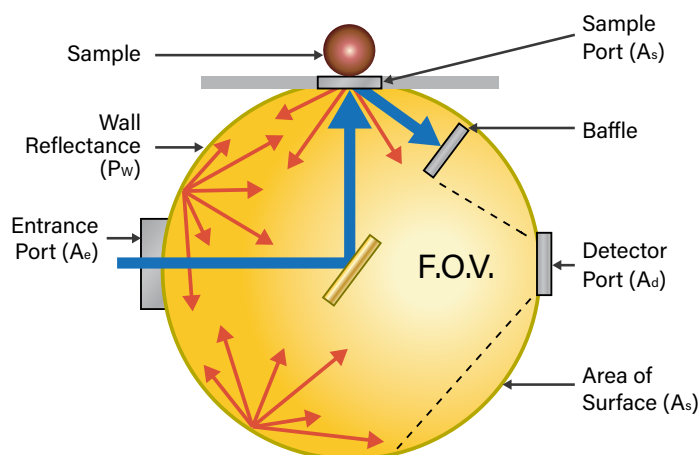
“viewing” the sample. When the overall reflectance needs to be measured reproducibly, for example to measure the concentration of a minor ingredient in the sample, only isotropic optical systems, insensitive to such directionalities could be utilized.

In some cases, not just the reflectance in a small solid angle is sought, but the reflectance in all angles. Most reflection accessories measure at fixed or variable angles, narrower or wider collection angles, but there is a need for a device that uniformly collects all reflected light from a sample. In other words, it measures the total reflectance of the sample.

### INTEGRATING SPHERE OPTICS

Integrating spheres are highly reflective enclosures that are placed in close proximity to the sample, such that the reflected light enters the sphere, bounces around the highly reflective diffuse surface of the sphere wall and finally impinges upon the detector—usually part of the integrating sphere assembly. The name, integrating sphere, refers to one of the main functions of the device, namely that it spatially integrates the light flux. In our application, the light reflected from a sample. In spite of the long history of engineering and development of the sphere, the applications and further developments continue to this day. Advances in the theory, detector and electronics development and most of all, new applications, drive the progress.

As the name implies, the main part of the device is a sphere with a highly reflecting inner surface. The surface should approach the ideal Lambertian scatterer, which means that the light falling on the surface is evenly scattered in all directions and the scattered light intensity is proportional to the cosine of the angle of observation.



In an upward-sample-positioning sphere the infrared beam from the interferometer is directed through an entrance port onto the sample, placed on top of the sphere. Samples can be directly touching the sphere or separated from the sphere by a thin, infrared transparent window. The detector is placed close to the sphere, so that it can view the integrating sphere with a large solid angle. In order to improve the isotropy (non-directionality) of the detection, the detector is not directly in the line of sight of the sample. A small, highly reflective and scattering baffle is placed in the sphere such that it blocks the first reflection of the sample from reaching the detector.

A well-designed sphere has the sample close to the sphere geometry so that the sphere will collect nearly all the available hemispherical reflectance ( $2\pi$  steradians). A window to separate the sphere and sample may be important in some cases, but it will place the sample a small distance from the sphere, thereby somewhat reducing the collected high-angle reflectance.

The PIKE Technologies integrating spheres are coated with the highest possible reflective gold surface for the desired wavelength region. The coating of the surface of the sphere has to be uniform and close to being a perfect Lambertian scatterer. These characteristics allow the light falling in the sphere to be uniformly distributed over the entire surface of the sphere. It is also important how much of this light is actually collected on the detector surface.

## INTEGRATING SPHERE THEORY

The throughput of a single sphere may be defined as a function of the hemispherical reflectance to the average spherical wall reflectance ratio. The closer the sphere surface is to ideal reflectance, the higher the throughput. The detector, the sample and the illumination require that a portion of the sphere wall be removed. Smaller cutouts for beam input and output result in higher energy throughput. Due to other considerations, such as reduction of light scatter from the edges of the sphere cutouts, called ports, these have to be optimized and cannot be too small.

The throughput can be expressed with these sphere design parameters:

$$\tau = \frac{A_d}{A_s} x \frac{\rho_w}{(1 - \rho_{w, \text{avg}})}$$

Where  $A_d$  is the detector area,  $A_s$  is the sphere area,  $\rho_w$  is the sphere wall hemispherical reflectance,  $\rho_{w, \text{avg}}$  is the average sphere wall reflectance. The sphere throughput is higher if the light falling on the detector is increased by the multiple reflections of the light.

Another way of looking at the integrating sphere is that it enhances the detector signal by collecting the light, and if the wall surface is reflective enough, bounce it around until it illuminates the detector. The factor that is used to express this gain is called the sphere multiplier ( $M$ ), which is a function of the wall reflectance ( $\rho_w$ ), the proportion of the total area of ports to the surface of the sphere ( $f$ ).

$$M = \frac{\rho_w}{1 - \rho_w (1 - f)}$$

The brightness of the sphere ( $L_s$ ), using the same amount of input light flux, is dependent on the wall reflectivity, the port-to-sphere surface ratio and the size of the sphere surface.

$$L_s = \frac{\Phi_i}{\pi A_s} \frac{\rho_w}{1 - \rho_w (1 - f)}$$

where  $\Phi_i$  is the input light flux.

For the sphere the area depends on the sphere diameter ( $D$ ), and thus the formula shows that a smaller sphere is brighter than one with a larger diameter.

$$L_s \sim \frac{M}{D^2}$$

The sphere diameter cannot be reduced too far however, because the sample diameter will also have to be decreased proportionally when the sphere is smaller. For typical spectroscopic applications the optimum sphere diameter is influenced by the beam size coming from the FTIR spectrometer and the typical sample size of 3–25 mm. Most integrating sphere modules use a 2–4 inch diameter sphere to accommodate the above design parameters. In a practical design, the openings of the sphere need to be kept around 5% for optimum throughput. Wall reflectance is usually between 95–99% and results in a sphere gain of 10–30.

## INTEGRATING SPHERES FOR MID-IR AND NIR

Integrating spheres, although much more efficient than an optical system with an equivalent detector position, still have lower throughput than the direct imaging optics. In the visible and NIR spectral region, where there are very good sources and excellent, high-speed detectors are readily available, the SNR is usually not limited by the reduced light level. In the mid-IR spectral region, in order to utilize the above discussed advantages and benefits of integrating spheres, the reduced throughput needs to be offset by the use of the high sensitivity, cooled detectors, such as the liquid nitrogen cooled MCT detector utilized by PIKE Technologies. The near-infrared and mid-infrared measurements using integrating sphere optics have different analytical and measurement goals as well as different features. PIKE Technologies offers both mid-IR and NIR versions.



# Microsampling



For samples considerably smaller than a typical 8–10 mm IR beam, microsampling accessories and microhandling tools make ideal additions to your FTIR spectrometer. Our microsampling accessories demagnify the FTIR beam to a smaller dimension, thereby increasing IR throughput for small samples.

# μMAX

## AT A GLANCE

- ▶ Compact sample compartment design to save lab space
- ▶ Uses FTIR detectors – DTGS or MCT
- ▶ Available in transmission, reflection and ATR modes
- ▶ High throughput optical design
- ▶ Simultaneously view and collect spectrum
- ▶ Easy-to-use, robust design
- ▶ Trinocular with USB camera option
- ▶ Available for most FTIR spectrometers



The μMAX™ is an IR microscope for microanalysis providing high-performance sampling at low-cost with exceptional ease-of-use.

## OPTICAL DESIGN

The μMAX fits into the sample compartment of most FTIR spectrometers. The compact, planar optical layout minimizes the pathlength of the IR beam and thereby maximizes IR throughput.

All operations with the μMAX are intuitive and made even easier with standard dichroic optics which provides full viewing of the sample while collecting IR spectra. With this feature, you can view the sample area and simultaneously search for appropriate IR spectral content—greatly speeding microanalysis. The fully variable X, Y, θ see-through aperture for transmission provides optimized sample dimensioning for getting the maximum IR signal from every sample.

The μMAX IR microscope uses a 7.45X Schwarzschild objective and condenser to focus the IR beam onto the sample and provide excellent sample visualization – better than 1-micron visible image resolution. An optional CCD camera enables video image projection onto the PC. With the dichroic optics and spectral preview of the FTIR software one can view changing IR spectra and sample position in real-time.

## MICROSAMPLING MODES

The μMAX is the first sample compartment IR microscope accessory capable of transmission, reflection and ATR analysis. The μMAX uses the spectrometers detector for convenience and sampling flexibility. For relatively larger micro samples (100 microns and greater) the DTGS detector provides excellent performance with the μMAX and enables full mid-IR spectral range coverage to 450 cm<sup>-1</sup>. For smaller micro samples to 20 microns in size an MCT detector is recommended.

## TRANSMISSION TO MICRO REFLECTION ANALYSIS

Switching from transmission to reflection on the μMAX is easy with a thumb wheel selection. Reflection sampling area is defined by use of the aperture slide with pre-defined sizes from 40 to 1000 microns. Micro reflection analysis of small areas of interest on reflective surfaces is easy. Simply focus and position the sampling stage, select the sample area with the aperture slide and collect the spectrum. The background spectrum is collected using the same dimension aperture using the gold-surfaced reference slide.

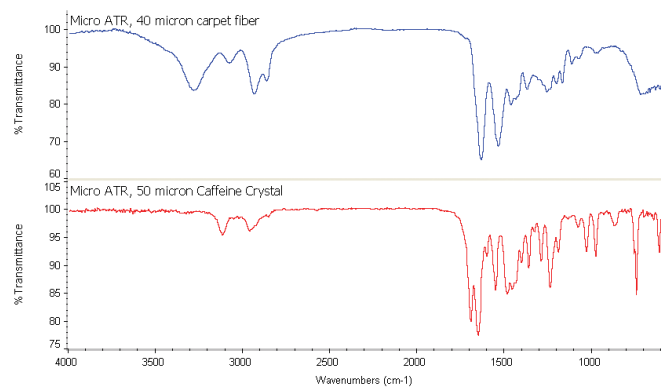
## MICRO ATR

ATR is an excellent sampling option for the μMAX IR microscope. The RotATR™ is a unique, pivot-designed germanium ATR providing easy and precise operation and



excellent micro ATR spectra. Focus and select the sample area, rotate the ATR crystal into sample position, make sample contact and collect the IR spectrum.

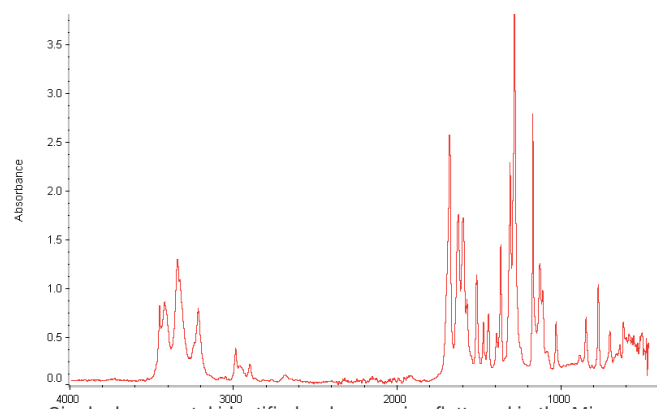
Micro ATR works exceptionally well with the  $\mu$ MAX IR microscope. The 100-micron flat-tipped micro ATR crystal makes intimate contact with the sample easily achieved, providing high spectral quality as seen in the data below.



Micro ATR spectra of a 40-micron carpet fiber (upper – blue) and a 50-micron caffeine crystal (lower – red) using DTGS detector.

### MICRO DIAMOND CELL

The Micro Diamond Cell is an excellent option for use with the  $\mu$ MAX IR Microscope. Tiny chips or fiber segments can be flattened to obtain excellent transmission spectra. Typical samples include crystals, fibers, paint chips, rubbers and plastic materials including laminates.



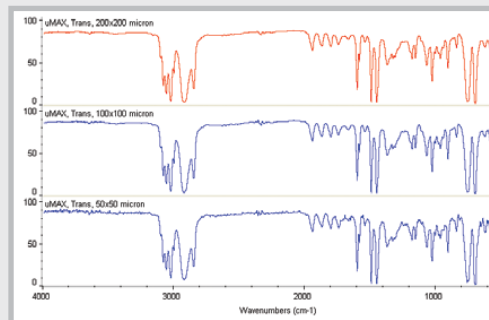
Single drug crystal identified as benzocaine flattened in the Micro Diamond Cell. Data collected using DTGS detector.



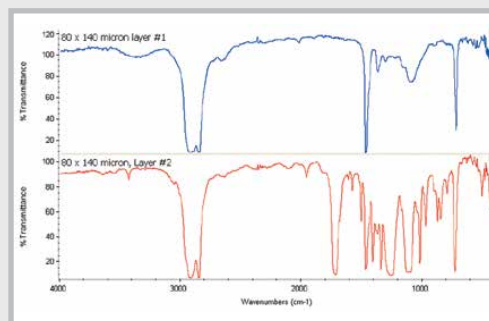
Micro Diamond Cell.

## APPLICATION

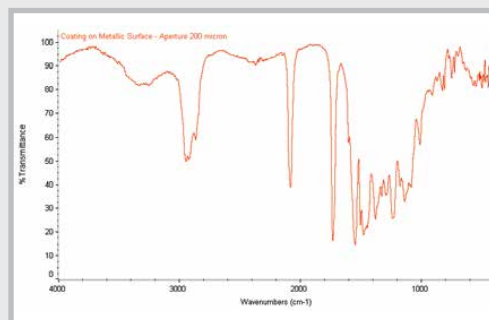
The  $\mu$ MAX is an in-sample compartment IR microscope, which conveniently uses your spectrometer's detector. Data quality may be optimized by choosing the most appropriate sampling technique—ATR, transmission or reflection.



**Transmission spectra** of polystyrene film at aperture sizes of 200 x 200, 100 x 100, and 50 x 50 microns using the  $\mu$ MAX IR Microscope and the DTGS detector of the FTIR spectrometer (collected at 4  $\text{cm}^{-1}$  spectral resolution using a 2-minute collection time).



**Transmission spectra** of polymer laminate sample using DTGS detector. Samples held in PIKE Micro Compression Cell.



**Micro reflection spectrum** of a coating on a reflective base metal, 200 x 200 microns sampling area using DTGS detector.



## SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Sampling Modes</b>         | Transmission, Reflection and ATR  |
| <b>Objective</b>              | 7.45X Schwartzschild, N.A. 0.64, fixed for sturdy, permanent alignment  |
| <b>Optional Condenser</b>     | 7.45X Schwartzschild, N.A. 0.64, Z-adjust to optimize sample focus  |
| <b>Micro ATR</b>              | RotATR with 100 micron tip, pivot pinned-in-place and easily removable for maximum sample area access. Universal Ge crystal for analysis of all micro samples.  |
| <b>Sample Stage</b>           | Z focus including X, Y slide sample holder, with 20 x 50 mm travel  |
| <b>IR Collection/Sample</b>   | Dichroic optics reflect IR energy and transmit visible, providing continuous view of the sample during data collection. Dichroic optics eliminate the need to switch optics from view sample to collect spectrum. |
| <b>Sample Masking Viewing</b> | X, Y, $\theta$ variable glass aperture for transmission sampling to view sample and surrounding sample area. Standard pinhole aperture slide for reflection sampling.   |
| <b>Illumination</b>           | Köhler, variable intensity, 50 watt   |
| <b>Sample Viewing</b>         | Binocular or Trinocular Viewer with 10X eyepieces. Standard eyepiece reticule for sample dimensioning, optional video camera with USB interface.  |
| <b>Visible Field Of View</b>  | 1600 microns  |
| <b>Visible Image Contrast</b> | Better than 1 micron  |
| <b>Station</b>                | In sample compartment, fits most FTIR spectrometers. Mounted on a baseplate for the FTIR spectrometer.  |
| <b>Detector</b>               | Uses standard detectors of the FTIR, typically DTGS and MCT   |
| <b>Purge</b>                  | Includes purge tubes and purge inlet for additional purge. Compatible with sealed and desiccated FTIR spectrometers.  |
| <b>Regulatory</b>             | RoHS compliant<br>Please contact PIKE Technologies for additional product details.  |

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 034-21XX    | Complete μMAX Sample Compartment IR Microscope with transmission, reflection, Ge ATR and video camera |
| 034-22XX    | μMAX Sample Compartment IR Microscope with transmission, reflection and Ge ATR                        |
| 034-41XX    | Complete μMAX Sample Compartment IR Microscope for reflection, Ge ATR and video camera                |
| 034-42XX    | μMAX Sample Compartment IR Microscope with reflection and Ge ATR                                      |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. All bundled μMAX packages include trinocular viewer, slide aperture for reflection, X, Y sample stage, microsampling kit, spectrometer base mount, purge tubes and storage case. Transmission versions include X, Y, θ variable see-through aperture.

#### Configurable μMAX Systems

|          |  |
|----------|--|
| 034-20XX | μMAX Sample Compartment IR Microscope for transmission and reflection (ATR optional) |
| 034-40XX | μMAX Sample Compartment IR Microscope for reflection (ATR optional)                  |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. The μMAX Sample Compartment IR Microscope is available in versions for transmission and reflection sampling or reflection only – both versions are also compatible with ATR sampling. RotATR μMAX ATR must be purchased separately. Both versions include slide aperture for reflection, X, Y sample stage, microsampling kit, spectrometer base mount, purge tubes, and storage case. Transmission version includes X, Y, θ variable see-through aperture.

#### Sample Viewing Options (*must select one or more*)

|          |                   |
|----------|-------------------|
| 034-3020 | Binocular Viewer  |
| 034-3030 | Trinocular Viewer |
| 034-3010 | Video Camera      |

**Notes:** Trinocular Viewer is required for selection of the Video Camera option. Binocular and Trinocular Viewers include adjustable reticule to assist with sample dimensioning.

#### Micro ATR (*optional*)

|          |                              |
|----------|------------------------------|
| 034-3040 | RotATR, μMAX ATR, Ge Crystal |
|----------|------------------------------|

**Note:** The RotATR micro ATR is compatible with the μMAX Sample Compartment IR Microscope.

| PART NUMBER           | DESCRIPTION   |
|-----------------------|---|
| Microsampling Options |   |
| 034-3060              | Micro Compression Cell for 13-mm IR transparent windows   |
| 160-1135              | Window, KBr, 13 x 2 mm  |
| 162-0030              | Micro Plane, carbide blade  |
| 162-0040              | Micro Plane, diamond blade  |
| 162-0010              | Micro Diamond Cell, 1.6 mm  |
| 162-0020              | Micro Diamond Cell, 2.0 mm  |
| 162-0045              | Micro TouchPick Pen Set Includes pen with tip size 0.62 mm and 0.17 mm, scalpel/roller knife, cleaning compound and holder case |
| 162-0046              | Diamond Window, 2.5 mm  |
| 162-0047              | Diamond Window, 3.5 mm  |
| 162-0048              | Micro Vice-Mini   |
| 034-0923              | Micro Roller Knife  |

**Note:** For additional product information, see the microsampling tools section.

#### μMAX IR Microscope Upgrades

|          |   |
|----------|---|
| 034-0090 | μMAX IR Microscope Transmission Upgrade |
|----------|---|

**Notes:** Transmission Upgrade requires shipment of the accessory to PIKE Technologies. Upgrade includes μMAX condenser, X, Y, θ variable see-through aperture, and all additional optics required for transmission, reflection and optional ATR sampling.

#### μMAX IR Microscope Replacement Parts

|          |  |
|----------|--|
| 300-0025 | Gold-Surfaced Disk, 13 mm, for reflection analysis   |
| 034-3070 | IR Microsampling Kit Includes 3-position sample slide with gold mirror, 2 KBr windows, scissors, tweezers, probes and roller knife with replacement blades |
| 162-6401 | 3-position Sample Slide for 13-mm windows  |
| 300-0002 | Gold-Surfaced Sample Slide, 1" x 3"  |
| 034-3080 | Replacement Illumination Bulb for μMAX   |

**Note:** For options not listed here, please contact PIKE Technologies.

# Microsampling Tools

## MICRO COMPRESSION CELL

An excellent sampling tool for supporting small samples for transmission analysis with the PIKE  $\mu$ MAX IR microscope. Single crystals, flattened fibers, multi-layer polymer micro samples are firmly supported between salt windows – typically KBr for transmission analysis. The cell uses 13 x 2 mm windows and has a clear aperture of 10 mm. Compression of the sample is achieved by rotation of the knurled retainer.



## MICRO PLANE WITH CARBIDE OR DIAMOND BLADE

A useful tool for preparation of thin slices of multi-layered samples for transmission microanalysis. The Micro Plane is available with either carbide or diamond blade. The carbide blade is recommended for general polymer materials. The diamond blade is recommended when the multi-layered sample has metallic content. The Micro Plane features an adjustable knife edge to control sample thickness.



## MICRO TOUCHPICK PEN SET

Ideal for the delicate maneuvering of your specimens. The benefits are excellent control of sample handling, ease of handling fragile and statically charged samples, and no residue is left on the sample. The ergonomic pen set includes two pens with different sized adhesive tips (0.17 and 0.62 mm).



## MICRO VICE-MINI

A multi-use sample holder fitting most microscope stages including IR, Raman and light microscopes. It makes holding round and unevenly-shaped samples easy. It may tilt the sample for correcting oblique sample orientation, and may be used to stretch fibers and polymer films.



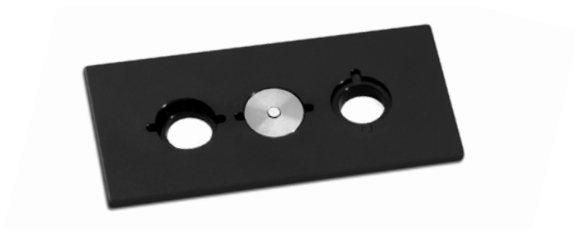
## 3-POSITION SAMPLE SLIDE

A convenient sample holder for placement of 13-mm windows for transmission analysis or the 13-mm gold-surfaced disk for reflection analysis when using the  $\mu$ MAX IR Microscope. The slide's open port supports a flattened free-standing fiber for transmission analysis.



## DIAMOND WINDOW

A durable, multi-use, window for microscopic transmission measurements spanning from the UV to the far-IR regions. Two diamond sizes are available, 2.5 and 3.5 mm, and are secured in a 13-mm diameter housing. The window is compatible with the 3-Position Sample Slide (sold separately).





The PIKE μMAX IR microscope with a 3-Position Sample Slide.

## MICRO DIAMOND CELL

Micro Diamond Cell is designed for compressing, flattening to an ideal thickness and holding samples for microanalysis. The diamond windows offer excellent transmission from the UV through far-IR spectral regions. The hardness of diamond (Type IIa) enables maximum pressure to be applied to all types of crystalline, fiber, or amorphous materials. Typical samples include fibers, paint chips, rubbers, and plastic materials including laminates.

The large clear aperture of the Micro Diamond Cell (either 1.6 or 2.0 mm) makes it easy to place the micro sample into position while viewing under a stereomicroscope. The cell is mounted on a standard 2 x 3" plate compatible with your FTIR spectrometer sample compartment. However, it performs best with a beam condenser or IR microscope. Cell thickness is 9.3 mm fully assembled.



| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 034-3060    | Micro Compression Cell<br>(requires selection of two 13 x 2 mm windows)   |
| 160-1135    | Window, KBr, 13 x 2 mm (1 ea.)  |
| 160-1008    | Windows, KBr, 13 x 2 mm (6 pack)  |
| 162-0030    | Micro Plane, carbide blade  |
| 162-0040    | Micro Plane, diamond blade  |
| 162-0045    | Micro TouchPick Pen Set<br>Includes pen with tip size 0.62 mm and 0.17 mm   |
| 162-0048    | Micro Vice-Mini   |
| 162-0046    | Diamond Window, 2.5 mm aperture   |
| 162-0047    | Diamond Window, 3.5 mm aperture   |
| 162-6401    | 3-Position Sample Slide<br>(recommended selection of window or disk)  |
| 300-0025    | Gold-Surfaced Mirror, 13 x 2 mm   |
| 034-3070    | IR Microsampling Kit<br>Includes 3-position sample slide with gold mirror, 2 KBr windows, scissors, tweezers, probes and roller knife with replacement blades |
| 034-0923    | Micro Roller Knife  |
| 162-0010    | Micro Diamond Cell, 1.6 mm  |
| 162-0020    | Micro Diamond Cell, 2.0 mm  |

**Note:** For items not in this list please contact PIKE Technologies. For other 13 x 2 mm windows available, see the Transmission section.

# S-100R

## AT A GLANCE

- ▶ Compact design fits most stages of FTIR and Raman microscopes
- ▶ Direct transmission measurements in sample compartments of FTIR spectrometers
- ▶ Precise temperature control up to 600 °C
- ▶ Vacuum, reaction gas or inert gas chamber environment
- ▶ Easy sample loading, assembly and disassembly



TEMPERATURE CONTROL  
OPTIONS AVAILABLE

The S-100R Microscope Heat Stage is designed for spectroscopic analysis and monitoring of small samples at varying temperatures.

The accessory can be located directly on the sampling stages of most FTIR and Raman microscopes. It can also be used for transmission measurements when placed in the sample compartment of the spectrometer.

## STAGE DESIGN

The stage features a lightweight aluminum body that is 16-mm thick. The sample is located between two IR transparent windows (transmission measurements) or between the IR reflecting mirror and single window (reflection configuration). Samples can be easily loaded and removed by twisting the upper window plate by hand. Optional inserts for varying sample sizes and shapes are available and a wide selection of window materials can be used with the stage.

The accessory can be used under ambient conditions or under vacuum. Pressure up to 0.5 MPa is possible with appropriate windows. In addition, inert or reaction gas can be flowed through the stage chamber. Valves and connectors required for these special configurations should be ordered separately.

Liquid cooling is integrated into the accessory base in order to minimize heat transfer to the microscope stage, improve temperature stability and aid the cooling process.

## TEMPERATURE CONTROL

The S-100R Microscope Heat Stage can be heated from ambient to 600 °C, using a temperature controller. PIKE TempPRO software (optional) offers a graphical user interface for easy profile set up, and initiates data collection as a function of time and temperature when used with most commercial spectrometers.



## SPECIFICATION

|  |  |
|--|--|
| <b>Stage Body</b>                        | Aluminum   |
| <b>Aperture</b>                          | Maximum: 4 mm, Minimum: 1 mm   |
| <b>Chamber Window</b>                    | 20 x 2 mm  |
| <b>Sample Port Window</b>                | 13 x 1 mm  |
| <b>Leak Rate</b>                         | $< 1 \times 10^{-9}$ Pa m <sup>3</sup> /sec  |
| <b>Vacuum Achievable</b>                 | $1 \times 10^{-3}$ Torr  |
| <b>Pressure Maximum</b>                  | 0.5 MPa (requires BaF <sub>2</sub> , CaF <sub>2</sub> , ZnSe, SiO <sub>2</sub> windows)  |
| <b>Gas Connection</b>                    | 1/16" Swagelok®  |
| <b>Coolant Connection</b>                | 4-mm quick connection (optional)   |
| <b>Stage Dimensions (W X D X H)</b>      | 84 x 100 x 16 mm   |
| <b>Stage Weight</b>                      | 0.5 kg   |
| <b>Temperature Control</b>               | Resistive heating  |
| <b>Temperature Range</b>                 | Ambient to 600 °C  |
| <b>Accuracy</b>                          | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C  |
| <b>Sensor Type</b>                       | Type K thermocouple  |
| <b>Temperature Controllers</b>           | Touch-panel display with USB interface. PIKE TempPRO software (sold separately) for PC control with unlimited ramps and automated data collection. |
| <b>Input Voltage</b>                     | 115/230 VAC, user-selectable   |
| <b>Output Voltage</b>                    | 115 VAC/80 W maximum   |
| <b>Controller Dimensions (W X D X H)</b> | 130 x 230 x 210 mm   |

| PART NUMBER   | DESCRIPTION  |
|---|--|
| 162-4186  | S-100R Microscope Heat Stage<br>Includes holders for 1-, 2-, and 3-mm samples, coolant tube and 13 x 1-mm reference mirror |
| <b>Temperature Controllers (<i>must select one</i>)</b>   |  |
| 076-2710  | S-100R Temperature controller, 115 V   |
| 076-2720  | S-100R Temperature Controller, 230 V   |
| 007-0207  | PIKE TempPRO Software  |
| <b>Note:</b> Digital Temperature Control Module is required. PIKE TempPRO software sold separately.   |  |
| <b>Windows (<i>must select</i>)</b>   |  |
| (1) 20 x 2 mm and (1) 13 x 1 mm for reflection measurement  |  |
| (2) 20 x 2 mm and (1) 13 x 1 mm for transmission measurement  |  |
| 160-1134  | Disk, KBr, 20 x 2 mm   |
| 160-1148  | Disk, BaF <sub>2</sub> , 20 x 2 mm   |
| 160-1144  | Disk, CaF <sub>2</sub> , 20 x 2 mm   |
| 160-5003  | Disk, KBr, 13 x 1 mm, max temp 300 °C  |
| 160-1149  | Disk, BaF <sub>2</sub> , 13 x 1 mm, max temp 500 °C  |
| 160-5001  | Disk, CaF <sub>2</sub> , 13 x 1 mm, max temp 900 °C  |
| <b>Note:</b> Maximum temperature restriction applies to sample window. The temperature of the outer windows is significantly less due to required liquid recirculated water flow. |  |
| <b>Options and Replacement Parts</b>  |  |
| 162-4114  | Plate for Motorized Microscope Stage*  |
| 162-4115  | Slide Mount for transmission measurements, 2 x 3"  |
| 162-4116  | Holder for 1-, 2-, 3-mm diameter samples   |
| 162-4109  | Gas Valve, 1/16" (gas connection) – 2 needed   |
| 162-4110  | Quick Connector for external circulating liquid – 2 needed   |
| 162-4111  | Reference Mirror, 13 x 1 mm  |
| 170-1100  | Liquid Recirculator  |
| *Must provide information for microscope make and model   |  |

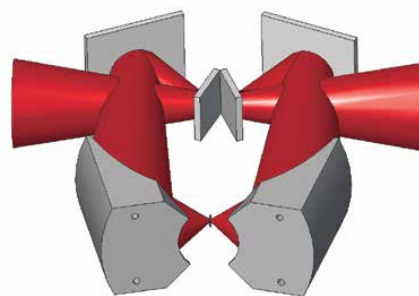
# Beam Condensers

## AT A GLANCE

- ▶ 4X and 6X versions – providing improved spectral data for microsampling
- ▶ High optical throughput – beam condensing optics provide higher signal-to-noise ratio for small samples
- ▶ Standard pin mounting for sample holders – providing a precise, reproducible mount for samples
- ▶ A variety of optional sample holders
- ▶ Enclosed accessory for complete purging

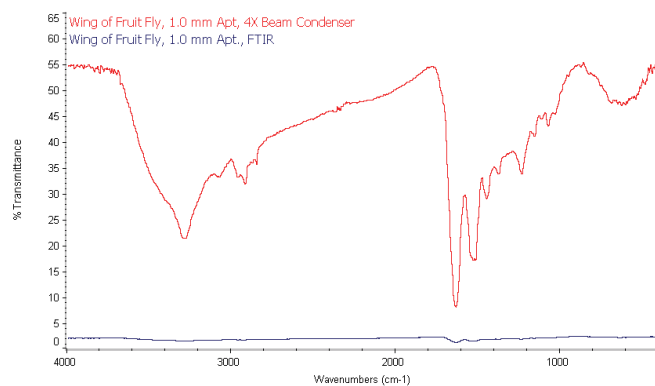
Beam condensers offer easy transmission sampling with minimal preparation for small samples or for mapping small areas within a larger sample.

Available in 4- and 6-times beam demagnification, these accessories' optical design incorporates a layout of six mirrors, adjustable input and output mirrors and two matched 4:1 (or 6:1) ellipsoidal mirrors. Both provide a large working area to accept many types of transmission sampling accessories, including high-pressure diamond cells, liquid cells, mull cells, and micro holders. The sample area uses pins to ensure accurate and reproducible accessory alignment requiring no further adjustment. Either 4X or 6X beam condensers are available in standard or gold-coated optics for high-performance mid-IR or near-IR operation. The unique enclosed optics provide a purged environment.

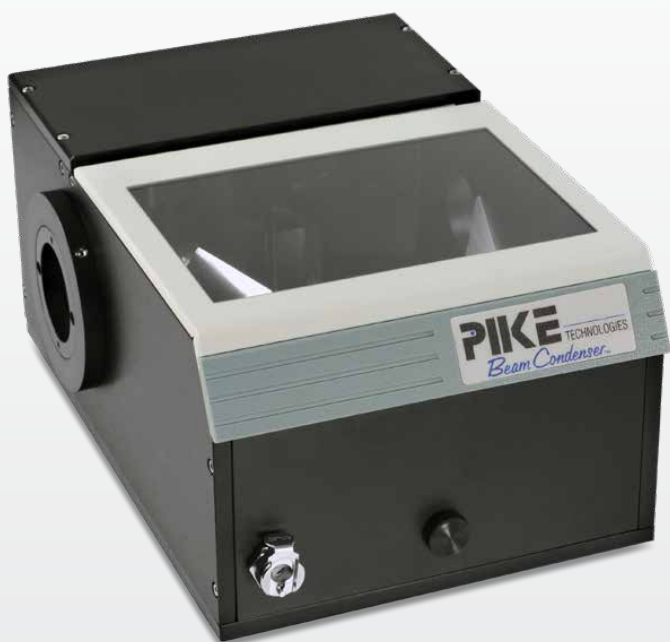


Beam Condenser optical diagram.

For the most demanding applications, a precision X, Y, Z Stage is available as an option, which accommodates all sample holders to achieve the highest possible optical throughput and allows a point-by-point surveying of an extended sample.



Wing of fruit fly within 1-mm aperture with and without use of a beam condenser.





## SPECIFICATIONS

|                                   |  |
|-----------------------------------|--|
| <b>Optics</b>                     | All reflective, aluminum (standard)<br>Gold-coated (optional)                                      |
| <b>Configurations</b>             | 4X and 6X demagnifications   |
| <b>Sampling Options</b>           | Standard sample holders.<br>X, Y, Z adjustable stage.<br>Pressure diamond cells.<br>Micro holders. |
| <b>Purgeable</b>                  | Yes  |
| <b>Dimensions<br/>(W X D X H)</b> | 165 x 242 x 114 mm (4X)<br>165 x 318 x 114 mm (6X)   |
| <b>FTIR Compatibility</b>         | Most, specify model and type   |

## SAMPLE HOLDERS FOR BEAM CONDENSERS

A range of sample holders are available for making sample positioning easier. These may be mounted on the X, Y, Z stage for precision positioning or on the standard mount.

Universal Spring Sample Holder – Ideal for small spheres and gems.



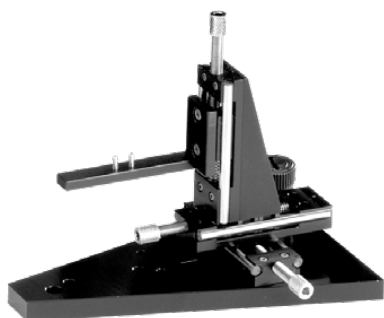
Magnetic Sample Holder – Ideal for 1 or 3-mm pellet die.



Micro KBr Pellet and Mull Holder – Ideal for very small volume solids, liquids and paste samples (holds 13-mm windows).



X, Y, Z Adjustable Sample Position Staged.



| PART NUMBER | DESCRIPTION   |
|-------------|---|
|             | 4X and 6X Beam Condensers   |
| 031-40XX    | 4X Beam Condenser<br>Includes the Non-Adjustable Sample Position Stage, 1.5 mm alignment aperture, purge tubes and mount for the FTIR of your selection |
| 031-60XX    | 6X Beam Condenser<br>Includes the Non-Adjustable Sample Position Stage, 1.5 mm alignment aperture, purge tubes and mount for the FTIR of your selection |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Contact PIKE Technologies for gold-coated mirror option.

| Adjustable Sample Position ( <i>optional</i> ) |  |
|--|--|
| 031-2010                                       | X, Y, Z Adjustable Sample Position Stage |

**Note:** The X, Y, Z Adjustable Sample Position Stage can be easily exchanged with the Non-Adjustable Sample Position Stage.

| Sample Holders ( <i>optional</i> ) |                                  |
|------------------------------------|----------------------------------|
| 031-2030                           | Universal Spring Sample Holder   |
| 031-2040                           | Magnetic Sample Holder           |
| 031-2050                           | Micro KBr Pellet and Mull Holder |

**Note:** All of these sample holders fit to the pin position of either the Non-Adjustable Sample Position Stage or the X, Y, Z Adjustable Sample Position Stage.

| Micro Diamond Cell ( <i>optional</i> ) |                                       |
|--|---------------------------------------|
| 162-0010                               | Micro Diamond Cell, 1.6 mm            |
| 162-0020                               | Micro Diamond Cell, 2.0 mm            |
| 031-2070                               | Mounting Stage for Micro Diamond Cell |

**Notes:** Micro Diamond Cell includes anvil pressure cell assembly and Type IIa diamonds. Stage for Micro Diamond Cell is required for use with beam condenser.

| Beam Condenser Replacement Parts |                                      |
|----------------------------------|--------------------------------------|
| 031-2020                         | Non-Adjustable Sample Position Stage |

**Note:** For options not listed here, please contact PIKE Technologies.

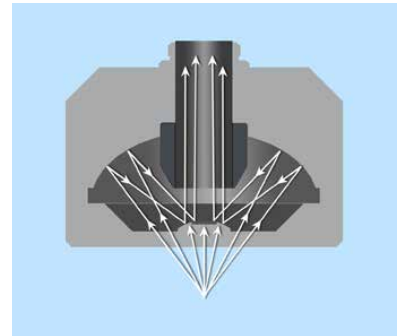
# Reflective Objectives

## AT A GLANCE

- ▶ 15X, 20X, 25X 40X, 100X
- ▶ High NA greater than 0.7
- ▶ Optimal brightness, high resolution
- ▶ Long working distance
- ▶ Full spectral range
- ▶ No alignment required
- ▶ Finite conjugate and infinity corrected configurations

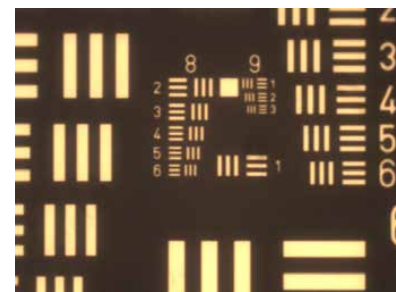
PIKE reflective objectives are ideal for applications requiring the high numerical aperture (NA) for creating higher resolution. Applications include IR microsampling and imaging of micron-level spot sizes.

The all-reflective objectives – often referred to as Reverse Cassegrain or Schwarzschild objective – have zero chromatic aberration. Aspheric surfaces are designed, fabricated, actively aligned, and measured in-house to optimize high NA surfaces for performance.



Beam path of Reflective Objective.

PIKE objectives are easy to use and to implement standard mechanical dimensions for tube lengths, threads, heights, and parfocal lengths to ensure compatibility with your existing microscopes and adapters. Once installed, no further adjustment is necessary.

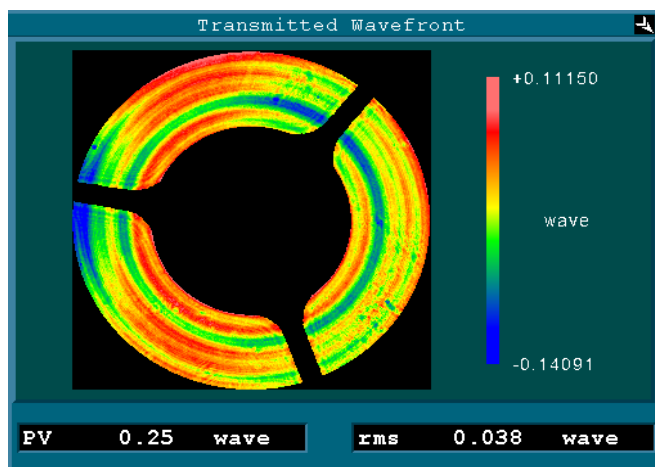


Objectives are checked for visible resolution.

## REFLECTIVE OBJECTIVES SPECIFICATIONS

|   | 20X                   | 40X                   | 100X                  |
|---|-----------------------|-----------------------|-----------------------|
| <b>Infinite PN</b>  | <b>891-0001</b>       | <b>891-0007</b>       | <b>891-0003</b>       |
| <b>Finite PN</b>  |                       | <b>891-0002</b>       | <b>891-0004</b>       |
| <b>Numerical Aperture</b>                                       | 0.70                  | 0.78                  | 0.80                  |
| <b>Outer Dia</b>  | 80 mm                 | 72.0 mm               | 70.0 mm               |
| <b>Thread</b>   | RMS                   | RMS                   | RMS                   |
| <b>Entrance Pupil Diameter</b>                                  | 15.0 mm               | 8.5 mm                | 3.4 mm                |
| <b>Obscuration</b>  | 52.9%                 | 42.9%                 | 60%                   |
| <b>Spider</b>   | 3 legs                | 3 legs                | 3 legs                |
| <b>Design Spot Size @ <math>\lambda = 550 \text{ Nm}</math></b> | 0.50 $\mu\text{m}$    | 0.45 $\mu\text{m}$    | 0.44 $\mu\text{m}$    |
| <b>Design Spot Size @ <math>\lambda = 5 \mu\text{m}</math></b>  | 4.55 $\mu\text{m}$    | 4.11 $\mu\text{m}$    | 3.98 $\mu\text{m}$    |
| <b>Surface Type</b>   | Aspheric              | Aspheric              | Aspheric              |
| <b>Surface Accuracy</b>   | $\lambda/4$           | $\lambda/4$           | $\lambda/4$           |
| <b>WD</b>   | 14.0 mm               | 8.3 mm                | 1.8 mm                |
| <b>Parfocal</b>   | 67.0 mm               | 60.0 mm               | 60.0 mm               |
| <b>MTL (for Finite Conjugate)</b>                               | 160 mm (DIN Standard) | 160 mm (DIN Standard) | 160 mm (DIN Standard) |
| <b>Tube Lens F.L. (for Infinite Conjugate)</b>                  | 200 mm                | 200 mm                | 200 mm                |
| <b>Height</b>   | 58.0 mm               | 57.0 mm               | 63.0 mm               |
| <b>Adjustment</b>   | No                    | No                    | No                    |

Available coatings include bare gold, protected aluminum, protected gold, protected silver, enhanced UV, and custom reflective coatings. All values are subject to change. Specifications based on performance in PIKE Technologies' Inverted/Horizontal Microscope. Contact us for more information.



| PART NUMBER | DESCRIPTION                                   |
|-------------|---|
| 891-0001    | 20X, 0.70NA Infinite Schwarzschild Objective  |
| 891-0005    | 20X, 0.70NA Finite Schwarzschild Objective    |
| 891-0007    | 40X, 0.78NA Infinite Schwarzschild Objective  |
| 891-0002    | 40X, 0.78NA Finite Schwarzschild Objective    |
| 891-0003    | 100X, 0.80NA Infinite Schwarzschild Objective |
| 891-0004    | 100X, 0.80NA Finite Schwarzschild Objective   |
| 891-0010    | 20X, Narrow Infinite Schwarzschild Objective  |
| 891-0008    | 40X, Narrow Infinite Schwarzschild Objective  |
| 891-0009    | 15X, LWD Finite Schwarzschild Objective       |
| 891-0016    | 15X, 0.60NA Infinite Schwarzschild Objective  |
| 891-0017    | 25X, 0.81NA Infinite Schwarzschild Objective  |

Objectives are aligned and evaluated for transmitted wavefront using Zygo Fizeau Interferometer.

