**Technical specification**

Terms and conditions:

Standard warranty: 12 months after installation, max. 15 months after delivery

Manufacturer: Bruker Optik GmbH

Country of origin: Federal Republic of Germany

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| **#** | **Qty** | **Item** | **Description** |
| 1. | 1 | V70V | Infrared Fourier Vacuum Spectrometer VERTEX 70v  Versatile FT-IR vacuum spectrometer VERTEX 70v for demanding applications in the analytical and research laboratory. All optics are gold coated for highest optical throughput. The standard spectral range covers 8,000 to 350cm-1. The following for the operation required components are included in the basic system price:  - Standard sample holder for transmission measurements (incl. standard 2x3“ pellet holder for 13 mm pellets) - MIR-KBr beamsplitter (T303/3) - Room temperature DLaTGS detector (D301/B) - High power IR source (glowbar)  - Laser: HeNe  - Interferometer: RockSolid, Michelson type with cube-corner mirrors, permanently aligned (w/o need of compensations techniques like dynamic alignment). Wear-free mirror movement mechanism. - Aperture wheel with 12 positions - Validation wheel with 6 positions - Scan speed: 8 velocities standard, 1.6 – 80 kHz (1.0 - 50mm/s opd); Optional: 12 velocities, 1.6 - 160 kHz (1.0 - 100mm/s opd)  - Wavenumber accuracy better than 0.005 cm-1 @ 1,554 cm-1 - Photometric accuracy better than 0.1% T  - Signal-to-Noise 55,000:1 (1 min, 7.8 x 10-6 AU noise) peak-to-peak - Vacuum optics bench with oil-free vacuum pump  - Sample compartment and internal optics compartment with detector, interferometer, source and beamsplitters can be evacuated separately - Vacuum: Contamination free, better than 0.2hPa (mbar), control by two pressure sensors  - Five output ports at the right, front and left side of the optics bench, software selectable  -Two input ports at the right (uses aperture and optical filter wheels) and rear side of the optics bench, software selectable  - Automatic Accessory recognition (AAR) for the sample compartment  - Automated and continuous monitoring of instrument performance (monitoring of individual components e.g. source, inteferometer, laser, electronics, detectors) and level of humidity  - Communication with data station via ethernet cable (TCP/IP protocol). Instrument has unique IP address. - OPUS/IR software package Range extension packages are available to extend the measurement region from the very far- to the near-IR as well as the visible and ultraviolet regions (28,000-10cm-1). Standard resolution is 0.4cm-1 with an option for 0.16cm-1. A scan rate of more than 20spectra/s at 8cm-1 spectral resolution is standard and can be upgraded to higher rates of 70 spectra/s at 16cm-1. For kinetic experiments in the microsec and nanosec range optionally the Step-Scan technique is available. See document "Vertex 70v Specification and Options" for detailed description of the instrument specification and available options.  For control of the spectrometer optics and signal processing a PC-based data system which might be quoted below is required (we recommend to order the data system with the spectrometer optics in order to make sure that the system performs flawlessly). The requirements for a suitable the data system are available on request. |
| 2. | 1 | A225/QHP | Platinum-ATR Universal accessory, Diamond, 1 bounce, high pressure clamp, QuickLock  The Platinum-ATR Universal accessory facilitates the infrared spectroscopic analysis of virtually any liquid and solid sample. The universal high pressure clamp generates intimate sample contact with the robust and inert diamond ATR measurement interface. Next to powders and films the module even allows the analysis of particularly hard specimen, like polymer pellets/ granules, and variably shaped parts.  Specifications: - Diamond monocrystal, single reflection, edged in tungsten carbide (mechanically fixed w/o need of any glues or adhesives).  - Work disk: stainless steel - Spectral range: 10-10,000cm-1 - Slip clutch high pressure applicator - Exchangeable pressure stamps; flat surface for powders, films and shaped parts, conical surface for pellets and granules - Working distance (max. sample height) >20mm - Easy cleaning due to the rotatable pressure applicator - Easy unit exchange due to QuickLock mount - Purgeable and sealed beam path  Recommended: - I20631 raised sample compartment cover for T27/37 and V70/80 - 1826986 raised sample compartment cover for TENSOR II - W170/I raised sample compartment cover for INVENIO Required for vacuum spectrometers: - W170/8V raised sample compartment cover for work under full vacuum or - Vented sample compartment with W160/8V or W163/V with F131-x flange and windows |
