# Nicolet FT-IR Spectrometer

## The Power of FT-IR

Highest FT-IR Performance

Multiple Spectral Ranges

Smart Accessories

Microscopy/Imaging, Raman, GC-IR, TGA-IR

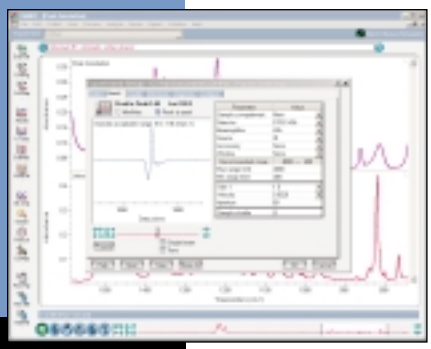
Advanced Experimentation –
Step Scan, VCD, VLD, IRRAS

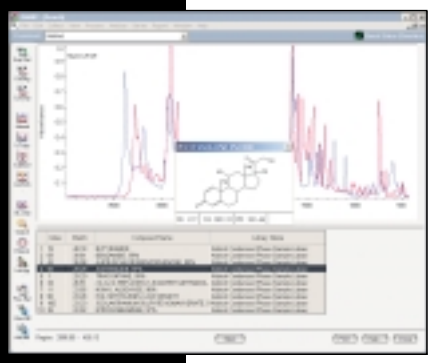
# POWERFUL PERFORMANCE

Nicolet™ FT-IR spectrometers from Thermo Electron Corporation are the highest performance FT-IR systems available. While the spectrometer has the power to handle the most advanced research-level experiments, routine analyses are performed just as conveniently. Every facet of the Nicolet FT-IR spectrometer has been engineered to facilitate sample handling, introduce options to scientists, and increase laboratory throughput.


## Nicolet FT-IR

Reproducible results speak directly to the bottom line of the laboratory. Stability, reproducibility and throughput have guided the design of Nicolet FT-IR spectrometers.





***ETC EverGlo* Source***

- Electronically controlled stability
- Rest mode
  - *– Extended lifetime*
  - *– Greater reliability, lower maintenance*
- Turbo mode
  - *– Higher performance on tough samples*

***Gold-Coated Optics***

- Highest throughput

***Precision-Cast Baseplate***

***Continuous Dynamic Alignment***

***High Performance Detectors***

- TE cooled technology – high stability
- Patented dual technology – over 12-hour hold time

***Enhanced Synchronous Protocol (ESP)***

- Real time feedback on all aspects of the analysis

***Integrated Scan Buttons on the Spectrometer***

***USB 2.0 Interface***

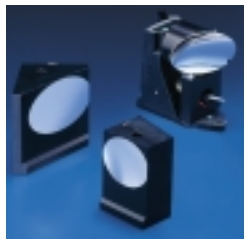
***New OMNIC™ Features:***

- Advanced ATR correction
- Integrated curve fitting for spectral analysis
- Enhanced reporting and annotation

## Superior Optics

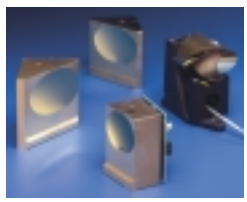
All Nicolet FT-IR systems can be configured for multiple spectral ranges, with the option of gold-coated or aluminum mirrors:

- Far-IR
- Mid-IR
- Near-IR
- UV-Visible



### Precision-Cast Optics

- Unmatched reproducibility
- Pinned-in-place
- Compact optical path
- Monolithic diamond-turned mirrors
- Permanent alignment
- Highest throughput



** Patent Pending*

# INTUITIVE SOLUTIONS

## Smart Beamsplitters

Smart Beamsplitter technology allows each beamsplitter to be recognized. The system automatically configures and optimizes performance.

| BEAMSPLITTER | HIGH ($cm^{-1}$) | LOW ($cm^{-1}$) |
|---|---|---|
| Ge-on-KBr | 7800 | 350 |
| XT-KBr | 11000 | 375 |
| Quartz | 27000 | 2800 |
| Si-on-$CaF_2$ | 14500 | 1200 |
| ZnSe | 6000 | 650 |
| CsI | 6400 | 200 |
| Solid-Substrate™ | 700 | 15 |

## Smart Detectors

Detectors are recognized instantly on installation. Electrical connection is made at once and the correct beam path is selected.