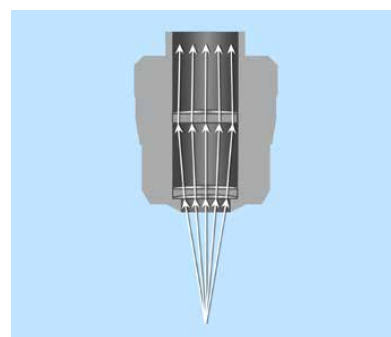
# Refractive Objectives

## AT A GLANCE

- ▶ 5X, 10X, 20X, 25X
- ▶ Near and mid-infrared spectral region
- ▶ High NA
- ▶ No central obscuration to affect throughput and resolution
- ▶ No spider legs or edges that scatter laser illumination
- ▶ Similar in size and design to conventional visible objectives

PIKE Refractive Microscope Objectives uniquely target the mid-IR spectral region. For these multi-lens objectives, applications include imaging in the mid-IR fingerprint region and thermal imaging—all at micron-level resolution.

Our refractive microscope objectives are manufactured through vertical integration of diamond turning, polishing, coating, precision asphere-metrology and active alignment. Thanks to cutting-edge aspheric fabrication capabilities, PIKE objectives reach exceptionally high numerical aperture without sacrificing image quality.



Beam path of Refractive Objective.

PIKE offers a variety of IR tube lenses for use with infinite conjugate objectives. The most common is a 1" diameter air-spaced doublet with aspheric and chromatic correction from 2-13 $\mu\text{m}$  (PN 892-0003).

Contact us for custom options including larger diameters, alternative optical elements, custom coatings, and custom focal lengths. We also offer objectives to cover the visible and infrared regions simultaneously. .



Simulated images with raytracing software to emphasize the advantage of a multilens infrared microscope objective (left) over a singlet aspheric lens (right). These images simulate a 0.5mm field of view at 10X magnification in the wavelength range of 4-10  $\mu\text{m}$ .

## REFRACTIVE OBJECTIVES SPECIFICATIONS

|                                | 892-0007                               | 892-0016                               | 892-0005  | 892-0008              | 892-0004              |
|--------------------------------|--|--|---|-----------------------|-----------------------|
| <b>Magnification</b>           | 5X LWD                                 | 10X LWD                                | 10X Plan Apo  | 20X Plan Apo          | 25X Achro             |
| <b>Numerical Aperture</b>      | 0.17                                   | 0.28                                   | 0.40  | 0.80                  | 0.40                  |
| <b>Entrance Pupil Diameter</b> | 11.4 mm                                | 8.0 mm                                 | 16.0 mm   | 16.0 mm               | 8.0 mm                |
| <b>Conjugate</b>               | Finite                                 | Finite                                 | Infinite  | Infinite              | Infinite              |
| <b>Working Distance</b>        | 23.0 mm                                | 15.5 mm                                | 5.2 mm  | 1.0 mm                | 2.5 mm                |
| <b>Parfocal Length</b>         | 45 mm                                  | 45 mm                                  | 45 mm   | 50 mm                 | 16 mm**               |
| <b>Barrel Outer Diameter</b>   | 25.5 mm                                | 25.5 mm                                | 36.4 mm   | 40.0 mm               | 16.0 mm               |
| <b>Threads</b>                 | RMS                                    | RMS                                    | RMS   | RMS                   | RMS                   |
| <b>Mechanical Tube Length*</b> | 160 mm                                 | 160 mm                                 | N/A   | N/A                   | N/A                   |
| <b>Tube Lens Correction</b>    | N/A                                    | N/A                                    | 200 mm  | 200 mm                | 200 mm                |
| <b>Height</b>                  | 22.5 mm                                | 34.5 mm                                | 45.6 mm   | 54.2 mm               | 19.3 mm               |
| <b>Adjustment</b>              | No                                     | No                                     | No  | No                    | No                    |
| <b>Standard AR Coating***</b>  | 3-12 $\mu\text{m}$                     | 3-12 $\mu\text{m}$                     | 5-10 $\mu\text{m}$                                      | 5-10 $\mu\text{m}$    | 3-12 $\mu\text{m}$    |
| <b>Design Wavelength</b>       | 5 $\mu\text{m}$                        | 5 $\mu\text{m}$                        | 8 $\mu\text{m}$   | 8 $\mu\text{m}$       | 9 $\mu\text{m}$       |
| <b>Material Wavelength</b>     | 2-17 $\mu\text{m}$                     | 2-17 $\mu\text{m}$                     | 0.53-10 $\mu\text{m}$                                   | 0.53-10 $\mu\text{m}$ | 0.53-13 $\mu\text{m}$ |
| <b>Miscellaneous</b>           | Matching visible obj<br>also available | Matching visible obj<br>also available | 3 $\mu\text{m}$ focal shift.<br>Over 5-10 $\mu\text{m}$ |                       |                       |

IR Tube Lens (PN 892-0003) available for use with Infinite Conjugate objectives.

\*Modifications for conjugate length available upon request.

\*\*Adapters available upon request.

\*\*\*Alternative coatings available upon request.

| PART NUMBER | DESCRIPTION                                      |
|-------------|--|
| 892-0003    | IR Tube Lens                                     |
| 892-0004    | 25X, 0.40NA IR Refractive Objective              |
| 892-0005    | 10X, 0.40NA IR Plan Achro Refractive Objective   |
| 892-0014    | 25X, 0.40NA IR VIS Parfocal Refractive Objective |
| 892-0016    | 10X, 0.28NA Ge IR Refractive Objective           |
| 892-0007    | 5X, LWD Ge IR Refractive Objective               |
| 892-0008    | 20X, Plan Apo IR Refractive Objective            |



# Remote Sampling



Hollow waveguide and fiber optic sampling accessories provide a new dimension of flexibility—expanding the reach of the sample compartment. The probe is flexible and may be taken to the sample, such as an unwieldy object too large to be placed on an accessory or in a chemical reaction vessel. PIKE offers NIR and mid-IR versions of remote sampling probes.

# Mid-IR FlexIR with MCT detector

## AT A GLANCE

- ▶ Fast, easy identification of solids and liquid samples outside of the sample compartment
- ▶ 1 or 2 meter, hollow waveguides offer exceptional durability and high throughput
- ▶ Full mid-IR spectral range coverage
- ▶ ATR, specular and diffuse reflection probes for a complete array of sampling applications
- ▶ Standard and high-temperature/high-pressure probes for reaction monitoring
- ▶ Permanent alignment of sampling probe to the hollow waveguide for consistent analysis results
- ▶ MCT or DTGS detector choice for maximum sensitivity and convenience
- ▶ Compatible with most FTIR spectrometers



Mid-IR FlexIR.



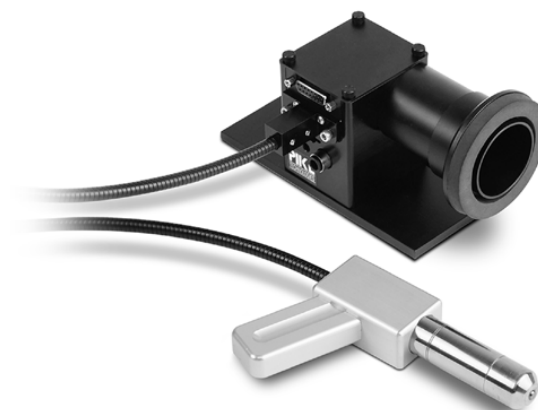
Probes for reaction monitoring.

The FlexIR™ Mid-IR, a hollow waveguide accessory for remote infrared sampling, is an excellent tool for the analysis of visible-surface contamination, small area material identification, bulky materials too large to fit into the FTIR sample compartment and reaction monitoring.

## DESIGN

The FlexIR is designed for ruggedness and wide spectral range. It utilizes a customized optical design with diamond-turned focusing optics to provide exceptional energy throughput. The hollow waveguides are very durable and free from the typical fracture problems encountered with polycrystalline core fibers. The highly-reflective hollow waveguides transmit maximum energy through the full mid-IR spectral region—eliminating the need for multiple fibers for complete spectrum coverage when chalcogenide or halide probes are used.

For maximum configurability two FlexIR bases, with an MCT or DTGS detector, are available. Two detector options serve to optimize the signal-to-noise ratio (SNR) against the required spectral range and the application needs. The mid-band MCT style is the most versatile and common detector offered because of its high sensitivity and the most fast data collection. A DTGS FlexIR base is an option for those applications that do not require a high SNR, and benefit from the flexibility and convenience of a room temperature detector. To optimize its performance, the DTGS detector is integrated into the probe tip. This probe is equipped with a short handle for ease of positioning and sampling.



FlexIR with DTGS.

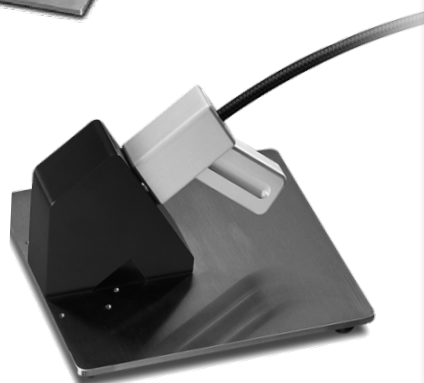


## REACTION MONITORING

For reaction monitoring, the accessory can be equipped with a high-temperature/high-pressure probe. The probe is made of Hastelloy and features a two-reflection diamond ATR crystal. The 6.35-mm shaft diameter and 178-mm length make it suitable for use in a wide variety of reaction vessels. The probe maximum temperature is 150 °C, with maximum pressure up to 1000 psi (6.9 MPa).



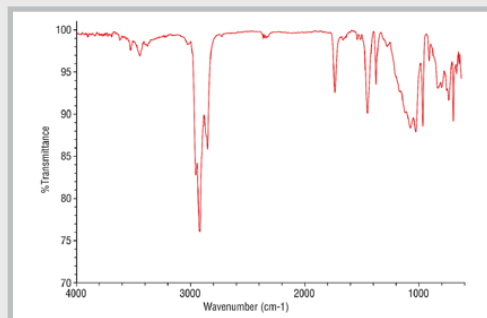
Adjustable Probe Holder.



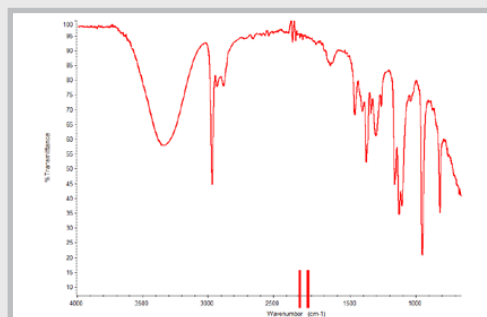
Standard Probe Holder.

## APPLICATION

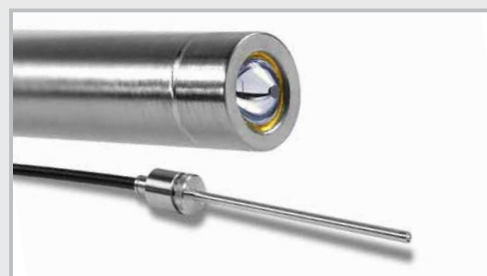
Some applications are more easily facilitated by or require having the capability to make IR measurements outside of the sample compartment because of sample size and shape or restriction of a reaction vessel, for example. With the variety of probes available (diffuse reflection, specular reflection and ATR), Mid-IR FlexIR accessory is a helpful tool to make sampling possible.



Visible defect on manufactured product - Mid-IR FlexIR accessory with ATR probe.



Spectrum of isopropyl alcohol measured using the high-temperature/high-pressure diamond ATR probe (below).



## ACCESSORY SPECIFICATIONS

|   |   |                                     |
|---|---|-------------------------------------|
| <b>Optical Design</b>                               | All reflective, diamond-turned focus optics |                                     |
| <b>Accessory Dimensions, MCT Model (W X D X H)</b>  | 153 x 132 x 150 mm                          | (excludes FTIR baseplate and mount) |
| <b>Accessory Dimensions, DTGS Model (W X D X H)</b> | 60 x 67 x 80 mm                             | (excludes FTIR baseplate and mount) |

## SPECTRAL SPECIFICATIONS

|                                |                           |                           |
|--------------------------------|---------------------------|---------------------------|
| <b>Spectral Range ATR</b>      | Mid MCT                   | DTGS                      |
| ZnSe                           | 5000–700 cm <sup>-1</sup> | 5000–575 cm <sup>-1</sup> |
| Ge                             | 5000–700 cm <sup>-1</sup> | 5000–700 cm <sup>-1</sup> |
| Diamond                        | 5000–700 cm <sup>-1</sup> | 5000–575 cm <sup>-1</sup> |
| <b>Spectral Range Specular</b> | 5000–700 cm <sup>-1</sup> | 5000–575 cm <sup>-1</sup> |

## PROBE SPECIFICATIONS

|   |  |
|---|--|
| <b>Probe Design</b>                                 | Hollow waveguide, full mid-IR reflective                     |
| <b>Bend Radius, Minimum</b>                         | 150 mm   |
| <b>HWG Dimensions</b>                               | 1 or 2 m long, 1.6 mm OD, 1.0 mm ID                          |
| <b>Diamond ATR Probe</b>                            |  |
| Probe Body  | Hastelloy C-276  |
| ATR Crystal   | Monolithic Diamond   |
| ATR Crystal Diameter                                | 4.5 mm   |
| Number Of Reflections                               | 2  |
| Maximum Temperature                                 | 150 °C (High-Temperature/High-Pressure)                      |
| Maximum Pressure                                    | 1000 psi (6.9 MPa)   |
| Shaft Dimensions                                    | 178 mm length, 6.35 mm diameter                              |
| <b>Standard ATR Probes MCT Version</b>              |  |
| Probe Body  | Handle: Aluminum<br>Sampling Tip: Stainless Steel            |
| Maximum Sample Depth                                | 60 mm  |
| ATR Crystal Types                                   | Diamond/ZnSe, ZnSe, and Ge                                   |
| ATR Crystal Diameter                                | 4.5 mm   |
| Maximum Operating Temperatures - MCT Version        | Diamond/ZnSe: Ambient<br>ZnSe: 60 °C<br>Germanium: 60 °C     |
| Maximum Operating Temperatures - DTGS Version       | Diamond/ZnSe: Ambient<br>ZnSe: Ambient<br>Germanium: Ambient |
| <b>Specular Reflectance Probe</b>                   | Gold-coated, 20 degree AOI                                   |
| <b>Diffuse Reflectance Probe</b>                    | Gold-coated, 2.5 mm port                                     |
| <b>Shaft Dimensions Of All Standard Probes, MCT</b> | 102 mm length, 22 or 12 mm diameter                          |

| PART NUMBER | DESCRIPTION  |
|-------------|--|
|             | Mid-IR FlexIR Base with MCT Detector   |
| 045-30XX    | Mid-IR FlexIR Base for MCT Version   |
|             | <b>Notes:</b> Replace <b>XX</b> with your spectrometer's Instrument Code listed in the back of the catalog. The FlexIR is provided with base optics mounting for the sample compartment of your FTIR spectrometer. An on-board MCT detector must be selected (below). Your FTIR spectrometer must be capable of interfacing with an external detector. |
|             | Hollow Waveguide MCT Detectors ( <i>must select</i> )  |
| 045-3200    | Mid-band MCT Detector  |
| 045-3100    | Narrow-band MCT Detector   |
|             | Probes for Mid-IR FlexIR with MCT Detector ( <i>select one or more</i> )   |
| 045-4300    | Diamond ATR Probe, High-Temperature/High-Pressure, 1 m   |
| 045-4100    | Diamond/ZnSe ATR Probe, 1 m length, 22 mm diameter   |
| 045-4102    | Diamond/ZnSe ATR Probe, 2 m length, 22 mm diameter   |
| 045-4010    | ZnSe ATR Probe, 1 m length, 22 mm diameter   |
| 045-4012    | ZnSe ATR Probe, 2 m length, 22 mm diameter   |
| 045-4050    | Ge ATR Probe, 1 m length, 22 mm diameter   |
| 045-4052    | Ge ATR Probe, 2 m length, 22 mm diameter   |
| 045-6000    | Diamond/ZnSe Probe, 1 m length, 12 mm diameter   |
| 045-6100    | ZnSe Probe, 1 m length, 12 mm diameter   |
| 045-6200    | Ge Probe, 1 m length, 12 mm diameter   |
| 045-4030    | Specular Reflectance Probe, 1 m length, 22 mm diameter   |
| 045-4032    | Specular Reflectance Probe, 2 m length, 22 mm diameter   |
| 045-4020    | Diffuse Reflectance Probe, 1 m length, 22 mm diameter  |
|             | <b>Notes:</b> Sampling probes are fixed to the hollow waveguides for maximum sampling reproducibility. Diffuse and specular probes are open-tipped and are not suitable for powder or liquid sampling.   |

| PART NUMBER | DESCRIPTION   |
|-------------|---|
|             | Mid-IR FlexIR Base with DTGS Detector   |
| 045-35XX    | Mid-IR FlexIR Base for DTGS Version   |
|             | <p><b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. The FlexIR is provided with base optics mounting for the sample compartment of your FTIR spectrometer. Your FTIR spectrometer must be capable of interfacing with an external detector. The DTGS detector is integrated into the probe.</p> |
|             | Probes for Mid-IR FlexIR with DTGS Detector<br>(select one or more)   |
| 045-5100    | Diamond/ZnSe ATR Probe, 1 m   |
| 045-5010    | ZnSe ATR Probe, 1 m   |
| 045-5050    | Ge ATR Probe, 1 m   |
| 045-5030    | Specular Reflectance Probe, 1 m   |
|             | <p><b>Notes:</b> Sampling probes are fixed to the hollow waveguides for maximum sampling reproducibility. DTGS detector is integrated into the probe. Specular probe is open-tipped and is not suitable for powder or liquid sampling.</p>  |
|             | Hollow Waveguide Probe Holders  |
| 045-3400    | Adjustable Probe Holder   |
| 045-3410    | Standard Probe Holder   |
|             | <p><b>Note:</b> Probe holders may be used with all standard hollow waveguide probes.</p>  |



Diamond/ZnSe, ZnSe and specular reflection probes for Mid-IR FlexIR with MCT detector.

# NIR FlexIR

## AT A GLANCE

- ▶ Fast, easy identification of solids and liquid samples in situ
- ▶ 2 meter, low-OH fibers providing exceptional throughput and excellent spectral data with short analysis time
- ▶ Spectral range from 1.0 to 2.5 microns (10,000 to 4000  $\text{cm}^{-1}$ )
- ▶ Integrated, high-sensitivity, extended range InGaAs detector with electronics connection for your FTIR spectrometer
- ▶ Standard SMA connectors providing maximum flexibility with fiber probes
- ▶ Standard diffuse reflection sampling tip with inert sapphire window for solid samples
- ▶ Optional transfectance sampling tip for liquid samples
- ▶ Compatible with most FTIR spectrometers configured for NIR operation

The PIKE Near-IR (NIR) FlexIR™ fiber optic accessory is an excellent tool for remote and speedy analysis of a wide variety of materials. Powders, plastics, coatings, and liquid samples are readily measured—typically within 30 seconds. The NIR FlexIR is ideal for performing incoming QC of materials used in pharmaceutical, polymer and chemical manufacturing.

NIR sampling is fast and efficient as it eliminates the need for sample preparation. The NIR FlexIR accessory further speeds analysis since the probe tip simply contacts the sample, often in drums, and the spectrum is collected. Powdered samples packaged within a plastic bag can be analyzed without removal from the bag, which further speeds analysis time and eliminates analyst exposure to chemical materials.

## DESIGN

The NIR FlexIR is designed for maximum throughput and performance. The fiber optic cable is directly coupled to the integrated indium gallium arsenide (InGaAs) detector—eliminating energy loss due to additional transfer optics and beam divergence. The NIR FlexIR accessory is built and tested for optimum performance for your FTIR spectrometer.

### LIQUID SAMPLING TIP

With the optional Liquids Sampling Tip, it is easy to identify incoming liquids by inserting the wand tip into the liquid sample and collecting its spectrum.



## SPECIFICATIONS

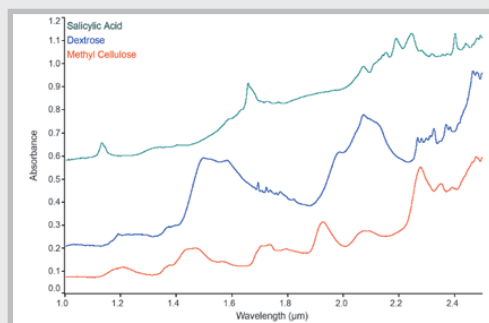
|   |  |
|---|--|
| <b>Optical Design</b>                       | Remote sampling  |
| <b>Probe</b>                                | Diffuse reflection<br>Transflection liquid tips          |
| <b>Probe Length</b>                         | 2 m  |
| <b>Probe Diameter</b>                       | 16 mm  |
| <b>Detector</b>                             | InGaAs   |
| <b>Spectral Range</b>                       | 10,000 - 4000 $\text{cm}^{-1}$                           |
| <b>Accessory Dimensions<br/>(W X D X H)</b> | 108 x 91 x 137 mm<br>(excludes FTIR baseplate and mount) |



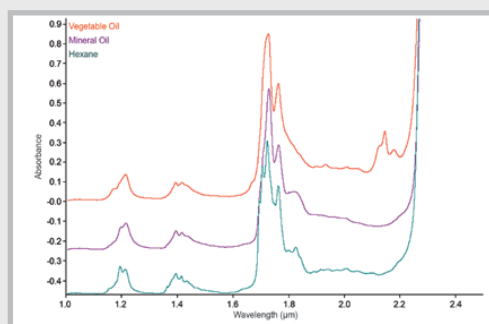
Taking measurement outside of the sample compartment of the IR instrument with the NIR FlexIR accessory.

## APPLICATION

The NIR FlexIR accessory provides a means for making measurements outside the sample compartment of an IR instrument. It is ideal for quality control screening of incoming raw materials.



Spectra of incoming pharmaceutical materials measured and verified with the NIR FlexIR accessory.



Spectra of incoming liquid materials measured and verified with the NIR FlexIR accessory.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 045-10XX    | FlexIR NIR Fiber Optic Accessory<br>Includes base optics mounting for the sample compartment of your FTIR spectrometer, electronic cabling, diffuse reflection probe and probe stand. |

**Notes:** Replace **XX** with your spectrometer's Instrument Code listed in the back of the catalog. Your FTIR spectrometer must be configured with NIR beamsplitter and NIR source for optimum performance of the FlexIR accessory. Your FTIR spectrometer must be capable of interfacing with an external detector.

### Sampling Options

|          |  |
|----------|--|
| 045-2001 | Liquids Sampling Tip for FlexIR, 1.0 mm pathlength |
| 045-2000 | Liquids Sampling Tip for FlexIR, 1.5 mm pathlength |
| 045-2002 | Liquids Sampling Tip for FlexIR, 2.0 mm pathlength |

**Note:** The Liquids Sampling Tip is screw-mounted and easily exchanged with the solids sampling tip on the FlexIR sampling probe.

### Replacement Parts

|          |   |
|----------|---|
| 045-2010 | Diffuse Reflection Tip for NIR FlexIR probe |
| 045-7051 | NIR FlexIR Probe Stand                      |

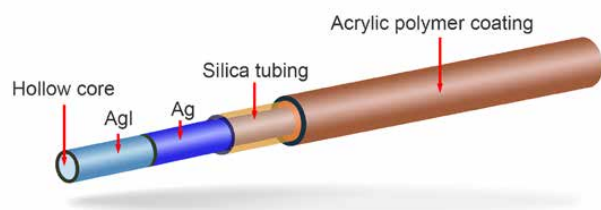
# Remote Sampling

## Introduction and Applications

Fourier transform infrared (FTIR) remote sampling offers a viable solution for the analysis of samples which are not conducive to the use of traditional FTIR sampling accessories due to constraints posed by the size of a bench-top instrument's sample compartment or the nature of the sample.

Taking an IR probe to a sample is desirable in numerous applications and a necessity in others. Examples of remote IR sampling may be found across many fields. In the fine arts, priceless paintings and artifacts may be analyzed with limited sample handling. Mid-IR analysis of intractable samples such as large painted panels may be conducted. Biomedical applications encompass soft tissue and skin analysis. In chemical production, remote sampling allows for reaction monitoring and the analysis of samples restricted to glove boxes and fume hoods.

PIKE Technologies offers the next generation of commercially-available FTIR remote sampling accessories with the Mid-IR FlexIR. Hollow waveguides (HWGs), the cornerstone of these mid-IR remote sampling accessories, offer enhanced performance characteristics compared to traditional mid-IR optical fibers. The most popular type of HWGs consists of reflective coated silica tubing. The inner portion of silica tubing is coated with Ag followed by converting some of the Ag to AgI to form a dielectric layer, which exhibits a highly reflective and very smooth surface. The exterior of the silica tubing is coated with acrylate polymer to provide additional strength.



Hollow waveguide.

HWGs used in the design of the Mid-IR FlexIR accessory address many of the limitations found with the use of traditional chalcogenide glass and silver halide polycrystalline fibers. Chalcogenide fibers exhibit a strong absorption band located near  $2170\text{ cm}^{-1}$  due to S-H or Se-H bonds; as a consequence, the signal-to-noise ratio (SNR) in this spectral region is significantly decreased. To address this issue, two different fiber types, chalcogenide and silver halide, are often employed to generate a full spectral range. The chalcogenide fiber generally used in mid-IR spectroscopy covers approximately  $6500\text{--}2250\text{ cm}^{-1}$  and  $2050\text{--}1000\text{ cm}^{-1}$

while the silver halide fiber covers  $2100\text{--}600\text{ cm}^{-1}$ . In contrast, HWGs are capable of spanning a wide spectral range from  $11,000$  to  $700\text{ cm}^{-1}$  eliminating the need for a complementary fiber set. The spectral range of the Mid-IR FlexIR accessory is dependent on the probe type and the configured detector.

Durability of traditional fibers has been a concern and a hindrance in past mid-IR remote sampling accessories. Additionally, intrinsic flaws originating during the manufacture of glass fibers significantly increase fiber fragility, and may often result in catastrophic failure under routine application use. Furthermore, the bend radius of traditional fibers are limited. Contrary to these properties, HWGs offer a robust means of delivering and collecting IR radiation and offers a smaller bend radius.

For ultimate flexibility the Mid-IR FlexIR offers a choice of detector, either a liquid nitrogen MCT detector for applications that require high sensitivity or a DTGS detector for applications that require less sensitivity yet desire the convenience of a room temperature detector. Two models of MCT detectors are available (narrow-band and mid-band) to allow the optimization of signal-to-noise ratio and spectral range. The MCT detector is mounted on the base optics while the DTGS detector is nested in the probe tip.

The sample probe is permanently aligned to the HWG for consistent analysis results. A variety of probes are available covering ATR, diffuse reflection, and specular reflection sampling techniques. ATR probe crystal offerings are zinc selenide, germanium, diamond/zinc selenide composite, and monolithic diamond. Fiber length is 1 or 2 m.

To illustrate the diverse capabilities of the newest technology in mid-IR remote sampling—the Mid-IR FlexIR, three application examples will be presented highlighting applications using attenuated total reflection (ATR), diffuse reflection and specular reflection sampling probes.

## BIOMEDICAL APPLICATION: ATR PROBE

The simplicity of ATR sampling has led to its use in numerous biomedical applications. Confining the ATR crystal sampling surface to an FTIR sample compartment limits *in vivo* studies.

Remote ATR sampling, however, expands the flexibility of FTIR studies and applications in this field. For example, remote ATR sampling makes it possible to investigate chemical diffusion through the skin, residual chemicals retained on the skin from body lotions and washes and the investigation of skin aberrations.

The objective of this biomedical application was to investigate residual chemicals found on human skin after the application of a commercially-available sunscreen spray. A spectrum was collected before and after the application of the skin care product using the FlexIR ZnSe ATR probe.

Spectral data of untreated skin clearly shows the IR chemical signature of skin including the amide I and amide II bands at 1650 and 1550  $\text{cm}^{-1}$ , respectively. The result from spectral subtraction allows for the investigation of the sunscreen chemicals remaining on the skin (Figure 1). Capabilities of collecting in vivo data allow for the optimization of formulations and the study of time-based efficacy of existing products and those in the product development stage.

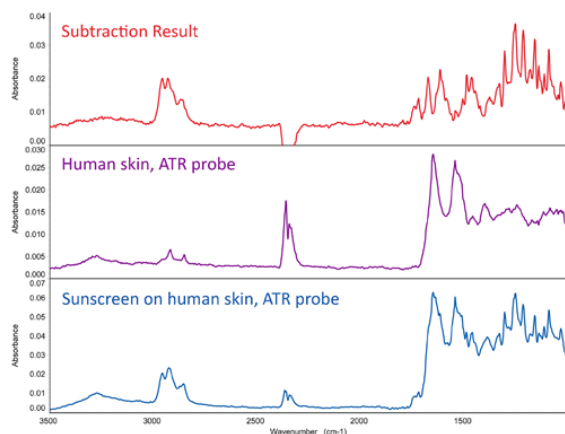


Figure 1. Spectra of untreated and treated skin.

## INTRACTABLE PANELS: DIFFUSE REFLECTION AND SPECULAR REFLECTION

Reflective-type measurements may be classified as either diffuse or specular. Coatings and thin films on reflective substrates are candidates for specular reflection measurements. Using this sampling technique, the reflected beam from the sample is collected at an angle of incidence equal to that of the incoming beam as it is delivered to the sample. Diffuse samples scatter the reflected beam across a wide range of angles and in IR sampling must be gathered using a collection optic.

To illustrate non-destructive mid-IR testing using remote sampling, two intractable samples were analyzed. One sample consisted of a coating on a smooth reflective surface, conducive to specular reflection measurements. The other sample type had a painted diffuse surface. Figure 2 shows the spectrum of a coating on a smooth reflective surface obtained by using the Mid-IR FlexIR configured with a specular reflection probe, and Figure 3 shows spectra of painted diffuse panels collected with the diffuse reflection probe. The two diffuse painted panels clearly show differing chemical coatings. In each sample the high SNR results in quality spectra. The spot size of both probes is 2.5 mm in diameter allowing for concise measurements of small defects. Remote sampling offers a convenient method of non-destructive analysis.

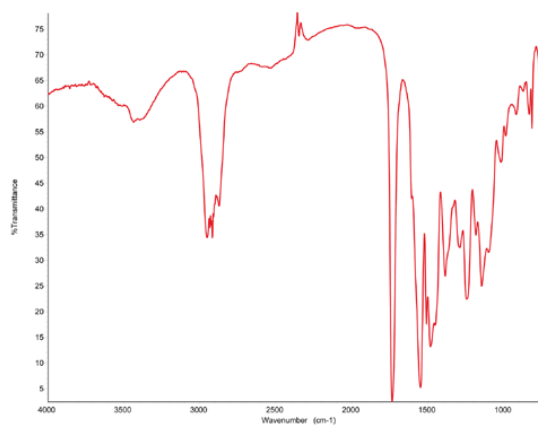


Figure 2. Spectrum of a coating on aluminum.

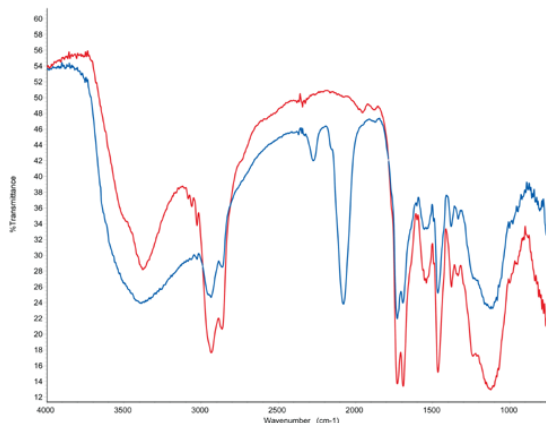


Figure 3. Spectrum of a panel with diffuse finish.

## CONCLUSIONS

HWGs bring new technology to mid-IR remote sampling accessories. The diversity of sampling probes covering ATR, diffuse reflection and specular reflection used in conjunction with HWGs and high precision optics offers the capability to collect quality spectra of a wide range of samples, which may be prohibited with traditional in-compartment FTIR sampling accessories.





# Transmission



Transmission sampling is a popular method for the collection of infrared spectra for qualitative or quantitative analysis. Samples range from solids to liquids and gases. Applying automation technologies to transmission sampling can improve precision and workflow efficiency.

# Multi-SamplIR

## AT A GLANCE

- ▶ In-compartment automated transmission sampling
- ▶ Selectable number of samples, size, configuration and placement
- ▶ Multiple point analysis on single sample
- ▶ Custom sampling plates



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE



| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 074-26XX    | Automated Transmission Multi-SamplIR for FTIR<br>Includes AutoPRO software and a motion control unit (85–265 VAC), and a Standard Sampling Plate for 13-mm pellets (18 positions)<br><br><b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. This accessory requires a minimum FTIR beam height of 3.5". |
| Options     |   |
| 074-3661    | Additional Standard Sampling Plate<br><br><b>Note:</b> If you need custom sampling plates or options not described here, please contact us.   |

The Multi-SamplIR accessory is designed to speed FTIR analysis of a wide range of materials including films, slides, pellets, windows and large area samples like multilayer coated substrates.

The accessory accommodates up to 18 samples (depending on sampling plate configuration) for unattended analysis. Flexible test sequences are easily defined and automatically implemented.

Samples are conveniently mounted onto a sampling plate and held in place during the analysis. The plates can be configured for different sample quantities, types and geometries. The system can be set to perform automated mapping of the sample, producing transmission spectra as a function of position. Sampling plates easily mount on the accessory's drive and is rotated and translated laterally through a distance of 75 mm to produce an R-theta motion covering the entire sampling range of the accessory.

Each system incorporates two precision stepper motors for rotation and translation of the plate. The motors are driven by the PIKE Motion Control Unit.

## AUTOMATION

The operation is managed by PIKE Technologies' AutoPRO software, which provides full user programmability and an easy-to-learn user interface. Polar or X, Y coordinates may be used to define test points. Test sequences can be stored as methods and implemented with full flexibility. Spectral data collection of pre-defined positions may be initiated through AutoPRO when using most FTIR spectrometers. The USB Motion Control Unit incorporates a smart power supply and works with 85–265 VAC, 47–63 Hz power lines.

# RotatIR

## AT A GLANCE

- ▶ Automated selection of sample transmission angle
- ▶ Programmable from 0 to 90 degrees with resolution of 0.2 degree
- ▶ Automated collection of spectra at the defined angle of transmission via AutoPRO software
- ▶ Compatible with most FTIR systems



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE

The RotatIR is designed for automated selection of the sample transmission angle relative to the IR beam in the FTIR sample compartment. Applications include the study of sample thickness and sample reflectivity.

Selection of the angles of transmission is automated through the use of PIKE Technologies' AutoPRO software, the Motion Control Unit and the integrated servo motor. Spectral data collection of pre-defined angles may be initiated through AutoPRO when using most FTIR spectrometers.



| PART NUMBER   | DESCRIPTION   |
|---|---|
| 091-18XX  | RotatIR Automated Rotating Sample Stage<br>Includes AutoPRO software and a Motion Control Unit (85–265 VAC, 47–63 Hz) |
| 091-19XX  | RotatIR with Polarizer Mount  |
| 091-22XX  | Dual RotatIR  |
| <b>Note:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. |   |
| Options   |   |
| 162-5400  | Film Sampling Card, 20-mm clear aperture (10 ea.)   |
| <b>Note:</b> If you need options not described here, please contact us.                             |   |

The RotatIR features a standard 2 x 3" slide mount for easy positioning of different types of transmission sample holders. The PIKE RotatIR accessory is designed to fit most FTIR spectrometers. Please contact us for more product details.

## AUTOMATION

The operation is managed by PIKE Technologies' AutoPRO software, which provides full user programmability and an easy-to-learn user interface. Test sequences can be stored as methods and implemented with full flexibility. Spectral data collection of pre-defined positions may be initiated through AutoPRO when using most FTIR spectrometers. The USB Motion Control Unit incorporates a smart power supply and works with 85–265 VAC, 47–63 Hz power lines.

## DUAL ROTATIR

The Dual RotatIR is designed for the transmission measurements of thicker optics. As the beam passes through an optic placed at an angle, the refractive index of the optic will cause the beam to refract. As a result of this beam displacement, only part of the beam could strike the spectrometer detector. By placing two testing optics at equal angle, the first optic will displace the beam and the second optic returns it to a position which may be effectively focused on the FTIR detector.



Film sampling cards for the RotatIR accessory.

# Automated Horizontal Transmission Accessory

## AT A GLANCE

- ▶ Fully automated transmission analysis of polymer films, pellets or other transmission samples for FTIR
- ▶ Standard specular reflectance sampling
- ▶ Sampling capacity of up to 114 samples, depending upon size
- ▶ Standard and custom plates available
- ▶ Purgeable optical design for high-quality FTIR spectra
- ▶ Compatible with most FTIR spectrometers



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE



The Automated Horizontal Transmission Accessory is great for increasing sample throughput for analysis of films and pellet samples.

## DESIGN

The Automated Horizontal Transmission Accessory is available in an 8" or a 12" version depending upon sample loading requirements. The 8" version will accommodate up to 37 25-mm diameter samples. The 12" version will accommodate up to 83 25-mm diameter samples. PIKE manufactures custom sampling plates to meet your sampling needs. Please contact us for other configurations.

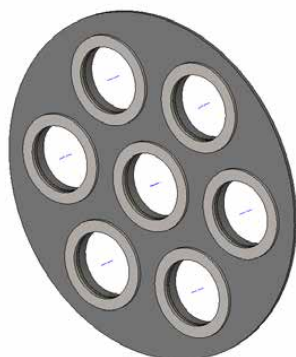
Both the 8" and 12" versions are capable of performing specular reflection analysis as well as transmission analysis, if required for your application.

## AUTOMATION

The operation is managed by PIKE Technologies' AutoPRO software, which provides full user programmability and an easy-to-learn user interface. Test sequences can be stored as methods and implemented with full flexibility. Spectral data collection of pre-defined positions may be initiated through AutoPRO when using most FTIR spectrometers. The USB Motion Control Unit incorporates a smart power supply and works with 85–265 VAC, 47–63 Hz power lines.

## CUSTOM WAFERS

PIKE Technologies offers custom inserts to accommodate a variety of sample types. These are uniquely designed to fit the your needs. Below an example of some of our popular options. Contact PIKE Technologies for options not described here



1" Filter Mount.



5" Square Wafer Mount.

### SPECIFICATIONS

|                            | 8 inch                     | 8 inch<br>purge ready | 12 inch   |
|----------------------------|----------------------------|-----------------------|-----------|
| <b>Angle Of Incidence</b>  | 15 Degree                  | 15 Degree             | 20 Degree |
| <b>Beam Size At Sample</b> | 1.5X                       | 1.5X                  | 0.33X     |
| <b>Computer Interface</b>  | USB                        | USB                   | USB       |
| <b>Depth</b>               | 7.22"                      | 7.22"                 | 6.25"     |
| <b>Width</b>               | 5.55"                      | 5.55"                 | 11.71"    |
| <b>Height</b>              | 12.04"                     | 14.16"                | 16.41"    |
| <b>Power Requirements</b>  | 100-240 Volts AC; 50/60 Hz |                       |           |

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 075-28XX    | Automated 8" Horizontal Transmission Accessory<br>Includes motion control unit (85-265 VAC), AutoPRO software and one 37-position sampling plate              |
| 075-29XX    | Purge-Ready Automated 8" Horizontal Transmission Accessory<br>Includes motion control unit (85-265 VAC), AutoPRO software and one 37-position sampling plate. |
| 076-28XX    | Automated 12" Horizontal Transmission Accessory<br>Includes motion control unit (85-265 VAC), AutoPRO software and one 83-position sampling plate             |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. P/N 076-28XX is purge-ready; order Purge Enclosure separately.

#### Options

|          |                                       |
|----------|---------------------------------------|
| 075-3881 | Additional Sampling Plate for 8" HTA  |
| 076-3881 | Additional Sampling Plate for 12" HTA |
| 016-3000 | Purge Enclosure for 8" HTA            |
| 017-3000 | Purge Enclosure for 12" HTA           |

**Notes:** Purge Enclosures will not fit all spectrometer models. For more options or custom plates, please contact PIKE Technologies.

# XY Autosampler

## AT A GLANCE

- ▶ Complete hardware and software package for automated analysis with standard 24-, 48-, or 96-well plates. Special plate configurations available
- ▶ Transmission sampling with integrated DTGS or InGaAs detector
- ▶ Diffuse reflectance of powdered samples or specular reflectance sampling for reaction residues
- ▶ Gold-coated optics version for highest performance mid-IR and near-IR sampling
- ▶ Fully enclosed, purgeable design with loading tray
- ▶ In-compartment mounting, compatible with most FTIR spectrometers

The XY Autosampler is designed around standard 24-, 48- or 96-well microplate architectures—ideal for high-efficiency sample loading and FTIR analysis. Transmission and reflection measurements may be preformed. Applications include high throughput analysis of liquid residues and chemical reactions, and powdered samples.

## DESIGN

The loading tray moves to a position outside of the accessory for easy loading and unloading of samples while conserving the purge. This also allows for a robot/autoloader.

The XY Autosampler is available with standard all reflective aluminum optics or with gold-coated optical components for highest performance in mid-IR and optimized NIR sampling.

The optical design of the XY Autosampler is based upon a precision ellipsoidal reflector. The size of the spot illuminated at the sample is approximately 2 mm—ideal for up to 96-well configurations. The accessory is compatible with most FTIR spectrometers.



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE



96-well Si transmission plate.

A unique 96-well silicon plate is used for mid-IR sample analysis by transmission. Silicon is one of the infrared transmitting materials that is readily available in these large sizes and is mechanically robust enough even at 1-2 mm thicknesses. Additionally, at this thickness the full mid-IR spectral range may be realized. In most applications, the minimum sample volume is 20  $\mu$ l.

## AUTOMATION

The XY Autosampler features an X, Y stage with both axes driven by high-precision motors for speed and reproducibility. USB and DC power are the only external connections required for this accessory. The transmission option requires a spectrometer external IR detector port.

## SPECIFICATIONS

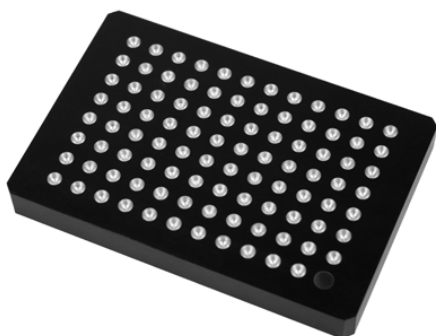
|                                  |   |
|----------------------------------|---|
| <b>Optics</b>                    | Elliptical – 3X beam demagnification                    |
| <b>Accuracy</b>                  | +/- 25 $\mu\text{m}$                                    |
| <b>Mechanical Specifications</b> | +/- 5 $\mu\text{m}$                                     |
| <b>Repeatability</b>             | 1 $\mu\text{m}$   |
| <b>Resolution</b>                | 56 seconds for 96-well plate                            |
| <b>Minimum Run Time</b>          | (actual time is spectrometer and application dependent) |
| <b>Computer Interface</b>        | USB   |
| <b>Dimensions (W X D X H)</b>    | 159 x 336 x 141 mm (including micrometer)               |
| <b>Weight</b>                    | 4.6 kg  |

## AUTOMATION WITH AUTO PRO 7

Programming and control of the XY Autosampler is done through PIKE Technologies' AutoPRO software, which can be integrated easily with most FTIR software packages.

## DIFFUSE REFLECTION

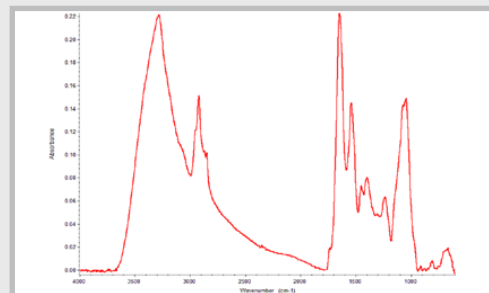
For diffuse reflection measurements a dedicated plate is available featuring 96 polished cavities for placement of powder samples. Please contact us if you require specialized sampling plate configurations.



96-well diffuse reflection sampling plate.

## APPLICATION

The XY Autosampler offers a flexible platform to automate diffuse/specular IR measurements, which increases lab productivity by running several samples within a run. This accessory may also be used as a precision mapping stage.



