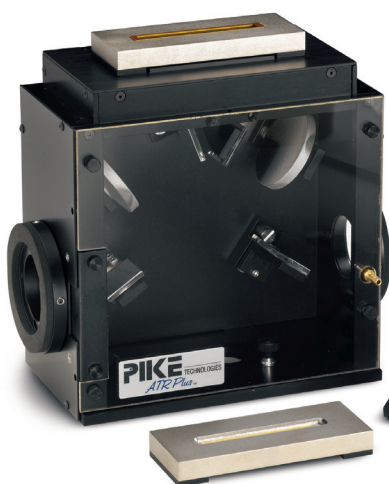


## Multiple Reflection HATR – Maximum Sensitivity and Highly Versatile FTIR Sampling

HATR Accessory –  
in-compartment  
HATR for liquid  
and solid  
samples



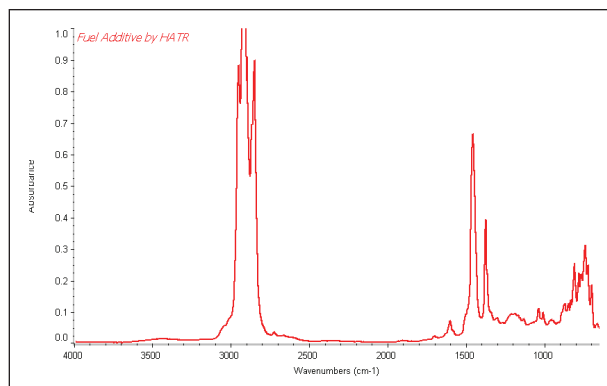
HATRPlus™ Accessory –  
out-of-compartment  
HATR for liquid  
and extra large  
solid samples

Horizontal Attenuated Total Reflectance (HATR) accessories successfully replace constant path transmission cells, salt plates and KBr pellets used in the analysis of liquid, semi-liquid materials and a number of solids. HATRs feature a constant and reproducible effective pathlength and are well suited for both qualitative and quantitative applications. In general, sampling is achieved by placing the sample onto the HATR crystal – generally eliminating sample preparation.

PIKE Technologies HATR products are available in 2 base optic configurations. The HATR is an **in-compartment** design for samples which fit into the FTIR sample compartment.

The PIKE Technologies HATRPlus is an **out-of-compartment** design for samples which are larger and do not fit into the FTIR sample compartment. The sampling surface of the HATRPlus extends above the FTIR cover, thereby permitting analysis of very large samples. Applications examples include coatings on large manufactured components, layered composition analysis on large objects, and skin analysis in the health care industry.

The PIKE Technologies HATRs are high performance accessories, carefully designed to provide excellent results with minimum effort. The accessories are easily installed in the sample compartment, locking into position on the sample compartment baseplate.



FTIR spectrum of fuel additive using HATR trough plate with ZnSe crystal

### FEATURES OF THE HATR

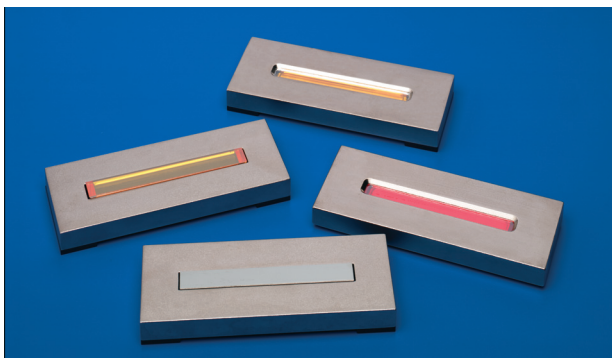
- Excellent energy throughput offering high signal-to-noise ratio and spectral quality
- Up to 20 internal reflections for maximum sensitivity for low concentration components
- Removable crystal plates with pinned positioning for high precision and quick cleanup
- HATR plates with ZnSe, KRS-5, Ge, AMTIR or Si crystals with selectable face angles to optimize sampling depth
- In-compartment (HATR) and out-of-compartment (HATRPlus) versions for small and extra large sample sizes
- Several temperature controlled and flow-through crystal plate options

Stable alignment provides excellent analytical precision. Crystal plate changeover is rapid, allowing a wide range of samples to be analyzed with maximum convenience. PIKE Technologies HATRs have been optimized for maximum optical throughput and excellent quality spectra can be obtained from demanding samples. Several high quality crystal materials covering a full spectrum of applications are available. Trough crystal plates are sealed using metallic gaskets, eliminating premature failure and the risk of cross-contamination associated with inferior, epoxy-bonded systems. Flat crystal plates are designed with positive surface relief to aid in improved sample contact.