New thermoelectric design allows for rapid response of the detector, improving the stability and accuracy of results.

| DETECTOR | HIGH ($cm^{-1}$) | LOW ($cm^{-1}$) |
|---|---|---|
| DLaTGS | 12500 | 350 |
| TE-cooled DLaTGS | 12500 | 350 |
| MCT-High D* | 11700 | 800 |
| MCT-A | 11700 | 600 |
| MCT-B | 11700 | 400 |
| Time-resolved MCT | 11700 | 650 |
| Silicon | 27000 | 8600 |
| PbSe | 13000 | 2000 |
| InGaAs (1.9 µm) | 12000 | 5300 |
| InGaAs (2.6 µm) | 12000 | 3800 |
| InSb | 11500 | 1850 |
| CsI | 6400 | 200 |
| Poly(ethylene) | 700 | 50 |
| Si bolometer | 600 | 15 |
| Photoacoustic | 10000 | 400 |

## External Beam Options

All external beam mirrors are motorized and controlled through the software allowing for rapid reconfiguration of the system.

### Five External Beam Options

- Emission port
- Right-side Passport™
- Left-side Passport
- Front-facing external port
- Front-facing external detector port

## Environmental Options

Nicolet FT-IR offers system purge and a sealed and desiccated option to meet the needs of your climate, laboratory environment, and sample type. The unique Smart Purge option optimizes and speeds up purge recovery without requiring you to close off manual purge ports. Smart Purge senses when you are changing samples and automatically turns up the purge. This ensures rapid recovery of purge – in a few seconds!

## Smart Accessories™

Smart Accessories snap into your Nicolet FT-IR system and give you uncompromising sampling performance. Using innovative technology unique to Thermo Electron spectrometers, Smart Accessories provide the highest optical throughput and sampling flexibility. Smart Accessories are pinned-in-place and permanently aligned, ensuring your results are reliable and reproducible. The smart system automatically recognizes the accessory and loads the correct operating parameters for your unique experiment. It then performs a set of quality checks to verify that the accessory and system are working optimally. With over 18 and counting to choose from, there is a Smart Accessory for almost any sampling need:

- Transmission
- Diffuse Reflectance
- Diamond HATR
- Single bounce ATR
- Multiple bounce ATR
- Specular reflectance
- Mid-IR fiber optics
- Near-IR fiber optics

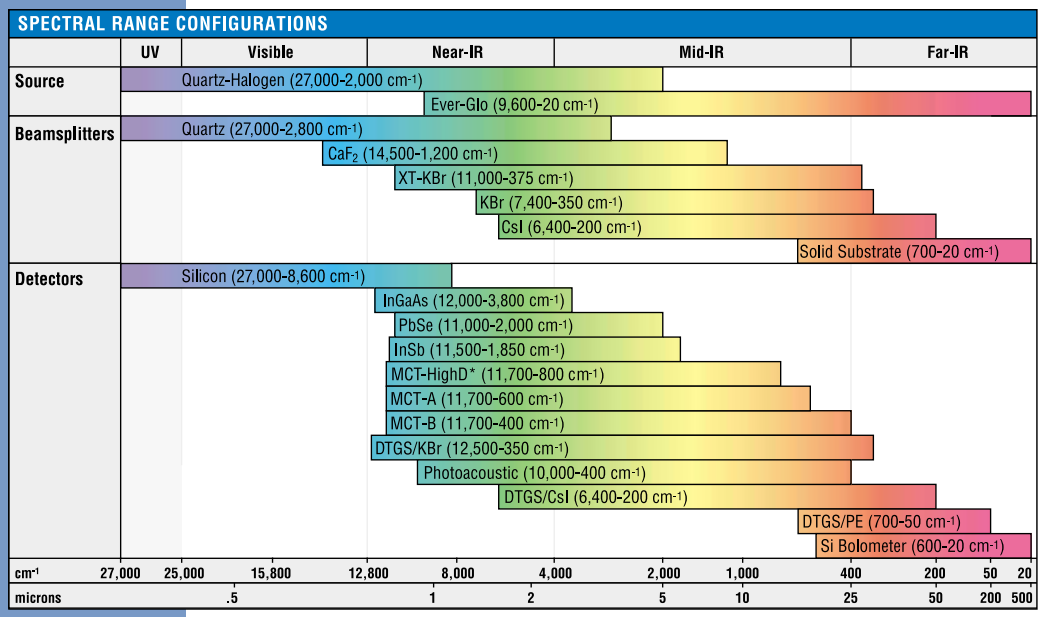
Smart Accessories are the cornerstones to successful sample handling. Thermo Electron's Smart Accessory standard is supported by all major accessory vendors.