Infrared transmission of dried yeast spectrum collected with the XY Autosampler.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 047-22XX    | XY Autosampler – Diffuse Reflectance/Transmission<br>Includes AutoPRO software, integrated DTGS detector, 96-well diffuse reflectance and 96-well transmission sampling plates                          |
| 047-62XX    | XY Autosampler – Diffuse Reflectance/Transmission with Gold-Coated Optics.<br>Includes AutoPRO software, integrated DTGS detector, 96-well diffuse reflectance and 96-well transmission sampling plates |
| 047-23XX    | XY Autosampler – Diffuse Reflectance/Transmission<br>Includes AutoPRO software, integrated InGaAs detector, 96-well diffuse reflectance sampling plate  |
| 047-63XX    | XY Autosampler – Diffuse Reflectance/Transmission with Gold-Coated Optics<br>Includes AutoPRO software, integrated InGaAs detector, 96-well diffuse reflectance sampling plate                          |

**Notes:** Replace **XX** with your spectrometer's Instrument Code listed in the back of the catalog. For transmission option your spectrometer must be capable of interfacing with an external detector. A glass-bottom well plate is recommended for NIR transmission measurements. For diffuse-only options of this accessory, please see the Diffuse Reflectance section.

## Options

|          |  |
|----------|--|
| 073-9110 | 96-Well Diffuse Reflectance Sampling Plate |
| 073-9130 | 96-Well Si Transmission Sampling Plate     |

# 10 Degree Transmission Accessory

## AT A GLANCE

- ▶ Horizontal sample mount
- ▶ High energy throughput
- ▶ Fiber mount for sample irradiation
- ▶ Purgeable optics

The 10 Degree Transmission Accessory is designed to allow for IR analysis in transmission mode while the sample may be simultaneously subjected to external light source, making this an ideal for accessory for monitoring photocatalytic reactions.

This accessory offers an optical platform for samples that require horizontal positioning. The angle of incidence of the beam is 10 degree to the sample. To maximize the energy throughput through the sample, the accessory is designed to focus the beam at the sample position when using most commercial spectrometers.



| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

|          |                                  |
|----------|----------------------------------|
| 109-10XX | 10 Degree Transmission Accessory |
|----------|----------------------------------|

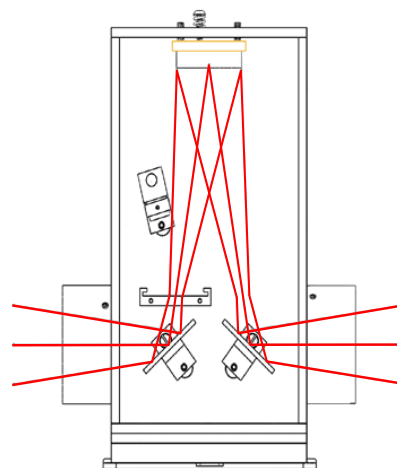
**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Base Optics includes purge tubes, purge kit and spectrometer base mount.

### Optional Parts

|          |   |
|----------|---|
| 162-5600 | Universal Sample Holder, 20-mm aperture                 |
| 162-5300 | Magnetic Film Holder for 13-mm pellets and film samples |
| 162-5410 | Film Card for 13-mm pellets (10 ea.)                    |
| 162-5400 | Film Sampling Cards, 20-mm aperture (10 ea.)            |

## SPECIFICATIONS

|                               |                                     |
|-------------------------------|-------------------------------------|
| <b>Optics</b>                 | All reflective                      |
| <b>Sample Orientation</b>     | Horizontal                          |
| <b>Angle Of Incidence</b>     | 10°                                 |
| <b>Purge Sealing</b>          | Purge tubes and purge barb included |
| <b>Dimensions (W X D X H)</b> | 152 x 102 x 284 mm                  |
| <b>FTIR Compatibility</b>     | Most, specify model and type.       |



Proprietary beam path within the 10 Degree Transmission Accessory.

This accessory includes a convenient fiber holder to position an external light guide to the sample. The integrated sample holder accommodates 2 x 3" standard slide mount sample holders for infrared solid and liquid holders.



# Press-On Demountable Liquid Cell

## AT A GLANCE

- ▶ Flexible window selection for optimizing spectral range and sample compatibility
- ▶ Demountable cell design for optimal cleaning of difficult samples
- ▶ Compatible with all FTIR spectrometers

The Press-On Demountable Liquid Cell is recommended for fast and convenient qualitative analysis of viscous liquids and mull samples.

Simply spot the sample onto the middle of the transparent IR window and slip the second window over the top. The windows are conveniently held in place by the friction fit of the Demountable Cell cap. The Press-On Demountable Cell is available in 2 sizes: 25-mm and 32-mm diameter, and has optional Teflon spacers to assist with sampling pathlength. A wide variety of window types and spacer pathlengths are available to cover near-IR, mid-IR and far-IR spectral regions and sample composition from organic to aqueous.

The Press-On Demountable Liquid Cell is designed with a standard 2 x 3" plate for use with all FTIR spectrometers.



| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

|          |   |
|----------|---|
| 162-3600 | Press-On Demountable Liquid Cell Holder for 25-mm Windows Includes cell holder and O-ring |
|----------|---|

|          |   |
|----------|---|
| 162-3610 | Press-On Demountable Liquid Cell Holder for 32-mm Windows Includes cell holder and O-ring |
|----------|---|

### Windows (select minimum of 2)

| 25 x 4 mm | 32 x 3 mm | Description      |
|-----------|-----------|------------------|
| 160-1217  | 160-1147  | BaF <sub>2</sub> |
| 160-1211  | 160-1143  | CaF <sub>2</sub> |
| 160-1138  | 160-1137  | Ge               |
| 160-1133  | 160-1132  | KBr              |
| 160-1127  | 160-1126  | KRS-5            |
| 160-1124  | 160-1122  | NaCl             |
| 160-5214  | 160-5216  | Polyethylene     |
| 160-1116  | 160-1159  | Si               |
| 160-1114  | 160-1113  | ZnSe             |

**Notes:** For window compatibility please consult the Materials Properties table on page 152 of this catalog. Find additional window selections starting on page 138.

### Optional Spacers

| 25 mm    | 32 mm    | Pathlength (mm) |
|----------|----------|-----------------|
| 162-1110 | 162-1210 | 0.015           |
| 162-1120 | 162-1220 | 0.025           |
| 162-1130 | 162-1230 | 0.05            |
| 162-1140 | 162-1240 | 0.1             |
| 162-1150 | 162-1250 | 0.2             |
| 162-1160 | 162-1260 | 0.5             |
| 162-1170 | 162-1270 | 1.0             |
| 162-1190 | 162-1290 | Assortment      |

**Notes:** Spacer pathlength packages above include 12 each of the spacers. The assortment package includes 2 each of the different pathlengths.

### Replacement Parts

|          |   |
|----------|---|
| 162-3621 | Viton® Barrel O-Rings for 25-mm cell (12 ea.) |
|----------|---|

|          |  |
|----------|--|
| 162-1330 | Viton Barrel O-Rings for 32-mm cell (12 ea.) |
|----------|--|

|          |                                |
|----------|--------------------------------|
| 162-3620 | Teflon® O-Ring, 25 mm (12 ea.) |
|----------|--------------------------------|

|          |                              |
|----------|------------------------------|
| 162-1320 | Teflon O-Ring 32 mm (12 ea.) |
|----------|------------------------------|

### Mulling Agents

|          |        |
|----------|--------|
| 161-0500 | Nujol® |
|----------|--------|

|          |             |
|----------|-------------|
| 161-0510 | Flourolube® |
|----------|-------------|

# Demountable Liquid Cell

## AT A GLANCE

- ▶ A selection of window materials for optimizing spectral range and sample compatibility
- ▶ Flexible pathlength to optimize sample absorbance
- ▶ Easy cleaning of difficult samples
- ▶ Compatible with all FTIR spectrometers

The Demountable Liquid Cell is ideal for qualitative and quantitative analysis of liquid samples where it is desirable to optimize the pathlength for varying samples.

This liquid transmission cell is well suited for samples where it is useful to disassemble the cell for cleaning. A wide selection of window types and spacer pathlengths are available to cover mid-IR, NIR and far-IR spectral regions and sample composition from organic to aqueous.

The cell is designed with a standard 2 x 3" plate for use with all FTIR spectrometers. The needle plate includes Luer-Lok™ fittings for easy syringe filling of the sample. The window size is 32 x 3 mm and the clear aperture of the cell is 13 mm.

An O-ring seal model of the demountable cell replaces the flat sealing gasket with two small O-rings to seal around the drilled window filling holes. This modified needle plate version is recommended for users with highly volatile, low surface tension samples and low-pressure flow experiments.



| PART NUMBER | DESCRIPTION                                     |
|-------------|---|
| 162-1100    | Demountable Liquid Cell Holder                  |
| 162-1200    | Demountable Liquid Cell Holder with O-ring Seal |

**Note:** Requires selection of windows and 2 syringes.

### Replacement Parts

|          |                                      |
|----------|--------------------------------------|
| 162-1104 | Demountable Liquid Cell Needle Plate |
|----------|--------------------------------------|

32 x 3 mm Windows for Demountable Liquid Cell (*must select minimum of 1 Plain and 1 Drilled*)

| Plain    | Drilled  | Description      |
|----------|----------|------------------|
| 160-1147 | 160-1146 | BaF <sub>2</sub> |
| 160-1143 | 160-1142 | CaF <sub>2</sub> |
| 160-1137 | 160-1136 | Ge               |
| 160-1132 | 160-1131 | KBr              |
| 160-1126 | 160-1125 | KRS-5            |
| 160-1122 | 160-1121 | NaCl             |
| 160-5216 | 160-5215 | Polyethylene     |
| 160-1159 | 160-1158 | Si               |
| 160-1113 | 160-1112 | ZnSe             |

**Notes:** Demountable Liquid Cell Holder with O-ring Seal (PN 162-1200) is recommended with polyethylene windows. For window compatibility please consult the Materials Properties table on page 152 of this catalog. Find additional window selections starting on page 138.

### Spacers for Demountable Liquid Cell (*optional*)

| Part Number | Pathlength (mm) | Part Number | Pathlength (mm) |
|-------------|-----------------|-------------|-----------------|
| 162-1210    | 0.015           | 162-1250    | 0.2             |
| 162-1220    | 0.025           | 162-1260    | 0.5             |
| 162-1230    | 0.05            | 162-1270    | 1.0             |
| 162-1240    | 0.1             | 162-1290    | Assortment      |

**Notes:** Spacer pathlength packages above include 12 each of the spacers. The assortment package includes 2 each of the different pathlengths.

|          |   |
|----------|---|
| 162-1113 | Demountable Alignment Caps (2 ea.)        |
| 162-1112 | Nylon Leur Caps (2 ea.)                   |
| 162-1300 | Teflon Stoppers for Needle Plate (12 ea.) |
| 162-1310 | Teflon Gaskets (12 ea.)                   |
| 162-1320 | Teflon O-Rings (12 ea.)                   |
| 161-0520 | Glass Syringe, 1 mL                       |
| 161-0521 | Glass Syringe, 2 mL                       |

**Note:** For more options, please contact PIKE Technologies.

# SmartSeal Liquid Cell

## AT A GLANCE

- ▶ Permanently mounted cell with fixed pathlength for maximum reproducibility of sample absorbance
- ▶ Flexible window selection for optimizing spectral range and sample compatibility
- ▶ Full range of cell pathlengths for optimized quantitative measurements
- ▶ RoHS compliant
- ▶ Compatible with all FTIR spectrometers



The SmartSeal Liquid Cells are ideal for quantitative analysis of liquid samples, especially where precise, reproducible pathlength is required.

Using a proprietary sealing technique, these are designed to be leakproof for long-lasting sampling and cost efficiency. The cells are fully RoHS compliant.

Each cell is mounted on a 2 x 3" slide mount card compatible with all FTIR spectrometers and includes Luer-Lok™ fittings for easy syringe filling of the sample. The clear aperture of the assembled cell is 13 mm. SmartSeal Cells are available in a wide variety of window materials and sampling pathlengths.



| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

### Options and Replacement Parts

|          |                          |
|----------|--------------------------|
| 161-0520 | Glass Syringe, 1 mL      |
| 161-0521 | Glass Syringe, 2 mL      |
| 162-1300 | Teflon Stoppers (12 ea.) |

**Note:** For other options please contact PIKE Technologies.

## SmartSeal Liquid Cells – Window Options

| Path (mm)        | 0.015    | 0.025    | 0.05     | 0.10     | 0.15     | 0.20     | 0.50     | 1.00     | 5.00     | 10.00    |
|------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Volume (mL)      | 0.007    | 0.012    | 0.025    | 0.049    | 0.022    | 0.098    | 0.073    | 0.145    | 0.727    | 1.455    |
| BaF <sub>2</sub> | 165-4000 | 165-4001 | 165-4002 | 165-4003 | 165-4004 | 165-4005 | 165-4006 | 165-4007 | 165-4009 | 165-4010 |
| CaF <sub>2</sub> | 165-5000 | 165-5001 | 165-5002 | 165-5003 | 165-5004 | 165-5005 | 165-5006 | 165-5007 | 165-5009 | 165-5010 |
| CsI              | 165-9000 | 165-9001 | 165-9002 | 165-9003 | 165-9004 | 165-9005 | 165-9006 | 165-9007 | 165-9009 | 165-9010 |
| KBr              | 165-1000 | 165-1001 | 165-1002 | 165-1003 | 165-1004 | 165-1005 | 165-1006 | 165-1007 | 165-1009 | 165-1010 |
| KRS-5            | 162-1660 | 162-1661 | 162-1662 | 162-1663 | 162-1669 | 162-1664 | 162-1665 | 162-1666 | 162-1667 | 162-1668 |
| NaCl             | 165-2000 | 165-2001 | 165-2002 | 165-2003 | 165-2004 | 165-2005 | 165-2006 | 165-2007 | 165-2009 | 165-2010 |
| SiO <sub>2</sub> | 165-6000 | 165-6001 | 165-6002 | 165-6003 | 165-6004 | 165-6005 | 165-6006 | 165-6007 | 165-6009 | 165-6010 |
| ZnSe             | 165-3000 | 165-3001 | 165-3002 | 165-3003 | 165-3004 | 165-3005 | 165-3006 | 165-3007 | 165-3009 | 165-3010 |
| ZnS              | 165-7000 | 165-7001 | 165-7002 | 165-7003 | 165-7004 | 165-7005 | 165-7006 | 165-7007 | 165-7009 | 165-7010 |

**Notes:** Please select 2 syringes (above) for filling the SmartSeal Cell. All SmartSeal Cells include Teflon® stoppers. For more pathlength options please contact PIKE Technologies.

# SmartSeal Flow Liquid Cell

## AT A GLANCE

- ▶ Stainless steel body
- ▶ Permanently mounted, precision pathlengths for maximum reproducibility
- ▶ RoHS compliant
- ▶ Compatible with all FTIR spectrometers

The SmartSeal Flow Cells are ideal for infrared transmission measurements of liquid samples in flow environments.

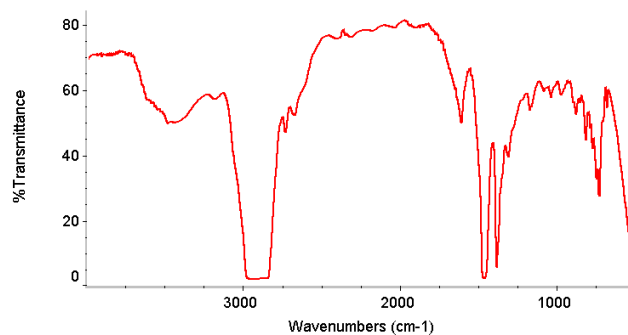
The precise, reproducible pathlength allows for obtaining reliable quantitative results. Using a proprietary sealing technique, these are designed to be leakproof for long-lasting sampling. The cells are fully RoHS compliant. Each cell is mounted on a 2" x 3" slide mount card compatible with all FTIR spectrometers. The cell body is stainless steel. The flow direction is vertical, and fittings are 1/8<sup>th</sup> inch compression fitting for easy connection to flow lines. The clear aperture of the assembled cell is 13 mm. SmartSeal Cells are available with ZnSe, CaF<sub>2</sub> and SiO<sub>2</sub> windows.



## SmartSeal Flow Liquid Cells - Window Options

| Pathlength (mm) | ZnSe     | CaF <sub>2</sub> | SiO <sub>2</sub> |
|-----------------|----------|------------------|------------------|
| 0.1             | 166-1001 | 166-1011         | 166-1021         |
| 0.2             | 166-1002 | 166-1012         | 166-1022         |
| 0.5             | 166-1003 | 166-1013         | 166-1023         |
| 1.0             | 166-1004 | 166-1014         | 166-1024         |
| 2.0             | 166-1005 | 166-1015         | 166-1025         |
| 5.0             | 166-1006 | 166-1016         | 166-1026         |
| 10              | 166-1007 | 166-1017         | 166-1027         |

**Note:** Contact us for cells requiring pathlength and window material not shown here.



IR transmission spectrum of oil.

# Long-Path Quartz Liquid Cells

## AT A GLANCE

- ▶ For the analysis of hydrocarbon content of water, soil and other environmental samples
- ▶ For analysis of polymer additives after extraction
- ▶ Highest quality quartz cells for clear infrared spectral transmission and optimized result

The Long-Path Quartz Liquid Cells are ideal for the quantitative analysis of hydrocarbons in water and soil samples or for the analysis of additive content in polymers after extraction.

Sample extracts are easily transferred to the quartz cells for infrared analysis. Pathlengths ranging from 10 mm to 100 mm are available for optimization of the sample absorbance. The cells are manufactured of special grade IR quartz which is fully transparent in the hydrocarbon absorbance region. The quartz cells are compatible with organic and aqueous solvents and are suitable for use with the D7066-04 ASTM method. A 2 x 3" slide mount holder is available for the cells.



| PART NUMBER | DESCRIPTION                   |
|-------------|-------------------------------|
| 162-1801    | Long-Path Quartz Cell, 10 mm  |
| 162-1802    | Long-Path Quartz Cell, 20 mm  |
| 162-1805    | Long-Path Quartz Cell, 50 mm  |
| 162-1810    | Long-Path Quartz Cell, 100 mm |

**Notes:** Cells include Teflon stoppers. Select slide sample holder below.

### Cylindrical Cells with Teflon Stoppers - 22-mm Diameter

| Pathlength mm | Volume mL | Optical Glass 334–2500 nm | Far UV Quartz 170–2700 nm | NIR Quartz 220–3800 nm |
|---------------|-----------|---------------------------|---------------------------|------------------------|
| 10            | 2.8       | 162-1831                  | 162-1841                  | 162-1801               |
| 20            | 5.6       | 162-1832                  | 162-1842                  | 162-1802               |
| 50            | 14.1      | 162-1835                  | 162-1845                  | 162-1805               |
| 100           | 28.2      | 162-1840                  | 162-1850                  | 162-1810               |

**Note:** All cylindrical cells have an outside diameter of 22 mm and an inside diameter of 19 mm.

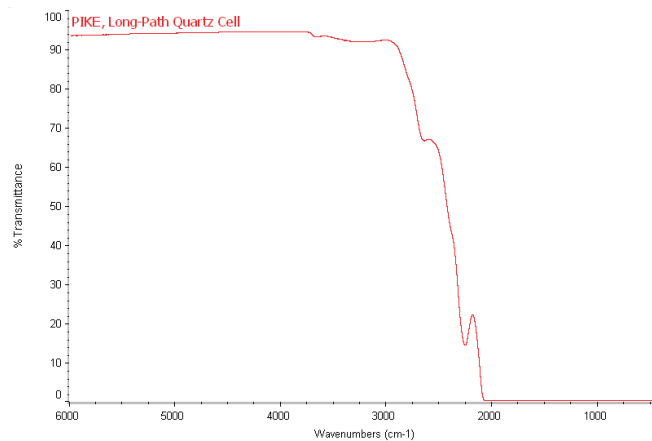
### Holders for Long-Path Quartz Liquid Cell

161-2530 Slide Sample Holder, Quartz Cell, 10–20 mm

161-2540 Slide Sample Holder, Quartz Cell, 50 mm

161-2550 Slide Sample Holder, Quartz Cell, 100 mm

**Note:** Please contact PIKE Technologies for replacement Teflon stoppers and items not described on this list.



Spectrum of 10-mm Long-Path Quartz Cell.

# Mid-IR Falcon

## AT A GLANCE

- ▶ Peltier temperature control from 5 to 130 °C
- ▶ Wide selection of windows for optimizing spectral range and sample compatibility
- ▶ Flexible pathlength to control sample absorbance
- ▶ Demountable cell design for easy cleaning of difficult samples
- ▶ Available for most FTIR spectrometers



### TEMPERATURE CONTROL

The Mid-IR Falcon Transmission Accessory is recommended for qualitative and quantitative analysis of liquids and protein solutions where it is necessary to control the temperature of the sample.

Temperature range of the accessory is 5 to 130 °C. Heating and cooling is controlled by a built-in Peltier device providing for reproducible ramping and for reaching target temperatures quickly and reliably. The system is driven by a digital temperature controller – directly or via PC.


A wide variety of window types and spacer pathlengths are available for this product. Window options cover NIR, mid-IR and far-IR spectral regions and sample compositions from organic to aqueous. A complete transmission cell for use with the Falcon Mid-IR Accessory consists of two 32 x 3-mm windows (drilled and undrilled), an assorted spacer set, the needle plate with Luer-Lok fittings, two gaskets and a proprietary cell mount.

PIKE Technologies offers temperature controllers with optional TempPRO software. TempPRO allows for easily programmed temperature profiles and unattended data collection with most FTIR software platforms.



Mid-IR Falcon with temperature controller.

## SPECIFICATIONS

|   |  |
|---|--|
| <b>Temperature Control</b>  | Peltier (cooling and heating)  |
| <b>Temperature Range</b>  | 5 to 130 °C  |
| <b>Accuracy</b>   | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C  |
| <b>Sensor Type</b>  | 3 wire Pt RTD (low drift, high stability)  |
| <b>Dimensions (W X D X H)</b>   | 89 x 121 x 83 mm (without FTIR baseplate and mount)  |
| <b>Temperature Controller</b>   | Touch-panel display with USB interface. PIKE TempPRO software for PC with unlimited ramps and automated data collection.   |
|  |  |
| <b>Input</b>  | 100–240 VAC, auto setting, external power supply   |
| <b>Output</b>   | 16 VDC/150 W maximum   |
|   | Notes: Peltier device must be water cooled for proper operation – this is achieved by running cold tap water through the water jacket integrated into the accessory shell, or by the use of an external liquid circulator. |

## LIQUID RECIRCULATOR

The Peltier element of the Falcon requires flowing water to act as a heat sink. The liquid circulator is a small footprint (10 x 7 x 6 inch) recirculator option. It includes a pump, quick disconnect water line fittings and a viewable water-level guide.



Liquid Recirculator.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 111-40XX    | Mid-IR Falcon Base with Cell Holder<br>Includes temperature-controlled base, demountable cell, gaskets and one complete set of spacers. Select digital temperature controller (below) and windows |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Please select 2 syringes (next page) for filling the demountable liquid cell.

32 x 3 mm Windows for Falcon Demountable Liquid Cells  
(*must select minimum of 1 Plain and 1 Drilled*)

| Plain    | Drilled  | Description      |
|----------|----------|------------------|
| 160-1147 | 160-1146 | BaF <sub>2</sub> |
| 160-1143 | 160-1142 | CaF <sub>2</sub> |
| 160-1137 | 160-1136 | Ge               |
| 160-1132 | 160-1131 | KBr              |
| 160-1126 | 160-1125 | KRS-5            |
| 160-1122 | 160-1121 | NaCl             |
| 160-1159 | 160-1158 | Si               |
| 160-1113 | 160-1112 | ZnSe             |

**Notes:** For window compatibility please consult the Materials Properties table on page 152 of this catalog. Find additional window selections starting on page 138.

Temperature Controllers (*must select one*)

|          |   |
|----------|---|
| 076-1510 | Digital Temperature Control Module for Falcon Accessory |
| 007-0207 | PIKE TempPRO Software                                   |

**Notes:** Digital Temperature Control Module is required to control temperature. PIKE TempPRO software is sold separately.

## Liquid Recirculator

|          |                     |
|----------|---------------------|
| 170-1100 | Liquid Recirculator |
|----------|---------------------|

Spacers for Demountable Liquid Cell (*optional*)

| Part Number | Pathlength (mm) | Part Number | Pathlength (mm) |
|-------------|-----------------|-------------|-----------------|
| 162-1210    | 0.015           | 162-1250    | 0.2             |
| 162-1220    | 0.025           | 162-1260    | 0.5             |
| 162-1230    | 0.05            | 162-1270    | 1.0             |
| 162-1240    | 0.1             | 162-1290    | Assortment      |

**Notes:** Spacer pathlength packages above include 12 each of the spacers. The assortment package includes 2 each of the different pathlengths.

## Demountable Liquid Cell Replacement Parts

|          |   |
|----------|---|
| 162-1600 | Demountable Liquid Cell for the Mid-IR Falcon Accessory |
| 162-1300 | Teflon Stoppers (12 ea.)                                |
| 162-1311 | Viton Gasket, 32 mm (12 ea.)                            |
| 162-1310 | Teflon Gasket, 32 mm (12 ea.)                           |
| 161-0520 | Glass Syringe, 1 mL                                     |
| 161-0521 | Glass Syringe, 2 mL                                     |

**Note:** For other options for the Falcon Demountable Liquid Cell, please contact PIKE Technologies.

# NIR Falcon

## AT A GLANCE

- ▶ Fast, easy quantitative and qualitative analysis of samples under precise Peltier temperature control
- ▶ Choice of cuvette and vial adapters
- ▶ Compatible with disposable 5-, 8- and 12-mm vials
- ▶ Excellent thermal accuracy and precision
- ▶ Available for most FTIR spectrometers



### TEMPERATURE CONTROL

The NIR Falcon Transmission Accessory is an excellent choice for quantitative and qualitative analysis of liquid samples in the NIR spectral region.

The temperature range of the NIR Falcon is 5 to 130 °C. Heating and cooling is controlled by a built-in Peltier device. The Peltier element provides for reproducible ramping and for reaching target temperatures quickly and reliably. The system is driven by a Digital Temperature Controller.

Individual sample holders are designed to accommodate standard 5-, 8- and 12-mm glass vials and 1-cm cuvettes. Sample holders are pin-positioned to ensure maximum reproducibility.

PIKE Technologies offers temperature controllers with digital and PC programmable set points with the optional TempPRO software. This allows for easily programmed temperature profiles and unattended data collection with most FTIR software platforms.




The complete NIR Falcon configuration requires the accessory base, cell holder, and temperature controller. The Falcon accessory is compatible with most brands of FTIR spectrometers.



NIR Falcon with temperature controller.



## SPECIFICATIONS

|   |  |
|---|--|
| <b>Temperature Control</b>  | Peltier (cooling and heating)  |
| <b>Temperature Range</b>  | 5 to 130 °C  |
| <b>Accuracy</b>   | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C  |
| <b>Sensor Type</b>  | 3 wire Pt RTD (low drift, high stability)  |
| <b>Dimensions (W X D X H)</b>   | 89 x 121 x 83 mm (without FTIR baseplate and mount)  |
| <b>Temperature Controller</b>   | Touch-panel display with USB interface. PIKE TempPRO software for PC with unlimited ramps and automated data collection.   |
|    |  |
| <b>Input</b>  | 100-240 VAC, auto setting, external power supply   |
| <b>Output</b>   | 16 VDC/150 W maximum   |
|   | Notes: Peltier device must be water-cooled for proper operation – this is achieved by running cold tap water through the water jacket integrated into the accessory shell, or by the use of an external liquid circulator. |

## LIQUID RECIRCULATOR

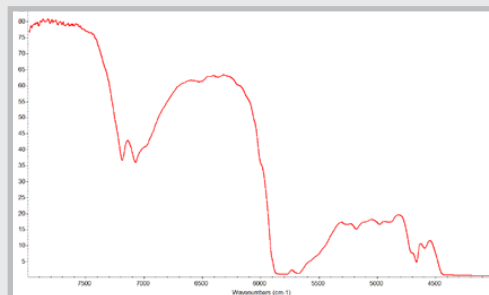
The Peltier element of the Falcon requires flowing water to act as a heat sink. The liquid circulator is a small footprint (10 x 7 x 6 inch) recirculator option. It includes a pump, quick disconnect water line fittings and a viewable water-level guide.



Liquid Recirculator.

## APPLICATION

For NIR liquid transmission sampling, temperature control provides added consistency to quantification measurements. In addition, disposable vials offer a convenient sample holder. Various vial holders allow measurement sensitivity to be tailored by choosing the optimal vial diameter.



**NIR transmission spectra** of cooking oils in 8-mm glass vials measured at 32 °C with the NIR Falcon Transmission Accessory.

| PART NUMBER                                      | DESCRIPTION   |
|--|---|
| 110-60XX   | NIR Falcon Base<br>Includes temperature-controlled base. Digital Temperature Controller and sample holder need to be selected from the tables below for a complete system.<br><br><b>Note:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. |
| <b>Temperature Controllers (must select one)</b> |   |
| 076-1510   | Digital Temperature Control Module for Falcon Accessory   |
| 007-0207   | PIKE TempPRO Software<br><br><b>Notes:</b> Digital Temperature Control Module is required to control temperature. If PC control is desired, TempPRO software must be purchased (sold separately).   |
| <b>Sample Holders (must select one or more)</b>  |   |
| 111-3610   | Vial Holder, 5 mm   |
| 111-3620   | Vial Holder, 8 mm   |
| 111-3630   | Vial Holder, 12 mm  |
| 111-3640   | Cuvette Holder, 1 cm  |
| <b>Options</b>                                   |   |
| 162-0205   | Glass Vials, 5 mm (200 ea.)   |
| 162-0208   | Glass Vials, 8 mm (200 ea.)   |
| 162-0212   | Glass Vials, 12 mm (200 ea.)  |
| 162-0255   | Falcon Quartz Cuvette, 1 cm<br><br><b>Note:</b> Please see more cuvette options on page 165.  |
| <b>Liquid Recirculator</b>                       |   |
| 170-1100   | Liquid Recirculator   |

# Ember Vial Heater

## AT A GLANCE

- ▶ Temperature range from ambient to 130 °C
- ▶ Precision temperature stability
- ▶ Interchangeable vial block inserts
- ▶ Integrated digital temperature controller
- ▶ Small footprint



### TEMPERATURE CONTROL

Ember is multi-purpose vial/cuvette dry block heater. It is designed to provide superior sample temperature stability for laboratory and spectroscopic applications.

For added flexibility, Ember provides interchangeable vial blocks that can accommodate vial diameters from 5 to 12 mm and cuvettes.

The control panel and LED display are conveniently positioned on the front panel. Temperature may be set easily by using the up and down buttons. Ember features an integrated count-down timer.

Ember is an ideal companion to the NIR Falcon Accessory.



| PART NUMBER   | DESCRIPTION                       |
|---|-----------------------------------|
| 162-5000  | Ember Vial Preheat Station, 115 V |
| 162-5005  | Ember Vial Preheat Station, 230 V |
| <b>Note:</b> Requires a selection of block insert.                            |                                   |
| <b>Heater Block Inserts and Options</b><br>( <i>must select one or more</i> ) |                                   |
| 162-5010  | 5 mm Vial Ember Block, 9x5        |
| 162-5012  | 8 mm Vial Ember Block, 7x6        |
| 162-5014  | 12 mm Vial Ember Block, 6x4       |
| 162-5015  | 1 cm Cuvette Ember Block, 6x3     |
| 162-5016  | Falcon Insert Ember Block, 2x1    |
| 162-5020  | Ember Sample Temperature Probe    |

**Note:** The 8mm vial block holds 41 samples, as the center position accommodates the lift handle.

## SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Temperature Range</b>      | Ambient to 130 °C                       |
| <b>Accuracy</b>               | +/- 0.1 °C                              |
| <b>Sensor Type</b>            | 10K Thermistor                          |
| <b>Base Weight</b>            | 2.0 kg                                  |
| <b>Insert Weight</b>          | 0.8 kg                                  |
| <b>Total Weight</b>           | 2.8 kg                                  |
| <b>Dimensions (W X D X H)</b> |   |
| Base                          | 171 x 178 x 97 mm                       |
| Insert                        | 76 x 127 x 38 mm                        |
| <b>Controller Input</b>       | 100-120V 50/60Hz or<br>200-240V 50/60Hz |



# Heated Solid Accessory

## AT A GLANCE

- ▶ Temperature range from ambient to 300 °C
- ▶ Quick sample loading and unloading
- ▶ Selection of different size sample holders
- ▶ Environmentally enclosed configuration



### TEMPERATURE CONTROL

The Heated Solid Transmission Accessory is designed to analyze solid samples at temperatures ranging from ambient to 300 °C.

Available sample mounts can hold samples from 12 to 30 mm in diameter and up to 3-mm thick. Sample loading is simple and does not require any tools. The accessory is equipped with a standard 2 x 3" slide that makes it easy to mount in all types of spectrometers and most spectrophotometers. The heating time from ambient temperature to 300 °C is 30 minutes.

Two models are available, standard and environmental. The environmental configuration features a sealed sample area. This creates an inert or reacting gas blanket around the sample making it an ideal accessory for glove box applications.

PIKE Technologies offers temperature controllers with optional TempPRO software (sold separately). TempPRO allows for easily programmed temperature profiles and unattended data collection with most FTIR software platforms. The accessory requires a liquid recirculator to prevent overheating.



| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

|          |  |
|----------|--|
| 112-1000 | Heated Solid Transmission Accessory, standard      |
| 112-1100 | Heated Solid Transmission Accessory, environmental |

**Note:** Select at least one holder for either standard or environmental configuration.

#### Sample Holders (*must select one or more*)

|          |  |
|----------|--|
| 112-2010 | 12–15 mm Diameter Sample Holder, standard      |
| 112-2020 | 16–20 mm Diameter Sample Holder, standard      |
| 112-2030 | 21–25 mm Diameter Sample Holder, standard      |
| 112-2040 | 26–30 mm Diameter Sample Holder, standard      |
| 112-2110 | 12–15 mm Diameter Sample Holder, environmental |
| 112-2120 | 16–20 mm Diameter Sample Holder, environmental |
| 112-2130 | 21–25 mm Diameter Sample Holder, environmental |

#### Temperature Controllers (*must select one*)

|          |                                    |
|----------|------------------------------------|
| 076-2550 | Digital Temperature Control Module |
| 007-0207 | PIKE TempPRO Software              |

**Note:** Digital Temperature Control Module is required. PIKE TempPRO software sold separately.

#### Liquid Recirculator




|          |                     |
|----------|---------------------|
| 170-1100 | Liquid Recirculator |
|----------|---------------------|

25 x 2 mm Windows (*must select two or more for environmental model only*)

|          |                  |          |                           |
|----------|------------------|----------|---------------------------|
| 160-1306 | BaF <sub>2</sub> | 160-5086 | SiO <sub>2</sub>          |
| 160-1212 | CaF <sub>2</sub> | 160-5122 | SiO <sub>2</sub> , Low OH |
| 160-1305 | KBr              | 160-1155 | ZnSe                      |
| 160-5213 | Polyethylene     | 160-1168 | NaCl                      |

**Note:** Find additional window options on page 162

## SPECIFICATIONS

|  |  |
|--|--|
| <b>Cell Body</b>   | Aluminum   |
| <b>Mount</b>   | 2 x 3" Slide Mount   |
| <b>Temperature Range</b>   | Ambient to 300 °C  |
| <b>Sample Thickness</b>  | 3 mm max.  |
| <b>Dimensions (W X D X H)</b>  | 77 x 51 x 93 mm  |
| <b>Cooling Requirements</b>  |  |
| Coolant Temp   | 6 to 28 °C   |
| Coolant Pressure   | 0.1–2 kgf/cm <sup>2</sup>  |
| Coolant Flow Rate  | 20–1000 mL/min   |
| <b>Temperature Controller</b>  | Touch-panel display with USB interface. PIKE TempPRO software for PC with unlimited ramps and automated data collection. |
|    |  |
| <b>Input</b>   | 100–240 VAC auto-setting external power supply   |
| <b>Output</b>  | 4.2A/28 VDC 120 W maximum  |
| <b>Controller Dimensions (W X D X H)</b>   | 140 x 200 x 60 mm  |

# Bolt Press & Hydraulic Die

## AT A GLANCE

- ▶ Affordable KBr pellet making tools
- ▶ Small and portable
- ▶ Easy to use

The Bolt Press and Hydraulic Die are low-cost tools for making KBr pellets for transmission FTIR analysis.

The press and die consist of a stainless steel barrel with two hardened and polished 13-mm rams. The barrels are equipped with a fitting which allows evacuation of air while the pellet is formed. For the Bolt Press, the pressure is applied to the sample by tightening the bolts against each other with standard  $\frac{1}{4}$ " wrenches are included. For the Hydraulic Die the pressure is applied to the sample by placing it in a hydraulic press—up to 10,000 psi (5 ton).

Once a clear pellet is formed, the rams are removed and the sample is analyzed while still in the barrel. The measurement is made by placing the barrel directly in the beam using the Press Holder with a standard 2 x 3" slide mount. Both accessories form a 13-mm pellet.

The PIKE Technologies Bolt Press and Hydraulic Die both include a holder.

| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

|          |                              |
|----------|------------------------------|
| 161-2500 | Bolt Press for 13-mm pellets |
|----------|------------------------------|

|          |                                 |
|----------|---------------------------------|
| 161-3500 | Hydraulic Die for 13-mm pellets |
|----------|---------------------------------|

**Notes:** The Bolt Press includes evacuable barrel, 2 anvil bolts, 2  $\frac{1}{4}$ " wrenches, and Bolt Press Holder. The Hydraulic Die includes evacuable barrel, 2 rams and Hydraulic Die Holder. The maximum force limit 5 ton.

### Options and Replacement Parts

|          |                   |
|----------|-------------------|
| 160-8010 | KBr Powder, 100 g |
|----------|-------------------|

|          |                                |
|----------|--------------------------------|
| 161-5050 | Agate Mortar and Pestle, 50 mm |
|----------|--------------------------------|

|          |                                   |
|----------|-----------------------------------|
| 161-2511 | Wrench Set for Bolt Press (2 ea.) |
|----------|-----------------------------------|

|          |   |
|----------|---|
| 161-2520 | Holder for the Bolt Press and Hydraulic Die |
|----------|---|

|          |                       |
|----------|-----------------------|
| 161-2513 | Barrel for Bolt Press |
|----------|-----------------------|

|          |                       |
|----------|-----------------------|
| 161-2525 | Anvils for Bolt Press |
|----------|-----------------------|

|          |                          |
|----------|--------------------------|
| 161-3502 | Anvils for Hydraulic Die |
|----------|--------------------------|

**Note:** For more pellet press options, please contact PIKE Technologies.



Hydraulic Die.



Bolt Press.

# Hand Press

## AT A GLANCE

- ▶ Includes 7-, 3- and 1-mm die sets.
- ▶ Efficient and reliable
- ▶ Affordable

The Hand Press is an ideal solution for laboratories that require only occasional preparation of KBr pellets.

The Hand Press is an efficient, reliable and inexpensive tool which simplifies making small pellets. It consists of a long stainless steel barrel and movable stage controlled by a lever capable of applying high pressure to the KBr/powder mixture. The Hand Press comes complete with three standard die sets (7-, 3- and 1-mm).

The pellet preparation involves loading of the powdered sample into the die chamber, placement of the upper anvil in the press and application of hand pressure to the lever (this is sufficient to provide clear, high-quality KBr disks). The Die Collar with the formed pellet is removed from the press and in most cases it can be placed directly in the beam of the spectrometer for analysis. The Hand Press is equipped with a platen position dial for adjustment of the force applied to the die for reproducible sample preparation.

| PART NUMBER   | DESCRIPTION   |
|---|---|
| 161-1100  | Hand Press for 7-, 3-, and 1-mm pellets<br>Includes 7-, 3-, and 1-mm die sets, anvils, die collars, anvil ejectors and Dual Pellet Holder |
| Options and Replacement Parts   |   |
| 161-5700  | Dual Pellet Holder for 7-, 3-, and 1-mm pellets   |
| 161-1018  | Single Pellet Holder for 7-mm pellets   |
| 161-1025  | Single Pellet Holder for 1- and 3-mm pellets  |
| 160-8010  | KBr Powder, 100 g   |
| 161-5050  | Agate Mortar and Pestle, 50 mm  |
| 161-1027  | Hand Press Body   |
| 161-1028  | Die Set, 1 mm   |
| 161-1024  | Die Set, 3 mm   |
| 161-1010  | Die Set, 7 mm   |
| 161-1019  | Die Sets, 1, 3 and 7 mm   |
| 161-1011  | 7-mm Collar   |
| 161-1020  | 7-mm Collar (10-pack)   |
| <b>Note:</b> For more Hand Press options, please contact PIKE Technologies. |   |



# Evacuatable Pellet Press

## AT A GLANCE

- ▶ Ideal for making high-quality KBr pellets
- ▶ Applied force up to 10 tons
- ▶ Evacuatable to prevent cloudy pellets
- ▶ Requires hydraulic press

Preparation of KBr pellets with a 13-mm die and a hydraulic press is the most popular method used to make samples for transmission measurements.

KBr pellets are required by a number of standardized procedures, including some USLP and ASTM methods. Advantages of this approach include the generation of high-quality pellets, reproducibility, and the ability to deal with relatively difficult samples.

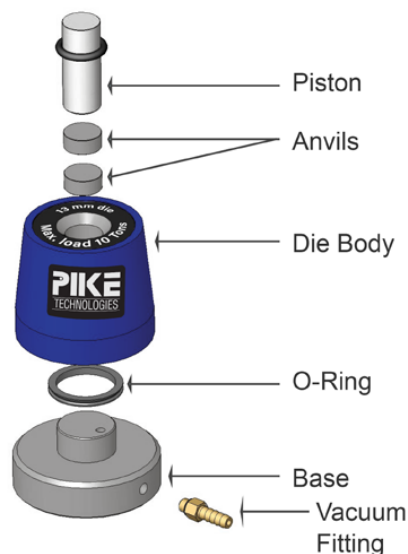
The Evacuatable Pellet Press Kit features the following components: a stainless-steel base with vacuum outlet, the main die block with a 13-mm cylinder, two polished anvils and a plunger. All components are made of hardened stainless steel and surfaces that come in contact with the sample are highly polished. Two O-rings are used to seal the base/die assembly and the plunger.

Pellet preparation involves placement of the anvil in the die chamber and covering it with the pre-measured amount of KBr/sample mix. The second anvil is placed on the sample and the plunger is inserted into the chamber. The entire

| PART NUMBER                          | DESCRIPTION   |
|--------------------------------------|---|
| 161-1900                             | Evacuatable Pellet Press for 13-mm pellets<br>Includes die block, anvils and pellet extracting tool |
| <b>Options and Replacement Parts</b> |   |
| 160-8010                             | KBr Powder, 100 g   |
| 161-5050                             | Agate Mortar and Pestle, 50 mm  |
| 162-5300                             | Magnetic Film Holder for 13-mm pellets and film samples   |
| 162-5410                             | Sample Card for 13-mm pellets (10 ea.)  |
| 161-1908                             | Pellet Extracting Tool  |
| 161-1903                             | Anvils for PIKE Evacuatable Pellet Press (2 ea.)  |
| 161-1902                             | Pellet Die Piston   |
| 161-1906                             | Piston O-Rings (2 ea.)  |
| 161-1907                             | Base O-Rings (2 ea.)  |
| 430-1110                             | Vacuum Pump, 110V   |
| 430-1220                             | Vacuum Pump, 220V   |
| 161-1070                             | ShakIR, Heavy Duty Sample Grinder, 110-220V<br>Includes mount for 1" vials                          |
| 161-1035                             | ShakIR Stainless Steel Vial with Ball, 1" long x 0.5"   |

**Notes:** ShakIR requires stainless steel vial and ball P/N 161-1035. For more Evacuatable Pellet Press options, please contact PIKE Technologies.

assembly is placed in a hydraulic press and compressed (a vacuum line can be connected to the base to remove air from the sample matrix). For analysis, the formed pellet is ejected from the die with an extractor and mounted onto a standard 2 x 3" sample holder.



