

# FTIR Spectroscopy

Fourier Transform Infrared Spectrometers, Microscopes and Accessories



**Jasco**

Performance  
Innovation  
Reliability



JASCO designs and manufactures a comprehensive range of FTIR products at its research headquarters in Tokyo, Japan. With a commitment to advanced optical instrument design spanning more than five decades, culminating in the latest FT/IR-4000 and 6000 Series of FTIR spectrometers. JASCO is proud to offer unrivaled, class-leading performance in FTIR spectroscopy, using the best in materials and electronics technology available today.

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# Instrument Features

Redefine this powerful and easy-to-use technique with the JASCO FT/IR-4000 and 6000 series. Each compact model offers reliable operation with industry-leading sensitivity and the most advanced technology available today.

## Stable Interferometer

High-quality FTIR measurements start with the precision and stability of the interferometer. That is why the FT/IR-4000 and 6000 spectrometers utilize a Michelson interferometer with corner-cube mirrors for permanent alignment to prevent light-path deviation, eliminating the need for dynamic alignment. The optical bench's vibration-proof mounting prevents interference from sources of vibration.

## IQ Accessory/Quick Start and Smart Purge

IQ Accessory and IQ Start intelligently links sampling accessories (see more on page 18) mounted in the sample compartment to a measurement program and automatically selects the optimum measurement parameters. In addition, efficient nitrogen purge (Smart Purge) of the accessory can be performed by direct connection to the instrument's standard purge system.

## AccuTrac™ DSP Control

FT/IR-4000 and 6000 Series spectrometers control the interferometer drive using the latest Digital Signal Processing (DSP) technology. Compared to analog control of the moving mirror, DSP system shortens the time interval for speed control. This mechanism provides precise moving mirror control, and enhances the constant-speed performance of the mirror drive.

## Spectra Manager™ Control and Analysis

Spectra Manager™, the comprehensive laboratory companion software, captures and processes data from the wide portfolio of JASCO instruments, reducing the overheads for user-training. Display and process data from infrared, Raman, UV-visible and fluorescence experiments together in one easy to learn analysis package. *Find out more on page 14.*

## Excellent Signal-to-Noise Ratio

Both the FT/IR-4000 and 6000 Series achieve exceptional signal-to-noise ratios using DSP control and a 24-bit A/D converter. The 4000 series, for routine analysis, achieves a consistent S/N greater than 25,000:1 and provides fast high-quality data. The FT/IR 6000 Series starts with an S/N greater than 45,000:1 (FT/IR-6800 - 55,000:1).

## KnowItAll™ Informatics

KnowItAll™ Informatics JASCO Edition, includes a suite of comprehensive spectroscopic analysis functions such as a spectral search program (SearchIt, more than 230,000 spectra), a spectral interpretation program (Analyzelt with functional group analysis), and user-customized report templates.

## QC Compare

For simple QA/QC analysis, build-your-own spectral library of your known standard reference materials. QC Compare can quickly correlate incoming or outgoing materials against the standard reference database and provide a statistical comparison to confirm a batch of material.

## Moisture Protection

The sealed interferometer housing has optimal thermal stability, thanks to a power management system which maintains the ceramic light source (CLS) at a constant low-level power when the instrument is not in use. This results in an increase in the lifetime of optical components by keeping the interferometer free from moisture. The high stability power supply also ensures a long lifetime for the CLS.

## High Sensitivity Detectors

All models include an exceptionally sensitive, highly stable DLaTGS detector. The detector's performance is enhanced by a temperature-controlled TGS element, which uses Peltier effect thermoelectric cooling. The FT/IR-6000 Series spectrometers can also be used with a variety of detectors from the visible to the far-IR/THz spectral regions.

## GxP/FDA 21 CFR Part 11 Compliant

For GxP-regulated industries, instrument validation is included to verify instrument performance compliant with ASTM, EP and JP protocols. A CFR-compliant version of Spectra Manager provides software security and control compliant to FDA 21 CFR Part 11 guidelines. *Learn more on page 14.*



## Start Button

Initiate measurement from the simple press of the instrument's start button without needing to interact with the PC keyboard; this is especially useful for routine measurements. The Start button is combined with the Quick Start sequence function for effortless routine measurement, data analysis and reporting.

## Removal of Interferences from CO<sub>2</sub> and H<sub>2</sub>O

The FT/IR Series includes several methods to remove or minimize the effects of environmental CO<sub>2</sub> and H<sub>2</sub>O such as N<sub>2</sub> purge or vacuum. However, Spectra Manager includes an option for CO<sub>2</sub> and H<sub>2</sub>O removal which includes preloaded spectra of pure standards that can be used for the automatic subtraction of CO<sub>2</sub> and H<sub>2</sub>O. This allows the evaluation of both the raw spectrum and the spectrum with CO<sub>2</sub> and H<sub>2</sub>O removed for more comprehensive data evaluation.

## Wavelength Range

The FT/IR-4000 Series can be configured as dedicated mid-, near- and far-IR models. The FT/IR-6000 Series spectrometer can be configured for any spectral region within the measurement range 25,000 cm<sup>-1</sup> to less than 10 cm<sup>-1</sup>. Automatic beam splitter and window exchange allow uninterrupted measurement across the entire spectral range.



# FT/IR-4600/4700 Spectrometers

## Obtain high-quality, reproducible data — simply.

The 45 degree Michelson interferometer with corner-cube mirrors used in the FT/IR-4000 series provides class-leading performance normally found in research-grade spectrometers. Designed principally for use in the mid-IR region it can also be used for dedicated near- and far-IR applications. The rigid cast-aluminum construction, coupled with advanced optical and electrical components, provide performance and durability. The high-throughput ATR PRO ONE with monolithic diamond can be used for many sampling applications. The FT/IR-4000 Series also has many options for other measurements, from simple transmission and gas analysis to diffuse and specular reflectance. The FT/IR-4000 is well suited to QA/QC, teaching and simple research. With  $0.4\text{cm}^{-1}$  resolution the FT/IR-4700 can be used for higher resolution gas analysis.



### Features

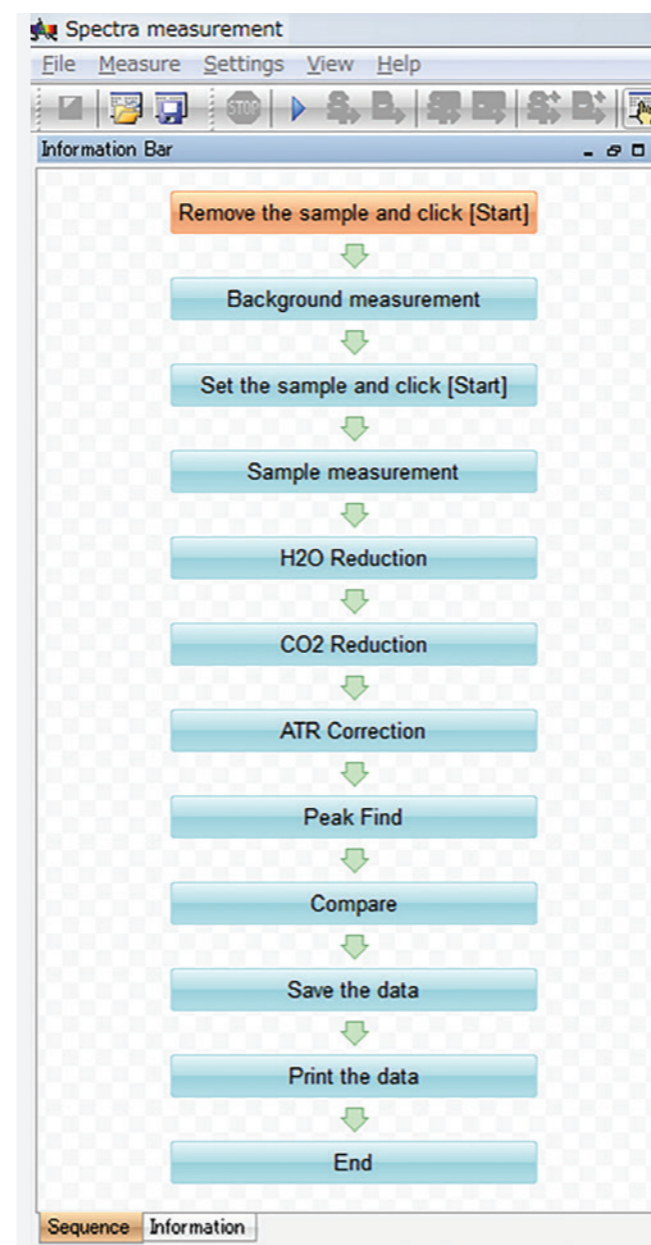
- Excellent signal-to-noise ratio
- Large sample compartment
- One-click auto-alignment optics
- Long lifetime ceramic source
- High sensitivity thermally stabilized DLaTGS detector
- Automatic validation (standard)
- IQ accessory recognition
- Configurable for near- and far-IR applications
- Optional high sensitivity MCT and InGaAs detectors
- Expandable system for FTIR microscopy
- Rapid scan for kinetics measurement