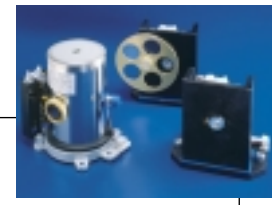
# Sampling Ergonomics

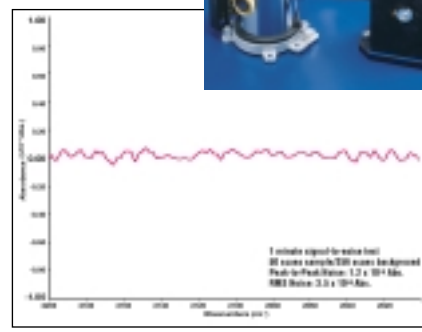
*Thermo Electron proudly takes you on a trip into the most powerful FT-IR spectrometer.*


*Unleash The Power*

# Productivity & Efficiency





## Standard Accessories

- Accommodates all commercially available accessories
- Smart Purge keeps sample environment stable during sample or accessory changes
- Compatible with Nicolet FT-IR accessories for the added benefit of accessory recognition
- Multimedia tutorials and training

## Smart Accessories

- Snap-in installation and pinned, permanent alignment
- Automatic accessory recognition and experiment setup
- High throughput, high performance
- Spectral quality checks
- Fast, automatic purge (on purged systems)
- Multimedia tutorials and training

## High-Performance Electronics

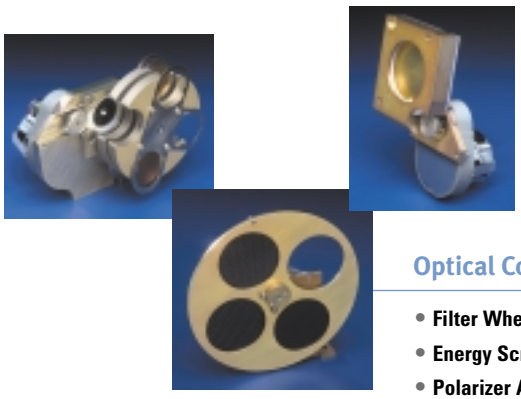
- 24 bit A/D converter
- 500 KHz A/D speed
- Blazing speed USB 2.0 interface
- Energy efficient
- Fully upgradeable

## Qualification and Regulatory Compliance

- DQ, IQ, OQ software, services and documentation to facilitate regulatory audits
- Automated performance testing and tracking for proof of performance
- Comprehensive 21 CFR Part 11 compliance tools for meeting regulatory requirements in the pharmaceutical industry

## Smart Detectors

- Automatic detector recognition and beam path setup in any position
- Detectors for applications covering: Mid-IR, Near-IR, Far-IR, UV/Vis
- High-performance TE cooled detectors. Faster cooling using less power – higher stability, quicker response time

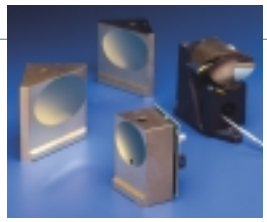


## Optical Configuration Options (software controlled)

- Filter Wheel: multiple high or low pass filters
- Energy Screen Wheel: multiple screens for IR beam attenuation
- Polarizer Accessory: rotation of filter at 1 degree intervals

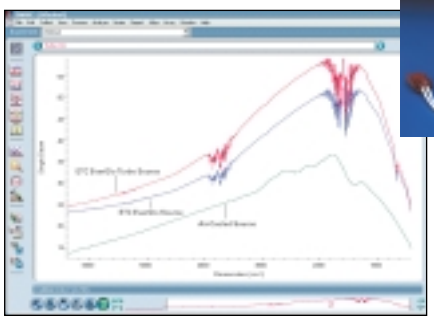
## Vectra-Piezo Step-Scan Technology

- Best performance in the industry
- Better than 0.2 nm positional stability
- 5 to 1,000 Hz phase modulation
- 0.5 to 3.5 $\lambda_{HeNe}$ phase modulation amplitude



