

Spectrum 3 Optica FT-IR System Technical Specifications

Infrared Spectroscopy



Spectrum 3™ Optica FT-IR Spectrometer

Introduction

The Spectrum 3™ Optica Systems from PerkinElmer® are built to the highest ISO-9001 standards. This document describes confirmed performance specifications based on 100% factory testing. This means all instruments will meet or exceed the confirmed specifications below, under normal conditions of operation as described in the User Manual.

The Spectrum 3 Optica is a mid-IR Fourier transform (FT) spectrometer designed for applications where it is necessary to quantify the absolute transmission of high refractive index materials. The system offers improved specifications for ordinate accuracy performance in the mid-infrared regions in addition to the high wavenumber accuracy and reproducibility expected of FT-IR systems. Ordinate performance is verified at the factory using both germanium samples measured by NIST and traceable reference materials. The unique precision optical design and system configurability provide high accuracy on the ordinate scale and a level of control over beam geometry that enables performance to be optimized for a range of sample types and thicknesses. Reflection measurements are possible using optional reflectance accessories designed for the standard sampling compartment.

As expected with advanced PerkinElmer® IR spectrometers, a suite of sophisticated built-in instrument standardization and validation capabilities are included with the standard instrument configuration, to ensure the utmost confidence in your results.

OPTICAL PERFORMANCE		
Spectral Range		
Usable wavelength range	7800-350 cm ⁻¹ (1.3-28 μm)	KBr beamsplitter.
Range meeting ordinate accuracy specification	5000-400 cm ⁻¹ (2-25 μm)	
Spectral Resolution		
Resolution	0.5 cm ⁻¹ to 64 cm ⁻¹	Software selectable intermediate values in increments of 0.1 cm ⁻¹ . Setting automatically optimized for Variable J-stop iris resolution selected and given frequency.
Wavelength Accuracy		
Standard IR	0.1 cm ⁻¹ at 1600 cm ⁻¹ (6.25 μm)	
Wavelength Repeatability		
Standard IR	0.02 cm ⁻¹ at 1600 cm ⁻¹ (6.25 μm)	0.007 cm ⁻¹ achievable.
Ordinate Performance		
Ordinate accuracy	Better than 0.25 %T at 47 %T	Measured with 1 mm uncoated Ge (nominal 47 %T) calibrated at NIST*. Sample requirements: Wedge angle 0-0.1°, 0-0.2° in vertical axis. Angle of incidence 0-5°, sample thickness < 6 mm.
	Better than 0.01 %T at 0 %T	Measured in stop-band regions (nominal 0 %T).
Signal-to-noise		
Open beam	2100:1 p/p, 10500:1 RMS	5 seconds measurement.
Artifact levels	Within noise for 1 minute accumulated scan excluding CO ₂ and H ₂ O regions over the range 7800-450 cm ⁻¹ (1.3-22 μm)	

OPTICAL SYSTEM	
General	Sealed and desiccated optical unit. Vibration isolated baseplate.
Interferometer	Improved rotary Michelson interferometer for maintenance-free, reliable operation. Self-compensating for dynamic alignment changes due to tilt and shear, incorporating high reflectivity first-surface Al-coated optics.
Source	Proprietary mid IR long-life user-replaceable source with hot spot stabilization and optimized baffle assembly.
Beamsplitter	Proprietary optimized, multi-layer potassium bromide standard.
Detector	High performance, high linearity lithium tantalate pyroelectric detector for highest accuracy in filter bandpass regions.
Principal	Fully adjustable dual-iris aperture system allowing full control of both beam diameter and beam divergence at the sample position to minimize beam alignment and defocusing issues. Integrated baffle system to minimize effects of back-reflections from highly polished samples.
Variable J-stop	Software controlled variable Jaquinot stop allows user-control of beam divergence through interferometer and sample focus image size. Iris size automatically optimized for resolution and J-stop wavenumber settings.
Variable B-stop	Software controlled variable B-stop allows user control of beam intensity and beam divergence at sample position without changing beam diameter at sample position. Smaller B-stop diameters produce a more collimated beam at the sample position.
Optical filter wheel	7-position software controlled optical filter wheel. User-replaceable filters.
External windows	Sample compartment windows providing independent purging of sample compartment.
Desiccant	Accepts disposable or rechargeable desiccant packs. Visible desiccant status indicator.
IR beam at sample position	Semicircular profile, user variable diameter ca 2-11 mm. Ordinate accuracy specifications at 6 mm diameter using 6 mm B-stop setting giving ~f/7 beam at sample position.