### Interferometer

A 45 degree Michelson interferometer with corner-cube mirrors is used for permanent alignment. The HeNe laser is placed off axis from the IR beam to maximize the usable area through the beam-splitter.

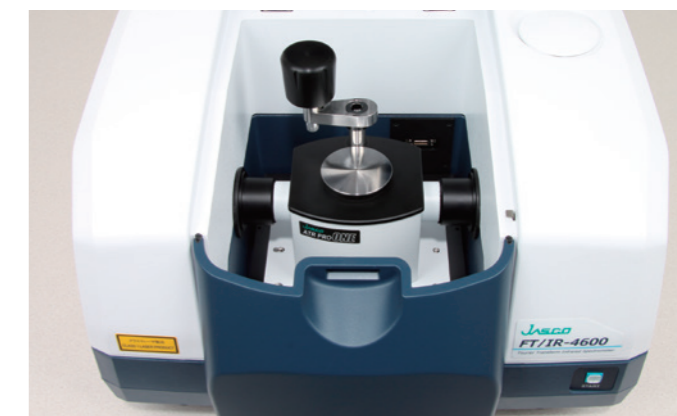
### IQ Accessory™

When an accessory with an IQ Accessory™ identification chip is fitted in the sample compartment, the measurement program automatically loads the information (model name, serial number, etc.) and automatically selects optimal measurement parameters. This accessory data is also recorded in the measured spectrum.



### Quick Start™

Quick Start is used to automate measurements for fast high quality data acquisition and analysis. The process can be edited to guide the user through routine functions including: correction, QC Compare, quantitation, analysis and reporting.



### ATR Measurement

The monolithic diamond prism used in the ATR PRO ONE and ATR PRO ONE VIEW does not require a condensing lens or transfer optics and offers a wide spectral range. The prism also has an anti-reflective coating to improve energy throughout the spectral range. Crystal options include a wider spectral-range diamond, Ge and ZnSe, which can be easily exchanged on the base unit without the need for alignment.

In addition, the prism plate can be replaced with an optional acid/base resistant Hastelloy type.



### Automatic Validation

The validation program is combined with the automatic validation function to provide comprehensive automatic validation using polystyrene film and Schott glass standards.



# FT/IR-6600/6700/6800 Spectrometers



The FT/IR-6000 Series of research-grade spectrometers offers a highly configurable optical system applicable to virtually any FTIR application, from simple mid-IR measurement to more complex analysis in the farthest reaches of the electromagnetic spectrum. With three levels of optical configurations, research-based measurements are easily performed on the FT/IR-6000 Series with options such as full-vacuum, gold-coated optics, rapid & step-scan and FT-Raman for more advanced experiments.

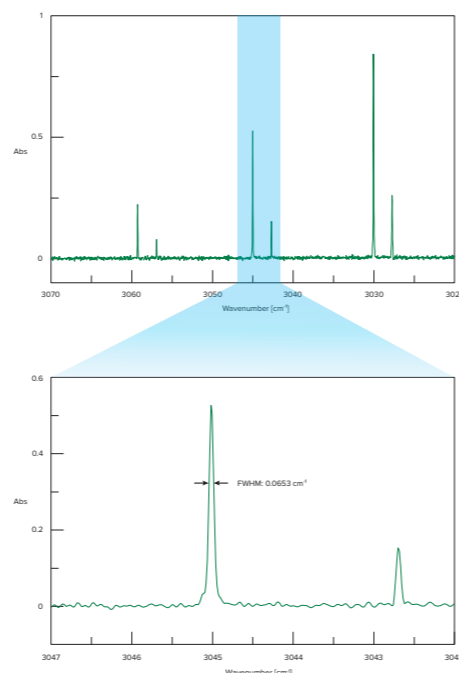
Exchangeable elements combined with full automation can be used for spectral measurement from 25,000  $\text{cm}^{-1}$  to less than 10  $\text{cm}^{-1}$  without touching the system. Utilize a range of vacuum and configurable emission ports to perform experiments outside the sample compartment. Pair the FT/IR-6000 series with our comprehensive range of FTIR microscopes, shown on pages 11-12.

## Features

- Excellent signal-to-noise ratio: 55,000:1 (FT/IR-6800)
- High resolution 0.07  $\text{cm}^{-1}$  (standard for FT/IR-6800)
- Rapid scan (standard for the FT/IR-6800)
- Micro and nano second step-scan options with amplitude and phase modulation
- Extended wavenumber range (25,000 - 10  $\text{cm}^{-1}$ )
- Expandable for FTIR microscopy
- FT-Raman option
- Full-vacuum option
- Nanosecond time-resolved spectroscopy (nsTRS)
- Photo-acoustic spectroscopy (PAS)
- PM-IRRAS
- Vibrational circular dichroism (VCD)

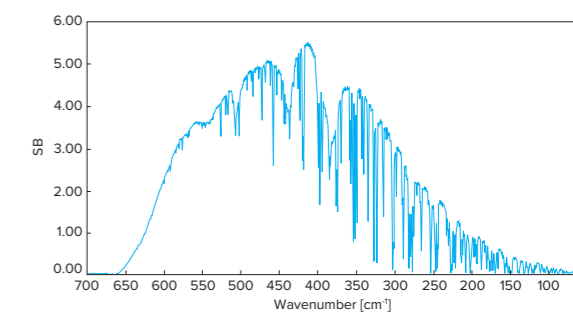
## Resolution

The highly accurate 28 degree Michelson interferometer with HeNe laser and near frictionless moving-mirror offers class-leading resolution down to 0.07  $\text{cm}^{-1}$ .

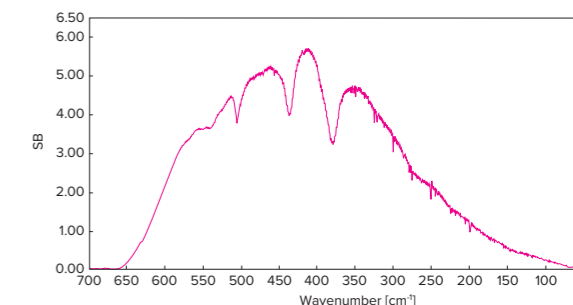


## Vacuum Option

When measuring in the IR range, eliminating the effects of water vapor in the instrument is extremely important for obtaining high-precision data. Although purging with dry air or nitrogen gas is the conventional solution to this problem, the FT/IR-6000 Series has options for a full or partially evacuable optical system. This system can be used for performing low ppb-level water vapor monitoring, thin-film measurement and dilute solution measurement. Where measurement across wide spectral regions is required, automatic window and/or beam-splitter exchange can be included for uninterrupted spectral acquisition.