All PIKE HATRs include a purge tube interface for the FTIR spectrometer. This provides full integration of the accessory with the FTIR spectrometer's purging system (sealed and desiccated or purged) and removal of water and carbon dioxide artifacts from the FTIR spectra. Thanks to this, purging is very efficient and the spectrometer can be operated with the sample compartment door open.

## HATR Crystal Plate Choices

PIKE Technologies HATR crystal plates are available in trough and flat plate configurations.



PIKE Technologies Crystal Plate Choices – for the HATR and HATRPlus

The **trough plate** is designed for easy sampling, with a large, recessed crystal to accommodate the sample – generally a liquid, powder, or paste. The trough plate is ideal when samples must be cleaned from the crystal with some type of aqueous or organic solvent.



Trough plate HATR crystal plate – ideal for liquids, powders, pastes and gels

Typically, only a thin layer of the sample needs to be applied onto the crystal surface. For fast evaporating samples, a volatiles cover should be used to cover the sampling area.

Soft powders will often produce good spectra when analyzed by HATR, assuming that they can be put in intimate contact with the crystal. A powder press option is used to achieve this. This device is placed directly on top of the sample filled trough and pressed by hand until the desired result is obtained.

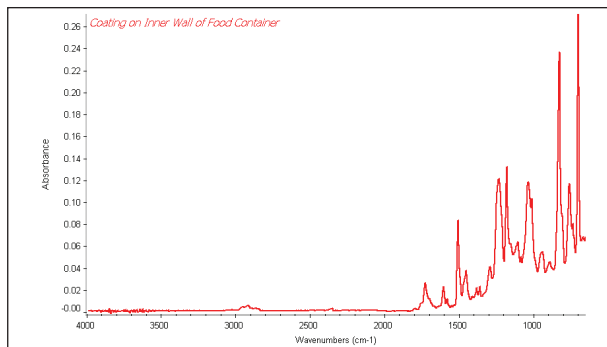


Flat plate HATR crystal plate – ideal for solids, polymer films and coatings

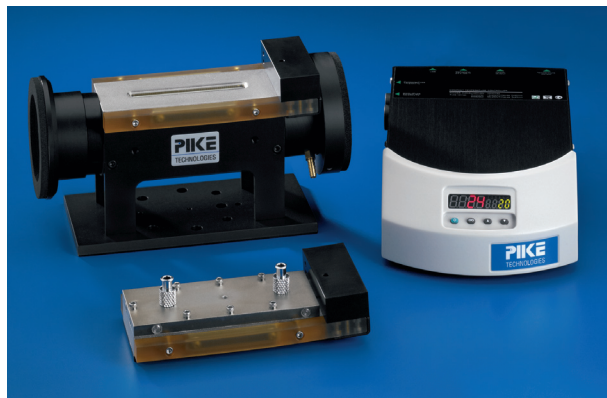
The **flat plate** is used for the analysis of solid materials – including polymer and film samples. It is ideal for solid samples which are too large to fit within the trough plate configuration.

The crystal is mounted slightly above the surface of the metal plate, which helps to achieve good crystal/sample contact when the flat plate press is used (the press attaches easily to the back of the HATR with two thumb screws).

The ZnSe 45° flat plate is available in a sealed version, which is ideal for sampling of oils and other types of low surface tension liquids.



FTIR spectrum of coating on inner wall of food container by HATR with ZnSe flat plate and pressure clamp



HATR with Heated Trough Plate – foreground shows Heated Flow-Through Cell

All resistively heated HATR plates are controlled by PIKE temperature controllers in digital or digital PC versions. The selection of the digital PC version includes PIKE TempPRO software, which provides a graphical user interface for temperature control and kinetic measurements.



PIKE TempPRO Software for Kinetic Experiments with our Resistively Heated Crystal Plates

A large number of temperature-controlled and flow-through sampling plates are available for PIKE Technologies HATRs – all are pin-mounted to the HATR with no alignment required.

All temperature controlled and flow-through crystal plate options are compatible and interchangeable with HATR and HATRPlus products. PIKE Technologies temperature controllers provide static or ramped temperature control.



HATR with Liquid Jacketed Flow Cell (background). Liquid Jacketed trough plate is shown in foreground.

