

***Specac***

Product  
Catalogue  
2016-7



[www.specac.com](http://www.specac.com)



**ANADIS**  
INSTRUMENTS BENELUX B.V.



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## Momentous times as Specac reaches its Sapphire anniversary.

The company that became Specac in 1971 started out of the back of a garage in the 1950's and we've come a long way since then. 2016 sees Specac's Sapphire anniversary. We have been providing high specification, quality accessories for 45 years, and we will continue to flourish.

The Sapphire anniversary is a symbolic representation of the use of different optical materials that has become Specac's hallmark. We have designed products that give an optimal balance between sensitivity and robustness using materials such as diamond, zinc selenide and potassium bromide.

The use of the monolithic diamond is our signature skill. We were first to market with the Golden Gate® ATR more than twenty years ago, and now the Quest® ATR has become the leading product of its type in the industry.

These are momentous times for Specac. In April 2015 we embarked upon a management buy-out, supported by our partner investors, The Foresight Group. This new opportunity means that we can invest for our future in a pro-active manner, developing more accessories to help our customers solve their applications.

We will build upon our key strategic aim of bringing new products to market (the Quest® ATR, launched in 2012 has been a huge success). We launched the Pearl® Liquid Analyser in November 2015 for routine laboratory transmission spectroscopy. The Pearl®, like the Golden Gate® before it, is the first product to market of its type, and we believe it will become the must-have accessory of 2016/17.

All of our products emerge from Specac's unique, robust design processes, ensuring high specification, high quality accessories, reflecting great British engineering.

We have confidence in the quality of our products, and we always strive to improve, including our drive for excellence in customer service.

I hope that this catalogue gives you a flavour of the solutions that Specac can provide for your applications. However, if you don't find quite what you are looking for, let us know, and we'll see if we can make it for you.

**David Smith**, Managing Director

**Whatever your application - you can be sure that we already have the ideal sampling solution. And if not? We can make it for you...**

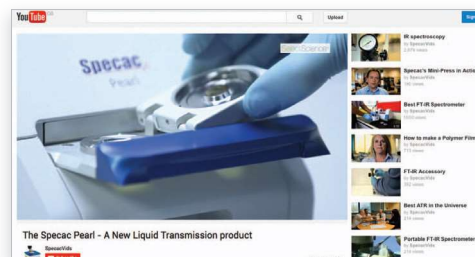


# Stay in contact with Specac 24/7.

Interact, and stay in touch, with the latest developments at Specac round the clock.

With our team of spectroscopists, engineers and chemists, you can be assured of unrivalled technical back-up and applications advice, giving complete peace of mind with every Specac purchase.

And through our social media presence you can get the latest Specac news via Twitter, stay in contact with us through LinkedIn and Facebook and watch our latest instructional videos on YouTube.



## Key to catalogue symbol usage.

The symbols below indicate the service requirements for Specac accessories.



Electric power is required for this accessory



Communications option on the 4000 Series Controller is available with this accessory



Gases are used with this accessory



Essential spares kit is offered with this accessory (ESK)



Vacuum Pump kit is required for this accessory



This accessory is Benchmark® Baseplate compatible



Cooling water required for this accessory (see Thermocirculator Pump with 5 litre bath GS11127)



Cooling water required for this accessory (see Thermocirculator Pump with 12 litre bath GS11128)



Water heating required for this accessory (see Thermocirculator Pump with 5 litre bath GS11127)

# Specac Product Selector

For virtually any sample type, there is a Specac accessory for either the transmission or reflection technique. This table will help you identify the best accessory for your sampling application and shows which accessories can be used for various sample types under various conditions. (Additional accessory options where indicated).

Key ★ Ideal for application ❖ May be suitable; (contact Specac for further details)  ■ Requires additional accessory		Reflection								HTHP Cell
		ATR				Diffuse		Specular		
		Quest®	Golden Gate®	Gateway®	25R	MiniDiff Plus	Selector®	30° Fixed Angle Unit	Monolayer Grazing Angle	
Solid	Flat/smooth	★	★	★	★	❖	❖	★	★	★
	Rough/abrasive	❖	★	❖	❖	★	★			★
	High temperature		★	★			★			★
	Low temperature		★							
	High pressure		★				★		★	
Powder	Finely ground	★	★	★		★	★			★
	Coarse/crystalline	❖	★	❖		★	★			★
	High temperature		★	★			★			★
	Low temperature		★							
	High pressure		★			★	★			★
Liquid	Fixed pathlength		★							❖
	Variable pathlength									
	Ambient conditions	★	★	★						❖
	Flow experiments		★	★						
	High pressure		★	❖						❖
	High temperature		★	★						❖
	Low temperature		★							
	pH <4 or >11	❖	❖	❖	❖					❖
Gas	Fixed pathlength						❖			★
	Variable pathlength									
	High pressure						❖			★
	High temperature						❖			★
	pH < 4 or > 11						❖			★
Advanced Research	Reaction		★				★			★
	Catalysis		❖				★			★
	Supercritical		★							
	Part number	GS10800	GS10500	GS11165	GS11000	GS04510	GS19900	GS19820	GS19650	GS05850 GS05855
	Spectral range	Mid/Far IR								

**Golden Gate® advanced applications**

<b>GS10642</b>	High Temperature Golden Gate®
<b>GS10507</b>	Reaction Cell Top Plate
<b>GS10514</b>	Specular Reflectance
<b>GS10566</b>	Germanium Top Plate
<b>GS10585</b>	Super Critical Top Plate
<b>GS10590</b>	Low Temperature Top Plate
<b>The Selector®</b>	
<b>GS19930</b>	Environmental chamber

**Liquid Cells**

<b>GS21525</b>	Variable Temp. Cell Holder
<b>GS21530</b>	Variable Temp. Cell Holder
<b>GS20730</b>	Electrical Heating Jacket

**Cyclone®**

<b>GS24302</b>	C2 Heating Jacket
<b>GS24305</b>	C5 Heating Jacket
<b>GS24310</b>	C10 Heating Jacket

<b>Key</b>		<b>Transmission</b>										
		<b>Liquid Cells</b>						<b>Solid Cells</b>		<b>Gas Cells</b>		
		Pearl® Liquid Analyser	Omni Cell®	Variable Pathlength Cell	High Pressure Liquid Cells	Sealed Heatable Cell	Demountable Heatable Cell	Solids Holder	DC Cell & Microfocus Beam Condenser	Tornado®	Cyclone®	Storm®
<b>Solid</b>	Flat/smooth							★	★			
	Rough/abrasive							❖	★			
	High temperature							★				
	Low temperature							★				
	High pressure							❖				
<b>Powder</b>	Finely ground	mull	mull						★			
	Coarse/crystalline	mull	mull						❖			
	High temperature											
	Low temperature							★				
	High pressure											
<b>Liquid</b>	Fixed pathlength	★	★	★	★	★	★		gum			
	Variable pathlength	★	★	★	★		★					
	Ambient conditions	★	★	★	★	★	★					
	Flow experiments				★	★	★					
	High pressure				★	★	★					
	High temperature				★	★	★					
	Low temperature				★	★	★					
	pH <4 or >11	❖	❖	❖	★	★	★			❖	❖	❖
<b>Gas</b>	Fixed pathlength									★	★	★
	Variable pathlength										★	
	High pressure									★	★	★
	High temperature										★	★
	pH < 4 or > 11										❖	❖
<b>Advanced Research</b>	Reaction											
	Catalysis											
	Supercritical				❖							
	Part number	GS31000 Series	GS01800 Series	GS07500	GS05910	GS20500 Series	GS20510 Series	GS20600 GS20610	GS02555 GS02560	GS242XX	GS241XX	GS05000 GS05800 GS05670
	Spectral range	UV / Vis / IR										

# Pearl<sup>®</sup>

## Liquid Analyser



**NEW**  
Request an on-site  
demonstration

 Pearl<sup>®</sup> - simpler, easier, faster

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# FT-IR Starter Kits

Page 10  
**Basic  
Starter Kit**



Page 11  
**Analyst  
Starter Kit**



Page 12  
**Research  
Starter Kit**



Page 13  
**Advanced  
Starter Kit**



## Get started with a Specac FT-IR starter kit

Specac provide a number of sampling kits for FT-IR spectroscopy. These off-the-shelf kits are composed of different combinations of infrared sampling accessories to equip a laboratory with the necessary spectroscopic accessories for specific or varied sample analysis.



# Basic Starter Kit



P/N GS01140



P/N GS01150

## ordering information

### Basic Starter Kit

#### GS01180 Basic Starter Kit

consists of

GS01140 **Liquid Pack**

and

GS01150 **Basic Solid Pack**

### Optional Gas Pack add-on



P/N GS01170

**GS01181 Basic Starter Kit plus Gas Pack add-on**

### Liquid Pack (contents below)

- GS01110 Luer Syringe 2ml
- GS01800 Omni-Cell® assembly
- GS01811 KBr windows (pair) for liquids
- GS01812 CaF2 windows (pair) for liquids
- GS01831 KBr windows (pair) for Mulls
- GS01864 10 off assorted PTFE Liquid Cell spacers
- GS01871 5 off PTFE 0.1mm Mull Cell spacers
- GS03620 Bottle of Nujol (25ml)
- GS03621 Bottle of Fluorolube (25ml)

### Basic Solid Pack (contents below)

- GS03940 Mini-Pellet Press (2T)
- GS03950 7mm Pellet Die with Pellet Ring Holder
- GS03951 7mm spare Pellet Ring Holder
- GS03600 Pestle and Mortar
- GS03610 KBr Powder (50g)
- GS03960 7mm Disc Holder with rectangular mount

# Analyst Starter Kit



P/N GS01140



P/N GS01160

## ordering information

### Analyst Starter Kit

- GS01185 Analyst Starter Kit**  
consists of
- GS01140 Liquid Pack**  
and
- GS01160 Advanced Solid Pack**

### Optional Gas Pack add-on



P/N GS01170

- GS01186 Analyst Starter Kit plus Gas Pack add-on**

### Liquid Pack (contents below)

- GS01110** Luer Syringe 2ml
- GS01800** Omni-Cell® assembly
- GS01811** KBr windows (pair) for liquids
- GS01812** CaF<sub>2</sub> windows (pair) for liquids
- GS01831** KBr windows (pair) for Mulls
- GS01864** 10 off assorted PTFE Liquid Cell spacers
- GS01871** 5 off PTFE 0.1mm Mull Cell spacers
- GS03620** Bottle of Nujol (25ml)
- GS03621** Bottle of Fluorolube (25ml)

### Advanced Solid Pack (contents below)

- GS15011** 15T Manual Hydraulic Press
- GS03600** Pestle and Mortar
- GS03610** KBr Powder (50g)
- GS03410** 13mm Disc Holder with rectangular mount
- GS03000** 13mm Evacuatable Pellet Die

# Research Starter Kit



## ordering information

### Research Starter Kit

- GS01190 Research Starter Kit** consists of
- GS01140 **Liquid Pack**
  - GS01150 **Basic Solid Pack** and
  - GS10802 **Quest® ATR ZnSe**

### Optional Gas Pack add-on



- GS01191 Research Starter Kit plus Gas Pack add-on**

### Liquid Pack (contents below)

- GS01110 Luer Syringe 2ml
- GS01800 Omni-Cell® assembly
- GS01811 KBr windows (pair) for liquids
- GS01812 CaF2 windows (pair) for liquids
- GS01831 KBr windows (pair) for Mulls
- GS01864 10 off assorted PTFE Liquid Cell spacers
- GS01871 5 off PTFE 0.1mm Mull Cell spacers
- GS03620 Bottle of Nujol (25ml)
- GS03621 Bottle of Fluorolube (25ml)

### Basic Solid Pack (contents below)

- GS03940 Mini-Pellet Press (2T)
- GS03950 7mm Pellet Die with Pellet Ring Holder
- GS03951 7mm spare Pellet Ring Holder
- GS03600 Pestle and Mortar
- GS03610 KBr Powder (50g)
- GS03960 7mm Disc Holder with rectangular mount

# Advanced Starter Kit



P/N GS01140



P/N GS01160



P/N GS10802

## ordering information

### Advanced Starter Kit

- GS01195** Advanced Starter Kit  
consists of
- GS01140** Liquid Pack
- GS01160** Advanced Solid Pack  
and
- GS10802** Quest® ATR ZnSe

### Optional Gas Pack add-on



P/N GS01170

- GS01196** Advanced Starter Kit plus Gas Pack add-on

### Liquid Pack (contents below)

- GS01110** Luer Syringe 2ml
- GS01800** Omni-Cell® assembly
- GS01811** KBr windows (pair) for liquids
- GS01812** CaF<sub>2</sub> windows (pair) for liquids
- GS01831** KBr windows (pair) for Mulls
- GS01864** 10 off assorted PTFE Liquid Cell spacers
- GS01871** 5 off PTFE 0.1mm Mull Cell spacers
- GS03620** Bottle of Nujol (25ml)
- GS03621** Bottle of Fluorolube (25ml)

### Advanced Solid Pack (contents below)

- GS15011** 15T Manual Hydraulic Press
- GS03600** Pestle and Mortar
- GS03610** KBr Powder (50g)
- GS03410** 13mm Disc Holder with rectangular mount
- GS03000** 13mm Evacuatable Pellet Die

# FT-IR Individual Application Packs



## FT-IR individual Application Packs

Our individual application packs are built around a range of key accessories which have a proven track record:

**Liquid Pack:** The versatile Omni-Cell® System is at the core of the Liquid Pack which contains all the essential accessories that a spectroscopist needs for the analysis of liquids, gums and pastes.

**Basic Solid Pack:** This pack is built around the Mini-Pellet Press and includes all the necessary tools for the preparation of 7mm diameter KBr pellets. The Mini-Pellet Press' hydraulic operation enables the pressing of high quality KBr pellets and the integral pressure gauge ensures repeatability.

This lightweight, portable KBr sample press has a small footprint and can be transported to different work stations or easily stored.

**Advanced Solid Pack:** The Specac 15T Manual Hydraulic Press has been a workhorse in laboratories around the world for many years and is the central accessory of the Advanced Solids Pack; the other accessories included in this pack include everything required to produce 13mm KBr pellets.

**Gas Pack:** The Storm® 10cm Pyrex gas cell is the ideal choice for measuring the infrared spectra of concentrated gases, gas mixtures and vapours (>1% levels). Also included in the Gas Pack are KBr windows, all necessary seals and a cell mount.

**Quest® ATR:** The flexibility of ATR is now well known and the Specac Quest® ATR accessory provides flexibility through its interchangeable crystal pucks with a choice of Diamond, Extended Range Diamond, ZnSe, or Ge crystals.



# FT-IR Individual Application Packs

## ordering information



### Liquid Pack

#### GS01140 Liquid Pack Complete

(contents below)

- GS01110 Luer Syringe 2ml
- GS01800 Omni-Cell® Assembly
- GS01811 KBr Windows (Pair) for liquids
- GS01812 CaF<sub>2</sub> Windows (Pair) for liquids
- GS01831 KBr Windows (Pair) for Mulls
- GS01864 Assorted PTFE Spacers (10 - for liquid cells)
- GS01871 PTFE 0.1mm Spacers (5 - for mull cells)
- GS03620 Bottle of Nujol (25ml)
- GS03621 Bottle of Fluorolube (25ml)



### Basic Solid Pack

#### GS01150 Basic Solid Pack Complete

(contents below)

- GS03940 Mini-Pellet Press (2T)
- GS03950 7mm Pellet Die with Pellet Ring Holder
- GS03951 7mm spare Pellet Ring Holder
- GS03600 Pestle and Mortar
- GS03610 KBr Powder (50g)
- GS03960 7mm Disc Holder with Rectangular Mount



### Advanced Solid Pack

#### GS01160 Advanced Solid Pack Complete

(contents below)

- GS15011 15T Manual Hydraulic Press
- GS03600 Pestle and Mortar
- GS03610 KBr Powder (50g)
- GS03410 13mm Disc Holder with Rectangular Mount
- GS03000 13mm Evacuatable Pellet Die



### Gas Pack

#### GS01170 Gas Pack Complete

(contents below)

- GS05021 KBr Windows (Pair)
- GS05030 Storm 10cm Cell Mount
- GS05000 Storm 10cm Pyrex Gas Cell (Body Only)
- GS05040 Storm 10cm Complete Seal Kit



### Quest® ATR ZnSe

- GS10802 Quest® ATR Single Reflection ATR with ZnSe Flat Crystal Top Plate

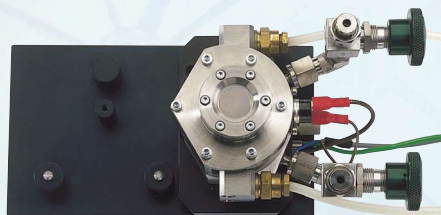
# Turn up the heat, pile on the pressure.



-190°C - +250°C



200°C - 125psi



800°C - 500psi



800°C - 1000psi

## We can handle it.

Specac works across the complete spectral range from UV, VIS, Mid, Far & NIR to millimeter wavelengths. Our solutions can cope with the most extreme temperature range -190°C to 800°C, pressures from high vacuum to 5000 psi and corrosive conditions that will leave other companies flummoxed and yet are the most cost-effective sampling solutions.

**Specac**

THE WORLD'S LEADING SPECTROSCOPIC ACCESSORY MANUFACTURER



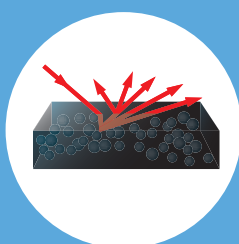
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# Infrared Reflectance Spectroscopy

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**IR Reflectance Spectroscopy introduction**



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**Attenuated Total Reflectance Accessories**



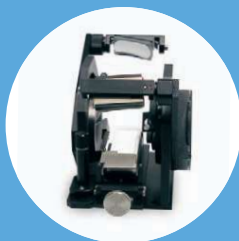
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**Diffuse Reflectance Accessories**



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**Specular Reflectance Spectroscopy**



## A complete and comprehensive range

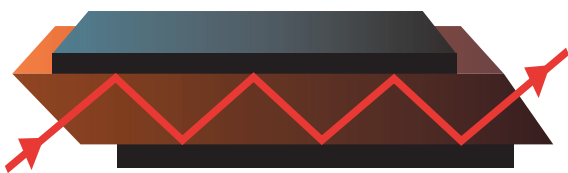
A comprehensive range of FT-IR Accessories are available for a variety of infrared spectroscopic sampling techniques. These products include: ATR Accessories, Diffuse Reflectance and Specular Reflectance Accessories, Liquid and Gas Transmission Cells, Infrared Windows, FT-IR Sampling Kits, FT-IR Consumables, and other spectroscopic accessories for FT-IR spectrometers.

# IR Reflectance Spectroscopy introduction

Infrared reflectance spectroscopy is used for samples that are difficult to analyze by transmission. An advantage of many reflectance techniques is that the samples can usually be analyzed without any preparation.

## 1. Internal Reflectance

- **measurements:** made using an (ATR) Attenuated Total Reflectance element in contact with the sample



Internal reflection occurs when infrared radiation enters an ATR crystal made of a highly refractive infrared transmitting material. ATR crystals are designed to enable total internal reflection creating an evanescent wave at the crystal surface.

This wave extends into a sample held in intimate contact with the crystal and absorption spectra can be recorded as a result. The depth of penetration of the evanescent wave into the sample is a function of the crystal material and the angle of incidence.

Deeper penetration is achieved with either a smaller incidence angle or a lower refractive index crystal. The depth of penetration also increases with the wavelength.

## 2. External Reflectance

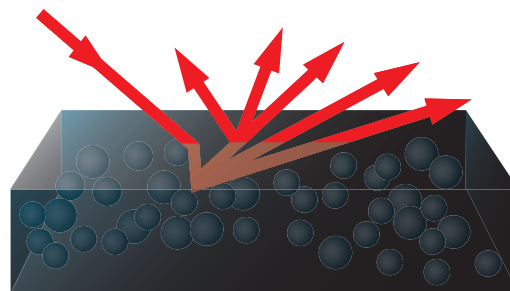
- **measurements:** made by collecting the infrared beam reflected from the sample surface.

In external reflectance, incident radiation is focused directly on to the surface of a sample.

The light reflected from the sample may be scattered in different directions or reflected directly, depending upon the physical form of the sample. When reflected light is scattered by the sample it is called diffuse reflection. When it is reflected directly, it is called specular reflection.

### Diffuse Reflectance

In diffuse reflection infrared spectroscopy (DRIFTS) diffusely scattered light can be collected either directly from a sample, or from an abrasive sampling pad previously abraded against an intractable sample. Many samples will give diffuse reflectance spectra.



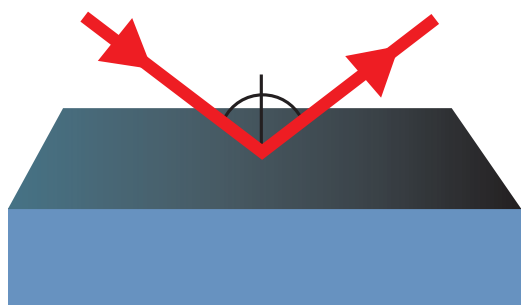
These include powders, fibers or matt surfaced samples such as textiles.

Where samples have a rough surface, such as a powder, specularly reflected light is a minor contributor to the overall signal. Specac diffuse reflection accessories are optimized to increase collection of the diffuse reflectance and decrease the specular component, as the specular component may adversely affect the spectrum.

## Specular Reflectance

Specular reflectance is a nondestructive method for surface measurements using the mirror-like reflection from the shiny surface of a sample.

Specular reflectance occurs when the reflected angle of infrared radiation equals the angle of incidence.



The amount of light reflected depends on the angle of incidence, and the refractive index, surface roughness, and absorption properties of the sample. Specular reflection accessories for infrared spectroscopy are used typically to measure coatings on reflective surfaces. This type of measurement is actually a transmission measurement of the coating, rather than a specular reflection measurement from the front surface. Typical applications include the study of surface coatings on surface treated, painted, or polymer coated metals.

Increased pathlengths through thin coatings can be achieved by increasing the angle of incidence.

The maximum sensitivity is achieved at the grazing angle ( $80^\circ - 85^\circ$ ). Monolayer films at a liquid-air interface can be studied using a grazing angle of incidence. Thicker coatings, in the micrometer thickness range, are studied typically using angles of  $30^\circ$ . Band intensities of the spectra also depend

on the type and degree of polarization as well as the effective pathlength.

The Specac range of reflectance accessories includes both fixed and variable incidence angle accessories.





# QUEST® ATR



## A journey into performance and value

The Quest® ATR is a high performance single reflection ATR accessory designed for laboratory spectroscopic sample analysis in the mid- and far-infrared. With innovative optical design and durable monolithic diamond ATR crystal option, it sets the benchmark in performance and value for ATR spectroscopy.

**Specac**

THE WORLD'S LEADING SPECTROSCOPIC ACCESSORY MANUFACTURER



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# Attenuated Total Reflectance Accessories

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**Quest®  
ATR**



Page 24

**Golden Gate®  
ATR**



Page 32

**Gateway®  
ATR**



Page 35

**25 Relection  
ATR**



## A high performance range of accessories

Specac offers a comprehensive range of Attenuated Total Reflectance (ATR) accessories for the analysis of solids, liquids, pastes, and gels.

These ATR accessories are compatible with a range of FT-IR spectrometers, and options are available for heated, cooled, or other advanced material analysis.

The product range includes the high-performance Golden Gate single reflection diamond ATR accessory and innovative Quest® ATR accessory.

# Quest® Single Reflection ATR

The most significant innovation in infrared spectroscopy in the last 10 years, designed for laboratory spectroscopic sample analysis in the mid- and far-infrared

## Quest® Single Reflection ATR

The Quest® ATR Accessory is a performance single reflection ATR accessory from Specac designed for laboratory spectroscopic sample analysis in the mid- and far-infrared.

With innovative optical design and durable monolithic diamond ATR crystal option, this sets the benchmark in performance and value for ATR spectroscopy.

In its standard configuration, the Quest® ATR Accessory has a strong and durable monolithic diamond ATR crystal which is ideal for analysing hard inflexible solid materials without risk of being scratched or damaged even for extreme point loads. Coupled with diamond's inherent chemical resilience, this allows the Quest® ATR Accessory to be used with the broadest range of sample types. A 1.8mm diameter diamond sample area means that good contact can be achieved even with the smallest amount of material available for analysis.

The Quest® ATR Accessory features an all-reflective optical design, based around Specac's proprietary Synopti-Focal Array technology.

This comprises precision-moulded aspheric mirrors and gold-coated optics as standard, and provides the Quest® ATR Accessory with high transmission throughput and an extended wavelength range capability to match that of your mid- and far-infrared FT-IR instrument.

Together with an optimised angle of incidence on the ATR crystal, these features ensure outstanding quality of spectra.



## Key features

- > Strong and durable monolithic diamond
- > Extended wavelength capability from 10,000 to 40 wavenumbers
- > High spectral quality and high throughput capability
- > Interchangeable Diamond, ZnSe & Ge crystal puck options

Four easily-interchangeable crystal pucks are available for use with the Quest® ATR Accessory: a high-throughput diamond puck for mid-infrared analysis (7800 to 400cm<sup>-1</sup>), an extended wavelength range diamond puck for the mid- and far-infrared (10000 to 40cm<sup>-1</sup>), a ZnSe crystal puck for softer materials, and a Ge crystal puck for strongly absorbing samples. These ATR crystal are mounted in a durable stainless steel puck and held in place against a robust metal seal to ensure compatibility with a broad range of sample types.

Repeatable and reproducible sample loads are enabled by a full-function pressure tower. This has an audible 'click' to indicate at the preset pressure limit, and features a swing anvil arm to allow easy access to the ATR crystal puck.

Both plane and pellet anvils are provided with the accessory to allow analysis of samples of various shapes. These anvils are easily interchangeable and stored on the top plate when not in use.



(Note: Quest® ATR accessory is Benchmark® Baseplate compatible - see next page)

# Quest® Single Reflection ATR



## The Benchmark® Baseplate System

Specac believe that your accessory should be able to be quickly and easily switched from instrument to instrument in your laboratory.

To facilitate this we have developed the Benchmark® Baseplate system as an interface between the accessory and instrument, and to which the accessory can be fitted with a single thumbscrew fixing. The Benchmark® Baseplate is unique to the instrument model being used (a baseplate is supplied with the Quest® ATR accessory) and can be left in the sample compartment, if required, for use with other Specac Benchmark® compatible accessories.

## Why is a monolithic diamond important?

Diamond ATR accessories on the market are generally available in two forms: those that feature a solid monolithic diamond and those with a thin diamond wafer supported by an optical element (typically ZnSe). Monolithic diamond ATR accessories are seen to benefit from the inherent robustness and durability of a solid diamond element, and are particularly resilient to high point loads typically encountered when analysing hard irregularly formed samples. They can also take advantage of the broad transmission window of diamond (10,000 to 40cm<sup>-1</sup>).

Conversely, diamond wafer ATR accessories are

seen to be more fragile under point loads, can suffer de-lamination from the supporting element, and have a useable transmission range that is often limited by the support material. However, featuring a thinner diamond, they also have weaker diamond absorption features at 2000 to 2500cm<sup>-1</sup>.

## ordering information

### Quest® ATR accessory complete

Please specify make and model of spectrometer

**GS10800-X** Quest® ATR Diamond

**GS10801-X** Quest® ATR Diamond-Extended Range

**GS10802-X** Quest® ATR ZnSe

**GS10803-X** Quest® ATR Ge



### X = Top-plate colour

Please choose Top-plate colour

**B** = Black   **O** = Orange   **Y** = Yellow   **P** = Purple

**G** = Green   **R** = Red   **A** = Aqua

### Quest® ATR Puck only

**GS10810** Quest® ATR Diamond Crystal Puck

**GS10811** Quest® ATR Diamond Extended Range Crystal Puck

**GS10812** Quest® ATR ZnSe Crystal Puck

**GS10813** Quest® ATR Ge Crystal Puck

### Spares and accessories

**GS10820** Quest® ATR Stainless Steel Flat Anvil

**GS10821** Quest® ATR Stainless Steel Pellet Anvil

**GS10825** Quest® ATR Volatiles Cover

**GS10707** Purge bellows (pair)

# Golden Gate® Single Reflection Diamond ATR Series MkII

The Golden Gate® is the world's most versatile infrared sampling system. It analyzes all types of samples, from hard solids to corrosive liquids, and it is easy to use, sensitive and robust.

## Golden Gate® Diamond ATR

Outstanding sensitivity is achieved using high pressure contact against a solid, type IIIa diamond, selected for its unparalleled sensitivity as a single reflection ATR element together with its unique physical and chemical stability.

The accessory can be used to analyze a range of samples from single particles and fibers to corrosive liquids. While the large working area sample platform is ideal for macro sampling.

The diamond is high temperature bonded into its tungsten carbide mount, giving performance and strength to withstand the high pressures required for maximum optical contact with hard samples.

The quick lock and release bridge allows for fast sample change around. The built-in pressure control mechanism means reproducible results are obtainable and optimum sample clamping is achieved.

Polarization studies can be carried out using the Benchmark® polarizer mount (GS12510 - see p104)



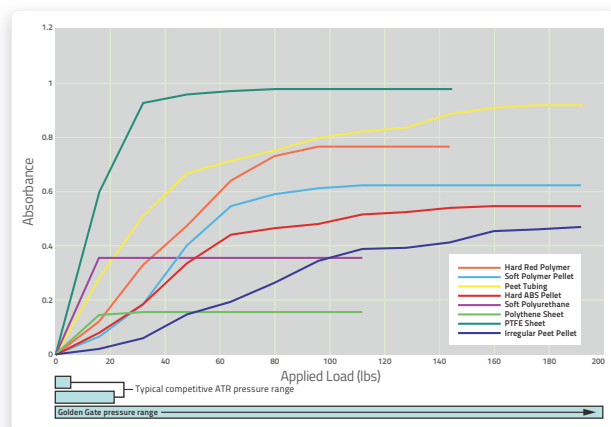
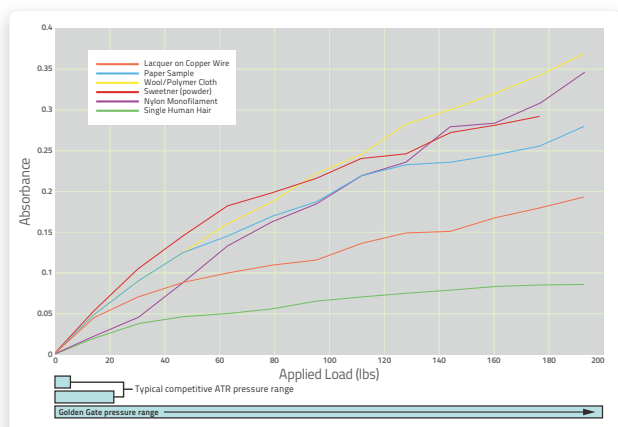
## Key features

- > High sample throughput - no preparation
- > Rugged type IIIa diamond ATR metal-bonded into a tungsten carbide mount
- > Hard, inert, sapphire self-levelling pressure anvil
- > Pressure bridge for highest sensitivity
- > A wide choice of available options
- > Quick release bridge with safety interlock
- > Built-in pressure control for reproducible results

## Applications

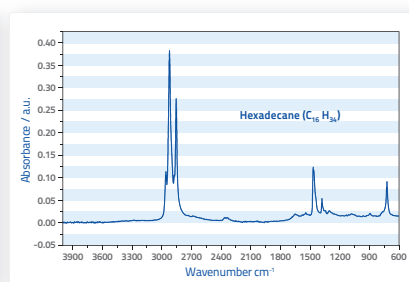
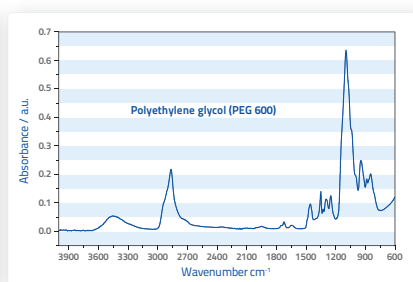
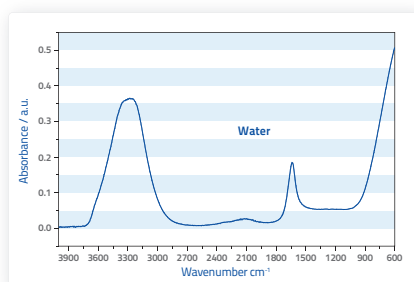
- > QA on pharmaceutical powders
- > Analysis of hard and soft polymer pellets
- > Forensic sampling, paint chips and single fibers
- > Hard samples, e.g. rock and geochemicals
- > Corrosive liquids
- > Coated wires
- > Air sensitive samples





## The effect of load on ATR sensitivity

## Measurements for typical samples



### Ultimate sensitivity and reproducibility

A key feature of the Golden Gate® Single Reflection ATR System is the outstanding contact achievable between solid samples and the diamond crystal.

For many sample types (particularly powders and fibers), as the load is applied to the sample and optical contact between the diamond and the sample increases, the intensity of the absorbance bands also increase. In other words, increasing the load increases the sensitivity.

The Golden Gate® gives the highest load capability of any commercial diamond ATR (over 180 lbs) and the diagrams above illustrate how that impacts sensitivity for a variety of sample types.

For softer samples, such as polymers, a similar effect is seen. However, once the sample has fully contacted the ATR surface, the absorbance stops increasing with increasing pressure.

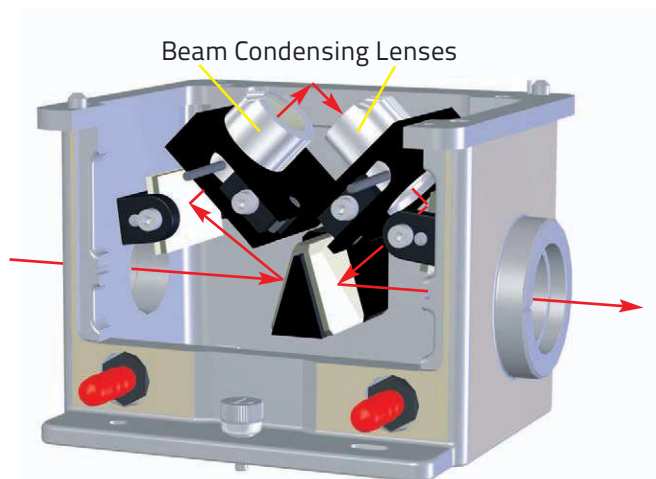
In order to achieve the best measurement repeatability and reproducibility for these samples, the instrument should ideally apply a load above the “knee” of the curve where the absorbance becomes much less sensitive to load.

The diagrams above illustrate some measurements for typical samples. Note how the harder sample types need a higher load to reach this ideal situation - and very often the Golden Gate® is the only product that can do it.