DATA SYSTEM AND ELECTRONICS

Signal sampling	Over-sampling delta-sigma converter.
Communication	TCP/IP interface allows direct connection with LAN. Instruments can be configured with their own IP address allowing control via the internet.
Internal system monitoring and error trapping	Each spectrum checked for common problems. Key instrument components and functions monitored.
Automatic accessory recognition system	All key sampling systems, including individual ATR top-plate types, are automatically detected and instrument parameters set up accordingly. Custom accessories may be programmed to be automatically recognized and instrument settings configured.
Instrument standardization	Unique, patented instrument standardization provides accurate on-demand calibration to high resolution gas-phase spectral lines. Standardization on both wavelength calibration and instrument lineshape.
Inter-instrument calibration transfer	Instruments will reproduce the absorbance spectra of toluene ($6000\text{-}4100\text{ cm}^{-1}$, $1.7\text{ }\mu\text{m}$ - $2.4\text{ }\mu\text{m}$) in a 0.5 cm transmission cell at $28\text{ }^{\circ}\text{C} \pm 0.5\text{ }^{\circ}\text{C}$ to within 0.002A .
J-stop wavenumber correction	Removes expected frequency shifts of sharp bands that occur due to changing geometrical lineshape with optical resolution (J-stop) setting.
Automatic Atmospheric Vapor (AVC) compensation	Minimizes the effect of atmospheric water and CO_2 interference without the need for purging or reference spectra.
Extra-productivity switch	Unique Look-Ahead function detects when sample is placed in position and initiates scanning, enabling data to be collected while the operator is entering sample information.
General	Windows® 10 compatible.

BENCH DETAILS

Size (WxDxH)	520 mm x 600 mm x 300 mm. Additional bench space for power supply not required.
Weight	35 kg
Sample compartment	Full size sample compartment with quick-release cover and service access.

SAMPLING

IR Sampling	Internal sample compartment (standard). Configured for transmission using standard sample slide. Full size compartment with quick-release cover and service access. Variable beam diameter at focus (see Optical System above). Transmission configuration uses dedicated MIR detector. Compatible with dedicated Spectrum One/NTS/100/100N/Frontier sampling pods and a wide range of third party accessories.
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SOFTWARE	
Spectrum 10 instrument software	Single software platform for infrared data collection in a modern, configurable, easy to use environment with instrument control, data manipulation and flexible report and data export utilities. Includes powerful equation editor and macros to configure custom data calculation on spectra. A suite of optional software packages provide advanced capabilities or functions designed for specific application areas. Compatible with Windows® 10 platforms. See separate Spectrum 10 software note for further details.
Instrument control	Comprehensive suite of control functions with multi-level user interface, graphical display of optical element ranges for optimized operation, automatic instrument setup with smart sample accessories and configurable toolbar. A range of standard productivity features includes Sample Table allowing multiple sample data entry, Look-Ahead for faster data collection with multiple samples and instrument SmartPanel for remote operation.
Access control	Password-protected user login with local domain or Windows® system passwords. Access to methods and functions, toolbar and toolbox functions can be controlled by supervisor.
Reports	Quick-print facilities plus user-definable templates for customized reports.
Spectral processing	Range of derivative, smooth, subtraction, normalization, convert to wavelengths and other spectral data transforms available. Macro Editor and Equation Editor for custom operations.
Validation	Comprehensive IQ/OQ documentation and services available.
User training	HTML tutorials provide on-line training for common operations and maintenance. Context-sensitive help provides assistance throughout the software.
Optional Software Packages	
Quantitative analysis	Software for PLS and PCR quantitative method development.
Cloud connectivity	Cloud connectivity with NetPlus IR software