Background spectrum at standard temperature and pressure



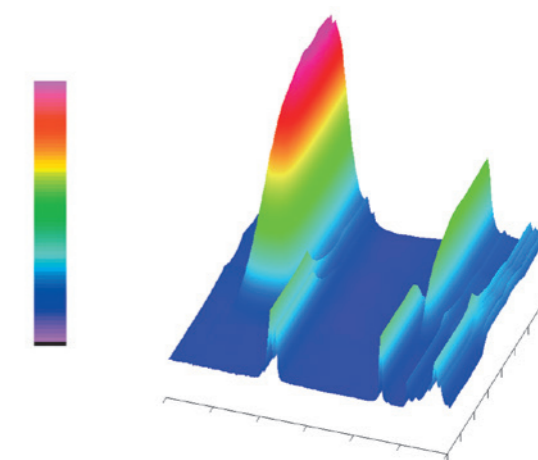
Background spectrum under vacuum

## Rapid-Scan and Step-Scan Measurement

For time-resolved measurements, both rapid-scan and step-scan measurement options are available for the FT/IR-6000 Series. Rapid-scan provides measurement up to a maximum of 20 Hz. Step-scan offers microsecond and/or nanosecond measurement options.

Step-scan measurements require an infinitely repeatable and reproducible experiment. Some key application examples include:

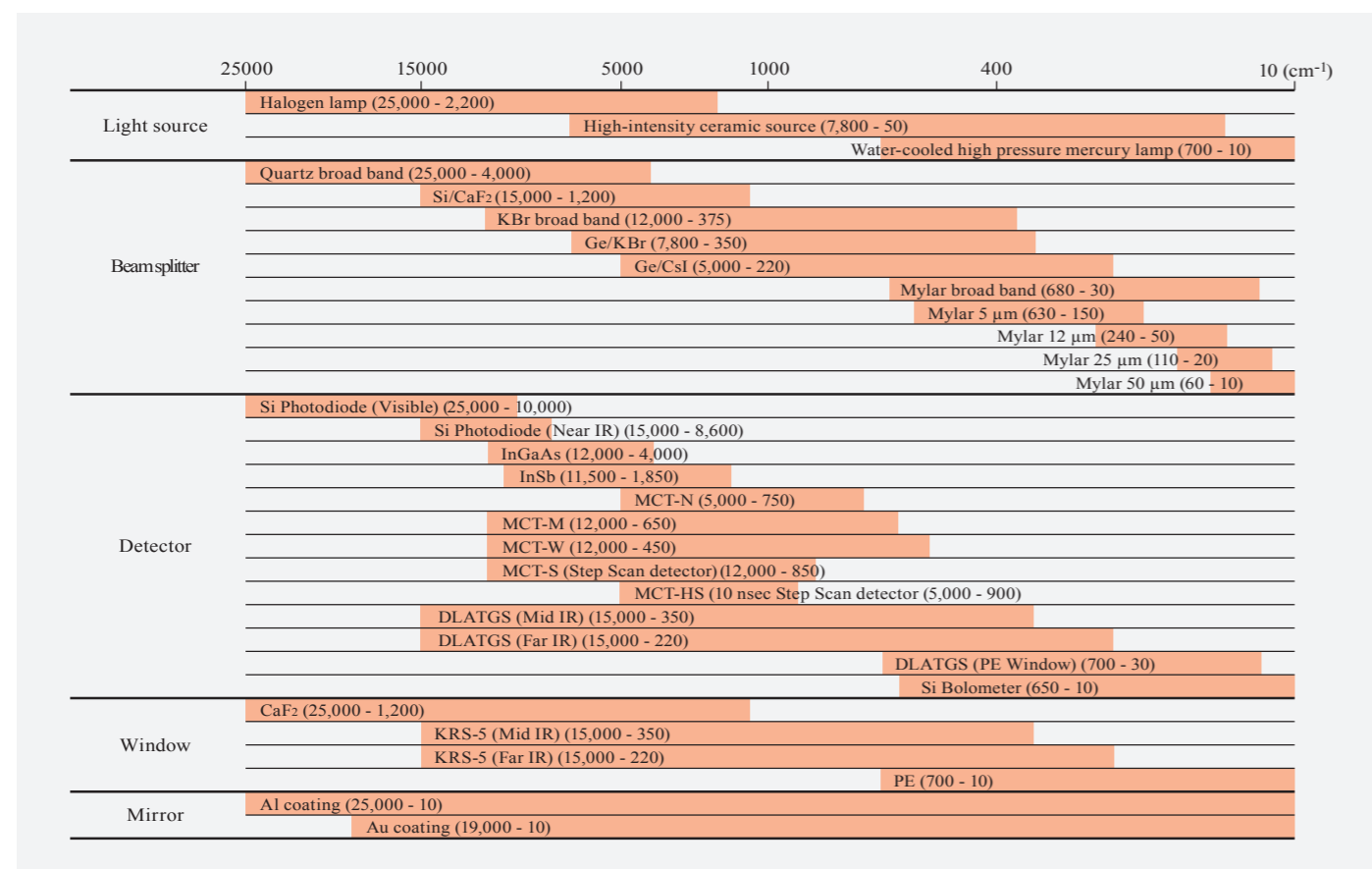
- Depth profiling with PAS
- Thin film measurements with PM-IRRAS
- Chemical transitions in the electric field orientation of liquid crystals
- Materials rheology with polymer stretching
- Protein folding



Interval scan analysis

# FT/IR-6600/6700/6800 Spectrometers

## Additional Instruments



Extend the spectral range of your system by selecting from the components above.

### A Wide Range of Detectors

#### MCT Detector

**Specifications**  
 Measurement range: 5000 - 750 cm<sup>-1</sup> (MCT-N)  
 12000 - 650 cm<sup>-1</sup> (MCT-M)  
 12000 - 450 cm<sup>-1</sup> (MCT-W)  
 Element: Photoconductive type  
 Vessel: Aluminum dewar  
 Capacity of dewar vessel: Approx. 100 mL  
 Liq. nitrogen holding time: 8 hours



Optional 24+ hour hold time dewar available

#### InSb Detector

**Specifications**  
 Measurement range: 11500 - 1850 cm<sup>-1</sup>  
 Element: Photovoltaic type  
 Vessel: Aluminum dewar  
 Capacity of dewar vessel: Approx. 100 mL  
 Liq. nitrogen holding time: 8 hours



#### IR Photo-Acoustic Measurement

Measure photoacoustic spectra using a high-sensitivity microphone. In addition to easy sampling, obtain depth profile information by changing the interferometer scan speed or phase modulation using a step-scanning interferometer.



**Specifications**  
 Microphone sensitivity: 50 mV/Pa  
 Mirror focusing factor: 2 to 1  
 Gain range: 2 - 10000 in 12 steps  
 Maximum sample size: 10 mm diameter x 8 mm height  
 Spectral range: Visible to far-IR, depending on the window material

#### Si Bolometer

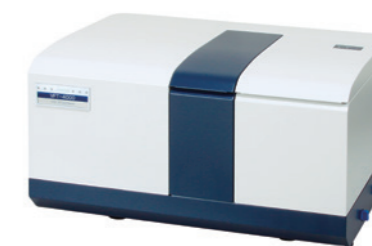
**Specifications**  
 Measurement range: 650 - 10 cm<sup>-1</sup>



### Vibrational Circular Dichroism (VCD)

#### VFT-4000

Perform FTIR measurement and vibrational circular dichroism with the same system. The VFT-4000 VCD accessory is easily installed in the field without complicated adjustments and features auto-alignment, a narrow-band mode, purge capability and a wide spectral range from 3,200 to 850 cm<sup>-1</sup>. A dedicated VCD spectrometer is also available.