# Golden Gate® Single Reflection ATR

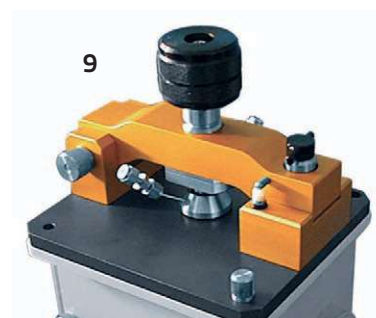
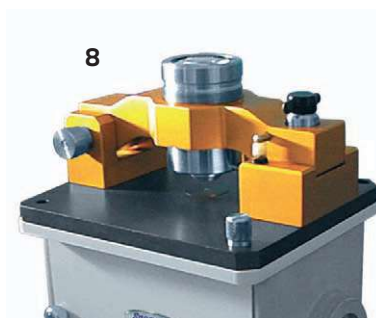
Top-plates of the Golden Gate® Single Reflection ATR Series are supplied on an optical unit which contains mirrors and a choice of beam condensing optics (ZnSe or KRS-5). All Top-plates are interchangeable with the optical unit.

A schematic is shown opposite of the beam path through the Golden Gate® optical system. The symmetrical design coupled with the use of the Benchmark® base-plate system means that the Golden Gate® can be used in most commercially available FT-IR instruments.



## Golden Gate® Anvil options

A variety of special anvils are available for use with the Golden Gate® Top-plates. The use of an appropriate anvil improves the sample handling capabilities of the Golden Gate® Single Reflection ATR System.



### 1 Reactive Sample Anvil

Samples which are sensitive to air or moisture can be loaded and pressed in a dry box. The anvil has a seal which compresses as the sample is pressed, thus keeping it in an inert environment while the spectrum is being run.

### 2 & 5 Grooved Anvils

(Narrow and Wide) To study the coating on transformer wire the grooved anvils hold the wire exactly in the middle of the diamond.

### 3 Sapphire Anvil

This is the standard anvil and is used for most sample types. It has the advantage of being very hard, and easy to clean to prevent sample carryover. It is also self-leveling to accommodate non flat samples.

### 4 Stainless Steel Flat Anvil

This is used for fibers or fine wires. It is not self-

levelling, which can be an advantage with this type of sample.

### 6 Pellet Anvil

Polymer pellets are held firmly in position with this concave anvil. With a flat anvil they could move when pressure is applied.

### 7 Volatiles Cover

If liquid samples are very volatile the cover is useful to minimize evaporation.

### 8 View-Thru Anvil

The View-Thru Anvil allows the sample to be viewed through a 4x lens system with a built-in reflective illuminator.

### 9 Flow-Thru Anvil

This micro flow cell anvil seals under pressure around the diamond. Its volume is 28 microliters and it can operate at 1000 psi. It may be used as a flow cell or as a micro reaction chamber.

# Golden Gate® Top-plate options

## High Temperature Top-plate

P/N GS10640



Many reactions and processes occur at high temperatures. The Heated Diamond Top-plate includes all the normal features of the Golden Gate® sampling technique but with the added benefit of heating samples up to 300°C. Diamond has a uniquely high thermal conductivity.

The Top-plate has a low thermal mass, and in combination with high power heaters in close proximity to the diamond, both rapid and efficient heating is achieved. This gives a high degree of temperature control. A rapid sample turn around is therefore possible. The Top-plate can be used

### Key features

- > Heatable to 300°C
- > Diamond in tungsten carbide mount
- > Low voltage heaters
- > Thermal safety fuses
- > Programmable temperature control via optional RS232, RS485 or USB connection
- > Complies with CE regulations
- > Low thermal mass
- > Thermal safety fuses

### Applications

- > Polymerization studies
- > Thermochemical studies
- > Curing reactions
- > Degradation / decomposition

with a computer controlled temperature controller with digital readout to 1°C. With safety in mind, low voltage (30V) heaters are used, and for additional protection thermal fuses are fitted as standard. The controller complies with European CE regulations.

## Reaction Cell

P/N GS10507



The Reaction Cell allows in-compartment reaction monitoring over a broad range of extreme conditions. The diamond is metal bonded into a tungsten carbide mount and this is contained within a high pressure reaction vessel.

The unique strength and durability of the diamond element makes it ideal for withstanding combinations of aggressive chemical contact at high temperatures and pressures.

### Key features

- > Controlled temperatures to 200°C
- > Low voltage (30V)
- > Cell volume 28ml
- > Pressures up to 3000psi
- > Water jacket to prevent overheating
- > Stainless steel construction with a choice of other materials
- > Stirring option available (contact Specac)
- > Flow through configuration option

### Applications

- > Chemical reaction analysis at high temperatures and pressures
- > Caustic solutions
- > Slurries with abrasive particulates
- > Acidic reactions
- > Optimization of process parameters

# Golden Gate® Top-plate options cont'd

## Low Temperature Top-plate

P/N GS10590



The Golden Gate® low temperature diamond ATR system is the first ATR accessory to provide high performance ATR measurements down to near liquid nitrogen temperature. The system uses a thermally insulated copper and stainless steel dewar in conjunction with an integral heater

The high thermal conductivity of the diamond crystal provides rapid temperature stabilization, accurate temperature measurement, and avoids temperature gradients across the sample.

The diamond ATR crystal is high temperature metal bonded into a tungsten carbide support disk and the top plate is hard-anodized to make the accessory chemically resistant and capable of withstanding the pressures required for optimum crystal and sample contact. Pressure is applied to the sample using the quick lock and release bridge from the proven Golden Gate® diamond ATR system.

### Key features

- > Continuous control of sample temperature from -150°C to 80°C
- > High thermal conductivity provides rapid cooling and temperature stabilization
- > Proven, strong clamping device, based on the Golden Gate® Diamond ATR, allows rapid, reproducible sample throughput
- > Thermally insulated copper and stainless steel dewar allows for the use of liquid nitrogen, dry ice, or salt & water refrigerant mixtures

This clamping device allows rapid sample throughput and reproducible solid sampling.

It also has a built-in torque limiter to control the loads applied to the diamond.

The Golden Gate® low temperature diamond ATR is constructed in such a way that the crystal mounting is under a constant load. This ensures that the diamond is kept in constant optical alignment, negating the effects of thermal expansion and contraction.

The upper thermal dewar body of the system is separated from the top-plate by a replaceable, thermally conducting spacer, avoiding the need for use of sealants that may contaminate the diamond surface. The system is easily and quickly taken apart for cleaning.

## Micro Specular Reflectance Top-plate

P/N GS10514



### Applications

- > Micro reflectance samples
- > Very highly absorbing samples
- > Carbon black containing polymers

A 45° angle Micro Specular Reflection Top-plate is for flat samples of greater than 3mm x 6mm, or powders that can be pressed into a self-supporting wafer. A scribed reference grid allows accurate repeat positioning of samples.

# Golden Gate® Top-plate options cont'd

## Supercritical Fluids Top-plate

P/N GS10585



The Supercritical Fluids Analyzer version of the Golden Gate® Diamond ATR is designed for operation at extreme temperatures and pressures.

The diamond ATR element is high temperature metal bonded into a tungsten carbide disk, avoiding the use of adhesives or resins that may be dissolved or attacked by the chemical aggressiveness of supercritical fluids.

The sample chamber has been specially constructed using stainless steel and is capable of withstanding

### Key features

- > Pressures up to 6000 psi
- > Temperature controlled to 300°C
- > Low volume 28µl stainless steel sample cell
- > Standard 1/16th inch fittings
- > CE Marked

### Applications

- > Supercritical and near supercritical fluids
- > Extreme condition analysis of polymers
- > In-situ ATR studies at high temperatures and pressure

pressures up to 6000 psi and temperatures up to 300°C. The high thermal conductivity of the diamond element is ideal for fast temperature equilibrium and accurate temperature measurement, reducing analysis time and increasing sample throughput.

The analyzer is equipped with a thermal protection system to prevent thermal runaway.



# Golden Gate®

## ordering information

### Golden Gate® ATR Mk II series

A complete Golden Gate® ATR Mk II System consists of an Optics Unit with ZnSe or KRS-5 Lenses, Top-plate (GS10563), Baseplate and Purge Bellows.

**GS10500 Complete Golden Gate® ATR Mk II**  
with ZnSe Lenses

**GS10515 Complete Golden Gate® ATR Mk II**  
with KRS-5 Lenses

(A Golden Gate® top-plate can be provided as a complete accessory on a ZnSe or KRS-5 lens optical unit or as an upgrade additional top-plate)

(Please specify make and model of spectrometer)



### Top-plate options

**GS10563 Diamond ATR Top-plate Mk II**  
Including Sapphire, Pellet anvils,  
and Volatiles cover

**GS10566 Germanium ATR Top-plate Mk II**  
Including Large stainless steel anvil  
and Volatiles cover

**GS10514 Micro Specular Reflectance Top-plate**  
including Reference mirror

**GS10507 In-Situ Reaction Cell Top Plate**  
including Temperature controller  
(Specify 220V or 110V and country  
for controller)

**GS10513 Stirring option for Reaction Cell**

**GS10585 Supercritical fluids top-plate**  
including Temperature controller  
(Specify 220V or 110V and country  
for controller)

**GS10590 Low Temperature Diamond ATR Top-plate** including Temperature controller  
(Specify 220V or 110V and country  
for controller)

**GS10640 High Temperature Top-plate**  
Including Sapphire and Pellet anvils,  
Volatiles cover & Temp. controller  
(Specify 220V or 110V and country  
for controller)

### Accessory options

#### GS10642 High Temp. Golden Gate® ATR Mk II

A complete heatable Golden Gate® ATR Mk II System consisting of an Optics Unit with ZnSe or KRS-5 lenses, Heated Top-plate, Baseplate, Purge Bellows and Temperature Controller  
(Please specify Spectrometer make and model for the appropriate baseplate - 220V or 110V and country for the Controller and ZnSe or KRS-5 lenses)



#### GS10586 Supercritical Golden Gate® ATR MK II

A complete Supercritical fluids Golden Gate® ATR Mk II System consisting of an Optics Unit with ZnSe or KRS-5 lenses, Supercritical fluids top-plate, Baseplate, Purge Bellows and Temperature Controller  
(Please specify Spectrometer make and model for the appropriate baseplate - 220V or 110V and country for the Controller and ZnSe or KRS-5 lenses)



#### GS10592 Low Temperature Golden Gate® ATR MK II

A complete Low Temperature Golden Gate® ATR Mk II System consisting of an Optics Unit with ZnSe or KRS-5 lenses, Low Temperature top-plate, Baseplate, Purge Bellows and Temperature Controller.  
(Please specify Spectrometer make and model for the appropriate baseplate - 220V or 110V and country for the Controller and ZnSe or KRS-5 lenses)



#### GS10525 Reaction Cell Golden Gate® ATR MK II

A complete Reaction Cell Golden Gate® ATR Mk II System consisting of an Optics Unit with ZnSe or KRS-5 lenses, Reaction Cell Top-plate, Baseplate, Purge Bellows and Temperature Controller  
(Please specify Spectrometer make and model for the appropriate baseplate - 220V or 110V and country for the Controller and ZnSe or KRS-5 lenses)



#### GS10513 Stirring option for Reaction Cell

Ask Specac for full details

# Golden Gate®

## ordering information cont'd

### Upgrade - Lenses

- GS10552 ZnSe lens upgrade kit 6500 - 600cm<sup>-1</sup>  
 GS10508 KRS-5 lens upgrade kit 6500 - 400cm<sup>-1</sup>

### Anvil options - Golden Gate® ATR MKII

#### Top-plates

- GS10503 Volatiles Cover  
 GS10531 Sapphire Anvil  
 GS10532 Pellet Anvil  
 GS10536 Reactive sample Anvil  
 GS10547 Grooved Anvil - narrow gauge  
 GS10548 Grooved Anvil - wide gauge  
 GS10549 Stainless steel flat Anvil  
 GS10567 Stainless steel large Anvil for  
 Germanium Top-plate  
 GS10568 Micro Reaction/Flow Cell Anvil  
 GS10569 View-Thru Anvil/Bridge assembly

#### Spares

- GS10707 Purge bellows  
 GS10550 Golden Gate® ATR Accessories ESK  
 GS10527 Golden Gate® Microspecular ATR ESK  
 GS10528 Golden Gate® Reaction Cell ATR ESK  
 GS10529 Golden Gate® SCF ATR ESK

#### Options

- GS28000 RS232 Connection kit  
 GS28001 USB Connection kit  
 GS28002 RS485 Connection kit  
 GS12510 Benchmark® polarizer mount



# Gateway® ATR System

An advanced 6 reflection ATR system for the infrared analysis of solids, liquids, pastes and gels



## Gateway® ATR System

The Specac Gateway® ATR system is a low cost multi-reflection horizontal ATR accessory.

High performance transfer optics and anti-reflection coated ZnSe crystals ensures unrivalled throughput and sampling sensitivity.

The rugged design, simple optical layout and Specac's unique Benchmark® base-plate system ensures optimum performance no matter which instrument make or model you use. The standard dual top plate configuration offers the most versatile package while optional, additional top plates allow sampling flexibility and system expandability.

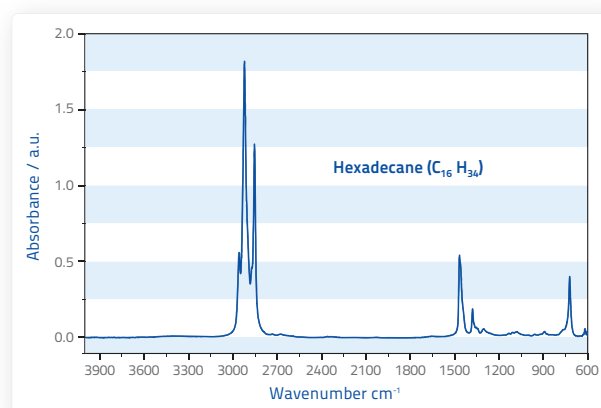
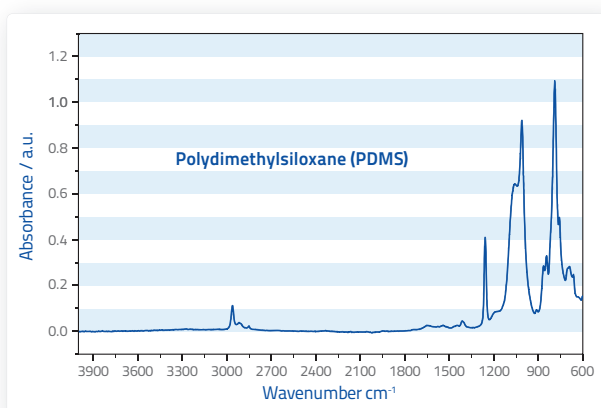
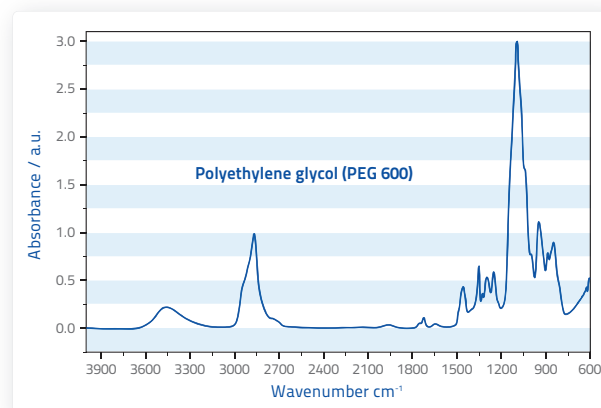
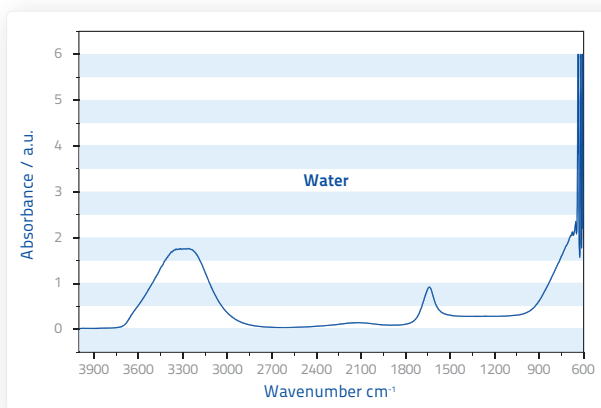
For the study of samples at elevated temperatures up to 200°C, there is an additional option of the electrically heated trough top plate with 45° angle ZnSe crystal and dedicated temperature controller P/N GS11155. The plate is an open trough design similar to the standard trough top plate P/N GS11166, whereby a liquid is simply poured in to cover the crystal.

## Key features

- > Replaceable crystals ZnSe, Ge and Si options
- > High optical throughput
- > Purgeable optics
- > Extensive range of optional top plates
- > Benchmark® base-plate system

## Applications

- > Aqueous solutions
- > Liquids – static or flowing
- > Pastes and gels
- > Polymer films
- > Fine powders
- > Quality control
- > Temperature sensitive samples
- > Reaction kinetics
- > Education



## Measurements for typical samples

The thermostabilized open trough top plate P/N GS11139 is similar to the P/N GS11155 top plate, but relies on a thermocirculating fluid for heating rather than from an electrically powered temperature controller.

An alternative type of heatable top plate for Gateway ATR is the 550 microliter thermostabilized flow through top plate assembly with 45° angle ZnSe crystal P/N GS11118.

A liquid sample can be flowed across the sampling surface of a ZnSe crystal in an enclosed chamber. The outer casing can be heated by the flow of a thermocirculating solution surrounding the sample/crystal area. The temperature achievable is dependent upon the thermocirculating fluid being used i.e. water or oil, etc.

A liquid sample pumping system can be used for delivery of the liquid sample via peristaltic type flow through flexible tubing attached to the sample ports on the flow plate. The sample flow through the thermostabilized flow through top plate is rated up to a 60psi maximum.

There is also a room temperature flowthrough top plate version with 550µl volume P/N GS11116.

All of the Gateway ATR top plates are supplied with a 45° angle ZnSe crystal P/N GS11145, but alternative germanium P/N GS11147 and silicon P/N GS11146 crystals at a 45° angle are also available. They can be supplied on their own for placement into the trough or thermostabilized top plates, but they must be pre-affixed into a flat top plate assembly.

# Gateway® ATR Top-plate options

## ordering information

**GS11165 Gateway® ATR System** including optics unit, Benchmark® Base-plate, ZnSe trough and flat top plates, sample clamp, purge bellows



### Other options

**GS11132 Volatiles Cover**  
**GS28000 RS232 Connection kit**  
**GS28001 USB Connection kit**  
**GS28002 RS485 Connection kit**

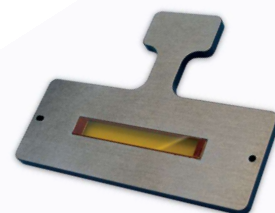
### Spares and consumables

**GS10707 Pair of Purge Bellows** for enclosing Benchmark® ATR beam path in spectrometer sampling compartment  
**GS11129 Gasket Replacement Kit** for GS11130, GS11139 and GS11155 Top-plates  
**GS11152 Flow Through Top-plate** silicone tubing  
**GS11133 ZnSe Flat Top-plate**  
**GS11134 Si Flat Top-plate**  
**GS11134 Ge Flat Top-plate**  
**GS11145 Replacement ZnSe Crystal** for all Top-plates (except Flat GS11133)  
**GS11146 Replacement Si Crystal** for all Top-plates (except Flat GS11133)  
**GS11147 Replacement Ge Crystal** for all Top-plates (except Flat GS11133)  
**GS11150 Kalrez Gaskets** for 550ml Top-plates  
**GS11167 Kalrez Gasket set** for trough Top-plate GS11166  
**GS11170 Gateway® optics unit** only  
**GS11171 Sample Clamp**

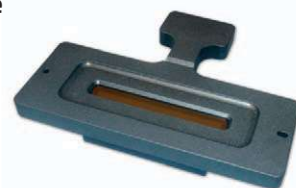
(Other crystal materials available on request)

### Optional Top-plates

**GS11133 Flat Top-plate**  
Ideal for solids or films  
Variety of crystals available



**GS11166 Trough Top-plate**  
Ideal for liquids and pastes  
Removable crystal  
Variety of crystals available



**GS11116 Flow thru Top-plate**  
Process control  
550µl volume  
Removable crystal  
Variety of crystals available  
Reaction monitoring



**GS11118 Thermostabilized Top-plate**  
Reaction kinetics  
550µl volume  
Heatable to 90°C  
Removable crystal  
Stainless steel top-plate and Kalrez spacer



**GS11139 Water heated trough Top-plate**  
A sub ambient to 90°C  
Top-plate heated or cooled by thermocirculating fluid



**GS11155 Electrically heated trough Top-plate**  
An electrically heated top-plate with dedicated temperature controller. This top-plate is heatable to 200°C.  
(Specify 220V or 110V)





# 25 Reflection ATR

For high sensitivity ATR measurements with FT-IR or dispersive instruments

## 25 Reflection ATR

The 25 Reflection Variable Incidence ATR (P/N GS11000) is a vertically mounted ATR crystal accessory capable of being operated for a crystal incidence angle of between 30° to 60°. The angle of incidence for the crystal is quickly and easily selected by rotation of a knurled adjustment screw. This moves the sample holder and crystal assembly to the correct position when the back face of the holder is in line with the required angle setting as indicated on the graduated plate.

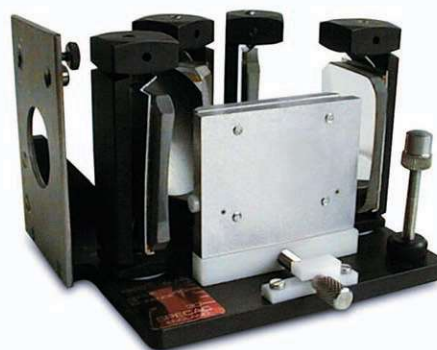
The standard crystal holder (P/N GS11001) supplied with the ATR Accessory is for solid samples, but a liquids holder (P/N GS11003) and a paste holder (P/N GS11002) are available on request. Although the sample holder and crystal assembly can be positioned between the angles of 30° to 60°, it is only when the holder and crystal assembly are correctly aligned at the 45° angle, that 25 internal reflections are obtained within the crystal. Sufficient sample is required to cover both faces of the trapezium shaped crystal for 25 reflection events to be measured.

The ATR Accessory is supplied with a KRS-5 crystal as standard, but a variety of crystal materials such as ZnSe, Ge and Si are available to extend the sample handling and study capabilities of the accessory.

The IR beam is directed through and collected from the crystal by four mirrors which are adjustable for both their rotation and tilt.

The accessory is supplied with a standard 3" x 2" mounting plate that allows it to be positioned in the spectrometer sample compartment using the instruments own 3" x 2" mounting baseplate.

In addition, the accessory is supplied with a support foot that is used in one corner of the base.



## Key features

- > Variable angle of incidence (30° - 60°)
- > 25 Reflections
- > Suitable for both FT-IR and dispersive instruments
- > Two pin sample location on sample mount
- > Standard 3" x 2" slide mounting
- > Choice of crystal materials; KRS-5 as standard
- > Interchangeable sample holders (solids, liquids and pastes)

## Applications

- > Solids    > Liquids    > Pastes
- > Variable depth studies for coatings and films

The foot is adjustable for height to provide mechanical stability of the accessory whilst in the sample compartment. A thumb nut locks the foot in position.

## ordering information

**GS11000 25 Reflection Variable Incidence Angle ATR** includes Solids holder and KRS-5 crystal (45°)

### Options

**GS11001 Solids holder for 25 Reflection ATR**  
**GS11002 Paste holder for 25 Reflection ATR**  
**GS11003 Liquid holder for 25 Reflection ATR**

### Spares and Consumables

**GS11004 KRS-5 crystal (45°)**  
**GS11006 Ge crystal (45°)**  
**GS11009 Si crystal (45°)**  
**GS11014 ZnSe crystal (45°)**  
**GS11008 PTFE gaskets (1 large, 1 small) for liquid holder (5 sets)**

# 'Spot', click, read, repeat.



## The NEW Specac Pearl® liquids analyser

- The smartest, easiest-to-use FTIR liquid sampling system available.
- Faster and more reliable than any traditional liquid cell - saving time and money.
- Accurate, repeatable pathlengths with wedging option, eliminating troublesome fringing.
- Different pathlengths and window materials, changed in seconds.
- Handles viscous materials with ease.



● Pearl® - simpler, easier, faster

**Specac**

THE WORLD'S LEADING SPECTROSCOPIC ACCESSORY MANUFACTURER



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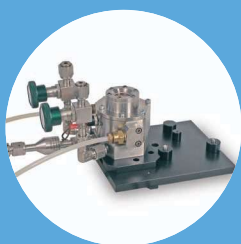


# Diffuse Reflectance Accessories

Page 38  
**The Selector®**



Page 39  
**Environmental Chamber**



Page 40  
**Minidiff® Plus**



## Innovative and designed to perform

Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFTS) accessories allow the study of the diffuse reflection from solid, powdered, and crystalline materials in the NIR and Mid-IR.

The technique allows material characterisation without recourse to extensive sample preparation. Specac provides diffuse reflectance accessories for both ambient environment and heated/pressurized environment analysis.

# The Selector®

An expandable diffuse reflectance sampling system that can change with your applications



## The Selector®

Diffuse reflectance is based upon the collection of radiation that has been diffusely scattered from the sample. The Specac Selector® uses an optimized off axis optics configuration which selectively collects the diffusely reflected components, whilst minimizing the specular component.

Various sampling cups are offered including a standard 11 mm diameter cup, a micro 4 mm diameter cup, and tilted cups. The tilted cups allow for collection of total reflectance, diffuse and specular components. In addition, an abrasive sampler, 12 mm diameter, can be used with Diabrase pads to allow quick and easy sample preparation of intractable solids.

The abrasive pad is simply rubbed against the sample of interest and mounted in The Selector® accessory. The Selector® is mounted on its own baseplate. The off-axis design allows room for the use of specialist alternative configurations. The Environmental Chamber option (see next page) extends the sampling capabilities of The Selector®.

## Key features

- Diffuse or total reflectance capabilities
- Minimal alignment
- Easy sample handling
- Macro, micro and tilted cups
- Diabrase synthetic diamond abrasive pads
- Sampling expandability via special baseplate option

## Applications

- Powders
- Intractable solids
- Liquid samples as a dispersion over KBr matrix

## ordering information

### GS19900

#### The Selector®

**Diffuse Reflectance System** includes

Optical unit with dedicated baseplate

Micro sample cup (4mm diameter)

2 Standard cups (11mm diameter)

20 Diabrase abrasive sample pads (12mm diameter)

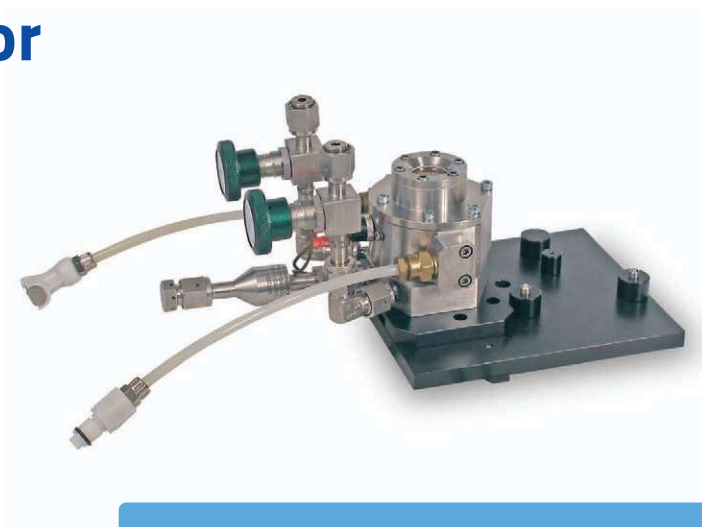
2 Mounts for abrasive sample pads

Tilted cup for total reflectance measurements

Please specify make and model of spectrometer

# Environmental Chamber option for The Selector®

The Environmental Chamber, in conjunction with The Selector®, is ideal for use in chemical research



## Environmental Chamber®

This accessory allows for the study of diffusely reflecting solid samples in a controlled atmosphere ranging from ambient temperature to 800°C, and vacuum (10<sup>-3</sup> Torr) to 500 psi pressure.

The standard chamber window is ZnSe, which gives a good balance between IR transmission and mechanical strength. Other optical transmitting windows are available on request.

The body is constructed from 316 stainless steel for ruggedness and chemical resistance.

Safety features include a low voltage automatic power supply and an automatic shut-down feature, should the temperature sensor detect an overheating fault.

A water cooling jacket keeps the outside of the chamber cool when operating at high temperatures and a safety "burst disk" activates whenever the pressure exceeds the recommended safety limit.

The Environmental Chamber, in conjunction with the Selector®, is ideal for use in chemical research such as kinetics, catalysis, surface analysis, polymerization and co-ordination chemistry.

## Key features

- > Programmable controlled temperatures to 800°C
- > Operates from vacuum (10<sup>-3</sup> Torr) to high pressure (500 psi)
- > Provides controlled atmosphere (gas inlet and outlet)
- > Extensive safety features

## ordering information

**GS19930** Environmental Chamber includes High Stability Controller & RS232 interface

Please specify make and model of spectrometer  
Please specify 220V or 110V & country of usage

## Options

**GS28000** RS232 Connection kit

**GS28001** USB Connection kit

**GS28002** RS485 Connection kit

## Spares and Consumables

**GS03610** KBr powder (50g)

**GS19915** Selector® 4mm diameter micro cup

**GS19916** Selector® 11mm diameter standard cup

**GS19917** Tilted cup - total reflectance measurements

**GS19918** Selector® abrasive pad sample mount

**GS19919** Selector® diabras abrasive sample pads  
12mm diameter (100 off)

**GS19931** Environmental Chamber ESK

**GS19934** Spare ZnSe housing





# Minidiff® Plus

A diffuse reflectance accessory for routine analysis



## Minidiff® Plus Diffuse Reflectance Accessory

For routine diffuse reflectance sampling, the Minidiff® Plus is the ideal accessory of choice.

High performance solids analysis is made simple through a minimal alignment optical system. Solid sampling versatility is maintained through the use of standard sampling cups and Diabrase abrasive sampling pads.

The sample introduction system reduces the risk of sample spillage, with up to 3 samples being loaded at the same time. The Benchmark® baseplate mounting provides consistent, stable and reliable positioning of the accessory in the spectrometer.

## ordering information

### GS04510 Minidiff® Plus



#### Diffuse Reflectance Accessory

includes

Optical unit and baseplate

2 Abrasive sample holders with 3 mounts

2 Sample cup holders with three cups

20 Diabrase abrasive pads (9mm dia.)

KBr Powder (50g)

Pestle and Mortar

## Key features

- > Pre-aligned mirrors
- > Easy sample handling
- > Diabrase sampling
- > Benchmark® baseplate mounted
- > Micrometer focusing adjustment

## Applications

- > Powders
- > Intractable solids
- > Liquid samples as a dispersion over KBr matrix

## Spares and Consumables

GS03610 KBr powder (50g)

GS04505 2 Sample cup holders with 3 cups

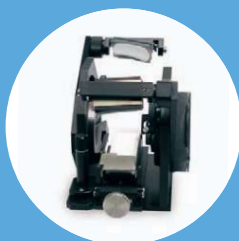
GS04506 100 Diabrase abrasive pads (9mm dia.)

GS04508 2 Abrasive sample holders with 3 mounts

# Specular Reflectance Accessories

Page 42

**Monolayer/  
Grazing Angle  
Specular  
Reflectance  
Accessory**



Page 44

**Specular  
Reflectance  
Accessory 30°**



## Cost effective and engineered to last

Specular reflectance accessories allow non-destructive spectral analysis of coatings, thin films, or other similar materials, deposited on or pressed against a reflective surface.

Specac offers both ambient temperature and high temperature, high pressure versions of specular reflectance accessory.

# Monolayer/ Grazing Angle Specular Reflectance Accessory

A dual purpose sampling device designed to provide the means of in-situ FT-IR monolayer investigation of films at an air or liquid interface and grazing incidence angle measurements of thin film coatings on solid reflective surfaces.

## Monolayer/Grazing Angle Specular Reflectance Accessory

The Monolayer/Grazing Angle Specular Reflectance Accessory P/N GS19650 is a dual purpose sampling device designed to provide the means of in-situ FT-IR monolayer investigation of films at an air/liquid interface and grazing incidence angle measurements of thin film coatings on solid reflective surfaces. The accessory can be easily converted from one form to the other by simple changeover of the appropriate sample holder.

The range of grazing incident angles available with this accessory are from 8° to 85° with no stray light, on most spectrometer systems. Aperture stops are provided to redefine the beam profile, for prime position on samples at or near grazing angles, to enhance the performance.

In the monolayer mode a variety of monolayer systems including surfactants, proteins, detergents, oils, polymers and phospholipids in biological membranes can be studied in their native environment for information such as solvation,



### Key features

- > Grazing angle capability
- > Monolayer analysis
- > Continuously variable incidence angles from 8° - 85° (dependant on spectrometer)
- > Volume of trough 8.9ml
- > Sample size 85 x 22mm liquid & 140 x 35mm solid
- > Built-in polarizer mount
- > Aperture stop facility for controlling the sampled area
- > Liquid film compression/expansion capability
- > Inert PTFE sample trough (liquids)

### Applications

- > Reflection-absorption spectra of solids
- > Langmuir-Blodgett films
- > Surfactant studies
- > Liquids in biological membranes
- > Semi-conductors
- > Paints
- > Resins
- > Polymer coatings
- > Matt surfaced samples
- > Molecular orientation of surfaces

molecular orientation, configuration and phase transition. A special liquid sampling trough, fabricated in PTFE, is used to contain the sample of interest. A rotatable polarizer mount and surface film stretching device are provided to aid in the studies. Any of Specac's P/N GS12000 series polarizers can be placed into the polarizer mount. The polarizer substrate chosen will determine the frequency range that can be observed in the Mid IR.

For solid surface sampling, an alternative flat sampling stage is used within the Monolayer/Grazing Angle accessory in place of the liquid sampling trough.

An important point about the sampling area requirement for the monolayer grazing angle accessory is that it is chiefly dependent on the incident angle of the beam of light being projected to the sample surface.

Whether it is a liquid sample or a solid surface, as the angle gets shallower (i.e. towards the 85° maximum for monolayer experiments) the spread of light across the surface gets larger as the elliptical shaped pool of light gets longer.

You therefore need a longer and thinner sample size area to make use of the available light, to maximise a sample signal. At grazing angles the amount of specularly reflected light can be very low in intensity and hence Specac would normally recommend that a sensitive detection system such as an MCT detector is used for measurement.

For liquid samples, the maximum length and width for a liquid surface is limited to 85mm and 22mm respectively. For the solid sampling platform, the maximum length of sample that can be accommodated is 140mm and the maximum width is 35mm.

The Monolayer/Grazing Angle accessory is baseplate mounted within a spectrometer sample compartment and an appropriate baseplate or fixings are supplied when ordered for a specific

spectrometer system. It is not compatible for attachment to a Benchmark® style baseplate.

However, in the majority of instances, the Monolayer Grazing Angle accessory can be adapted for use in a different spectrometer sample compartment by simple changeover to the appropriate baseplate.