Evacuatable pellet press assembly.

# Pixie Hydraulic Press

## AT A GLANCE

- ▶ 7-mm diameter die
- ▶ Applied force up to 2.5 tons
- ▶ Integrated force gauge
- ▶ Easy-to-use, ergonomic design
- ▶ Small footprint

The Pixie is a portable, manual, hydraulic press for making high-quality KBr pellets.

With the press' ergonomic design, pellet making is easy and effortless. Pixie's small footprint makes it ideal for limited bench-space environments and glove boxes, and for storability. KBr pellets for IR transmission measurements are required by a number of standardized procedures, including some USLP and ASTM methods. Advantages of pellet making are spectral reproducibility and the ability to deal with relatively difficult or limited-mass samples.

The pellet preparation involves loading of the powdered KBr/sample matrix into the die chamber and placing the assembled die onto the platform of the hydraulic press. Force up to 2.5 tons may be applied. The die collar containing the newly formed pellet is placed into the designated holder and is positioned in the spectrometer's 2 x 3" slide mount holder for measurement.

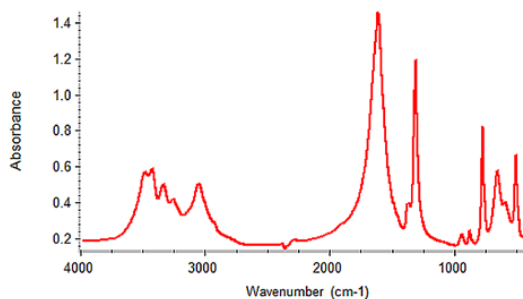


| PART NUMBER                          | DESCRIPTION   |
|--------------------------------------|---|
| 181-1410                             | Pixie Hydraulic Press Package<br>Includes Pixie Hydraulic Pellet Press, 7-mm die set with two additional die collars, pellet holder, 35-mm agate mortar, KBr (50 g) and spoon spatula                                 |
| 162-1010                             | Premium Transmission Sampling Kit<br>Includes Pixie Hydraulic Pellet Press, sample preparation tools, mull liquids, cells, windows and cell holders required for preparation and analysis of solid and liquid samples |
| 181-1400                             | Pixie Hydraulic Pellet Press  |
| <b>Options and Replacement Parts</b> |   |
| 161-1010                             | 7-mm Die Set  |
| 161-1018                             | Single Pellet Holder for 7-mm pellets   |
| 161-1011                             | 7-mm Collar   |
| 161-1020                             | 7-mm Collar (10-pack)   |
| 160-8010                             | KBr Powder, 100 g   |
| 161-5035                             | Agate Mortar and Pestle, 35 mm  |
| 042-3035                             | Spatula – spoon   |
| 042-3050                             | Spatula – flat  |

## SPECIFICATIONS

|                               | Metric          | English                   |
|-------------------------------|-----------------|---------------------------|
| <b>Ram Force, Max</b>         | 2.3 metric tons | 2.5 tons                  |
| <b>Platen Diameter</b>        | 20.2 mm         | 0.8"                      |
| <b>Die Height Range</b>       | 22–39 mm        | 0.86–1.54"                |
| <b>Maximum Die Width</b>      | 79 mm           | 3.11"                     |
| <b>Mass</b>                   | 4.5 kg          | 10 lbs                    |
| <b>Dimensions (W X D X H)</b> |                 |                           |
|                               | Metric          | 127 x 192 x 201 (min.) mm |
|                               | English         | 5.0 x 7.8 x 7.9 (min.)"   |

The comprehensive Pixie Package provides all necessary components to start making pellets in the lab. It includes a 7-mm die, two extra pellet collars, pellet holder, pestle and mortar set, KBr powder and spatula. All die components are made of hardened stainless steel and the parallel surfaces that come in contact with the sample are highly polished for obtaining optimal pellet quality.



Spectrum of calcium oxalate hydrate; KBr pellet made with Pixie Press.

# CrushIR Hydraulic Press

## AT A GLANCE

- ▶ Up to 15 US tons of force
- ▶ Digital force readout for exceptional reproducibility
- ▶ Adjustable maximum force
- ▶ Small footprint
- ▶ Transparent safety shield

The CrushIR is an advanced hydraulic press for making excellent-quality KBr pellets and thin films for transmission FTIR analysis. With its integrated digital force reading, the CrushIR™ provides exceptional reproducibility.

The PIKE CrushIR features a small footprint and includes a transparent protective shield, making it safe for operation in a busy laboratory environment. Access for vacuum hose and other utilities is made through a port in the rear of the press.



| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

### Hydraulic Press (*select one*)

|          |   |
|----------|---|
| 181-1100 | CrushIR Hydraulic Press   |
| 181-1110 | CrushIR Hydraulic Press, Evacuatable Pellet Press and Magnetic Holder                                     |
| 181-1120 | CrushIR Heated Platens Package<br>Includes CrushIR, Heated Platens and Digital Temperature Control Module |

**Note:** The PIKE CrushIR Hydraulic Press includes an integrated safety shield.

### Options and Replacement Parts

|          |   |
|----------|---|
| 161-1900 | Evacuatable Pellet Press for 13-mm pellets  |
| 160-8010 | KBr Powder, 100 g                           |
| 161-5050 | Agate Mortar and Pestle, 50 mm              |
| 162-5300 | Magnetic Film Holder for 13-mm pellets      |
| 162-5410 | Sample Card for 13-mm pellets (10 ea.)      |
| 430-1110 | Vacuum Pump, 110V                           |
| 430-1220 | Vacuum Pump, 220V                           |
| 161-1070 | ShakIR, Heavy Duty Sample Grinder, 110-220V |
| 161-1035 | Stainless Steel Vial with Ball for ShakIR   |

**Notes:** ShakIR requires stainless steel vial and ball P/N 161-1035. For more Evacuatable Pellet Press options, please contact PIKE Technologies.

## SPECIFICATIONS

|                               | Metric  | English          |
|-------------------------------|---|------------------|
| <b>Clamp Force, Max</b>       | 13.6 metric tons                              | 15 US tons       |
| <b>Platen Diameter</b>        | 100 mm  | 3.94"            |
| <b>Ram Stroke</b>             | 5 mm  | 0.2"             |
| <b>Die Height Range</b>       | 5–11.5 cm                                     | 2–4"             |
| <b>Dimensions (W X D X H)</b> | 31 x 25 x 35 cm                               | 12 x 9.8 x 13.5" |
| <b>Mass</b>                   | 23.6 kg                                       | 52 lbs           |
| <b>Power Supply</b>           |   |                  |
| Input                         | 90–264 V, auto setting, external power supply |                  |
| Output                        | 9 VDC/18 W maximum                            |                  |

The adjustable top screw provides flexibility for die designs of short and longer dimensions yielding an open stand range from 2 to 4" (5 to 11.5 cm). The efficient sized ram stroke of 0.2" (5 mm) and adjustment screw speeds pellet making by minimizing the time required to achieve the desired force. All mechanical components of the press are enclosed in a safety metal cabinet.

The PIKE Evacuatable Pellet Press and 13-mm pellet holder are an excellent addition to the PIKE CrushIR. A packaged version of these three products is available.



# PressPRO 15-Ton

## AT A GLANCE

- ▶ Variable force from 1 to 15 US tons
- ▶ Microprocessor controlled, consistent and reproducible force application for quality pellet making
- ▶ Easy to use touch-screen programming
- ▶ Wide access door with transparent window and safety interlock

The PressPRO 15-Ton microprocessor controlled automated hydraulic press introduces an element of consistency into hydraulic press applications such as KBr pellet making.

Pressure and corresponding hold time are easily entered through its integrated touch-screen control panel. Up to four pressure hold time and ramps may be programmed and performed within a run. During operation the force measurement is shown on the bright color display. This level of control enhances the uniformity and quality of transmission samples.



| PART NUMBER  | DESCRIPTION  |
|--|--|
| 181-1325   | PressPRO Hydraulic Press, Evacuatable Pellet Press and Magnetic Holder |
| 181-1320   | PressPRO Hydraulic Press   |
| <b>Note:</b> The PIKE PressPRO Hydraulic Press includes an integrated safety shield. |  |
| Options and Replacement Parts  |  |
| 161-1900   | Evacuatable Pellet Press for 13-mm pellets                             |
| 160-8010   | KBr Powder, 100 g  |
| 161-5050   | Agate Mortar and Pestle, 50 mm   |
| 162-5300   | Magnetic Film Holder for 13-mm pellets                                 |
| 162-5410   | Sample Card for 13-mm pellets (10 ea.)                                 |
| 430-1110   | Vacuum Pump, 110V  |
| 430-1220   | Vacuum Pump, 220V  |
| 161-1070   | ShakIR, Heavy Duty Sample Grinder, 110-220V                            |
| 161-1035   | Stainless Steel Vial with Ball for ShakIR                              |

**Notes:** ShakIR requires stainless steel vial and ball P/N 161-1035. For more Evacuatable Pellet Press options, please contact PIKE Technologies.

## SPECIFICATIONS

|                               | Metric                   | English          |
|-------------------------------|--------------------------|------------------|
| <b>Clamp Force, Max</b>       | 13.6 metric tons         | 15.0 US tons     |
| <b>Force Resolution</b>       | 0.09 metric ton          | 0.10 US ton      |
| <b>Platen Diameter</b>        | 100 mm                   | 3.94"            |
| <b>Ram Stroke</b>             | 12 mm                    | 0.45"            |
| <b>Die Height Range</b>       | 2.5–11.5 cm              | 1–4.5"           |
| <b>Dimensions (W X D X H)</b> | 24 x 43 x 34 cm          | 9.5 x 17 x 13.5" |
| <b>Weight</b>                 | 37.0 kg                  | 81.6 lbs         |
| <b>Power Supply</b>           |                          |                  |
| Input                         | 100–240 VAC              |                  |
| Operating                     | 6A/24 VDC, 150 W maximum |                  |

PressPRO is equipped with a wide access door that allows for easy insertion and removal of the pellet press. The door features an impact resistant, polycarbonate window and safety interlock which prevents operation while the door is open, making it safe for operation in a busy laboratory environment.

The adjustable screw at the top of the press provides flexibility for short and tall die designs, yielding an open stand range from 1 to 4.5" (2.5 to 11.5 cm). The optimal ram stroke of 0.45" (12 mm) and easy top screw adjustment speed-up pellet making by reducing time required to achieve the desired force.

# PressPRO Plus 25-Ton

## AT A GLANCE

- ▶ Variable force from 1 to 25 US tons
- ▶ Ideal for FTIR and XRF pellet preparation
- ▶ Microprocessor controlled, consistent and reproducible force application for quality pellet making
- ▶ Easy to use touch-screen programming
- ▶ Wide access door with transparent window and safety interlock

The PressPRO Plus 25-ton hydraulic press introduces an element of consistency into pellet making for XRF and IR analysis.

Within a single run, up to four pressure steps and corresponding hold time are easily entered through its integrated touch-screen control panel. Release pressure rate may be prescribed. During operation the real-time applied force is shown on the color display. This level of control enhances the uniformity and quality of prepared samples.

PressPRO is equipped with a wide access door that allows for easy insertion and removal of the pellet press. The door features an impact resistant, polycarbonate window



| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

|          |                               |
|----------|-------------------------------|
| 181-1340 | PressPRO Plus Hydraulic Press |
|----------|-------------------------------|

**Note:** The PIKE PressPRO Plus Hydraulic Press includes an integrated safety shield.

### Options and Replacement Parts

|          |  |
|----------|--|
| 161-2020 | Evacuatable Pellet Press for 20-mm pellets |
|----------|--|

|          |  |
|----------|--|
| 161-2025 | Evacuatable Pellet Press for 25-mm pellets |
|----------|--|

|          |  |
|----------|--|
| 161-2032 | Evacuatable Pellet Press for 32-mm pellets |
|----------|--|

|          |  |
|----------|--|
| 161-1900 | Evacuatable Pellet Press for 13-mm pellets |
|----------|--|

|          |                   |
|----------|-------------------|
| 160-8010 | KBr Powder, 100 g |
|----------|-------------------|

|          |                                |
|----------|--------------------------------|
| 161-5050 | Agate Mortar and Pestle, 50 mm |
|----------|--------------------------------|

|          |  |
|----------|--|
| 162-5300 | Magnetic Film Holder for 13-mm pellets |
|----------|--|

|          |  |
|----------|--|
| 162-5410 | Sample Card for 13-mm pellets (10 ea.) |
|----------|--|

|          |                   |
|----------|-------------------|
| 430-1110 | Vacuum Pump, 110V |
|----------|-------------------|

|          |                   |
|----------|-------------------|
| 430-1220 | Vacuum Pump, 220V |
|----------|-------------------|

|          |   |
|----------|---|
| 161-1070 | ShakIR, Heavy Duty Sample Grinder, 110-220V |
|----------|---|

|          |   |
|----------|---|
| 161-1035 | Stainless Steel Vial with Ball for ShakIR |
|----------|---|

**Notes:** ShakIR requires stainless steel vial and ball P/N 161-1035.

## SPECIFICATIONS

|                               | Metric                   | English        |
|-------------------------------|--------------------------|----------------|
| <b>Applied Force, Max</b>     | 22.7 metric tons         | 25.0 US tons   |
| <b>Force Resolution</b>       | 0.18 metric ton          | 0.20 US ton    |
| <b>Platen Diameter</b>        | 100 mm                   | 3.94"          |
| <b>Ram Stroke</b>             | 12 mm                    | 0.45"          |
| <b>Die Height Range</b>       | 2.5–15.2 cm              | 1–6"           |
| <b>Dimensions (W X D X H)</b> | 24 x 43 x 38 cm          | 9.5 x 17 x 15" |
| <b>Weight</b>                 | 44.5 kg                  | 98 lbs         |
| <b>Power Supply</b>           |                          |                |
| Input                         | 100–240 VAC              |                |
| Operating                     | 6A/24 VDC, 150 W maximum |                |

and safety interlock which prevents operation while the door is open, making it safe for operation in a busy laboratory environment.

The adjustable screw at the top of the press provides flexibility for short and tall die designs, yielding an open stand range from 1 to 6" (2.5 to 15.2 cm). The optimal ram stroke of 0.45" (12 mm) and easy top screw adjustment speed-up pellet making by reducing time required to achieve the desired force.

A wide range of pellet dies are available, ranging from 13 to 32 mm to most cover KBr and XRF pellet making needs. For sizes not listed here, please contact PIKE Technologies.

# Heated Platens

## AT A GLANCE

- ▶ Fast, efficient means of making polymer thin films for transmission spectroscopy
- ▶ Temperature control to 300 °C
- ▶ Standard stainless steel spacer set included
- ▶ Easy insertion and removal of heated platens into the hydraulic press

The Heated Platens Accessory is designed to efficiently make thin films of polymer materials for infrared transmission spectroscopy.

IR transmission spectra of thin films, which are made from polymer pellets or other plastic sample forms, offer more sensitivity than typical ATR spectra. Polymer films are ideal for investigating polymer additives.

Typically a 2–5 milligram portion of polymer is cut from the pellet or other plastic sample and placed between aluminum disks within the heated base of the platens. The temperature of the platens is chosen to match the melting point of the polymer material. The top plate of the heated platens accessory is placed over the assembly and the unit is inserted into the hydraulic press. A low force (2 tons) is applied to the sample in the heated platens accessory to make excellent films.

The Heated Platens Accessory includes insulating disks to maintain the desired temperature at the sample's melting point when making thin polymer films. These insulating disks improve the quality of thin films by making them more IR transmissive. Flattening the polymer below its melting point produces a cloudy film. Pressing the polymer film when it is above its melting point may cause polymer degradation.

The PIKE Heated Platens Accessory is compatible with the PIKE CrushIR™ Hydraulic Press and other hydraulic presses.



| PART NUMBER  | DESCRIPTION  |
|--|--|
| 181-2000   | PIKE Heated Platens Accessory  |
| 181-1120   | PIKE CrushIR Heated Platens Package<br>Includes CrushIR hydraulic press, Heated Platens and digital temperature control module |
| <b>Notes:</b> The Heated Platens Accessory includes spacer set, thermal insulating disks, cooling chamber, aluminum disks and magnetic film holder. P/N 181-2000 requires selection of temperature controller below. |  |
| <b>Temperature Controller for Heated Platens (<i>must select</i>)</b>  |  |
| 076-2550   | Digital Temperature Control Module   |
| <b>Note:</b> The digital temperature controller is required for operation of the Heated Platens Accessory.   |  |
| 181-3000   | Spacer Set, 15, 25, 50, 100, 250, 500 microns  |
| 181-3020   | Aluminum Disks (50 ea.)  |
| 181-3010   | Spacer, 15 microns   |
| 181-3011   | Spacer, 25 microns   |
| 181-3012   | Spacer, 50 microns   |
| 181-3013   | Spacer, 100 microns  |
| 181-3014   | Spacer, 250 microns  |
| 181-3015   | Spacer, 500 microns  |
| 162-5300   | Magnetic Film Holder for 13-mm pellets and film samples  |
| 162-5410   | Sample Card for 13-mm pellets (10 ea.)   |
| <b>Note:</b> See page 137 for more film holder options.  |  |

## SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Composition</b>            | Stainless steel platens, mirrored surfaces                      |
| <b>Temperature Range</b>      | Ambient to 300 °C   |
| <b>Temperature Stability</b>  | Insulated, < 3 °C loss at 125 °C set point during press of film |
| <b>Sensor Type</b>            | 3 wire Pt RTD (low drift, high stability)                       |
| <b>Heating Time</b>           | Ambient to 100 °C, less than 7 minutes                          |
| <b>Cooling Chamber</b>        | Standard, convection via liquid circulation (not supplied)      |
| <b>Pressing Height</b>        | 33 mm   |
| <b>Spacer Thickness</b>       | 15, 25, 50, 100, 250 and 500 microns                            |
| <b>Spacer ID</b>              | 25 mm   |
| <b>Dimensions (W X D X H)</b> | 64 x 264 x 52 mm  |
| <b>Maximum Force</b>          | 3 US tons   |
| <b>Temperature Controller</b> | Touch-panel display with USB interface.                         |
| <b>Input</b>                  | 100–240 VAC, auto setting, external power supply                |
| <b>Output</b>                 | 24 VDC/100 W maximum  |

# ShakIR & Super ShakIR

## AT A GLANCE

- ▶ Produce finely powdered mix of sample and diluent—ideal for clear pellets and excellent diffuse reflectance spectra
- ▶ Minimize exposure of sample to atmospheric moisture—a chief cause of cloudy pellets
- ▶ Options for grinding ordinary and difficult samples
- ▶ Built-in safety features

The ShakIR accessories are ball mills for a fast and simple mixing and grinding of samples. These mills are ideal for diffuse reflection sampling and in preparation for making KBr pellets.

A small amount of sample or the IR transparent diluent (typically KBr) is simply scooped into a vial with mixing ball. The accessory thoroughly mixes and pulverizes the contents within seconds.



Super ShakIR.

Standard ShakIR.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 161-1070    | ShakIR, Heavy Duty Sample Grinder, 110-220V Includes mount for 1" vials   |
|             | ShakIR Vials ( <i>required</i> )  |
| 161-1035    | Stainless Steel Vial with Ball, 1" long x 0.5"  |
|             | Options and Replacement Parts for ShakIR  |
| 161-1037    | Spare Stainless Steel Ball  |
| 160-8010    | KBr Powder, 100 g   |
|             | Super ShakIR  |
| 161-1080    | Super ShakIR, Sample Grinder, 110-220V Includes mount for 1.7" vials with 2 end-cups, a stainless steel vial, 50 stainless steel balls and a bullet-shaped bead |
|             | Options and Replacement Parts for Super ShakIR  |
| 161-1038    | Bullet-Shaped Bead  |
| 161-1039    | Stainless Steel Vial, 1.7" long   |
| 161-1041    | Stainless Steel Balls, assorted sizes (50 pieces)   |
| 161-1036    | Polymer Vials (20 ea.)  |

The standard ShakIR uses reciprocating motion of the vial holder that follows a "figure 8" path. The vial is swung through a 5-degree arc at high RPMs causing the ball to strike the end of the vial, which is sufficient to grind most materials into a powder.

The accessory provides electronic control for precise and reproducible setting of grinding time up to 95 seconds. The protective shield provides security to grinder operation. The ShakIR construction and weight offer long-term, reliable operation and minimized vibration and noise. The ShakIR features a small footprint. The base is 15 cm x 18 cm with a height of 28 cm.

The Super ShakIR also uses "figure 8" reciprocating motion for sample grinding, plus it offers more control over grinding speed and time intervals – specifically, 6 RPM levels from 2500 to 4600 are available and samples can be ground from 5 to 60 seconds. This provides a wide range of settings for bringing even very difficult samples to fine powder consistency quickly.

The Super ShakIR features a heavy-duty metal body with a chemically-resistant stainless steel grinding chamber. The unit operates quietly, regardless of RPM settings. The grinding chamber is protected by the door with a viewing window. For safety, the accessory will not operate until the door is fully closed. The Super ShakIR footprint is 18 cm x 28 cm and its height is 16 cm.

# Sample Preparation Accessories

## AT A GLANCE

- ▶ Accessories for analysis of solids by transmission and diffuse reflectance
- ▶ Materials for pellets and mulls

Preparation of samples for FTIR analysis by diffuse reflection or transmission analysis requires a number of tools and accessories for convenient and high quality results.

PIKE Technologies has assembled these tools to make your FTIR sampling easier. IR transparent powders and chunks, mulling agents and manual sample grinding tools with a complete selection of agate mortars and pestles are in stock and ready for immediate delivery.

| PART NUMBER  | DESCRIPTION              |
|--|--------------------------|
| IR Transparent Powders   |                          |
| 160-8010   | KBr Powder, 100 g        |
| IR Transparent Chunks  |                          |
| 160-8015   | KBr Chunks, 100 g        |
| Mulling Agents   |                          |
| 161-0500   | Nujol®                   |
| 161-0510   | Fluorolube®              |
| Agate Mortar and Pestles   |                          |
| 161-5035   | 35 mm O.D., 33 mm I.D.   |
| 161-5040   | 40 mm O.D., 37 mm I.D.   |
| 161-5050   | 50 mm O.D., 44 mm I.D.   |
| 161-5065   | 65 mm O.D., 55 mm I.D.   |
| 161-5095   | 95 mm O.D., 80 mm I.D.   |
| 161-5100   | 100 mm O.D., 82 mm I.D.  |
| 161-5225   | 125 mm O.D., 104 mm I.D. |
| 161-5150   | 150 mm O.D., 124 mm I.D. |
| <b>Note:</b> The 50-mm Agate Mortar and Pestle is our most popular size and recommended for most applications. |                          |
| Spatulas for Solids and Mulls  |                          |
| 042-3035   | Spatula – spoon          |
| 042-3050   | Spatula – flat           |
| <b>Note:</b> For more sample preparation tool options contact PIKE Technologies.                               |                          |



# Sample Holders For Transmission FTIR Analysis

Transmission sample holders are convenient tools to have in the lab. They position KBr pellets, films, mulls and smears at the correct beam height in the sample compartment for quick measurements. All holders are constructed of high-quality materials and feature a 2 x 3" standard slide mount compatible with all FTIR spectrometers.



## UNIVERSAL SAMPLE HOLDERS

Feature a spring-loaded mechanism which conveniently keeps in place films, salt plates, KBr pellets and other materials. The clear aperture of the holders is 20 and 10 mm. This universal holder offers great sample mounting flexibility.



## HEAVY-DUTY MAGNETIC FILM HOLDER

Designed to hold thick polymer materials and other transmission samples. The holder features a large size magnet and steel plate with a 20-mm aperture.



## THE SINGLE PELLETT HOLDER

Holds 7-mm KBr pellet collar, and is designed for use with the PIKE Technologies Hand Press and Pixie Hydraulic Press. For making only 7-mm pellets, this version is more convenient than the Dual Pellet Holder.



## A DUAL PELLETT HOLDER

Holds 1-, 3- and 7-mm KBr pellet collars, and features semi-circular mounts with slots accommodating specified size pellets as made using the PIKE Technologies Hand Press.



## PRESS-ON DEMOUNTABLE CELL HOLDERS

Used for the analysis of smears and mulls. Available in 25- and 38-mm versions, both include mounting plate and pressure cap. Windows and spacers must be ordered separately.



## THE MAGNETIC FILM/PELLET HOLDER

Used to mount KBr pellets and thin polymer films. Its components include a steel plate and flexible magnetic strip. The holder is designed to support 13-mm KBr pellets and films less than 0.5-mm thick.



## BOLT PRESS AND GAS CELL HOLDERS

Available in three different sizes. Each holder has detachable support rods for different sized accessories. The holders can also be used for placing salt plates and other large samples.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 162-5600    | Universal Sample Holder, 20-mm aperture*                |
| 162-5610    | Universal Sample Holder, 10-mm aperture*                |
| 162-5500    | Heavy-Duty Magnetic Film Holder                         |
| 162-5300    | Magnetic Film Holder for 13-mm pellets and film samples |
| 162-3600    | Press-On Demountable Cell Holders for 25-mm windows     |
| 162-3610    | Press-On Demountable Cell Holders for 32-mm windows     |
| 161-1018    | Single Pellet Holder for 7-mm pellets                   |
| 161-1025    | Single Pellet Holder for 1- and 3-mm pellets            |
| 161-5700    | Dual Pellet Holder*                                     |
| 162-5410    | Sample Card for 13-mm pellets (10 ea.)*                 |
| 162-5400    | Film Sampling Card, 20-mm aperture (10 ea.)*            |
| 161-2520    | Bolt Press Holder                                       |
| 162-2105    | Gas Cell Holder, 25 x 50 or 100 mm                      |
| 162-2205    | Gas Cell Holder, 38 x 50 or 100 mm                      |

**Notes:** For more sample holder options, please contact PIKE Technologies. Holders marked "\*" fit all standard 2 x 3" slide mounts, but due to their height may not allow for a complete sample compartment door closure on some smaller spectrometers. Please consult PIKE Technologies before placing an order.

### Replacement Parts

|          |   |
|----------|---|
| 162-5611 | O-Rings for 20-mm Universal Sample Holder (6 ea.) |
| 162-5612 | O-Rings for 10-mm Universal Sample Holder (6 ea.) |



## SAMPLING CARDS

Inexpensive sample holders for analysis of films, polymers, 13-mm KBr pellets and other materials. Self-adhesive treated sides make sample preparation easy. The cards also offer compact and convenient means of sample storage. Two aperture sizes are available, 10-mm and 20-mm.

# Disks, Windows, Powders

## AT A GLANCE

- ▶ Wide variety of window material
- ▶ High-quality materials
- ▶ A Range of sizes for all applications
- ▶ Fits accessories and holders

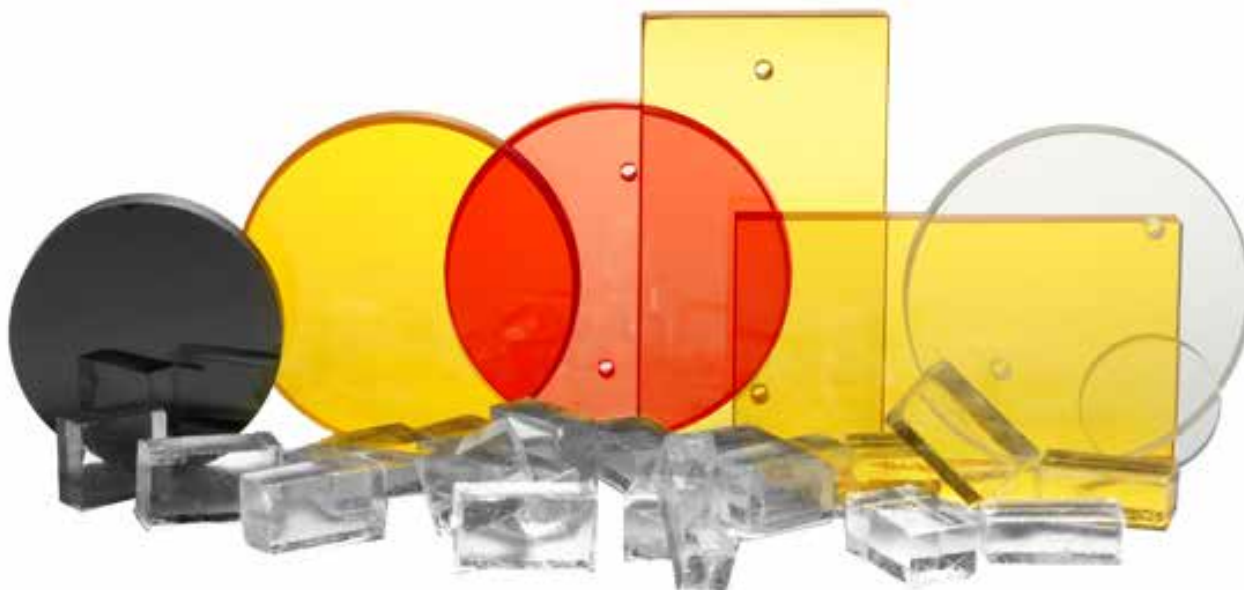
## For Transmission FTIR Analysis of Solid and Liquid Samples

PIKE Technologies offers premier stock window and crystal materials – a carefully selected range of IR transparent materials most often used by IR spectroscopists. They fit PIKE accessories and cell holders available from other vendors. All windows, crystals and powders are made from the best quality material.

The optical components are individually packaged and silica gel is included with those materials which are affected by humidity. Products highlighted in red are in stock and available for immediate delivery. Please refer to the next pages for full range of IR optical materials, windows and crystals.

Save on price and shipping cost by selecting 6-pack versions of popular crystals.

| PART NUMBER | DESCRIPTION       |
|-------------|-------------------|
|             | Powders           |
| 160-8010    | KBr Powder, 100 g |
|             | Chunks            |
| 160-8015    | KBr Chunks, 100 g |







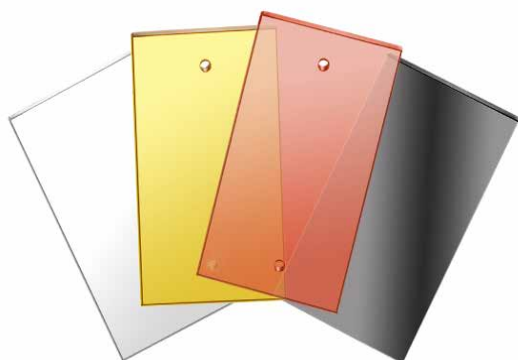
| PART NUMBER                           | DESCRIPTION                          |
|---------------------------------------|--------------------------------------|
| Disks, 13 mm Diameter                 |                                      |
| 1 mm Thickness                        |                                      |
| 160-5003                              | KBr, 13 x 1 mm                       |
| 160-5004                              | NaCl, 13 x 1 mm                      |
| 160-1149                              | BaF <sub>2</sub> , 13 x 1 mm         |
| 160-5001                              | CaF <sub>2</sub> , 13 x 1 mm         |
| 2 mm Thickness                        |                                      |
| 160-1301                              | AMTIR, 13 x 2 mm                     |
| 160-1218                              | BaF <sub>2</sub> , 13 x 2 mm         |
| 160-1213                              | CaF <sub>2</sub> , 13 x 2 mm         |
| 160-1198                              | CsI, 13 x 2 mm                       |
| 160-1191                              | Ge, 13 x 2 mm                        |
| 160-1135                              | KBr, 13 x 2 mm                       |
| 160-1008                              | KBr, 13 x 2 mm (6-pack)              |
| 160-1173                              | KRS-5, 13 x 2 mm                     |
| 160-1170                              | NaCl, 13 x 2 mm                      |
| 160-1005                              | NaCl, 13 x 2 mm (6-pack)             |
| 160-5201                              | SiO <sub>2</sub> , 13 x 2 mm         |
| 160-5120                              | SiO <sub>2</sub> , low OH, 13 x 2 mm |
| 160-1160                              | Si, 13 x 2 mm                        |
| 160-1241                              | ZnS, 13 x 2 mm                       |
| 160-1115                              | ZnSe, 13 x 2 mm                      |
| 160-1001                              | ZnSe, 13 x 2 mm (6-pack)             |
| Disks, 20 mm Diameter, 2 mm Thickness |                                      |
| 160-1148                              | BaF <sub>2</sub> , 20 x 2 mm         |
| 160-1144                              | CaF <sub>2</sub> , 20 x 2 mm         |
| 160-1197                              | CsI, 20 x 2 mm                       |
| 160-1139                              | Ge, 20 x 2 mm                        |
| 160-1134                              | KBr, 20 x 2 mm                       |
| 160-1128                              | KRS-5, 20 x 2 mm                     |
| 160-1169                              | NaCl, 20 x 2 mm                      |
| 160-5211                              | Polyethylene, 20 x 2 mm              |
| 160-5119                              | SiO <sub>2</sub> , 20 x 2 mm         |
| 160-5121                              | SiO <sub>2</sub> , low OH, 20 x 2 mm |
| 160-1118                              | Si, 20 x 2 mm                        |
| 160-5118                              | ZnS, 20 x 2 mm                       |
| 160-1304                              | ZnSe, 20 x 2 mm                      |

| Disks, 25 mm Diameter |                                       |
|-----------------------|---------------------------------------|
| 2 mm Thickness        |                                       |
| 160-1201              | AMTIR, 25 x 2 mm                      |
| 160-1306              | BaF <sub>2</sub> , 25 x 2 mm          |
| 160-1212              | CaF <sub>2</sub> , 25 x 2 mm          |
| 160-1002              | CaF <sub>2</sub> , 25 x 2 mm (6-pack) |
| 160-1308              | CsI, 25 x 2 mm                        |
| 160-1307              | Ge, 25 x 2 mm                         |
| 160-1305              | KBr, 25 x 2 mm                        |
| 160-1172              | KRS-5, 25 x 2 mm                      |
| 160-1168              | NaCl, 25 x 2 mm                       |
| 160-1004              | NaCl, 25 x 2 mm (6-pack)              |
| 160-5213              | Polyethylene, 25 x 2 mm               |
| 160-5086              | SiO <sub>2</sub> , 25 x 2 mm          |
| 160-5122              | SiO <sub>2</sub> , low OH, 25 x 2 mm  |
| 160-1117              | Si, 25 x 2 mm                         |
| 160-5084              | ZnS, 25 x 2 mm                        |
| 160-1155              | ZnSe, 25 x 2 mm                       |
| 160-1007              | ZnSe, 25 x 2 mm (6-pack)              |
| 4 mm Thickness        |                                       |
| 160-1217              | BaF <sub>2</sub> , 25 x 4 mm          |
| 160-1211              | CaF <sub>2</sub> , 25 x 4 mm          |
| 160-1196              | CsI, 25 x 4 mm                        |
| 160-1138              | Ge, 25 x 4 mm                         |
| 160-1133              | KBr, 25 x 4 mm                        |
| 160-1009              | KBr, 25 x 4 mm (6-pack)               |
| 160-1127              | KRS-5, 25 x 4 mm                      |
| 160-1124              | NaCl, 25 x 4 mm                       |
| 160-1012              | NaCl, 25 x 4 mm (6-pack)              |
| 160-5214              | Polyethylene, 25 x 4 mm               |
| 160-5089              | SiO <sub>2</sub> , 25 x 4 mm          |
| 160-5123              | SiO <sub>2</sub> , low OH, 25 x 4 mm  |
| 160-1116              | Si, 25 x 4 mm                         |
| 160-5087              | ZnS, 25 x 4 mm                        |
| 160-1114              | ZnSe, 25 x 4 mm                       |
| 160-1109              | ZnSe, double AR coated, 25 x 4 mm     |
| 160-1110              | ZnSe, single AR coated, 25 x 4 mm     |
| 5 mm Thickness        |                                       |
| 160-1311              | BaF <sub>2</sub> , 25 x 5 mm          |
| 160-1210              | CaF <sub>2</sub> , 25 x 5 mm          |
| 160-1316              | CsI, 25 x 5 mm                        |
| 160-1313              | Ge, 25 x 5 mm                         |
| 160-1189              | KBr, 25 x 5 mm                        |
| 160-1003              | KBr, 25 x 5 mm (6-pack)               |
| 160-1312              | KRS-5, 25 x 5 mm                      |
| 160-1123              | NaCl, 25 x 5 mm                       |
| 160-1011              | NaCl, 25 x 5 mm (6-pack)              |
| 160-5100              | SiO <sub>2</sub> , 25 x 5 mm          |
| 160-5124              | SiO <sub>2</sub> , low OH, 25 x 5 mm  |
| 160-5090              | ZnS, 25 x 5 mm                        |
| 160-1154              | ZnSe, 25 x 5 mm                       |

| PART NUMBER                             | DESCRIPTION                                    |
|---|--|
| Disks, 32 mm Diameter, 3 mm Thickness   |  |
| 160-1200                                | AMTIR, 32 x 3 mm                               |
| 160-1199                                | AMTIR, drilled, 32 x 3 mm                      |
| 160-1147                                | BaF <sub>2</sub> , 32 x 3 mm                   |
| 160-1017                                | BaF <sub>2</sub> , 32 x 3 mm (6-pack)          |
| 160-1146                                | BaF <sub>2</sub> , drilled, 32 x 3 mm          |
| 160-1018                                | BaF <sub>2</sub> , drilled, 32 x 3 mm (6-pack) |
| 160-1143                                | CaF <sub>2</sub> , 32 x 3 mm                   |
| 160-1142                                | CaF <sub>2</sub> , drilled, 32 x 3 mm          |
| 160-1195                                | CsI, 32 x 3 mm                                 |
| 160-1194                                | CsI, drilled, 32 x 3 mm                        |
| 160-1137                                | Ge, 32 x 3 mm                                  |
| 160-1136                                | Ge, drilled, 32 x 3 mm                         |
| 160-1132                                | KBr, 32 x 3 mm                                 |
| 160-1010                                | KBr, 32 x 3 mm (6-pack)                        |
| 160-1131                                | KBr, drilled, 32 x 3 mm                        |
| 160-1015                                | KBr, drilled, 32 x 3 mm (6-pack)               |
| 160-1126                                | KRS-5, 32 x 3 mm                               |
| 160-1125                                | KRS-5, drilled, 32 x 3 mm                      |
| 160-1122                                | NaCl, 32 x 3 mm                                |
| 160-1013                                | NaCl, 32 x 3 mm (6-pack)                       |
| 160-1121                                | NaCl, drilled, 32 x 3 mm                       |
| 160-1014                                | NaCl, drilled, 32 x 3 mm (6-pack)              |
| 160-5216                                | Polyethylene, 32 x 3 mm                        |
| 160-5215                                | Polyethylene, drilled, 32 x 3 mm               |
| 160-5049                                | SiO <sub>2</sub> , 32 x 3 mm                   |
| 160-5125                                | SiO <sub>2</sub> , low OH, 32 x 3 mm           |
| 160-5052                                | SiO <sub>2</sub> , drilled, 32 x 3 mm          |
| 160-5126                                | SiO <sub>2</sub> , drilled, low OH, 32 x 3 mm  |
| 160-1159                                | Si, 32 x 3 mm                                  |
| 160-1158                                | Si, drilled, 32 x 3 mm                         |
| 160-5047                                | ZnS, 32 x 3 mm                                 |
| 160-5048                                | ZnS, drilled, 32 x 3 mm                        |
| 160-1113                                | ZnSe, 32 x 3 mm                                |
| 160-1112                                | ZnSe, drilled, 32 x 3 mm                       |
| Disks, 37.5 mm Diameter, 4 mm Thickness |  |
| 160-1281                                | BaF <sub>2</sub> , 37.5 x 4 mm                 |
| 160-1286                                | ZnSe, 1-side AR coated, 37.5 x 4 mm            |
| 160-1287                                | CaF <sub>2</sub> , 37.5 x 4 mm                 |
| 160-1288                                | KBr, 37.5 x 4 mm                               |
| 160-1289                                | KCl, 37.5 x 4 mm                               |
| 160-1290                                | NaCl, 37.5 x 4 mm                              |
| 160-1291                                | ZnSe, 37.5 x 4 mm                              |

|                                       |                                      |
|---------------------------------------|--------------------------------------|
| Disks, 38 mm Diameter                 |                                      |
| 3 mm Thickness                        |                                      |
| 160-1349                              | BaF <sub>2</sub> , 38 x 3 mm         |
| 160-1350                              | Ge, 38 x 3 mm                        |
| 160-5220                              | KBr, 38 x 3 mm                       |
| 160-1344                              | KRS-5, 38 x 3 mm                     |
| 160-5218                              | Polyethylene, 38 x 3 mm              |
| 160-1233                              | SiO <sub>2</sub> , 38 x 3 mm         |
| 160-5127                              | SiO <sub>2</sub> , low OH, 38 x 3 mm |
| 160-1353                              | Si, 38 x 3 mm                        |
| 160-1315                              | ZnS, 38 x 3 mm                       |
| 160-5025                              | ZnSe, 38 x 3 mm                      |
| 6 mm Thickness                        |                                      |
| 160-1357                              | AMTIR, 38 x 6 mm                     |
| 160-1322                              | BaF <sub>2</sub> , 38 x 6 mm         |
| 160-1342                              | CaF <sub>2</sub> , 38 x 6 mm         |
| 160-1326                              | CsI, 38 x 6 mm                       |
| 160-1323                              | Ge, 38 x 6 mm                        |
| 160-1320                              | KBr, 38 x 6 mm                       |
| 160-1343                              | KRS-5, 38 x 6 mm                     |
| 160-1321                              | NaCl, 38 x 6 mm                      |
| 160-5219                              | Polyethylene, 38 x 6 mm              |
| 160-1355                              | SiO <sub>2</sub> , 38 x 6 mm         |
| 160-5128                              | SiO <sub>2</sub> , low OH, 38 x 6 mm |
| 160-1324                              | Si, 38 x 6 mm                        |
| 160-1329                              | ZnSe, 38 x 6 mm                      |
| Disks, 41 mm Diameter, 3 mm Thickness |                                      |
| 160-1216                              | BaF <sub>2</sub> , 41 x 3 mm         |
| 160-1209                              | CaF <sub>2</sub> , 41 x 3 mm         |
| 160-1188                              | KBr, 41 x 3 mm                       |
| 160-1167                              | NaCl, 41 x 3 mm                      |
| 160-5217                              | Polyethylene, 41 x 3 mm              |
| 160-5157                              | ZnS, 41 x 3 mm                       |
| 160-1341                              | ZnSe, 41 x 3 mm                      |
| Disks, 49 mm Diameter                 |                                      |
| 3 mm Thickness                        |                                      |
| 160-5161                              | ZnS, 49 x 3 mm                       |
| 160-1153                              | ZnSe, 49 x 3 mm                      |
| 6 mm Thickness                        |                                      |
| 160-5027                              | BaF <sub>2</sub> , 49 x 6 mm         |
| 160-5206                              | CaF <sub>2</sub> , 49 x 6 mm         |
| 160-5029                              | CsI, 49 x 6 mm                       |
| 160-1187                              | KBr, 49 x 6 mm                       |
| 160-5205                              | KRS-5, 49 x 6 mm                     |
| 160-1166                              | NaCl, 49 x 6 mm                      |
| 160-5164                              | SiO <sub>2</sub> , 49 x 6 mm         |
| 160-5129                              | SiO <sub>2</sub> , low OH, 49 x 6 mm |

| PART NUMBER                           | DESCRIPTION                  |
|---------------------------------------|------------------------------|
| Disks, 50 mm Diameter, 3 mm Thickness |                              |
| 160-5030                              | BaF <sub>2</sub> , 50 x 3 mm |
| 160-1208                              | CaF <sub>2</sub> , 50 x 3 mm |
| 160-5173                              | CsI, 50 x 3 mm               |
| 160-1186                              | KBr, 50 x 3 mm               |
| 160-1171                              | KRS-5, 50 x 3 mm             |
| 160-1165                              | NaCl, 50 x 3 mm              |
| 160-5177                              | ZnS, 50 x 3 mm               |
| 160-1152                              | ZnSe, 50 x 3 mm              |



| Windows, 29 x 14 x 4 mm |  |
|-------------------------|--|
| 160-1215                | BaF <sub>2</sub> , 29 x 14 x 4 mm          |
| 160-5010                | BaF <sub>2</sub> , drilled, 29 x 14 x 4 mm |
| 160-1207                | CaF <sub>2</sub> , 29 x 14 x 4 mm          |
| 160-5011                | CaF <sub>2</sub> , drilled, 29 x 14 x 4 mm |
| 160-5007                | Ge, 29 x 14 x 4 mm                         |
| 160-5012                | Ge, drilled, 29 x 14 x 4 mm                |
| 160-1185                | KBr, 29 x 14 x 4 mm                        |
| 160-1184                | KBr, drilled, 29 x 14 x 4 mm               |
| 160-5009                | KRS-5, 29 x 14 x 4 mm                      |
| 160-5014                | KRS-5, drilled, 29 x 14 x 4 mm             |
| 160-1164                | NaCl, 29 x 14 x 4 mm                       |
| 160-1163                | NaCl, drilled, 29 x 14 x 4 mm              |

| Windows, 38 x 19 x 2 mm  |  |
|--|--|
| 160-1269   | AMTIR, 38 x 19 x 2 mm                              |
| 160-1270   | AMTIR, drilled, 38 x 19 x 2 mm                     |
| 160-1157   | Si, 38 x 19 x 2 mm                                 |
| 160-1156   | Si, drilled, 38 x 19 x 2 mm                        |
| 160-1275   | ZnS, 38 x 19 x 2 mm                                |
| 160-1276   | ZnS, drilled, 38 x 19 x 2 mm                       |
| 160-1151   | ZnSe, 38 x 19 x 2 mm                               |
| 160-1150   | ZnSe, drilled, 38 x 19 x 2 mm                      |
| Windows, 38 x 19 x 4 mm  |  |
| 160-1214   | BaF <sub>2</sub> , 38 x 19 x 4 mm                  |
| 160-1145   | BaF <sub>2</sub> , drilled, 38 x 19 x 4 mm         |
| 160-1141   | CaF <sub>2</sub> , 38 x 19 x 4 mm                  |
| 160-1140   | CaF <sub>2</sub> , drilled, 38 x 19 x 4 mm         |
| 160-1193   | CsI, 38 x 19 x 4 mm                                |
| 160-1192   | CsI, drilled, 38 x 19 x 4 mm                       |
| 160-1190   | Ge, 38 x 19 x 4 mm                                 |
| 160-5032   | Ge, drilled, 38 x 19 x 4 mm                        |
| 160-1130   | KBr, 38 x 19 x 4 mm                                |
| 160-1129   | KBr, drilled, 38 x 19 x 4 mm                       |
| 160-5031   | KRS-5, 38 x 19 x 4 mm                              |
| 160-5016   | KRS-5, drilled, 38 x 19 x 4 mm                     |
| 160-1162   | NaCl, 38 x 19 x 4 mm                               |
| 160-1006   | NaCl, 38 x 19 x 4 mm (6-pack)                      |
| 160-1161   | NaCl, drilled, 38 x 19 x 4 mm                      |
| 160-1292   | SiO <sub>2</sub> , 38 x 19 x 4 mm                  |
| 160-5130   | SiO <sub>2</sub> , low OH, 38 x 19 x 4 mm          |
| 160-1293   | SiO <sub>2</sub> , drilled, 38 x 19 x 4 mm         |
| 160-5131   | SiO <sub>2</sub> , drilled, low OH, 38 x 19 x 4 mm |
| Windows, 41 x 23 x 3 mm  |  |
| 160-1277   | ZnS, 41 x 23 x 3 mm                                |
| 160-1279   | ZnS, drilled, 41 x 23 x 3 mm                       |
| 160-1111   | ZnSe, 41 x 23 x 3 mm                               |
| 160-1280   | ZnSe, drilled, 41 x 23 x 3 mm                      |
| Windows, 41 x 23 x 6 mm  |  |
| 160-5146   | BaF <sub>2</sub> , 41 x 23 x 6 mm                  |
| 160-5152   | BaF <sub>2</sub> , drilled, 41 x 23 x 6 mm         |
| 160-5147   | CaF <sub>2</sub> , 41 x 23 x 6 mm                  |
| 160-5153   | CaF <sub>2</sub> , drilled, 41 x 23 x 6 mm         |
| 160-1183   | KBr, 41 x 23 x 6 mm                                |
| 160-1182   | KBr, drilled, 41 x 23 x 6 mm                       |
| 160-1120   | NaCl, 41 x 23 x 6 mm                               |
| 160-1119   | NaCl, drilled, 41 x 23 x 6 mm                      |
| <b>Notes:</b> For disk and window sizes other than shown here, please contact PIKE Technologies. |  |

# Crystal Polishing Kit

## AT A GLANCE

- ▶ Complete kit for polishing IR transparent windows
- ▶ Reduces cost of transmission analysis by extending KBr and NaCl window lifetime

Scratched and fogged windows diminish the quality of transmission FTIR spectra. Polishing them using a crystal polishing kit can extend the life of IR transparent salt windows.