### Raman Measurement

#### RFT-6000

The RFT-6000 Raman accessory is designed for quick, non-destructive FT-Raman analysis when paired with the FT/IR-6000 Series. FT-Raman spectroscopy at 1064nm virtually eliminates fluorescence and the sample prep sometimes required for FTIR.

Features include:

- Air-cooled 1,064 nm laser source with laser interlock safety system
- Horizontal sample stage for simple sampling
- Easy switching between Macro/Micro mode (optional)



### Broad-Band Measurement

#### EXBS-6000 / EXPT-6000WIN / EXPT-6000GV

By combining the FT/IR-6000 Series with the automated beam splitter exchange and automated window-switching unit (or automated gate valve unit), the instrument can perform measurements across a wide spectral range under vacuum without manually switching optical elements.



### Automatic Y/θ Stage for 12-Inch Wafer

#### AYT-12-4000

The AYT-4000 is used for automated measurement of the transmittance, reflectance and film thickness of semiconductor wafers up to a maximum size of 12 inches. This system includes dedicated software for various applications, such as mapping measurement and multilayer film-thickness, quantitation of lightweight elements in Si and more. Wafer sizes include: 12 inches (standard) and 4, 5, 6, 8 inches (optional).







# SEE THINGS YOU NEVER SAW BEFORE.

IQ Mapping lets you visualize your sample without moving the stage or disturbing the sample. Spectra Manager™ Imaging Analysis identifies and maps the structural arrangement of functional groups in the sample's matrix to create a detailed high-resolution image.

## Powerful FTIR Microscopy

The IRT Series of FTIR microscopes can be easily paired with either the FT/IR-4000 or FT/IR-6000 Series spectrometers to create systems for materials identification and sample imaging. The simple IRT-1000 microscope fits directly into the sample compartment and can be exchanged as easily as an ATR. The IRT-5000 and IRT-7000 microscopes are permanently aligned with an external optical port for automatic switching between measurement modes without optical alignment. All models can be used for transmission, reflectance and ATR sample measurement, with a choice of manual or automatic XYZ stages.

### Compact, In-Compartment Microscope

#### IRT-1000



Designed for ease-of-use and compatible with both the FT/IR-4000 and 6000 series, this in-compartment microscope features:

- Quick in-compartment installation without optical alignment
- Transmittance, reflectance and ATR analysis modes
- Manual stage
- Front-panel controls for simplified measurements
- Dedicated PC software for control and analysis
- View sample and record spectral data simultaneously

### Infrared Microscopes

#### IRT-5100/5200

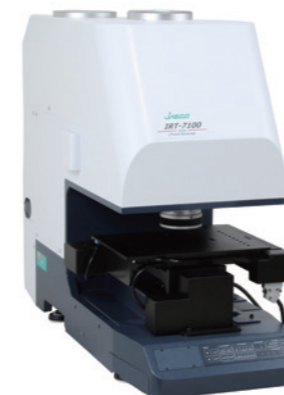


With an expandable spectral range and high-clarity visual observation, the IRT-5000 series features:

- IQ Mapping\* for sample imaging without moving the stage
- Automatic XYZ stage with joystick control
- Dual detectors and user-swappable detectors
- Multiple objectives with automatic switching
- Spectrum preview to check conditions before measurement
- Data storage linked with sample image and measurement information

### Multi-Channel/Automated IR Microscopes

#### IRT-7100/7200



With a fully automated sample stage, autofocus and up to four objectives, the IRT-7100 features:

- Dual detector and user-swappable detectors
- IQ Mapping
- Field upgrade for ultrafast IR imaging

The IRT-7200 linear array FTIR microscope, has the same features as the IRT-7100 model plus:

- Linear array imaging detector
- Ultrafast IR Imaging function up to 9,600 data/minute
- Dynamic Imaging with an FTIR step-scan option

\*IQ Mapping is an option on the IRT-5100



# Spectra Manager™ Software Suite

## Instrument Control

Drivers are included to control each JASCO spectroscopy system. Parameter dialogs allow easy editing of pre-saved parameter files. Data acquired from each instrument is automatically loaded into the analysis program to free up the PC and control software to acquire more data during post acquisition processing. Each instrument driver also has its own dedicated application for instrument hardware diagnostics and validation.

## Flexible Display Features

User-friendly features include overlay printing in colors and patterns, autoscale mode, full control of style and font, with customizable workspace and toolbars.

## Data Processing and Spectral Analysis

View and process several types of measurement data files (CD, Polarimetry, Raman, UV-visible/NIR, FTIR, Fluorescence, etc.) in a single window, using a full range of data processing functions. Features include arithmetic operations, derivatives, peak detection and processing, smoothing (several methods) and baseline and spectral corrections.

## Report Publishing

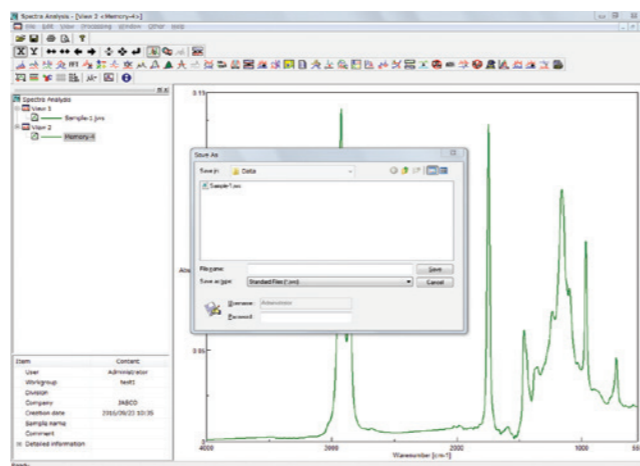
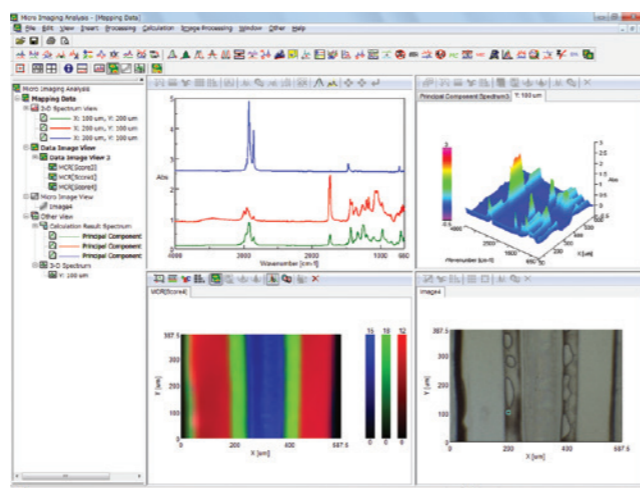
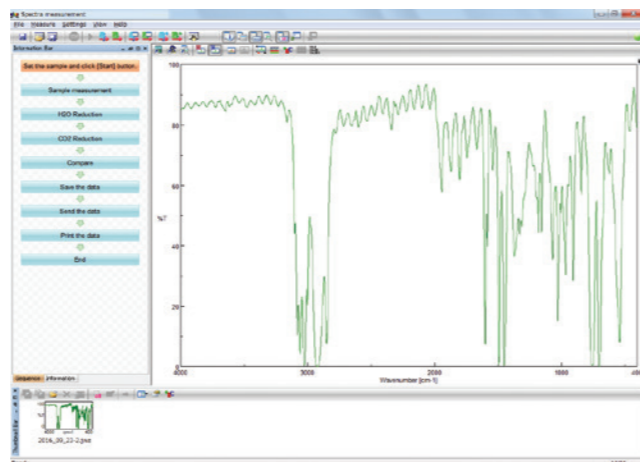
JASCO canvas is used to create layout templates of spectral data and results to meet individual reporting requirements.