## ordering information

### GS19650 Monolayer/Grazing Angle Accessory

consists of

- Optical unit with baseplate
- Horizontal sample stage
- Aperture stops
- Polarizer mount
- PTFE sample trough

**Please specify make and model of spectrometer**

### Spares and Consumables

**GS19662** PTFE trough for monolayer mode samples

**GS19663** Aperture stops and holder for the Monolayer/Grazing Angle accessory

# Specular Reflectance Accessory 30°

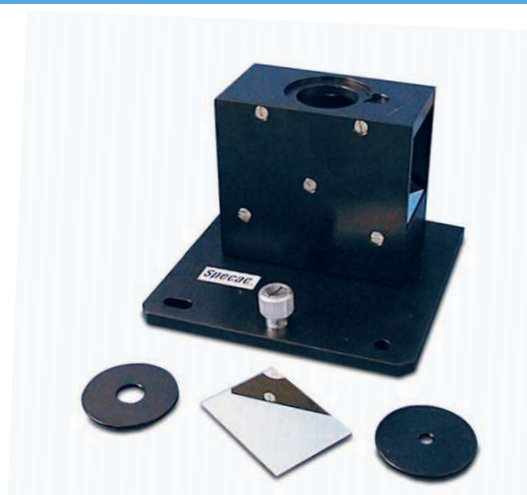
For surface analysis of solids by specular reflectance

## Specular Reflectance Accessory 30°

Specular reflectance is a non-destructive method for surface measurements using a mirror-like reflection from the shiny or semi-matt surface of a sample. Specular reflectance occurs when the reflected angle of infrared radiation equals the angle of incidence. The amount of light reflected depends on the angle of incidence, the refractive index, surface roughness and absorption properties of the sample.

The fixed angle specular reflectance accessory P/N GS19820 allows for a beam of radiation at a fixed angle of 30 degrees incidence to fall upon the surface of a solid material, in order to gain spectroscopic information on any surface layers of the flat solid sample. (Liquids or gums etc. cannot be analyzed due to the orientation of the sample).

The solid sample is inverted and placed over the aperture at the top of the accessory. The incident beam is projected from a fixed mirror block surface to the sample surface and is specularly reflected from the sample surface back to the fixed mirror block and then directed to the detector. The sample spectral collection is carried out after a reference spectrum has been collected using the reference mirror (supplied) in place of the sample. There are two different aperture stops (5mm and 10mm dia.) that can be used to mask down the area of study on the sample if desired. The sample sits flat over the aperture and its size is necessarily limited by the



### Key features

- > 30° fixed angle
- > Convenient horizontal sample position (20.8mm diameter full aperture)
- > Accommodates powder samples
- > Suitable for dispersive and large beam FT-IR
- > Minimal alignment

### Applications

- > Analysis of surface coatings (polymer, optical)
- > Local analysis of defects and inclusions
- > Fragile samples

dimensions of the sample compartment and the size of the aperture stop chosen.

The accessory is installed within a spectrometer using a Benchmark® type baseplate and so when ordering, you need to state which spectrometer is to be used to receive the appropriate baseplate.

## ordering information

### GS19820 Specular Reflectance Accessory 30°



Fixed Angle Specular Reflectance for FT-IR Spectrometers

includes:

Optical unit

Reference mirror

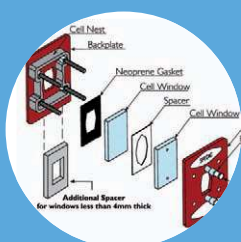
Sample aperture masks

(5mm and 10mm diameter)



# Infrared Transmission Spectroscopy

Page 46  
IR Transmission Spectroscopy Introduction



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Liquid/Solid Cells



Page 61  
Sample Cell Holders



Page 67  
Gas Cells



Page 83  
Transmission Cells



## Specac delivers performance and value

Transmission sampling techniques are applicable for liquid, solid, and gas spectroscopic analysis in the UV, visible, NIR, and infrared.

Specac provides a variety of products and consumables to meet these spectroscopic transmission analysis needs.

# IR Transmission Spectroscopy Introduction

Transmission spectroscopy is the oldest and simplest technique for analyzing samples in the infrared.

## Transmission spectroscopy

Transmission spectroscopy is the oldest and simplest technique for analyzing samples in the infrared.

This method of analysis is based upon the absorption of the infrared beam by a sample at specific wavelengths. Different compounds each display a unique infrared spectrum allowing them to be identified.

The extent of absorption 'A' is defined by the Beer-Lambert Law:  $A=abc$  where 'a' is the absorptivity coefficient, 'b' is the pathlength, and 'c' is the concentration. This law enables scientists to use infrared data to determine quantitative information.

Small amounts of sample can be analyzed by using an appropriate microsample holder in conjunction with a beam condenser.

## Solids

A variety of methods exist for analyzing solid samples by transmission spectroscopy. Thin polymer films can be analyzed directly by using a film holder.

Transmission spectra of solids can also be obtained by grinding the sample together with an infrared transparent matrix, such as KBr, and pressing the resulting powder into a thin disk.

Another method of analyzing solids is to make a mull by combining the sample with a liquid paraffin,

such as Nujol, and placing it between two infrared transparent windows.

A diamond compression cell is available for transmission studies of single fibres and other micro samples.

## Liquids

In transmission spectroscopy, liquids are analyzed as a thin film sandwiched between two windows in a liquid cell. The type of cell, choice of window material, and pathlength is determined by the sample.

Samples can be analyzed neat, or diluted with an appropriate solvent. In order to perform quantitative analysis, the sample should be analyzed in a cell with a known pathlength. A guide to pathlength selection for different concentrations in the mid infrared is shown below.

Analytical concentration	Typical pathlength
> 10 %	0.05 mm
10 % – 1 %	0.1 mm
1 % – 0.1 %	0.2 mm
< 0.1 %	> 0.5 mm

## Gases

Gases have densities several orders of magnitude lower than liquids and solids at standard temperature and pressure.

Therefore, transmission spectroscopy of gases requires cells with a longer pathlength than those used for liquid or solid analyses, usually 10 cm or longer.

Low concentrations of gases require a pathlength of several meters. This is achieved in a short space by using a multi-pass cell, where the infrared beam is bounced through the sample several times in order to obtain the desired pathlength.

# Liquid/Solid Cells

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**Pearl®  
Liquid Analyser**



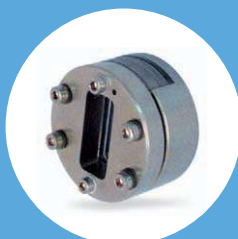
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**Omni-Cell®  
System**



Page 53

**Advanced  
Solid/Liquid  
Sampling  
Cells**



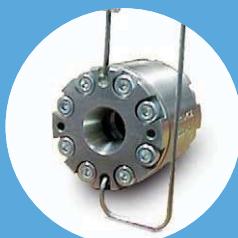
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**Flow Cells**



Page 58

**High Pressure  
Liquid Cell**



Page 59

**Variable  
Pathlength Cell**



Page 60

**Window  
Polishing Kit**



## A wide range for every application

Specac offers a selection of sealed and demountable liquid transmission cells to suit a variety of UV, visible, NIR, and infrared application needs.

These range for entry-level ambient temperature transmission sampling cells, to high-temperature high-pressure transmission sampling cells for advanced liquid transmission spectroscopic analysis.

Spectroscopic transmission cells are available with a choice of high-quality window materials to match analytical needs.

# Pearl® Liquids Analyser

The easiest to use FTIR liquid sampling system available



## Pearl® Liquids Analyser

The Pearl® is a high specification liquid transmission accessory designed for laboratory spectroscopic sample analysis in the near and mid Infrared.

The Pearl® accessory contains Specac's innovative Oyster® Lift and Tilt cell assembly, which holds the sample in a horizontal plane. The top Oyster® cell is simply lifted and tilted to one side to allow for fast and easy application of the sample, and for cleaning between samples.

For more volatile samples, there is an injection access port in the top Oyster®, so the cell assembly does not have to be fully opened. At all times, the sample can be viewed through the two windows, allowing the user to ensure that no bubbles have been trapped.

The Oyster® cell can be cleaned very easily and quickly using tissue and an appropriate solvent. The Pearl® has been designed to provide a more accurate pathlength than can be achieved using a traditional liquid transmission accessory, with pathlengths repeatable to significantly better than 1µm thanks to the innovative 'Lift and Tilt' mechanism. Oyster® cells have the unique feature of being offered as either parallel or wedged cells to eliminate troublesome fringing.

Pearl® can be fitted with ZnSe or CaF<sub>2</sub> windows which can be interchanged in seconds. Oyster® cells are available in five pathlengths, 50µm, 100µm, 200µm, 500µm and 1,000µm.

## Key features

- > The easiest to use FTIR liquid sampling system available
- > Faster, more accurate and more repeatable than traditional liquid cells
- > Wedged cell option to eliminate troublesome fringing completely
- > Different pathlengths and window materials changed in seconds
- > Handles viscous materials with ease

## Key applications

- > In-service oil analysis
- > Quantitative and qualitative analysis
- > Adulterated edible oil analysis
- > Highly viscous samples such as greases

The Oyster® cell mechanism is so easy to use that it makes the Pearl® accessory suitable for handling highly viscous samples such as oils and greases.

## The Benchmark® Baseplate System

Specac believe that your accessory should be able to be quickly and easily switched from instrument to instrument in your laboratory.

To facilitate this we have developed the Benchmark® Baseplate system as an interface between the accessory and instrument, and to which the

# Pearl® Liquids Analyser



accessory can be fitted with a single thumbscrew fixing. The Benchmark® Baseplate is unique to the instrument model being used (a baseplate is supplied with the Pearl® accessory) and can be left in the sample compartment, if required, for

use with other Specac Benchmark® compatible accessories.

## ordering information

### Pearl® base unit

- Blue: **GS31000-A**      ■ Black: **GS31000-B**      ■ Green: **GS31000-G**      ■ Orange: **GS31000-O**
- Purple: **GS31000-P**    ■ Red: **GS31000-R**      ■ Yellow: **GS31000-Y**

### Oyster® - complete

		Pathlength				
Window	Wedge	50µm	100µm	200µm	500µm	1000µm
ZnSe	Parallel windows	GS31211	GS31212	GS31213	GS31214	GS31215
ZnSe	Wedged windows	GS31221	GS31222	GS31223	GS31224	GS31225
CaF2	Parallel windows	GS31311	GS31312	GS31313	GS31314	GS31315
CaF2	Wedged windows	GS31321	GS31322	GS31323	GS31324	GS31325

### Oyster® - top

Window	
ZnSe	GS32200
ZnSe	GS32300

### Oyster® - bottom

		Pathlength				
Window	Wedge	50µm	100µm	200µm	500µm	1000µm
ZnSe	Parallel windows	GS33211	GS33212	GS33213	GS33214	GS33215
ZnSe	Wedged windows	GS33221	GS33222	GS33223	GS33224	GS33225
CaF2	Parallel windows	GS33311	GS33312	GS33313	GS33314	GS33315
CaF2	Wedged windows	GS33321	GS33322	GS33323	GS33324	GS33325



# Omni-Cell® System

A Universal Transmission Cell for the analysis of liquids and mulls in FT-IR or Dispersive Spectroscopy

## Omni-Cell® System

The Omni-Cell® System is a low cost novel approach to the analysis of liquid samples in transmission spectroscopy - one cell is suitable for all applications.

The cells are compatible with all FT-IR Spectrometers as well as older dispersive systems and can easily be configured for use as demountable liquid cells, permanently sealed liquid cells or as mull cells.

Transmission is a well established technique for analyzing samples in the infrared. The choice of window material, pathlength and window configuration are determined by the sample and wavelength range of interest. Samples can be analyzed neat or diluted with an appropriate solvent. For quantitative analysis, the sample is often analyzed in a cell with a known pathlength. A guide to the selection of the correct pathlength for various concentrations is given below:

Analytical concentration	Typical pathlength
> 10 %	0.05 mm
10 % – 1 %	0.1 mm
1 % – 0.1 %	0.2 mm
< 0.1 %	> 0.5 mm

Solid samples can be analyzed using the mull technique. The solid is combined with a mulling agent such as Nujol or Fluorolube to form a mull which is analyzed between circular windows.

(All cells are shipped as a kit of parts and require assembly by the user)



### Key features

- > Quick to assemble and change windows
- > Windows and Spacers compatible with older Specac cells
- > FT-IR and Dispersive compatibility
- > Quick release clamping mechanism
- > Low cost and reliable
- > Wide choice of window materials

### Applications

#### Demountable Cells

- > General Purpose
- > All liquids
- > Quantitative analysis

#### Sealed Cells

- > Volatile liquids
- > Quantitative applications
- > Low viscosity liquids

#### Mull Cells

- > High viscosity liquids
- > Gels and pastes
- > Oils and greases
- > Solids suspended as mulls

## Demountable Cell

This is a general-purpose cell for all liquids. It has the advantage of being easy to dismantle for cleaning, and for changing windows and spacers.

### Applications

- General purpose
- All liquids
- Quantitative analysis

## Sealed Cell

The window pair and spacer are amalgamated as an assembly. The advantages of this cell are constant pathlength for quantitative analysis and suitability for use with volatile liquids.

### Applications

- Volatile liquids
- Quantitative applications
- Low viscosity liquids

## Mull Cell

The Mull Cell does not use the standard liquid filling ports. A suitable sample is placed between 2 circular windows, then squeezed together by tightening the Omni-Cell® body parts. The advantage is that very viscous liquids, gels and pastes can easily be analyzed.

### Applications

- High viscosity liquids
- Gels and pastes
- Oils and greases
- Solids suspended as mulls

## Liquid Omni-Cell® Volumes

(Rectangular windows - top drilled, bottom undrilled)

Mylar spacer 0.006 mm thick - 1.82 microliters

Mylar spacer 0.012 mm thick - 3.64 microliters

Mylar or lead spacer 0.025 mm thick - 7.5 microliters

PTFE or lead spacer 0.05 mm thick - 15.50 microliters

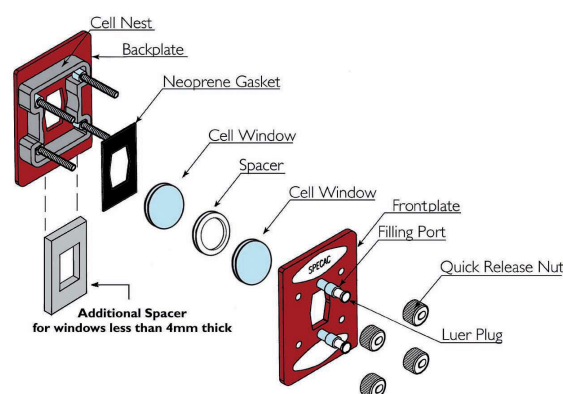
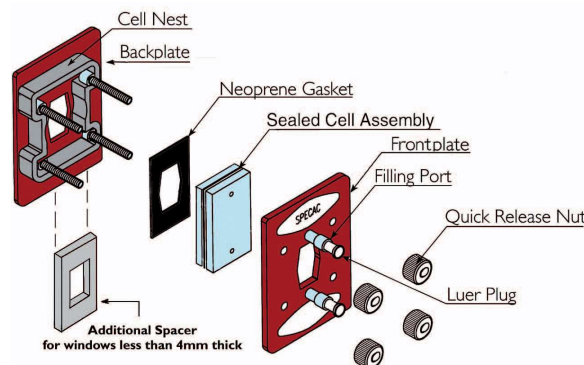
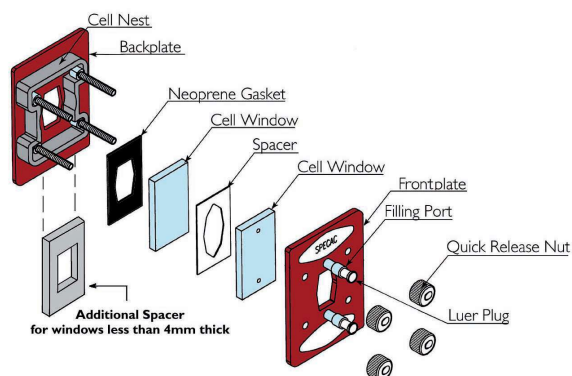
PTFE or lead spacer 0.10 mm thick - 30.00 microliters

PTFE or lead spacer 0.20 mm thick - 60.00 microliters

PTFE or lead spacer 0.50 mm thick - 150.00 microliters

PTFE or lead spacer 1.00 mm thick - 300.00 microliters

N.B. Please note that the figures produced are for an approximate volume of liquid contained between the window faces only. It does not include any extra amount of liquid that may be contained in the filling port sections of either type of liquid cell.



## ordering information

Ordering an Omni-Cell® is easy - just order the Universal Omni-Cell® Body, and buy the windows and spacers to suit your application.

**GS01800** The Omni-Cell® Body includes front and back plates, cell nest, 4 quick release nuts, bonded front PTFE gasket, rear neoprene gasket and 2 PTFE Luer plugs.

## Demountable Liquid Omni-Cell® Window Pairs (Rectangular) 41mm x 23mm

<b>GS01810</b>	NaCl Liquid Omni Windows
<b>GS01811</b>	KBr Liquid Omni Windows
<b>GS01812</b>	CaF2 Liquid Omni Windows
<b>GS01813</b>	BaF2 Liquid Omni Windows
<b>GS01814*</b>	ZnSe Liquid Omni Windows
<b>GS01815</b>	KRS-5 Liquid Omni Windows
<b>GS01816</b>	CsI Liquid Omni Windows
<b>GS01817</b>	CsBr Liquid Omni Windows
<b>GS01818*</b>	Silica (IR) Liquid Omni Windows
<b>GS01819*</b>	AgBr Liquid Omni Windows
<b>GS01820*</b>	Silicon Liquid Omni Windows
<b>GS01821*</b>	Polythene Liquid Omni Windows

## Liquid Omni-Cell® Spacers (Rectangular)

<b>GS01850</b>	0.05mm PTFE Spacers (5)
<b>GS01851</b>	0.10mm PTFE Spacers (5)
<b>GS01852</b>	0.20mm PTFE Spacers (5)
<b>GS01853</b>	0.50mm PTFE Spacers (5)
<b>GS01854</b>	1.00mm PTFE Spacers (5)
<b>GS01855</b>	0.025mm Lead Spacers (5)
<b>GS01856</b>	0.05mm Lead Spacers (5)
<b>GS01857</b>	0.10mm Lead Spacers (5)
<b>GS01858</b>	0.20mm Lead Spacers (5)
<b>GS01859</b>	0.50mm Lead Spacers (5)
<b>GS01860</b>	1.00mm Lead Spacers (5)
<b>GS01861</b>	0.006mm Mylar Spacers (5)
<b>GS01862</b>	0.012mm Mylar Spacers (5)
<b>GS01863</b>	0.025mm Mylar Spacers (5)
<b>GS01864</b>	Assorted PTFE Spacers (10) 2 of each thickness supplied

## Mull Omni-Cell® Window Pairs (Circular) 25mm Dia

<b>GS01830</b>	NaCl Mull Omni Windows
<b>GS01831</b>	KBr Mull Omni Windows
<b>GS01832</b>	CaF2 Mull Omni Windows
<b>GS01833</b>	BaF2 Mull Omni Windows
<b>GS01834*</b>	ZnSe Mull Omni Windows
<b>GS01835</b>	KRS-5 Mull Omni Windows
<b>GS01836</b>	CsI Mull Omni Windows
<b>GS01837</b>	CsBr Mull Omni Windows
<b>GS01838*</b>	Silica (IR) Mull Omni Windows
<b>GS01839*</b>	AgBr Mull Omni Windows
<b>GS01840*</b>	Silicon Mull Omni Windows
<b>GS01841*</b>	Polythene Mull Omni Window

## Mull Omni-Cell® Spacers (Circular)

<b>GS01870</b>	0.05mm PTFE Spacers (5)
<b>GS01871</b>	0.10mm PTFE Spacers (5)
<b>GS01872</b>	0.20mm PTFE Spacers (5)
<b>GS01873</b>	0.50mm PTFE Spacers (5)
<b>GS01874</b>	1.00mm PTFE Spacers (5)
<b>GS01875</b>	0.025mm Lead Spacers (5)
<b>GS01876</b>	0.05mm Lead Spacers (5)
<b>GS01877</b>	0.10mm Lead Spacers (5)
<b>GS01878</b>	0.20mm Lead Spacers (5)
<b>GS01879</b>	0.50mm Lead Spacers (5)
<b>GS01880</b>	1.00mm Lead Spacers (5)
<b>GS01881</b>	0.006mm Mylar Spacers (5)
<b>GS01882</b>	0.012mm Mylar Spacers (5)
<b>GS01883</b>	0.025mm Mylar Spacers (5)

\* These windows require additional spacer  
P/N GS01893

## Permanently Sealed Omni-Cell® Window Units (Rectangular with Lead Spacer)

These Sealed Cell Assemblies are used in the  
Omni-Cell® Body P/N GS01800

Material	0.025 mm	0.05mm	0.10mm	0.20mm	0.50mm	1.00mm
NaCl	GS01910	GS01920	GS01930	GS01940	GS01950	GS01960
KBr	GS01911	GS01921	GS01931	GS01941	GS01951	GS01961
CaF2	GS01912	GS01922	GS01932	GS01942	GS01952	GS01962
BaF2	GS01913	GS01923	GS01933	GS01943	GS01953	GS01963
ZnSe*	GS01914	GS01924	GS01934	GS01944	GS01954	GS01964
KRS-5	GS01915	GS01925	GS01935	GS01945	GS01955	GS01965
CsI	GS01916	GS01926	GS01936	GS01946	GS01956	GS01966
CsBr	GS01917	GS01927	GS01937	GS01947	GS01957	GS01967
Silica (IR)*	GS01918	GS01928	GS01938	GS01948	GS01958	GS01968

Please note: All windows are 4mm thick except ZnSe, Silica (IR), AgBr and Si, which are 2mm and Polythene, which are 3mm thick. These windows require the additional spacer for thin windows P/N GS01893

## Spares

<b>GS01110</b>	Luer Syringe (2ml)
<b>GS01890</b>	Rear Neoprene Gaskets (2)
<b>GS01891</b>	Quick Release Nuts (4)
<b>GS01892</b>	Luer Plugs for Omni-Cell® (2)
<b>GS01893</b>	Spacer for thin windows (1)
<b>GS03620</b>	Bottle of Nujol (25ml)
<b>GS03621</b>	Bottle of Fluorolube (25ml)

# Advanced Solid Sampling Cells

Choice of sample sizes from 12mm to 30mm diameter and 0.1mm to 8mm thick



P/N GS20600

There are two types of solids holder, P/N GS20600 and P/N GS20610. P/N GS20600 is used in the Electrical Heating Jacket P/N GS20730.

The body has a fixed size aperture of 10mm and hence solid samples can be analyzed from 12mm to 28mm dia. and up to 3mm thick.

P/N GS20610 is used in the Variable Temperature Cell Holder P/N GS21525. The solids holder consists of outer and inner cell threaded bodies and three pairs of pressure plates. The varying aperture sizes of the pressure plates enable samples with a diameter. of 12 - 17mm, 17 - 22mm and 22 - 30mm



P/N GS20610

and thicknesses of a few microns to 8mm thick to be analyzed.

Both of the solids holders do not require any windows for operation.

## ordering information

**GS20600** Solids Holder for Heating Jackets  
P/N GS20730 and P/N GS20710

**GS20610** Solids Holder for Variable Temperature Cell P/N GS21525

# Advanced Liquid Sampling Cells

For high sensitivity ATR measurements with FT-IR or dispersive instruments

## Liquid sampling cells

There are many combinations for liquid cells and they can be provided as static sealed (P/N GS20500 series), static demountable (P/N GS20510 series), flow sealed (P/N's GS20560 and GS20570 series) and flow demountable (P/N's GS20580 and GS20590 series) versions.

When you order a particular version you will receive the complete cell with windows of choice and a spacer at pathlength of choice all assembled together. Sealed cells have a lead spacer and lead top gasket and all components are permanently amalgamated/sealed together.

Demountable cells have a PTFE spacer and PTFE top gasket and as such allow for windows and spacer pathlengths to be interchangeable within these version cells. A threaded luer fitting, flushing tube, syringe needle, 2 PTFE washers and 3/32" Allen key are also included with the static version cells. The liquid is contained within the static version of liquid cells (sealed or demountable) by threaded stainless steel screw plugs.

The flow cells (GS20570 and GS20580 series) have an alternative front plate with permanent Swagelok connection fittings for 1/16" tubing.

The threaded luer and flushing tube cannot be attached to the flow cell front plate. The P/N's GS20570 and GS20580 series flow cells are, however, only suitable for use in the Electrical Heating Jacket P/N GS20730. For a liquid flow cell to be accommodated in the Variable Temperature Cell holder P/N GS21525, a different type of front flow plate is used with a static sealed GS20500 series cell.

These versions of flow cells for the Variable Temperature Cell Holder are P/N GS20560 series cells. The flow front plate on these liquid cells has



### Key features

- > Choice of pathlength
- > Sealed or demountable cells
- > Variety of window materials
- > Static or flow modes
- > Luer fittings and stainless steel plugs

two 1/16" stainless steel flow tubes welded to the sample inlet and outlet ports on the plate. The flow tubes are specifically shaped to allow for a liquid flow cell to fit in the Variable Temperature Cell Holder and be connected via Swagelok fittings to an external liquid supply.

Specac recommends use of a sealed cell within the Variable Temperature Cell Holder to offer the best sealing integrity to contain a liquid sample when in the local operating vacuum environment.

There are demountable flow cell equivalent versions of these sealed liquid flow cells that could be used in the Variable Temperature Cell holder. The flow front plate with stainless steel tubing and Swagelok fittings is attached to the demountable liquid cells GS20510 series. These demountable flow cells are GS20590 series type cells.

Either a sealed (GS20560 series) or demountable (GS20590 series) flow cell can be used in both the Variable Temperature Cell Holder and Electrical Heating Jacket. It is important to note that the P/N's GS20570 and GS20580 series flow cells cannot be used in the Variable Temperature Cell Holder. Please note that in order to use the flow cells in the Variable Temperature Cell Holder the flow option GS20080 must be fitted.



# Advanced Liquid Sampling Cells

## Liquid Cells GS20500 Series volumes

(Rectangular windows - top drilled, bottom undrilled)  
 Mylar spacer 0.006 mm thick - 1.60 microliters  
 Mylar spacer 0.012 mm thick - 3.25 microliters  
 Mylar or lead spacer 0.025 mm thick - 6.80 microliters  
 PTFE or lead spacer 0.05 mm thick - 13.50 microliters  
 PTFE or lead spacer 0.10 mm thick - 27.00 microliters  
 PTFE or lead spacer 0.20 mm thick - 54.00 microliters  
 PTFE or lead spacer 0.50 mm thick - 135.00 microliters  
 PTFE or lead spacer 1.00 mm thick - 270.00 microliters

N.B. Please note that the figures produced are for an approximate volume of liquid contained between the window faces only. It does not include any extra amount of liquid that may be contained in the filling port sections of either type of liquid cell.

## ordering information

**GS20500\*** NaCl Sealed Heatable Liquid Cell  
 (Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20501\*** KBr Sealed Heatable Liquid Cell  
 (Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20502\*** CaF<sub>2</sub> Sealed Heatable Liquid Cell  
 (Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20503\*** BaF<sub>2</sub> Sealed Heatable Liquid Cell  
 (Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20508\*** ZnSe Sealed Heatable Liquid Cell  
 (Specify pathlength, from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20510\*\*** NaCl Demountable Heatable Liquid Cell  
 (Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

**GS20511\*\*** KBr Demountable Heatable Liquid Cell  
 (Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

**GS20512\*\*** CaF<sub>2</sub> Demountable Heatable Liquid Cell  
 (Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

**GS20513\*\*** BaF<sub>2</sub> Demountable Heatable Liquid Cell  
 (Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

## GS20519\*\* ZnSe Demountable Heatable Liquid Cell

(Specify pathlength, from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

\* Includes a complete cell with front plate, top lead gasket, top window, lead spacer (choice of pathlength) and bottom window all sealed together.

\*\* Includes a complete cell with front plate, top PTFE gasket, top window, PTFE or Mylar spacer (choice of pathlengths) and bottom window that can be separated from each other.

## Windows for Liquid Cells

**GS20520** Pair of NaCl windows

**GS20521** Pair of KBr windows

**GS20522** Pair of CaF<sub>2</sub> windows

**GS20523** Pair of BaF<sub>2</sub> windows

**GS20596** Pair of ZnSe windows

**GS20598** Pair of Spec B (UV) windows

## Spares and Consumables for Liquid Cells

**GS20040** 10 off Front PTFE Gaskets

**GS20060** 10 off Rear PTFE Gaskets

**GS20050** PTFE and Mylar Spacers Assorted  
 (2 each of 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)\*\*\*

**GS20070** 10 off PTFE and Mylar Spacers (select from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)\*\*\*

**GS10030** Flushing Tube Kit

**GS10040** Threaded Luer Fitting

**GS10050** 10 off Syringe Needles

**GS10060** 2 off Stainless Steel Plugs

**GS10070** 10 off PTFE Sealing Washers

## Heatable Cell

**GS20539** Heatable Liquid Static Cells ESK



\*\*\* Please note that 0.006, 0.012 and 0.025mm spacers are only available in Mylar while all other sizes are in PTFE only.

# Flow Cells for Variable Temperature Cell Holder & Heating Jackets

Please note :- In order to use the flow cells in the Variable Temperature Cell holder (GS21525) the flow option kit GS20080 must be fitted.

## ordering information

**GS20560\*** NaCl Sealed Heatable Liquid Cell with 1/16" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20561\*** KBr Sealed Heatable Liquid Cell with 1/16" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20562\*** CaF<sub>2</sub> Sealed Heatable Liquid Cell with 1/16" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

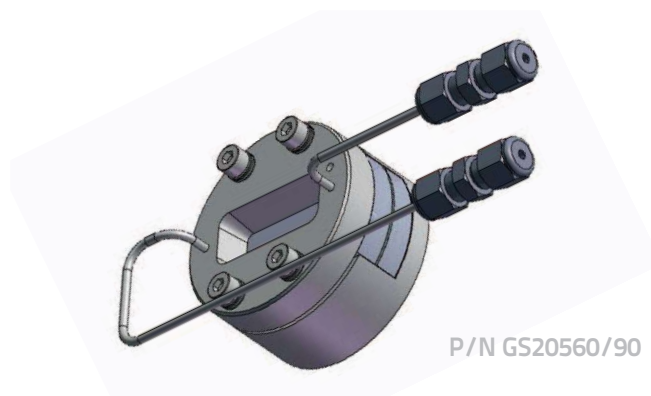
**GS20563\*** BaF<sub>2</sub> Sealed Heatable Liquid Cell with 1/16" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20566\*** ZnSe Sealed Heatable Liquid Cells with 1/16" Swagelok fittings for flow purposes. (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20590\*** NaCl Demountable Heatable Liquid Cells with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

**GS20591\*\*** KBr Demountable Heatable Liquid Cells with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

**GS20592\*\*** CaF<sub>2</sub> Demountable Heatable Liquid Cells with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)



P/N GS20560/90

### Key features

- > Choice of pathlength
- > Sealed or demountable cells
- > Variety of window materials
- > Flow mode

**GS20593\*\*** BaF<sub>2</sub> Demountable Heatable Liquid Cells with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

**GS20594\*\*** ZnSe Demountable Heatable Liquid Cells with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

### Heatable Flow Cell

**GS20569** Heatable Liquid Flow Cell ESK



\* Includes a complete cell with front flow plate, top lead gasket, top window, lead spacer and bottom window all sealed together.

\*\* Includes a complete cell with front flow plate, top PTFE gasket, top window, PTFE or Mylar spacer (choice of pathlengths) and bottom window that can be separated from each other.

# Flow Cells for Heating Jackets

Flow Cells for P/N GS20710 and GS20730 only

## ordering information

**GS20570\*** NaCl Sealed Heatable Liquid Cell with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20571\*** KBr Sealed Heatable Liquid Cell with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20572\*** CaF<sub>2</sub> Sealed Heatable Liquid Cell with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20573\*** BaF<sub>2</sub> Sealed Heatable Liquid Cell with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20576\*** ZnSe Sealed Heatable Liquid Cell with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.025, 0.05, 0.1, 0.2, 0.5 and 1.0mm)

**GS20580\*\*** NaCl Demountable Heatable Liquid Cells 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

**GS20581\*\*** KBr Demountable Heatable Liquid Cells 1/16" Swagelok fittings for flow purposes. (Specify pathlength from 0.006, 0.012, 0.05, 0.025, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

**GS20582\*\*** CaF<sub>2</sub> Demountable Heatable Liquid Cells 1/16" Swagelok fittings for flow purposes. (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

**GS20583\*\*** BaF<sub>2</sub> Demountable Heatable Liquid Cells 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)



P/N GS20570/80

### Key features

- > Choice of pathlength
- > Sealed or demountable cells
- > Variety of window materials
- > Flow mode

**GS20586\*\*** ZnSe Demountable Heatable Liquid Cells with 1/16" Swagelok fittings for flow purposes (Specify pathlength from 0.006, 0.012, 0.025, 0.05, 0.1, 0.2, 0.25, 0.5 and 1.0mm)

### Heatable Flow Cell

**GS20569** Heatable Liquid Flow Cell ESK



\* Includes a complete cell with front flow plate, top lead gasket, top window, lead spacer and bottom window all sealed together.

\*\* Includes a complete cell with front flow plate, top PTFE gasket, top window, PTFE or Mylar spacer (choice of pathlengths) and bottom window that can be separated from each other.

# High Pressure Liquid Cell

## High Pressure Liquid Cell

Specac produce High Pressure Liquid Cells that are capable of being operated to 5000psi with Sapphire or Spectrosil B windows and 2000psi with ZnSe windows. The pathlength of these cells can be 0.1mm, 0.2mm, 0.5mm, 1.0mm, 2mm, 5mm or 10mm as standard. The windows are permanently sealed in their window housing assemblies using Viton material O-rings and for most purposes the cells are rated to 180°C temperature operation. The cells as standard are provided with their own 3" x 2" mounting plate, which can be removed if the cell is placed into a heating accessory.

There are two 1/16" stainless steel flow tubes brazed to the High Pressure Liquid Cell body to introduce the fluid to the inner chamber of the cell. The cell can be filled for static operation or for flow. There is no security valve or over-pressurization device fitted as standard to the cell, but because the flow tubing is connected via Swagelok fittings, a safety device could be attached in line at this point to the Swagelok connections if required.

To be heated, the High Pressure Liquid Cell requires a heating device such as the Electrical Heating Jacket and temperature controller (GS20730), or the Variable Temperature Cell holder and temperature controller (GS21525).

Either heating accessory is designed to fit into the sampling compartment of a spectrometer via the standard 3" x 2" mounting plate, with the High Pressure Liquid Cell fitting directly into the Electrical Heating Jacket or the cell holder part of the Variable Temperature Cell holder. As an additional mounting option, the Variable Temperature Cell Holder can also be installed into a spectrometer via an appropriate Benchmark® Baseplate.

For a volume of fluid needed to fill the High Pressure Liquid Cell, the smallest pathlength cell at 0.1mm requires approximately 15 microliters of fluid, whereas the 10mm pathlength cell requires



### Key features

- > Choice of pathlength
- > Sealed to ensure pressure capability
- > Choice of windows from ZnSe, Spec B or sapphire

15 milliliters. This is the approximate amount of fluid that will be contained in the inner cell chamber at any time, irrespective of it being operated for static or flow conditions.

As standard the High Pressure Cells are fabricated in EN58 stainless steel but other materials are available on request.