All PIKE HATR flow cells have removable HATR crystals. The upper and lower part of the crystal plate is removed, and the crystal can be easily taken out of the plate. This feature enables replacement of the crystals and facilitates special cleaning for proteins and other “sticky” samples.



RCPlate for HATR

For special applications where you need to look at coatings on an HATR crystal, PIKE Technologies offers the RCPlate™ option. The new RCPlate is designed to enable easy removal and reinsertion of the HATR crystal. Applications include analysis of coatings, mono-molecular layers, or bio-films deposited directly upon the HATR crystal. With these new RCPlates, it is easy to collect the background spectrum on the clean crystal, remove the HATR crystal from the RCPlate, coat the crystal and then reposition it into the RCPlate to collect the sample spectrum.

### Summary

The PIKE Technologies HATR accessory provides high sensitivity for analysis of low concentration components in liquid, solid, and polymer samples. The highly flexible accessory is available for in-compartment and out-of-compartment configurations with complete selection of crystal material, sample format, and temperature and flow-through configurations.

Do you need an HATR product or feature not shown here in our catalog? Please contact us to discuss your application.

## ORDERING INFORMATION

### Complete HATR Systems

**Bundled HATR Systems** (must select, insert spectrometer model for XX)

PART NUMBER	DESCRIPTION
022-10XX	HATR Trough Plate System with 45° ZnSe Crystal <i>Includes: Trough Plate, Volatiles Cover and Powder Press</i>
022-11XX	HATR Flat Plate System with 45° ZnSe Crystal <i>Includes: Flat Plate and HATR Pressure Clamp</i>
022-12XX	HATR Combined Trough and Flat Plate System with 45° ZnSe Crystals <i>Includes: Trough Plate, Flat Plate, Volatiles Cover, Powder Press and Sample Clamp</i>
024-11XX	HATRPlus Flat Plate System with 45° ZnSe Crystal <i>Includes: Flat Plate and HATR Pressure Clamp</i>

*Notes: HATR and HATRPlus Systems may be purchased with crystal plates other than ZnSe. Just add – Ge for germanium, – KR for KRS-5, –AM for AMTIR, or –Si for Silicon. Additional plates can be added to an order for any system above. Other configurations may be selected from the options below. Please see the FTIR instrument code sheet.*

### Configurable HATR Systems

**HATR Base Optics** (insert spectrometer model for XX)

PART NUMBER	DESCRIPTION
022-19XX	HATR Platform Optics Assembly
024-19XX	HATRPlus Platform Optics Assembly

*Notes: HATR and HATRPlus Platform Optics Assemblies include volatiles cover, powder press, purge tubes, purge kit and spectrometer base mount. Please see the FTIR instrument code sheet.*

**HATR and HATRPlus Crystal Plates** (must select 1 or more)

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

*Notes: HATR Crystal Plates are pre-aligned and pinned-in-place. Changing crystal plates is easy and fast to optimize sampling results. For all HATR crystal plates, 30 and 60 degree face angles are also available. Due to critical angle ZnSe, KRS-5 and AMTIR are not available in 30 degree face angle. Where not noted, crystals are 4 mm thick and generate 10 internal reflections. 2 mm crystals generate 20 reflections (45° cut). If you need a crystal not listed here, please contact us.*

## ORDERING INFORMATION

### HATR and HATRPlus Pressure Clamp

(must select for solids, films or powder analysis)

PART NUMBER	DESCRIPTION
022-3050	HATR (pivoting) Pressure Clamp
022-3054	HATR High-Pressure Clamp
024-3050	HATRPlus (pivoting) Pressure Clamp
024-3053	HATRPlus High-Pressure Clamp

Notes: The pressure clamp is required for solids, films, coatings and powdered samples.

### HATR and HATRPlus Flow Cells

PART NUMBER	DESCRIPTION
022-4010	HATR Flow Cell, ZnSe, 45°
022-4020	HATR Flow Cell, AMTIR, 45°
022-4030	HATR Flow Cell, KRS-5, 45°
022-4040	HATR Flow Cell, Si, 45°
022-4050	HATR Flow Cell, Ge, 45°

Notes: HATR flow cells include Luer-Loc fittings for easy connection with a syringe. A set of 1/16" Swageloc fittings are included with each flow cell for connection with 1/16" tubing. Flow cell volume is 500 µl.