Continuous replacement can be impractical and quite expensive. A number of standard infrared windows can be quickly restored to quality condition with the PIKE Technologies Crystal Polishing Kit. The kit includes all the necessary components to repolish KBr and NaCl windows quickly and effectively.

Note: We do not recommend polishing KRS-5 windows due to safety hazards and for this reason do not include materials for polishing KRS-5 windows.

| PART NUMBER  | DESCRIPTION  |
|--|--|
| 162-4000   | Crystal Polishing Kit<br>Includes wooden base, glass plates, polishing pads, brushes and polishing compounds |
| Replacement Parts  |  |
| 162-4010   | Glass Plate  |
| 162-4011   | Polishing Pads (6 ea.)   |
| 162-4015   | Brushes (6 ea.)  |
| 162-4012   | Grinding Compound, 400 grit  |
| 162-4013   | Grinding Compound, 600 grit  |
| 162-4014   | Polishing Compound   |
| <b>Note:</b> For other options for window polishing, please contact PIKE Technologies. |  |



# Short-Path Gas Cells

## AT A GLANCE

- ▶ High throughput and economy versions
- ▶ 100-mm and 50-mm pathlengths
- ▶ Fits all FTIR spectrometers

For gas concentrations generally above 1% by weight, short path gas cells offer a suitable pathlength for mid-IR analysis.

Our Short-Path HT Gas Cells provide high throughput by virtue of their greater inside diameter providing more energy at the FTIR detector. The HT Gas Cell models also include glass stopcocks for flow input of the gas sample and sealing.

The PIKE Technologies Short-Path EC Gas Cells are recommended for use with occasional gas sampling and offer an economical choice with standard septum-styled sealing of the vapor phase sample.

Both our Short-Path HT and EC Gas Cells are available in 50-mm and 100-mm versions. The complete gas cell requires your selection of the appropriate IR transparent windows. HT and EC Gas Cells are slide mount accessories, compatible with most FTIR spectrometers.



100-mm Short-Path HT Gas Cell.



100-mm Short-Path EC Gas Cell.

| PART NUMBER | DESCRIPTION                               |
|-------------|---|
| 162-2200    | Short-Path HT Gas Cell, 100 mm pathlength |
| 162-2250    | Short-Path HT Gas Cell, 50 mm pathlength  |
| 162-2100    | Short-Path EC Gas Cell, 100 mm pathlength |
| 162-2150    | Short-Path EC Gas Cell, 50 mm pathlength  |

**Notes:** Short-Path Gas Cells include the glass body, o-rings and cell holder. HT Gas Cells require selection of two 38 x 6 mm windows. EC Gas Cells require selection of two 25 x 4 mm windows.

### Windows for Short-Path Gas Cell (must select minimum of 2)

| 38 x 6 mm | 25 x 4 mm | Description      |
|-----------|-----------|------------------|
| 160-1322  | 160-1217  | BaF <sub>2</sub> |
| 160-1342  | 160-1211  | CaF <sub>2</sub> |
| 160-1320  | 160-1133  | KBr              |
| 160-1321  | 160-1124  | NaCl             |
| 160-1329  | 160-1114  | ZnSe             |

**Notes:** For window compatibility please consult the Materials Properties table on page 152 of this catalog. Find additional window selections starting on page 138.

### Replacement Parts

| HT Cell  | EC Cell  | Description                |
|----------|----------|----------------------------|
| 162-2209 | 162-2109 | Viton O-Rings (2 ea.)      |
| 162-2202 | 162-2102 | Cell Window Cap            |
| 162-2205 | 162-2105 | Gas Cell Holder            |
| 162-2201 | 162-2101 | Glass Body for 100-mm Cell |
| 162-2255 | 162-2155 | Glass Body for 50-mm Cell  |
| 162-2107 | 162-2106 | Septum Caps (12 ea.)       |

# Heated Gas Flow Cell

## AT A GLANCE

- ▶ High IR throughput, minimum cell volume ideal for preserving flowing gas composition
- ▶ Temperature control up to 300 °C
- ▶ Your choice of IR transparent windows – user-changeable



### TEMPERATURE CONTROL

The Heated Gas Flow Cell is recommended for high-performance FTIR sampling of flowing gas samples.

The beam-conforming design of the Heated Gas Flow Cell provides for low cell volume (38.5 mL) and a 100-mm pathlength, compatible with most FTIR spectrometers. This beam-conforming design also provides maximum IR throughput with no vignette of the IR beam. The gas cell may be heated up to 300 °C to prevent condensation of higher molecular weight gas species. The PIKE Technologies Heated Gas Flow Cell includes standard Swagelok® fittings for connection to 1/8" tubing and its stainless steel composition is compatible with pressurized applications up to 100 psi when using an appropriate IR window.

Temperature control is provided by the digital controller. Ramp and soak profiles and integrated data collection are available when using PIKE TempPRO software.



| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

|          |  |
|----------|--|
| 162-20XX | Heated Gas Flow Cell<br>Includes cell, high-temp O-rings, and FTIR mounting plate<br><br><b>Note:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. |
|----------|--|

#### Temperature Controllers (*must select one*)

|          |                                    |
|----------|------------------------------------|
| 076-2550 | Digital Temperature Control Module |
| 007-0207 | PIKE TempPRO Software              |

**Note:** Digital Temperature Control Module is required. PIKE TempPRO software sold separately.

#### IR Transparent Windows for Heated Gas Flow Cell (*select minimum of 2*)

|          |                                    |
|----------|------------------------------------|
| 160-1322 | BaF <sub>2</sub> Window, 38 x 6 mm |
| 160-1320 | KBr Window, 38 x 6 mm              |
| 160-1343 | KRS-5 Window, 38 x 6 mm            |
| 160-1329 | ZnSe Window, 38 x 6 mm             |

**Notes:** For window compatibility please consult the Windows Materials Properties table on page 152 of this catalog. Find additional window selections starting on page 138. ZnSe windows should not be used above 250 °C.

#### Replacement Parts and Options

|          |   |
|----------|---|
| 162-2009 | Viton O-Rings, max. temp. 200 °C, (2 ea.)           |
| 162-2309 | High-Temperature O-Rings, max. temp. 325 °C (1 ea.) |
| 162-2308 | High-Temperature O-Rings, max. temp. 325 °C (4 ea.) |

**Notes:** Gas Cell requires 4 O-rings total. For high-temperature purge tubes and other options, please contact PIKE Technologies.

## SPECIFICATIONS

|                               |  |
|-------------------------------|--|
| <b>Temperature Range</b>      | Ambient to 300 °C  |
| <b>Accuracy</b>               | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C  |
| <b>Sensor Type</b>            | 3 wire Pt RTD (low drift, high stability)  |
| <b>Dimensions (W X D X H)</b> | 91 x 140 x 121 mm<br>(excludes baseplate mount)  |
| <b>Controller</b>             | Touch-panel display with USB interface. PIKE TempPRO software for PC with unlimited ramps and automated data collection. |
| <b>Input</b>                  | 100–240 VAC, auto setting, external power supply   |
| <b>Output</b>                 | 6 A/24 VAC 150 W maximum   |

# Low-Vol Heated Gas Cell

## AT A GLANCE

- ▶ Short pathlength, 10 or 12-cm
- ▶ Volume less than 5 mL
- ▶ Temperature control to 300 °C
- ▶ Precision transfer optics for beam focusing



### TEMPERATURE CONTROL

The Low-Volume Heated Gas Cell is ideal for infrared applications such as determining and quantifying off-gassing and headspace species where gas volume is limited.

At less than 5 mL, the gas cell volume is a fraction of that found in typical short-path gas cells of similar lengths (10 to 12 cm). It connects easily to simple gas flow experimental setups as an IR screening diagnostic tool. Due to its low internal volume, it offers near-instantaneous feedback on gas compositional changes.

This gas cell is an experimentally attractive, independent solution for the practitioner dealing with gas analysis and quantitative challenges. In the polymer materials field, for example, it offers simple gas compositional analysis of headspace volatiles originating in small-volume sealed material aging experiments.



## PART NUMBER DESCRIPTION

164-62XX Low-Volume Heated Gas Cell, 10 cm

164-61XX Low-Volume Heated Gas Cell, 12 cm

**Note:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog.

### Temperature Controllers (*must select one*)

076-2550 Digital Temperature Control Module

007-0207 PIKE TempPRO Software

**Note:** Digital Temperature Control Module is required. PIKE TempPRO software sold separately.

### Replacement Parts

164-6001 Viton O-Rings, max. temp. 200 °C (2 ea.)

164-6002 High-Temperature O-Rings, max. temp. 300 °C (2 ea.)

**Note:** Low-Volume Heated Gas Cell requires 4 O-rings total.

### 13 x 2 mm Windows (*must select minimum of two*)

|          |                  |          |                  |
|----------|------------------|----------|------------------|
| 160-1218 | BaF <sub>2</sub> | 160-1170 | NaCl             |
| 160-1213 | CaF <sub>2</sub> | 160-1115 | ZnSe             |
| 160-1135 | KBr              | 160-5201 | SiO <sub>2</sub> |

## SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Gas Cell Pathlength</b>    | 10 or 12 cm   |
| <b>Gas Cell Diameter</b>      | 7 mm  |
| <b>Gas Cell Volume</b>        | 3.8 or 4.6 mL   |
| <b>Temperature Range</b>      | Ambient to 300 °C                                       |
| <b>Accuracy</b>               | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C |
| <b>Sensor Type</b>            | 3-wire Pt RTD (low drift, high stability)               |
| <b>Controller</b>             |   |
| <b>Input</b>                  | 115/230V  |
| <b>Output</b>                 | 10A/24 VAC 240 W maximum                                |
| <b>Dimensions (W X D X H)</b> |   |
| 12-cm Pathlength              | 223 x 110 x 134 mm                                      |
| 10-cm Pathlength              | 197 x 110 x 134 mm<br>(excludes baseplate mount)        |
| <b>Gas Ports</b>              | 1/8" tubing, welded                                     |

To optimize the energy throughput, this unique cell uses a set of transfer optics that focuses the IR beam from the spectrometer onto the entrance of the 7-mm bore cell body. The interior of the gas cell body is highly polished and gold coated for maximum IR transmission. The gas cell may be heated up to 300 °C to prevent condensation of higher molecular weight gas species.

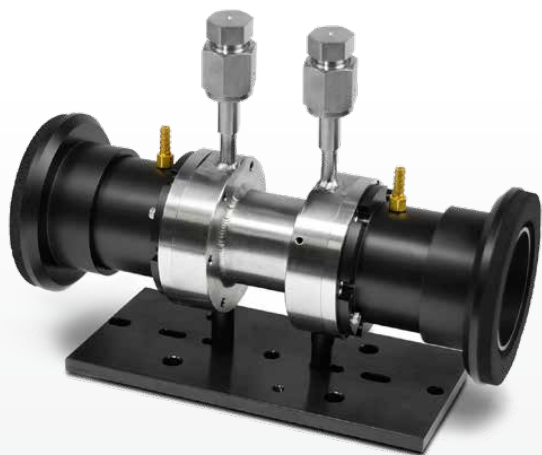
# Stainless Steel Short-Path Gas Cells

## AT A GLANCE

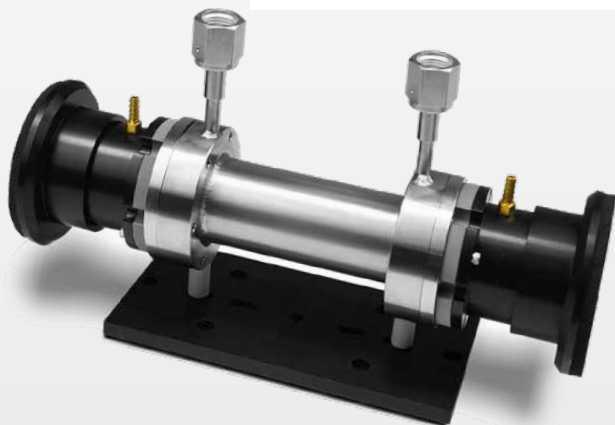
- ▶ Measurement of high concentration vapor phase samples
- ▶ Wide range of pathlengths, 1-20 cm
- ▶ Heated option up to 300 °C
- ▶ Baseplate-mounted for stability in the sample compartment



TEMPERATURE CONTROL  
OPTIONS AVAILABLE



5-cm Stainless Steel Short-Path Gas Cell.



10-cm Stainless Steel Short-Path Gas Cell.

The Stainless Steel Short-Path Gas Cells are great for analysis of highly concentrated vapor components.

## DESIGN

The durable construction of the metal body may be used under pressure when matched with a suitable IR window. Cell pathlengths are 1, 2, 5, 10, 15, and 20 cm. For maximum precision or to prevent condensation of specific components, heated models are available for a maximum temperature of 300 °C.



10-cm Stainless Steel Short-Path Gas Cell.

All cells are delivered with welded VCR fittings. To offer the greatest flexibility, users may optimize their configuration further by choosing Swagelok valves with VCR or ¼" compression termination. PIKE gas cells have been designed for easy maintenance and cleaning. Our gas cells are baseplate-mounted for stability in the spectrometer sample compartment and offer purge collars to eliminate atmospheric water vapor and CO<sub>2</sub> interferences in the spectrum.



¼" termination.



Valve with VCR termination.



## SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Temperature Range</b>      | Ambient to 300 °C                                       |
| <b>Accuracy</b>               | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C |
| <b>Sensor Type</b>            | RTD   |
| <b>Temperature Controller</b> |   |
| <b>Digital Display</b>        | +/- 0.1 °C  |
| <b>Input</b>                  | 115/230 V, switchable                                   |
| <b>Output</b>                 | 10 A/24 VAC 240 W maximum                               |

## MADE-TO-ORDER

Custom pathlengths and cell materials are available. Contact PIKE Technologies for special orders.

| PART NUMBER                         | DESCRIPTION     |
|-------------------------------------|-----------------|
| Stainless Steel Short-Path Gas Cell |                 |
| 164-21XX                            | Gas Cell, 1 cm  |
| 164-22XX                            | Gas Cell, 2 cm  |
| 164-25XX                            | Gas Cell, 5 cm  |
| 164-20XX                            | Gas Cell, 10 cm |
| 164-27XX                            | Gas Cell, 15 cm |
| 164-29XX                            | Gas Cell, 20 cm |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Windows not included; order separately. 1 and 2 cm pathlength gas cells use 25 x 4 mm windows and all others use 38 x 6 mm windows. Not all pathlengths fit commercial spectrometer sample compartments.

| Heated, 300 °C, Short-Path Gas Cells |                        |
|--------------------------------------|------------------------|
| 164-31XX                             | Heated Gas Cell, 1 cm  |
| 164-32XX                             | Heated Gas Cell, 2 cm  |
| 164-35XX                             | Heated Gas Cell, 5 cm  |
| 164-30XX                             | Heated Gas Cell, 10 cm |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Windows not included; order separately. 1 and 2 cm pathlength gas cells use 25 x 4 mm windows and all others use 38 x 6 mm windows. Not all pathlengths and heating options fit commercial spectrometer sample compartments. High-temperature O-rings are included. Heated short-path gas cells include a digital temperature controller and heating assembly. Please contact PIKE Technologies for custom pathlengths.

| IR Transparent Windows for Stainless Steel Short-Path Gas Cell (select minimum of 2) |                                 |  |
|--|---------------------------------|--|
| 25 x 4 mm<br>(1, 2 cm)   | 38 x 6 mm<br>(5, 10, 15, 20 cm) | Description                            |
| 160-1217   | 160-1322                        | BaF <sub>2</sub>                       |
| 160-1211   | 160-1342                        | CaF <sub>2</sub>                       |
| 160-1133   | 160-1320                        | KBr                                    |
| 160-1127   | 160-1343                        | KRS-5                                  |
| 160-1124   | 160-1321                        | NaCl                                   |
| 160-1114   | 160-1329                        | ZnSe                                   |
| 160-1110   | NA                              | ZnSe, Anti-Reflective Coating, 1-side  |
| 160-1109   | NA                              | ZnSe, Anti-Reflective Coating, 2-sides |

**Note:** ZnSe windows should not be used above 250 °C

| Valves and Replacement Parts |   |
|------------------------------|---|
| 164-4000                     | VCR Valve to VCR Termination Kit                |
| 164-4001                     | Valve to ¼ inch Compression Termination Kit     |
| 164-4002                     | ¼ inch Termination Kit                          |
| 164-4006                     | Viton O-Rings, 25 mm, max. temp. 200 °C (2 ea.) |
| 164-4008                     | Viton O-Rings, 38 mm, max. temp. 200 °C (2 ea.) |
| 164-4007                     | High Temperature O-Rings, 25 mm, 300 °C (2 ea.) |
| 164-4009                     | High Temperature O-Rings, 38 mm, 300 °C (2 ea.) |

**Notes:** Fitting kits include one for inlet and one for outlet. Contact us for other fitting options. Gas cell requires 4 O-rings total.

# Long-Path Gas Cells

## AT A GLANCE

- ▶ Long-Path gas cells for measurements of low concentration vapor species
- ▶ Concentrations may range from the ppm to ppb levels
- ▶ Fixed and variable pathlength versions
- ▶ Heated versions available up to 200 °C
- ▶ Standard fully purgeable optics
- ▶ Fits most FTIR spectrometers



TEMPERATURE CONTROL  
OPTIONS AVAILABLE



From left to right: 10m, 2.4m, 5m.

The Long-Path Gas Cells are designed for the analysis of trace components in gas samples. Typical applications include air pollution studies, gas purity determinations, monitoring of industrial processes, exhaust gas analysis and more.

## DESIGN

The Long-Path Cells feature a folded path design providing an extended pathlength within a compact dimension. The FTIR beam enters the cell through an IR transparent window and reflects a number of times between the accessory mirrors before exiting to the detector. The number of reflections is determined by the optical configuration of the cell and may be selected as a permanently aligned version or a user-adjustable version (variable-path cell).

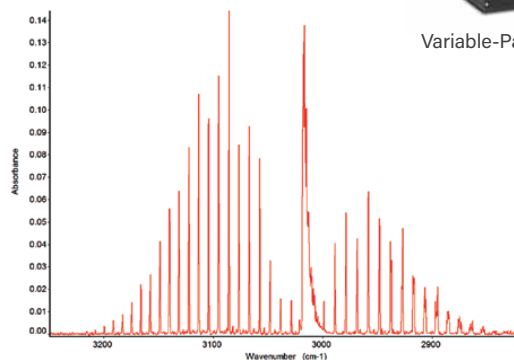
The fixed and variable long-path body assemblies are nickel-coated aluminum, stainless steel or heavy-wall borosilicate glass. Gas cells may be operated under vacuum or pressure. The top of the cell is enclosed by the valve assembly with stainless steel Swagelok® valves with barb fittings. Tube compression fittings are available upon request.

For optimal performance the mirrors have been diamond turned and coated with the highest quality gold for maximum reflectivity and inertness. The accessory mirrors are mounted permanently with mechanical mirror mounts to eliminate outgassing chemicals that may occur when using epoxies to secure the mirrors. Windows are easily replaceable and a variety of window materials are available.

The anodized aluminum base includes spectrometer-specific baseplate allowing placement of the accessory in the FTIR sample compartment. As a standard feature, the optical base is fully purgeable allowing for the elimination of atmospheric water vapor and CO<sub>2</sub> interference in the spectrum.



Variable-Path Gas Cell.

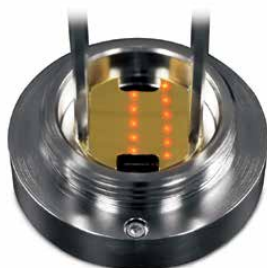


C-H stretch spectral region for methane gas.

## LONG-PATH GAS CELL SPECIFICATIONS




|                              | 2.4 m    | 5.0 m  | 10.0 m         | 20.0 m         | 30.0 m         | 1-16 m   |
|------------------------------|----------|--------|----------------|----------------|----------------|----------|
|                              | Fixed    | Fixed  | Fixed          | Fixed          | Fixed          | Variable |
| <b>Base Path (mm)</b>        | 100      | 157    | 250            | 500            | 625            | 333      |
| <b>Body Material</b>         | Metal    | Metal  | Glass or Metal | Glass or Metal | Glass or Metal | Glass    |
| <b>Optics Coatings</b>       | Gold     | Gold   | Gold           | Gold           | Gold           | Gold     |
| <b>Window Material</b>       | KBr      | KBr    | KBr            | KBr            | KBr            | KBr      |
| <b>Window Dimension (mm)</b> | 37.5 x 4 | 25 x 4 | 25 x 4         | 25 x 4         | 25 x 4         | 25 x 4   |
| <b># Window</b>              | 1        | 2      | 2              | 2              | 2              | 2        |
| <b>Cell Volume (L)</b>       | 0.1      | 0.5    | 2.2            | 7.2            | 12.8           | 3.5      |

The construction and main components of the variable-path gas cells are identical to fixed pathlength cells, with an exception of the internal mirror assembly. The cell has an adjustable mirror located at the top of the enclosure (position controlled with a micrometer) and one stationary mirror. Adjustments to the mirror position allow selection of different pathlengths supported by the cell. The variable-path gas cell has an integrated laser that enables the determination of the pathlength by counting the number of laser reflections on the bottom mirror.



Laser reflections shown on the bottom mirror of the variable-path gas cell for pathlength determination.

## SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Temperature Range</b>      | Ambient to 200 °C   |
| <b>Accuracy</b>               | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C   |
| <b>Sensor Type</b>            | RTD   |
| <b>Temperature Controller</b> | Touch-panel display with USB interface. PIKE TempPRO software for PC with unlimited ramps and automated data collection.  |
|                               |    |
| <b>Digital Display</b>        | +/- 0.1 °C  |
| <b>Input</b>                  | 115 or 230 V, specify   |
| <b>Output</b>                 | 115 or 230 VAC/10A 2400W maximum depending on pathlength  |
|                               | Note: Other lines may require an additional transformer.  |

## TEMPERATURE CONTROL

Some gas measurement applications require temperature control for higher precision or to prevent condensation of specific components. PIKE Technologies offers heated versions of our fixed- and variable-path gas cells up to 200 °C. For temperature accuracy, the temperature sensor has been embedded inside the gas cell as opposed to mounted on the exterior of the cell.

Contact PIKE Technologies on how to upgrade an existing cell to the heated version. Custom pathlengths, cell materials and heated transfer line are available. Contact us for special orders.

| PART NUMBER                | DESCRIPTION                    |
|----------------------------|--------------------------------|
| <b>Long-Path Gas Cells</b> |                                |
| 163-12XX                   | 2.4 m Metal Gas Cell           |
| 163-13XX                   | 2.4 m Stainless Steel Gas Cell |
| 163-15XX                   | 5 m Metal Gas Cell             |
| 163-14XX                   | 5 m Stainless Steel Gas Cell   |
| 163-10XX                   | 10 m Metal Gas Cell            |
| 163-17XX                   | 10 m Stainless Steel Gas Cell  |
| 163-11XX                   | 10 m Glass Gas Cell            |
| 163-16XX                   | 1-16v Glass Gas Cell           |
| 163-18XX                   | 20 m Stainless Steel Gas Cell  |
| 163-20XX                   | 20 m Glass Gas Cell            |
| 163-30XX                   | 30 m Glass Gas Cell            |
| 163-19XX                   | 30 m Stainless Steel Gas Cell  |

**Notes:** Replace **XX** with your spectrometer's Instrument Code listed in the back of the catalog. Metal Gas Cell bodies are made of nickel-plated aluminum. Long-Path Gas Cells include KBr window(s) and Swagelok™ valves with barb fittings. Compression fittings are available upon request; specify size. Additional window materials can be ordered from the table.

#### Replacement Windows

| 25 x 4 mm | 37.5 x 4 mm | Description                           |
|-----------|-------------|---------------------------------------|
| 160-1217  | 160-1281    | BaF <sub>2</sub>                      |
| 160-1211  | 160-1287    | CaF <sub>2</sub>                      |
| 160-1133  | 160-1288    | KBr                                   |
| 160-1178  | 160-1289    | KCl                                   |
| 160-1127  | NA          | KRS-5                                 |
| 160-1124  | 160-1290    | NaCl                                  |
| 160-1114  | 160-1291    | ZnSe                                  |
| 160-1110  | 160-1286    | ZnSe, Anti-Reflective Coating 1-Side  |
| 160-1109  | NA          | ZnSe, Anti-Reflective Coating 2-Sides |

**Note:** The 2.4 m gas cell requires one 37.5 x 4 mm window, and 5 m and greater pathlength cells require two 25 x 4 mm windows.

#### Heated Long-Path Gas Cells

|             |                                       |
|-------------|---------------------------------------|
| 163-42XX    | 2.4 m Metal Gas Cell, 115 V           |
| 163-42XX-30 | 2.4 m Metal Gas Cell, 230 V           |
| 163-35XX    | 2.4 m Stainless Steel Gas Cell, 115 V |
| 163-35XX-30 | 2.4 m Stainless Steel Gas Cell, 230 V |
| 163-45XX    | 5 m Metal Gas Cell, 115 V             |
| 163-45XX-30 | 5 m Metal Gas Cell, 230 V             |
| 163-31XX    | 5 m Stainless Steel Gas Cell, 115 V   |
| 163-31XX-30 | 5 m Stainless Steel Gas Cell, 230 V   |
| 163-40XX    | 10 m Metal Gas Cell, 115 V            |
| 163-40XX-30 | 10 m Metal Gas Cell, 230 V            |
| 163-32XX    | 10 m Stainless Steel Gas Cell, 115 V  |
| 163-32XX-30 | 10 m Stainless Steel Gas Cell, 230 V  |
| 163-41XX    | 10 m Glass Gas Cell, 115 V            |
| 163-41XX-30 | 10 m Glass Gas Cell, 230 V            |
| 163-46XX    | 1-16v Glass Gas Cell, 115 V           |
| 163-46XX-30 | 1-16v Glass Gas Cell, 230 V           |
| 163-43XX    | 20 m Glass Gas Cell, 115 V            |
| 163-43XX-30 | 20 m Glass Gas Cell, 230 V            |
| 163-33XX    | 20 m Stainless Steel Gas Cell, 115 V  |
| 163-33XX-30 | 20 m Stainless Steel Gas Cell, 230 V  |
| 163-47XX    | 30 m Stainless Steel Gas Cell, 115 V  |
| 163-47XX-30 | 30 m Stainless Steel Gas Cell, 230 V  |

#### Replacement Parts

|            |  |
|------------|--|
| 076-1710   | Long-Path Gas Cell Temperature Control Module, 115 VAC |
| 076-1720   | Long-Path Gas Cell Temperature Control Module, 230 VAC |
| 007-0207   | PIKE TempPRO Software                                  |
| 163-1009   | Pathlength Verification Tool, 2.4 m and 5 m            |
| 163-100910 | Pathlength Verification Tool, 10 m and 20 m            |
| 163-1001   | Viton Gas Cell Window O-Ring, 5, 10, 20, 16v m (4 ea.) |
| 163-1208   | Perfluoroelastomer O-Ring Kit, 2.4 m                   |
| 163-1506   | Perfluoroelastomer O-Ring Kit, 5 m                     |
| 163-1007   | Perfluoroelastomer O-Ring Kit, 10 m                    |
| 163-2006   | Perfluoroelastomer O-Ring Kit, 20 m                    |

**Note:** Please call PIKE Technologies for replacement O-rings or other parts not listed here.

**Notes:** Replace **XX** with your spectrometer's Instrument Code listed in the back of the catalog. Metal Gas Cell bodies are made of nickel-plated aluminum. Heated Long-Path Gas Cells include KBr window(s) and Swagelok™ valves with barb fittings. Compression fittings are available upon request; specify size. Additional window materials can be ordered. Heated Long-Path Gas Cells include a digital temperature controller and heating jacket. If PC control is desired, PIKE TempPRO software (sold separately) can be used for graphical setup and automated data collection for thermal experiments. TempPRO is compatible with most FTIR spectrometers. Heated Long-Path Gas Cells may be heated to 200 °C.

Pressure gauge.

Gas valves.

Heating jacket.

Internal temperature sensor.



5-m Heated Gas Cell.

# Transmission

## Theory and Applications

FTIR sampling by transmission is a very popular method for collection of infrared spectra. The methods are intuitive and do not require sophisticated sampling accessories. In many cases, the sample can be placed directly into the path of the infrared beam (with the help of sample holder) and scanned. Further benefits of transmission sampling techniques include compatibility with automated sampling and microsampling techniques such as IR Microscopy.

### HOW TRANSMISSION WORKS

Transmission techniques are well documented and have been successfully used for many years. A large number of spectral libraries contain transmission spectra and are often used as references for the purpose of qualitative analysis. Transmission techniques offer many advantages and should be used whenever possible, unless reliable sample preparation becomes too difficult, too time consuming or impossible. Transmission is also widely used for quantitative applications, as significant numbers of basic measurements adhere to the Beer-Lambert law. The law provides a mathematical relationship between the infrared radiation absorbed by the sample and the sample concentration:

$$A = a \cdot b \cdot c$$

Where

- ▶ A = absorbance
- ▶ a = absorptivity
- ▶ b = pathlength
- ▶ c = sample concentration

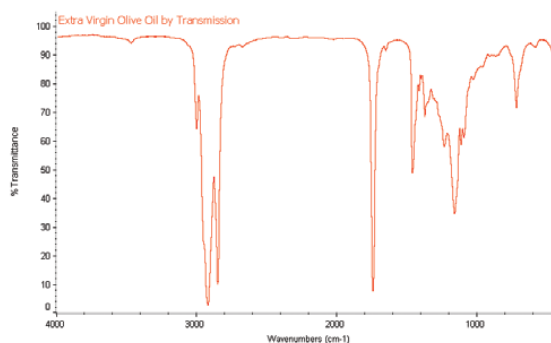
The Beer-Lambert law states that absorbance is linearly proportional to sample concentration (with sample pathlength and absorptivity constant). The actual measurements are generated in percent transmittance (which is not a linear function of concentration); however, they can be converted in real time to absorbance by all modern FTIR software packages. As mentioned before, transmission measurements are intuitive and simple. Many samples are too thick to be measured directly and they have to be processed in some way before meaningful data can be collected. Some of the sample preparation techniques are time consuming and can be destructive. Liquids and pastes are generally the easiest samples to run. A large number of liquid cells and windows are available for liquid measurements. Solid samples (with the exception of thin films) require sample preparation –

making a pellet (typically KBr) or a mull. Gas samples require a suitable gas cell with a pathlength sufficient to detect the desired component.

### PREPARATION AND ANALYSIS

#### LIQUID SAMPLES

Most liquids and dissolved solids are easy to measure by transmission. Viscous liquids or pastes can be simply pressed between two IR transparent windows and measured by FTIR.



FTIR spectrum of 1 drop of extra virgin olive oil pressed between 25-mm KBr windows and held in the IR beam using the PIKE Universal Sample Holder.

Thin liquids or samples in solvent may be best run by using a demountable liquid cell or a sealed cell, consisting of two windows with a precision spacer in-between. One of the windows has two drilled holes for the introduction and evacuation of the sample. A large number of cell options are available – these include permanently sealed cells and demountable cells with different window materials and a wide selection of spacers.

The pathlength of liquid cells can be easily measured with your FTIR spectrometer. Just place the empty cell into the FTIR and collect its spectrum. The frequency of the sine wave spectrum (produced by back reflection within the cell) provides the pathlength using the following equation;

$$P = (10 \cdot N) / (2 \cdot \Delta \text{ cm}^{-1})$$

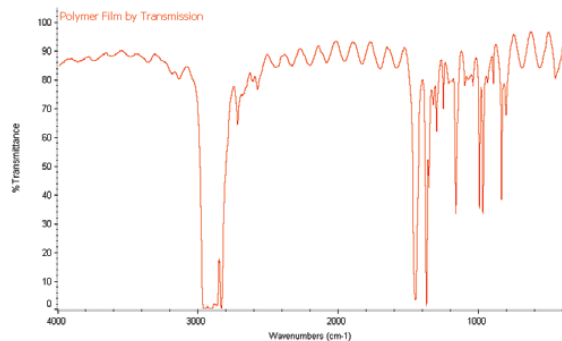
Where

- ▶ P = pathlength of cell in mm
- ▶ N = number of fringes within  $\Delta \text{ cm}^{-1}$
- ▶  $\Delta \text{ cm}^{-1}$  = wavenumber difference of fringe count

It is very important to select compatible IR transparent windows for your liquid samples. Please refer to the table on the last page of this note to select your windows. If you still have questions, please call us.

## SOLID SAMPLES

The easiest to analyze are film and polymer samples less than 200 micrometers thick (ideal thickness for the major component of a polymer film is about 20 microns). These samples can be simply placed into a sample holder and immediately scanned.



Polymer film from product packaging material – held in place with the PIKE Universal Sample Holder. Polymer is identified as Atactic Polypropylene and the film is determined to be 27.1 microns thick.

The thickness of the polymer film can be calculated from the fringe pattern in the spectrum using the following equation:

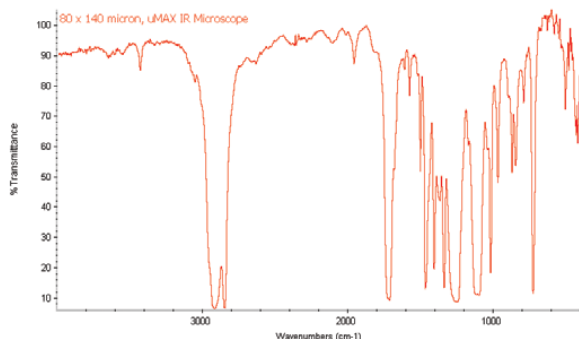
$$T = (10000 \cdot N) / (2 \cdot n \cdot \Delta \text{ cm}^{-1})$$

Where

- ▶ T = thickness of polymer film in microns
- ▶ N = number of fringes within  $\Delta \text{ cm}^{-1}$
- ▶  $\Delta \text{ cm}^{-1}$  = wavenumber difference of fringe count
- ▶ n = refractive index of polymer

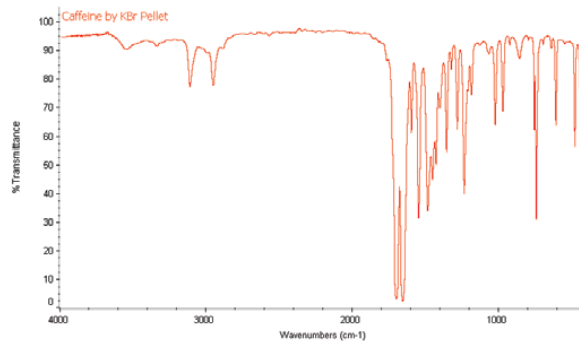
The same procedure can be used for samples which can be sliced and pressed to an appropriate thickness – especially for IR microsampling. PIKE Technologies' Heated Platens Accessory is ideal for making thin polymer films.

For IR microsampling, one can place a small sliced sample into a compression cell and apply pressure to hold the sample and to thin it to a useable thickness – as shown in the following spectral data.



Micro spectrum of a layered polymer using a PIKE  $\mu$ MAX IR Microscope and Compression Cell with KBr windows.

However, the majority of solid materials must be prepared before their infrared spectra can be collected. In many cases sample preparation involves grinding of the sample and mixing it with an IR transparent material such as KBr and then pressing a pellet. While this method of solids analysis is time consuming, it produces an excellent result.



FTIR spectrum of caffeine prepared as a 13-mm KBr Pellet and held in position with the PIKE Sampling Card.

## SOLID SAMPLE PREPARATION TIPS

The best method for preparation of solid samples involves mixing the sample (about 5% by weight) with an IR transparent material (typically KBr) and pressing a pellet. The mixing is best done with the ShakIR accessory which produces a fully mixed and pulverized sample in about 20 seconds. The grinding and mixing can also be done with a mortar and pestle – but not as well. Generation of a pellet involves pressing the prepared mixture with a hydraulic or hand press into a hard disk. The pellet, ideally 0.5 to 1 mm thick is then placed in a transmission holder and scanned. Typically, the pellet technique provides good quality spectra with a wide spectral range.

Samples which do not grind well and/or are affected by solvents and mulling agents can be analyzed with high-pressure techniques. Typical samples include fibers and paint chips. The accessory used for such applications utilizes two diamond anvils. Difficult samples are placed between the diamonds and crushed, compressed and flattened to the thickness necessary to obtain good-quality FTIR spectra. Diamond cells are transparent to IR radiation except in the region of  $2400 \text{ cm}^{-1}$  to  $1700 \text{ cm}^{-1}$ . The high-pressure diamond cells require the use of a beam condenser or an infrared microscope.

An alternate method for analysis of solid materials involves making a mull. Mulls are sample suspensions in Nujol (refined mineral oil) or Fluorolube (perfluorohydrocarbon). The process is based upon mixing 1 to 2 drops of the mulling agent with a ground sample until a uniform paste is formed. The paste is transferred onto a KBr or other IR transparent disk, placed in the sample compartment of the spectrometer and scanned. The advantage of this technique is that it is a relatively quick and simple procedure; disadvantages include interference from mulling agent absorption bands. Both Nujol and Fluorolube have characteristic spectral features and in most cases have to be used as a pair in order to generate a complete mid IR spectrum. Nujol is used below  $1330 \text{ cm}^{-1}$ , Fluorolube above  $1330 \text{ cm}^{-1}$ . Some sample preparation is needed and the quality of the results and amenability to automation and microsampling offer significant advantages.

## PROPERTIES OF SELECT INFRARED TRANSMITTING MATERIALS FOR TRANSMISSION SPECTROSCOPY

| Material         | Comments   | SWL<br>cm <sup>-1</sup> | LWL<br>cm <sup>-1</sup> | RI   | Solubility<br>g/100 g | Hardness<br>kgf/mm <sup>2</sup> | MP<br>°C        | pH Range |
|------------------|--|-------------------------|-------------------------|------|-----------------------|---------------------------------|-----------------|----------|
| AMTIR            | GeAsSe glass, brittle  | 11000                   | 593                     | 2.50 | 0                     | 170                             | 370             | 1-9      |
| BaF <sub>2</sub> | Barium Fluoride  | 66600                   | 691                     | 1.45 | 0.17                  | 82                              | 1280            | 5-8      |
| CaF <sub>2</sub> | Calcium Fluoride   | 79500                   | 896                     | 1.40 | 0.0017                | 158                             | 1360            | 5-8      |
| CsI              | Cesium Iodide, very hygroscopic, Somewhat Toxic                            | 42000                   | 172                     | 1.73 | 44                    | 20                              | 621             | NA       |
| Diamond          | Type IIa, strong IR absorbance between 2700-1800 cm <sup>-1</sup> , costly | 30000                   | <2                      | 2.40 | 0                     | 5700                            | 550 flash point | 1-14     |
| Ge               | Germanium, brittle, becomes opaque at elevated temperatures                | 5500                    | 432                     | 4.00 | 0                     | 780                             | 936             | 1-14     |
| KBr              | Potassium Bromide, most widely used for mid-IR applications                | 48800                   | 345                     | 1.52 | 53                    | 6                               | 730             | NA       |
| KRS-5            | Thallium Bromide/Thallium Iodide, Extremely Toxic!                         | 17900                   | 204                     | 2.37 | 0.05                  | 40                              | 414             | 5-8      |
| NaCl             | Sodium Chloride  | 52600                   | 457                     | 1.49 | 36                    | 18                              | 801             | NA       |
| Polyethylene     | For Far-IR, swells with some organic solvents                              | 625                     | <4                      | 1.52 | 0                     |                                 | 110             | 1.5-14   |
| SiO <sub>2</sub> | Silicon Dioxide  | 50000                   | 2315                    | 1.53 | 0                     | 460                             | 1713            | 1-14     |
| Si               | Silicon, strong IR absorbance between 624-590 cm <sup>-1</sup>             | 8900                    | 624, 30                 | 3.41 | 0                     | 1150                            | 1420            | 1-12     |
| ZnS              | Zinc Sulfide   | 17000                   | 690                     | 2.20 | 0                     | 240                             | 1830            | 5-9      |
| ZnSe             | Zinc Selenide  | 15000                   | 461                     | 2.40 | 0                     | 120                             | 1526            | 5-9      |

**Notes:** The above table is meant to be a general guide - brief and concise. For more information about these materials, consult appropriate reference books and Safety Data Sheets (SDS).