## ordering information

- GS05910 High Pressure Short Pathlength Cell**  
2000 psi (Specify pathlength from 0.5, 1 and 2mm and window material from ZnSe, Sapphire and Spec B)
- GS05915 High Pressure Short Pathlength Cell**  
5000 psi (Specify pathlength from 0.5, 1 and 2mm and window material from Sapphire or Spec B)
- GS05920 High Pressure Long Pathlength Cell**  
2000 psi (Specify pathlength from 5 and 10mm and window material from ZnSe, Sapphire and Spec B)
- GS05925 High Pressure Long Pathlength Cell**  
5000 psi (Specify pathlength from 5 and 10mm and window material from Sapphire and Spec B)

# Variable Pathlength Cell

Cells that allow adjustment of sample pathlength in situ.



## Variable Pathlength Liquid Cell

The Variable Pathlength Cells P/N GS07500 Series allow for liquids to be studied over a range of pathlengths obtainable from one cell.

The pathlength range is adjustable from 0.040mm to 6.000mm in increments of 0.005mm by anti-clockwise rotation of an outer sleeve cap assembly about the cell body that separates the windows of the cell. Micrometer and vernier scales are marked on the cell body for accurate pathlength setting and readability.

The windows of the cell do not rotate in relation to the movement of the outer sleeve cap assembly with the cell body and hence remain parallel to each other throughout the pathlength range. Choice of window materials allows for the study of many liquid sample types and there is a standard 3" x 2" mount fixing, such that the cell can be used in a very wide range of spectrometer systems.

## Key features

- > Continuous adjustment of sample pathlength
- > Micrometer and vernier scales for accurate pathlength setting and readability
- > Standard 3" x 2" slide mounting
- > Non-rotating windows
- > Pathlength variation: 0.04-6mm
- > Scale division: 5µm
- > Volume at maximum pathlength: 6ml

## Applications

- > Liquid analysis without dilution
- > Determination of absorption coefficient

## ordering information

GS07500	Variable Pathlength Cell (NaCl windows)
GS07501	Variable Pathlength Cell (KBr windows)
GS07502	Variable Pathlength Cell (CaF <sub>2</sub> windows)
GS07503	Variable Pathlength Cell (BaF <sub>2</sub> windows)
GS07509	Variable Pathlength Cell (ZnSe windows)

### Options

GS01110	Luer syringe (2ml)
GS07130	Neoprene gaskets for 7500 series (10)
GS07135	Luer plug & reservoir cap for 7500 series
GS07140	PTFE gaskets (0.1mm) for 7500 series (10)
GS07150	Spare Window Key

## Replacement Windows for 7500 Series

GS07020	Set of NaCl windows
GS07021	Set of KBr windows
GS07022	Set of CaF <sub>2</sub> windows
GS07023	Set of BaF <sub>2</sub> windows
GS07024	Set of CSi windows
GS07025	Set of CsBr windows
GS07026	Set of KRS-5 windows
GS07027	Set of Fused Silica (IR)
GS07028	Set of AgBr Windows
GS07095	Set of Polyethylene windows
GS07096	Set of ZnSe windows
GS07097	Set of Silicon Windows



# Window Polishing Kit

Keep windows in top condition with the Specac Window Polishing Kit

## Window Polishing Kit

This kit contains all the essential materials required to clean and repolish windows to a flatness within a few fringes. It is especially effective in use with window materials such as NaCl and KBr. Repolishing can be achieved efficiently and economically with a minimum degree of skill.

Full instructions are included and all consumable parts are replaceable.

## ordering information

- GS04000 Polishing Kit Complete**
- GS04010 Polishing Selvyt** (self adhesive pads) (5)
- GS04040 Polyethylene bottle** (2)
- GS04050 Cleaning sponge** (1)
- GS04060 Bottle of polishing rouge** (approx 75g net)
- GS04080 Plain Selvyt strips** (2) (non adhesive)
- GS04090 Lapping paper** (5)
- GS04095 Brushes** (2)



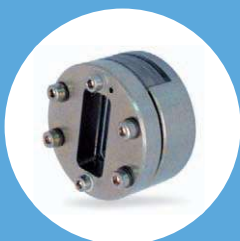
### Kit includes

- > Polishing Selvyt
- > Polyethylene bottle
- > Cleaning sponge
- > Bottle of polishing rouge
- > Plain Selvyt strips
- > Lapping paper
- > Brushes

# Sample Cell Holders

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**Introduction and compatibility table**



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**Variable Temperature Cell Holder**



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**Electrical Heating Jacket**



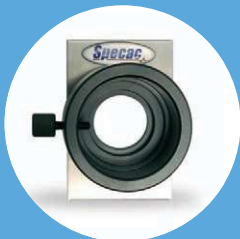
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**Water Heating Jacket**



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**Ambient Cell Holder**



## An advanced range of sample cell holders

A range of sample cell holders are available for use with Specac's liquid and solid advanced transmission cells, cuvettes, and diamond compression cell, as appropriate. These allow either ambient temperature analysis, or heated/cooled spectroscopic analysis over a broad temperature range.

# Sample Cell Holders introduction

## Advanced Solid and Liquid Sample Cell Holders for Variable Temperature, Pressure and flow conditions

Specac offers a range of transmission accessories to allow a sample to be studied at temperatures other than ambient.

The Variable Temperature Cell holder (P/N GS21525) can be used for the temperature range of -190°C to 250°C and the Electrical Heating Jacket (P/N GS20730) is used for temperatures from ambient to 250°C. Specific sample cell holders for liquids and solids are used within these accessories.

These are known as GS20500/GS20510 Series liquid cells and GS20600 and GS20610 solid cells. Liquid cells are supplied with windows from a wide range of materials, to suit for specific sample applications. (A comprehensive list of IR transmitting materials and their properties can be found at the back of the Specac catalogue.)

All of the sample cells can also be operated at ambient temperature and pressure when used with the 3" x 2" mount sample holder (P/N GS20740). For experiments at high pressures, High Pressure Heatable Liquid Flow Cells (P/N GS05910) series can be used in the Electrical Heating Jacket and Variable Temperature Cell holder. These cells are supplied with their own 3" x 2" mounting plate for use in Spectrometers at ambient temperature.

## 20500/20510 Series Liquid Cells Solids Holders & High Pressure Liquid Cells and Mount Holders compatibility table

Key: ■ = compatible      \*Cell holder/Mount\*\*

Cell Series Type	*VT Cell / GS21525**	*EHJ / GS20730**	*WHJ / GS20710**	*Ambient / GS20740**
<b>Liquid Cells</b>				
GS20500 Sealed/Static	■	■	■	■
GS20510 Demountable/Static	■	■	■	■
GS20560 VT Cell Sealed/Flow	■	■	■	■
GS20570 EHJ Sealed/Flow		■	■	■
GS20580 EHJ Demountable/Flow		■	■	■
GS20590 VT Cell Demountable/Flow	■	■	■	■
<b>Solids Holders</b>				
GS20600		■	■	■
GS20610	■		■	■
<b>High Pressure Liquid Cells</b>				
GS05910	■	■	■	
GS05915	■	■	■	
GS05920	■	■	■	
GS05925	■	■	■	

# Variable Temperature Cell Holder

For the analysis of liquids or solids between  $-190^{\circ}\text{C}$  and  $250^{\circ}\text{C}$

## Variable Temperature Cell Holder

The Variable Temperature Cell Holder P/N GS21525 is the ideal accessory to use for the transmission study of liquid or solid samples at various temperatures ranging from  $-190^{\circ}\text{C}$  to  $250^{\circ}\text{C}$ .

The Variable Temperature Cell Holder consists of a vacuum jacket with two window ports and a set of windows (NaCl as standard) which contains a refrigerant dewar/cell holder assembly. Liquid or solid sample holders are inserted into the heating block part of the dewar/cell holder and the assembled cell is operated within a vacuum environment maintained by the outer jacket.

Using a combination of refrigerant and control from the cell block heaters any temperature from  $-190^{\circ}\text{C}$  to  $250^{\circ}\text{C}$  can be achieved. Choice of window materials for both the jacket and sample cell holders allows for use of this accessory in the UV, visible and IR regions.

The Variable Temperature Cell Holder is supplied with a high stability controller with a factory fitted option for control via RS232, RS485 or USB connectivity if ordered.

For certain applications such as Raman, Fluorescence and UV spectral measurements Specac offer a four window port version on the vacuum jacket as the Variable Temperature Cuvette Holder (GS21530), special quartz glass cuvettes are used to contain a liquid sample. The four window ports allow for collection of the scattered radiation



### Key features

- > Programmable controlled temperatures from  $-190^{\circ}\text{C}$  to  $250^{\circ}\text{C}$
- > Dewar cooling system
- > Heated Jacket windows to prevent condensation
- > Flow mode option kit for liquids
- > Benchmark® Baseplate or 3"x2" mounting options

### Applications

- > Analysis under extreme temperature conditions
- > Absorption band study at low temperatures
- > Polymerization studies
- > Phase transition studies
- > Reaction kinetics
- > Polymorphism
- > Catalysis
- > Oxidation studies

from a cuvette cell at a 90 deg incident angle as well as at a 180 deg (standard transmission) as measured from the Variable Temperature Cell Holder (GS21525). (Note cuvettes not supplied by Specac).

# Variable Temperature Cell Holder

## ordering information

- GS21525 Variable Temperature Cell Holder**  
Includes: Refrigerant dewar/cell holder  
2 window port vacuum jacket with pair of NaCl windows (P/N GS 20800)  
Fixed thermocouple (copper-constantan)  
Low voltage supply cables  
High Stability Temperature Controller with factory fitted option for control via RS232, RS485 or USB connectivity if ordered  
This accessory also requires a liquid or solids sample holder (See pages 51 - 57)

Please specify spectrometer make and model for Baseplate version. For controller specify 220V or 110V and country of usage

- GS21530 4 Port Variable Temperature Cuvette holder**  
Includes: Refrigerant dewar/cell holder  
4 window port vacuum jacket with 2 pairs of Spectrosil-B quartz glass windows (P/N GS 20898)  
Fixed thermocouple (copper-constantan)  
Low voltage supply cables  
High Stability Temperature Controller with factory fitted option for control via RS232, RS485 or USB connectivity if ordered

Please specify spectrometer make and model for Baseplate version. For controller specify 220V or 110V and country of usage

## Replacement Windows for Variable Temperature Cell (copper-constantan)

- GS20800** Pair of NaCl windows  
**GS20801** Pair of KBr windows  
**GS20802** Pair of CaF2 windows  
**GS20803** Pair of BaF2 windows  
**GS20896** Pair of ZnSe windows  
**GS20898** Pair of Spec B (UV) windows

## Spares for Variable Temperature Cell holder

- GS20200** Monitoring Thermocouple (copper-constantan)  
**GS20201** System Control Thermocouple (copper-constantan)  
**GS20810** Replacement set of O-rings  
**GS21526** VT Cell Holder ESK

## Options

- GS28000** RS232 Connection kit  
**GS28001** USB Connection kit  
**GS28002** RS485 Connection kit





# Electrical Heating Jacket

For liquid and solid sampling in transmission from ambient to 250°C

## Electrical Heating Jacket

The Electrical Heating Jacket P/N GS20730, is used for the study of samples by transmission spectroscopy over a temperature range from ambient to 250°C. It consists of a central heatable chamber with a front cover plate. Liquid and solid sample cells are placed within the central chamber and held in place by the cover plate. The whole assembly (Jacket plus sample cell) is installed into a spectrometer sample compartment via the 3" x 2" slide mounting plate.

Heating to the Jacket is provided by its own dedicated low voltage (30 Volts) temperature controlling system, that is provided with the Heating Jacket as standard. A water cooling back plate incorporated into the 3" x 2" slide mounting plate of the Jacket acts to keep any heat at the central chamber from spreading to the mount area of the sample compartment during operation.

For the study of liquid samples, the liquid cells of



### Key features

- > Programmable controlled temps. up to 250°C
- > Static or flow sampling capabilities
- > Fully CE Safety compliant
- > Protective water cooling system
- > Standard 3" x 2" slide mount

the (GS20500/20510) Series type (static and flow versions) are placed into the Electrical Heating Jacket's central chamber. If solid samples are to be analysed, then the specific solids holder (GS20600) is used within the Electrical Heating Jacket.

The Electrical Heating Jacket is supplied with a high stability power controller with a factory fitted option for control via RS232, RS485 or USB connectivity if ordered.

## ordering information

### GS20730 Electrical Heating Jacket

Includes: Low voltage heated jacket with water cooling system NiCr/NiAl thermocouple

High Stability Temperature

Controller factory fitted option for control via RS232, RS485 or USB connectivity if ordered

This accessory also requires a liquid or solids sample cell (See pages 51 - 57)

Please specify 220V or 110V and country of usage

### Options

**GS28000** RS232 Connection kit

**GS28001** USB Connection kit

**GS28002** RS485 Connection kit



# Water Heating Jacket

For liquid and solid sampling in transmission to 90°C

## Water Heating Jacket

The Water Heating Jacket is similar to the Electrical Heating Jacket, but it uses circulating water to heat the sample cell. A jacket around the circular aperture is filled with a solution, for example water, heated by a thermocirculating system.

Temperature control of the sample holder is reliant upon this thermocirculating system.

The sample cell holders used with Electrical Heating Jacket can also be used in this accessory.



## ordering information

### GS20710 Water Heating Jacket

Includes, Water Heating Jacket on a 3" x 2" mount

Requires, but does not include:

1. A liquid or solid sample cell
2. Thermocirculating system



# Ambient Temperature Cell Holder

The Ambient Temperature Cell Holder has been designed to hold a variety of liquid and solid sample cell holders at ambient temperatures.



## ordering information

### GS20740 Ambient Temperature Cell Holder

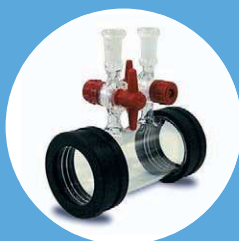
Requires, but does not include:

Liquid or solid sample cell

# Gas Cells

Page 68

**Storm® 10cm  
Gas Cell**



Page 69

**Storm® 10cm  
Heated  
Gas Cell**



Page 70

**Cyclone®  
Gas Cells**



Page 78

**Tornado®  
Gas Cells**



## Gas transmission cells for every application

A broad variety of gas transmission cells are available for the analysis of gas and vapour phase components in infrared optical spectroscopy. These range from short pathlength gas cells for percent level concentration measurement, to long pathlength gas cells for part-per-billion concentrations. Options include fixed and variable pathlength gas cells, as well as ambient temperature and heated gas cells.

# Storm® 10cm Gas Cell

Designed for routine gas analysis

## Storm® 10cm Gas Cell

These gas cells are ideal for analyzing gases and vapors at room temperature and low pressures. Gases and gaseous mixtures can be examined in static or flow modes.

The cells consist of threaded cylindrical vessels with end caps, window seals and removable windows. The cell bodies are available in Pyrex® and stainless steel.

Pyrex®, PTFE taps, valves and glass cone connectors (10-19 taper) are used for the Pyrex® cells while stainless steel and Viton® sealed valves with barbed hose connections are used for the stainless steel cells to introduce samples into these cells.



## ordering information

### Storm® 10cm Gas Cells

**GS05000** Series Storm® 10cm Pyrex® Gas Cell  
(specify windows)

**GS05800** Series Storm® 10cm Stainless Steel Gas Cell (specify windows)



### Cell mounts

**GS05030** Cell Mount for Pyrex® and Stainless Steel Storm® Gas Cells



### Key features

- > Demountable for ease of cleaning and window replacement
- > Choice of cell material: stainless steel or Pyrex®
- > Choice of window materials
- > Window diameter: 47mm
- > Clear aperture: 39mm
- > Two ports for static or flow experiments
- > Slide mounted cell holder
- > Cell volume; 0.125 litres

### Applications

- > Qualitative gas analysis
- > Residual solvent vapour analysis
- > Liquid head-space analysis

### Replacement windows

- GS05020** Pair of NaCl windows
- GS05021** Pair of KBr windows
- GS05022** Pair of CaF<sub>2</sub> windows
- GS05023** Pair of BaF<sub>2</sub> windows
- GS05096** Pair of ZnSe windows

### Spares and consumables

- GS05040** Seal kit for Pyrex® Gas Cell
- GS05803** Vacuum Valve for Stainless Steel Gas Cell
- GS05804** Seal kit for Stainless Steel Gas Cell

# Storm® 10cm Heated Gas Cell

Analyze gaseous samples and vapours from room temperature to 250°C

## Storm® 10cm Heated Gas Cell

The Storm® 10cm Heated Gas Cell analyzes gaseous samples and vapours from ambient temperature to 250°C.

The cell is an evacuable stainless steel chamber with an injection septum sample introduction port and is heated by a low voltage (30v) heater surrounding the body.

The exact gas temperature can be measured with an additional monitoring thermocouple (supplied) which passes through a vacuum tight seal into the gas cavity. The cell is supplied with a High Stability Temperature Controller with a factory fitted option for control via RS232, RS485 or USB connectivity if ordered.

The cell can be converted to a flow mode via 1/16" stainless steel flow tube in exchange at the injection septum and additional monitoring thermocouple connection ports.



## ordering information

### Storm® 10cm Heated Gas Cell

**GS05670 Series Storm® 10cm Heated Gas Cell**  
(specify windows) includes high stability temperature controller

Please specify 220V or 110V & country of usage

### Options

**GS28000 RS232 Connection kit**  
**GS28001 USB Connection kit**  
**GS28002 RS485 Connection kit**



### Key features

- > Stainless steel construction
- > Stainless steel vacuum stopcock
- > Chemically resistant window seals
- > Choice of window materials
- > 10cm pathlength
- > 30 volt heater system for operator safety
- > Programmable controlled temperature via optional RS232, RS485 or USB connection
- > Slide mounting supplied
- > Flow mode (optional)
- > Window size 47mm diameter
- > Clear aperture 39mm diameter
- > Cell volume 0.125 litres

### Applications

- > Gases and vapours at elevated temperatures
- > Vapours generated by solids and liquids at elevated temperatures
- > Decomposition studies

### Replacement Windows

**GS05020 Pair of NaCl windows**  
**GS05121 Pair of KBr windows**  
**GS05022 Pair of CaF2 windows**  
**GS05023 Pair of BaF2 windows**  
**GS05096 Pair of ZnSe windows**

Please note part No GS05121 are thicker KBr windows required for this cell.

### Spares and consumables

**GS05662 Stainless steel flow tubes (10)**  
**GS05665 Injection Septa (10)**  
**GS05667 Complete seal kit**

# Cyclone® Gas Cells

## Heatable long pathlength Gas Cells

### Cyclone® Gas Cells

Based on the White cell principle of multiple light passes between an arrangement of reflecting mirrors, Cyclone® gas cells are available in three sizes:

- **Cyclone® C2** - Fixed or adjustable pathlengths ranging from 0.5m to 2.5m
- **Cyclone® C5** - Fixed or adjustable pathlengths ranging from 1m to 8m
- **Cyclone® C10** - Fixed or adjustable pathlengths ranging from 2.1m to 10.6m

Cyclone® series gas cells are suitable for operation in all modern FT-IR spectrometers using the Specac Benchmark® baseplate provided as standard.

Cells are available as standard with a borosilicate glass body for operation at ambient temperatures and pressures ranging from vacuum to 15 psi. Protected gold mirrors, internal and external components made from nickel-plated aluminium and stainless steel, and Viton® 'O' rings are combined to ensure the highest chemical compatibility and protection from leaks.

Vacuum/gas inlet and outlet taps, KBr windows and a purgeable transfer optics box further enhance this already highly featured range.

### Unsurpassed Upgradeability

Cyclone's impressive list of optional features means that any analytical challenge can be met. Adjustable pathlength mirror carriages, and a range of fixed pathlength mirror carriages can be used within a single gas cell body to greatly enhance analytical flexibility and reduce costs.

Nickel-plated aluminium bodies can be specified for high pressure operation up to 125 psi, and heating jackets/high stability temperature controllers allow operation at temperatures up to 200°C.

CaF<sub>2</sub> or ZnSe windows can be specified to replace the KBr windows offered as standard. There is also

### Key features

- > Fixed pathlength
- > Borosilicate glass body
- > Ambient temperature operation
- > Vacuum to 15 psi operation
- > Gold mirrors (protected)
- > Viton® 'O' ring seals
- > KBr windows
- > Adhesive-free construction
- > Nickel-plated aluminium components
- > Vacuum/gas inlet & outlet taps
- > Purgeable transfer optics box
- > Benchmark® series baseplate mounting
- > CE compliant

### Optional features

- > Adjustable pathlength mirror carriage
- > Additional fixed pathlength mirror carriages (all models)
- > ZnSe or CaF<sub>2</sub> windows
- > Nickel-plated aluminium body for high pressures operation (up to 125 psi)
- > Heating jacket / controller for high temperature operation (up to 200°C)
- > Pressure gauge kit
- > Desiccant storage caps
- > Purge bellows
- > Laser alignment accessory
- > Kalrez O-rings

an option to replace the standard Viton seals with Kalrez O-rings for more challenging chemical environments.

Purge bellows allow the transfer optics to be used under inert gas atmospheres (e.g. nitrogen) in applications where the elimination of atmospheric H<sub>2</sub>O and CO<sub>2</sub> absorbances is required.

### Design Excellence

To ensure perfect operation and freedom from unwanted impurities, a number of unique features have been incorporated into the design and manufacture of the Cyclone® series.



# Cyclone® Gas Cells

Heatable long pathlength Gas Cells



## Cyclone® C2

- Pathlength: 0.5m - 2.5m (fixed or adjustable)
- Pathlength steps: 0.5m
- Volume: 0.19 litres
- Dimensions (mm): H384 W153 D120



## Cyclone® C5

- Pathlength: 1m - 8m (fixed or adjustable)
- Pathlength steps: 1m
- Volume: 1.33 litres
- Dimensions (mm): H536 W153 D130

### Cyclone® Gas Cells

Cyclone Gas Cells are completely free from adhesives and all of the Viton® 'O' ring seals are carefully pre-baked to eliminate any contamination from solvents or out-gassing.

Internal screws have small bleed holes drilled into them to prevent any trapped pockets of gas causing sample cross contamination.

### CE Compliance

All Cyclone® series heated gas cell systems are CE compliant ensuring that they can be operated safely at all times under the recommended conditions.

### General specifications

- > Cell body material: Borosilicate glass (optional metal body)
- > Pressure range: Vacuum to 15 psi (optional 125 psi)
- > Temperature range: Ambient (optional heated systems available)
- > Mirrors: Gold (protected)
- > Windows: KBr (optional ZnSe or CaF2)
- > Inlet/outlet fittings: Stainless steel taps
- > 'O' rings: Viton®
- > Internal components: Nickel-plated aluminium & stainless steel
- > Transfer optics: Aluminium mirrors in purgeable optics box
- > Cell mount: Benchmark® Baseplate series

# Cyclone® Gas Cells

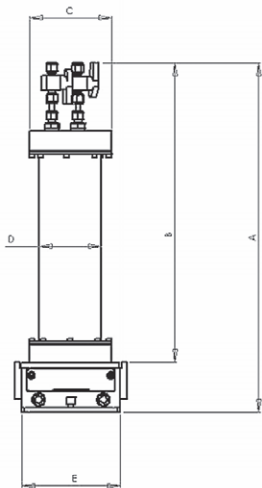
Heatable long pathlength Gas Cells



## Cyclone® C10

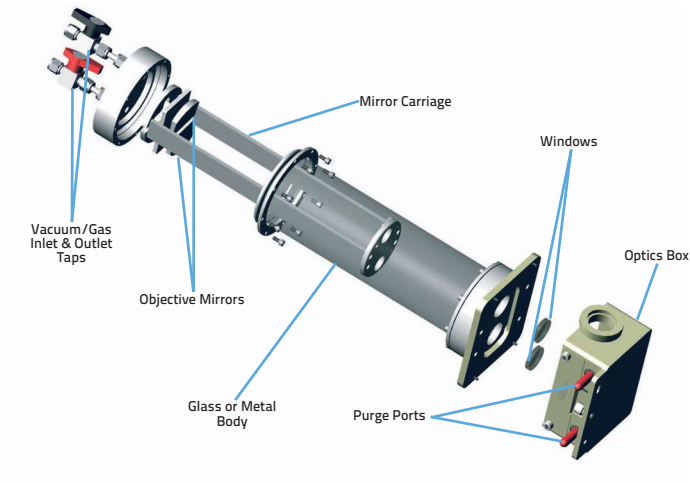
- Pathlength: 2.1m - 10.6m (fixed or adjustable)
- Pathlength steps: 1.06m
- Volume: 2.61 litres
- Dimensions (mm): H540 W153 D1146

Cyclone® Gas Cells key dimensions below



Cell	A	B	C	D	E
C2	384	314	73	47	153
C5	536	466	114	87	153
C10	540	470	143	113	153

All dimensions in mm



Cell	Base Pathlength	Pathlength Range	Volume
C2	12.5cm	0.5m to 2.5m (in 0.5m steps)	0.19 litres
C5	25cm	1m to 8m (in 1m steps)	1.33 litres
C10	26.4cm	2.1m to 10.6m (in 1.06m steps)	2.60 litres

# Cyclone® Gas Cells



## Optional features

Cyclone® series heatable long pathlength gas cells have been designed with the serious analyst in mind. These high performance, superior quality cells are backed by a comprehensive range of optional upgrades ensuring that they meet every analytical challenge.

### Purge Bellows

A pair of purge bellows is available for the Cyclone® series gas cells. These fit between the optics box of the cell and the spectrometer to allow the purging of transfer optics with inert gases such as nitrogen. This feature allows absorbances due to atmospheric H<sub>2</sub>O and CO<sub>2</sub> to be eliminated from spectral measurements. These bellows are designed to fit all Specac gas cells.

**GS10707 Purge Bellows (pair)**

### Desiccant Storage Caps

These caps are designed to fit over the optical inlet and outlet ports of the Cyclone® series gas cells to seal the transfer optics when the cells are not in use.

One of the caps contains a desiccant material which maintains a dry atmosphere within the transfer optics box and extends the life of KBr windows.

**GS24150 Desiccant Storage Caps**

### Pressure Gauge Kit

A pressure gauge kit is available to fit the Cyclone® series gas cells. Gauges can be specified for low pressure operation (vacuum to 15 psi) and high pressure operation (vacuum to 125 psi - metal bodied cell only). An integral pressure relief valve ensures that cells are automatically depressurised in the event of accidental over pressurisation.

Specac recommend the use of a pressure gauge when operating gas cells at elevated pressures.

**GS24160 Pressure Gauge Kit (pair)**

(Specify high or low pressure)

# Cyclone® Gas Cells

## Optional features



### Heating Jacket / High Stability Temperature Controller

All of the Cyclone® series gas cells (glass and metal bodied versions) can be upgraded to heatable gas cells by the addition of the appropriate Heating Jacket and High Stability Temperature Controller. The heating jacket simply slides over the gas cell and it can be operated from ambient temperatures up to 200°C.

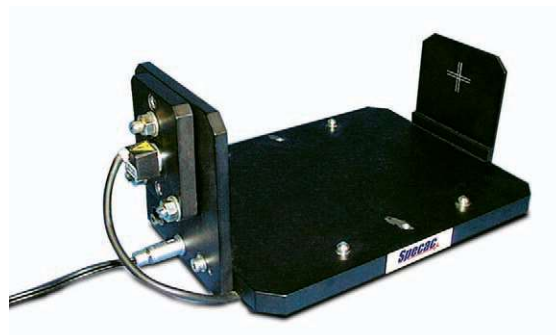
Low voltage (32V) heaters are used to ensure safe operation at all times and the temperature controller has a factory fitted option of RS232, RS485 or USB connectivity if ordered.

Temperature stability is  $\pm 1^\circ\text{C}$  and a key feature of the design is the uniformity of the heating across the whole cell, which prevents localised “cold spots” within the cell.

All of the Cyclone® series Heating Jacket / High Stability Temperature Controller systems are CE compliant ensuring that they can be operated safely at all times under the recommended conditions.

## ordering information

- GS24302** Heating Jacket/Controller for Cyclone® C2
  - GS24305** Heating Jacket/Controller for Cyclone® C5
  - GS24310** Heating Jacket/Controller for Cyclone® C10
- (Specify voltage and country of usage)



### Benchmark® Series Laser Alignment Accessory

This accessory allows the visual verification of the optical pathlength through Cyclone® series gas cells. This is especially useful when different pathlengths are regularly used with variable pathlength cells.

The accessory is based on a low power (0.8mW) visible continuous wave LED precisely located in position in a Benchmark® accessory alignment housing. The gas cell simply slots into the alignment accessory. The 635nm Class II laser can be powered from a battery unit or by the dedicated mains transformer supplied.

Benchmark® Laser Alignment Accessory is CE compliant ensuring that it can be operated safely at all times under the recommended conditions.

## ordering information

- GS24500** Benchmark® Series Laser Alignment Accessory
- (Specify voltage and country of usage)

# Cyclone® Gas Cells compatibility chart

This guide shows which Cyclone® gas cell and respective heating jacket can be used within a range of spectrometer sample compartments.

**Key:** **FWJ** - Fits (and also) With Jacket  
**FNJ** - Fits but No Jacket **DNF** - Does Not Fit

FT-IR Instrument	C2 Cell GS24102	C5 Cell GS24105	C10 Cell GS24110
Bomem M100	FWJ	FWJ	FWJ
Bomem MB100	FWJ	FWJ	FWJ
Bruker IFS66	FWJ	FWJ	FWJ
Bruker Tensor, Vertex, Vector Instruments	FWJ	FWJ	FWJ
Agilent Instruments	FWJ	FWJ	FWJ Close at rear
Mattson Genesis	FWJ	FWJ	FWJ Close at sides
Mattson Galaxy	FWJ	FWJ	FWJ Close at sides
Midac	FWJ	FWJ	FWJ
Nicolet 500, Avatar, Nexus, iS10 Instruments	FWJ	FWJ	FWJ Close at sides
Nicolet iS5	FWJ	FWJ	FNJ
Perkin Elmer 2000 (GX)	FWJ	FWJ	FWJ Close at sides
Perkin Elmer Spectrum One, 100, 400, Frontier Instruments	FWJ	FWJ	FWJ Close at sides
Perkin Elmer Spectrum Two	FWJ	FWJ	DNF
Jasco 400/600V, 5000/7000 instruments	FWJ	FWJ	FNJ
Shimadzu 8400, Prestige 21, IRAffinity Instruments	FWJ	FWJ	FNJ

Note: If your spectrometer is not listed, please contact Specac for further details

# Cyclone® Gas Cells

## ordering information

- GS24102 Cyclone® C2** Long Pathlength Gas Cell  
0.5m to 2.5m
- GS24105 Cyclone® C5** Long Pathlength Gas Cell  
1m to 8m
- GS24110 Cyclone® C10** Long Pathlength Gas Cell  
2.1m to 10.6m

### Fixed pathlengths available

**Cyclone® C2** - 0.5, 1.0, 1.5, 2.0 & 2.5m

**Cyclone® C5** - 1, 2, 3, 4, 5, 6, 7 & 8m

**Cyclone® C10** - 2.1, 3.2, 4.2, 5.3, 6.3, 7.4, 8.5, 9.5  
& 10.6m

### Cyclone® gas cell configuration step by step

- 1) Choose the size of gas cell with its part number  
eg for a Cyclone C5 cell the P/N would be GS24105
- 2) Choose the type of body from Glass (G) or Metal (M)
- 3) Choose the window material from KBr (K),  
CaF2(C) or ZnSe (Z) (Note: KBr windows cannot  
be used with a metal bodied cell)
- 4) Choose between a Fixed (F) or Adjustable (A)  
pathlength cell - (if fixed specify the pathlength  
from those available for the cell size)
- 5) Choose Viton (V) or Kalrez (X) O-ring seals
- 6) If required choose a Low (L) or High (H) pressure  
gauge kit to be fitted

Example: P/N GS24105GCAV would be for a Cyclone  
C5 cell with a glass body, CaF2 windows, adjustable  
pathlength, Viton O-rings and no pressure gauge

For all Gas Cells please specify Spectrometer make  
and model to include provision of the appropriate  
Benchmark® baseplate for installation.

## Options

- GS10707 Purge Bellows** (pair)
- GS24150 Desiccant Storage Caps**
- GS24152 Mirror Carriage Assembly** for Cyclone®  
series gas cells  
(specify model, variable or fixed pathlength, and  
pathlength where a fixed pathlength mirror carriage  
is required)
- GS24160 Pressure Gauge Kit**  
To fit Cyclone® and Tornado® gas cells  
(specify High or Low Pressure)
- GS24302 Heating Jacket /Controller**  
for Cyclone® C2  
(Specify voltage and country of usage)
- GS24305 Heating Jacket /Controller**  
for Cyclone® C5  
(Specify voltage and country of usage)
- GS24310 Heating Jacket /Controller**  
for Cyclone® C10  
(Specify voltage and country of usage)
- GS28000 RS232 Connection kit**
- GS28001 USB Connection kit**
- GS28002 RS485 Connection kit**
- GS24500 Laser Alignment Accessory**
- GS24153 Replacement KBr windows**  
for Cyclone® and Tornado® series gas cells  
(specify model)
- GS24154 Replacement ZnSe windows**  
for Cyclone® and Tornado® series gas cells  
(specify model)
- GS24155 Replacement CaF2 windows**  
for Cyclone® and Tornado® series gas cells  
(specify model)
- GS24103 Cyclone Gas Cell C2 ESK**
- GS24106 Cyclone Gas Cell C5, C10, ESK**

## Gas Cells



## Heating Jackets & Laser Alignment Accessory





# Tornado® Gas Cells

A low-cost range of gas cells for routine analysis at ambient conditions

## Tornado Gas Cells

The Tornado® series is the ideal choice for analysts requiring a fixed, long pathlength gas cell for routine applications.

Based on the White cell principle of multiple light passes between an arrangement of reflecting mirrors, Tornado® series is available in three sizes:

- **Tornado® T5** Pathlengths ranging from 1m to 8m in 1m steps
- **Tornado® T10** Pathlengths ranging from 2.1m to 10.6m in 1.06m steps
- **Tornado® T20** Pathlengths ranging from 2m to 20m in 2m steps

Tornado® series gas cells are suitable for operation in all modern FT-IR spectrometers using the Specac Benchmark® baseplate provided as standard.

Borosilicate glass body material and anodised aluminium/stainless steel internal and external components provide superior corrosion resistance against a wide range of gases and vapors. Viton® 'O' rings ensure leak-free performance under vacuum and ambient pressures as standard.

There is an option to configure the Tornado cell with a nickel coated aluminium body in place of the borosilicate glass for pressure up to 125 psi.

State-of-the-art optical design combined with gold mirrors ensures the highest possible light throughput giving superior analytical sensitivity.

The supreme, in-built flexibility of the Tornado® series allows additional mirror carriages to be used in the same body shell, maximising analytical capability and minimising operational costs.