## Smart Sources (ETC EverGlo*)

- More efficient than water-cooled sources
- Electronically controlled stability
- User-controlled rest mode – longer lifetime (five-year warranty)
- Turbo-mode option

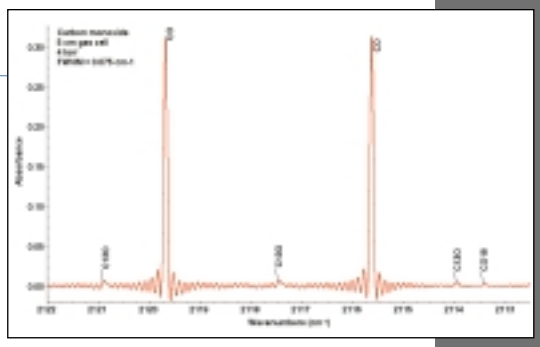


** Patent Pending*

# Innovation & Support

## High Performance Interferometer – Dynamic Alignment

- Dynamic alignment – a MUST for research FT-IR
- Exceptional high-resolution line shapes
- Superior long-term and short-term stability
- Easy beamsplitter interchange mechanism
- Automated diagnostics for peak performance



## Smart Beamsplitters

- Beamsplitter auto-recognition and setup of the spectral range
- Instant alignment
- A variety of beam-splitter options for full spectral range coverage
- Swap beamsplitters in less than 10 seconds

## Continuing Support

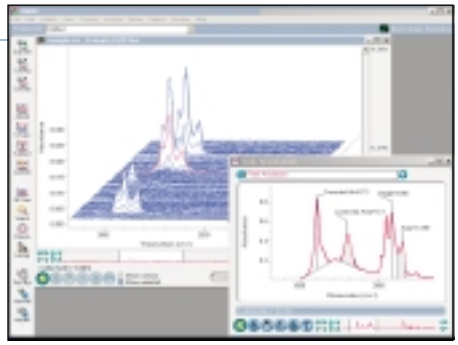
- Maintenance contracts
- Validation programs
- A variety of training options
- Internet support
- Trained and certified field service experts

## Precision Cast Optics

- Pinned-in-place – no adjustments or glue
- Automatic optimization of optical signal
- Installation, testing and optimization of any component in under 15 seconds
- Reproducible results
- Up to five external beam ports

## System Software

- Powerful and flexible OMNIC software
- Unprecedented integration with spectrometer
- Expandable with built-for-purpose add-ons
- Intuitive operation



## Manufacturing Excellence

- ISO 9001 certified design and manufactured hardware and software
- Certified Product Development Process
- More than 10,000 installed FT-IR systems worldwide

# FUTURE PROOF

The Nicolet FT-IR spectrometer has full upgrade potential. Thermo Electron is the only FT-IR spectrometer manufacturer who can offer you true upgradeability from the basic unit to a fully loaded advanced research system at any time as your needs change. This is possible because all Nicolet FT-IR spectrometers share a common optics and electronics platform.

Nicolet FT-IR Spectrometer with Nicolet Continuμm XL Imaging System and FT-Raman Module

Start with the basic system, and when your needs grow, you can add multiple beamsplitters, detectors and sources for expanded spectral range. You can add microscopy imaging, gas chromatography (GC-IR), thermogravimetric analysis (TGA-IR), FT-Raman, and polarization modulation (PEM Module) capabilities. You can even add step-scan capabilities to your system for advanced applications, such as time resolved spectroscopy (TRS), dynamic polymer rheology and phase modulation photoacoustic spectral (PAS) depth profiling.