## Macro Command Option

The Macro Command application is used to develop user-designed application programs for individual experimental set-up and routine measurement, including instrument control, data acquisition, post-acquisition data processing and reporting.

## Data Security with Spectra Manager CFR™

Spectra Manager CFR™ provides secure access and compliance with 21 CFR Part 11. System access requires a username and password, which are assigned by the Workgroup Manager. Individual levels determine the access to administrative tools, which includes instrument installation, analysis application installation, user setup, workgroup setup and security policies, as well as system and application history logs. Three levels of electronic signatures are included: creation, review and approval. An audit trail is included for every data file, recording all processing analysis and reporting of spectral data.



# A SINGLE PLATFORM FOR EVERY INSTRUMENT.

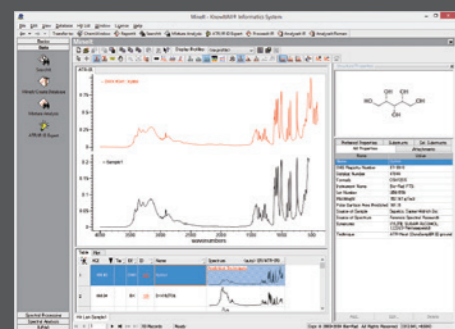
JASCO has developed the unique and powerful, cross-platform Windows® software package to control the widest range of optical spectroscopy instrumentation. Spectra Manager™ is a comprehensive lab companion for measuring and processing data, eliminating the need to learn multiple software programs and allowing data from many instruments to be analyzed and displayed together on the same platform.



# KnowItAll® JASCO Edition Spectral Search

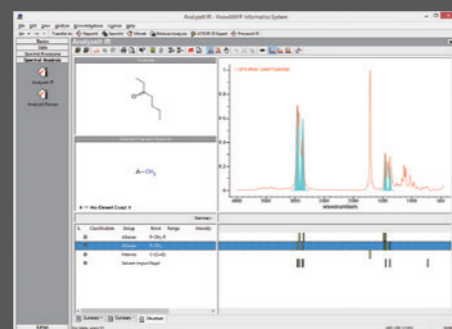
KnowItAll® Informatics System JASCO Edition is included\* with FT/IR-4000 and 6000 Series instruments. This comprehensive data search database and analysis software includes the following features:

- Search by field including, spectra, peaks, property/name, structure (SearchIt™)
- Identify components in a mixture (Mixture Analysis™)
- Interpret bands in an infrared spectrum (Analyzelt™)
- Draw chemical structures (DrawIt™)
- Unrestricted lifetime access to the Sadtler data library including 12,600 spectra of chemical, polymer and ATR
- Search JASCO's own data library including 400 spectra of organic and inorganic compounds
- Free access to Sadtler databases, including 230,000 IR spectra (HavelItAll®), for 90 days after software activation
- Build searchable databases that include physical properties, meta-data and more (Database Building Option, included as standard)



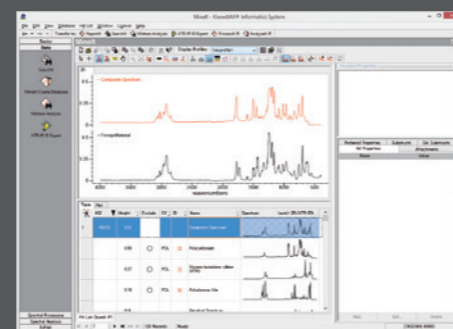
**SearchIt™**

Search against reference databases as well as your own imported spectra. Searches are customizable and driven by powerful algorithms. Searchable fields include name, structure, substructure, properties, and analytical data, such as spectra and peaks.



**Analyzelt™**

Interpret the bands in an infrared spectrum. Simply load a spectrum and click on a peak of interest to generate a list of possible functional groups at that position. Analyzelt features over 200 functional groups and hundreds of interpretation frequencies.



**Mixture Analysis™**

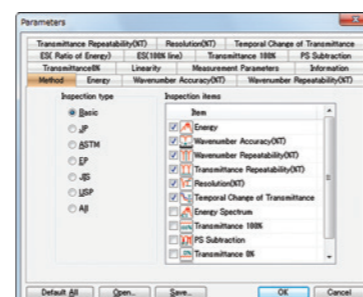
Determine the components in a mixture. Just transfer the spectrum to be analyzed, the software searches and compares the samples to reference databases of known compounds and predicts the possible mixture of components.

## Validation Program

All FT/IR-4000 and 6000 series instruments include the Validation Program, which is used to verify instrument performance to meet regulatory requirements set by GxP and standards established by ISO. The test protocols included in this program are compliant with ASTM, USP, EP and JP procedures. The automatic validation measurement unit includes a polystyrene film and glass plate standard (optional for the FT/IR-6000 series).

\*Except LE versions

KnowItAll® is a registered trademark of Bio Rad.



# Optional Software Programs

Spectra Manager™ includes a wide range of additional software applications. Examples of a few of the more commonly used applications are shown here. For details of more applications, please contact us.

## Multi-Component Quantitation

This program is used for quantitation of up to a maximum 50 components simultaneously. It can also be combined with the interval scan program to perform time based concentration measurement of each component. This software application easily transforms any JASCO FTIR into a dedicated turnkey process gas analyzer system when coupled with a gas sampling manifold.

## Multi-Variate Analysis

Multi-variate analysis techniques are widely used for multicomponent mixtures. Four types of multivariate analysis programs are available. The CLS, PCR and PLS methods are generally used for quantitative analysis of multi-component samples. The PCA and MCR methods are suitable for classification of multi-component samples.

## ITM-4000: Interval Scan Measurement

The ITM-4000 interval scanning program is used to acquire spectral data during a time course measurement. This program is commonly used for long-term observation of spectral changes in slow reactions. Intensity changes at a specified wavenumber can also be monitored. The spectral data can be displayed in 2-D at a specified time and as a 3-D plot. Time course data based on peak height, peak area or peak shift at a specified wavenumber can be calculated and displayed as a 2-D plot.

## QAU-4000: Spectral Quantitation

QAU-4000 is a quantitative analysis program based on the Beer-Lambert-Bouguer Law. Samples can be quantified using peak height, peak area etc. calibration curves include: linear, quadratic or cubic fitting functions.

## Two-Dimensional Correlation Analysis

The 2-D correlation analysis program performs a time domain Fourier transform of time-resolved spectra obtained, for example by, interval scan measurements, and then a plot of the correlation intensities of the real part (synchronous correction) and imaginary part (asynchronous correction) is made as separate contour maps. Analyzing the correlation spectra of each plot provides an estimation of the chemical and/or structural changes in a sample. By combining these results with other spectral analysis techniques (including near-IR, Raman, UV-Visible or CD) and infrared analysis, 2-D correlation can provide an analysis of peak assignments, lattice vibrations and the relationship between intramolecular vibrations, color or chiral information.

## SSE-4000: Secondary Structure Estimation

The amide region of a protein IR spectrum changes slightly according to changes in its secondary structure. SSE-4000 is used to estimate the protein secondary structure using either a PCR or PLS method with reference data sets correlated with the results of X-ray structure analysis. Samples can be measured either in liquid or solid phase (crystal and amorphous), which can be difficult for structural analysis using X-ray and CD. In addition, an IR imaging version of the SSE program can be used with IR microscopy for the analysis of protein secondary structure distribution.

## MCR-4000: Macro Command Program

The MCR-4000 macro command program is used to automate a series of tasks, for many types of measurement and for comprehensive analysis and printing. The Macro Script Generator uses simple tool buttons to allow the user to easily create macro scripts without any special programming knowledge.

## RAD-4000: Radiation Calculation

RAD-4000 is used to analyze the spectral emission of a black body source.