### HATR and HATRPlus Liquid Jacketed Crystal Plates

PART NUMBER	DESCRIPTION
022-5310	HATR Liquid Jacketed Trough Plate, ZnSe, 45°
022-5320	HATR Liquid Jacketed Trough Plate, AMTIR, 45°
022-5330	HATR Liquid Jacketed Trough Plate, KRS-5, 45°
022-5340	HATR Liquid Jacketed Trough Plate, Si, 45°
022-5350	HATR Liquid Jacketed Trough Plate, Ge, 45°

Notes: Liquid jacketed crystal plates require customer provided circulating water bath. Liquid jacketed crystal plates enable heating to 130 °C and cooling.

### HATR and HATRPlus Heated Crystal Plates

P/N FOR SINGLE RTD	DESCRIPTION
022-5110	HATR Heated Trough Plate, ZnSe, 45°
022-5120	HATR Heated Trough Plate, AMTIR, 45°
022-5130	HATR Heated Trough Plate, KRS-5, 45°
022-5140	HATR Heated Trough Plate, Si, 45°
022-5150	HATR Heated Trough Plate, Ge, 45°

PART NUMBER	DESCRIPTION
022-5210	HATR Heated Flow-Through Cell, ZnSe, 45°
022-5220	HATR Heated Flow-Through Cell, AMTIR, 45°
022-5230	HATR Heated Flow-Through Cell, KRS-5, 45°
022-5240	HATR Heated Flow-Through Cell, Si, 45°
022-5250	HATR Heated Flow-Through Cell, Ge, 45°

PART NUMBER	DESCRIPTION
076-1420	Digital Temperature Control Module, PC Control
076-1220	Digital Temperature Control Module

Notes: Temperature is adjustable to 130 °C for heated trough and flow-thru plates. Resistance heated plates require selection of a PIKE Technologies Temperature Controller. PC Control Module includes PIKE Technologies TempPRO software.

### RESISTIVELY HEATED HATR PLATES SPECIFICATIONS

Temperature Range	Ambient to 130 °C
Accuracy	+/- 0.5%
Sensor Type	3 wire Pt RTD (low drift, high stability)
Controllers	
Digital	+/- 0.5% of set point
Digital PC	+/- 0.5% of set point, graphical setup, up to 10 ramps, USB interface
Input Voltage	90–264 V, auto setting, external power supply
Output Voltage	24 VDC/50 W max.

### HATR and HATRPlus Liquid Jacketed, Flow-Through Crystal Plates

PART NUMBER	DESCRIPTION
022-5410	HATR Liquid Jacketed Flow-Through Plate, ZnSe, 45°
022-5420	HATR Liquid Jacketed Flow-Through Plate, AMTIR, 45°
022-5430	HATR Liquid Jacketed Flow-Through Plate, KRS-5, 45°
022-5440	HATR Liquid Jacketed Flow-Through Plate, Si, 45°
022-5450	HATR Liquid Jacketed Flow-Through Plate, Ge, 45°

Notes: Liquid jacketed flow-through crystal plates require customer provided circulating water bath. Liquid jacketed flow-through crystal plates enable heating to 130 °C and cooling. HATR flow cells include Luer-Loc fittings for easy connection with a syringe. A set of 1/16" Swageloc fittings are included with each flow cell for connection with 1/16" tubing.

### HATR RCPlate

PART NUMBER	DESCRIPTION
022-2300	RCPlate for HATR (for 45° crystals)

Notes: Requires a selection of HATR Crystal – see below.

### HATR and HATRPlus Replacement Parts

PART NUMBER	DESCRIPTION
022-3051	HATR Volatiles Cover
022-3052	HATR Powder Press
022-3110	Crystal, 45°, Trap, 80 x 10 x 4 mm ZnSe
022-3111	Crystal, 45°, Trap, 80 x 10 x 4 mm KRS-5
022-3112	Crystal, 45°, Trap, 80 x 10 x 4 mm Ge
022-3113	Crystal, 45°, Trap, 80 x 10 x 4 mm AMTIR
022-3114	Crystal, 45°, Trap, 80 x 10 x 4 mm Si
022-3130	Crystal, 60°, Trap, 80 x 10 x 4 mm ZnSe
022-3132	Crystal, 60°, Trap, 80 x 10 x 4 mm Ge
022-3040	Viton O-Ring, HATR Flow Cell, Upper (6 ea.)
022-3045	Viton O-Ring, HATR Flow Cell, Lower (6 ea.)
022-3042	HATR Flow Cell Upper Teflon O-Ring
022-3047	HATR Flow Cell Lower Teflon O-Ring

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