## External Experiment Options

- Infrared Microscopy
- Infrared Imaging
- Step Scan
- FT-Raman
- ns TRS
- GC-IR
- Phase modulation PAS
- TGA-IR
- Sample modulation
- PEM module (IRRAS, VCD, VLD) (polymer stretching)

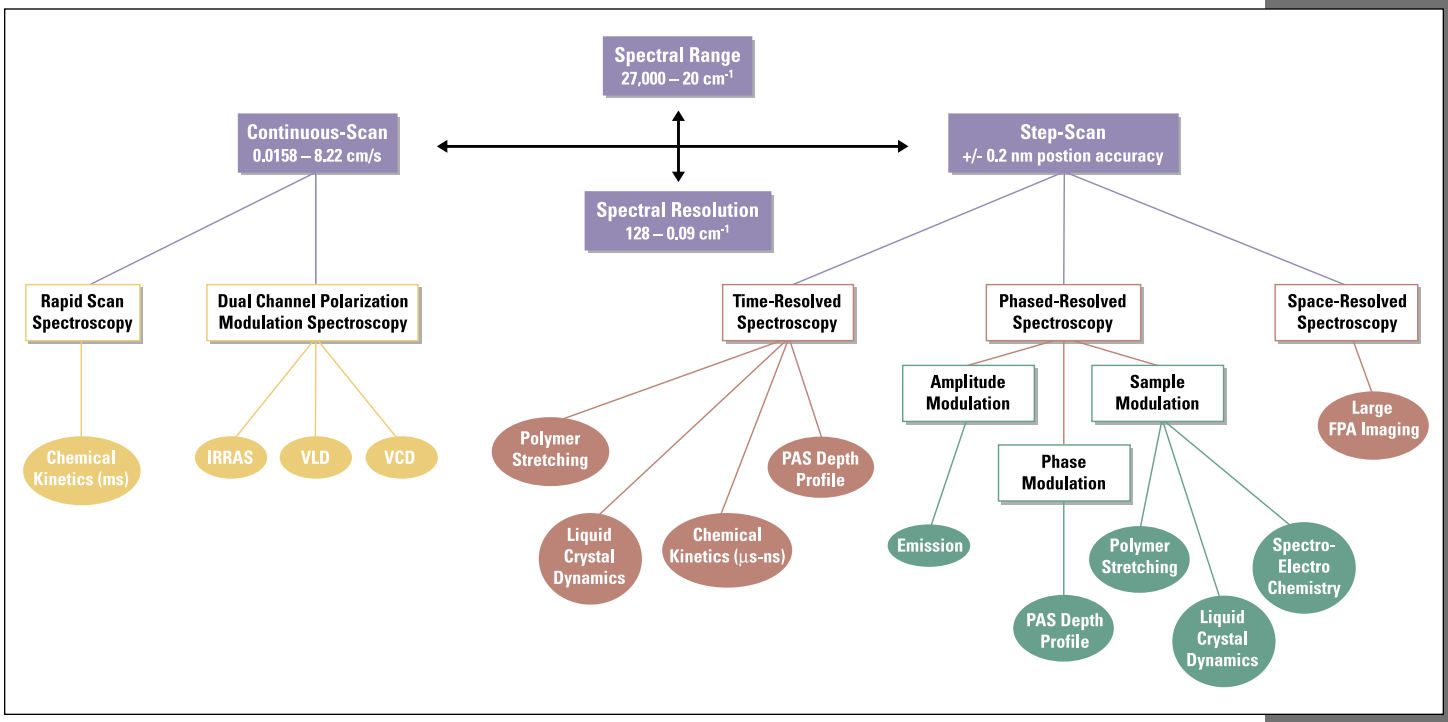
Every Nicolet FT-IR spectrometer can take advantage of all advanced capabilities available, whether part of the original system configuration or added at a later date.

Nicolet FT-IR Spectrometer with TGA Interface

Nicolet FT-IR Spectrometer with GC Module

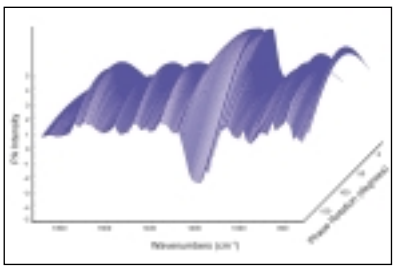
# ADVANCED APPLICATIONS

Research-grade Nicolet FT-IR spectrometers offer a full range of step-scan operation modes for time-resolved, phase-resolved and space-resolved experiments, and dual-channel continuous-scan mode for polarization modulation/demodulation experiments, as well as conventional single-channel continuous-scan operation for conventional applications.