## FTA-4000: Thin Film Analysis

The calculation of thin film thickness is made using a Fourier Transform of a 'spatialgram', the complex interference pattern can be used to measure film thickness for multiple layers (in theory this is unlimited, but the practical limitation is around 15 to 20 layers, depending on the refractive index of each layer).

## LHP-5000: Temperature Interval Scan

The LHP-5000 Temperature interval scanning program is used to acquire spectral data during a time course measurement with a temperature controlled accessory such as the ATR PRO670H-S ATR or Linkam stage. This program is typically used for kinetic measurement of samples including, chemical reactions, glass transition and acceleration testing with increased temperature. Data is handled similarly to the ITM-4000 interval scan measurement.

## SSP-4000: Spectral Search Program

Spectral Search Program is a simple library search function designed for use with the LE version when KnowItAll is not included. Supplied with a 300 spectra library.

# FTIR Sampling Accessories

## Attenuated Total Reflectance Measurement

The FT/IR-4000/6000 series includes a comprehensive range of ATR accessories for sample measurement. The ATR Pro One and ATR Pro One View are the 'signature' single reflection monolithic diamond models with wide spectral range and high optical throughput. Versatile models include: wide range sample temperature control, polarization and environmental control.

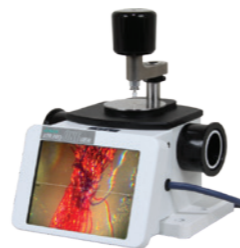
### ATR PRO ONE Single-Reflection ATR

<b>Specifications</b>	
ATR prism:	Diamond (High-throughput type, Wide-band type), ZnSe, Ge,
ATR/sample contact area:	2.5 mm diameter (ZnSe, Ge) 1.8 mm diameter (Diamond)
No. of reflections:	1
Angle of incidence:	45°
Pressure:	400 kg/cm <sup>2</sup> (ZnSe, Ge) 700 kg/cm <sup>2</sup> (Diamond)



### ATR PRO ONE VIEW Single-Reflection ATR with Camera

<b>Specifications</b>	
ATR prism:	Diamond (High-throughput type and Wide-band type), ZnSe, Ge (without image)
ATR/sample contact area:	2.5 mm diameter (ZnSe, Ge) 1.8 mm diameter (Diamond)
No. of reflections:	1
Angle of incidence:	45°
Pressure:	400 kg/cm <sup>2</sup> (ZnSe, Ge) 700 kg/cm <sup>2</sup> (Diamond)
Software:	Real-time image and recording in data file with Spectra Manager II



### ATR PRO470-H High-Pressure Single-Reflection ATR

<b>Specifications</b>	
ATR prism:	Diamond
ATR/sample contact area:	2.0 mm diameter (Diamond)
No. of reflections:	1
Angle of incidence:	45°
Pressure:	1,700 kg/cm <sup>2</sup> (Diamond)



### ATR PRO410-M Multi-Reflection ATR

<b>Specifications</b>	
ATR prism:	ZnSe, Ge
ATR/sample contact area:	5 x 20 mm
No. of reflections:	5
Angle of incidence:	45°



### ATR PRO550S-S, ATR PRO570S-H Sample-Shielding Single-Reflection ATR

<b>Specifications</b>	
ATR prism:	ZnSe, Ge, Diamond (550S-S) Diamond (570S-H)
ATR/sample contact area:	1.5 mm diameter (ZnSe, Ge) 2.0 mm diameter (Diamond)
No. of reflections:	1
Angle of incidence:	45°
Pressure:	400 kg/cm <sup>2</sup> (550S-S) 1,700 kg/cm <sup>2</sup> (570S-H)



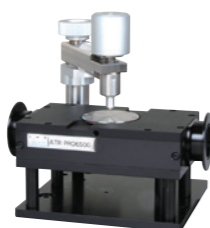
### ATR PRO610P-S, ATR PRO630P-H Polarizer Single-Reflection ATR

<b>Specifications</b>	
ATR prism:	ZnSe, Ge, Diamond (610P-S) Diamond (630P-H)
ATR/sample contact area:	1.5 mm diameter (ZnSe, Ge) 2.0 mm diameter (Diamond)
No. of reflections:	1
Angle of incidence:	45°
Pressure:	400 kg/cm <sup>2</sup> (610P-S) 1,700 kg/cm <sup>2</sup> (630P-H)
Polarizer/analyzer:	Wire-grid polarizer (KRS-5)
Polarizer rotation angle:	0 - 360°



### ATR PRO650G 65° Incident-Type Single-Reflection ATR

<b>Specifications</b>	
ATR prism:	Ge
ATR/sample contact area:	3.0 mm diameter
No. of reflections:	1
Angle of incidence:	65°
Maximum sample size:	6 inches
* A polarizer and attenuator mesh are optional	



### ATR PRO670H-S, ATR PRO690H-H Temperature Controlled Single-Reflection ATR

<b>Specifications</b>	
ATR prism:	ZnSe, Ge, Diamond (670H-S) Diamond (690H-H)
ATR/sample contact area:	1.5 mm diameter (ZnSe, Ge) 2.0 mm diameter (Diamond)
No. of reflections:	1
Angle of incidence:	45°
Pressure:	400 kg/cm <sup>2</sup> (670H-S) 1,700 kg/cm <sup>2</sup> (690H-H)
Operating temperature:	180°C (Diamond) 150°C (Ge) 120°C (ZnSe)



\* A connector panel is required when this accessory is fitted to the FT/IR-6000FV.

### ATR PRO ONE T Large Sample Single-Reflection ATR

<b>Specifications</b>	
ATR prism:	ZnSe, Ge, diamond (High-throughput type, Wide-band type)
ATR/sample contact area:	2.5 mm diameter (ZnSe, Ge) 1.8 mm diameter (Diamond)
No. of reflections:	1
Angle of incidence:	45°
Pressure:	400 kg/cm <sup>2</sup> (ZnSe, Ge) 700 kg/cm <sup>2</sup> (Diamond)



## Grazing-Angle Reflectance Measurement

Reflection Absorption Spectroscopy has the benefit of greater sensitivity - up to 1 or 2 orders of magnitude compared with transmission. When parallel polarized light is incident to a metal surface, the electric vectors in the incident and reflected light interfere to mutually strengthen and form a vertical standing wave. The interaction of this stationary wave with a thin film on the metal surface, causes an absorption that is stronger than simple transmission measurement.

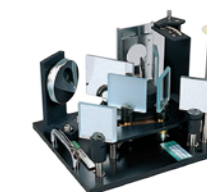
### RAS PRO410-H 85° Incident Angle without Mirror

<b>Specifications</b>	
Optical system:	Refractive optics
Angle of incidence:	85°
Polarizer/analyzer:	Wire-grid polarizer (KRS-5)
Polarizing direction:	Fixed at 0° to the plane of incidence
Sample placement:	Horizontal
Sample mask:	20 x 10 mm, 10 x 10 mm (Option: 10 x 5 mm)
IQ accessory:	Available
Smart purge:	Available



### PR-510i Variable Incident Angle

<b>Specifications</b>	
Angle of incidence:	55 - 85°
Polarizer/analyzer:	Wire-grid polarizer (KRS-5)
Sample placement:	Vertical
Sample size:	30 x 40 mm
IQ accessory:	Available



### RAS PRO410-B 80° Incident Angle

<b>Specifications</b>	
Angle of incidence:	80°
Polarizer:	PL-82 is required
Sample placement:	Horizontal
Sample mask:	20 x 10 mm, 10 x 10 mm
IQ accessory:	Available
Smart purge:	Available



### RAS-300/Hi 75° Incident Angle

<b>Specifications</b>	
Angle of incidence:	75°
Polarizer:	Polarizing mirror (parallel polarization only)
Sample placement:	Horizontal
Sample mask:	20 x 10 mm, 10 x 10 mm
IQ accessory:	Available

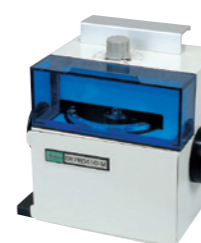


## Diffuse and Specular Reflectance Measurement

Diffuse reflectance is a useful technique for samples with a roughened surface which are not amenable to transmission or ATR measurement, such as some powders, pharmaceuticals, plastics and food products etc. The diverse range of diffuse reflectance products includes heated, vacuum and automatic sampling accessories.