| 3. | 1 | A225-RS | Attachment for ATR anvil die, screw-on type Useful for reaction sensitive samples and measurement of fine powdered samples under inert condition or in vacuum. |
| 4. | 1 | A528/Q | Harrick Research Diffuse Reflectance Accessory "Praying Mantis", 20% diffuse reflection efficiency with QuickLock base plate.  - includes standard sample holder for routine DRIFTS measurements  - possibility of purge (e.g. nitrogene/dry air) Optional reaction chambers: - A528-V: High Temperature, Low Pressure Reaction Chamber (HVC-DRP-5) for operation from high vacuum (133µPa or 10-6 torr) to 133kPa (2 ATM) and at temperatures up to 910°C (under vacuum). Readily adapted for operation up to 3.44MPa (500psi) with a high-pressure dome assembly. - Low Temperature Reaction Chamber (CHC-CHA) for studies from high vacuum (133mPa or 10-6 torr) to 133kPa (1 ktorr) and at temperatures from -150°C to 600°C (under vacuumCHC-CHA-3 (not available for vacuum spectrometers) |
| 5. | 1 | A528-V | High temperature reaction chamber Model HVC-DRP-5 for Harrick "Praying Mantis" (A528), including adaption for purge systems, temperature control unit (230/110V), 24V output Temperature: up to 910°C (under vacuum) Pressure: high vacuum (133 mPa or 10-6 Torr) to 133 kPa (1 kTorr)  Enables control of the atmosphere above the sample. Windows: KBr, echangable Required: - For vacuum spectrometers: Vented sample compartment with W160/8V sample compartment shutter or W163/V flanges and F131-x windows Recommended: - S134 Cooling unit with #1890011 tubing set (for heating only) - Temperature control software A528-VS for ATC 024-3/4" |
| 6. | 3 | 300664 | Windows ZnSe 15 X 2 for A528-V |
| 7. | 1 | A528-VS | Software for use with the Harrick Temperature Controller (ATC-024-3/4 models) and the Bruker OPUS software. Designed for integrated experiments, it enables user-defined time and temperature profiles, triggering data acquisition of the Bruker spectrometer at selected time intervals and /or temperature set points. Once the OPUS configuration file and the Temperature Controller are set up, the software allows the user to establish and execute a sequence of events. The events include changing the set point temperature, collecting the background, collecting the sample spectrum and pausing (based on either elapsed time or clock time). The sequence(s) can be saved and modified as needed.  Required: - Temperature Controller ATC-024-3/4 (included in A528-V) - Opus 7.2 or later |
| 8. | 1 | S134 | Cooling unit for liquid cooled sources and emission adapter A540/x and for A528-V water recirculator; 100/230V, 50/60Hz Up to 2 sources and/or emission adaptors can be connected in series |
| 9. | 1 | 1890011 | Tubing set for A528 and S134. |
| 10. | 1 | W105/Z | Unit for selecting an additional IR detector in position 2 (without detector) Required for liquid N2 cooled detectors with hold time of 12h: - D100-x/Z for VERTEX 70/80 - D100-M/8V for VERTEX 80v/70v |
| 11. | 1 | D316/B | MCT detector, medium band Liquid N2 cooled Spectral range: 12,000-600cm-1 D\*: >2x10\*\*10cm Hz1/W Hold time: typically 8h Integrated amplifier and digitizing electronics Required: - For INVENIO: W105/I additional digitect detector position or accessory/external module with suitable digitect detector position. Recommended accessory: D126 evacuation valve. |
| 12. | 1 | 1840699 | Praying Mantis Purge Shield for the High Temp Reaction Chamber |
| 13. | 1 | 1869638 | Front Cover for the sample compartment of VERTEX 70v/80v vacuum spectrometers in combination with the Harrick high temperature reaction chamber A528-V. The front cover allows for experiments keeping the complete optical path of the spectrometer under vacuum. The front cover includes feed throughs for all connectors of the reaction chamber: - cooling water - 3 gas in-/outlets - heating connector - thermocouple connector  Required: - A528/Q Harrick Research Diffuse Reflectance Accessory - A528-V High temperature reaction chamber - W163/V Window flanges (2 pieces) for permanent sealing  Recommended: - A528-VS Software for use with the Harrick Temperature Controller |