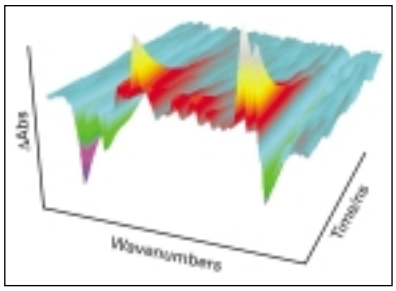



**There are nine, typical experimental categories, including:**

1) Extended spectral range experiments (27000 – 15 $cm^{-1}$, i.e. from far-IR up to near ultra violet)
2) High resolution spectroscopy (better than 0.09 $cm^{-1}$ for gas phase measurements)
3) Single-channel rapid-scan kinetics (77 spectra/sec at 8 $cm^{-1}$ spectral data resolution)
4) Dual-channel polarization modulation spectroscopic experiments (IRRAS, VLD, and VCD, absorbance level on the order of $10^{-3}$ to $10^{-5}$)
5) Step-scan amplitude modulation (electroluminescence measurement)
6) Step-scan phase modulation (photoacoustic depth profiling)
7) Step-scan sample modulation (polymer stretching, liquid crystal dynamics, and spectro-electrochemistry)
8) Step-scan time-resolved spectroscopy (ns chemical kinetics, polymer stretching, liquid crystal dynamics and photoacoustic depth profiling)
9) Step-scan space-resolved spectroscopy (focal plane array detector-based IR imaging)

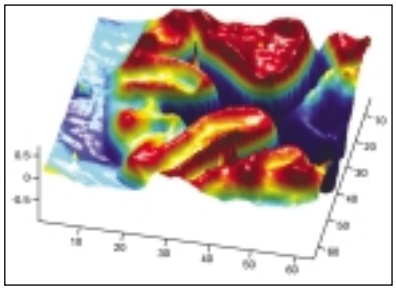


Phase-resolved FT-IR




Time-resolved FT-IR

*Data courtesy of Dr. Mike W. George of the University of Nottingham (UK).*



Space-resolved FT-IR

# Thermo Electron – The Leader in FT-IR

Thermo Electron, through its line of Nicolet FT-IR spectrometers, is the worldwide leader in FT-IR instrumentation. Smart firmware, user-friendly software, and robust hardware come together to create the most powerful tools for applying FT-IR solutions to chemical identification problems. With more than 10,000 systems installed and an unparalleled reputation steeped in a rich heritage, it is no surprise that Thermo is the best-rated FT-IR company.

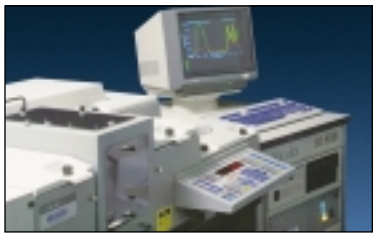
## FT-IR Spectrometers

**Nicolet FT-IR**
High-performance FT-IR-multiple ranges, Imaging, Raman, Step Scan capabilities

**Nicolet Avatar™**
First, smart FT-IR with fully integrated accessories

**Magna™**
OMNIC software – revolutionized reproducibility with unique pinned-in-place optics

**5PC**
First precision-cast baseplate with PC-based system



**60 SXB**
First highly flexible research FT-IR with microprocessor

**Nicolet 7199**
First FT-IR including real time data acquisition system

Present

1970

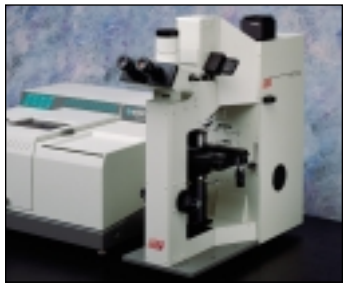
## FT-IR Microscopes

**Nicolet Continuμm™ XL**
Novel imaging design and uncompromised spatial resolution

**Nicolet Centaurμs™**
10X objective with integrated video and binocular viewer, and swappable ZnSe, Ge, Si ATR

**Nicolet Continuμm**
Unmatched spatial resolution, simultaneous sampling and viewing, dual detectors, infinity corrected

**Nic-Plan**
Introduced remote sample aperturing with grazing angle and ATR objective



**IR-Plan Advantage**
First IR microscope with Redundant Aperturing and Reflachromat feature

*In addition to these offices, Thermo Electron Corporation maintains a network of representative organizations throughout the world.*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