### Standard features

- > Wide pathlength range (1m - 20m)
- > Vacuum to 15 psi operation
- > Ambient temperature operation
- > Borosilicate glass body
- > Anodised components
- > Gold mirrors (protected)
- > Viton® 'O' ring seals
- > KBr, ZnSe or CaF<sub>2</sub> windows
- > Purgeable transfer optics box
- > Benchmark® series baseplate mounting

### Optional features

- > Additional mirror carriage assemblies
- > Vacuum/gas inlet & outlet taps
- > Pressure gauge
- > Desiccant storage caps
- > Purge bellows

A choice of KBr, ZnSe or CaF<sub>2</sub> window materials allows users to make the optimum window choice for their applications, and the transfer optics box is equipped with purge ports to allow operation under inert atmospheres. A range of optional features further enhances the flexibility of the Tornado® range.

# Tornado® Gas Cells

A low-cost range of gas cells for routine analysis at ambient conditions



## Tornado® T5

- Pathlength (fixed): 1m - 8m
- Pathlength steps: 1m
- Volume: 1.33 litres
- Dimensions (mm): H455 W153 D130



## Tornado® T10

- Pathlength (fixed): 2.1m - 10.6m
- Pathlength steps: 1.06m
- Volume: 2.6 litres
- Dimensions (mm): H470 W153 D146

### General specifications

- > Cell body material: Borosilicate glass
- > Pressure range: Vacuum to 15 psi
- > Temperature range: Ambient
- > Mirrors: Gold (protected)
- > Windows: KBr, ZnSe or CaF2
- > Inlet/outlet tubing: 1/4"
- > 'O' rings: Viton®
- > Internal components: Anodised aluminium & stainless steel
- > Transfer optics: Aluminium mirrors in purgeable optics box
- > Cell mount: Benchmark® series baseplate

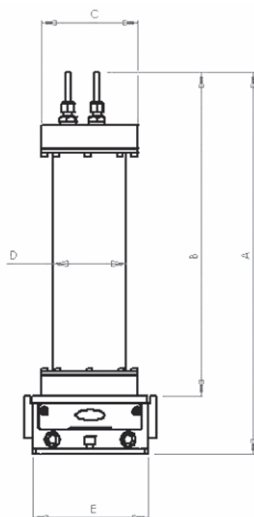
# Tornado® Gas Cells

Heatable long pathlength Gas Cells



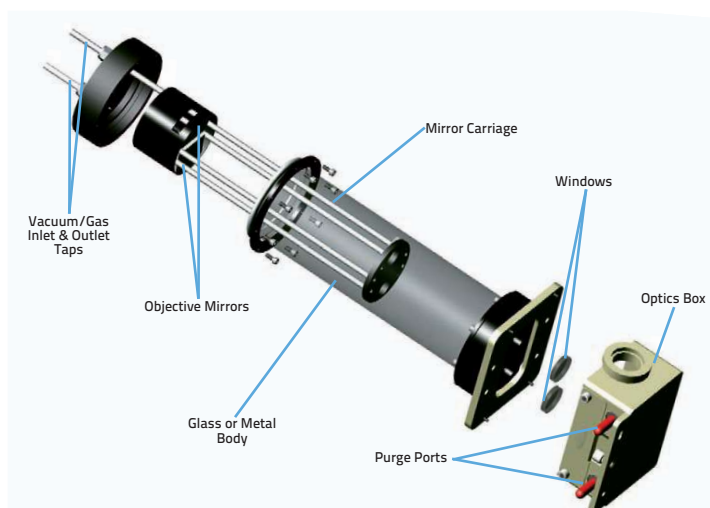
## Tornado® T20

- Pathlength (fixed): 2m - 20m
- Pathlength steps: 2m
- Volume: 4.7 litres
- Dimensions (mm): H675 W153 D146



Cell	A	B	C	D	E
<b>T5</b>	455	385	114	86	153
<b>T10</b>	470	400	143	113	153
<b>T20</b>	675	606	143	113	153

All dimensions in mm



Cell	Base Pathlength	Pathlength Range	Volume
<b>T5</b>	25cm	1m to 8m (in 1m steps)	1.33 litres
<b>T10</b>	26.4cm	2.1m to 10.6m (in 1.06m steps)	2.6 litres
<b>T20</b>	0.5cm	2m to 20m (in 2m steps)	4.7 litres

# Tornado® Gas Cells

## Optional features



### Optional features

Tornado® series long pathlength gas cells have been designed with the serious analyst in mind. These high performance, superior quality cells are backed by a range of optional upgrades to further enhance their performance.

#### Purge Bellows

A pair of purge bellows is available for the Tornado® series gas cells. These fit between the optics box of the cell and the spectrometer to allow the purging of transfer optics with inert gases such as nitrogen. This feature allows absorbances due to atmospheric H<sub>2</sub>O and CO<sub>2</sub> to be eliminated from spectral measurements.

**GS10707 Purge Bellows (pair)**

#### Desiccant Storage Caps

These caps are designed to fit over the optical inlet and outlet ports of the Tornado® series gas cells to seal the transfer optics when the cells are not in use. One of the caps contains a desiccant material, which maintains a dry atmosphere within the transfer optics box and extends the life of KBr windows.

**GS24150 Desiccant Storage Caps**

#### Pressure Gauge Kit

A pressure gauge kit is available to fit the Tornado® series gas cells. Gauges can be specified for low pressure operation (vacuum to 15 psi) and high pressure operation (vacuum to 125 psi - metal bodied cell only). An integral pressure relief valve ensures that cells are automatically depressurised in the event of accidental over pressurisation.

Specac recommend the use of a pressure gauge when operating gas cells at elevated pressures.

**GS24160 Pressure Gauge Kit (pair)**

(Specify high or low pressure)

# Tornado® Gas Cells compatibility chart

This guide shows which Tornado® gas cell type can be used within a range of spectrometer sample compartments.

Key: **F** - Fits    **DNF** - Does Not Fit

FT-IR Instrument	T5 Cell P/N GS24205	T10 Cell P/N GS24210	T20 Cell P/N GS24220
Bomem M100	F	F	F
Bomem MB100	F	F	F
Bruker IFS66	F	F	F
Bruker Tensor, Vertex, Vector Instruments	F	F	F
Agilent Instruments	F	F	F
Mattson Genesis	F	F	F
Mattson Galaxy	F	F	F
Midac	F	F	F
Nicolet 500, Avatar, Nexus, iS10 Instruments	F	F	F
Nicolet iS5	F	F	F
Perkin Elmer 2000 (GX)	F	F	F
Perkin Elmer Spectrum One, 100, 400, Frontier Instruments	F	F	F
Perkin Elmer Spectrum Two	F	DNF	DNF
Jasco 400/600V, 5000/7000 instruments	F	F	F
Shimadzu 8400, Prestige 21, IRAffinity Instruments	F	F	F

Note: If your spectrometer is not listed, please contact Specac for further details

# Tornado® Gas Cells

## Optional features



### Mirror Carriage Assembly

Additional mirror carriages can be specified for use within a single Tornado® body. This feature greatly enhances the analytical flexibility of the series, and significantly reduces operating costs.

**GS24252 Mirror Carriage Assembly**  
(specify model and pathlength)

## ordering information

- GS24205 Tornado® T5**  
1m - 8m Long Pathlength Gas Cell
- GS24210 Tornado® T10**  
2.1m - 10.6m Long Pathlength Gas Cell
- GS24220 Tornado® T20**  
2m - 20m Long Pathlength Gas Cell

### Fixed pathlengths available

- Tornado® T5** - 1, 2, 3, 4, 5, 6, 7, 8m
- Tornado® T10** - 2.1, 3.2, 4.2, 5.3, 6.3, 7.4, 8.5, 9.5 & 10.6m
- Tornado® T20** - 2, 4, 6, 8, 10, 12, 14, 16, 18 & 20m

### Tornado gas cell configuration step by step

- 1) Choose the size of gas cell with its part number  
eg for Tornado T5 cell the P/N would be GS24205
- 2) Choose body type from Glass (G) or Metal (M)
- 3) Choose the window material from KBr (K),  
CaF2 (C) or ZnSe (Z).
- 4) Specify a fixed pathlength from those available  
for the cell size
- 5) If required choose a Low (L) or High (H) pressure  
gauge kit to be fitted

Example: P/N GS24205GCFV would be for a Cyclone C5 cell with a glass body, CaF2 windows, fixed pathlength, Viton O-rings and no pressure gauge

For all Gas Cells please specify Spectrometer make and model to include provision of the appropriate Benchmark® baseplate for installation

(Please note: KBr windows cannot be used with a metal bodied cell)

### Options

- GS10707 Purge Bellows** (pair)
- GS24150 Desiccant Storage Caps**
- GS24152 Mirror Carriage Assembly** for Tornado® series gas cells  
(specify model & pathlength)
- GS24160 Pressure Gauge Kit**  
To fit Cyclone® and Tornado® gas cells  
(specify model & high or low pressure)
- GS24161 Vacuum/Gas Inlet & Outlet Taps**  
with push-on connectors for Tornado® series gas cells
- GS24206 Tornado Gas Cell T5 ESK**
- GS24207 Tornado Gas Cell T10, T20 ESK**

### Replacement windows

- GS24153 Replacement KBr windows**  
for Tornado® and Cyclone® series gas cells  
(specify model)
- GS24154 Replacement ZnSe windows**  
for Tornado® and Cyclone® series gas cells  
(specify model)
- GS24155 Replacement CaF2 windows**  
for Tornado® and Cyclone® series gas cells  
(specify model)





# Transmission Cells

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**HTHP Cells**



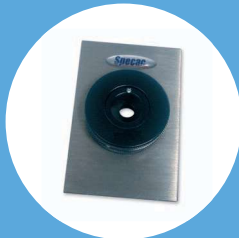
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**DC-3**



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## A wide selection of transmission cells

Transmission cells for the analysis of solid samples in UV, Vis and IR by means of optical spectroscopy.

These sampling cells are available for ambient temperature analysis as well as high temperature and/or high pressure spectroscopic analysis.

# High Temperature/High Pressure Cell

In-situ analysis under extreme conditions

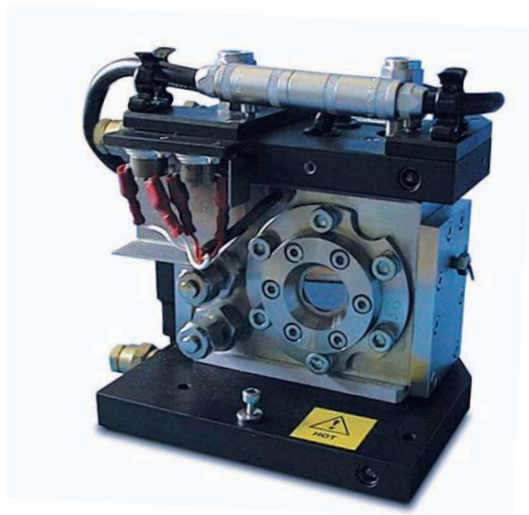


Figure 1 - Transmission analysis mode

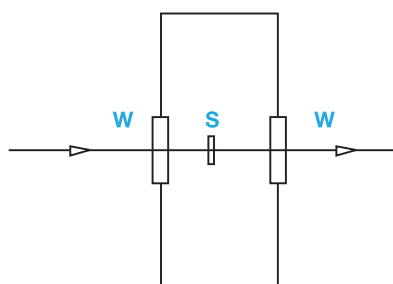


Figure 2 - Reflectance analysis mode

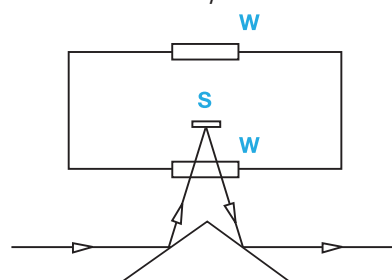
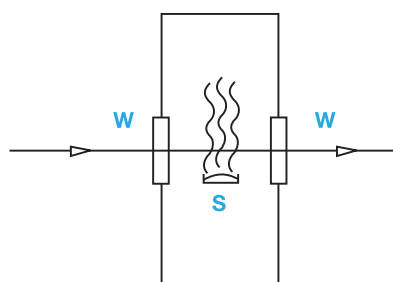


Figure 3 - Decomposition analysis mode



## High Temperature/High Pressure Cell

High technology products and modern industrial processes require in-situ analysis under extreme conditions of temperature and pressure.

The ability to recreate these conditions and spectroscopically analyse samples or monitor processes in the laboratory is provided by the Specac High Temperature/High Pressure Cell.

The cell has been designed for high optical throughput and allows simple interchange between its multi-purpose analysis configurations, Transmission, Reflectance and Decomposition (See figures 1, 2 and 3). Key: S = Sample W = Window

### Key features

- > **Extreme Condition Spectroscopy** - programmable controlled temperatures up to 800°C and pressures from vacuum to 1000 psi
- > **Multi-purpose Analyzer** - transmission, specular reflectance and decomposition
- > **Optimised Design** - permits easy interchange between analysis modes
- > **Safe and reliable construction** - rugged, durable construction incorporating safety approved electronics and safety burst disc

### Applications

- > Component failure
- > Decomposition studies
- > In-situ reaction monitoring
- > Surface emissivity measurements
- > Process gas analysis

# High Temperature/High Pressure Cell

The High Temperature/High Pressure Cell permits analysis of solid samples in transmission, specular reflectance and decomposition modes; and process gases in static or flow transmission mode. Sample temperatures of up to 800°C can be achieved and the cell can operate at pressures from vacuum to 1000 psi

The cell windows and body are separately heated and controlled up to 200°C to prevent condensation of evolved materials adhering to the ZnSe windows. Water cooled top and bottom blocks prevent undue heating of the spectrometer sample compartment and maintain accessible surfaces at a safe temperature.

Switching between transmission (maximum sample diameter 13mm) and specular reflectance modes is achieved by changing an optical pressurised window assembly on the cell body and fitting to an alternative baseplate.

The decomposition mode is obtained by a simple repositioning of the sample holder/heater assembly which places the heated sample in a pan just below the optical beam. Gases evolved from the sample at different temperatures can then be analyzed. The cell has provision for a steady gas flow for either gas analysis or purging. The cell volume is 80ml.

Cell temperature is regulated using a dedicated controller that can be programmed manually or through a computer. The design incorporates a number of important safety features. In particular, all electrical supplies to the cell comply to Canadian Standards Association (CSA) regulations (30 volts or less) and the temperature controllers are equipped with open circuit detection on the thermocouple inputs to prevent overheating.

The cell itself is fitted with a burst disk to prevent inadvertent over pressurisation and, if necessary, this can be piped to a fume cupboard or other outlet point. The cell as standard is ruggedly constructed from durable 316 stainless steel and can be disassembled for thorough cleaning if required.

## ordering information

### Specifications

**Body** Stainless steel

**Window** ZnSe

**Seals** Silicone

Note: check that your chemicals are compatible with these standard specs

**GS05850 High Temperature/High Pressure Cell**  
Includes: Optical unit with ZnSe windows and instrument baseplate, transmission/decomposition sample holder, programmable high stability temperature controller.

**Please specify spectrometer make and model.**

**GS05855 Advanced High Temperature/High Pressure Cell System**  
Includes: Optical unit with ZnSe windows and instrument baseplate, transmission/decomposition sample holder, reflectance mode wedge pressurised window assembly and reflectance mode baseplate, programmable high stability temperature controller.

**Please specify spectrometer make and model.**

**GS05860 Reflectance mode kit**  
Consists of a kit of parts to convert a GS05850 HTHP cell to a fully advanced HTHP cell as supplied under GS05855

**GS05865 Replacement Seal kit**

**GS05867 Replacement ZnSe cell windows**  
(tested and certified)

**GS05868 Decomposition Pans - spare set (2 off)**

**GS05869 Replacement 'Burst-Disk'**

### Options

**GS05870 HTHP Cell ESK**

**GS28000 RS232 Connection kit**

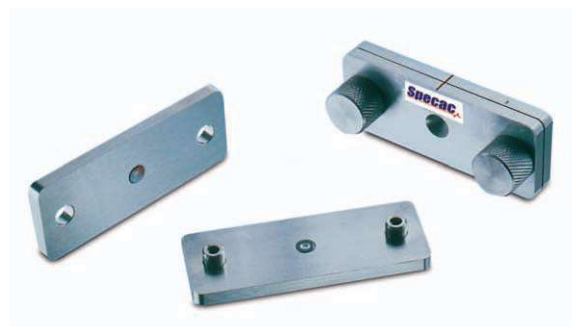
**GS28001 USB Connection kit**

**GS28002 RS485 Connection kit**



# DC-3 Diamond Compression Cell

A Universal Diamond Compression Cell specially designed for FT-IR microscopes and the Specac Microfocus Beam Condenser



## DC-3 Diamond Compression Cell

The DC-3 diamond compression cell enables samples to be compressed to an ideal thickness for transmission experiments. It uses two type IIIa diamond windows, each mounted into a Hastelloy plate. The clear aperture of 1.5 mm diameter provides excellent signal throughput when positioned at the beam focus of an FT-IR spectrophotometer using an MCT detector. For optimum performance with a DTGS detector, the Microfocus Beam Condenser P/N GS02560 (with ZnSe lenses) or P/N GS02561 (with KRS-5 lenses) is recommended to be used with the DC-3 in order to obtain high quality spectra.

The DC-3, because of its small size and shape can also be used with Infrared Microscopes, where the large aperture allows for more than one sample to be loaded and compressed at one time. Each individual sample could then be selectively moved into the light beam from the IR microscope, saving on the time needed to mount and prepare each sample between analyses.

## ordering information

**GS02555 DC-3 Diamond Compression Cell**

### Options

**GS02556\*** Diasqueeze Plus Kit with ZnSe lenses

**GS02557\*** Diasqueeze Plus Kit with KRS-5 lenses  
Includes: DC-3 Diamond Compression Cell  
Microfocus Beam Condenser Forceps  
Stainless steel sample needle  
Sample preparation knife Blades (10)  
Blade remover (2)

## Key features

- > Type IIIa flat diamond windows
- > Large clear aperture 1.5mm
- > Hastelloy body construction (3" x 2" x 9/16", 76.2 x 50.8 x 14.3mm)
- > Universal use with FT-IR microscopes and Microfocus Beam Condenser
- > High working pressure, high throughput

## Applications

- > Compression to optimum transmission thickness of polymers, rubbers and minerals
- > Microanalysis of brittle, elastic semi-rigid fibres, particles and fragments

**GS02560\*** Microfocus Beam Condenser-ZnSe Lenses

**GS02561\*** Microfocus Beam Condenser-KRS-5 Lenses

**GS02570** KRS-5 lens kit for use with Microfocus Beam Condenser

**GS02571** ZnSe lens kit for use with Microfocus Beam Condenser

## Spares and consumables

**GS02508** Sample forceps

**GS02509** Stainless steel sample needle

**GS02510** Sample preparation knife with blades (10) and blade remover

**\*Please specify spectrometer make and model.**

# Microfocus Beam Condenser

A rugged, high performance 4x Beam Condenser specially designed for use with the DC-3 Diamond Compression Cell

## Microfocus Beam Condenser

The Microfocus Beam Condenser is a high performance 4x beam condenser specially designed for use with the DC-3 Diamond Compression Cell (P/N GS02555). The simple two lens linear optical system ensures easy alignment and high throughput over a wide working wavelength range. The Microfocus beam condenser can be supplied with either ZnSe lenses (P/N GS02560) or with KRS-5 lenses (P/N GS02561). (KRS-5 allows an extended mid-infrared range to circa 350 cm<sup>-1</sup>).

Lens upgrade kits (P/N GS02570 KRS-5 lens kit, P/N GS02571 ZnSe lens kit) are available should you wish to change from one version to the other.

The Microfocus Beam Condenser is optically matched for the DC-3 Diamond Compression Cell (P/N GS02555), which locates accurately and reproducibly in the beam condenser using spring ball catches. The whole accessory combination (DC-3 in the Microfocus beam condenser) is mounted into a spectrometer sample compartment via a standard Specac Benchmark® baseplate. This allows for optimum stability in all FT-IR spectrometers.



## ordering information

**GS02560 Microfocus Beam Condenser ZnSe**  
Please specify spectrometer make and model

**GS02561 Microfocus Beam Condenser KRS-5**  
Please specify spectrometer make and model

**GS02570** Microfocus Beam Condenser KRS-5 Lens Kit

**GS02570** Microfocus Beam Condenser KRS-5 Lens Kit

**GS02508** Sample forceps

**GS02509** Stainless steel sample needle

**GS02510** Sample preparation knife with blades (10) and blade remover



# Micro Compression Cell

The Specac Micro Compression Cell is intended for soft solid or semi liquid sample analysis by FT-IR transmission or infrared microscopy

## Micro Compression Cell

The Specac Micro Compression Cell is intended for soft solid or semi liquid sample analysis by FT-IR transmission or infrared microscopy. The cell allows for samples to be compressed and flattened between two non-rotating transmission windows for analysis. It is supplied with a choice of NaCl or KBr windows as standard, but CaF<sub>2</sub>, BaF<sub>2</sub>, and ZnSe windows are also available. The cell is mounted to a standard spectrophotometer 3" by 2" slide mount for ease of use in a broad range of optical spectrometers.

With a clear aperture of 7.0 mm diameter, the Specac Micro Compression Cell allows for a good signal when placed at the sampling focus of a standard FT-IR spectrometer. Alternatively, the Micro Compression Cell can also be used with an infrared microscope, where the large aperture allows for more than one sample to be loaded at one time.



### Key features

- > Uniform pressure applied across sample
- > Non rotating windows
- > 7.0 mm clear aperture
- > Choice of window materials
- > Standard 3" by 2" slide mount

## ordering information

**GS02520 Micro Compression Cell**  
(With choice of NaCl or KBr windows)

### Micro Compression Cell Windows

- GS09070** NaCl windows circular 13mm dia (pair)  
**GS09071** KBr windows circular 13mm dia (pair)  
**GS09072** CaF<sub>2</sub> windows circular 13mm dia (pair)  
**GS09073** BaF<sub>2</sub> windows circular 13mm dia (pair)  
**GS09076** ZnSe windows circular 13mm dia (pair)



# Oil in Water Analysis Kit

For the analysis of total recoverable oil and grease or petroleum hydrocarbons in water

## Oil in Water Analysis Kit

The Oil In Water Analysis Kit enables the analysis of total recoverable oil and grease or petroleum hydrocarbons in water using a new method of analysis D7066-04 approved by the ASTM (American Society for Testing and Materials).

The existing standard EPA methods 413.2 and 418.1 have been replaced as they called for use of Freon as the extraction solvent for the recovery of oil and grease within a water sample.

Freon is now banned from usage as it is an Ozone depleting chemical and harmful to the environment. The D7066-04 method is very similar to the EPA methods but the Freon solvent is replaced by use of the dimer/trimer of chlorotrifluoroethylene (C2ClF3). This solvent is known commercially as S-316 available as an IR spectroscopy grade solvent.

The ASTM D7066-04 method can be purchased from the American National Standards Institute (ANSI). Go to their website page [www.webstore.ansi.org](http://www.webstore.ansi.org) and search for the method D7066-04. The method describes the procedure for testing and lists the relevant equipment and chemicals needed. (Specac does not provide this equipment or chemicals.)

The Oil in Water Analysis Kit from Specac contains matched pairs of infrared grade quartz cells supplied in three different pathlengths of 10mm, 50mm and 100mm. They are all stoppered to ensure retention of volatile materials in the samples. The cells have large filling ports to ensure quick and efficient sample introduction and removal. Matching of the cells ensure precise, repeat measurements.

The cells are placed into the spectrometer via the particular 3" x 2" mounting holder supplied.



### Key features

- > Matched transmission cell pairs
- > Large aperture to avoid scattering of IR beam
- > Stoppered
- > Three different pathlengths: (10mm, 50mm, 100mm)
- > Transmission range approximately  $40,000\text{cm}^{-1}$  to  $2,700\text{cm}^{-1}$
- > Slide mounted holder

## ordering information

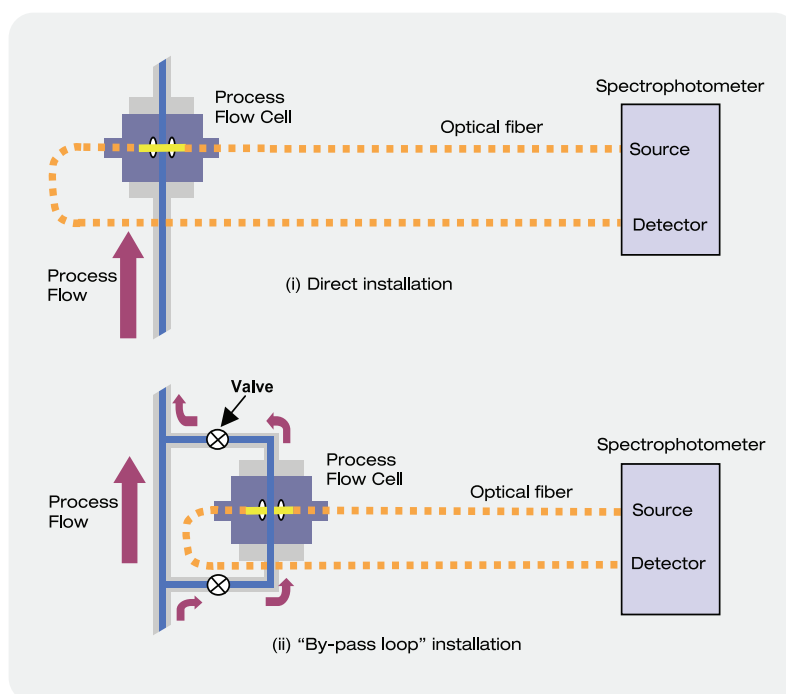
### GS08900 Oil in Water Analysis Kit

Includes:

- GS08901** Matched pair of 10mm pathlength rectangular infrared quartz cells
- GS08902** Matched pair of 50mm pathlength cylindrical infrared quartz cells
- GS08903** Matched pair of 100mm path length cylindrical infrared quartz cells
- GS08904** Slide mounted holder

# Specac Process Capabilities

A proven track record of reliability and robustness in the most demanding industrial environments



## ProCell® Process Flow Cells

Specac have over 15 years of process application experience. Our ProCell® process flow cells are designed to withstand the rigors of process and environmental conditions while maintaining continuous measurement stability and have a proven track record of reliability and robustness in the most demanding industrial environments.

- Process cells are a key enabling technology to facilitate the acquisition of continuous online UV/Vis and NIR spectroscopic absorbance process measurements

Process flow cells are typically installed as part of the process circuit either directly in the process stream or as a "by-pass loop".

- By adopting the process flow cell in a "by-pass loop" configuration, the user has the opportunity to isolate the process flow cell from the process cell for routine cleaning, servicing, or calibration.

Computer-aided optical design ensures that

Specac's process flow cells have the highest levels of optical throughput to ensure the best quality of spectroscopic data.

Specac process cells are customized to ensure exact matching with the client's process requirements.

- Material metallurgies, seal types, and window materials are chosen to be compatible with the chemical and environmental needs of the application. This often goes beyond standard operating conditions, and includes aggressive cleaning regimes and extreme weather conditions.
- Optical designs are configured for the UV/Vis or NIR spectral regions as appropriate, and optical pathlengths are set to ensure optimum spectral absorbance of the target chemical species.

- A range of pipe fittings and flange connections are available to interface the process flow cell with the process pipe work.
- Cleaning ports and seal leak warning ports can also be integrated into the cell design.

# Process Cells

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**ProCell® Cascade**



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**ProCell® Vortex**



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**ProCell® Typhoon**



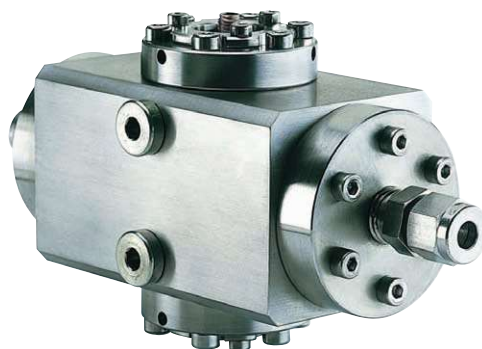
## Unique fibre-optic coupled NIR Process Cells

A broad range of fibre-optic coupled NIR Process Cells are available from Specac for on-line liquid, gas, or vapour phase NIR spectroscopic transmission analysis under process conditions.

These transmission cells have SMA optical fibre interfaces for connection to appropriate FTIR or optical spectrometers to facilitate on-line in-situ spectroscopic transmission analysis in real time.

# ProCell® Cascade

Liquid phase process flow cell



## ProCell® Cascade

The Specac ProCell® Cascade liquid phase process cell is a rugged transmission mode cell ideally suited for optical sampling of industrial fluids. The ProCell® Cascade series is designed to be pipe-mounted into the sample analysis part of the process stream or in a by-pass.

### Key features

- Optical transmission pathlengths are available from 1.0 to 10 mm to optimise UV/Vis or NIR spectroscopic absorption features for analysis.
- Capability for high temperature applications (up to 400°C)
- Can be configured for a wide range of ANSI and DIN flange sizes
- Cleaning port option for in-situ servicing

# ProCell® Vortex

Liquid phase process flow cell



## ProCell® Vortex

The Specac ProCell® Vortex liquid phase process cell is an extremely robust cell that delivers optimum sensitivity to process characteristics.

The ProCell® Vortex series is designed to be flange mounted directly into the process stream or in a by-pass.

### Key features

- Optical transmission pathlengths are available from 1.0 to 10 mm to optimise UV/Vis or NIR spectroscopic absorption features for analysis.
- Capability for high temperature applications (up to 400°C)
- Can be configured for a wide range of ANSI and DIN flange sizes
- Cleaning port option for in-situ servicing

# ProCell® Typhoon

Gas/vapour phase process flow cell



## ProCell® Typhoon

The Specac ProCell® Typhoon is a rugged pipe-mounted spectroscopic transmission cell for gas phase process monitoring in the UV/Vis or NIR region. The ProCell® Typhoon is typically fitted into the process stream or in a by-pass using Swagelok connectors.

Sapphire windows give outstanding abrasion and chemical resistance, in addition to the ability to withstand severe thermal shock (e.g. high pressure steam cleaning).

### Key features

- > To ensure optimum UV/Vis or NIR spectroscopic absorption features for pathlengths are available at 20cm, 30cm, or 50cm.
- > Cleaning ports allow the internal cell windows to be cleaned without removing the cell from the pipe work in the event of fouling (either from long term use or following a process upset)
- > Optical fibre connectivity is ensured by industry standard SMA 905 connectors
- > Anti-extrusion seal design to give high pressure capability and long-term reliability

## ordering information

**Please contact Specac for further details.**

# Absolute precision



An exclusive range of FT-IR polarizers, (fabricated using a technique originally developed in conjunction with the UK's National Physical Laboratory), used to polarize radiation from unpolarized sources, attenuate radiation from polarized sources or act as polarizing beamsplitters. For use in the 2-30 $\mu$ m spectral range, they are available in various materials and substrates and perform best in our rotatable polarizer mounts.

***Specac***

THE WORLD'S LEADING SPECTROSCOPIC ACCESSORY MANUFACTURER



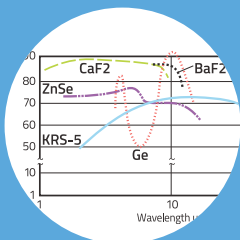
UK: 01689 892902 | [www.specac.com](http://www.specac.com) | US: +1 800 447 2558





# Polarizers

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**Polarizers introduction**



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**Standard Polarizers**



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**HER Polarizers**



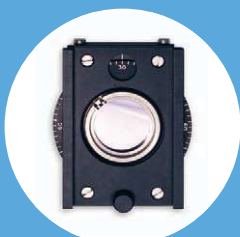
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**IQ Polarizers**



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**Opto-Physics Polarizers**



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**Rotatable Mounts**



## Precision polarizers in a range of materials

Holographic infrared wire grid polarizers are available from Specac for use in the IR range from 2 - 35  $\mu\text{m}$  (or 5000 - 285  $\text{cm}^{-1}$ ).

These polarizers consist of a wire grid polarizer structure photolithographically imprinted in a photoresist layer on an infrared transmitting substrate such as calcium fluoride ( $\text{CaF}_2$ ), barium fluoride ( $\text{BaF}_2$ ), zinc selenide ( $\text{ZnSe}$ ), germanium ( $\text{Ge}$ ), or thallium bromoiodide (KRS-5).

# Polarizers introduction

Polarizers are commonly used to polarize radiation from unpolarized sources, attenuate radiation from polarized sources, or act as polarizing beamsplitters. Specac offers a range of holographic wire-grid polarizers for use in the 2-30 $\mu$ m spectral range.

These precision polarizers are manufactured in a class 1000 clean room facility at Specac's United Kingdom factory, by means of a holographic fabrication technique originally developed in conjunction with the United Kingdom's National Physical Laboratory (NPL).

The process involves exposing a photo-resist coating on a suitable material substrate to an interferometrically-generated fringe pattern from a monochromatic UV source.

The regular sinusoidal profile of the developed photo-resist is subsequently metal coated at an oblique angle to create an array of fine parallel lines at a set period.

This technique lends itself well to the generation of extremely uniform sub-micron grid wire spacings (2500 - 4000 lines/mm), which have a significantly reduced level of light scattering in comparison to traditional ruled wire grid polarizers. As the wire grid is formed on the photo-resist itself, the technique is also well suited to fabricating polarizers on substrates that do not otherwise lend themselves to the ruling process.

Specac offers a range of polarizers on infrared materials such as Barium Fluoride (BaF<sub>2</sub>), Calcium Fluoride (CaF<sub>2</sub>), KRS-5, Zinc Selenide (ZnSe), and Germanium (Ge), in a range of categories to meet a broad scope of customer requirements.



## Applications

- Infrared spectroscopy of materials (typically plastics/polymers and crystallography)
- Infrared microscopy (sample characterization)
- NIR/Mid-IR thermal imaging systems
- Plasma diagnostics
- Beamsplitters in polarized light interferometry
- Analysis in infrared astronomy
- Low power laser polarization and beam attenuation
- Coupling devices for Mid-IR and long wavelength lasers

Standard, High Extinction Ratio (HER), and Image Quality High Extinction Ratio (IQ-HER) polarizers are offered mounted or unmounted, with a range of diameters from 25 to 75 mm depending on substrate material.

Square polarizers in these categories are also available upon request. The performance of Specac polarizers does not vary significantly with change of incident angle between 0 to 20 degrees.

# Basic types of polarizers

**Substrate** (optical material) based with holographic etched wire polarizer grid.

Choice of 4000 or 2500 lines per mm for polarizer grid spacing.

**Free Standing Wire Grid (FSWG)** on a frame.

Choice of wire diameter and spacing between wires to determine the lines per mm for the polarizer grid spacing.

## Substrate Based Polarizers

The transmission wavelength range of the substrate material (e.g. ZnSe, or KRS-5), usually determines the range over which a substrate based polarizer can operate. In general, the wavelength range regions classified as the Near IR (NIR), Mid IR (MIR) and the Far IR (FIR) can be used for sample study with an appropriate substrate based polarizer.

The following table can help to identify a substrate based polarizer part number family type for its line polarizer grid spacing, mounting option and spectral region compatibility (based on specific substrate type)

P/N Series	Description	Lines per mm	Rotator Mount	Spectral Region
GS12000	FTIR	4000	YES	NIR, MIR, FIR
GS57010	Standard	4000	YES	NIR, MIR, FIR
GS57010-HER	High Extinction Ratio	4000	YES	NIR, MIR, FIR
GS57010-IQ	Image Quality	4000	YES	MIR
GS57500	Opto-Physics	2500	NO	NIR, MIR, FIR

## Free Standing Wire Grid Polarizers

The transmission wavelength range of a FSWG polarizer extends from circa 20microns (MIR) to 10's of millimetres (beyond the FIR). In general, a FSWG polarizer would be offered if a substrate based polarizer does not operate (transmit) over the particular spectral range (region) required for the application study.