SWL - Shortest wavelength for transmission, 1 mm, 50% transmission.

LWL - Longest wavelength for transmission, 1 mm, 50% transmission.

RI - Refractive index, at relevant wavelength.

MP - Melting point

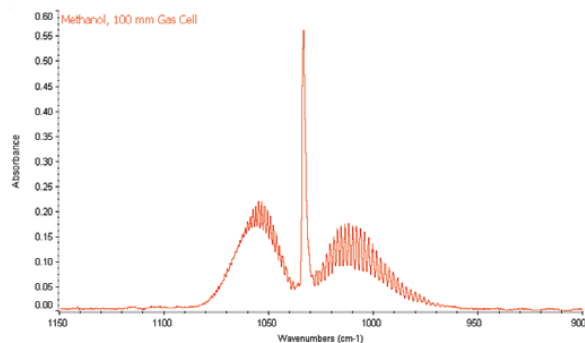
## GAS SAMPLES

Analysis of gas samples is a unique form of transmission sampling by FTIR as the identified sample does not need to be of pure composition. At high spectral resolution, most gas mixtures can be identified and quantified since absorbance bands can be selected within the spectrum, which are resolved and distinct from other components within the sample.

Short-path Gas Cells (1 mm to 100 mm) are recommended for samples in a 1-10% by weight concentration range.

Long-path gas cells are required for highly dilute samples (ppm to ppb concentrations). The long-path cell reflects the IR beam several times through the sample using a set of mirrors positioned on the opposite ends of the cell, producing a pathlength from 2.4 to 30 meters - or more. It is important to select window materials compatible with the investigated sample.

Gas sampling accessories can be fitted with different windows to accommodate the physical and chemical characteristics of the measured gas. Some gas measurement applications require temperature control for higher precision or to prevent condensation of specific components. Special designs for high-pressure and temperature controlled experiments are also available.



FTIR Spectrum of methanol vapor measured with the PIKE 100-mm gas cell using 0.50 cm<sup>-1</sup> spectral resolution.

## SUMMARY

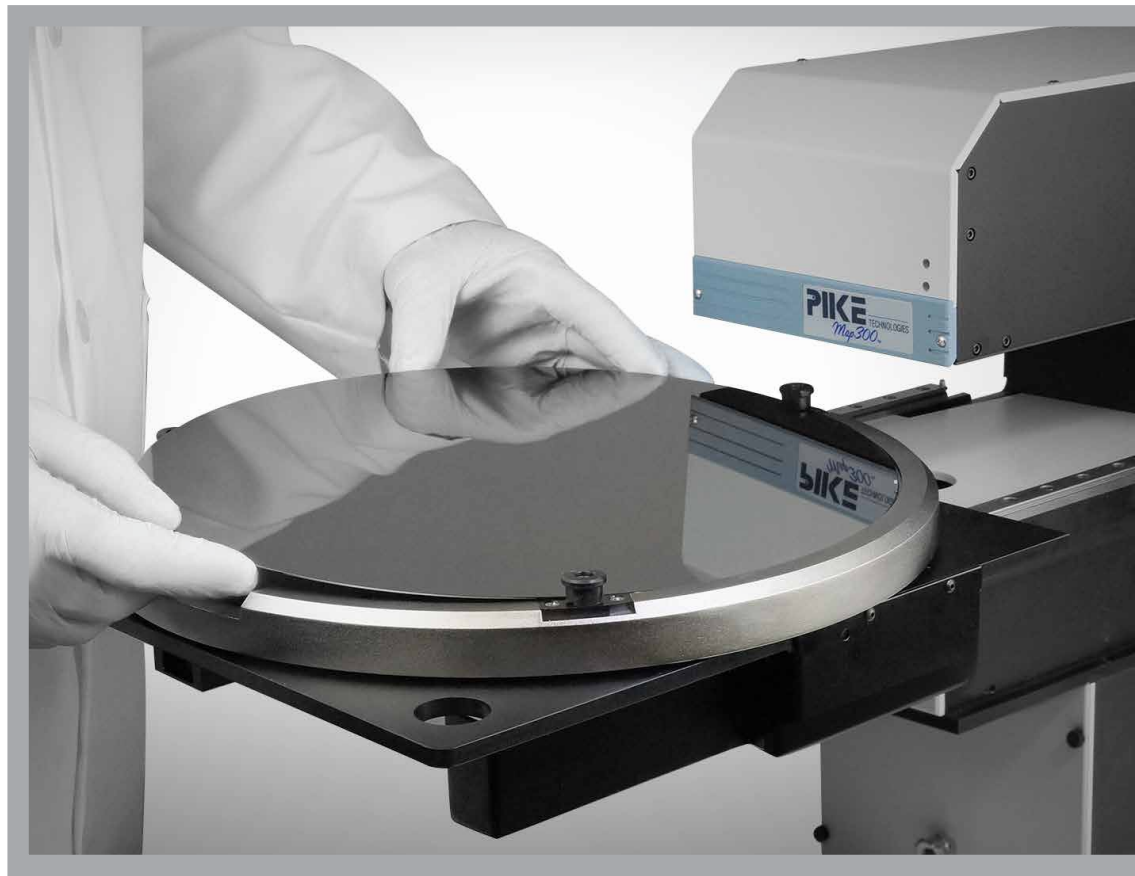
Transmission sampling by FTIR provides an excellent means for sample identification and quantification of sample components. Most samples measured by transmission techniques require some sample preparation; however, the quality of the results and amenability to automation and microsampling offer significant advantages.







# Special Applications



PIKE Technologies offers several FTIR accessories specially designed for use in a dedicated sampling environment. Our semiconductor sampling accessories highlight our dedication to providing tools to ease and streamline FTIR sampling technology. If you have special sampling needs not shown in our catalog, please contact us – we may be able to help.

# Vertical Wafer Accessory

## AT A GLANCE

- ▶ Transmission analysis of semiconductor wafers for carbon, oxygen and BPSG
- ▶ Fully automated operation
- ▶ R-theta (rotation/translation) motion control providing complete wafer analysis
- ▶ Contamination-free wafer mount
- ▶ 6", 5", 4", 3" and 2" wafer sizes
- ▶ Custom mounts and blanks



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE

The Vertical Wafer Accessory is designed for analysis of semiconductor wafers for carbon, oxygen and BPSG. This accessory is an automated in-compartment tool for transmission analysis.

## DESIGN

The Vertical Wafer Accessory accommodates wafers up to 6" (150 mm) in diameter. Wafers are secured in a demountable ring. Dimensional tolerances conform to SEMI standards. Delrin (hard polymer) mounting clips eliminate contact between the wafer and metal surfaces during the analysis. The clip mechanism facilitates convenient and repeatable wafer placement.

The wafer support ring may be rotated through 360° and translated laterally through a distance of over 3" (75 mm) to produce an R-theta motion covering the entire surface of the wafer.

## AUTOMATION

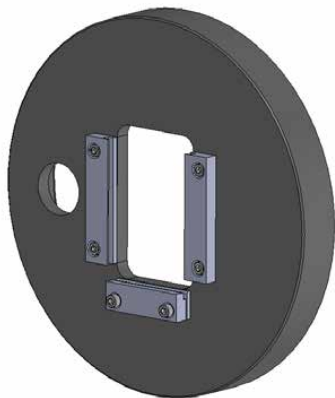
The automated system incorporates two precision stepper motors for rotation and translation of the plate. The motors are driven by the Motion Control Unit connected to a PC via USB. The operation is managed by PIKE AutoPRO software which provides full user programmability and an easy-to-learn user interface. Polar or Cartesian (X, Y) coordinates may also be used to define test points. Test sequences can be stored as methods and implemented with full flexibility. The Motion Control Unit features a smart power supply and operates at 85–265 VAC, 47–63 Hz. The data collection feature of AutoPRO is compatible with most FTIR software packages.

The PIKE Technologies Vertical Wafer Accessory requires minimum 3.5" beam height FTIR spectrometers. Please contact us for more product details.

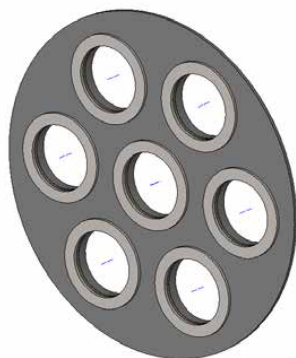


## CUSTOM WAFERS

PIKE Technologies offers a variety of inserts to support many different applications, including custom wafers that are designed uniquely to meet customer needs. Below an example of some of our popular options. Contact PIKE Technologies for options not described here.



2 x 3" Slide Mount.



1" Filter Mount.



5" Square Wafer Mount.

| PART NUMBER   | DESCRIPTION  |
|---|--|
| 073-26XX  | Vertical Wafer Accessory, Automated Version<br>Includes motion control unit and AutoPRO software<br><br><b>Notes:</b> Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Requires 3.5" beam height or greater in FTIR. |
| Options   |  |
| 073-3600  | 6" Wafer Mount, blank  |
| 073-3660  | Additional Wafer Mount   |
| 073-3650  | 5" Wafer Mount   |
| 073-3640  | 4" Wafer Mount   |
| 073-3630  | 3" Wafer Mount   |
| 073-3620  | 2" Wafer Mount   |
| 073-3663  | 2 x 3" Slide Mount   |
| <b>Note:</b> Contact PIKE Technologies for custom mounts or options not described here. |  |

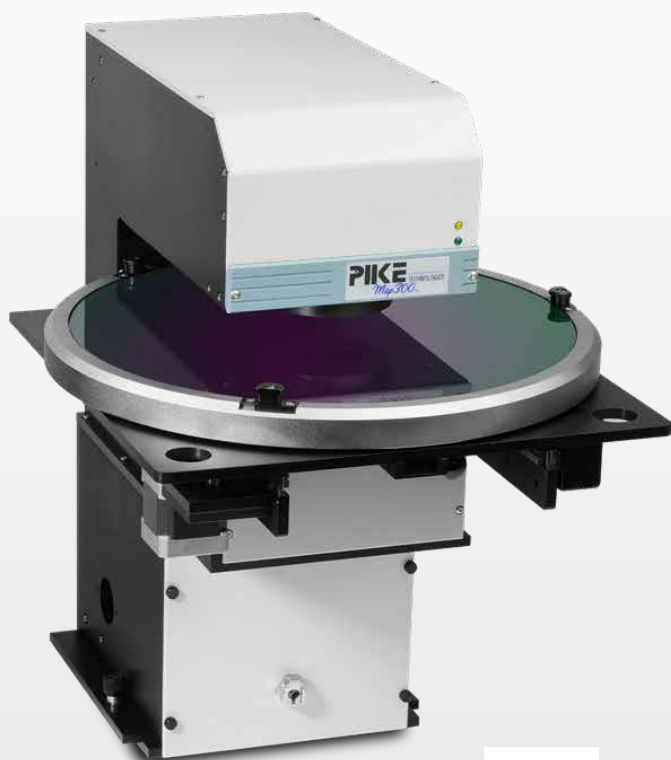
# MAP300 and MappIR

## AT A GLANCE

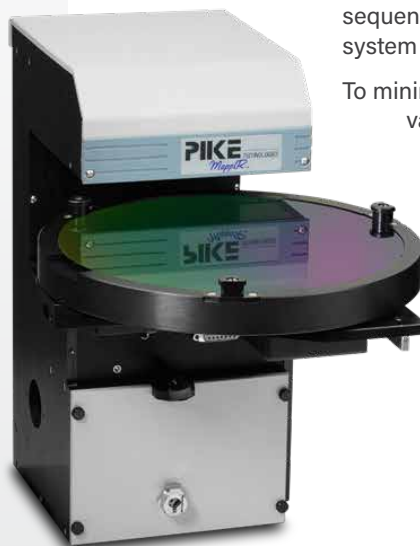
- ▶ Complete hardware and software package for automated, multi-position measurements and mapping of semiconductor wafers
- ▶ 8" (200-mm) and 12" (300-mm) semiconductor wafer handling
- ▶ Optional inserts for wafer sizes from 2 to 12"
- ▶ EPI, BPSG, oxygen and carbon determination
- ▶ Specular reflectance and transmission sampling – standard
- ▶ Purgeable accessory for removal of atmospheric interferences
- ▶ USB controller interface



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE



MAP300.



MappIR.

The MAP300 and MappIR are fully automated accessories for the analysis of semiconductor wafers. These accessories provide for analysis of EPI, BPSG, oxygen and carbon in wafer sizes ranging from 2 to 12" (50 to 300 mm).

## AUTOMATION

The MAP300 and MappIR have been developed to provide the semiconductor industry with affordable, automated tools for research and quality control of silicon wafers. The MappIR was developed for the analysis of 8" (200-mm) and smaller semiconductor wafers. The MAP300 is a larger version of this original design and it is capable of handling 12" (300-mm) wafer formats. The operation, electronics and software are identical for both systems. The MAP300 and MappIR accessories mount in the sample compartment of the FTIR spectrometer.

The MAP300 and MappIR allow for transmission and specular reflection measurements. Switching between the two measurement modes is done by means of a single-slide transmittance/reflectance control knob. For the MAP300, the beam size at the wafer sampling position is reduced by 33% relative to the sample compartment beam diameter, which depends on the J-stop setting. The MappIR's beam size at the sampling position is 1.5X larger than the beam diameter. The angle of incidence of the MappIR and the MAP300 are 15 and 20°, respectively.

Semiconductor wafers are held in place by spring-loaded Delrin® retaining clips and are never in contact with the aluminum stage of the accessory. A standard size slot for a vacuum or mechanical wand is provided for ease of wafer handling. Individual wafers are rotated and/or translated by stepper motors in a sequence pre-programmed by the system operator.

To minimize interferences of water vapor and carbon dioxide with infrared measurements, the optical path of the accessories is equipped with purging lines and can be purged with dry air or nitrogen. A wafer purge enclosure is offered as an option.

## AUTOPRO SOFTWARE

The accessories are controlled by AutoPRO software which provides a simple user interface for multiple point wafer analysis (mapping). Up to 320 points with 8-mm beam and 5-mm edge exclusion can be measured on a 12" wafer. The software provides ample flexibility in setting up various experiments.

## ADVANTAGES OF THE AUTOPRO SOFTWARE PACKAGE

- ▶ Graphical and intelligent user interface for setting up mapping patterns
- ▶ Selection of wafer size, IR beam diameter and edge exclusion
- ▶ Operator-selectable or pre-defined multiple point maps
- ▶ Polar and/or Cartesian coordinates options
- ▶ Real-time display of the experiment status
- ▶ Ability to save and recall various experimental patterns
- ▶ COM-enabled interface for use with macros/scripting
- ▶ KLA and CSV file importer

Data collection and processing is provided by the spectrometer software. A number of FTIR manufacturers offer dedicated packages which fully integrate the accessory with the spectrometer. If such an option is not available, AutoPRO can be controlled by the spectrometer's program via macros. AutoPRO is Windows compliant and when run separately, it allows configuration, programming and control of the accessory.

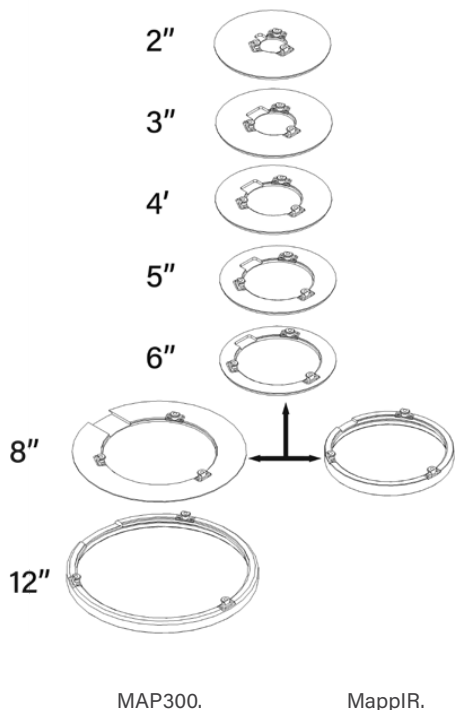
PIKE automated wafer accessories are compatible with most commercial FTIR spectrometers and software packages.

| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 016-28XX    | MappIR Accessory for 8" Wafers<br>Includes wafer mount, motion control unit, AutoPRO software and mount for your FTIR  |
| 016-29XX    | Purge-Ready MappIR Wafer Accessory for 8" Wafers<br>Includes wafer mount, motion control unit, AutoPRO software and mount for your FTIR (order purge enclosure separately) |
| 017-28XX    | MAP300 Accessory for 12" Wafers<br>Includes wafer mount, motion control unit, AutoPRO software, mount for your FTIR and insert to support 8" wafers                        |

**Notes:** Replace **XX** with your spectrometer's Instrument Code listed in the back of the catalog. P/N 017-28XX is purge enclosure ready. Order optional purge enclosure separately.

| Options for The MappIR and MAP300 Accessories |   |
|---|---|
| 073-3880                                      | Additional 8" Wafer Mount (MappIR only)         |
| 073-3800                                      | Blank Support – for custom wafers (MappIR only) |
| 017-3912                                      | Additional 12" Wafer Mount (MAP300 only)        |
| 017-3980                                      | Insert to Support 8" Wafer (MAP300 only)        |
| 073-3860                                      | Insert to Support 6" Wafer                      |
| 073-3850                                      | Insert to Support 5" Wafer                      |
| 073-3840                                      | Insert to Support 4" Wafer                      |
| 073-3830                                      | Insert to Support 3" Wafer                      |
| 073-3820                                      | Insert to Support 2" Wafer                      |
| 016-3000                                      | Purge Enclosure for MappIR                      |
| 017-3000                                      | Purge Enclosure for MAP300                      |

**Notes:** Purge enclosure will not fit with all spectrometer models. For more options or additional information, contact PIKE Technologies.



Optional purge enclosure mounted on 8" MappIR accessory.



# TGA/FTIR Accessory

## AT A GLANCE

- ▶ Gas cell design conforming to IR beam geometry – maximizes IR throughput with minimum cell volume
- ▶ 100-mm IR beam pathlength for maximized FTIR sensitivity
- ▶ Temperature control settable up to 300 °C for flow cell and transfer line
- ▶ User-changeable IR transparent windows to minimize cost of operation
- ▶ Heated, glass-lined stainless steel transfer line for inert transfer of TGA effluent
- ▶ Baseplate-mounted in your FTIR for flexible sampling

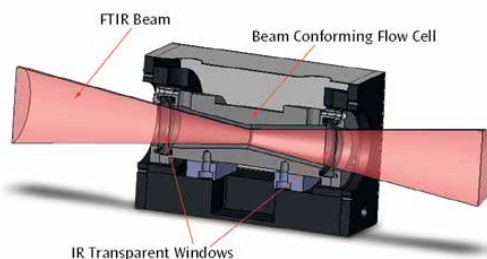


TEMPERATURE CONTROL  
OPTIONS AVAILABLE

The TGA/FTIR accessory is designed to be an interface for evolved gas analysis from a thermogravimetric analyzer (TGA) to your FTIR spectrometer. Qualitative and quantitative measurements are doable from sample masses—typically in the low milligram range.

## DESIGN

Evolved gases from the TGA pass through a heated transfer line into the beam conforming flow cell in the FTIR sample compartment. As these evolved gases travel through the flow cell, FTIR spectra are collected and stored for further processing. The PIKE TGA/FTIR Accessory is compatible with most FTIR spectrometers and most TGA instruments.



IR beam conforming optical design of TGA/FTIR Accessory.

## APPLICATIONS AND MEASURING TECHNIQUES

During the TGA analysis sample mass is lost through a combination of volatilization and degradation of the sample material. The heated TGA/FTIR system maintains the vapor state of the evolved gases throughout the FTIR analysis. Typical samples include polymers, epoxies, fibers and laminates for investigating deformation, thermal stability or comparative study applications.

Typically, the FTIR spectrometer is set to collect spectra at 10-second intervals during the evolved gas analysis using the kinetics software package for your FTIR. With this software you can generate reconstructions of total IR response versus time or temperature (Gram-Schmidt) or specific IR band reconstructions to isolate points of unique component evolutions. FTIR spectra are extracted from the data set and an identification is made by comparing these unknown spectra to vapor phase spectral libraries.



Controller.



TGA-FTIR Accessory.

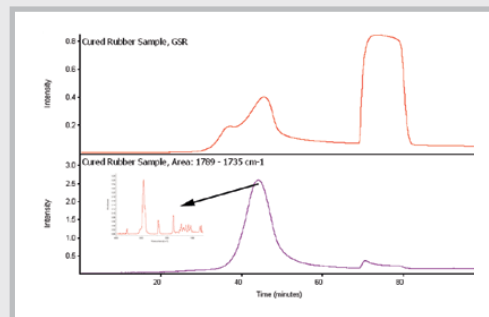


## SPECIFICATIONS

|                          |   |
|--------------------------|---|
| <b>Temperature Range</b> | Ambient to 300 °C                                       |
| <b>Accuracy</b>          | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C |
| <b>Voltage</b>           | 24 VAC  |
| <b>Sensor Type</b>       | 3 wire Pt RTD (low drift, high stability)               |
| <b>Controllers</b>       |   |
| Input Voltage            | 115/230 V, switchable                                   |
| Output Voltage           | 10 A/24 VAC   |
| <b>Dimensions</b>        | 91 x 140 x 121 mm<br>(excludes baseplate mount)         |

## APPLICATION

TGA only measures the mass loss caused by evolved gas events. By coupling TGA with an FTIR, unique spectroscopic data as well as functional group information of the evolved gases may be obtained.



**TGA/FTIR data for cured rubber sample spectrum.** Upper trace is the Gram-Schmidt reconstruct of the TGA evolved gases. Lower trace is a carbonyl reconstruction.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 162-24XX    | TGA/FTIR Accessory Flow Cell<br>Includes mount for your FTIR, exhaust line and high-temperature O-rings |

**Notes:** Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. Complete accessory requires selection of IR transparent windows, heated transfer line and temperature controller. The TGA/FTIR accessory requires installation by a trained service representative – please consult with your FTIR manufacturer.

| IR Transparent Windows for TGA/FTIR Accessory<br>(must select 2 or more) |                         |
|--|-------------------------|
| 160-1320   | Window, KBr, 38 x 6 mm  |
| 160-1329   | Window, ZnSe, 38 x 6 mm |

**Notes:** For window compatibility please consult our Materials Properties table, available in Transmission chapter. ZnSe windows should not be used above 250 °C.

| Heated Transfer Line for TGA/FTIR Accessory<br>(must select one) |   |
|--|---|
| 115-0001   | Heated Transfer Line for Shimadzu TGA50 with evolved gas port modifications |
| 115-0005   | Heated Transfer Line for Mettler 851 TGA                                    |
| 115-0006   | Heated Transfer Line for Mettler 851e/LF or TGA-DSC1/2/3 TGA                |
| 115-0007   | Heated Transfer Line for TA Instruments Q600 TGA                            |
| 115-0008   | Heated Transfer Line for TA Instruments Discovery/Q5000R                    |
| 115-0009   | Heated Transfer Line for TA Instruments Q50/Q500 TGA                        |
| 115-0010   | Heated Transfer Line for TA Instruments 2050/2950                           |
| 115-0011   | Heated Transfer Line for Netzsch TGA  |
| 115-0012   | Heated Transfer Line for PESTA6/4000 110V TGA                               |
| 115-0013   | Heated Transfer Line for SETARAM  |
| 115-0014   | Heated Transfer Line for PESTA6/4000 220V TGA                               |

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 115-0017    | TGA Universal Transfer Line<br>Includes the following adapters; 1/8" to 1/8" union, 1/4" to 1/8" reducing union, 3-mm to 1/8" union, 6-mm to 1/8" reducing union and 6-mm PTFE ferrules |
| 115-0018    | PTFE TGA Transfer Line, 230 °C max. Recommended for TGAs with evolved gas ports made of ceramic or moving furnace heads   |

**Notes:** Please consult your TGA supplier to ensure compatibility with evolved gas analysis. Contact PIKE Technologies about interfacing to other TGA instruments. Unless noted otherwise, all PIKE transfer lines are 1/8" OD, silica-lined stainless steel, 48" in length and offers a maximum temperature of 300 °C .

| Temperature Controllers for TGA/FTIR Accessory<br>(must select one) |  |
|---|--|
| 076-1120  | Dual Digital Temperature Control Module                    |
| 076-1130  | 4-Zone Digital Temperature Control Module for Shimadzu TGA |
| Replacement Parts and Options                                       |  |
| 162-2309  | High-Temperature O-Rings, max temp 325 °C, (1 ea.)         |
| 162-2308  | High-Temperature O-Rings, max temp 325 °C, (4 ea.)         |

**Note:** Gas cell requires 4 O-rings. For high-temperature purge tubes and other options, please contact PIKE Technologies.

# GC-FTIR Accessory

## AT A GLANCE

- ▶ Isomer identification
- ▶ Secondary confirmation of GC-MS results
- ▶ 120-mm IR beam pathlength for maximized FTIR sensitivity
- ▶ Temperature control settable up to 300 °C for flow cell and transfer line
- ▶ Purgeable module



TEMPERATURE CONTROL  
OPTIONS AVAILABLE

The GC-FTIR Accessory is an interface between the GC and the FTIR instruments.

Coupling gas chromatography with infrared spectroscopy provides an effective method of separating compounds as the sample moves through the GC column and identifying these compounds by spectroscopy. GC-FTIR is a preferred method for identifying isomers, which may be incorrectly identified using GC-MS. In addition, GC-FTIR may be used as a complementary analytical technique to confirm GC-MS results. Typical applications of GC-FTIR include the analysis of drugs, fragrances, and other organic compounds found in mixtures.

When fully installed, the sample pathway from the end of the GC column is diverted to a heated gas cell and back to the GC detector through the use of temperature-controlled transfer lines. To maximize sensitivity, the light pipe is gold-coated and the accessory includes an on-board MCT detector.



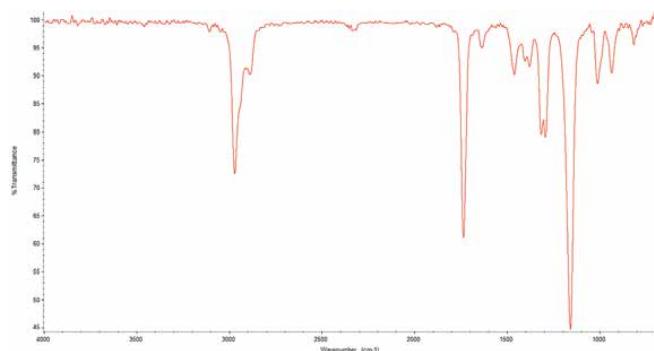
| PART NUMBER | DESCRIPTION   |
|-------------|---|
|             | GC-FTIR Base Accessory ( <i>must select external beam direction</i> ) |
| 140-10XXR   | GC-FTIR Accessory, Right Side   |
| 140-10XXL   | GC-FTIR Accessory, Left Side  |

**Notes:** Replace **XX** with your spectrometer's Instrument Code listed in the back of the catalog. GC-FTIR Accessory includes optics, mounting hardware, narrow-band MCT detector and detector electronics, heated gas cell and temperature controller. The GC-FTIR accessory requires installation by a trained service representative; please consult with your FTIR and GC manufacturer.

| Transfer Line for GC-FTIR ( <i>must select</i> ) |                                      |
|--|--------------------------------------|
| 115-0050   | GC-FTIR Accessory Transfer Line      |
| Replacement Parts                                |                                      |
| 160-1135   | Window, KBr, 13 x 2 mm (single)      |
| 160-1008   | Window, KBr, 13 x 2 mm (6-pack)      |
| 140-2001   | GC Graphite Window Gasket            |
| 140-2010   | Ferrule for 0.25-mm coupling (5 ea.) |
| 140-2015   | Ferrule for 0.32-mm coupling (5 ea.) |
| 140-2020   | Ferrule for 0.53-mm coupling (5 ea.) |

## SPECIFICATIONS

|                               |                    |
|-------------------------------|--------------------|
| <b>Dimensions (W X D X H)</b> | 51 x 45 x 27 cm    |
| <b>Weight</b>                 | 16 kg              |
| <b>FTIR Placement</b>         | Right or Left Side |
| <b>Beam Height</b>            | Specific for FTIR  |
| <b>Detector Options</b>       | Yes                |
| <b>Purge</b>                  | Purgeable          |
| <b>Light Pipe Diameter</b>    | 1 mm               |
| <b>Light Pipe Pathlength</b>  | 120 mm             |
| <b>Maximum Temperature</b>    | 300 °C             |



GC-FTIR data for Isobutyl methacrylate (IBMA).

# External Sample Module

## AT A GLANCE

- ▶ Keeps sample compartment free for general sampling
- ▶ Full sized dimensions for all sample compartment accessories
- ▶ Choice of integrated detector
- ▶ Ideal for heated applications or a difficult experimental setup
- ▶ Customizable configuration

The External Sample Module is a versatile sampling station for FTIR spectrometers.

It provides an additional sample compartment to keep the main sample compartment of the FTIR free for routine sampling and also provides a location for a more complex sampling setup. Examples of experiments ideally suited to using the External Sample Module include a long-path gas cell, PIKE TGA/FTIR accessory, MappIR™ and the AutoDiff™ (PIKE's automated diffuse reflectance accessory). The sample compartment of the External Sample Module is full sized, and compatible with all PIKE Technologies accessories.

In addition to being a traditional sample compartment, the External Sample Module has a screw-hole grid for customized optical layouts with removable inner and outer walls.

The External Sample Module is compatible with either sealed and desiccated or purged FTIR spectrometers. It may be paired with most FTIR spectrometers with an external beam.



| PART NUMBER | DESCRIPTION  |
|-------------|--|
|             | External Sample Module ( <i>select external beam direction</i> ) |
| 155-10XXR   | External Sample Module, Right Side                               |
| 155-10XXL   | External Sample Module, Left Side                                |

**Notes:** External Sample Module include optics, mounting hardware, electrical cabling for FTIR, sample compartment windows, purge tubing and fittings to connect to purge gas. Replace XX with your spectrometer's Instrument Code listed in the back of the catalog. FTIR must be capable of interfacing with an external detector and have optics required for the external beam. A conversion kit may be required to use your sampling accessory in the sample compartment - contact PIKE Technologies.

|          | Detector for External Sample Module ( <i>must select one or more</i> ) |
|----------|--|
| 155-2010 | DLaTGS Detector  |
| 155-2020 | MCT Detector (mid-band)  |
| 155-2030 | MCT Detector (narrow-band)   |
| 155-2040 | MCT Detector (wide-band)   |

**Notes:** Detectors for the ESM may be exchanged by the customer and are pin-mounted for easy exchange without alignment. Please ask us about other detector options.

|          | Replacement Windows                  |
|----------|--------------------------------------|
| 160-1186 | Window, KBr, 50 x 3 mm               |
| 160-5030 | Window, BaF <sub>2</sub> , 50 x 3 mm |
| 160-1165 | Window, NaCl, 50 x 3 mm              |

## SPECIFICATIONS

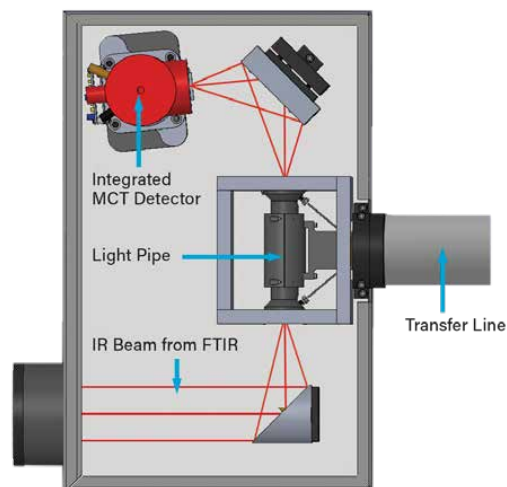
|  |                           |
|--|---------------------------|
| <b>Dimensions (W X D X H)</b>              | 615 x 490 x 205 mm        |
| <b>Weight</b>                              | 28 kg                     |
| <b>FTIR Placement</b>                      | Right or Left Side        |
| <b>Beam Height</b>                         | Specific for FTIR         |
| <b>Sample Compartment Size (W X D X H)</b> | 190 x 265 x 155 mm        |
| <b>Detector Options</b>                    | DTGS, MCT, others inquire |
| <b>Screw Hole Grid</b>                     | 1" OC, 1/4-20, sealed     |
| <b>Sample Compartment EFL</b>              | 6"                        |
| <b>Purge</b>                               | Purgeable                 |
| <b>Inner, Outer Walls</b>                  | Removable                 |
| <b>FTIR Compatibility</b>                  | Most                      |

# Optical Geometry

## External Accessories

### GC-FTIR ACCESSORY

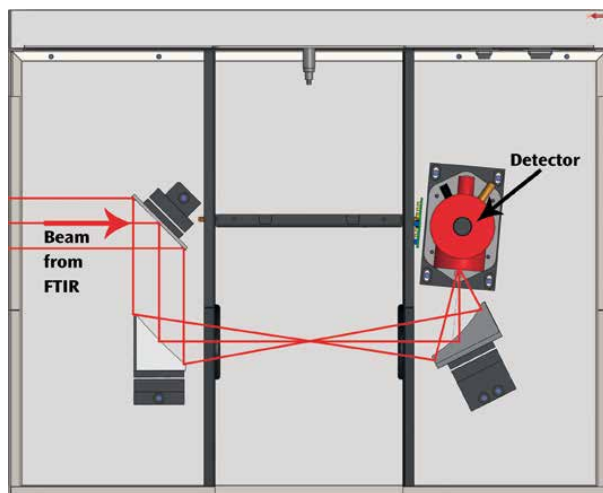
The GC-IR optical layout uses powered mirrors to focus the beam into the 1-mm gold light pipe and onto the detector. The heated transfer line introduces gas from the GC into the heated light pipe.



Optical geometry of the GC-FTIR Accessory.

### EXTERNAL SAMPLE MODULE

The External Sample Module provides a second full-size sample compartment to your FTIR instrument. The external sample compartment is fully purgeable and several detector options are available.



Optical geometry for right side External Sample Module.

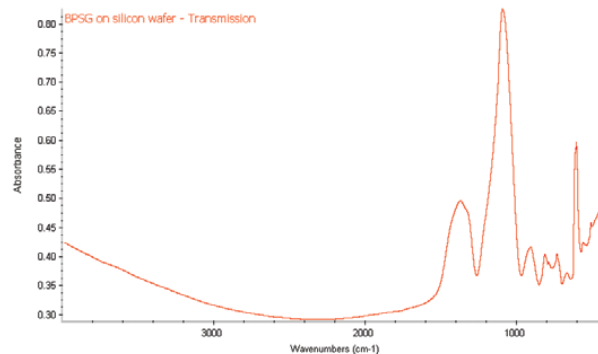
# Semiconductor Introduction and Applications

FTIR spectroscopy has established itself as a method of choice in several areas of industrial manufacturing. One of them is the quality control of semiconductor wafers. Here, the FTIR spectrometers are commonly used to measure Phosphosilicate glass (PSG) and Borophosphosilicate glass (BPSG) films, epitaxial film (EPI) thickness and interstitial oxygen and substitution carbon content.

Addition of boron and phosphorus to silicate glass during manufacturing improves the final product uniformity and reduces glass forming temperatures. Borophosphosilicate glass (BPSG) melts 100 °C lower than Phosphosilicate glass (PSG) and offers better flow characteristics. To maintain and optimize production processes, evaluation and verification of doping levels is required. FTIR allows simultaneous measurements of boron and phosphorus as well as the thickness of the glass in a quick and nondestructive procedure. The measurements are based on the interpretation of transmission spectra and quantification of boron, phosphorus and Si-O bands. K-matrix or Partial Least Squares (PLS) methods are used for concentration/ thickness calculations.

The epitaxial film (EPI) is a grown crystal layer having the same crystallographic orientation as the substrate crystal wafer. The epitaxial film differs from the substrate base as it is modified with various additives. Accurate, fast and precise determination of the EPI film thickness is important in the manufacturing process since film thickness and uniformity play a critical role in etching time and device yield across the wafer surface. Specular reflectance is used in FTIR measurements of the epitaxial layer thickness. The infrared beam enters the EPI layer, reflects off the substrate surface and makes another pass through the film when exiting. The film thickness calculations are based on one of the following methods:

- ▶ **Interference measurements** – also called Constant Angle Reflection Interference Spectroscopy or CARIS. This method uses the interference fringe pattern obtained in the specular reflectance experiment.
- ▶ **Interferogram subtraction** – based on the measurement of the primary and secondary interferogram of the sample and subtraction of this signal from that of the reference material.
- ▶ **Second Fourier Transform** of spectral response data (CEPSTRUM). This method takes the difference of two spectral response curves and performs a second Fourier transform which provides signal intensity versus sample thickness information.

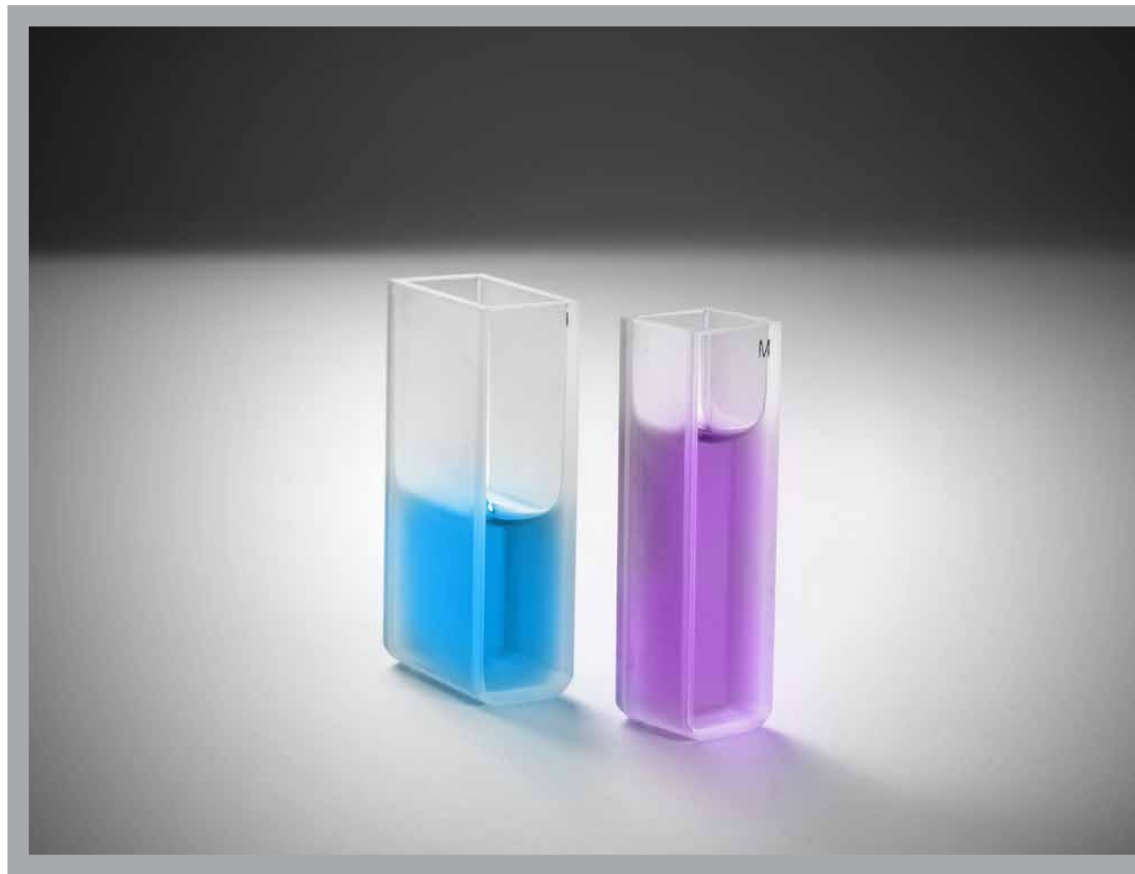


FTIR spectrum of BPSG on silicon wafer – transmission sampling mode.

Oxygen and carbon may be introduced to the molten silicon during the manufacturing process. These impurities can be trapped in the crystal lattice and affect final product characteristics. For these reasons, both need to be monitored and quantified. FTIR spectroscopy (transmission measurements) provides excellent means to perform this analysis. The application uses the absorption bands of Si-C and Si-O-Si to calculate concentration levels of substitution carbon and interstitial oxygen. Beer's law is typically used to determine their concentrations.



# UV-Vis Accessories



PIKE is addressing the growing need for more sophisticated UV-Vis accessories by featuring research-style specular reflectance accessories, polarizers and automated sampling stages. We also include a selection of most commonly used UV-Vis cuvettes and cuvette holders. Please contact us to discuss customized options.

# Cuvettes, Cells, Vials

PIKE Technologies offers a selection of the most popular cuvettes, vials and cell holders used in UV-Vis spectrophotometry.

The cuvettes are manufactured using a heat fusing method which ensures that they are fused into a single homogeneous unit. Cuvettes are carefully annealed to remove any residual strain for maximum cell integrity and physical strength. The cells can be used with most solvents and acidic solutions. Hydrofluoric acid (HF) and strong bases (pH >9) will negatively affect the cell surfaces.