### DR PRO410-M Multi-Sample Diffuse Reflectance

<b>Specifications</b>	
Sampling:	7-position sample holder x 2
IQ accessory:	Available
Smart purge:	Available
* Automatic sample switching is optional	



### SMART-400i Smart Tech Multi-Sample Diffuse Reflectance

<b>Specifications</b>	
Sampling:	7-position sample holder x 2
IQ accessory:	Available
Smart purge:	Available
* Automatic sample switching is optional	



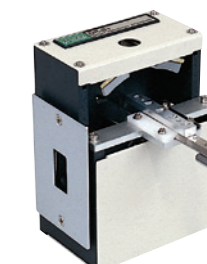
### DR-650Ai Bi, Ci Vacuum/Heated Diffuse Reflectance

<b>Specifications</b>	
Cell temperature:	1000°C (Ai), 800°C (Bi), 600°C (Ci)
Vacuum level:	0.13 Pa
Sample size:	6 mm in diameter
Window material:	KBr
Gas flow:	Available
Heater:	Kanthal heater
Cell cooling method:	Water-cooled
IQ accessory:	Available
* Temperature controller and related software are optional	



### DR-81 Diffuse Reflectance

<b>Specifications</b>	
Sampling:	5-position sample holder



### NRF PRO410-N Near IR Diffuse Reflectance

<b>Specifications</b>	
Wavenumber range:	15,000 - 4,000 cm <sup>-1</sup>
Angle of incidence:	11.2°
Spot size:	10 mm in diameter
Reference material:	Diffusion plate for reference
IQ accessory:	Available
Option:	Test tube holder Pellet holder Powder sample holder



### RF-81S Specular Reflectance

<b>Specifications</b>	
Angle of incidence:	10°
No. of reflections:	1
Sample mask:	1, 3 and 5 mm in diameter





## Transmission Measurement

Transmission remains one of the most sensitive methods used in mid-IR spectroscopy. However, correct sample thickness is essential for obtaining good spectra. The wide range of sampling accessories has been designed for the comprehensive analysis of gases, liquids and solid samples. For gas analysis, pathlengths range from 5 cm up to 20 m for ppm sensitivity. Various cell and window designs are available for the measurement of aqueous and non-aqueous liquids. Films and other solids are measured using film holders, KBr pellet presses and other accessories designed for the transmission of light through a prepared sample.

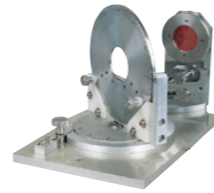
### AM-4000 Automated MAIRS Measurement Unit

**Specifications**  
 Sample holder: 2 positions  
 Rotation angle of sample: 0 - 45°  
 Polarizer: Wire-grid polarizer (KRS-5)  
 Solid-angle mask: Available (1 mm dia. manual adjust)  
 Angle of incidence: Available (4, 10 and 25%)  
 IQ accessory: Available  
 \* An MCT detector is required (order separately)



### VAT-500i Variable-Angle Transmission Accessory

**Specifications**  
 Measurement mode: Transmittance  
 Sample size: 4-inch diameter, 1-mm thickness  
 Angle of sample: 0 - 90°  
 Polarizer: Wire-grid polarizer (KRS-5)  
 IQ accessory: Available



### AS-50 Transmittance Measurement Autosampler

The AS-50 enables to perform the transmittance measurement of maximum 49 samples automatically.

**Specifications**  
 Sampling: 3 mm diameter pellet  
 Film holder  
 No. of samples: 49



### Demountable Cell

**Specifications**  
 Window: NaCl, KCl, KBr, KRS-5 Csl, CaF<sub>2</sub>, Quartz, Polyethylene  
 Pathlength: 0.025 - 100 mm  
 \* Polyethylene window is used for Far-IR



### Demountable Liquid Cell

**Specifications**  
 Window: NaCl, KCl, KBr, KRS-5 Csl, CaF<sub>2</sub>, Quartz  
 Pathlength: 0.025 - 100 mm



### Sealed Liquid Cell

**Specifications**  
 Window: NaCl, KCl, KBr, KRS-5 Csl, CaF<sub>2</sub>, Quartz, ZnSe  
 Pathlength: 0.025 - 100 mm  
 \* Please contact us if the cell is required for an FTIR vacuum system



### Micro Sealed Liquid Cell

**Specifications**  
 Window: NaCl, KCl, KBr, KRS-5  
 Optical pathlength: 0.025 - 0.5 mm  
 Cell capacity: Approx. 2 µL (when using 0.025 mm)



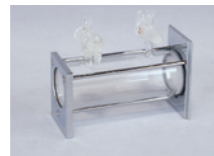
### Demountable/Small-Capacity Gas Cell

**Specifications**  
 Window: NaCl, KCl, KBr, KRS-5  
 Pathlength: 50, 100 mm (demountable)  
 75 mm (small-capacity)  
 Cell capacity: 25 mL



### Sealed Gas Cell

**Specifications**  
 Window: NaCl, KCl, KBr, KRS-5, CaF<sub>2</sub>  
 Optical pathlength: 50, 100 mm  
 \* Please contact us for details of special cells for corrosive analysis.



### LPC-12M-G / LPC-12M-S / LPC-12M-FV Long Path Gas Cells

**Specifications**  
 Pathlength: 12 m  
 Cell volume: 2.3 L  
 Glass (G)  
 Cell body: SUS316 (S / FV)  
 Inner coating: None (G)  
 Electro-polished (S / FV)  
 Window: KBr (Option: BaF<sub>2</sub>, CaF<sub>2</sub> and ZnSe)  
 O-ring: Viton  
 Transmission efficiency: 15%



### Micro KBr Pellet Die

Three types of die kits are available to form micro pellets of 2, 3 and 5 mm diameter. The average quantity of sample required is 50 µg for the 3 mm pellets die. A mini press or hydraulic press is required when forming pellets. In order to avoid to rust, coated pellet die kits of 5 and 3 mm pellet die are available.

**Specifications**  
 Pellet size: 5, 3 and 2 mm in diameter



### KBr Pellet Die with Pellet Holder

Three types of die kits are available to form pellets of 7, 10 and 20 mm diameter. The hydraulic oil press is required when forming pellets.

**Specifications**  
 Pellet size: 7, 10 and 20 mm in diameter



### Pellet Holder

The pellet holders are used for mounting a formed pellet in the sample compartment.

**Specifications**  
 Sampling size: Micro KBr pellet, 10 mm diameter pellet (III type)  
 13, 20 mm diameter pellet (IV type)



### Agate Mortar and Pestle

An agate mortar and pestle is used to grind samples and reduce particle size when making KBr pellets. Sizes of 60, 70 and 80 mm in external diameter are available.

**Specifications**  
 Size: 60, 70 and 80 mm in diameter



### Mini-Press

The mini-press is used when forming micro pellets of 2 and 3 mm in diameter. The micro pellets can be easily made by applying hand pressure.



### Hydraulic Press

The hydraulic press is used when forming pellets of samples with 5, 7, 10 and 20 mm in diameter. 100 kN and 200 kN types of presses are available.



### PL-82 Polarizer

The PL-82 linearly polarizes light in the IR region for measurements of polymer films, coatings and oriented film samples.