The following table can help to identify a FSWG polarizer part number family type for its line polarizer grid spacing, mounting option and spectral region compatibility (based on wire diameter and spacing).

P/N Series	Description	Lines/mm	Rotator Mount	Spectral Region
GS57200	FSWG	Depends on Wire Dia. Spacing	NO	MIR, FIR and beyond

# Basic types of polarizers

## Rotatable Mounts for Substrate Based Polarizers

Depending upon which part number family series of substrate based polarizer is chosen, there are specific rotatable polarizer mount options that can be offered.

The GS50710 Series (Standard, HER and IQ) polarizers are offered as four different substrate diameter sizes (clear aperture CA), so the rotatable mounts as GS57340 series match specifically a particular substrate diameter for the CA. Note, a Benchmark baseplate compatible Accessory (e.g. the Golden Gate ATR) accepts the Rotatable Polarizer mount P/N GS12510, but ONLY the 38mm CA GS57010 Series substrate based polarizers are compatible for fit in P/N GS12510.

The following table helps to identify what rotatable polarizer mount can be offered against the Specac range of substrate based polarizers.

Polarizer Series	Description	Rotatable Mount
GS12000	FTIR	GS12500 (3" x 2" slide)
GS57010	Standard	GS12510 (38mm CA only) GS57340 (Size dependent)
GS57010-HER	High Extinction Ratio	GS12510 (38mm CA only) GS57340 (Size dependent)
GS57010-IQ	Image Quality	GS12510 (38mm CA only) GS57340 (Size dependent)
GS57500	Opto-Physics	None

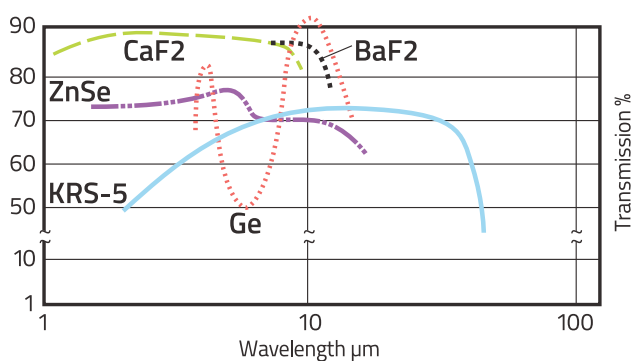
# FT-IR Infrared Polarizers

## GS12000 Series

FT-IR infrared polarizers are offered on BaF<sub>2</sub>, CaF<sub>2</sub>, KRS-5, Ge, and ZnSe substrates. Spring mounted with a 25mm clear aperture, they fit directly into the aperture ports of all Benchmark® baseplate compatible accessories. Manufactured at 4000 lines/mm

	Substrate Spectral Range (μm) Grid Period (μm)	KRS-5 2 - 35 0.25	CaF <sub>2</sub> 1 - 10 0.25	BaF <sub>2</sub> 1 - 12.5 0.25	Ge 8 - 12 0.4	ZnSe 1 - 15 0.25
Transmission Efficiency % (K1)	2.5μm	72	89	88		76
	5.0μm	84	88	88		85
	8.0μm				87	
	10.0μm	75	50	84	91	74
Transmission of Unwanted Radiation % (K2)	2.5μm	1.50	1.00	1.10		1.40
	5.0μm	0.50	0.28	0.30		0.50
	8.0μm				0.35	
	10.0μm	0.23	0.10	0.20	0.25	0.20
Degree of Polarization % (K1-K2) / (K1+K2)	2.5μm	95.8	97.8	97.5		96.3
	5.0μm	98.8	99.3	99.3		98.8
	8.0μm				99.2	
	10.0μm	99.7	99.5	99.5	99.4	99.4
Extinction/Contrast Ratio expressed as K1/K2	2.5μm	48:1	89:1	80:1		54:1
	5.0μm	168:1	314:1	293:1		170:1
	8.0μm				249:1	
	10.0μm	326:1	500:1	420:1	364:1	370:1

These specifications represent typical minimum performance. Actual results may vary. Maximum operating temperature for Ge is 80°C, all others are 110°C. Other materials, including Sapphire, CsI and MgF and custom specifications available upon request.



## ordering information

	Range (KRS-μm)	OD (mm)	CA (mm)	t (mm)	Part Number
<b>KRS-5</b>	2-35	34.9	25	7.9	<b>GS12000</b>
<b>Ge</b>	8-12	34.9	25	7.9	<b>GS12700</b>
<b>CaF<sub>2</sub></b>	1-10	34.9	25	7.9	<b>GS12800</b>
<b>BaF<sub>2</sub></b>	1-12.5	34.9	25	7.9	<b>GS12900</b>
<b>ZnSe</b>	1-15	34.9	25	7.9	<b>GS12950</b>



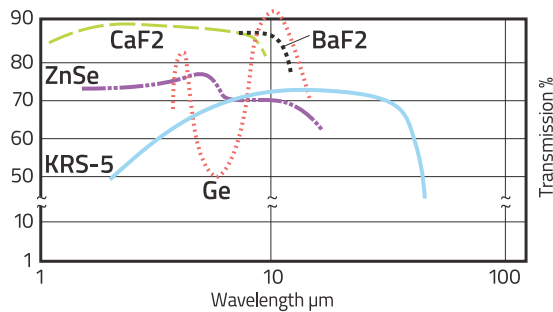
# Standard Infrared Polarizers

## GS57010 Series

Standard infrared polarizers are offered on BaF2, CaF2, KRS-5, Ge, and ZnSe substrates, in a choice of support rings. Manufactured at 4000 lines/mm, they ensure enhanced performance at shorter wavelengths for precision applications.

Substrate Spectral Range (μm) Grid Period (μm)		KRS-5 2 - 35 0.25	CaF2 1 - 10 0.25	BaF2 1 - 12.5 0.25	Ge 8 - 12 0.4	ZnSe 1 - 15 0.25
Transmission Efficiency % (K1)	2.5μm	72	89	88		76
	5.0μm	84	88	88		85
	8.0μm				87	
	10.0μm	75	50	84	91	74
Transmission of Unwanted Radiation % (K2)	2.5μm	1.50	1.00	1.10		1.40
	5.0μm	0.50	0.28	0.30		0.50
	8.0μm				0.35	
	10.0μm	0.23	0.10	0.20	0.25	0.20
Degree of Polarization % (K1-K2) / (K1+K2)	2.5μm	95.8	97.8	97.5		96.3
	5.0μm	98.8	99.3	99.3		98.8
	8.0μm				99.2	
	10.0μm	99.7	99.5	99.5	99.4	99.4
Extinction/ Contrast Ratio expressed as K1/K2	2.5μm	48:1	89:1	80:1		54:1
	5.0μm	168:1	314:1	293:1		170:1
	8.0μm				249:1	
	10.0μm	326:1	500:1	420:1	364:1	370:1

These specifications represent typical minimum performance. Actual results may vary. Maximum operating temperature for Ge is 80°C, all others are 110°C. Other materials, including Sapphire, CsI and MgF and custom specifications available upon request.



## ordering information

	Substrate		Ring Mount		Part Number
	OD (mm)	CA (mm)	OD (mm)	t (mm)	
KRS-5	25.0	unmounted	N/A	N/A	GS57001
	29.0	25.0	41.0	6.7	GS57010
	42.0	38.0	55.0	8.7	GS57012
	54.0	50.0	70.0	8.7	GS57014
Ge	25.0	unmounted	N/A	N/A	GS57003
	29.0	25.0	41.0	6.7	GS57070
	42.0	38.0	55.0	8.7	GS57072
	54.0	50.0	70.0	8.7	GS57074
	75.0	71.0	90.0	9.7	GS57076
CaF2	25.0	unmounted	N/A	N/A	GS57006
	29.0	25.0	41.0	6.7	GS57080
	42.0	38.0	55.0	8.7	GS57082
	54.0	50.0	70.0	8.7	GS57084
	75.0	71.0	90.0	9.7	GS57086
BaF2	25.0	unmounted	N/A	N/A	GS57008
	29.0	25.0	41.0	6.7	GS57090
	42.0	38.0	55.0	8.7	GS57092
	54.0	50.0	70.0	8.7	GS57094
	75.0	71.0	90.0	9.7	GS57096
ZnSe	25.0	unmounted	N/A	N/A	GS57016
	29.0	25.0	41.0	6.7	GS57050
	42.0	38.0	55.0	8.7	GS57052
	54.0	50.0	70.0	8.7	GS57054
	75.0	71.0	90.0	9.7	GS57056

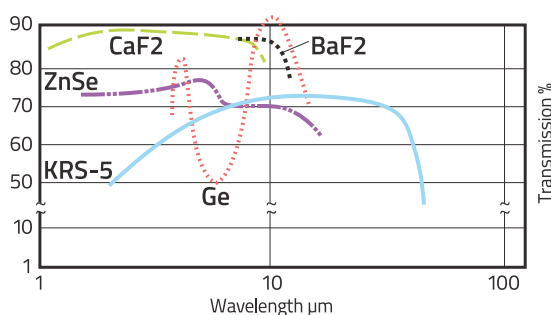


# High Extinction Ratio (HER) Infrared Polarizers GS57010 Series

HER polarizers are offered on BaF<sub>2</sub>, CaF<sub>2</sub>, KRS-5, Ge, and ZnSe substrates, in a choice of support rings. Manufactured at 4000 lines/mm, with enhanced coating process, they ensure higher polarization extinction without jeopardising transmission throughput.

Substrate Spectral Range (μm) Grid Period (μm)		KRS-5 2 - 35 0.25	CaF <sub>2</sub> 1 - 10 0.25	BaF <sub>2</sub> 1 - 12.5 0.25	Ge 8 - 12 0.4	ZnSe 1 - 15 0.25
Transmission Efficiency % (K1)	2.5μm	70	84	84		74
	5.0μm	80	86	86		81
	8.0μm				85	
	10.0μm	72	48	80	88	72
Transmission of Unwanted Radiation % (K2)	2.5μm	0.35	0.25	0.28		0.52
	5.0μm	0.15	0.13	0.15		0.20
	8.0μm				0.14	
	10.0μm	0.12	0.05	0.07	0.14	0.12
Degree of Polarization % (K1-K2) / (K1+K2)	2.5μm	99.0	97.4	99.3		96.6
	5.0μm	99.6	99.6	99.6		98.5
	8.0μm				99.6	
	10.0μm	99.7	99.8	99.8	99.6	99.6
Extinction/Contrast Ratio expressed as K1/K2	2.5μm	200:1	336:1	300:1		142:1
	5.0μm	533:1	662:1	573:1		405:1
	8.0μm				607:1	
	10.0μm	600:1	960:1	1143:1	629:1	600:1

These specifications represent typical minimum performance. Actual results may vary. Maximum operating temperature for Ge is 80°C, all others are 110°C. Other materials, including Sapphire, CsI and MgF and custom specifications available upon request.



## ordering information

	Substrate		Ring Mount		Part Number
	OD (mm)	CA (mm)	OD (mm)	t (mm)	
KRS-5	25.0	unmounted	N/A	N/A	GS57002
	29.0	25.0	41.0	6.7	GS57011
	42.0	38.0	55.0	8.7	GS57013
	54.0	50.0	70.0	8.7	GS57015
Ge	25.0	unmounted	N/A	N/A	GS57004
	29.0	25.0	41.0	6.7	GS57071
	42.0	38.0	55.0	8.7	GS57073
	54.0	50.0	70.0	8.7	GS57075
	75.0	71.0	90.0	9.7	GS57077
CaF <sub>2</sub>	25.0	unmounted	N/A	N/A	GS57007
	29.0	25.0	41.0	6.7	GS57081
	42.0	38.0	55.0	8.7	GS57083
	54.0	50.0	70.0	8.7	GS57085
	75.0	71.0	90.0	9.7	GS57087
BaF <sub>2</sub>	25.0	unmounted	N/A	N/A	GS57009
	29.0	25.0	41.0	6.7	GS57091
	42.0	38.0	55.0	8.7	GS57093
	54.0	50.0	70.0	8.7	GS57095
	75.0	71.0	90.0	9.7	GS57097
ZnSe	25.0	unmounted	N/A	N/A	GS57017
	29.0	25.0	41.0	6.7	GS57051
	42.0	38.0	55.0	8.7	GS57053
	54.0	50.0	70.0	8.7	GS57055
	75.0	71.0	90.0	9.7	GS57057

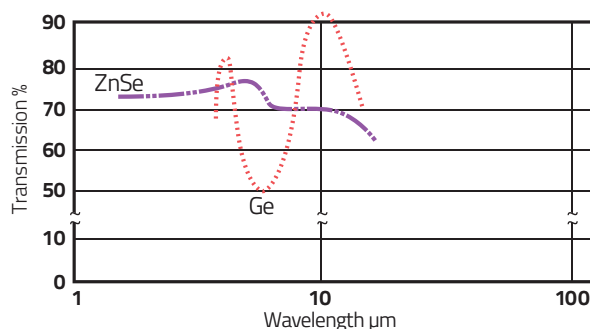
# Image Quality Infrared Polarizers

## GS57010 Series

These polarizers are offered on Ge and ZnSe substrates, in a choice of support rings. Anti-reflection coatings and a high specification of optical flatness and parallelism make these polarizers well suited for imaging applications.

Substrate		ZnSe		Ge
Spectral Range (μm)		3-5	8-12	8-12
Anti-reflection Coating		Yes	Yes	Yes
% Transmission Efficiency (K1)	4μm	93	-	-
	10μm	-	85	90
% Transmission of Unwanted Radiation (K2)	4μm	0.35	-	-
	10μm	-	0.12	0.14
% Degree of Polarization $\frac{(\hat{E}_1 - \hat{E}_2)}{(\hat{E}_1 + \hat{E}_2)}$	4μm	99.2	-	-
	10μm	-	99.7	99.7
Extinction Ratio	4μm	130:1	-	-
	10μm	-	350:1	320:1
Damage Threshold (watts/cm <sup>2</sup> ) CW		50	50	50
Max. Operating Temperature °C		110	110	80

These specifications represent typical minimum performance. Actual results may vary. Maximum operating temperature for Ge is 80°C, all others are 110°C. Other materials, including Sapphire, CsI and MgF and custom specifications available upon request.



## ordering information

	Range (KRS-μm)	OD (mm)	CA (mm)	t (mm)	Part Number
Ge	8-12	41	25	6.7	GS57078
	8-12	55	38	8.7	GS57079
	8-12	70	50	8.7	GS57068
	8-12	90	71	9.7	GS57069
ZnSe	3-5	41	25	6.7	GS57058
	3-5	55	38	8.7	GS57060
	3-5	70	50	8.7	GS57062
	3-5	90	71	9.7	GS57064
ZnSe	8-12	41	25	6.7	GS57059
	8-12	55	38	8.7	GS57061
	8-12	70	50	8.7	GS57063
	8-12	90	71	9.7	GS57065

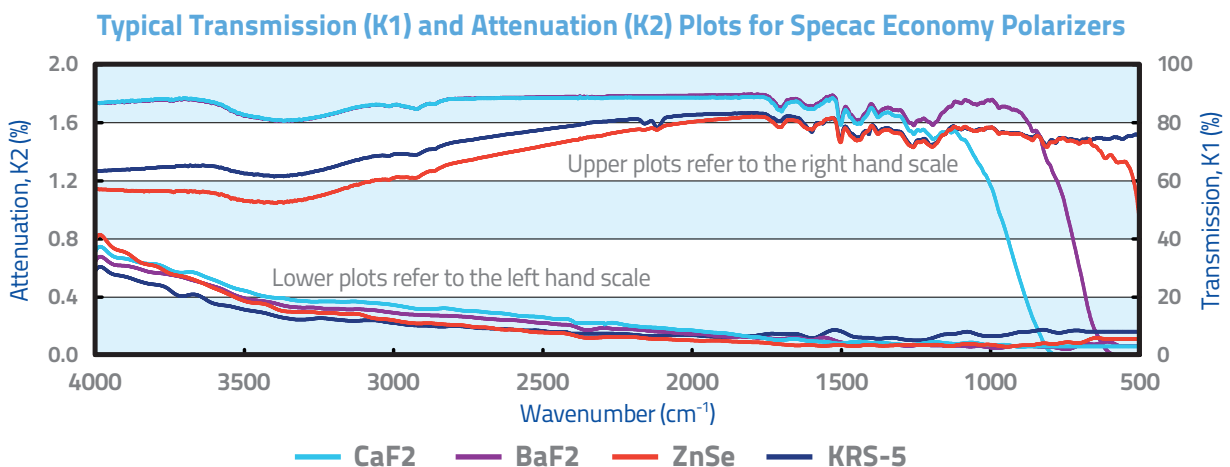
# Opto-Physics Infrared Polarizers

## GS57500 Series

Specac offer a range of opto-physics polarizers from stock in standard 25 or 50 mm support rings. These are provided on Barium Fluoride (BaF<sub>2</sub>), Calcium Fluoride (CaF<sub>2</sub>), KRS-5, and Zinc Selenide (ZnSe) substrates, and are manufactured at 2500 lines/mm to provide acceptable polarization performance at an economical price.

### Specifications

Wire Grid Spacing:	2500 lines/mm	Polarizer Clear Aperture:	18.0 ±0.1 mm (Ø 25 mm) 34.0 ±0.1 mm (Ø 50 mm)
Mounting Ring Diameters:	25.0 +0.0/-0.2 mm 50.0 +0.0/-0.2 mm	Substrate Thickness:	2.0 +0.0/-0.2 mm (Ø 25 mm) 4.0 +0.0/-0.2 mm (Ø 50 mm)
Mounting Ring Thickness:	5.0 ±0.1 mm (Ø 25 mm) 6.0 ±0.1 mm (Ø 50 mm)		



Substrate Material	Wavelength (µm) / Wavenumber (cm <sup>-1</sup> )	Typical Extinction Ratio (K1/K2)
KRS-5	2.5 / 4000	100
	5 / 2000	300
	10 / 1000	300
CaF2	2.5 / 4000	100
	5 / 2000	300
	10 / 1000	300
BaF2	2.5 / 4000	100
	5 / 2000	300
	10 / 1000	400
ZnSe	2.5 / 4000	100
	5 / 2000	300
	10 / 1000	400

Part Number	Substrate Material	Mounting Ring Dia. (mm)	Parallelism (arc minutes)	Flatness (fringes per inch@633 nm)
GS57500	KRS-5	25	5	4
GS57501	CaF2	25	3	2
GS57502	BaF2	25	3	2
GS57503	ZnSe	25	3	2
GS57504	KRS-5	50	5	4
GS57505	CaF2	50	3	2
GS57506	BaF2	50	3	2
GS57507	ZnSe	50	3	2

# Rotatable Polarizer Mounts



P/N GS12500



P/N GS12510



P/N GS57340

## GS12500 Rotator Mount for GS12000 Series Polarizers

The Polarizer Mount GS12500 is a rotatable 3" x 2" slide mount for use with the GS12000 series of FT-IR Infrared polarizers. This mount quickly and easily fits in to any spectrometer. This polarizer mount has an adjustable, rotatable ring that is marked with angular degree divisions. This allows for any GS12000 series polarizer to be accurately positioned for polarized radiation over the range from 0° (perpendicular) through to 90° (parallel) transmitted radiation in 5° graduated marks.

## GS12510 Benchmark® Mount for GS57010 Series Polarizers

The Polarizer Mount GS12510 is a rotatable mount that is attached directly to the aperture ports of any optical unit used with Specac Benchmark® baseplate compatible accessories. Such accessories include the Golden Gate® and Gateway® horizontal ATR systems.

The polarizer mount GS12510 accepts the Specac 38mm C.A. range of GS57010 Series, Standard Infrared polarizers. When a polarizer has been installed into the mount, it can be rotated for a particular angular degree of polarized light by adjustment of an outer rotating ring on the polarizer mount itself.

## GS57340 Series Mount for GS57010 Series Polarizers

The Rotatable Polarizer Mounts GS57340 Series are designed to accommodate the Specac GS57010 Series of Standard Infrared polarizers. When the polarizer is placed into its appropriate sized rotatable mount, the polarizing grid can be rotated for selection of a particular degree angle of polarized light.

The GS57340 Series rotatable polarizer mounts are graduated in 2 (two) degree angle intervals and can be estimated to 1 (one) degree accuracy. They can be mounted directly either to a bench or via a support post.

The GS57340 Series rotatable polarizer mounts are provided with their own protective covers, such that a GS57010 Series ring mount polarizer can be contained safely within the mount when not in use.

# Rotatable Polarizer Mounts

## ordering information

### GS12500 Series

**GS12500** FT-IR Infrared Polarizer rotatable  
3" x 2" slide mount

### GS12500 Series FT-IR Infrared Polarizer Kits

Includes: polarizer, polarizer mount and storage case

**GS12501** KRS-5 FT-IR Infrared Polarizer kit  
**GS12502** Ge FT-IR Infrared Polarizer kit  
**GS12503** CaF<sub>2</sub> FT-IR Infrared Polarizer kit  
**GS12504** BaF<sub>2</sub> FT-IR Infrared Polarizer kit  
**GS12505** ZnSe FT-IR Infrared Polarizer kit

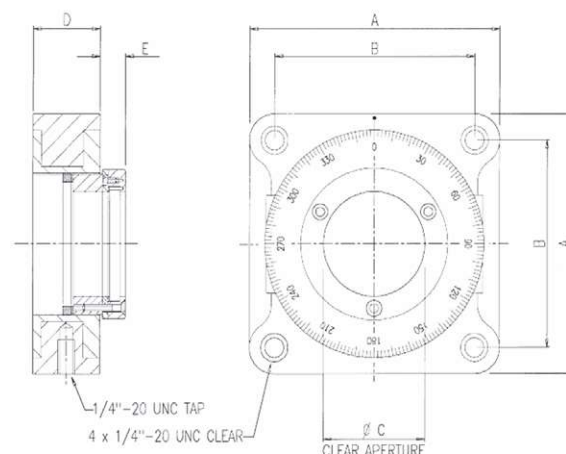
### GS57340 Series

**GS57340** Rotatable polarizer mount for  
25.0mm dia. clear aperture polarizer.  
**GS57350** Rotatable polarizer mount for  
38.0mm dia. clear aperture polarizer.  
**GS57360** Rotatable polarizer mount for  
50.0mm dia. clear aperture polarizer.  
**GS57370** Rotatable polarizer mount for  
71.0mm dia. clear aperture polarizer.

**Other sizes available upon request**

**GS12510** Benchmark® Series Rotatable Mount

**GS12510** Benchmark® Series Rotatable Mount



	A	B	C	D	E
GS57340	95	76.2	25.5	25.4	6.0
GS57350	95	76.2	38.5	25.4	9.7
GS57360	121	101.6	50.5	28.0	6.0
GS57370	121	101.6	67.0	28.0	15.7

All sizes in mm unless stated

Benchmark® Series rotatable mounts fitted with...

### Standard Infrared Polarizers

**GS12511** KRS-5 Polarizer with rotatable mount  
**GS12512** Ge Polarizer with rotatable mount  
**GS12513** CaF<sub>2</sub> Polarizer with rotatable mount  
**GS12514** BaF<sub>2</sub> Polarizer with rotatable mount  
**GS12515** ZnSe Polarizer with rotatable mount

### High Extinction Ratio (HER) Polarizers

**GS12516** KRS-5 HER Polarizer & rotatable mount  
**GS12517** Ge HER Polarizer & rotatable mount  
**GS12518** CaF<sub>2</sub> HER Polarizer & rotatable mount  
**GS12519** BaF<sub>2</sub> HER Polarizer & rotatable mount  
**GS12520** ZnSe HER Polarizer & rotatable mount

### Image Quality (IQ) Polarizers

**GS12521** Ge IQ Polarizer with rotatable mount  
**GS12522** ZnSe IQ (3-5μm) Polarizer  
& rotatable mount  
**GS12523** ZnSe IQ (8-12μm) Polarizer  
& rotatable mount

# Pressing matters



The most comprehensive range of sample preparation presses with the assurance of unrivalled technical back-up and applications advice, giving you complete peace of mind with every Specac purchase.

***Specac***

THE WORLD'S LEADING SPECTROSCOPIC ACCESSORY MANUFACTURER



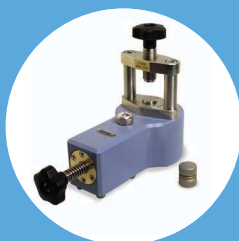
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# Sample Preparation

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## A comprehensive range for easy sample prep.

Specac pellet press products facilitate a broad range of laboratory applications.

Products include manual, power, and automatic laboratory hydraulic presses, KBr and XRF pellet presses, sample mills and grinders, evacuable hydraulic pellet press dies, heated platens and film making kits, and sample preparation supplies and consumables.

# Presses Introduction

A concise and easy to understand guide on which Specac Press to choose

Specac makes a variety of hydraulic presses for a wide range of pressing applications. There is also a range of accessories that can be used within the presses themselves, for the formation and preparation of particular sample types prior to analysis by techniques such as Infrared or XRay spectroscopy. The Specac accessories that can be used within the presses are evacuable pellet dies, heated platens and film maker systems.

The Specac presses themselves can be categorised as manual or automatic operated press systems. For manual operation this involves building up the pressure on the system and hence the load that can be applied by hand pumping the press, whereas an automatic press is the build up of pressure on the system and application of a load via pushing of a button.

There are different versions of automatic presses and they can be further categorised as to their mode of operation and functionality.

Each press can be specifically chosen to fulfil a particular application dependent principally on the load range that can be applied. The load is applied according to the operation and the way that the load is applied is due to the functionality of the press.

Further to the functionality in respect of the Atlas® Auto or Power presses, incorporated into the pressing mechanism are compression disc springs that allow for a slow release of any load to the sample pressing procedure.

In the compression process the disc springs will be initially compressed before full resistance is met to stop the travel of the piston.

When any stored load is released the disc springs will relax to their non-compressed state and hence provide for a slow release of a full load. For some samples, a slow load release helps to keep the sample in a compacted state and to minimise risk of sample pellet damage.

Press Name	Part Number	Type	Pressure System (Fluid)	Operation To Apply Load	Functionality To Apply Load	Load Range In Tons
Atlas® Manual 15T	GS15011	Manual	Oil (Renolin CL37)	Hand Pump	Manual	1 to 15
Atlas® Manual 25T	GS25011	Manual	Oil (Renolin CL37)	Hand Pump	Manual	1 to 25
Atlas® Power 8T	GS25400	Automatic	Oil (Renolin CL37)	Button Press	Power Assisted	1 to 8
Atlas® Power 15T	GS25430	Automatic	Oil (Renolin CL37)	Button Press	Power Assisted	2 to 15
Atlas® Power 25T	GS25420	Automatic	Oil (Renolin CL37)	Button Press	Power Assisted	3 to 25
Atlas® Auto 8T	GS25800	Automatic	Oil (Renolin CL37)	Button Press	Programmable Automatic	1 to 8
Atlas® Auto 15T	GS25810	Automatic	Oil (Renolin CL37)	Button Press	Programmable Automatic	2 to 15
Atlas® Auto 25T	GS25820	Automatic	Oil (Renolin CL37)	Button Press	Programmable Automatic	3 to 25
Atlas® Auto 40T	GS25830	Automatic	Oil (Renolin CL37)	Button Press	Programmable Automatic	4 to 40

**Please note:** Specac presses are designed to apply a specific load to a sample, but it is actually the accessory itself within the press that determines the specific pressure applied to the sample.

To give an example, if a 13mm evacuable pellet die P/N GS03000 filled with a powder sample is placed within a 15 ton manual hydraulic press P/N GS15011, an applied load of 10 tons (i.e. 22400 lbs) is being spread over an area of 132.73 mm<sup>2</sup> (or 0.205").

This equates to a pressure of 109,268 lbs per square inch or 48.78 tons per square inch.

Similarly, when a film maker accessory (P/N's GS15640 or GS15800) is placed in a press, the load is being spread over an area of film of 660.51 mm<sup>2</sup>, the films being produced having a 29mm diameter. During this method of film preparation from a melted sample, a load of 1 to 2 tons is usually sufficient to apply an appropriate pressure to the sample.

# Presses

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**Atlas® Manual Hydraulic Press**



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**Low Tonnage Conversion Kit**



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**Atlas® Autotouch Press**



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**Atlas® Power Press**



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**Mini-Pellet Press**



## Sample presses for a wide range of applications

Specac offers a range of manual, power, and automatic hydraulic presses for a variety of laboratory press applications. Our hydraulic press products include: KBr pellet presses and XRF pellet presses.

All laboratory hydraulic presses are bench-top mounted, and are compatible with a broad selection of Specac hydraulic pellet press dies and heated platens.

# Atlas® Manual Hydraulic Press - 15T & 25T

Easy to use, rugged and durable  
Hydraulic Presses suitable for a wide  
range of applications

## Atlas® Manual Hydraulic Press 15T & 25T

The Atlas® 15T and 25T Manual Hydraulic Presses have been designed to handle a wide variety of pressing applications. They are specifically suited to the preparation of KBr discs using the Specac Evacuatable Pellet Die assembly.

The Atlas® Presses can also be used with Specac Heated Platens for applications such as the preparation of thin polymer films.

## ordering information

**GS15011** Atlas® 15T Manual Hydraulic Press

**GS25011** Atlas® 25T Manual Hydraulic Press

### Spares and Consumables

**GS15100** Seals and Gaskets Kit  
for 15 and 25 Ton Presses

**GS15101** Hydraulic Oil  
for 15 and 25 Ton Presses (1 litre)

### Options / Associated products

**GS15051** Gauge Conversion Kit 0-1 Ton

**GS15052** Gauge Conversion Kit 0-2 Ton

**GS15055** Gauge Conversion Kit 0-5 Ton

### Service Kits for Atlas Manual Hydraulic Presses

**GS15110** Oil Bleed Kit Assembly of parts  
**GS15111** Seating Tool for Pressure Gauge ball bearing  
**GS15112** Seating Tool for Release Screw ball bearing  
**GS15113** Seating Tool for Pressure Relief Valve oil constrictor



### Key features

- > Polycarbonate safety guards
- > Adjustable upper bolster
- > Adjustable pressure control valve
- > Vacuum Ports
- > Pressure release valve
- > Gauges for low pressure applications (0-1, 0-2, 0-5 Tons optional)

### Specifications

Max height (at handle) 610mm  
Max width 310mm  
Max depth 190mm  
Weight 50kg  
Lower piston stroke 25.4mm upper bolster screw travel 89mm  
Minimum distance between pressing faces 38mm  
Maximum distance between pressing faces 152mm  
Lower pressing face diameter 86mm  
Upper pressing face diameter 32mm  
Max width of sampling  
Area (side-to-side) 134mm  
Max Depth of Sampling  
Area (back-to-front) 141mm

Advanced Solid Pack is also available (see Page 15)

# Low Tonnage Conversion Kit for Atlas® 15T Manual Hydraulic Press



The standard 0 to 15 ton manual hydraulic press P/N GS15011 can be operated to apply up to a 15 ton maximum load. On the press itself there is a pressure relief valve (located under the load gauge) which can be set to "vent off" any excess pressure in the pumping system such that a maximum load setting can be selected on the press. This maximum load is indicated on the standard 0 to 15 ton load gauge. Hence, if this pressure relief valve is adjusted accordingly, then it is possible to build up a pressure that corresponds to e.g. a maximum of 5 tons load as indicated at the 15 ton load gauge.

Any further pulls on the pump handle of the press results in this excess pressure being vented off at the pressure release valve. In this way it acts as a safety device to prevent overloading to a sample (or die assembly) in the pressing area.

The low tonnage gauge conversion kits, 0 to 1 tons (P/N GS15051), 0 to 2 tons (P/N GS15052) and 0 to 5 tons (P/N GS15055) provide an additional load gauge to be used along with the standard 15 ton load gauge on the press.

The appropriate gauge kit is fitted by the customer to allow both gauges to be connected to the press. The lower tonnage gauge can be isolated from the system but any pressure of oil in the system will always be registered at the 15 ton gauge. The lower tonnage load gauge has finer divisions for reading of an applied load so if it is important to know that you are applying say 4.1 tons as opposed to say possibly 4.5 tons, then the 0 to 5 ton load gauge reading may be required. But, the press itself could only be operated up to a maximum load allowable with the low tonnage gauge switched on line for reading. As a precaution it is recommended to have the pressure

release valve set at the low tonnage gauge load maximum to prevent possible damage to the lower tonnage gauge should it accidentally not be isolated from its own valve tap.

Therefore, in essence the 15 ton press will allow you to apply any load up to 15 tons to a sample or an evacuable pellet die in the pressing area.

However, if a finer reading of the load applied up to a maximum of 5 tons is required, then the additional gauge kit P/N GS15055 can be fitted to the press.

The low ton gauges available for the 15 ton manual hydraulic press and their divisions are:-

0 to 1 ton gauge - gauge divisions every 0.05 tons load.

0 to 2 ton gauge - gauge divisions every 0.10 tons load.

0 to 5 ton gauge - gauge divisions every 0.20 tons load.

As the gauges are analogue (needle pointers) it should be possible to read a value between these divisions, hence for a 0 to 1 ton gauge every 0.025 tons and so on.

## ordering information

<b>GS15051</b>	<b>Gauge Conversion Kit 0-1 Ton</b>
<b>GS15052</b>	<b>Gauge Conversion Kit 0-2 Ton</b>
<b>GS15055</b>	<b>Gauge Conversion Kit 0-5 Ton</b>

# Atlas® Autotouch Press

## 8T, 15T, 25T & 40T

### Atlas® Autotouch Press - 8T, 15T, 25T & 40T

The Atlas® Autotouch Presses 8T, 15T, 25T & 40T are programmable, microprocessor controlled, power assisted hydraulic presses, operating to 8 Tons, 15 Tons, 25 Tons and 40 Tons respectively. They have been designed for a wide variety of pressing applications including XRF and IR sample preparation. All presses are fully compatible with Specac dies and other sample preparation accessories.

The Presses enable the controlled application and release of an applied load, accommodating samples up to 200mm in diameter. The applied load can be maintained indefinitely, or to a specific time via user programmable functionality.

The graphic display shows the press program status and load conditions providing a digital display of load applied, together with an end of cycle alarm/indicator.

The power unit is extremely quiet and operates below 62dB.

Fitted with PETG safety guards as standard the Atlas® Autotouch Presses are fully CE marked to comply with strict European regulations.

The Atlas® Autotouch Presses have a generous working distance of up to 155mm between the pressing faces and are suitable for the preparation of KBr discs for infrared analysis using Specac evacuable pellet dies. They can also be used with the Atlas® Heated Platens for applications including the preparation of the polymer film substrates.

The Atlas® Autotouch Presses are simple to use and program via the use of screen symbols and prompts. Options include user selectable languages and load units. The Presses durability are ideal for applications such as X-ray fluorescence sample preparation using Atlas® Series Lightweight Dies.