## SPECIFICATIONS

|                                     |                  |
|-------------------------------------|------------------|
| <b>Window Thickness</b>             | 1.25 mm          |
| <b>Beam Height (Z-dimension)</b>    | 8.5 mm and 11 mm |
| <b>Optical Glass Spectral Range</b> | 334 to 2500 nm   |
| <b>Far UV Quartz Spectral Range</b> | 170 to 2700 nm   |
| <b>NIR Quartz Spectral Range</b>    | 220 to 3800 nm   |



With PTFE Cover



With PTFE Stopper



With PTFE Cover



With PTFE Stopper



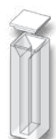
With PTFE Cover



With PTFE Stopper

## STANDARD RECTANGULAR CUVETTES

| Pathlength, mm | Volume, mL | Optical Glass (334–2500 nm) |          | Far UV Quartz (170–2700 nm) |          | NIR Quartz (220–3800 nm) |          |
|----------------|------------|-----------------------------|----------|-----------------------------|----------|--------------------------|----------|
| 1              | 0.4        | 162-0220                    | 162-0228 | 162-0236                    | 162-0244 | 162-0252                 | 162-0260 |
| 2              | 0.7        | 162-0221                    | 162-0229 | 162-0237                    | 162-0245 | 162-0253                 | 162-0261 |
| 5              | 1.7        | 162-0222                    | 162-0230 | 162-0238                    | 162-0246 | 162-0254                 | 162-0262 |
| 10             | 3.5        | 162-0223                    | 162-0231 | 162-0239                    | 162-0247 | 162-0255                 | 162-0263 |
| 20             | 7.0        | 162-0224                    | 162-0232 | 162-0240                    | 162-0248 | 162-0256                 | 162-0264 |
| 40             | 14.0       | 162-0225                    | 162-0233 | 162-0241                    | 162-0249 | 162-0257                 | 162-0265 |
| 50             | 17.5       | 162-0226                    | 162-0234 | 162-0242                    | 162-0250 | 162-0258                 | 162-0266 |
| 100            | 35.0       | 162-0227                    | 162-0235 | 162-0243                    | 162-0251 | 162-0259                 | 162-0267 |



With PTFE Cover/Clear



With PTFE Cover/Black Walled



With PTFE Stopper/Clear



With PTFE Stopper/Black Walled

## SEMI-MICRO RECTANGULAR CUVETTES – 4-mm Opening

| Pathlength, mm | Volume, mL | Optical Glass (320–2500 nm) |          |          |          |
|----------------|------------|-----------------------------|----------|----------|----------|
| 5              | 0.7        | 162-0268                    | 162-0273 | 162-0278 | 162-0283 |
| 10             | 1.4        | 162-0269                    | 162-0274 | 162-0279 | 162-0284 |
| 20             | 2.8        | 162-0270                    | 162-0275 | 162-0280 | 162-0285 |
| 40             | 5.6        | 162-0271                    | 162-0276 | 162-0281 | 162-0286 |
| 50             | 7.0        | 162-0272                    | 162-0277 | 162-0282 | 162-0287 |

| Pathlength, mm | Volume, mL | Far UV Quartz (170–2700 nm) |          |          |          |
|----------------|------------|-----------------------------|----------|----------|----------|
| 5              | 0.7        | 162-0288                    | 162-0293 | 162-0298 | 162-0303 |
| 10             | 1.4        | 162-0289                    | 162-0294 | 162-0299 | 162-0304 |
| 20             | 2.8        | 162-0290                    | 162-0295 | 162-0300 | 162-0305 |
| 40             | 5.6        | 162-0291                    | 162-0296 | 162-0301 | 162-0306 |
| 50             | 7.0        | 162-0292                    | 162-0297 | 162-0302 | 162-0307 |

## MICRO RECTANGULAR CUVETTES – 2-mm Opening

| Pathlength, mm | Volume, mL | Optical Glass (320–2500 nm) |          |          |          |
|----------------|------------|-----------------------------|----------|----------|----------|
| 5              | 0.35       | 162-0308                    | 162-0313 | 162-0318 | 162-0323 |
| 10             | 0.7        | 162-0309                    | 162-0314 | 162-0319 | 162-0324 |
| 20             | 1.4        | 162-0310                    | 162-0315 | 162-0320 | 162-0325 |
| 40             | 2.8        | 162-0311                    | 162-0316 | 162-0321 | 162-0326 |
| 50             | 3.5        | 162-0312                    | 162-0317 | 162-0322 | 162-0327 |

| Pathlength, mm | Volume, mL | Far UV Quartz (170–2700 nm) |          |          |          |
|----------------|------------|-----------------------------|----------|----------|----------|
| 5              | 0.35       | 162-0328                    | 162-0333 | 162-0338 | 162-0343 |
| 10             | 0.7        | 162-0329                    | 162-0334 | 162-0339 | 162-0344 |
| 20             | 1.4        | 162-0330                    | 162-0335 | 162-0340 | 162-0345 |
| 40             | 2.8        | 162-0331                    | 162-0336 | 162-0341 | 162-0346 |
| 50             | 3.5        | 162-0332                    | 162-0337 | 162-0342 | 162-0347 |

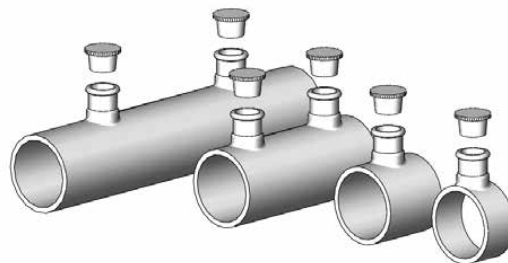


# Cell Holders

## CYLINDRICAL CELLS WITH TEFLON STOPPERS

| Pathlength mm | Volume mL | Optical Glass (334–2500 nm) | Far UV Quartz (170–2700 nm) | NIR Quartz (220–3800 nm) |
|---------------|-----------|-----------------------------|-----------------------------|--------------------------|
| 10            | 2.8       | 162-1831                    | 162-1841                    | 162-1801                 |
| 20            | 5.6       | 162-1832                    | 162-1842                    | 162-1802                 |
| 50            | 14.1      | 162-1835                    | 162-1845                    | 162-1805                 |
| 100           | 28.2      | 162-1840                    | 162-1850                    | 162-1810                 |

**Note:** All cylindrical cells have an outside diameter of 22 mm and an inside diameter of 19 mm.



Cylindrical cells.

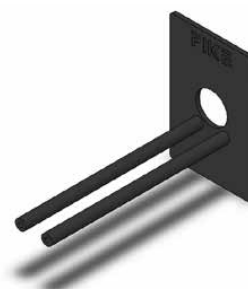
## VIALS AND DISPOSABLE CUVETTES

|          |   |
|----------|---|
| 162-0205 | 5-mm Disposable Glass Vials, 5 x 42 mm (200 ea.)                                |
| 162-0208 | 8-mm Glass Vials, 8 x 43 mm (200 ea.)   |
| 162-0212 | 12-mm Glass Vials, 12 x 32 mm (200 ea.)   |
| 162-0348 | Polystyrene, Disposable Cuvettes, 10-mm pathlength, 4.5 mL (100 ea.)            |
| 162-0349 | Polystyrene, Semi-micro Disposable Cuvettes, 10-mm pathlength, 1.5 mL (100 ea.) |

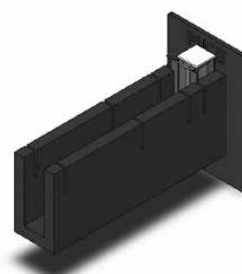
## CELL HOLDERS, SPACERS AND STOPPERS

|          |   |
|----------|---|
| 111-3650 | Cuvette Holder, 10 mm                           |
| 111-3660 | Adjustable Cuvette Holder, 10–100 mm            |
| 161-2530 | Slide Sample Holder, Cylindrical Cell, 10–20 mm |
| 161-2540 | Slide Sample Holder, Cylindrical Cell, 50 mm    |
| 161-2550 | Slide Sample Holder, Cylindrical Cell, 100 mm   |
| 162-1201 | Spacer for 1-mm pathlength cuvette              |
| 162-1202 | Spacer for 2-mm pathlength cuvette              |
| 162-1205 | Spacer for 5-mm pathlength cuvette              |
| 162-3685 | Vial Holder, 5 mm                               |
| 162-3688 | Vial Holder, 8 mm                               |
| 162-3682 | Vial Holder, 12 mm                              |

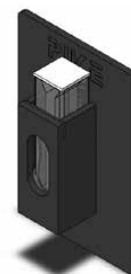
**Notes:** Please contact PIKE Technologies for replacement Teflon stoppers, covers, and for items not described on this list.



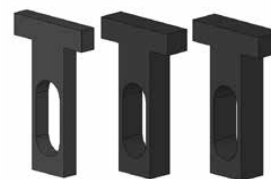
Cylindrical Cell Holder.



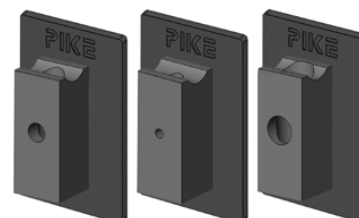
Adjustable Cuvette Holder.



10-mm Cuvette Holder.



Spacers for 1-, 2- and 5-mm cells.



Vial Holders for 12-, 8- and 5-mm cells.

# Peltier-Controlled Cuvette Holders

## AT A GLANCE

- ▶ Fast temperature response
- ▶ Precision temperature control
- ▶ Variable built-in magnetic stirring
- ▶ Single- and dual-beam configurations

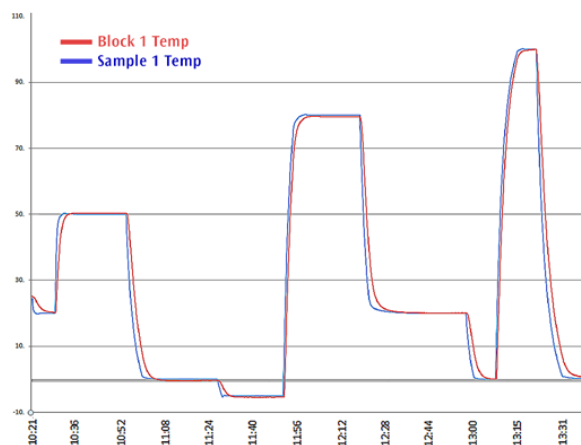


TEMPERATURE CONTROL  
OPTIONS AVAILABLE

Peltier-Controlled Cuvette Holders for UV-Vis spectrophotometers are designed for experiments under tightly-controlled temperature conditions. The temperature range is -5 to 110 °C.

The cuvette holder can be used with single- and dual-beam spectrophotometers, and is offered in single or twin configurations. Each temperature-controlled cuvette holder features an efficient heat exchange design, variable speed magnetic stirrers, and a thermoelectric cooler based on Peltier principle. Liquid flow is used to remove excess heat from Peltier elements.

The Peltier cuvette holders are designed to accommodate standard size 10-mm pathlength cuvettes and shorter path cuvettes with appropriate spacers. The holders accommodate 8.5-mm and 15-mm beam Z-height configurations.




Accessory performance showing block temperature (red) and sample probe temperature (blue).

The temperature controller is configured for a single or dual channel used with the single and twin design, respectively. Temperature may be controlled from the precision block RTD sensor or from an optional external temperature RTD probe inserted into the sample cell. All temperature control modules have a USB port for PC communication and may be used with PIKE TempPRO software, which provides functions for accessory programming, setting of temperature points and ramping. Temperature control modules have a touchscreen LCD panel featuring intuitive, menu-driven programming. Single set points or simple ramping functions can be preprogrammed and performed.



**SPECIFICATIONS**

**Cuvette Holders**  
 Temperature Range -5 °C to 110 °C  
 Precision +/- 0.05 °C  
 Temperature Accuracy +/- 0.3 °C from -5 °C to 110 °C  
 Stirring Speeds 10 Steps, Variable  
 Cuvette Size 12.5 x 12.5 mm  
 (accommodates smaller size with appropriate spacers)  
 Z-height 8.5 mm and 15 mm  
**RTD Probe** 2 Wire Pt RTD (low drift, high stability)  
**Dimensions** (W X D X H) 83 x 105 x 85 mm  
**Temperature Controller** Touch-panel display with USB interface. PIKE TempPRO software (sold separately) for PC control with unlimited ramps and automated data collection.  
  
**Precision** +/- 0.1 °C  
**Channels** Single or Dual  
**Functions** Set point, temperature ramping  
**Input** 100–240 VAC, auto setting, external power supply.  
**Output** 16 VDC/60 W maximum

| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 171-70XXX   | Peltier Cuvette Holder, single – liquid regulated          |
| 171-80XXX   | Peltier Cuvette Holder, twin – liquid regulated            |
| 076-1510    | Digital Temperature Control Module, LCD/PC, single channel |
| 076-1515    | Digital Temperature Control Module, LCD/PC, dual channel   |
| 007-0207    | PIKE TempPRO Software                                      |
| 171-1905    | RTD Probe for Peltier cuvette                              |
| 170-1100    | Liquid Recirculator for Peltier cuvette                    |
| 162-1905    | Micro Stir Bar, 6.35 mm (l) x 3 mm (dia)                   |

**Notes:** Replace XXX with your spectrophotometer's Instrument Code listed in the back of the catalog. Temperature Control Module must be selected.

| Spacers  |                                    |
|----------|------------------------------------|
| 162-1201 | Spacer for 1-mm pathlength cuvette |
| 162-1202 | Spacer for 2-mm pathlength cuvette |
| 162-1205 | Spacer for 5-mm pathlength cuvette |



With PTFE Cover      With PTFE Stopper      With PTFE Cover      With PTFE Stopper      With PTFE Cover      With PTFE Stopper

| STANDARD RECTANGULAR CUVETTES |            |                             |          |                             |          |                          |          |
|-------------------------------|------------|-----------------------------|----------|-----------------------------|----------|--------------------------|----------|
| Pathlength, mm                | Volume, mL | Optical Glass (334–2500 nm) |          | Far UV Quartz (170–2700 nm) |          | NIR Quartz (220–3800 nm) |          |
| 1                             | 0.4        | 162-0220                    | 162-0228 | 162-0236                    | 162-0244 | 162-0252                 | 162-0260 |
| 2                             | 0.7        | 162-0221                    | 162-0229 | 162-0237                    | 162-0245 | 162-0253                 | 162-0261 |
| 5                             | 1.7        | 162-0222                    | 162-0230 | 162-0238                    | 162-0246 | 162-0254                 | 162-0262 |
| 10                            | 3.5        | 162-0223                    | 162-0231 | 162-0239                    | 162-0247 | 162-0255                 | 162-0263 |
| 20                            | 7.0        | 162-0224                    | 162-0232 | 162-0240                    | 162-0248 | 162-0256                 | 162-0264 |
| 40                            | 14.0       | 162-0225                    | 162-0233 | 162-0241                    | 162-0249 | 162-0257                 | 162-0265 |
| 50                            | 17.5       | 162-0226                    | 162-0234 | 162-0242                    | 162-0250 | 162-0258                 | 162-0266 |
| 100                           | 35.0       | 162-0227                    | 162-0235 | 162-0243                    | 162-0251 | 162-0259                 | 162-0267 |

**Note:** Please see Cuvettes, Cells, Vials and Holders product page for a full selection of cuvettes.

# Falcon UV-Vis

## AT A GLANCE

- ▶ Fast and easy analysis of samples under precise Peltier temperature control
- ▶ Choice of cuvette and vial adapters
- ▶ Compatible with 1- to 10-mm pathlength cuvettes and vials
- ▶ Excellent thermal accuracy and precision
- ▶ Available for selected UV-Vis spectrophotometers



TEMPERATURE CONTROL  
OPTIONS AVAILABLE

Falcon UV-Vis temperature control accessory is an excellent choice for analysis of liquid samples that require precise temperature control.

## DESIGN




The accessory is well suited for pharmaceutical, life science and general industrial applications. Temperature range of the accessory is 5 °C to 130 °C with +/- 0.5% accuracy. Heating and cooling is controlled by a built-in Peltier device. The Peltier element provides for reproducible ramping and for reaching target temperatures quickly and reliably. The system is driven by a digital temperature control module – directly, or via PC. Individual sample holders are designed to accommodate standard 1- to 10-mm cuvettes (1-, 2- and 5-mm cuvettes require use of spacers) and 5-, 8- and 12-mm glass vials. Sample holders are pin positioned to ensure maximum reproducibility.

## UV-VIS CONFIGURATION

The complete Falcon UV-Vis configuration requires the accessory base, vial or cuvette holder, and the digital temperature control module. The Falcon accessory is compatible with select UV-Vis spectrophotometers.



## SPECIFICATIONS

|   |   |
|---|---|
| <b>Temperature Control</b>  | Peltier (cooling and heating)   |
| <b>Temperature Range</b>  | 5 °C to 130 °C  |
| <b>Accuracy</b>   | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C   |
| <b>Sensor Type</b>  | 3 wire Pt RTD (low drift, high stability)   |
| <b>Dimensions (W X D X H)</b>   | 89 x 121 x 83 mm<br>(without FTIR baseplate and mount)  |
| <b>Temperature Controller</b>   | Touch-panel display with USB interface.<br>PIKE TempPRO software (sold separately)<br>for PC control with unlimited ramps and<br>automated data collection. |
|    |   |
| <b>Input</b>  | 100–240 VAC, auto setting, external<br>power supply   |
| <b>Output</b>   | 16 VDC/150 W maximum  |

## WATER COOLING

Peltier device must be water-cooled for proper operation. This is achieved by running cold tap water through the water jacket integrated into the accessory shell, or by the use of an external liquid circulator.



Liquid Recirculator.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 110-60XXX   | Falcon UV-Vis Base  |
|             | <b>Note:</b> Replace XXX with your spectrophotometer's Instrument Code listed in the back of the catalog. |
|             | <b>Temperature Controllers (must choose)</b>  |
| 076-1510    | Digital Temperature Control Module  |
| 007-0207    | PIKE TempPRO Software   |
|             | <b>Note:</b> TempPRO software is needed to operate the Falcon using a PC.                                 |
|             | <b>Sample Holders (must choose at least one)</b>  |
| 111-3610    | Vial Holder, 5 mm   |
| 111-3620    | Vial Holder, 8 mm   |
| 111-3630    | Vial Holder, 12 mm  |
| 111-3640    | Cuvette Holder, 1 cm  |
|             | <b>Notes:</b> Spacers for short pathlength cuvettes are designed to work only with 1-cm cuvette holder.   |
|             | <b>Options</b>  |
| 162-0205    | Glass Vials, 5 mm, 5 x 42 mm OD (200 ea.)   |
| 162-0208    | Glass Vials, 8 mm, 8 x 43 mm OD (200 ea.)   |
| 162-0212    | Glass Vials, 12 mm, 12 x 32 mm OD (200 ea.)   |
| 162-0255    | Falcon Quartz Cuvette, 1 cm   |
| 162-1201    | Spacer for 1-mm Cuvette   |
| 162-1202    | Spacer for 2-mm Cuvette   |
| 162-1205    | Spacer for 5-mm Cuvette   |
| 170-1100    | Liquid Recirculator   |
|             | <b>Note:</b> Please see more cuvette options under Cuvettes, Cells, Vials and Holders.                    |

# UV-Vis DiffusIR

## AT A GLANCE

- ▶ Micrometer-controlled sample focus to optimize results for every sample
- ▶ Easy sample loading
- ▶ Optional environmental chambers for heating, cooling and high-vacuum applications
- ▶ Quick-release feature of environmental chambers for easy insertion and removal of sealed chambers
- ▶ Digital PC temperature controller option for programming ramping rates and isothermal hold times



TEMPERATURE CONTROL  
OPTIONS AVAILABLE



The UV-Vis DiffusIR™ diffuse reflection accessory is great for research and routine measurements.

## DESIGN

Powered optical mirrors are diamond-turned aluminum for optimal performance and reflectivity. The UV-Vis DiffusIR base is completely enclosed to shield against external light. To avoid additional stray light from filtering into the accessory, a magnetically-attached light shield is included to cover the sample slide. The standard configuration offers a two-position slide to accommodate reference and sample cups.

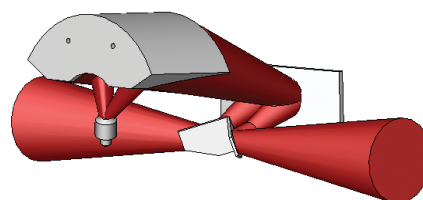
The heart of the UV-Vis DiffusIR is a unique monolithic ellipsoidal reflector permanently fixed in place – eliminating the need for repositioning the focus optics for sample placement. The optical design efficiently collects diffuse radiation generated from the sample. The sample Z-position can be optimized by using the micrometer sample focusing adjustment. In this manner the sensitivity of the accessory is maximized without sacrificing precision. The UV-Vis DiffusIR comes equipped with a Sample Preparation and Loading Kit.

For advanced temperature studies, environmental chambers are available and may be configured for temperatures from -150 °C to 1000 °C. Using the chamber's porous ceramic sample cups, reaction gases may be flowed through the sample. All chambers are compatible with the MIR/NIR DiffusIR also.



Environmental Chamber for the UV-Vis DiffusIR.

Coupling the UV-Vis DiffusIR and environmental chambers with the PIKE Digital Temperature Control Module and TempPRO™ software provides the ability to graphically set up the experiment with multiple ramps and hold times.



Optical geometry of the UV-Vis DiffusIR.

| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 041-10XXX   | UV-Vis DiffusIR Accessory<br>Includes Sample Preparation Kit with 2 micro and 2 macro sample cups, sample loading tools, alignment mirror, 35-mm mortar with pestle and KBr powder (100 g) |

**Notes:** Replace XXX with your spectrophotometer's Instrument Code listed in the back of the catalog.

#### Environmental Chamber Options

|          |  |
|----------|--|
| 162-4200 | Environmental Chamber, HTV, ambient to 1000 °C |
| 162-4140 | Environmental Chamber, LTV, -150 to 500 °C     |

**Notes:** HTV and LTV chambers require the selection of a temperature control module. UV-Vis DiffusIR chambers include front plate accommodating environmental chamber (easily changeable with standard UV-Vis DiffusIR front plate), Pin-Loc chamber insertion for easy sample exchange, KBr window, ceramic sampling cups compatible with vacuum and reaction formats, ports and 2 shut-off valves for vacuum operation and ports for connection of water cooling. Operation of the LTV at sub-ambient temperatures requires PN 162-4165 or 162-4166 Liquid Nitrogen-Cooled System and Temperature Control Module, and rotary pump for vacuum insulation. All chambers require a liquid circulator to reduce heat transfer to the outer housing and to preserve the life of the chamber heaters.

### ENVIRONMENTAL CHAMBER SPECIFICATIONS

|   |   |
|---|---|
| <b>Temperature Range, HTV</b>   | Ambient to 1000 °C  |
| <b>Temperature Range, LTV</b>   | -150 to 500 °C  |
| <b>Accuracy</b>   | +/- 0.5° up to 100 °C<br>+/- 0.5% of set point > 100 °C   |
| <b>Heating Rate, Maximum</b>  | Up to 20 °C/min HTV   |
| <b>Temperature Control</b>  | Digital   |
| <b>Kinetic Setup</b>  | Touch-panel display   |
| <b>Requires Digital Temperature Control Module, And PIKE TempPRO Software (sold Separately)</b> | Unlimited temperature ramps<br>Individual ramp rate and hold time settings<br>Graphical display of experiment settings<br>Trigger data collection at specified times or temperatures<br>USB interface |
| <b>Sensor</b>   | K Type (for HTV)<br>RTD Type, Pt100 (for LTV)   |
| <b>Input</b>  | 100–240 VAC (HTV and LTV versions)  |
| <b>Output</b>   | 28 VDC/84 W maximum (HTV version)<br>54VDC/84 W maximum (LTV version)   |
| <b>Vacuum Achievable</b>  | 1 x 10 <sup>-6</sup> Torr (13 x 10 <sup>-4</sup> Pa)  |
| <b>Window Size</b>  | 32 x 3 mm disk  |
| <b>Leaking Rate</b>   | < 6.0 x 10 <sup>-11</sup> Pa m <sup>3</sup> /sec  |
| <b>Sample Cup Size</b>  | 6.0-mm OD, 4.0-mm height<br>4.7-mm ID, 2.0-mm depth   |
| <b>Sample Cup Design</b>  | Porous ceramic compatible with powders and gas flow   |
| <b>Cooling Ports</b>  | Quick-Fit, 6-mm ID  |
| <b>Gas/Vacuum Ports</b>   | ½" Swagelok®  |

| Temperature Control Modules |  |
|-----------------------------|--|
| 076-2550                    | Digital Temperature Control Module   |
| 007-0207                    | PIKE TempPRO Software  |
| 162-4165                    | Liquid Nitrogen-Cooled System and Temperature Control Module DiffusIR Environmental Chamber, LTV, -150 to 500 °C (115 V) |
| 162-4166                    | Liquid Nitrogen-Cooled System and Temperature Control Module DiffusIR Environmental Chamber, LTV, -150 to 500 °C (230 V) |

**Notes:** Digital Temperature Control Module with TempPRO software (sold separately) provides a graphical user interface for setting experiment parameters and data collection. Please contact PIKE for PC compatibility. The Temperature Control Modules for the HTV and LTV chambers are not interchangeable.

#### Replacement Parts and Supplies

|          |   |
|----------|---|
| 170-1100 | Liquid Recirculator                               |
| 042-2010 | Sample Cup, micro, 6-mm diameter (2 ea.)          |
| 042-2020 | Sample Cup, macro, 10-mm diameter (2 ea.)         |
| 042-3010 | Abrasion Sampling Kit                             |
| 042-3020 | Abrasion Disks, silicon carbide (100 ea.)         |
| 042-3025 | Abrasion Disks, diamond (50 ea.)                  |
| 042-3030 | Sample Cup Holder and Base                        |
| 160-8010 | KBr Powder, 100 g                                 |
| 042-3040 | Sample Preparation Kit                            |
| 042-3060 | Flat Sample Post                                  |
| 042-3080 | Alignment Mirror, aluminum                        |
| 162-4298 | Rotary Pump for Vac Insulation, 115V              |
| 162-4299 | Rotary Pump for Vac Insulation, 230V              |
| 160-1132 | Disk, KBr, 32 x 3 mm                              |
| 160-1113 | Disk, ZnSe, 32 x 3 mm                             |
| 160-1372 | Disk, UV-Vis SiO <sub>2</sub> , 32 x 3 mm         |
| 160-5049 | Disk, SiO <sub>2</sub> , 32 x 3 mm                |
| 160-5125 | Disk, low OH SiO <sub>2</sub> , 32 x 3 mm         |
| 160-1143 | Disk, CaF <sub>2</sub> , 32 x 3 mm                |
| 162-4210 | O-Ring for DiffusIR chamber (10 ea.)              |
| 162-4215 | O-Ring for DiffusIR chamber cooling line (10 ea.) |
| 162-4251 | Ceramic Cup for DiffusIR chamber, porous          |
| 162-4270 | Alignment Mirror for DiffusIR chamber             |

**Note:** Please contact PIKE Technologies for items not described in this list.

### SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Optical Design</b>         | 3X ellipsoidal  |
| <b>Angle Of Incidence</b>     | 30 degrees, nominal   |
| <b>Dimensions (W X D X H)</b> | 102 x 225 x 201 mm<br>(excluding light guard tubes and baseplate)     |
| <b>Sample Focus</b>           | Micrometer  |
| <b>Sample Positions</b>       | 2 positions, slide stops for background and sample with no purge loss |
| <b>Sample Cups</b>            | Micro: 6 diameter x 1.6 mm deep<br>Macro: 10 diameter x 2.3 mm deep   |

# Calcite Polarizers

## AT A GLANCE

- ▶ Glan-Taylor and UV Glan-Thompson designs
- ▶ High-grade calcite
- ▶ High extinction ratio
- ▶ Manual versions – 2 degree settable angular resolution
- ▶ Automated version – 0.5 degree angular resolution
- ▶ Fits in a standard 2 x 3 inch mount



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE

PIKE Technologies offers Glan-Taylor and Glan-Thompson UV-Vis polarizers. These take advantage of the birefringent properties of UV-quality calcite.

## DESIGN

An air interface is assembled between two right angle calcite prisms in the Glan-Taylor polarizer whereas a UV-transparent cement separates the calcite prisms in the Glan-Thompson polarizer. In both styles, the polarized extraordinary ray passes through both prisms and the ordinary ray is internally reflected and absorbed. The spectral range of these polarizers is 250–2300 nm. Due to the natural origin of calcite the achievable minimum wavelength fluctuates from polarizer to polarizer. However, at 250 nm the transmission throughput is no less than 25%.

|                          |     |     |     |      |
|--------------------------|-----|-----|-----|------|
| Wavelength (nm)          | 250 | 300 | 400 | >500 |
| Minimum Transmission (%) | 25  | 40  | 65  | 85   |

Each polarizer type has a different field of view where the UV-Vis beam is polarized. The UV Glan-Thompson field of view is wider compared to the Glan-Taylor as shown in the figure on the next page.

Enhanced angular resolution of 0.5° is gained with the automated version of the PIKE UV-Vis polarizer. This automated feature is advantageous where highly precise angular settings are required and for increasing the measurement simplicity for determining the polarized orientation of a sample. By evaluating the transmission or reflection of a sample as a function of the automated polarizer angle at a given wavelength, parallel and perpendicular orientation of the sample relative to the polarizer degree setting may be determined. The automated version includes integrated data collection with some commercial UV-Vis spectrophotometer software packages.

## APPLICATIONS

The sample material and sampling configuration dictate the need for a UV-Vis polarizer. Typical materials that may require a polarizer during sampling are often crystals, films, paints, beam splitters, coated glass, and anti-reflective, and anti-glare coatings. Additionally, we recommend using a polarizer for specular reflection sampling at an angle of incidence greater than 15 degrees where the reflectivity becomes polarization dependent.

Automated Polarizer.



Manual Polarizer.



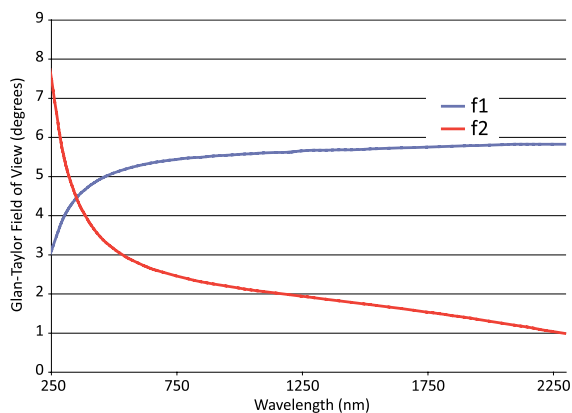
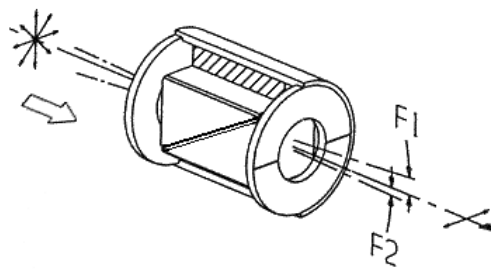
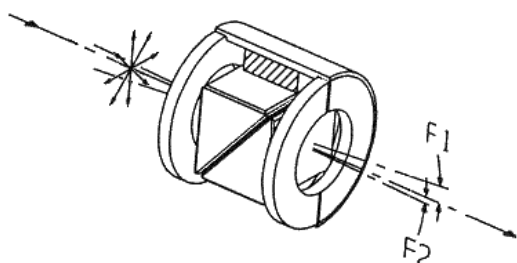


SPECIFICATIONS

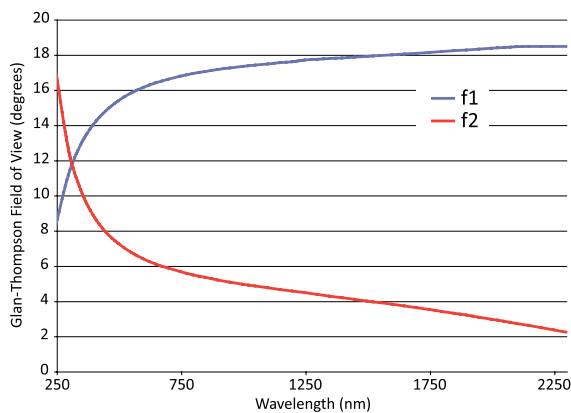
|   |                    |                    |
|---|--------------------|--------------------|
|   | Glan-Taylor        | UV Glan-Thompson   |
| <b>Material</b>                                   | Calcite            | Calcite            |
| <b>Spectral Range</b>                             | 250-2300 nm        | 250-2300 nm        |
| <b>Clear Aperture</b>                             | 12 mm              | 14 mm              |
| <b>Extinction Ratio</b>                           | $5 \times 10^{-5}$ | $1 \times 10^{-4}$ |
| <b>Manual Polarizer Dimensions (W X D X H)</b>    | 29 x 50 x 146 mm   | 49 x 50 x 146 mm   |
| <b>Automated Polarizer Dimensions (W X D X H)</b> | 56 x 50 x 146 mm   | 56 x 50 x 146 mm   |
| <b>Angular Resolution, Manual</b>                 | 2°                 | 2°                 |
| <b>Angular Resolution, Auto</b>                   | 0.5°               | 0.5°               |

| PART NUMBER | DESCRIPTION                |
|-------------|----------------------------|
| 198-1623    | Manual Glan-Taylor         |
| 198-1624    | Manual UV Glan-Thompson    |
| 198-1625    | Automated Glan-Taylor      |
| 198-1626    | Automated UV Glan-Thompson |

**Note:** Polarizers may not fit in the sample compartments of some smaller spectrophotometers. The automated polarizers include the PIKE Technologies Motion Control Unit and AutoPRO software for automated operation. Please consult PIKE Technologies before placing an order or to inquire about spectrophotometer slide mount holders.



Glan-Taylor field of view.



UV Glan-Thompson field of view.

# Nanowire Grid Polarizers

## AT A GLANCE

- ▶ Thin profile
- ▶ Large acceptance angle, up to 20 degrees
- ▶ High transmission and high contrast choices
- ▶ Manual and automated versions



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE

An innovative new line of high-contrast polarizers covering the UV region and the Vis to NIR region.

Using nanofabricating techniques, wire grid lines at a 100-nm pitch are etched on fused silica or glass substrate resulting in a high-performance polarizer. Compared to a traditional calcite polarizer, the large acceptance angle of the nanowire grid polarizer, greater than 20 degrees, eases alignment concerns during use. Additionally, the compact size makes these polarizers ideal for use in confined spaces.

Transmission and contrast ratio of the UV ultra contrast and the broadband polarizers are shown in the next column. Contrast ratio greater than 10,000:1 may be found, making these high-performance polarizers a competitive alternative to calcite polarizers.

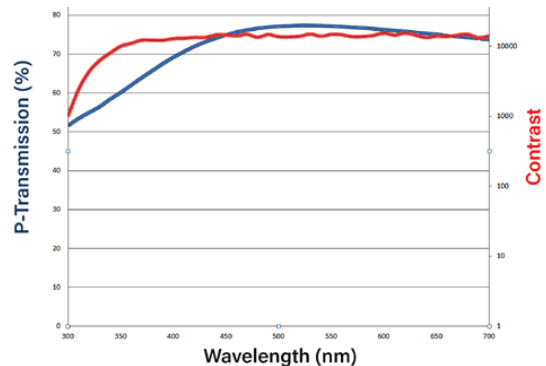
There are two manual polarizer types available. The manual polarizer has a 5 degree scale resolution and the precision polarizer has scale resolution of 1 degree. The automated precision polarizers offer the added benefit of increased setting reproducibility with accuracy of +/- 0.5 degree. With automated polarizers an analysis program can be set up through PIKE AutoPRO software, and includes data collection with some spectrophotometer software packages.

| PART NUMBER | DESCRIPTION   |
|-------------|---|
| 190-2010    | Precision UV Polarizer, Ultra Contrast                          |
| 190-2012    | Manual UV Polarizer, Ultra Contrast                             |
| 190-2015    | Precision UV Polarizer, Ultra Contrast, Automated               |
| 190-2020    | Precision Vis/NIR Broadband Polarizer, High Contrast            |
| 190-2022    | Manual Vis/NIR Broadband Polarizer, High Contrast               |
| 190-2025    | Precision Vis/NIR Broadband Polarizer, High Contrast, Automated |

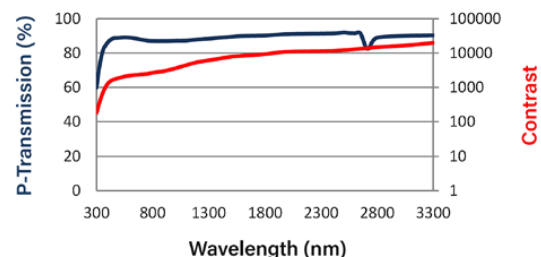
**Notes:** The element diameter is 25 mm. Polarizers may not fit in the sample compartments of some smaller spectrophotometers. The automated polarizers include the PIKE Technologies Motion Control Unit and AutoPRO software for automated operation. Please consult PIKE Technologies before placing an order or to inquire about spectrophotometer slide mount holders.

## SPECIFICATIONS

|                               |                       |
|-------------------------------|-----------------------|
| <b>Substrate</b>              | Fused silica or glass |
| <b>Performance Range</b>      |                       |
| UV, Ultra Contrast            | 240–400 nm            |
| Vis/NIR                       | 300–3200 nm           |
| <b>Element Diameter</b>       | 25 mm                 |
| <b>Clear Aperture</b>         | 19 mm                 |
| <b>Dimensions (W X D X H)</b> |                       |
| Manual                        | 50 x 86 x 17 mm       |
| Precision                     | 50 x 146 x 17 mm      |
| Automated                     | 50 x 146 x 55 mm      |



UV Ultra-Contrast Polarizer performance data.



Broadband Polarizer performance data.

Automated UV-Vis Nanowire  
Grid Polarizer.



# UV-Vis Spec Accessories

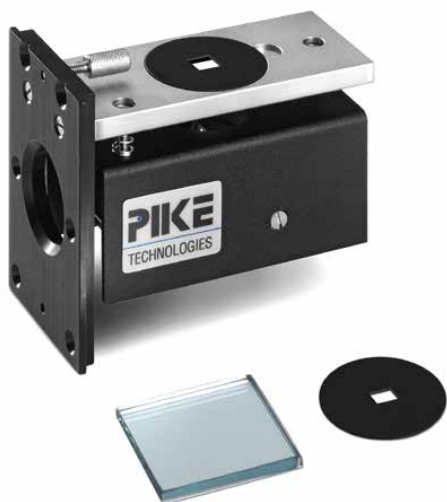
## AT A GLANCE

- ▶ Fixed angle reflection accessories including 15, 20, 30, 45 and 60 degrees
- ▶ Slide mount design for easy installation
- ▶ Optical and anti-reflective coatings testing
- ▶ Gloss measurements
- ▶ Determining reflectivity of mirrors
- ▶ Film thickness calculations

The relative fixed angle specular reflection accessories for UV-Vis spectrophotometers span from near-normal to grazing angle.

These specular reflection accessories featuring slide mount design. These cover mid-range angles of incidence, between 15–60 degrees, and may be aligned to maximize throughput.

In specular reflection sampling, the light source is directed to contact the sample at a given angle of incidence. Measured light is collected from the equivalent angle. Typical samples include semiconductors, anti-reflective coatings, color filters, semi-transparent and highly reflective mirrors, optical materials, reflection filters, multiple layers, solar mirrors and solar controlling films on glass. Measured parameters of interest include film thickness, material reflectivity, and coating uniformity and homogeneity.

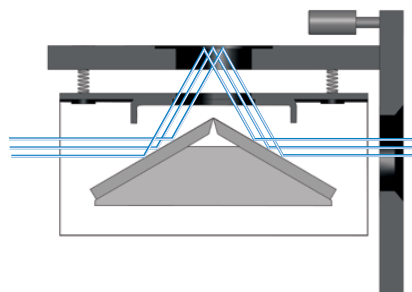


| PART NUMBER | DESCRIPTION                        |
|-------------|------------------------------------|
| 121-1500    | UV-Vis 15Spec                      |
| 121-2000    | UV-Vis 20Spec                      |
| 121-3000    | UV-Vis 30Spec                      |
| 121-4500    | UV-Vis 45Spec                      |
| 121-6000    | UV-Vis 60Spec                      |
| 300-0300    | UV Aluminum Mirror, 25.4 x 25.4 mm |
| 121-0500    | Aperture Mask, 4 x 7 mm            |

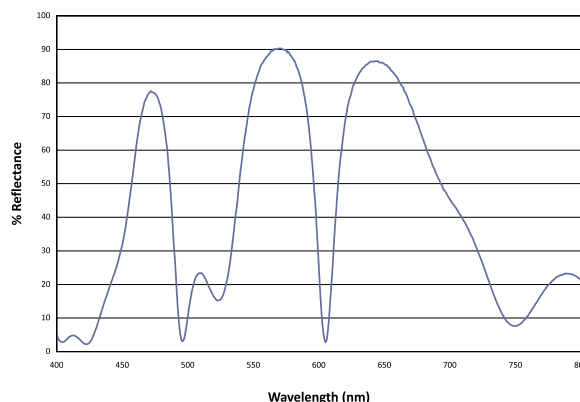
**Note:** Please contact PIKE Technologies to inquire about spectrophotometer sample compartment slide mounts.

## SPECIFICATIONS

|                               |                       |
|-------------------------------|-----------------------|
| <b>Mounting Method</b>        | Slide mount           |
| <b>Dimensions (W X D X H)</b> | 95 x 51 x 76 mm       |
| <b>Mask Aperture</b>          | 4 x 7 mm              |
| <b>Optical Mirrors</b>        | UV-optimized aluminum |



Optical geometry schematic for mid-range fixed angle specular reflection accessory.



Anti-reflective optics coating spectrum collected using the PIKE UV-Vis 60Spec.

# UV-Vis 10Spec

## AT A GLANCE

- ▶ Measure sample reflectance
- ▶ Fixed 10 degree angle of incidence
- ▶ Sample illumination using collimated beam precisely fixed at 10 degrees
- ▶ Sampling mask sizes of 7, 13 and 25 mm x 4 mm
- ▶ Baseplate mount design for stable operation and collection of high-quality spectra

The UV-Vis 10Spec is an optimized specular reflection accessory designed to make high-performance measurements of sample reflectivity.

For slightly focused beams, the UV-Vis 10Spec produces a collimated beam to illuminate the sample area such that the reflectivity measurement is uniformly 10 degrees and not an average of angles produced by a focused beam accessory design. This accessory fits most research-grade spectrophotometers.

The UV-Vis 10Spec may also be used to measure near-normal reflectivity of a wide variety of surfaces including military devices, reflecting optics, anti-reflective (AR) coated surfaces, and other reflecting and non-reflecting materials.



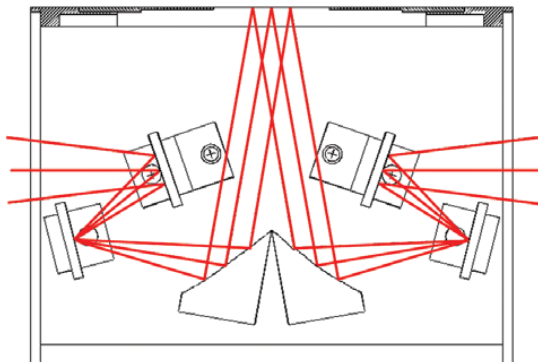
| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 010-10XXX   | UV-Vis 10Spec – 10 Degree Specular Reflection Accessory<br>Includes 3 sample masks (7, 13 and 25 x 4 mm), aluminum alignment mirror and base mount |

**Note:** Replace Replace XXX with your spectrophotometer's Instrument Code listed in the back of the catalog.

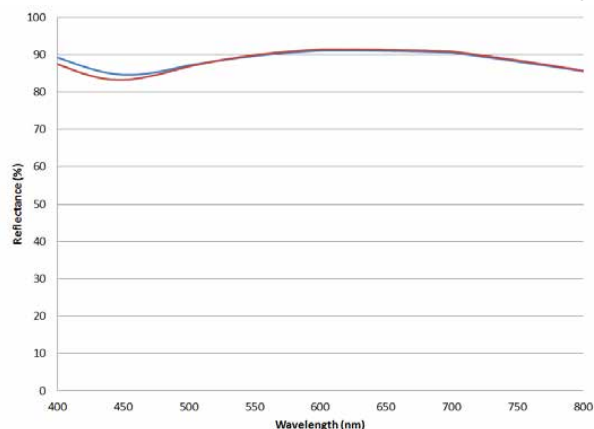
| Replacement Parts and Sampling Options |                                     |
|--|-------------------------------------|
| 013-4015                               | Aperture Mask Set, 7, 13, 25 x 4 mm |
| 300-0300                               | UV-Aluminum Mirror, 25.4 x 25.4 mm  |

## SPECIFICATIONS

|                               |   |
|-------------------------------|---|
| <b>Optics</b>                 | All reflective                            |
| <b>Angle Of Incidence</b>     | 10 degrees                                |
| <b>Sample Masks</b>           | 7, 13 and 25 x 4 mm                       |
| <b>Purge Sealing</b>          | Purge tubes and purge barb included       |
| <b>Dimensions (W X D X H)</b> | 149 x 88 x 118 mm<br>(excludes baseplate) |



Beam path within the UV-Vis 10Spec specular reflection accessory.



FTIR spectra measuring the reflectivity of SiO<sub>2</sub> coated aluminum mirror with the UV-Vis 10Spec.

# UV-Vis 85Spec

## AT A GLANCE

- ▶ Small footprint, compact design
- ▶ Fixed 85-degree angle of incidence
- ▶ Baseplate mount for stable operation and collection of high-quality spectra
- ▶ Thin film and coating measurements

The 85Spec is an 85-degree specular reflection accessory developed for UV-Vis applications.

The accessory is used to analyze mirror-like planar surfaces and thin films on planar surfaces. The grazing angle measurements give the longest possible pathlength through coated samples. Pre-mounted on a baseplate specific to your UV-Vis spectrophotometer, the 85Spec is an easy-to-use accessory.