**Specifications**  
 Polarizer: Wire grid polarizer (KRS-5)  
 Angle setting display: 0 - 180°



### AVC-6000 Control Panel for Full Vacuum System

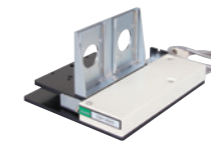
The AVC-6000 is used to automatically control the vacuum and purge for the FT/IR-6000 vacuum type spectrometers.



### SSH-4000 Sample Shuttle

Two position software controlled sample shutter.

**Specifications**  
 Number of positions: Two  
 Sample mounting: Standard film or pellet mount  
 Control: Spectra Manager II



Precision Cutting from 10-200 µm

## SliceMaster

SliceMaster is a compact, easy-to-use microtome that can make thin sections by cutting film-type samples.

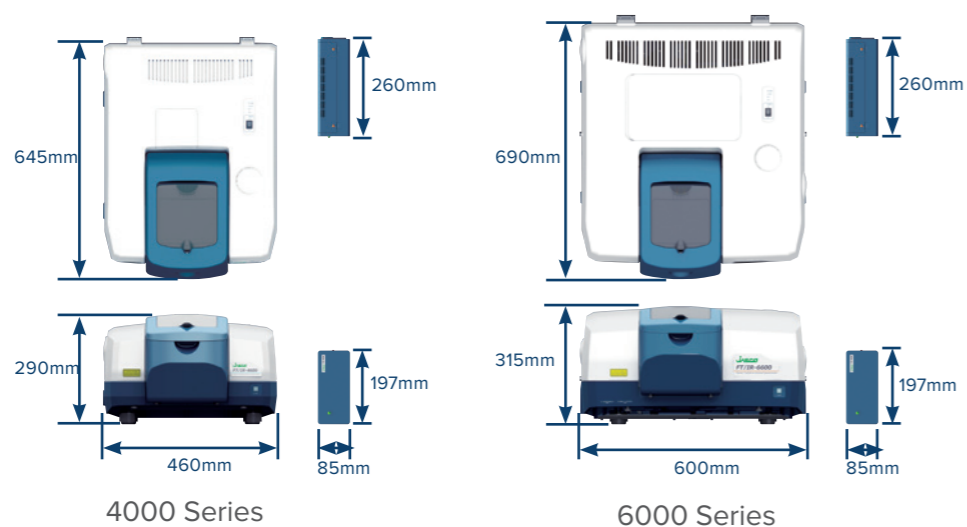


# Specifications

Model	FT/IR-4600	FT/IR-4700
Standard wavenumber measurement range	7,800 - 350 cm <sup>-1</sup>	
Optional extended wavenumber range	15,000 - 2,200 cm <sup>-1</sup> / 5,000 - 220 cm <sup>-1</sup>	
Maximum resolution	0.7 cm <sup>-1</sup>	0.4 cm <sup>-1</sup>
Resolution setting	0.7, 1.0, 2.0, 4.0, 8.0, 16.0 cm <sup>-1</sup>	0.4, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0 cm <sup>-1</sup>
Signal-to-noise ratio (with KRS-5 windows)	25,000:1	35,000:1
Detector	DLATGS (with Peltier temperature control) (standard) MCT-N, MCT-M, MCT-W, Si, InSb, InGaAs (option) Two detectors can be installed simultaneously in the instrument	
Beam splitter	Ge/KBr (standard) / Si/CaF <sub>2</sub> , Ge/CsI (option, not interchangeable)	
Light source	High-intensity ceramic source (standard) / Halogen lamp (option, not interchangeable)	
Interferometer	45° Michelson / corner-cube mirror interferometer with auto-alignment, DSP control, sealed structure (KRS-5 window)	
Purging (standard)	Interferometer sample compartment / detector	
A/D converter	24-bit A/D converter	
Drive method	Mechanical bearing, electromagnetic drive	
Drive speed	1, 2, 3, 4 mm/sec (rapid-scan option adds 16, 32 mm/sec)	
Rapid scan	Option: 10 Hz (16 cm <sup>-1</sup> resolution), requires Ge/KBr beam splitter and MCT detector	
High-sensitivity measurement	Option: manual or auto	
Communication / control	USB 2.0 / Spectra Manager™ or Spectra Manager™ CFR	
Vibration-proof	Vibration-proof design foot	
Supported OS	Windows 7 Professional (32- and 64-bit versions), Windows 8.1 Professional	
IQ accessory	Standard	
Start button	Standard	
Dimension/weight	Main unit: 460 (W) x 645 (D) x 290 (H) mm, 33 kg Power supply: 85 (W) x 260 (D) x 197 (H) mm, 4.7 kg	
Power consumption	AC 100 - 240 V, 50/60 Hz, Max 170VA	
Operation environment	Temperature: 17 - 27°C / Humidity: less than 70%	

Model	FT/IR-6600	FT/IR-6700	FT/IR-6800
Standard wavenumber measurement range	7,800 - 350 cm <sup>-1</sup>		
Optional extended wavenumber range	25,000 cm <sup>-1</sup> - 10 cm <sup>-1</sup>		
Maximum resolution	0.4 cm <sup>-1</sup>	0.25 cm <sup>-1</sup>	0.07 cm <sup>-1</sup>
Resolution setting	0.4, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0 cm <sup>-1</sup> (0.07 cm <sup>-1</sup> option)	0.25, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0 cm <sup>-1</sup> (0.07 cm <sup>-1</sup> option)	0.07, 0.25, 0.5, 1.0, 2.0, 4.0, 8.0, 16.0 cm <sup>-1</sup>
Signal-to-noise ratio (with KRS-5 windows)	45,000:1	47,000:1	55,000:1
Detector	DLATGS (with Peltier temperature control) (standard) MCT-N, MCT-M, MCT-W, Si, InSb, InGaAs (option) Two detectors can be installed simultaneously in the instrument Multiple external detectors can be installed		
Beam splitter	Ge/KBr (standard) / Si/CaF <sub>2</sub> , Ge/CsI, Mylar)		
Light source	High-intensity ceramic source (standard) / Options - Halogen and Mercury lamps		
Interferometer	28° Michelson / corner-cube mirror interferometer with auto-alignment, DSP control, sealed structure (KRS-5 window) / high-accuracy gold coating mirror (option for FT/IR-6600 and -6700, standard for FT/IR-6800)		
Vacuum system	Full or partial vacuum options		
Purging (standard)	Interferometer sample compartment/detector		
A/D converter	24-bit A/D converter		
Drive method	Mechanical bearing, electromagnetic drive		
Drive speed	0.5, 1, 2, 3, 4, 5, 6, 7, 8 mm/sec (rapid-scan option adds 12, 16, 20, 24, 28, 32, 36, 40 mm/sec)	0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 12, 16, 20, 24, 28, 32, 36, 40 mm/sec	
Rapid scan	Option: 20 Hz (16 cm <sup>-1</sup> resolution)	20 Hz (16 cm <sup>-1</sup> resolution)	
Step scan	Options include: Step Scan, Micro-Second TRS, Nano-Second TRS, Phase Modulation, and Amplitude Modulation		
High-sensitivity measurement	Option: manual or auto		
Communication / control	USB 2.0 / Spectra Manager™ or Spectra Manager™ CFR		
Vibration-proof	Vibration-proof design foot		
Supported OS	Windows 7 Professional (32- and 64-bit versions), Windows 8.1 Professional		
IQ accessory	Standard		
Start button	Standard		
Dimension/weight	Main unit: 600 (W) x 690 (D) x 315 (H) mm, 56 kg Power supply: 85 (W) x 260 (D) x 197 (H) mm, 4.7 kg		
Power consumption	AC 100 - 240 V, 50/60 Hz, Max 180VA		
Operation environment	Temperature: 17 - 27°C / Humidity: less than 70%		

## Installation Space Requirements



\*Installation area for PC and printer is required separately.





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Products described herein are designed and manufactured by ISO-9001- and ISO-14001-certified JASCO Corporation