### Key features

- > Programmable microprocessor controlled pressure application and release
- > Simple user operation procedures via symbols and prompts
- > Maintain load applied from automatic "top up"
- > Graphics display with LED backlight control
- > End of cycle alarm or indication
- > Integral high clarity PETG safety guards
- > Fully CE marked
- > Fully compatible with Specac sample preparation accessories



# Atlas® Autotouch Press

## 8T, 15T, 25T & 40T

### ordering information

#### 8T

<b>GS25800</b>	UK/Europe (230v, 50Hz)
<b>GS25801</b>	USA (110v, 60Hz)
<b>GS25802</b>	Japan (100v, 50/60Hz)
<b>GS25803</b>	China (230v, 50Hz)
<b>GS25804</b>	Korea (220v, 60Hz)

#### 15T

<b>GS25810</b>	UK/Europe (230v, 50Hz)
<b>GS25811</b>	USA (110v, 60Hz)
<b>GS25812</b>	Japan (100v, 50/60Hz)
<b>GS25813</b>	China (230v, 50Hz)
<b>GS25814</b>	Korea (220v, 60Hz)

#### 25T

<b>GS25820</b>	UK/Europe (230v, 50Hz)
<b>GS25821</b>	USA (110v, 60Hz)
<b>GS25822</b>	Japan (100v, 50/60Hz)
<b>GS25823</b>	China (230v, 50Hz)
<b>GS25824</b>	Korea (220v, 60Hz)

#### 40T

<b>GS25830</b>	UK/Europe (230v, 50Hz)
<b>GS25831</b>	USA (110v, 60Hz)
<b>GS25832</b>	Japan (100v, 50/60Hz)
<b>GS25833</b>	China (230v, 50Hz)
<b>GS25834</b>	Korea (220v, 60Hz)

#### Atlas® Series Dies

	Max. Load
<b>GS25410</b> Lightweight 32mm Die	25 Tons
<b>GS25411</b> Lightweight 40mm Die	25 Tons

#### Specifications

Max. Piston Load

8T	15T	25T	40T
8 Tons	15 Tons	25 Tons	40 Tons

<b>8T</b>	Digital Display (.2 Ton Steps)	1-8 Tons
<b>15T</b>	Digital Display (.2 Ton Steps)	2-15 Tons
<b>25T</b>	Digital Display (.5 Ton Steps)	3-25 Tons
<b>40T</b>	Digital Display (.5 Ton Steps)	4-40 Tons

#### Specifications 8T, 15T, 25T & 40T

Top Bolster Diameter	32mm
Top Lead Screw Vertical travel	90mm
Top Lead Screw Vertical travel	80mm (40T)
Ram (Piston) Bolster Diameter	82mm
Ram (Piston) Stroke	24mm
Ram (Piston) Stroke	38mm (40T)
Max/Min Pressing Faces Dist.	155mm - 40mm

Max/Min Pressing Faces Dist.	140mm - 60mm (40T)
Sample Area (Dia. x Hgt)	220mm x 155mm
Sample Area (Dia. x Hgt)	240mm x 155mm (40T)
Base Footprint (W x D)	425mm x 405mm
Base Footprint (W x D)	430mm x 405mm (40T)
Height (without lead screw)	500mm
Height (without lead screw)	550mm (40T)
Height (Lead screw at min. & max. distances between pressing faces)	545mm - 640mm
Height (Lead screw at min. & max. distances between pressing faces)	(40T) 580mm - 660mm
Oil Type	Tellus 37
Oil Reservoir Capacity	0.8 litres & 1litre (40T)
Weight	95Kg & 130Kg (40T)
Communication Type	USB
Display Units	Tons, Tonnes, US Tons
Hold Times	0.1 to 99 minutes and infinity
Optimised Release Rates	Fast, Medium, Slow
Stored Programs	6
Maximum Program Segments	10

#### Service Kits for Atlas Autotouch 8T, 15T and 25T

<b>GS25880</b>	- Checking Oil Level and Bleeding Air from Oil Kit of parts (and procedure)
<b>GS25881</b>	- Changing the Main Piston Assembly kit of parts (and procedure)
<b>GS25882</b>	- Changing the Motor Pump Assembly kit of parts (and procedure)
<b>GS25884</b>	- Changing an Internal fuse kit of parts (and procedure)
<b>GS25885</b>	- Gaining Access to the Compression Spring Rings kit of parts (and procedure)
<b>GS25886</b>	- Changing and Replacement Lead screw Assembly kit of parts (and procedure)

#### Service Kits for Atlas Autotouch 40T

<b>GS25890</b>	- Checking Oil Level and Bleeding Air from Oil Kit of parts (and procedure)
<b>GS25891</b>	- Changing the Main Piston Assembly kit of parts (and procedure)
<b>GS25892</b>	- Changing the Motor Pump Assembly kit of parts (and procedure)
<b>GS25894</b>	- Changing an Internal fuse kit of parts (and procedure)
<b>GS25895</b>	- Gaining Access to the Compression Spring Rings kit of parts (and procedure)
<b>GS25896</b>	- Changing and Replacement Lead screw Assembly kit of parts (and procedure)

# Atlas® Power Press 8T, 15T & 25T

## Atlas® Power Press 8T, 15T & 25T

The Atlas® Series Power Presses 8T, 15T & 25T, are power assisted hydraulic presses operating to 8 Tons, 15 Tons & 25 Tons respectively. They have been designed to handle a wide variety of pressing applications, including XRF & IR sample preparation. All Presses are fully compatible with Specac dies and other sample preparation accessories.

The presses enable the controlled application and release of applied load and can accommodate large samples up to 200mm in diameter. The LCD display shows press status and load conditions giving a digital display of load applied.

Specifications	8T	15T	25T
Max. Piston Load	8 Tons	15 Tons	25 Tons
Digital Display (.5 Ton steps)	1-8 Tons		
Digital Display (.5 Ton steps)	2-15 Tons		
Digital Display (1 Ton steps)	3-25 Tons		

## Specifications for all 8T, 15T & 25T

Top Bolster Diameter	32mm
Top Lead Screw Vertical travel	90mm
Ram (Piston) Bolster Diamete	83mm
Ram (Piston) Stroke	24mm
Max/Min Pressing Faces Dist.	155mm - 40mm
Sample Area (Dia x Ht)	220mm x 155mm
Base Footprint (W x D)	425mm x 405mm
Height (without lead screw)	500mm
Height	545mm - 640mm
Oil Type	Tellus 37
Oil Reservoir Capacity	0.8 litres
Weight	95Kg

## ordering information

8T	15T	25T	
GS25400	GS25430	GS25420	UK/Europe (230v, 50Hz)
GS25401	GS25431	GS25421	USA (110v, 60Hz)
GS25402	GS25432	GS25422	Japan (100v, 50/60Hz)
GS25403	GS25433	GS25423	China (230v, 50Hz)
GS25404	GS25434	GS25424	Korea (220v, 60Hz)



## Key features

- > Microprocessor controlled pressure application and release
- > Large working distance between pressing surfaces
- > Fully CE Marked
- > Low noise operation
- > Liquid crystal digital display
- > Multi-lingual display option
- > Integral high clarity PETG safety Guards
- > Fully compatible with Specac sample preparation accessories

Atlas® Series Dies	Max. Load
GS25410 Lightweight 32mm Die	25 Tons
GS25411 Lightweight 40mm Die	25 Tons

## Service Kits for Atlas Power Presses

- GS25480 – Checking Oil Level and Bleeding Air from Oil Kit of parts (and procedure)
- GS25481 – Changing the Main Piston Assembly kit of parts (and procedure)
- GS25482 – Changing the Motor Pump Assembly kit of parts (and procedure)
- GS25483 – Changing the Dowty Seals in the Manifold Block (and procedure)  
(Note: OLD motor pump assemblies only)
- GS25484 – Changing an Internal fuse kit of parts (and procedure)
- GS25485 – Gaining Access to the Compression Spring Rings kit of parts (and procedure)
- GS25486 – Changing and Replacement Lead screw Assembly kit of parts (and procedure)

# Mini-Pellet Press

A cost effective hydraulic press solution for FT-IR pellet preparation.

## Mini-Pellet Press

The Specac Mini-Pellet Press is an innovative low cost solution for the pressing of 7mm KBr pellets.

Designed for use on a laboratory bench top, this dedicated KBr pellet press enables the user to create consistently high quality KBr pellets for transmission FT-IR analysis.

Incorporating full hydraulic operation, the Mini-Pellet Press enables the user to apply the required load for sample preparation through the simple rotation of a load knob. An integrated pressure gauge enables the user to apply a reproducible load resulting in high quality KBr pellets suitable for quantitative studies. With a rugged and durable design and an innovative sealed hydraulic unit, the press is intended for daily laboratory use with maintenance free operation.

The dedicated 7mm diameter Pellet Die Assembly is shaped to securely locate onto the lower piston of the press and includes a pellet ring in which the sample pellet is held after pressing.

Once the KBr pellet is pressed this pellet ring is simply placed onto the special sample compartment mount, locating the sample directly into the IR beam for analysis.

The press is designed to be used on a laboratory bench top, but is small in size and light enough in weight to allow it to be moved to different points of use or stored when not required.

The Specac Mini-Pellet Press is also available as part of a Basic Solid Pack (P/N GS01150).

This is equipped with a range of sample preparation components necessary for FT-IR solid sample analysis by transmission, including: the Mini-Pellet Press, a 7mm Pellet Die Assembly, 7mm Disc Holder for a standard 3" x 2" mount, a pair of spare Pellet Ring Holders, a Pestle and Mortar, and KBr Powder (50g).



## Key features

- > Hydraulic operation enables all users to make high quality KBr pellets
- > Integrated pressure gauge ensures consistent pellet quality
- > Fast and simple process to get from sample to IR results
- > Simple operation requires minimal training
- > Small and lightweight
- > Low cost of ownership

## ordering information

### GS03940 Mini-Pellet Press

Also available as part of a Basic Solid Pack (P/N GS01150).

### GS03950 7mm Pellet Die Assembly

### GS03960 3" x 2" Slide Mounts

for 7mm pellet ring holder

## Mini-Pellet Press Spares and Consumables

### GS03951 Pair of Spare Ring Holders

### GS03600 Pestle and Mortar

### GS03610 KBr Powder (50g)

# Mini-Pellet Press

A cost effective solution for FT-IR pellet preparation

## Mini Pellet-Press specifications

Maximum load - **2 tons**

Pellet Die diameter - **7mm**

Maximum space between pressing faces - **50mm**

Minimum space between pressing faces - **12mm**

Piston stroke - **0.5mm**

Die assembly - **hardened 440°C stainless steel**

Upper pressing area

(top lead screw diameter) - **17.0mm**

Lower pressing area (piston diameter) - **21.6mm**

Dimension (ex. lead screws)

**W x L x H - 110 x 200 x 155mm**

Dimension (inc. lead screws)

**W x L x H - 110 x 265 x 215mm**

Weight - **4.2Kg**



## How to Press a KBr Pellet

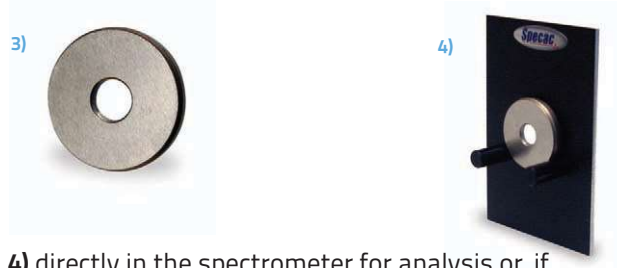
Pellet preparation involves the use of a 7mm Pellet Die Assembly.

**1)** The sample material is blended with KBr (or other halide salt) powder and loaded into a pellet ring holder and anvil die assembly.



**2)** This assembly is then placed over the Mini-Pellet Press piston, the top lead screw is lowered, and a load applied.

**3)** After compressing the sample into a transparent pellet, the pellet ring holder can then be placed on a 3" x 2" slide-mounted disc holder.



**4)** directly in the spectrometer for analysis or, if necessary, the formed pellet can be removed from the ring holder and stored for later analysis.

# Dies

Page 118

**Atlas®  
Evacuable  
Pellet Dies**



Page 120

**Lightweight  
Dies**



Page 121

**Specadie®**



## Cost effective dies - designed to last

Evacuable pellet press dies are available for Specac manual, power, and automatic hydraulic press products. These pellet press dies are available in a range of diameters from 5 mm to 40 mm as standard, and include the 13 mm KBr pellet press die for FT-IR applications and 32 mm / 40 mm XRF pellet press die.

# Atlas® Evacuatable Pellet Dies

Production of high quality sample pellets  
from 5mm to 40mm diameter

## Atlas® Evacuatable Pellet Dies

Specac manufactures a wide range of high-quality Atlas Series Evacuatable Pellet Dies suitable for compacting powdered samples into discs or briquettes. These are particularly well suited for the preparation of solid KBr pellets for FT-IR molecular spectroscopic analysis and XRF pellets for X-Ray Fluorescence atomic spectroscopic analysis (as required by a number of USLP and ASTM methods), but also find use in a broad range of other applications. Atlas Series Evacuatable Pellet Dies are typically used in conjunction with the Specac's Atlas Series of Hydraulic Press Products.

These Evacuatable Pellet Dies produce circular pellets in sizes from 5 mm to 40 mm diameter as standard, but other shapes and sizes are available on request. These pellet dies cover a range of load capabilities. For optimum quality and durability of the pellet die, all parts are manufactured from hardened stainless steel, and surfaces that come in contact with the sample are highly polished.

Each Pellet Die comprises of an evacuatable base, body, plunger, a pair of internal pellet pressing surfaces, extractor ring, and O Ring Kit. An evacuation port is provided for removal of moisture, if desired, during the pressing process.



### Key features

- > Hardened Stainless Steel
- > Highly polished pellets
- > Evacuatable for sample pellet clarity and quality
- > Vacuum pump kit for moisture free pressing (optional)

## ordering information

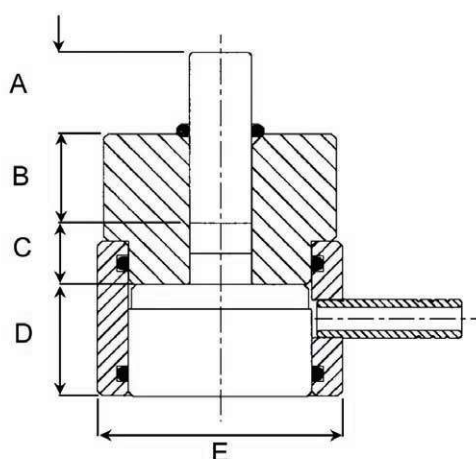
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|----------------|---|
| <b>GS03060</b> | <b>Atlas® 5mm</b> evacuatable pellet die<br>(Max load 2.0 Tons)   |
| <b>GS03100</b> | <b>Atlas® 10mm</b> evacuatable pellet die<br>(Max load 5.0 Tons)  |
| <b>GS03000</b> | <b>Atlas® 13mm</b> evacuatable pellet die<br>(Max load 10.0 Tons) |
| <b>GS03165</b> | <b>Atlas® 20mm</b> evacuatable pellet die<br>(Max load 25.0 Tons) |
| <b>GS03300</b> | <b>Atlas® 32mm</b> evacuatable pellet die<br>(Max load 50.0 Tons) |
| <b>GS03290</b> | <b>Atlas® 40mm</b> evacuatable pellet die<br>(Max load 85.0 Tons) |





# Atlas® Evacuatable Pellet Dies

Die Size	5mm	10mm	13mm	20mm	32mm	40mm
P/N	GS03060	GS03100	GS03000	GS03165	GS03300	GS03290
A	13.7	16	16.0	21.4	21.4	21.4
B	38.8	19.1	19.1	35.8	35.8	35.8
C	12.7	12.7	12.7	19.1	19.1	19.1
D	22.2	22.7	22.2	27.8	27.8	27.8
E	50.8	50.8	50.8	68.3	68.3	95.3



A+B = Plunger Height  
 C = Stainless Steel Pellet Height  
 D = Base Height  
 E = Diameter  
 A+B+C+D = Total Height of Die

## ordering information

### Atlas® Evacuatable Pellet Dies Options

Size (dia)	Die	Pellet Holder
5mm	GS03060	GS03400
10mm	GS03100	GS03404
13mm	GS03000	GS03410
20mm	GS03165	GS03193*
32mm	GS03300	GS03520*
40mm	GS03290	GS03298*

### Spares and consumables

<b>GS03600</b>	Agate Pestle and Mortar (Mortar Bowl dia. 4cm)
<b>GS03610</b>	KBr powder (50g)
<b>GS03460</b>	Paper rings for 13mm die (11mm diameter aperture) (100)
<b>GS03470</b>	Micro frames for 13mm die (11mm x 2mm aperture) (100)
<b>GS03475</b>	Ultra Micro frames for 13mm die (4mm x 1mm aperture) (100)

\*These pellet holders are sample retaining rings only and do not have a rectangular mounting plate.

Diameter	Sets of Pellets	Plunger	Body	Base	Extractor Ring	O Ring Kit
5mm	GS03061	GS03063	GS03064	GS03050	GS03069	GS03062
10mm	GS03101	GS03103	GS03104	GS03050	GS03025	GS03102
13mm	GS03010	GS03030	GS03040	GS03050	GS03025	GS03020
20mm	GS03166	GS03168	GS03169	GS03191	GS03521	GS03167
32mm	GS03310	GS03330	GS03340	GS03230	GS03521	GS03320
40mm	GS03291	GS03293	GS03294	GS03295	GS03297	GS03292

# Atlas® Lightweight Dies

## Atlas Lightweight Dies

The Atlas® Lightweight Evacuatable Pellet Dies have been specifically designed to work with the range of Atlas® automatic presses up to a maximum load rating of 25 tons. The dies are also compatible for use with Specac's 15 and 25 ton manual hydraulic presses.

The dies are made of 440C stainless steel and are designed to prepare pellet discs of 32mm (P/N GS25410) or 40mm (P/N GS25411) diameter size.

They are well suited for the preparation of solid pellets for study by X-Ray Fluorescence spectroscopy. When many samples are to be prepared for study, the physical effort required to load and remove an Atlas® Lightweight Evacuatable Pellet Die into a press is greatly reduced, as the dies themselves are physically smaller and lighter in weight by comparison to conventional 32mm and 40mm diameter pellet dies. The 32mm die P/N GS25410 is approximately 1.8Kgs and the 40mm die P/N GS25411 is approximately 1.9kgs in weight. By comparison the 40mm pellet die P/N GS03290 is close to 5.0kgs in weight.

To aid in the weight reduction there are no individual internal pressing pellets as with conventional dies and so a sample is compressed between the plunger and the base piece of the die assembly. For this reason the plunger itself has a highly polished surface that makes contact with the sample. The highly polished face helps in producing an even surface to the sample pellet and in release of the sample from the die components.

The Atlas® Lightweight Evacuatable Pellet Dies have an evacuation port and can be operated using a partial vacuum for the compression of samples into pellets that may be moisture sensitive.



## ordering information

- GS25410** Atlas® 32mm  
Lightweight Evacuatable Pellet Die
- GS25411** Atlas® 40mm  
Lightweight Evacuatable Pellet Die
- GS25412** Atlas® 32mm  
Evacuatable Pellet Die Body
- GS25413** Atlas® 32mm  
Evacuatable Pellet Die Plunger
- GS25414** Atlas® 32mm  
Evacuatable Pellet Die Base
- GS25415** Atlas® 32mm  
Evacuatable Pellet Die O-Ring Kit
- GS25416** Atlas® 40mm  
Evacuatable Pellet Die Body
- GS25417** Atlas® 40mm  
Evacuatable Pellet Die Plunger
- GS25418** Atlas® 40mm  
Evacuatable Pellet Die Base
- GS25419** Atlas® 40mm  
Evacuatable Pellet Die O-Ring Kit



# Specadie®

Produces KBr pellets without using a press

## Specadie®

The Specadie® accessory allows for the production of a solid KBr pellet for analysis by infrared spectroscopy without the need of a separate press and die.

The Specadie® consists of a die body and two bolts that each have a highly polished pressing face. In operation a ground KBr powder is placed in the die body and compressed between the two bolts that are tightened together. A KBr pellet of 8.5mm diameter is formed. The bolts are then removed and the compressed KBr powder is retained inside the die body. The die body in turn acts as the pellet holder and is placed into a spectrometer via the Specadie® holder 3" x 2" mount plate P/N GS03560

## ordering information

**GS03550** Specacdie® only, with bolts and seals

### Specadie® Kit

**GS03700** Includes: Specadie®  
Specadie® Holder  
Bench mounted wrench (spanner)  
Open ended wrench (spanner)  
Spare set of bolts  
Spare set of seals  
Bottle of KBr powder (50g)



### Key features

- > No press or pellet holder required
- > Rapid sample preparation
- > Evacuatable for sample clarity and quality

### Applications

- > Halide pellets for IR analysis

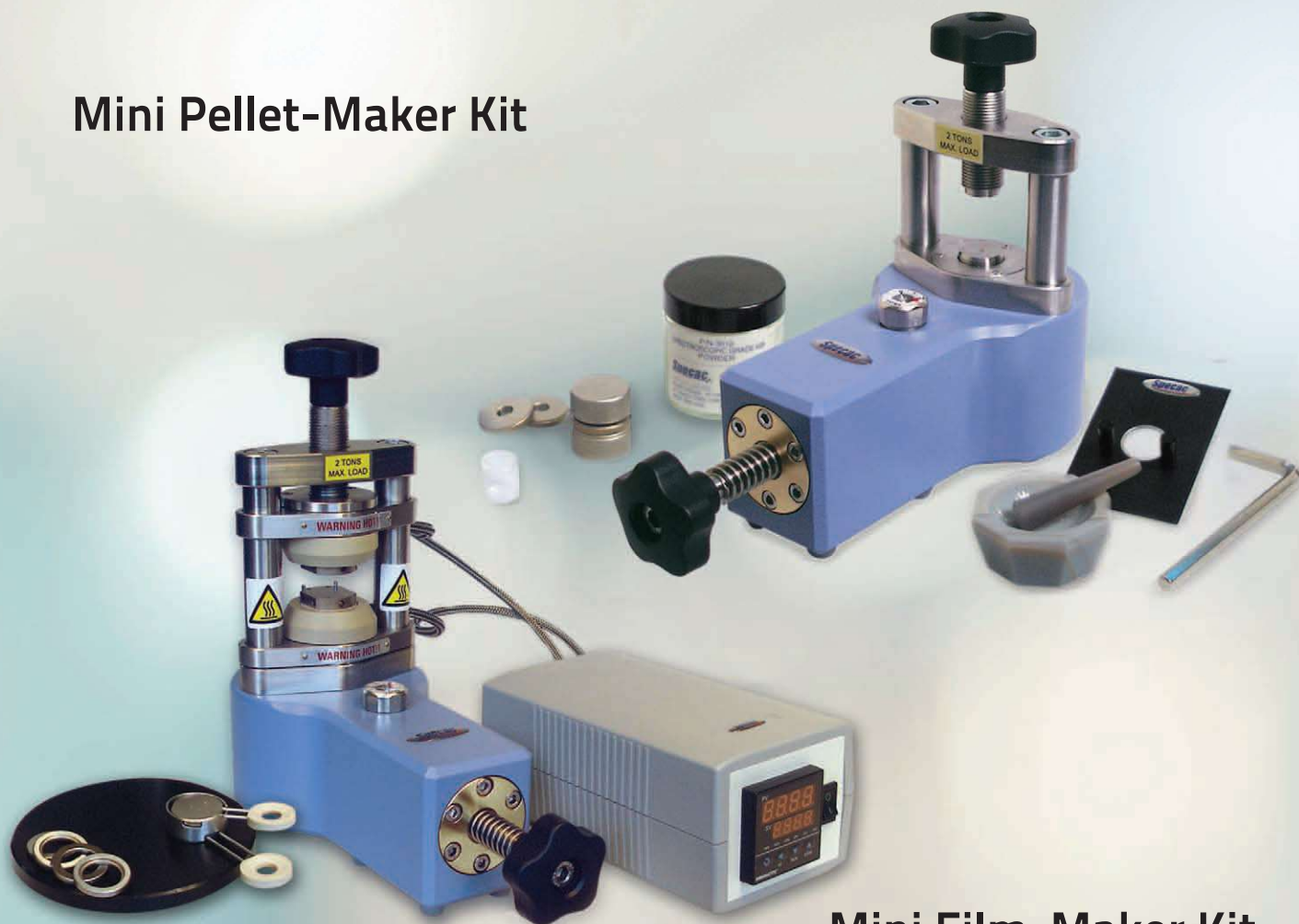
### Spares and consumables

**GS03560** Circular Specadie® Holder  
**GS03570** Set of bolts  
**GS03590** Set of two open ended wrenches (spanners), 9/16" (14.3mm) and 1/2" (12.7mm) AF  
**GS03595** Bench mounted wrench (spanner)  
**GS03580** Set of seals  
**GS03610** KBr powder (50g)



# Small size

## Mini Pellet-Maker Kit



## Mini Film-Maker Kit

# Big power

Innovative low cost solutions for the pressing of 7mm KBr pellets and 15mm polymer films. Designed for use on a laboratory bench top, these dedicated presses enable the user to create consistently high quality KBr pellets and high quality thin films of polymer and plastic materials for infrared transmission analysis.

**Specac**

THE WORLD'S LEADING SPECTROSCOPIC ACCESSORY MANUFACTURER



UK: 01689 892902 | [www.specac.com](http://www.specac.com) | US: +1 800 447 2558



# Film-Makers

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**Atlas®  
Heated Platens**



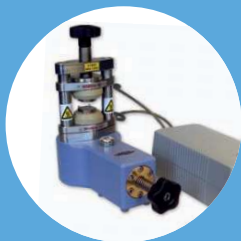
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**Atlas®  
Film-Makers**



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**Mini  
Film-Maker kit**



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**Specacards  
& Film Holders**



## For high quality, reproducible polymer films

Heated platen and thin film making accessories for Specac hydraulic presses.

These are designed for the fabrication of thin films of polymer materials for FT-IR transmission spectroscopy. Standard and high-temperature thin film-making kits are available.

# Atlas® Heated Platens

A quick and simple accessory for converting standard Hydraulic Presses to heatable versions



## Key features

- > Digital temperature display
  - > Controlled temperature to 300°C with water cooling
  - > 15 Ton load bearing capacity
  - > CE Safety Approved
  - > 100mm diameter pressing surface
- Compatible with all Specac Hydraulic Presses

## Atlas® Heated Platens

The Atlas® Heated Platens have been designed to provide heatable pressing surfaces compatible with all Specac Hydraulic Presses. The platens are easily installed by replacing the bolster fixing of the press by the top platen and placing the bottom platen over the lower pressing face of the press.

The platens have a large surface area, are rugged, durable and have full CE safety approval. They are fitted with a permanent thermocouple which monitors the temperature close to the pressing surface. The press connection ports are water cooled which allows for an efficient heating and cooling cycle.

The platens are controlled by a digital automatic temperature controller with a stability of  $\pm 1^\circ\text{C}$

## ordering information

**GS15515 Atlas® Water Cooled Heated Platens** and Automatic Temperature Controller with Digital Display.  
Includes 2 metres of 6mm id. PVC tubing and flow connectors.

**Specify 220V or 110V and country of usage**

## Spares and consumables

**GS15601 PTFE sheets** 0.25mm thick for Water Cooled Heated Platens (10)

**GS15512 Replacement heater** set for Platens (220V)

**GS15522 Replacement heater** set for Platens (110V)





# Atlas® Constant Thickness and High Temp. Film-Maker

Film making systems to produce high quality, reproducible polymer films

P/N GS15800



## Key features - GS15800

- > Up to 400°C operation
- > 40 minute cycle time
- > CE Safety Approved
- > Integral heating and cooling
- > 2 Ton load limit
- > 0.015, 0.025, 0.050, 0.100, 0.250, 0.500mm films of 29mm diameter
- > Easy film release

## Key features - GS15640

- > Up to 300°C operation
- > 30 minute cycle time
- > 4 Ton load limit
- > 0.015, 0.025, 0.050, 0.100, 0.250, 0.500mm films of 29mm diameter
- > Easy film release
- > Operates with Heated Platens P/N GS15515

## Atlas® Constant Thickness Film-Maker

Specac make two types of film-maker accessory that are ideal for the preparation of thin films from polymers materials. The films produced are 29mm in diameter and can vary in thickness due to use of a set spacing ring. Individual spacing rings are supplied for a nominal thickness of film at 0.015, 0.025, 0.050, 0.100, 0.250 and 0.500 millimeters. The principal difference between the two film-maker accessories is the maximum operating temperature allowable by each one.

The Constant Thickness Film-maker Accessory P/N GS15640 is designed to be used with the Atlas Heated Platens P/N GS15515 within a 15 Ton Manual Hydraulic Press P/N GS15011. However, the

P/N GS15640



25 Ton Manual Hydraulic Press P/N GS25011, the Atlas Power 8T Press P/N GS25400 and Atlas Auto 8T Press P/N GS25440 can also be used with the Atlas Heated Platens P/N 15515 and Film-maker Accessory P/N GS15640.

The Atlas® Heated Platens provide the temperatures necessary to melt a sample within the film maker accessory prior to compression via the press. The maximum temperature provided by the Atlas Heated Platens is 300°C, so any materials that have a melting point higher than this are not suitable for forming into thin films using the Atlas® Constant Thickness Film-maker P/N GS15640. The specified maximum load limit for this accessory within the press is 4 tons when indicated at the load gauge on the Manual Hydraulic Presses and digital display on the Atlas Power and Auto Presses. Typically a 1 ton load gives acceptable results for film thickness.

## Atlas® High Temperature Film-Maker

The High Temperature Film-maker Accessory P/N GS15800 has a set of heated platens already incorporated into the film making part of the accessory and so the Atlas Heated Platens P/N GS15515 are not needed for use when P/N GS15800 is installed in a press. (The High Temperature Film-maker Accessory P/N GS15800 will fit into the same presses for use as the combination of P/N's GS15515 and GS15640.)

The heated surfaces of P/N GS15800 are operable up to 400°C, so it is possible to make thin films of samples with melting points up to this temperature in this film maker accessory. The maximum load limit for this accessory is 2 tons when indicated at the load gauge on the Manual Hydraulic Presses and digital display on the Atlas Power and Auto Presses, but similar to the constant thickness film maker, acceptable results for film thickness is typically achieved at a 1 ton load.

# Atlas® Constant Thickness and High Temp. Film-Maker

## ordering information

**GS15640 Atlas® Constant Thickness Film-maker**  
Includes: 0.015, 0.025, 0.050, 0.100, 0.250 and 0.500 mm spacer rings  
Aluminium foil discs 40mm dia. (200 off)  
Specacards 10mm diameter clear aperture (20)  
Stainless steel forceps

**GS15800 Atlas® High Temperature Constant Thickness Film-maker**  
Includes: 0.015, 0.025, 0.050, 0.100, 0.250 and 0.500 mm spacer rings  
Aluminium disc foils 40mm dia. (200 off)  
Tool for making aluminium foil sample cup  
Specacards 10mm dia. clear aperture (20)  
Stainless steel forceps  
High stability digital temperature controller (400°C)  
Non-drip water connectors

### Film-maker Kits

**GS15631 Atlas® Constant Thickness Film-maker Kit 1**  
Includes: Constant Thickness Film-maker System (GS15640) Heated Platens and Digital Automatic Temperature Controller (300°C) (GS15515)

**GS15633 Atlas® Constant Thickness Film-maker Kit 2**  
Includes: Constant Thickness Film-maker System (GS15640) Heated Platens and Digital Controller (300°C) (GS15515)  
15 Ton Manual Hydraulic Press (GS15011)

(Specify 220V or 110V and country of usage for GS15800, GS15631 and GS15633 )

**GS15810 Atlas® High Temperature Constant Thickness Film-maker Kit**  
Includes: High Temperature Constant Thickness Film Maker System (GS15800)  
15 Ton Manual Hydraulic Press (GS15011)

(Specify 220V or 110V and country of usage)

### Spares and Consumables

**GS03800** 10mm diameter aperture Specacards (100)  
**GS03805** Nylon retaining rings for supporting elastic film samples (20)  
**GS03810** 10mm x 25mm aperture Specacards (100)  
**GS03820** Magnetic film holder  
**GS15627** 40mm diameter aluminium foil discs (200)  
**GS15641** Constant Thickness Film Maker Replacement Cooling Block Assy  
**GS15642** Constant Thickness Film Maker Replacement Platen Assy  
**GS15629** Constant Thickness Film Maker Replacement Spacer Ring Set  
**GS15805** High Temperature Film Maker Replacement Spacer Ring Set



# Mini Film-Maker Kit

A dedicated polymer thin film-making accessory for IR transmission analysis.

## Mini Film-Maker Kit

The Specac Mini Film-maker Kit is designed to produce high-quality thin films of polymer and plastic materials for infrared transmission analysis.

This product enables quick and easy hot pressing of pellets and other sample forms from ambient to 250°C, to give constant and reproducible thickness films over the range 15 to 500 microns with a formed diameter of 15 mm.

The accessory consists of an integrated hydraulic press, digital temperature controller, and heated platens, together with a lightweight film maker assembly.

This design allows the heated platens to be pre-heated and held at the melt-point temperature required for the sample. The film-maker assembly is separately prepared with a few tens of milligrams of the sample material and appropriate sizing ring, before being introduced to the pre-heated platens.

After the film maker assembly has stabilised to the preset temperature, a load of typically 0.5 Tons is applied by rotating the press lead screw to hot press the film. On removal from the heated press, the low-thermal mass film maker assembly quickly returns to ambient temperature on the cooling plate and the pressed film is removed.

The film can then be mounted in a 3 by 2 inch self adhesive card (Specacard) for infrared transmission analysis. This process appreciably shortens the film making process cycle time compared with



### Key features

- Quick and reproducible thin film production
- Sample melt points from ambient to 250°C
- Standard film sizing rings of 15, 25, 50, 100, 250 and 500 microns producing 15mm dia. films
- Dedicated film maker accessory with hydraulic press and integrated heated platens
- Cycle time 5 mins

conventional methods and, in practice, a cycle time of less than 5 minutes is possible for producing a thin film.

The Specac Mini Film-maker Kit includes the Mini Film-maker Press with integrated heated platens and digital temperature controller, a Film-maker Assembly with Film Sizing Rings of 15, 25, 50, 100, 250, and 500 microns, 200 pairs of Aluminium Foil Discs, a Cooling Plate, 100 Specacards, and Stainless Steel Tweezers (Forceps).

A set of US, EU, and UK power leads is provided as standard.

Typical uses of this accessory include producing thin films for infrared quantitative analysis of polymers and plastics for regulatory or production quality assurance purposed, as well as method development for process analysis. Other applications include thin film making for tensile strength studies.