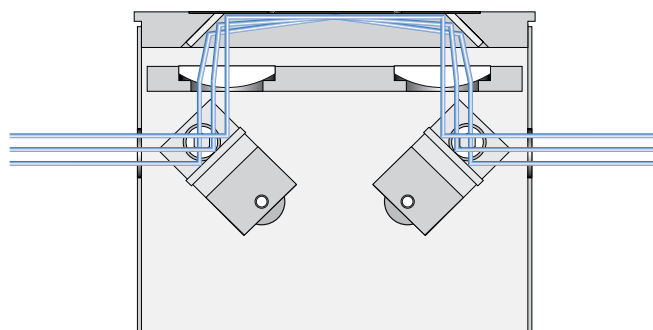
The mounting allows the 85Spec to be inserted and removed from the sample compartment without alignment.



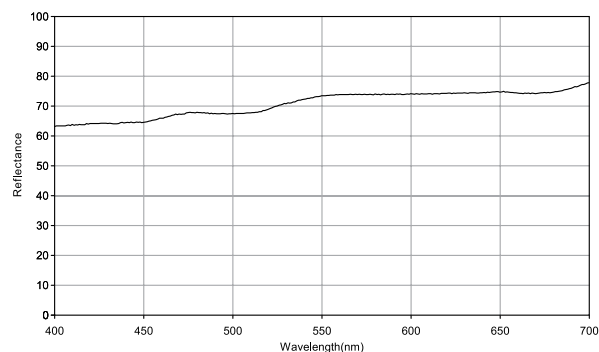
| PART NUMBER              | DESCRIPTION   |
|--------------------------|---|
| 121-85XXX                | UV-Vis 85Spec – 85 Degree Specular Reflection Accessory<br>Includes an Al substrate alignment mirror and sample mask<br><br><b>Note:</b> Replace XXX with your spectrophotometer's Instrument Code listed in the back of the catalog. |
| <b>Replacement Parts</b> |   |
| 300-0039                 | UV-Aluminum Mirror, 38.1 x 38.1 mm  |
| 121-0501                 | Aperture Mask, 35 x 3 mm  |

## SPECIFICATIONS

|                               |                       |
|-------------------------------|-----------------------|
| <b>Angle Of Incidence</b>     | 85 degrees            |
| <b>Mounting Method</b>        | Baseplate             |
| <b>Dimensions (W X D X H)</b> | 105 x 84 x 76 mm      |
| <b>Mask Aperture</b>          | 35 x 3 mm             |
| <b>Optical Mirrors</b>        | UV-optimized aluminum |



Optical diagram of the UV-Vis 85Spec specular reflection accessory.



AR-coated ZnSe crystal measured using the 85Spec specular reflection accessory.

# UV-Vis VeeMAX

## AT A GLANCE

- ▶ Selectable angle of incidence—from 30 to 80 degrees in one-degree increments
- ▶ Film and coating thickness measurements at optimized angle of incidence
- ▶ Grazing angle measurements for the longest path through ultra-thin films
- ▶ Characterization of variable reflectivity materials

The UV-Vis VeeMAX™ accessory offers versatility for specular reflection measurements. The angle of incidence from 30 to 80 degrees is easily changed by turning the angle setting dial.

The UV-Vis VeeMAX™ flexibility allows for optimization of spectral quality for film and coating measurements. It also makes an ideal accessory used to replicate real-world situations.

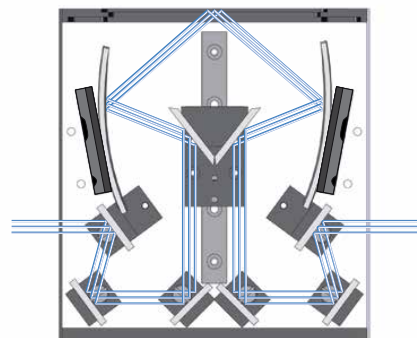
Typical samples include semiconductors, anti-reflective coatings, spectral wavelength filters, semi-transparent and highly reflective mirrors, optical materials, reflection filters, multiple layers, solar mirrors, and solar controlling films on glass. Measured parameters of interest include film thickness, material reflectivity, and coating uniformity and homogeneity.



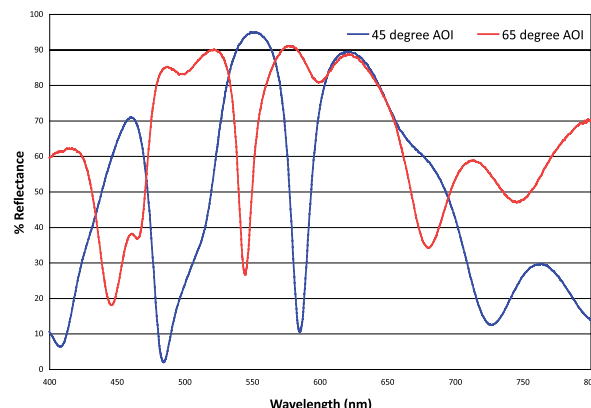
| PART NUMBER              | DESCRIPTION   |
|--------------------------|---|
| 013-10XXX                | UV-Vis VeeMAX Variable Angle Specular Reflection Accessory<br>Includes masks and aluminum mirror<br><br><b>Note:</b> Replace XXX with your spectrophotometer's Instrument Code listed in the back of the catalog. |
| <b>Replacement Parts</b> |   |
| 300-0300                 | UV Aluminum Mirror, 25.4 x 25.4 mm  |
| 013-4015                 | Aperture Mask Set, 7, 13 and 25 x 4 mm  |

## SPECIFICATIONS

|   |  |
|---|--|
| <b>Angle Of Incidence</b>                       | 30–80 degrees  |
| <b>Mounting Method</b>                          | Baseplate  |
| <b>Nominal Accessory Dimensions (W X D X H)</b> | 145 x 135 x 158 mm (dimensions vary with spectrophotometer type) |
| <b>Minimum Beam Height</b>                      | 50 mm  |
| <b>Mask Apertures</b>                           | 7 x 4 mm, 13 x 4 mm, 25 x 4 mm                                   |
| <b>Optical Mirrors</b>                          | UV-optimized aluminum  |



Optical geometry schematic for UV-Vis VeeMAX.



Specular reflection collected at two different angles of incidence of an anti-reflective coating.

# Microplate Reader

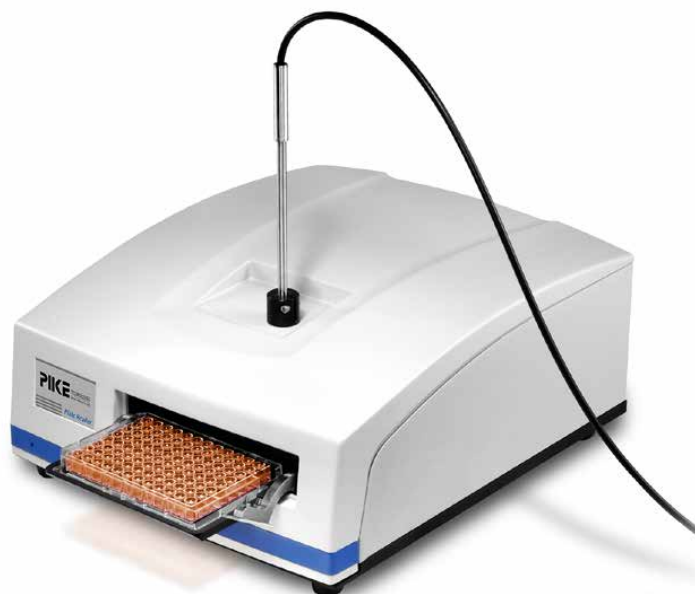
## AT A GLANCE

- ▶ Microplate reading option for standard UV-Vis spectrophotometers
- ▶ Scanning and fixed wavelength measurements
- ▶ On-board detector
- ▶ 6-well to 384-well microplate reading capability
- ▶ Custom configurations for automated sampling



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE

The Out-of-Compartment Microplate Reader is a unique option available for UV-Vis spectrophotometers. It offers high throughput plate reading for instruments with a standard sample compartment leaving the compartment available for other optical accessories or expanding your instrument's capabilities.



| PART NUMBER  | DESCRIPTION  |
|--|--|
| 047-10XXX  | Microplate Reader Accessory<br><b>Note:</b> Replace XXX with your spectrophotometer's Instrument Code listed in the back of the catalog.   |
| Required Optical Components (must select probe and detector) |  |
| 047-3011   | Photodiode Detector, Cary 50/60  |
| 047-3030   | Optical Fiber Probe  |
| Option   |  |
| 162-1910   | 96-Well Polystyrene Sample Plate<br><b>Note:</b> Contact PIKE Technologies to verify that the accessory is compatible with your spectrophotometer. Requires fiber optic launch optics or fiber couple from spectrophotometer manufacturer. |

## SPECIFICATIONS

|                                  |   |
|----------------------------------|---|
| <b>Optics</b>                    | Transfer optics module, optical fiber probe and photodiode detector |
| <b>Accuracy</b>                  | +/- 25 $\mu$ m  |
| <b>Mechanical Specifications</b> |   |
| <b>Repeatability</b>             | +/- 5 $\mu$ m   |
| <b>Resolution</b>                | 1 $\mu$ m   |
| <b>Run Time</b>                  | 96-well plate – 32 seconds<br>384-well plate – 84 seconds           |
| <b>Computer Interface</b>        | USB   |
| <b>Power Requirements</b>        | 100–240 VAC ; AC 50–60 Hz   |
| <b>Dimensions (W X D X H)</b>    | 295 x 348 x 152 mm  |
| <b>Weight</b>                    | 6.8 kg  |

A traditional microplate reading capability is often required in research and quality control in the pharmaceutical and biotechnological and academia. The PIKE accessory can also be adapted to perform automated measurements of filters, optical components and other materials as well as sample mapping.

The Microplate Reader module features a small footprint and can be positioned next to or above the spectrophotometer. Using a fiber coupler in the sample compartment, the light is sent to the accessory via a single optical fiber probe and collected by an on-board photodiode detector. The mechanical design of the accessory relies on an X, Y stage with both axes driven by high-precision servo motors with optical encoders for speed and reproducibility. Programming and control of the Microplate Reader is done through PIKE Technologies AutoPRO software, which can be integrated with many third-party UV-Vis software packages

# R-Theta Accessories

## AT A GLANCE

- ▶ R-theta motion mapping optical samples
- ▶ Complete hardware and software interface package for automated, multi-position measurements
- ▶ Light-tight enclosure included
- ▶ Custom inserts available



FULLY AUTOMATED  
WITH AUTOPRO SOFTWARE

The vertical R-theta computer-controlled accessories for translating and rotating samples in the spectrophotometer beam.

These accessories enable transmission mapping of sample surfaces and generating spectroscopy data as a function of sample position. Suitable for determination of film and coating thickness, multilayer film analysis, reflectivity studies and characterization of optical materials. Using the standard sample wheel and custom inserts, these R-Theta Stages are suitable for analyzing small and large size samples including coated and uncoated glass, optical filters, solar panels and similar materials. Support ring mounts on the accessory's drive and is rotated and translated laterally to cover the entire sampling range of the accessory. Each system incorporates two precision stepper motors for the plate movement.



| PART NUMBER | DESCRIPTION  |
|-------------|--|
| 073-4011    | Vertical 12" (300 mm) Transmission Accessory - Cary 5000/6000          |
| 073-5100    | Vertical 12" (300 mm) Transmission Accessory - Lambda 750/850/950/1050 |
| 073-5011    | Vertical 8" (200 mm) Transmission Accessory - Cary 5000/6000           |
| 073-5010    | Vertical 8" (200 mm) Transmission Accessory - Cary 500/500             |

**Notes:** All accessories include vertical mapping stage with light enclosure, motor controller. For sizes not listed here or custom inserts, please contact PIKE Technologies. Ask about X, Y movement accessories and horizontal stages.

## AUTOPRO SOFTWARE

The operation is managed by PIKE AutoPRO™ software which provides full user programmability and an easy to learn "point-and-click" environment. Polar or X and Y coordinates may be used to define test points. The AutoPRO software allows complex test sequences to be set up, stored as methods and implemented for full flexibility. Each automated accessory is tailored to meet specific sampling needs. This includes adjustments for sample shape/size, and the type of spectroscopic data required. Please contact PIKE Technologies to verify that the selected stage can be integrated into your spectrophotometer's sample compartment and for custom sample inserts.







# Standards and Databases



We strive to provide you with useful sampling tools for spectroscopy and offer these additional products and information to serve your laboratory requirements. If you have not found the ideal sampling tool, please contact us. Your spectroscopy sampling requirements may become one of our product offerings in the future.

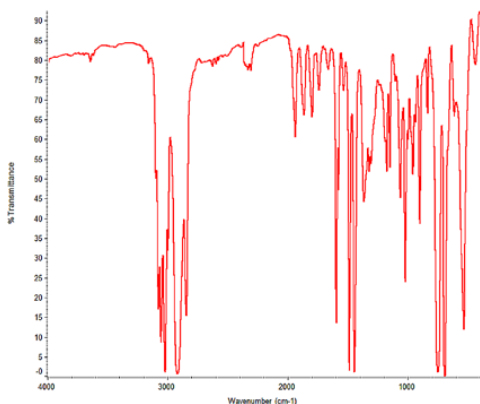
# Reference Standards

Mid-IR and Near-IR reference standards are designed for calibrating and affirming the performance of FTIR instruments.

PIKE offers several traceable reference standards. These include mid-IR transmission standards to confirm photometric linearity and wavelength accuracy of your FTIR instrument. ATR, and diffuse and specular standards may be used to evaluate accessory performance.

## POLYSTYRENE REFERENCE STANDARD

The 1.5-mil thick polystyrene are generally specified for calibrating wavenumber accuracy. A NIST traceable polystyrene version of the polystyrene film is available.

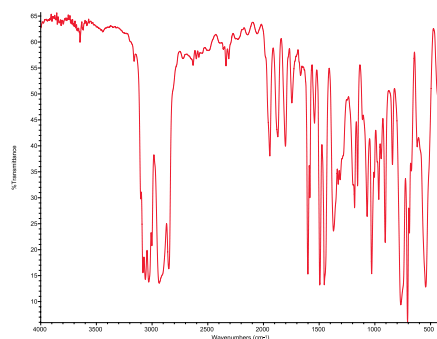


Polystyrene Reference Standard spectrum.



## MID-IR DIFFUSE REFLECTION WAVELENGTH STANDARD

Diffuse reflection sampling in the mid-infrared region is used to measure the reflection of powders, films, painted panels and other samples. Exhibiting sharp peaks throughout the mid-IR spectral region, the Mid-IR Diffuse Reflection Wavelength Standard is used to verify and calibrate for wavelength accuracy or diffuse reflection measurements. This standard is traceable to NIST 1921b and an analysis certificate is included.



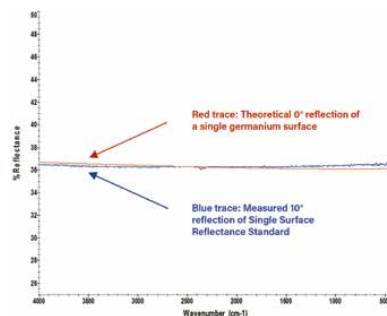
Mid-IR Diffuse Reflection Standard spectrum.



## SPECULAR REFLECTION STANDARD

The Specular Reflection Standard is a unique material for calibration of your reflection measurement system. The standard is a specially treated germanium element which only allows reflection from its front surface – thereby providing a reflection value which can be calculated relative to Fresnel equations.

The Specular Reflection Standard includes documentation to trace the specular reflection to published refractive index data. It is compatible with the following PIKE Technologies specular reflection accessories: VeeMAX III, 10Spec, 30Spec, 45Spec and 80Spec.

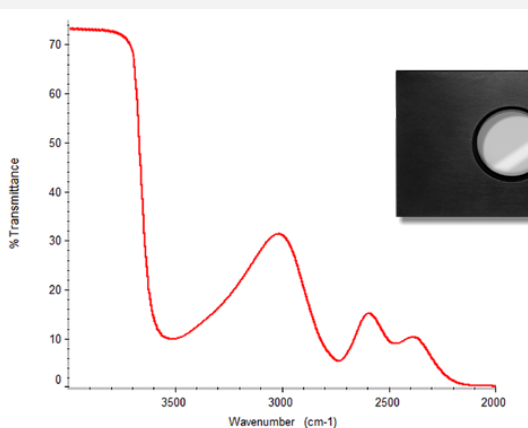


Comparison of measured and calculated reflection for the Specular Reflection Standard using the PIKE 10Spec accessory.



## NG11 REFERENCE STANDARD

To evaluate FTIR instrument photometric linearity, PIKE offers the NG11 Reference Standard traceable to National Research Council of Canada. The traceability documentation included shows transmission values at seven band assignments. The range covered is 4000 to 2000  $\text{cm}^{-1}$ . The NG11 element comes mounted in a standard 2 x 3" slide.

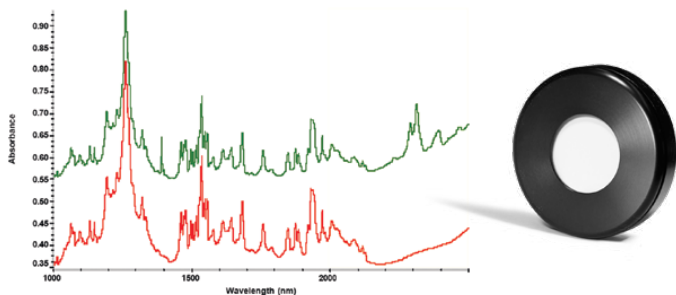


NG11 Reference Standard spectrum.



## NEAR INFRARED STANDARD

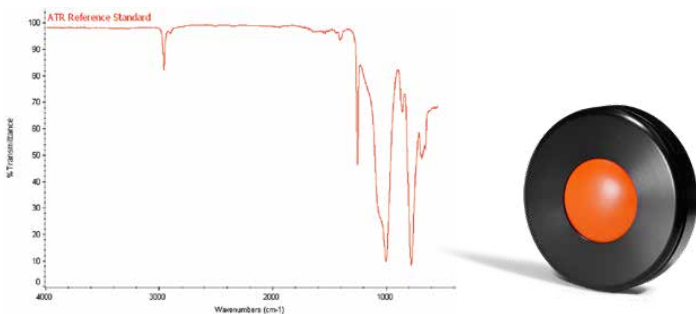
In the near infrared (NIR) spectral region, PIKE Technologies offers its NIR Wavelength Standard for calibrating a NIR spectrometer. The NIR Wavelength Standard meets USP wavelength requirements, provides calibration beyond 2.0  $\mu\text{m}$  and is NIST traceable. This standard is compatible with NIR analysis in the diffuse reflection sampling mode. The NIR Wavelength Standard includes analysis certificate and traceability documentation.



NIR Wavelength Standard spectral data. PIKE NIR Wavelength Standard (upper green spectrum), NIR standard from another supplier (lower red spectrum).

## ATR REFERENCE STANDARD

ATR spectra are somewhat different than those produced by transmission sampling techniques – both in relative intensity of the absorbance bands and also the position of the bands. To assist with calibrating your ATR/FTIR system, PIKE Technologies offers an ATR Reference Standard. The ATR Reference Standard is available as a standard material and also in a version which includes a recommended validation procedure for your ATR/FTIR system.



ATR Reference Standard spectrum.

| PART NUMBER                         | DESCRIPTION  |
|-------------------------------------|--|
| Polystyrene Reference Standards     |  |
| 162-5450                            | NIST Traceable Polystyrene Reference Standard, 1.5 mil   |
| 162-5420                            | Polystyrene Reference Standard, 1.5 mil (38 micron)<br><b>Note:</b> Polystyrene reference standards are mounted in a 2 x 3" card and are compatible with all FTIR spectrometers. |
| NG11 Linearity Reference Standard   |  |
| 162-5490                            | NG11 Transmission Standard   |
| Specular Reflection Standard        |  |
| 162-5460                            | Specular reflection Standard<br><b>Note:</b> Compatible with 10Spec, 30Spec, 45Spec, 80Spec and VeeMAX III accessories.  |
| Mid-IR Diffuse Reflection Standards |  |
| 162-5485                            | Mid-IR Diffuse reflection Wavelength Standard, 1.75" optical diameter  |
| 162-5486                            | Mid-IR Diffuse reflection Wavelength Recertification   |
| ATR Reference Standard              |  |
| 162-5470                            | ATR Reference Standard   |
| 162-5475                            | ATR Reference Standard with Recommended Validation Procedure and Validation Certificate, ZnSe  |
| 162-5473                            | ATR Reference Standard with Recommended Validation Procedure and Validation Certificate, Diamond   |
| 162-5474                            | ATR Reference Standard with Recommended Validation Procedure and Validation Certificate, Ge  |
| 162-5476                            | ATR Reference Standard Recertification<br><b>Note:</b> Compatible with MIRacle, IRIS, GladiATR and VeeMAX III with ATR accessories.  |
| NIR Wavelength Standard             |  |
| 162-5483                            | Traceable NIR Reference Standard, 0.9" optical diameter  |
| 162-5484                            | Traceable NIR Reference Standard Recertification   |

# ATR Databases

## AT A GLANCE

- ▶ Select from databases with over 40,000 ATR spectra
- ▶ All spectra collected using FTIR spectrometers and a single reflection ATR
- ▶ Complete collections and applications databases available

Spectral search is greatly improved when using databases collected using the same sampling mode, especially ATR. PIKE Technologies offers a large selection of ATR spectral databases.

The Aldrich ATR Spectral Database contains 18,513 spectra produced by the Aldrich Chemical Company. The collection includes organic and inorganic compounds and also includes polymers and industrial chemicals. Spectral range is 4000–650  $\text{cm}^{-1}$ .

The IChem ATR Spectral Database contains 13,557 spectra produced by Fine Chemical manufacturers in Japan. This collection includes organic and inorganic compounds, basic polymers and industrial chemicals. Spectral range is 4000–650  $\text{cm}^{-1}$ .

The Aldrich-IChem ATR Spectral Database Package includes 40,810 spectra, a combination of all ATR spectra from both databases – with no duplicate entries.

A wide variety of applications spectral database packages are formed from the Aldrich ATR and the IChem ATR databases. These spectral databases are compatible with ABB Horizon MB™, ACD/Labs, Bruker Opus, Jasco Spectra Manager™ Suite, Lumex SpectraLUM/Pro®, PerkinElmer Spectrum 10™, WinFirst™, Shimadzu IRSolution and HyperIR, LabControl SPECTACLE, Thermo Scientific OMNIC™, Varian Resolutions Pro™, GRAMS and Spectral ID software packages and more. A USB port is required on your PC where a dongle is installed for copy protection.

| PART NUMBER   | DESCRIPTION  |
|---|--|
| ATR Spectral Databases  |  |
| 008-1000  | Aldrich ATR (18,513 spectra)                                 |
| 008-2000  | IChem ATR (13,557 spectra)                                   |
| 008-3000  | Aldrich-IChem ATR Package (40,810 spectra)                   |
| <b>Notes:</b> The spectral databases include a USB-based device – dongle for copy protection. Please designate either 2 $\text{cm}^{-1}$ or 4 $\text{cm}^{-1}$ spectral data format.  |  |
| ATR Application Specific Spectral Databases   |  |
| 008-3002  | Polymers and Polymer Additives (7,970 spectra)               |
| 008-3003  | Food Additives and Food Packaging (4,239 spectra)            |
| 008-3004  | Solvents (1,313 spectra)                                     |
| 008-3005  | Organometallics and Inorganics (2,125 spectra)               |
| 008-3006  | Biochemicals (7,529 spectra)                                 |
| 008-3007  | Aldehydes and Ketones (5,162 spectra)                        |
| 008-3008  | Alcohols and Phenols (3,700 spectra)                         |
| 008-3009  | Esters and Lactones (8,326 spectra)                          |
| 008-3010  | Hydrocarbons (1,141 spectra)                                 |
| 008-3011  | Flavors, Fragrances and Cosmetic Ingredients (4,060 spectra) |
| 008-3012  | Pesticides (3,211 spectra)                                   |
| 008-3013  | Semiconductor Chemicals (1,379 spectra)                      |
| 008-3014  | Forensic (3,770 spectra)                                     |
| 008-3015  | Dyes, Pigments and Stains (3,561 spectra)                    |
| 008-3016  | Sulfur and Phosphorus Compounds (5,655 spectra)              |
| 008-3017  | Hazardous Chemicals (6,698 spectra)                          |
| 008-3018  | Hazardous and Toxic Chemicals (4,022 spectra)                |
| 008-3020  | Pharmaceuticals, Drugs and Antibiotics (4,796 spectra)       |
| 008-3021  | High Production Volume (HPV) Chemicals (2,032 spectra)       |
| 008-3025  | Coatings (2,433 spectra)                                     |
| 008-3026  | Paints (3,426 spectra)                                       |
| <b>Notes:</b> The spectral databases include a USB-based device – dongle for copy protection. Please designate either 2 $\text{cm}^{-1}$ or 4 $\text{cm}^{-1}$ spectral data format. Specify your FTIR software for correct format. Due to new additions or revisions to databases, spectral quantities may fluctuate. Please call for exact specifications at time of order. |  |

# Transmission Databases

## AT A GLANCE

- ▶ Select from databases with over 50,000 transmission spectra
- ▶ All spectra collected using FTIR spectrometers and transmission sampling mode
- ▶ Complete collections and applications databases available

PIKE Technologies offers a large collection of high-quality, spectral databases collected in the transmission sampling mode.

The **SDBS Transmission Spectral Databases** include over 50,000 spectra produced by Fine Chemical manufacturers in Japan. All spectra were collected at the Japanese National Laboratories under highly controlled conditions with secondary verification of the materials by NMR and MS. Data is measured using several sample preparation methods. Spectral range is 4000–400  $\text{cm}^{-1}$ .

The **SDBS Transmission by KBr Pellet Spectral Database** contains 22,995 spectra. This collection includes organic and inorganic compounds, basic polymers and industrial chemicals.

The **SDBS Transmission by Liquid Film Spectral Database** contains 7,018 spectra. This collection includes organic compounds and industrial chemicals.

The **SDBS Transmission by Nujol Mull Spectral Database** contains 21,127 spectra. This collection includes organic and inorganic compounds and industrial chemicals.

A wide variety of applications spectral database packages are formed from the KBr Pellet and Liquid Film Spectral Databases. These spectral databases are compatible with ABB Horizon MB™, ACD/Labs, Bruker Opus, Jasco Spectra Manager™ Suite, Lumex SpectraLUM/Pro®, PerkinElmer Spectrum 10™, WinFirst™, Shimadzu IRSolution and HyperIR, LabControl SPECTACLE, Thermo Scientific OMNIC™, Varian Resolutions Pro™, GRAMS and Spectral ID software packages and more. A USB port is required on your PC where a dongle is installed for copy protection.

| PART NUMBER  | DESCRIPTION  |
|--|--|
| <b>Transmission Spectral Databases</b>   |  |
| 008-4001   | SDBS Transmission by KBr Pellet (22,995 spectra)             |
| 008-4004   | SDBS Transmission by Liquid Film (7,018 spectra)             |
| 008-4005   | SDBS Transmission by Nujol Mull (21,127 spectra)             |
| <p><b>Notes:</b> The spectral databases include a USB based device – dongle for copy protection. Please designate either 2 <math>\text{cm}^{-1}</math> or 4 <math>\text{cm}^{-1}</math> spectral data format.</p>  |  |
| <b>Application Based Spectral Databases</b>  |  |
| 008-5002   | Polymers and Polymer Additives (1,273 spectra)               |
| 008-5003   | Food Additives and Food Packaging (1,684 spectra)            |
| 008-5004   | Solvents (668 spectra)                                       |
| 008-5005   | Organometallics and Inorganics (1,445 spectra)               |
| 008-5006   | Biochemicals (4,590 spectra)                                 |
| 008-5007   | Aldehydes and Ketones (4,226 spectra)                        |
| 008-5008   | Alcohols and Phenols (2,744 spectra)                         |
| 008-5009   | Esters and Lactones (4,335 spectra)                          |
| 008-5010   | Hydrocarbons (1,417 spectra)                                 |
| 008-5011   | Flavors, Fragrances and Cosmetic Ingredients (1,912 spectra) |
| 008-5012   | Pesticides (958 spectra)                                     |
| 008-5013   | Semiconductor Chemicals (664 spectra)                        |
| 008-5014   | Forensic (1,555 spectra)                                     |
| 008-5015   | Dyes, Pigments and Stains (1,473 spectra)                    |
| 008-5016   | Sulfur and Phosphorus Compounds (5,025 spectra)              |
| 008-5017   | Hazardous Chemicals (2,664 spectra)                          |
| 008-5018   | Toxic Chemicals (6,604 spectra)                              |
| 008-5020   | Pharmaceuticals, Drugs and Antibiotics (2,806 spectra)       |
| 008-5021   | High Production Volume (HPV) Chemicals (1,123 spectra)       |
| 008-70051  | Kidney Stones (1,668 spectra)                                |
| <p><b>Notes:</b> The spectral databases include a USB-based device – dongle for copy protection. Please designate either 2 <math>\text{cm}^{-1}</math> or 4 <math>\text{cm}^{-1}</math> spectral data format. Specify your FTIR software for correct format. Due to new additions or revisions to databases, spectral quantities may fluctuate. Please call for exact specifications at time of order.</p> |  |





# Software



# PIKE Software

PIKE specializes in automated and temperature controlled FTIR, NIR and UV-Vis accessories. To optimize your workflow, we offer AutoPRO and TempPRO software platforms.

## *Auto*PRO Version 7

AutoPRO is a flexible platform that controls stage movement for our automated accessories. You can readily generate custom mapping profiles to suit needs, and your data collection protocols can be saved and imported for later use.

For easier record management, you can organize your files by selecting from numerous file naming schemes. What's more, AutoPRO supports multiple users, providing you with better control over your records.

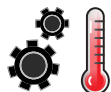
Through automation, you will save time and improve consistency across measurements.

## *Temp*PRO Version 7

TempPRO is an intuitive platform that drives all of our temperature-controlled accessories. Setting up your temperature profiles is easy. You can program as many ramps and hold-times as you need into a single profile, which you may save and load for later use.

TempPRO can also trigger spectral data collection as a function of time and/or temperature, providing a hands-free operation, with most FTIR instruments.

All automated and temperature-controlled accessories in the catalog are noted with:





## SOFTWARE AT A GLANCE

### EASY

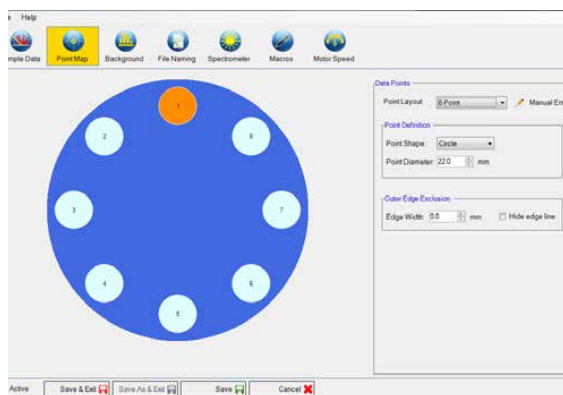
- ▶ Intuitive graphical interfaces using toolbars and data grids
- ▶ Most operational parameters are concealed until needed
- ▶ At-a-glance experiment status

### FLEXIBLE

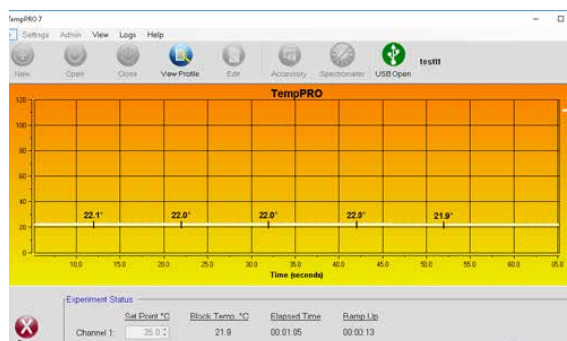
- ▶ Repeat background collection during the middle of an experiment
- ▶ Collect backgrounds at all points or at a single point
- ▶ Use an existing background file
- ▶ Choose not to collect a background
- ▶ Build spectral names from sample descriptions or time stamp
- ▶ Positional or temperature information saved with spectra

### CUSTOMIZABLE

- ▶ Create customizable experiments
- ▶ Library searching/peak picking
- ▶ Macros for easy report generation and data analysis
- ▶ Export results to spreadsheets



AutoPRO 7 user interface.



TempPRO 7 user interface.

# PIKECalc Software

## AT A GLANCE

- ▶ Convert from wavelength (micron and nanometer) to wavenumber
- ▶ Calculate depth of penetration, critical angle, effective pathlength, effective angle of incidence and number of reflections for ATR
- ▶ Calculate cell pathlength, thickness of free-standing film and thickness of coating
- ▶ FREE access online at [www.piketech.com](http://www.piketech.com)

| PART NUMBER | DESCRIPTION |
|-------------|-------------|
|-------------|-------------|

|          |                         |
|----------|-------------------------|
| 007-0300 | PIKECalc Software on CD |
|----------|-------------------------|

**Notes:** PIKECalc is loaded on a CD disk for upload to your PC and operates with current versions of Microsoft operating systems.

PIKECalc software is easy to use – just select the type of computation, enter values from your spectral data and click on the calculate button. An instant calculation is performed.

PIKECalc eliminates the need to search through literature references to find the correct conversions and formulae and gives you immediate results. All formulae and equations are documented in the software, if you wish to reference our mathematics. Help and how to use PIKECalc is included within the software.

Please ask us about other FTIR spectroscopy calculations you may need.

Use our free online interactive Crystal Properties program and FTIR Calculator on our website: [www.piketech.com](http://www.piketech.com). The FTIR Calculator allows for wavelength to wavenumber conversion, pathlength and film thickness determination, and ATR calculations. Refer to our Crystal Properties program to choose the best crystal to use for your application.

**PIKE** *Calc*



UNIT CONVERSION

ATR CALCULATION

THICKNESS CALCULATION

CRYSTAL PROPERTIES

Depth of Penetration

Effective Angle (°)

Wavenumber (cm<sup>-1</sup>)

Material

Sample Refractive Index

Depth (d<sub>p</sub>, μ)

Effective Depth (d<sub>e</sub>, μ)

**CALCULATE DEPTH**

Effective Angle of Incidence for Variable Angle ATRs

Scale-Setting Angle (°)

Crystal Face Angle (°)

Material

Effective Angle (°)

**CALCULATE ANGLE**

Number of Reflections for ATR Crystals

Effective Angle (°)

Crystal Length (mm)

Crystal Thickness (mm)

Number of Reflections

**CALCULATE REFLECTIONS**

Effective Pathlength for Multi-Reflection ATR Crystals

Number of Reflections

Effective Depth (μ)

Pathlength (μ)

**CALCULATE PATHLENGTH**

Critical Angle

Sample Refractive Index

Material

Critical Angle (°)

**CALCULATE CRITICAL ANGLE**

**RETURN TO PIKE TECHNOLOGIES**

ATR Calculation.

UNIT CONVERSION

ATR CALCULATION

THICKNESS CALCULATION

**CRYSTAL PROPERTIES**

**AMTR**

CaF<sub>2</sub>

Diamond

Ge

Si

SiC

SiO<sub>2</sub>

Si<sub>3</sub>N<sub>4</sub>

AlN

ZnS

AMTR

|                      |                            |                   |                         |
|----------------------|----------------------------|-------------------|-------------------------|
| Transmission Range   | 1000-4000 cm <sup>-1</sup> | Salt pH Range     | 1-14                    |
| ATR Range            | 1000-4000 cm <sup>-1</sup> | Temperature Limit | 200 °C                  |
| Refractive Index     | 1.1                        | Melting Point     | 2100 °C                 |
| Depth of Penetration | 1.7 μm                     | Hardness          | 1100 kg/mm <sup>2</sup> |
| Water Solubility     | insoluble                  |                   |                         |
| Harmful Substances   | none                       |                   |                         |

Crystal Properties.

UNIT CONVERSION

ATR CALCULATION

**THICKNESS CALCULATION**

CRYSTAL PROPERTIES

Pathlength of Transmission Liquid Cell

Wavenumber @ Port 1

Wavenumber @ Port 2

# of Traps between 1 and 2

Thickness (μm)

**CALCULATE THICKNESS**

Thickness of Free Standing Film by Spots or Reflection

Wavenumber @ Port 1

Wavenumber @ Port 2

# of Traps between 1 and 2

Angle of Incidence (°)

Refractive Index of Traps

Thickness (μ)

**CALCULATE THICKNESS**

Thickness of Free Standing Film by Transmission

Wavenumber @ Port 1

Wavenumber @ Port 2

# of Traps between 1 and 2

Refractive Index of Traps

Thickness (μ)

**CALCULATE THICKNESS**

**RETURN TO PIKE TECHNOLOGIES**

Thickness Calculation.



# Additional Information

# Instrument Codes

When ordering a PIKE accessory, replace the XX or XXX portion of the product's part number with your spectrometer's instrument code below. For assistance, please contact a PIKE customer service representative at 608.274.2721 or email, [info@piketech.com](mailto:info@piketech.com).

## FTIR INSTRUMENT CODES

| BRAND (A-Z)                    | MODEL  | CODE |
|--------------------------------|--|------|
| <b>ABB Bomem</b>               | FTLA2000-100 (Arid Zone)                                 | 80   |
|                                | Michelson 100, MB Series                                 | 81   |
|                                | MB 3000, 3600  | 82   |
| <b>Agilent</b>                 | Excalibur™, Scimitar™, FTS, 600-IR Series                | 10   |
|                                | Excalibur™, Scimitar™, 600-IR Series with recognition    | 13   |
| <b>Analect</b>                 | See Hamilton Sundstrand                                  |      |
| <b>Bio-Rad</b>                 | See Agilent  |      |
| <b>Bruker Optics</b>           | IFS™, Vector™, Equinox™ Series                           | 50   |
|                                | Tensor™, Vertex™, INVENIO® with recognition (Quick-Lock) | 51   |
| <b>Buck Scientific</b>         | M500   | 65   |
| <b>Digilab</b>                 | See Agilent  |      |
| <b>Hamilton Sundstrand AIT</b> | Diamond 20   | 60   |
| <b>Horiba</b>                  | 7000 Series  | 35   |
| <b>Interspectrum</b>           | Interspec 200-X  | 90   |
|                                | Interspec 300-X  | 91   |
| <b>Jasco</b>                   | 300 and 600 Series                                       | 56   |
|                                | 400  | 57   |
|                                | 4000 and 6000 Series                                     | 58   |
| <b>JEOL</b>                    | Winspec™ Series  | 46   |
| <b>Lambda Scientific</b>       | Lambda FTIR 7600   | 66   |
|                                | Lambda FTIR 8600   | 64   |
| <b>Lumex</b>                   | INFRALUM FT-08   | 68   |
| <b>Mattson</b>                 | See Thermo   |      |
| <b>Midac</b>                   | M Series   | 30   |
| <b>Nicolet</b>                 | See Thermo   |      |
| <b>Oriel</b>                   | Oriel  | 95   |
| <b>PerkinElmer</b>             | 1700 Series  | 70   |
|                                | Spectrum™ GX, 2000                                       | 71   |
|                                | Spectrum BX and RX, 1600, Paragon 1000                   | 73   |
|                                | Frontier, Spectrum 1, 3, 65, 100, 400 with recognition   | 74   |
|                                | Spectrum 2 with recognition                              | 75   |



| BRAND (A-Z)                   | MODEL   | CODE |
|-------------------------------|---|------|
| <b>Shimadzu</b>               | 8300, 8400 Series, IRPrestige™-21, IRAffinity-1s            | 15   |
|                               | IRPrestige™-21, IRAffinity-1s with recognition (QuickStart) | 16   |
|                               | IRTracer™-100   | 18   |
|                               | IRTracer™-100 with recognition                              | 19   |
|                               | IRSpirit™   | 11   |
|                               | IRSpirit™ with recognition                                  | 12   |
| <b>Thermo Nicolet Mattson</b> | Infinity, Galaxy, RS Series                                 | 20   |
|                               | Genesis™, Satellite, IR 300                                 | 21   |
|                               | Impact™ 400, Magna, Protege™, 500 and 700 Series            | 40   |
|                               | Avatar™, Nexus™, Nicolet™ iS™10, iS™20, iS50                | 40   |
|                               | Nicolet iS™5, Nicolet™ Summit                               | 42   |
|                               | Avatar, Nexus, Nicolet Series with recognition (Smart)      | 47   |
| <b>Rayleigh</b>               | WQF-510 and 520   | 62   |
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| <b>Varian</b>                 | See Agilent   |      |

## UV-VIS INSTRUMENT CODES

| BRAND (A-Z)                     | MODEL                              | CODE |
|---------------------------------|------------------------------------|------|
| <b>Agilent/Varian</b>           | Cary 50                            | 100  |
|                                 | Cary 60                            | 111  |
|                                 | Cary 4000, 5000, 6000i             | 120  |
| <b>Jasco</b>                    | 600, 700 Series                    | 600  |
| <b>Oriel</b>                    | Oriel                              | 900  |
| <b>PerkinElmer</b>              | Lambda 650, 750, 850, 950 and 1050 | 700  |
|                                 | Lambda 365                         | 710  |
|                                 | Lambda 25, 35, 45                  | 730  |
| <b>Shimadzu</b>                 | 1600, 1700                         | 200  |
|                                 | 1800, 1900                         | 210  |
|                                 | 2600                               | 240  |
|                                 | 3600                               | 220  |
| <b>Thermo Fisher Scientific</b> | Evolution 300, 600                 | 400  |
|                                 | Evolution 200                      | 410  |

# Useful Information

## PART NUMBERS AND PRICE

The PIKE price list includes accessories that may be used with a variety of makes and models of spectrometers. Please specify the part number and description when ordering, including your instrument type and model number. Visit our website for a list of spectrometer and spectrophotometer instrument codes. When placing an order, substitute these codes for the final digits (XX) or (XXX) in the accessory part number.

PIKE Technologies is continually extending the accessory product range. If you are unable to find a required item, please contact us to discuss your needs. We will be glad to assist.

## PAYMENT TERMS

Purchase Order Number, cash in advance, MasterCard and Visa are acceptable. Payment is net 30 days, and shipments are FOB Madison, WI USA. Freight charges are prepaid and added to your invoice. If you wish to pay freight charges, please specify this on your order. Prepayment is required for international customers.

## INTERNATIONAL HANDLING FEE

For orders placed from outside the United States or Canada, a handling fee of \$40 will apply per order to cover the costs associated with the additional documentation and bank charges required for international shipments.

## WAYS TO ORDER

Please include the following information when placing an order: your name, phone number, product part number, quantity, ship to address, bill to address, purchase order number and spectrometer model on which the accessory will be used.

Orders may be placed via mail, phone, fax, and e-mail. We accept Visa and MasterCard via phone or fax. For security purposes, do not send credit card information via e-mail. There is no minimum order requirement.

To place an order, contact us:

608-274-2721  
608-274-0103 (Fax)  
orders@piketech.com

PIKE Technologies, Inc.  
6125 Cottonwood Drive  
Madison, WI 53719

## DELIVERY

The delivery/shipment date is confirmed upon receipt of an order. Special requirements and custom accessories are subject to different lead times. Please contact us for price quotes and delivery information on these products.

## GUARANTEE

All PIKE products are guaranteed to be free from defects in material and workmanship for a period of 12 months from the date of shipment. Should you have any queries, please contact us immediately and we will promptly repair or replace the product at no charge.

## PRODUCT RETURNS

Please contact PIKE to receive your Return Material Authorization (RMA) number if you wish to return any of our products. A restocking fee may apply. Customers are responsible for shipping charges for all returned products. For products under warranty, back-to-customer shipping charges will be covered by PIKE. Please do not return any products without obtaining the RMA number first.

## TECHNICAL ASSISTANCE

PIKE Technologies offers comprehensive technical assistance. Please contact us via mail, phone, fax or e-mail with your questions.

## INTERNATIONAL DISTRIBUTION

PIKE Products are available worldwide. Call or send us an e-mail and we will provide you with an address of the sales office closest to your location. All exports are handled in accordance with the US Export Administration Regulations.

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Customer satisfaction is very important to all of us here at PIKE Technologies, Inc. We have hopefully made the ordering process very fast and easy for you. If you have any questions or concerns about our products or services, we encourage you to contact us. We will be happy to make adjustments to fit your needs.

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