| 14. | 1 | W170/8V | Sample compartment cover, raised and vacuum tight for operation under vacuum condition, sample compartment internally raised by approx. 70mm For VERTEX vacuum spectrometer series |
| 15. | 1 | W240-T/BDV | Wide band spectral range extension VERTEX FM for mid-IR and far-IR Covers spectral range from 6.000-50cm-1 w/o any exchange of optical components, optionally extendable up to 9,200cm-1 (requires Tungsten source Q428/7), suitable for spectral resolution up to 0.9cm-1, improved signal to noise ratio at 610cm-1 compared to W240/BDV. Including: - T240-T/3 Wide-range beamsplitter instead of standard KBr beamsplitter (T303/3) - D201/BD Wide-range room temperature DLATGS detector instead of standard DLaTGS (D301/B) - W160/8V Automatic shutters with optionally exchangable inserts (windows F131-X must be selected) Recommended: - 1814583 FIR test sample - F131-x window, 2 pieces  In combination with internal and external accessories like HYPERION (A670-x), Aquaspec (A741/Q), BioATR (A737/Q and A729/Q), HTS-XT (A750/B), PMA50 (A173/B) and TGA coupling (A587x and A588x), the standard KBr beamsplitter T303/3 is required.  For VERTEX 70v Vacuum spectrometer only (ex works) Can not be combined with HR option S125/Z, W304/Z-U and D301T/BU |
| 16. | 1 | T303/3 | Standard KBr beamsplitter (standard) Spectral range 8.000-350cm-1 For VERTEX 70 spectrometer series. |
| 17. | 1 | S239/V | Interferometer cover with BMS-opening Interferometer cover with rotatational opening for easy acces to the beamsplitter and the storage position for 2 BMS inside the interferometer compartment. Only for VERTEX 70v vacuum spectrometer. |
| 18. | 2 | F131-5 | KBr window, 49.5mm diameter for window flange W162/V, W163/V or W162/8V |
| 19. | 2 | F131-9 | Polyethylene window, 49.5mm diameter for window flange W162/V, W163/V or W162/8V |
| 20. | 1 | A101 | Evacuable pellet die for 13mm pellets |
| 21. | 1 | DEW | Dewar vessel 20l incl. drain valve |
| **Software and PC** | | | |
| 22. | 1 | CS81/29+ | Control Data System, High-Performance Dedicated and optimized data station for work with spectrometers / microscopes. The connection of the data station is done already during the assembly of the device. This allows you to deliver a complete and tested solution for users.  This reduces device installation time and speeds implementation for user needs. Specifications: - Intel i7 processor, 8 x 3.0 GHz (or better), x86-64 compatible, PassMark CPU min 16500. - 64GB RAM - 256GB SSD or better - 1TB Hard Drive or better - CD/DVD writer - 23.8" min. TFT display, 16:9 resolution (1920x1080) or 16:10 (1920x1200), LCD with IPS or PLS panel and LED illumination, HDMI; Response time max. 7 ms; Brightness min. 250 cd/m2 - 2 or more USB 3.0, 4 or more USB 2.0 (or better); 2x RJ-45 Network (100/1000Mb Ethernet.); 2 DisplayPort; Line-in (stereo/microphone), Line-out (headphone/speaker) - 1x PCIe 16x - 1x PCIe 4x - 1x PCIe 1x - Operating System: Windows 10 Enterprise (64 bit) or better  (only available with order of spectrometer) |
| 23. | 1 | CS81/29 PC | Data System, High-Performance  - Intel i7 processor, 8 x 3.0 GHz (or better), x86-64 compatible, PassMark CPU min 16500. - 64GB RAM - 256GB SSD or better - 1TB Hard Drive or better - 23.8" min. TFT display, 16:9 resolution (1920x1080) or 16:10 (1920x1200), LCD with IPS or PLS panel and LED illumination, HDMI; Response time max. 7 ms; Brightness min. 250 cd/m2 - 2 or more USB 3.0, 4 or more USB 2.0 (or better); 2x RJ-45 Network (100/1000Mb Ethernet.); 2 DisplayPort; Line-in (stereo/microphone), Line-out (headphone/speaker) - 1x PCIe 16x - 1x PCIe 4x - 1x PCIe 1x - Operating System: Windows 10 (64 bit) or better |