# Mini Film-Maker Kit

## Mini Film-Maker Specifications

Maximum load - **2 Tons**

Temperature range Ambient to - **250°C**

Temperature control - **1°C steps**

Thin film formed diameter - **15 mm**

Thin film thickness **15, 25, 50, 100, 250 & 500 microns** (nominal)

Press dimensions **104mm x 198mm x 197mm** (W x H x L) (excluding lead screw)

Weight of press and controller - **5.7Kg**

Supply voltage - **110/220V**

Output voltage - **30V DC**

Heater power - **35W**

## ordering information

### Mini Film-Maker Kit

**GS03970** Mini Film-Maker Kit



### Spares and consumables

- GS03971** Mini-Film maker Assembly (includes to platen assembly, shield, lower platen assembly, and set of sizing rings)
- GS03972** Sizing rings set (15, 25, 50, 100, 250 & 500 microns)
- GS03973** Set of aluminium foil discs (200 pairs)
- GS03974** Cooling Plate for Mini Film-maker
- GS03975** Mini Film-maker Platen Set (includes top platen assembly, shield, and lower platen assembly)
- GS03800** Specacards (pkt 100) 10mm dia. aperture
- GS15628** Stainless steel tweezers (forceps)

## How to produce a thin film

Place the shield, selected sizing ring and smaller foil on the lower assembly.

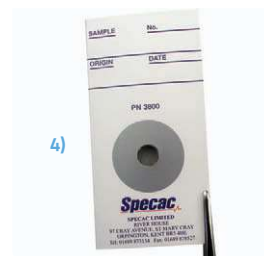
**1)** The sample is put into the middle of the foil before the larger foil and upper assembly are added on top.



**2)** The whole assembly is placed between the pre-heated platen surfaces so that a tonnage load can be applied.



**3)** Once the sample has been compressed and removed from the press, take apart the assembly and carefully peel the foils away from the film inside.



**4)** The film can then be put in a Specacard and placed into the spectrometer for analysis.

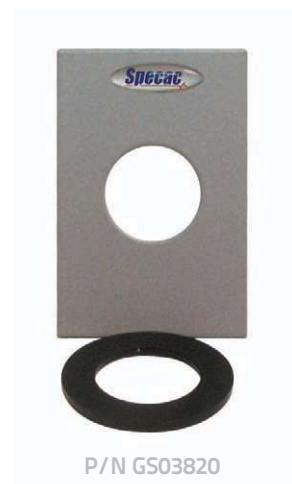
# Specacards & Magnetic Film Holder



P/N GS03800



P/N GS03810



P/N GS03820

## Key features

- > Self sealing adhesive coating (Specacard)
- > Magnetic ring (Film Holder)
- > Indexing space (Specacard)
- > Clear aperture:
  - 10mm diameter or 25 x 10mm (Specacard)
  - 25mm diameter (Magnetic Film Holder)
- > 3" x 2" Slide mounted

## ordering information

### Specacards & Magnetic Film Holders

**GS03800** Specacards 10mm diameter aperture (100 off)

**GS03810** Specacards 25 x 10mm aperture (100 off)

**GS03820** Magnetic Film Holder



# Gas sample



Just a small sample from our comprehensive range of laboratory gas cells. Innovative technology allows us to offer sampling cells in a wide range of pathlengths, volumes, construction materials and windows. Optional upgrades further enhance adaptability, creating a cost-effective gas measurement solution, with no compromise in performance.

**Specac**

THE WORLD'S LEADING SPECTROSCOPIC ACCESSORY MANUFACTURER



UK: 01689 892902 | [www.specac.com](http://www.specac.com) | US: +1 800 447 2558





# Sample Preparation Supporting Accessories

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**Specamill®**



Page 133  
**Specacabinet®**



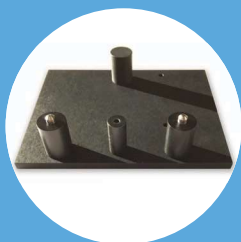
Page 134  
**Thermostatic Bath**



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**Vacuum Pump System**



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**Benchmark® Baseplate**



## Sample preparation supporting accessories

Various additional products are available from Specac with associated uses for hydraulic press and pellet press laboratory applications. These include vacuum pump kits, sample drying cabinets, mill and grinding accessories.

# Specamill®

Provides efficient grinding and blending of solid materials



## Specamill®

The Specamill® grinding accessory is designed to mix a solid sample with an excess of KBr powder for the preparation of powder samples prior to compression into KBr pellets for IR study. It can also be used in preparing samples for diffuse reflectance spectroscopy. The target particle size of the sample is at least 0.025mm (if not smaller) to coincide with the wavelength of light in the classical Mid IR region. Final particle size will depend specifically on the actual sample and the mixture proportions and the amount of time being applied for the grinding process.

There are two capsule sets that can be used within the Specamill® grinding accessory P/N GS06000. One capsule set P/N GS06200 is an agate capsule set and the other P/N 6100 is a stainless steel capsule set. Each set consists of a capsule body, stopper and three grinding balls fabricated in the agate or stainless steel.

The reason for use of either set is principally due to the difference in hardness of material. Agate, being a naturally occurring mineral is typically between 6 and 7 on the Mohs scale of hardness. Steel, depending on its fabrication and chemical make up, can vary from between 5 to 8.5 on the same Mohs scale of hardness. The Specac stainless steel capsule set is typically of a Mohs hardness of 7.5.

The capacity of each capsule is 3ml and the recommended filling volume is 30% (excl. spheres).

## Key features

- Rapid grinding
- Choice of capsule and sphere materials
- Adjustable vibration
- Timer with manual override

## Key features

- Grinding and blending a wide variety of materials
- Sample preparation for KBr pellets
- Sample preparation for diffuse reflectance spectroscopy

## ordering information

**GS06000** Specamill® (220V, 50Hz) UK

**GS06001** Specamill® (220V, 50Hz) EU

**GS06800** Specamill® (110V, 60Hz) US

**The Specamill requires a capsule set**

## Capsule sets

**GS06100** Stainless steel capsule for Specamill®  
Includes Stainless steel stopper Stainless steel spheres (3)

**GS06200** Agate capsule for Specamill®  
Includes Agate stopper  
Agate spheres (3)

## Spares and consumables

**GS06300** Agate spheres for Specamill® (3)

**GS06400** Stainless steel spheres for Specamill® (3)

**GS06500** Replacement Blade for Specamill®

**GS06600** Replacement Clip for Specamill®

**GS06700** Spare Capsule Holder for Specamill®

# Specacabinet®

Allows storage of hygroscopic infrared materials under controlled conditions



## Specacabinet®

The Specacabinet® is a drying cabinet suitable for the storage of hygroscopic materials (such as IR cell windows or reference samples) and any other accessories that require a moisture free storage environment.

The Specacabinet® is thermostatically controlled over the temperature range from ambient to 80°C.

A drying agent is included with a colour indicator allowing for a constant check on the humidity.

## ordering information

**GS19100** Specacabinet® (220V, 50Hz) UK

**GS19102** Specacabinet® (220V, 50Hz) EU



## Specifications

- > Thermostatically controlled up to 80°C (stability  $\pm 0.5^\circ\text{C}$ )
- > Sliding doors
- > Size (L x W x H): Internal: 737 x 331 x 432mm
- > External: 762 x 356 x 508mm
- > Can be wall mounted

# Thermostatic Bath

## Thermostatic baths for temperature control

### Thermostatic Bath

These thermostatic baths are designed to supply accurately temperature controlled fluid to any thermo-circulated accessory that requires temperature control. They can be used from ambient temperature up to 120°C. They can also be used with certain accessories that require a source of cooling water but are not able to be sited near to a water source. In this case the heating system is not used and the integral pump simply circulates the water back to the bath. Note that the bath water will need to be replaced with cold water at intervals dependant on the amount of heating being removed from the accessory. The 12 litre tank is recommended for this application.

The baths consist of a digital immersion thermostat with a choice of two tank sizes (5 or 12l). The immersion thermostat includes a powerful pump, timer function and a variable high temperature alarm setting. The temperature range and heater power are automatically limited according to the liquid type selected.



### Specifications

- > Temperature range: 0°C to 120°C
- > Stability, stainless steel tanks @ 37°C +/- 0.02°C
- > Uniformity, stainless steel tanks @ 37°C +/- 0.05°C
- > Setting resolution: 0.1°C
- > Display: 4 digit 13 mm LED
- > Display resolution: 0.1°C
- > Timer function: 1 to 9999 mins
- > No. stored temperature values: 4

## ordering information

**GS11127** 5 Litre Thermo Circulator with lid

**GS11128** 12 Litre Thermo Circulator with lid



# Vacuum Pump System

## Vacuum Pump System for Evacuatable Dies

### Vacuum Pump System

The vacuum pump P/N GS03640 is a two stage vacuum pump capable of pulling a vacuum to 0.05 Torr or better. It is an ideal vacuum pump to use with the Specac Accessories that have the capability of being operated under these vacuum conditions.

It is designed for normal starting in low temperature and low voltage conditions. (Typically temperatures at or above 5°C with a +/- 10% rated voltage).

An air passage prevents any pump oil from returning into the pipeline or vacuum vessel being pumped after the vacuum pump is stopped.

There is an inbuilt oil mist eliminating device and it has an oil/gas separator at the air exhaust outlet which removes any oil contamination in the air exhaust. The pump operates at a high ultimate vacuum with low noise.

Each vacuum pump has been factory tested for its vacuum pump speed in both CFM and micron units.

The vacuum pump GS03640 is supplied along with an appropriate kit of parts (a pressure gauge, vacuum tubing and particular connecting unions) compatible for immediate use with the appropriate Specac accessories.

## ordering information

### GS03640 Vacuum Pump System

For producing clear, moisture free sample pellets with the Evacuatable Pellet Dies.  
Includes: Vacuum Pump (1 x 10<sup>-1</sup> mbar), gauge & connector tube.

(Please state 220V or 110V and country)

### Spares and consumables

GS03643 Vacuum Pump Oil (1 litre)

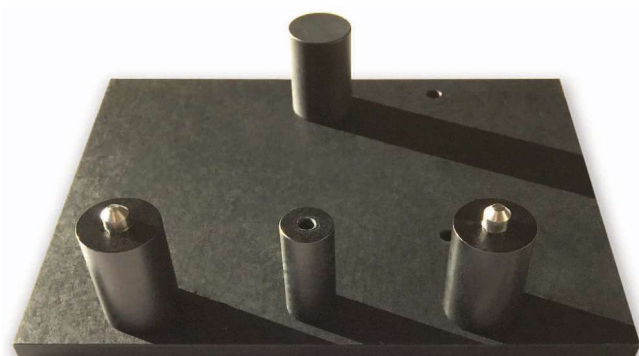


### Specifications

- > No of stages: 2
- > Free Air Displacement: 85 litres/min at 220 volts operation
- > Ultimate vacuum: 15 microns
- > Pump motor: 0.25 HP
- > Pump speed: 2880 rpm (220Volts), 3440 rpm (110Volts)
- > Electrical connectivity: 220Volts/50Hz, 110Volts/60Hz
- > Oil capacity: 400mls
- > Maximum operating temperature capability: 80°C
- > Minimum operating temperature capability: 1°C
- > Overall width (side to side dimension): 150mm
- > Overall length (front to back dimension): 350mm
- > Overall height (to top of handle): 250mm

# Benchmark® Baseplate

A Benchmark® Baseplate is required to install most Specac accessories into the spectrometer sample compartment



Most Specac accessories are installed into a spectrometer sample compartment via an adapter baseplate.

The most commonly used type is known as a Benchmark® Baseplate. The accessory locates onto the top of the Benchmark® Baseplate and is held secure by a single thumbscrew fixing, usually into a location pillar at the front of the baseplate. There are three further support and location pillars arranged in a triangular configuration on the plate to match the height of the thumbscrew location pillar, such that the accessory is placed level to be presented at the correct beam height and spatial position in the spectrometer sample compartment. It is this arrangement of pillars (or location holes and pins for low beam height spectrometer systems) on a support plate that denotes a Benchmark® Baseplate configuration.

The metal plate that carries the pillars or location holes and pins is a particular shape and unique to a specific spectrometer sample compartment. It is this metal plate that is directly attached to the floor of a spectrometer. The Benchmark® Baseplate may be suitable for a number of spectrometer models from the same manufacturer, and when placed into the spectrometer, will allow any Benchmark® Baseplate compatible accessory to be correctly mounted for operation.

The accessories can be changed over for operation simply by undoing the thumbscrew connection on the accessory itself. The Benchmark® Baseplate part does not need to be removed from the spectrometer sample compartment. An advantage is that once an accessory has been finely aligned for operation in a particular spectrometer on the Benchmark® Baseplate, as long as the optical settings on the accessory are not altered, it can be removed from the spectrometer as many times as required and is ready for use the next time it is installed.

## ordering information

### Compatibility

Quest® ATRs (GS10800)

Golden Gate® ATRs (GS10500)

Gateway® ATRs (GS11165)

Pearl® Liquid Analyser (GS31000)

Cyclone® Gas Cells (GS24102, GS24105, GS24110, GS24120)

Tornado® Gas Cells (GS24205, GS24210, GS24220)

Minidiff Plus (GS04510)

Microfocus Beam Condenser (GS02560, GS02561)

Variable Temperature Cell Holders (GS21525, GS21530)

Fixed Angle Specular Reflectance Accessory (GS19820)



Benchmark® Baseplate compatible:  
look for this symbol.



# Spectroscopist's Hints and Tips

The following hints and tips on infrared sampling may help you achieve better spectra with greater ease. Don't forget to contact your local Specac representative if you need any help with your application. Contact details are listed at the back of this catalogue.

## Sample preparation

For the preparation of halide disks, pestles, mortars and KBr powder should be stored in a dry environment such as the Specacabinet. The equipment should be used while still warm to minimize water contamination of the disk.

A good approximation for "first time right" halide disks is to choose a weight-to-weight ratio of 1% sample to 99% KBr. This approximation is good for most organic materials.

Don't take shortcuts by insufficient grinding of halide disk constituents. The target particle size is 0.025 mm, to coincide with the wavelength of light in the classical mid-infrared region.

Fold a sheet of paper in half to make a simple funnel for swift and easy transfer of the groundup halide disk constituents into the pellet dies.

Take the time to use a vacuum pump with evacuable pellet dies when producing halide disks. The resulting higher quality disks produce improved spectra.

If a finished halide disk absorbs too strongly, there is no need to start again completely.

Simply break off a small piece and regrind with additional KBr. When using diamond compression cells it is worth checking to see if the sample has preferentially adhered to just one of the windows.

If so, use the one window only for improved spectral quality. Always run background data for both one and two windows in anticipation of this.

When using liquid transmission cells in quantitative measurements it is useful to check the pathlength before and after an experiment. This is especially helpful with demountable cells.

Try using two syringes, one in each cell port, when filling and emptying liquid transmission cells. This helps to prevent air bubbles in the liquid film, and is especially useful when using very thin spacers.

Whilst doing a series of concentration solutions it is advisable to change the sample via the filling ports rather than dismantling the cell.

Concentration contamination effects are avoided in quantitative work by analyzing the sample set in increasing order of concentration.

Typical transmission pathlengths for organic solvent based solutions are as follows:

Analytical concentration	Typical pathlength
> 10 %	0.05 mm
10 % – 1 %	0.1 mm
1 % – 0.1 %	0.2 mm
< 0.1 %	> 0.5 mm

# Spectroscopist's Hints and Tips

## Reflection measurements

Two ways of reducing the ATR penetration depth into a strongly absorbing sample are choosing an ATR crystal with a higher refractive index (see the list of optical material properties at the back of this catalogue), and selecting a larger angle of incidence.

When analyzing powdered samples using ATR, pre-grinding the sample will improve the homogeneity of the sample particles, and yield better spectra.

Aerosol spray samples can be conveniently analyzed using the ATR technique. Spray the contents onto a flat or trough top-plate, in a fume cupboard, away from the spectrometer compartment.

Lacquers and coatings can be analyzed for specular reflectance in the following way. Wrap aluminium foil (shiny side out) around the reference mirror and apply the coating. Allow to dry and record spectra of the resulting film.

When using diffuse reflectance the sample heights are not always uniform. Each time the sample is changed it is desirable to reach the optimum height and peak energy as quickly as possible. A rolling micrometer on the Specac Minidiff Plus accessory adjusts the height in seconds, without using tools.

Level the surface of a sample for diffuse reflectance measurement by gently tamping down the surface, using a glass slide resting on the surface under its own weight. Do not press the surface hard, and risk compacting the sample. The surface can be seen through the glass slide.



# Spectroscopist's Hints and Tips

## Transmission measurements

Always wear gloves when handling all infrared windows to avoid contamination. This is good practice even for non-hygroscopic windows.

For accessories that are, or maybe, out of alignment, a small beam white light source is ideal for recreating the beam path. Once rough alignment has been recovered, use the energy level output on the spectrometer in order to fine tune the signal.

Test the identity of an unknown window or crystal by measuring the transmission characteristics in the spectrometer. Be aware that the cut-off values quoted in transmission characteristics tables are typically for short pathlengths of a few millimeters. Longer paths through ATR crystals will reduce the absorption cut-off back towards shorter wavelengths.

When using a temperature controlled accessory, always remember to set the temperature to 20°C after use. This will remove the risk of accidentally heating the accessory the next time it is switched on.

Always check the chemical compatibility of a window or crystal material by using scrap fragments. If in doubt, contact your local Specac representative for assistance.

When cleaning accessory optics it is advisable to remove the accessory from the spectrometer. If this is undesirable, be economical with the amount of solvent used, as large amounts of solvent vapour

can have an effect on subsequent spectra. It is also advisable to purge the accessory before use.

Choosing Fluorolube as a mulling agent allows the study of all CH stretching bands in an infrared spectrum using the mull technique. These are masked by paraffin absorptions when using Nujol.

The use of an O-ring on the plunger body of an evacuable pellet die prevents the plunger falling onto the newly pressed disk when removing the disk from the body of the die.

Fingerprints can be removed from mirrors by slowly dragging a methanol soaked lens tissue over the surface of the mirror. Use a stream of dry air to remove excess solvent.



# Notes

# Optical Materials for Spectroscopy

Window material	← Range →		Refractive Index at 2000cm <sup>-1</sup>	General Properties
	from	to		
MgF <sub>2</sub>	91,000	1,100	1.37	Almost insoluble in water. Hard material suited to relatively high pressure applications. Bi-refrangent and subject to thermal shock. Should not be used above 500°C.
LiF	83,000	1,400	1.33	Slightly water soluble. Hard, brittle material. Subject to thermal shock. Should not be used above 400°C.
CaF <sub>2</sub>	77,000	900	1.40	Insoluble in water, resists most acids and alkalis. Soluble in ammonium salts. Its high mechanical strength makes it particularly useful for high pressure work. Sensitive to mechanical and thermal shock. Does not fog.
BaF <sub>2</sub>	66,666	800	1.45	Insoluble in water, soluble in acids and NH <sub>4</sub> Cl. Very sensitive to mechanical and thermal shock. Good resistance to fluorine and fluorides. Does not fog.
NaCl	40,000	600	1.52	Soluble in water and glycerine. Slightly soluble in alcohols. Fair resistance to mechanical and thermal shock and can be easily polished.
AMTIR	11,000	725	2.50	Amorphous Material which Transmits Infrared Radiation. A chalcogenide glass which although relatively hard is brittle. Insoluble in water, resistant to acid but attacked by alkalis.
AgBr	22,000	300	2.30	Insoluble in water, soluble in acids and NH <sub>4</sub> Cl. Very sensitive to mechanical shock and is malleable. Will cold form. Good resistance to thermal shock. Corrosive to metals and alloys. Sensitive to strong UV radiation and will darken with long exposure.
KCl	33,000	400	1.40	Hygroscopic material similar to NaCl but with extended transmission range. Less soluble and lower reflection losses.
KBr	43,500	400	1.54	Hygroscopic material similar to NaCl. Soluble in water, glycerine and alcohols. Slightly soluble in ether. Fairly good resistance to mechanical and thermal shock.
KRS-5	17,000	250	2.38	This material is a mixture of Thallium Bromide and Thallium Iodide salts and is extremely toxic. Orange/red in colour. Slightly soluble in water, soluble in bases, but not soluble in acids. Not hygroscopic.
CsBr	42,000	250	1.66	Hygroscopic material. Soluble in water and acids. Soft, hence easily deformed.
CsI	42,000	200	1.74	Extremely hygroscopic material. Soluble in water and alcohols. Useful because of wide transmission range. Mildly toxic.
Silica SiO <sub>2</sub> UV Grade	59,000	3700	1.46	Resistant to acids and alkalis and unaffected by most solvents. Transmission at 50,000cm <sup>-1</sup> is 98% for UV grade and 40% for IR grade.
Silica SiO <sub>2</sub> IR Grade	40,000	3000	1.46	Resistant to acids and alkalis and unaffected by most solvents. Transmission at 50,000cm <sup>-1</sup> is 98% for UV grade and 40% for IR grade.
ZnS (Cleartran)	50,000	770	2.25	Insoluble in water, normal acids and bases and virtually all organic solvents. Reacts to strong oxidising agents. Good resistance to thermal and mechanical shock. Suitable for work in temperature range -200°C to 800°C.
ZnSe	20,000	500	2.43	Toxic, hard and brittle material. Amber/yellow in colour. Insoluble in water, but attacked by strong acids and bases (pH range 4 to 11 tolerant). Organic solvents have no effect. Ideal for ATR work.
Ge	5,000	550	4.01	Hard and very brittle material. Is temperature sensitive and loses transmission when heated. Optically opaque at 190°C. Insoluble in water. Soluble in hot sulphuric acid and aqua regia. Suitable for ATR work where high pressure contact is not required.
Diamond	40,000	10	2.40	Very hard and extremely chemically resistant. A diamond window is often chosen for high pressure applications. Excellent for ATR work.
Si	8,333	33	3.42	Very hard, but brittle and relatively inert material. Is attacked by a combination of HF and HNO <sub>3</sub> . Withstands thermal shock. Useful for Far IR. in the region 400-30cm <sup>-1</sup> .
Poly-ethylene	625	4	1.52	Inexpensive Far IR window material. Insoluble in water but tends to swell and be contaminated with some organic solvents. Melting point 110°C.

# A-Z of IR

## 100% Line

Ratio of two background spectra under identical conditions. Determines condition of spectrometer, or accessory, and quality of spectra. An ideal 100% Line would be a horizontal line at 100%.

## A

### Absorbance

The amount of Infrared radiation absorbed by a sample. It is proportional to concentration, and is defined by Beer's Law, so it can be used for Quantitative Analysis. Often the Y-axis unit in Infrared spectra, absorbance is related to transmittance by  $A = \log_{10} (1/T)$ , where A is the absorbance and T is the transmittance.

### Attenuated Total Reflectance (ATR)

A reflectance sampling technique, used in such accessories as the Golden Gate® and the Benchmark® 6 Reflection ATR System. A beam of Infrared radiation is passed through a prism of material which is Infrared transparent, and has a high refractive index, at least higher than the sample being analyzed. Due to internal reflectance, the light reflects off the surface of the crystal at least once, setting up an evanescent wave, which extends into the sample by typically a few microns. The sample must be held in intimate contact with the crystal.

## B

### Background Spectrum

A single beam spectrum produced without a sample in the Infrared beam. It is used to record the contributions that the instrument and the environment make to the measurement. The sample spectrum can be ratioed against the background spectrum to remove these contributions.

### Baseline correction

The manipulation of a spectrum to correct a sloped or curving baseline. The spectroscopist draws a function parallel to the baseline which is then subtracted from the spectrum.

### Beamsplitter

An optical device which reflects half the radiation striking it, and transmits half.

## Benchmark® system

Specac's universal compatibility baseplate system, adapting Specac accessories to all spectrometer models. Also Specac's 6 Reflection ATR System, capable of analyzing almost any sample.

## C

### Calibration

In Quantitative Analysis, the correlation of peak heights and areas in a spectrum with the concentrations of standard analytes. After calibration, unknown analyte concentrations can be calculated.

### Calibration curve

An Absorbance vs. Concentration plot used in calibration. If the sample obeys Beer's Law, the plot will be linear and unknown concentrations can be calculated.

### Condenser

The optical element that condenses light on a sample.

### Critical Angle

Defined as being:  $c = \arcsin (n_1/n_2)$  where 'c' is the critical angle for an interface between two specific media,  $n_1$  and  $n_2$  are the refractive indices of the two media and  $n_2$  has the higher refractive index; the critical angle is the smallest angle of incidence at which total internal reflection occurs.

## D

### Depth of Penetration

When a sample is analyzed using ATR, the depth of penetration is the depth at which the evanescent wave has decreased to  $1/e$  (or 36.788%) of its original value after penetrating the sample. The depth of penetration is dependent on many factors, including the angle of incidence, the refractive index of the ATR crystal, and the wavelength of the Infrared radiation.



# A-Z of IR

## Diffraction

The bending of light around the edge of an opaque body, or through a narrow slit, resulting in a series of alternately high and low intensities in the shadow of the obstacle.

## Diffuse reflection

The random reflection resulting when a beam of light reflects off a rough, matt surface e.g. powder or fibre.

## Dispersive Instruments

Infrared spectrometers that use a grating or prism to disperse Infrared radiation into its component wavelengths before detecting them. This type of instrument is less widespread since the arrival of FT-IR spectrometers.

## DRIFTS (Diffuse Reflectance Infrared Fourier Transform Spectroscopy)

A reflection sampling technique making use of the phenomenon of diffuse reflectance.

## E

### Evanescent wave

A standing wave of radiation set up in an ATR crystal at the interface with the sample. The wave penetrates into the sample and an Infrared spectrum can be obtained.

## F

### Far IR

Infrared radiation between 400 and 10 cm<sup>-1</sup>.

### Fluorolube

Polymer of trifluorovinyl chloride (-CF<sub>2</sub>-CFCl-)x used for the preparation of mulls. Unlike Nujol, it doesn't mask CH stretch bands.

## Fourier Transform

The integration performed upon an interferogram to produce an Infrared spectrum.

## Fourier Transform Infrared (FT-IR) Spectrometer

The instrument used for FT-IR spectroscopy.

## FT-IR Spectroscopy

A method of obtaining an Infrared spectrum by measuring the interferogram of a sample using an

interferometer, then performing a Fourier Transform upon the interferogram to obtain the spectrum.

## G

### Germanium

Element, atomic number 32, atomic weight 72.6: a gray-white metallic semiconductor. Its high refractive index (4.01) makes it an important material for ATR crystals, used to analyze highly absorbing samples.

### Golden Gate®

Specac's world-famous single reflection ATR accessory, analyzing almost all sample types: hard solids, to powders, to corrosive liquids, to fibres. The Golden Gate® is the world's most versatile sampling system. The standard Diamond Golden Gate® uses a type IIa diamond as the ATR element for unparalleled optical sensitivity, while diamond's unique physical strength makes it ideal for excellent contact with the hardest of solids. Its tremendous chemical stability allows it to withstand corrosive liquids.

Other Golden Gate® versions available, to accommodate various types of sample, include a Germanium Golden Gate®, whose high refractive index is useful for highly absorbing samples, and a heatable version for high temperature analysis.

### Grazing angle reflection

An optical phenomenon occurring when the incident Infrared radiation strikes a sample, deposited on a reflective material, at an angle of around 80° to the normal. Useful for the analysis of thin coatings, e.g. paints on metallic surfaces.

## I

### Index of refraction

A property of a material describing the behaviour of electromagnetic radiation when travelling through it (not all EM radiation can travel through all materials). It is defined as being the ratio of the speed of light in a vacuum to the speed of light in the material concerned. Also called refractive index.

# A-Z of IR

## Infrared (IR) radiation

The region of the electromagnetic spectrum from 14,000 to  $10\text{cm}^{-1}$ .

## Infrared Spectroscopy

The study of the characteristic Infrared spectra of matter.

## Infrared spectrum

A plot of Intensity of Infrared radiation vs. Wavenumber. A spectrum can be interpreted to determine the molecular structure of the sample from which it has been obtained, because different functional groups in a molecule will each produce a unique feature, or fingerprint, in the spectrum.

## Interferogram

A plot of Infrared detector response vs. Optical path difference. This is what an FT-IR spectrometer measures, to be Fourier Transformed to obtain a spectrum.

## Interferometer

An optical device causing two beams of light to travel different distances to produce an optical path difference. This allows constructive and destructive interference to occur, and changing the optical path difference allows measurement of an interferogram.

## Internal reflection

The effect where electromagnetic radiation passing through a material reflects off the surface of the material at the interface with another medium, which has a lower refractive index, instead of leaving the material to enter the new medium. If the angle of incidence is larger than the critical angle, then none of the light will be transmitted to the new medium, it will all be reflected. This phenomenon is called total internal reflection.

## K

### KBr pellet

A pellet produced for use in transmission analysis. This technique is used for powders and other solids. The sample is ground, then "diluted" with KBr powder, before being pressed into a pellet. The pellet is then mounted on a Specacard before being placed directly in the Infrared beam for analysis.

## Kramers-Kronig Transform

A mathematical calculation performed upon specular reflectance spectra to eliminate the effect of variations in the refractive index of the sample. It results in a  $k$ -spectrum and an  $n$ -spectrum, which are the true absorbance spectrum and a plot of Refractive index vs. Wavenumber respectively.

## KRS-5

Trade name for thallium iodide bromide, a common ATR crystal material (Refractive index 2.38) with Near IR and Mid IR transmission characteristics.

## Kubelka-Munk units

Unit of intensity of diffuse reflected light. The Kubelka-Munk equation relates this intensity to the concentration and scattering factor of a sample. The scattering factor is determined by the particle size, shape and packing density, but can be difficult to quantify.

## M

### Micrometer

A gauge for accurately measuring small distances, thicknesses etc.

### Mid IR

Infrared radiation between 4,000 and  $400\text{cm}^{-1}$ .

## Mull

A Transmission sampling technique. A solid sample is ground, then dispersed in a mulling agent (e.g. Nujol). The mull mixture is then sandwiched between two windows (e.g. KBr) in an Omni-Cell® body before being placed directly in the Infrared beam.

## Mulling agent

(Usually) an oil added to a ground sample in the preparation of a mull.

## N

### Near IR

Infrared radiation between 14,000 and  $4,000\text{cm}^{-1}$ .

### Nujol

A liquid paraffin used for the preparation of mulls. Nujol is not always the best mulling agent as it masks any CH stretch bands that would otherwise be seen in the sample spectrum.

# A-Z of IR

## Omni-Cell®

With over 400 window and pathlength combinations available as standard, to cater for every sample and wavelength of interest, Specac's Omni-Cell® is the simple stand most versatile Infrared transmission cell system available anywhere. The Omni-Cell® can be configured as a sealed liquid cell, a demountable liquid cell, or a mull cell. Easily assembled, or disassembled, in a few seconds, it is designed for fast sample turn-around. With a known pathlength, the spectrum from an Omni-Cell® is suitable for Quantitative Analysis.

## P

### Peak-to-Peak Noise

A noise measurement often made on a 100% Line to determine spectrum quality and instrument performance when obtained under controlled conditions. It is measured as the difference between the lowest and highest transmittance value in a specific wavenumber range.

### Polarizer

A device for converting light into polarized light. Typically, polarizers are a ZnSe substrate with thin parallel gold wires on the surface to form a grid.

### Polymer film

A thin film, of precise thickness, pressed at an elevated temperature using a Specac Constant Thickness Film Maker Kit. The film can then be mounted in a magnetic film holder before being placed directly in the Infrared beam for transmission analysis.

## Q

### Quantitative Analysis

Calculation of sample concentration using measurements from a spectrum, such as band ratios and peak areas and heights. This technique requires a calibration before unknown concentrations can be determined.

## R

### Raman effect

When monochromatic light is scattered by molecules, a small fraction of the scattered light is observed to have a different frequency from that of

the incident beam; this is the Raman effect. Raman spectroscopy can reveal vibrations that may be inactive under Infrared analysis, and therefore can provide complementary information about the molecular structure of the sample under examination. The Specac Variable Temperature Cell holder is suitable for the Raman Technique

### Reflection Absorption

Also known as "Double-transmission", reflection absorption is a sampling technique used on thin coatings on metal. The Infrared beam passes through the coating again after reflecting off the metal surface, before reaching the detector.

### Refractive Index

See Index of Refraction.

### Resolution

Measure of the ability of a spectrometer to distinguish features of a spectrum which are very close together.

## S

### Scan

The measuring of an interferogram in FT-IR. Usually involves cycling the mirror in the interferometer once.

### Sealed Liquid Cells

Basic accessories used to obtain transmission spectra of liquids. Consists of two IR transparent windows (e.g. NaCl), held apart by a spacer, filled with the liquid under consideration. The cell is then put directly into the beam. Specac's advanced Omni-Cell® system can be configured for use as a sealed liquid cell, with 9 options for windows and 6 options for pathlength to give 54 standard combinations.

### The Selector®

Specac's versatile diffuse reflectance accessory, featuring unique off-axis optics to fully minimize unwanted specular reflectance, offers rapid FT-IR analysis of solids with minimal sample preparation. The Selector® can include an Environmental Chamber, for extreme temperature and pressure analyses.

# A-Z of IR

## Signal-to-Noise Ratio (SNR)

To determine the quality of a spectrum, or spectrometer, the SNR is the ratio of the signal, or intensity, of the spectrum to the noise at a nearby point on the baseline.

## Silicon

Element, atomic number 14, atomic weight 28.09, grayish metallic semiconductor. A very hard, inert crystal with a refractive index of 3.42, Silicon is very useful for Far IR in the range 400 to 30cm<sup>-1</sup>.

## Single Beam Spectrum

The spectrum obtained after Fourier Transforming an interferogram. The single beam spectrum is a combination of the spectra of the sample (if applicable), the instrument and the environment.

## Specac Gas Cell

Specac's advanced transmission gas analysis cell is a new concept in gas cell specification. With an extensive array of standard features on the base unit, personalized modifications can be made from a range of precision engineered options. A range of pathlength options allows analysis at low pressures to be performed in the longer cells, and pathlengths can be verified with a laser alignment accessory.

## Specacard®

Mount for the transmission analysis, and storage, of KBr pellets. Specacards can also be used, with a magnetic film holder, for polymer films.

## Specular Reflectance

The reflectance occurring when a beam of light strikes a smooth, shiny surface, e.g. a mirror, such that the angle of incidence equals the angle of reflection. Specular reflectance can be used to obtain Infrared spectra.

## T

## Transmission

A physical phenomenon where radiation passes through a body. When producing a transmission spectrum a proportion of the energy is absorbed by the sample, while the remainder travels on to the detector.

## Transmission Sampling

The method of sampling whereby the Infrared beam passes directly through the sample before being detected, used in such accessories as the Variable Temperature Cell holder, the Omni-Cell® and the Long Pathlength Series Gas Cell. An appropriate pathlength must be selected so as to avoid total absorption of the Infrared.

## Transmittance

Unit of measurement of the amount of radiation transmitted by a sample. It is often the Y-axis of Infrared spectra. Transmittance is not linearly proportional to the concentration of the sample, therefore spectra plotted with these units cannot be used for Quantitative Analysis.

## V

## Variable Temperature Cell holder

Specac's most advanced accessory for the transmission analysis of liquids and solids at temperatures from -190°C to 250°C. Choice of window material allows this accessory to be used in UV, Visible and Infrared regions. This accessory can also be used for Fluorescence and the Raman Technique.

## W

## Wavelength

One wavelength is the distance between two identical points on two adjacent identical waves in a beam.

## Wavenumber

Wavenumber is defined as the reciprocal of the wavelength expressed in cm. Units are cm<sup>-1</sup>. Wave numbers are normally the units along the X-axis in Infrared spectra.

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