| 24. | 1 | O/IR8+ | OPUS/IR, FT-IR Spectroscopy Software Package version 8: newest released OPUS version 8.x for this spectrometer type.  OPUS is integrated all-in-one software for the spectrometer control and for the acquisition, processing, evaluation and reporting of IR-spectroscopic data in laboratory and process environments and is compliant with cGMP/GLP/GAMP regulations such as 21 CFR Part 11 and the FDA data integrity guideline.  OPUS is easy to use:  - Compatible with OS Windows 10  - Configurable user interface and access to executable functions  - Automated accessory recognition  - Automatic consistency-test of measurement parameters - Multi Tasking: Measurement and data manipulation/evaluation at the same time - Step-by-step analysis assistant for quality control applications  OPUS delivers reliable measurement results in a short time: - Single and repeated measurements  - Advanced setting of measurement parameters - Auto sampler support  OPUS provides versatile functionality for efficient data analysis:  1.) Interactive functions for comfortable data processing and pre-processing, such as - Automated advanced atmospheric correction for water vapor and CO2 in MIR without the need for reference spectra - Normalization, baseline correction, derivative calculation and spectra subtraction - Averaging of spectra - Spectrum calculator  - Advanced ATR correction algorithm (correction of wavelength shift, baseline shape and compensation of anomalous dispersion phenomenon).  2.) Wide range of data evaluation methods for generation of clear results, e.g.: - Single and multiple peak picking, interactive and automated modes  - Spectra comparison method for material verification - Library search for material identification, User specific library set- up and editation. - Free starter libraries - Spectra interpretation tool - Analyze peak areas and heights and widths, quantitative analysis (Lambert-Beer's Law) - Automated multi-step and multi-method evaluation of spectra (MultiEvaluation) - Curve fit  3.) Easy-to-use tools for reporting and data exchange - Analytical report generation with predefined print layouts, customizable - Easy export of spectral data and evaluation results to other programs - Option to store spectral data and evaluation results either in an internal or a user-defined database  OPUS is validated software and supports the validation of the spectrometer: - Fully automated test routines and setup for operational and performance qualification (OQ, PQ) - Permanent instrument status indicator, online monitoring of system performance  OPUS is compliant with cGMP/GLP: - Multi level user management, log-in with user name and password, separated administrative and measurement /evaluation functionality - Audit trail (history log function) of system and user, spectra, measurement parameters and evaluation methods - Data integrity mode (ALCOA principle) with protected data pool (OPUS/VALIDATION required) - All data, incl. manipulation and evaluation results, stored in ONE file - Electronic signature of spectra and methods; 21 CFR Part 11 compliance (OPUS/VALIDATION required)  OPUS supports user during daily routine work: - Run, create and edit macros and VB scripts - Automated execution of repeated actions via calendar - Lab journal functionality - Online help - Multimedia FT-IR tutorial  - Easy import and export of spectra  This OPUS software package is included in the standard delivery of the spectrometer system.  Note: 32 Bit Microsoft Office versions are not compatible with OPUS 8 and must not be installed on the same computer. Bruker does therefore take no liability for this unsupported software combination. |
| 25. | 1 | 1025048 | ATR-FTIR-Library COMPLETE (ATR-LIB-COMPLETE+) includes ATR spectra from polymers, monomers, additives, plasticizer, fillers, building materials, cosmetics, excipients, organic and inorganic chemicals, biochemicals, fibres, proteins, fatty acids, lipids, ingredients, natural products, silicon containing compounds, solvents, pesticides, pollutants, semiconductors, dyes, paints, coatings, food, food additives, minerals, lubricants, surfactants, kidney stones, pharmaceuticals and drugs. > 26,000 ATR-FTIR-Spectra of solids and liquids; requires OPUS 7.2 or higher; only available with order of spectrometer |
| 26. | 1 | O/QU-N | OPUS/QUANT, quantitative analysis software using a full spectrum multivariate analysis (PLS) method for setting up models. Provides a wide range of pre-processing and validation options and offers an automatic routine for the optimization of calibration methods. |
| 27. | 1 | O/SR-N | OPUS/SEARCH, Software Package for comprehensive search functionality in spectra libraries Completes the basic Search functions in OPUS with - Mixture analysis: Identifies and quantifies single components in mixture spectra. To visualize the quality of the match a composite spectrum from the library component spectra and the difference spectrum between composite and query spectrum (=residual) are calculated. - Peak search: Search of user defined peak tables. Includes intuitive set-up of peak tables by interactive peak pick on one or several reference spectra. - Information search: Powerful and intuitive search of terms and numbers in the complete information matrix of one or several spectral libraries. Includes option for advanced info search for accurate discovery of specific information. - Unlimited set-up and editing of user spectra libraries. The user is guided through an intuitive set-up procedure. Contains the option to import info tables from external programs by copy & paste. - Structure search: Allows searching of chemical structures stored in spectra libraries. - Library browser: Function to view library content and to maintain user libraries. - Library validation: Function to evaluate the differentiation power of the spectral library.  Options: OPUS/STRUCTURE, software package for creation of structures  Recommended: One or several spectral libraries adequate to application and measurement technique. The ATR-FTIR-Library COMPLETE provides a comprehensive data base of reference spectra and information for almost all ATR-applications. |
| 28. | 1 | O/RM | OPUS Reaction Monitoring for interactive analysis of chemical reactions. Enables acquisition and processing of time-resolved 3D spectra. The 4-window view with spectra, trend, 3D, and event-log view offers the operator a fast and complete overview about the measured and analyzed data. Different data preprocessing, traces, integration methods or PCA analysis can be interactively used to analyze the measured data. Required: OPUS 7.0 or higher Validation is not available for O/RM! |
| 29. | 1 | O/NLU | OPUS, add. license Includes all OPUS software packages and Bruker spectral libraries that are registered in the original license. Excludes spectral libraries that are dongle-protected (from vendors other than Bruker) for schools and universities only |
| **Others** | | | |
| 30. | 1 | S881 | Warranty Extension to 10 Years for Interferometer Covers material costs on the replacement of defective parts of the scanning mechanism of the interferometer. The warranty starts with delivery of the spectrometer. |
| 31. | 1 | S882-P | Warranty Extension to 10 Years for Platinum ATR A220/Dx or A225/Qx, or W112/Ix with diamond ATR-crystal. Covers material and labor costs in case of potentially necessary repairs in the Bruker factory. Defects resulting from improper operation are excluded from this. The warranty starts with the delivery of the accessory. |
| 32. | 1 | INS | Installation, training and support The installation is performed by a service technician certified by the manufacturer Bruker Optics. The output of the installation are test protocols confirming the correct functionality of the instrument. Part of the installation is the customization of the instrument and software - adjusting the work environment, setting the necessary functions in the software, creating user accounts, etc. Part of the delivery is also a wide support provided from the headquarters of Optik Instruments in Brno. This standard support explicitly includes: - 3 days of training for up to 6 persons directly at the place of installation of the instrument - free participation for 1 pers. on the Training of Basic Skills in FTIR and Raman Spectroscopy and 1 pers. on the Training of Advanced Skills in OPUS Spectroscopic Software. - free participation for 2 pers. at the Bruker FTIR and Raman User Meeting. - telephone consultations and remote problem diagnosis - ensuring service and availability of spare parts (10 years)   Possibility of extension by service contracts including annual maintenance of the device, or by individual application trainings at the customers site, etc. |
| 33. | 1 | TRANS | Packaging, transport, insurance |

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Optik Instruments s.r.o.