
# Magna-IR® Advanced Experiments - Photoelastic Modulation

*A powerful research system for dual-channel spectroscopy*

The Magna-IR 860 spectrometer combines high performance and advanced data collection technology with unlimited research capabilities. Multiple digital signal processors (DSP) provide data collection and signal control for the Magna-IR 860 SST™ module, providing simultaneous digitization of two spectroscopic channels of information during linear scan experiments. The OMNIC® SST with PEM (photoelastic modulation) Experiments package provides the ability to collect multiple channels of information at single sampling points.

Independent selection of the on-board computer high-pass. low-pass and gain parameters for each channel can be performed in the simultaneous data collection experiment. These parameters (along with the existing single channel collection parameters) allow the researcher to optimize performance for the various PEM experiments. Simultaneous measurement of two channels reduces the time required to perform the experiment. It also minimizes spectral artifacts of time dependent atmospheric and spectrometric deviations occurring during the measurement period which are more apparent in experiments which use sequential data collection. Digital dynamic alignment of the interferometer during linear data collection provides outstanding long-term stability for dual channel spectroscopy.

Powerful Research OMNIC software for the Magna-IR 860 provides a fully Windows® compatible interface for data collection and processing. A supplemental channel of spectral information may be collected and reprocessed using the functions available in OMNIC software. Applications for multiple channel data collection techniques include Polarization Modulation Infrared Reflection Absorption Spectroscopy (PM-IRRAS), Vibrational Circular Dichroism (VCD) spectroscopy and Vibrational Linear Dichroism (VLD) spectroscopy. These experiments require the use of an infrared photoelastic modulator which may be included as a part of an experiment configuration from Nicolet. A range of sampling optics and electronics is available for double modulation experiments on the Magna-IR 860 spectrometer.

Polarization Modulation Infrared Reflection Absorption Spectroscopy (PM-IRRAS) experiments are used in the characterization of monolayers and thin films. In PM-IRRAS experiments, a photoelastic modulator generates alternating linear states of polarized light. This light illuminates the sample at grazing angle to optimize sample absorption. The difference between the spectrum of the sample at both polarization states is measured and then divided by the steady state (background) spectrum to produce the resulting PM-IRRAS spectrum.

Vibrational Circular Dichroism (VCD) spectroscopy measures the optical activity of chiral molecules. The VCD spectrum is a measurement of the difference in molecular absorption of left- and right-circularly polarized light. The resulting absorption difference can have a positive or negative sign. The difference between the spectrum of the sample at both polarization states is measured and then divided by the steady state (background) spectrum to produce the final spectrum. With

interpretation, the experimental spectrum can provide the researcher stereochemical information on the molecule under study.

Vibrational Linear Dichroism (VLD) spectroscopy measures the linear polarization nature of molecules. The VLD spectrum is a measurement of the difference in molecular absorption of plane parallel and perpendicular linear polarized light. Vibrational Linear Dichroism (VLD) experiments are used in the characterization of the orientation nature of polymer films.

The Magna-IR 860 with photoelastic modulation provides a high speed, high performance interface for a wide variety of dual channel experiments, including PM-IRRAS, VCD, and VLD. Fully Windows compatible Research OMNIC software provides pull-down menu options for complete experimental control and optimization of the dual channel experiment.

# Magna-IR Photoelastic Modulation Experiment Specifications

## OPTICS AND HARDWARE

**Analog-to-Digital Converters:**
Two independent, electronically balanced, 100 kHz, 20 bit high-speed ADCs provide accurate digitization at precise laser crossings

**Electronic Filter and Gain:**
Dual, independent settings for the high-pass filter (1, 10, 20 or 200 Hz), low pass filter (11, 20, 50 or 90 kHz) and input gain (1, 2, 3 or 5) are available for optimization of spectral signals

**Detector Inputs:**
Independent BNC signal input channels with 4 Kohm impedance and ±10 volt signal range are present in the SST module multi-channel input compartment

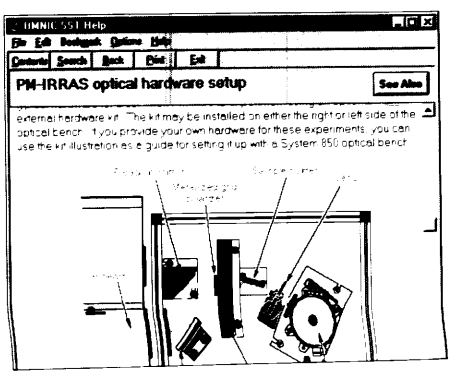
**External Beam Optics:**
Optional Passport™ dual, right or left external optics. Computer controlled single optical element to send a collimated beam to external sampling modules

## SYSTEM SOFTWARE

**Spectral Display:**
Real-time and interactive display of multiple channel data during parameter selection and data collection

**Advanced Processing:**
Ratio command generates a ratioed spectrum from any two spectra; baseline correction functions include the ability to fit a cubic spline or polynomial curve to the selected spectrum; phase array operations include the ability to calculate, view, store and apply a phase array to any given interferogram

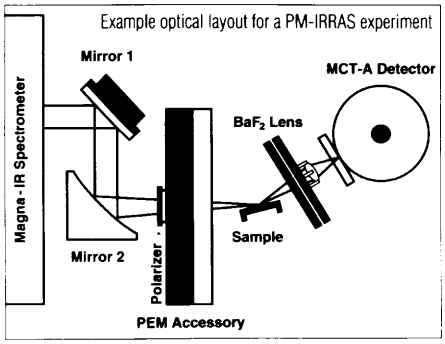
**On-Line Help:**
Comprehensive on-line documentation of experiment configurations, parameter selection and information about spectral acquisition; pictorial representations for optical configurations and electronics setup for each experiment




## SYSTEM FEATURES

**Linear Scan Velocities for Dual Channel Spectroscopy:**
User selectable from 0.158 cm/sec (2.5 kHz) to 3.16 cm/sec (50 kHz) using a Nyquist sampling limit of 7901 $cm^{-1}$ (sample spacing equal to 2); user-selectable from 0.158 cm/sec (2.5 kHz) to 1.26 cm/sec (20 kHz) using a Nyquist sampling limit of 15802 $cm^{-1}$ (sample spacing equal to 1); user-selectable from 0.158 cm/sec (2.5 kHz) to 0.63 cm/sec (10 kHz) using a Nyquist sampling limit of 31605 $cm^{-1}$ (sample spacing equal to 0.5)

## SYSTEM ACCESSORIES




**Optics Table:**
Right or left side mounted 2' x 2' TOM™ (Tabletop Optics Module) table with purgeable cover provides flexible optical layout for IRRAS, VCD or VLD experiments; other optical elements listed here are compatible with the flexible TOM table

**External Optics:**
External mirror pair, (1) 6" parabolic mirror and (1) flat mirror for IRRAS experiment

**Polarizer:**
ZnSe wire grid polarizer required for IRRAS, VCD and VLD

**Photoelastic Modulator:**
Photoelastic Modulator including controller, ZnSe wire grid polarizer and optical low pass filter (<4000 $cm^{-1}$) required for IRRAS, VCD and VLD experiments

**Sample Holders:**
Available for PM-IRRAS and VCD experiments

**Lens Optics:**
ZnSe lens and mount for VCD experiment

**Detector Mount:**
External, Magna-IR detector mounting base including internal and external connecting cables.

**Lock-In Amplifier:**
Stanford Research Systems Model SR830 DSP Lock-in Amplifier and SR650 Dual Channel Filters, or equivalent required for IRRAS, VCD and VLD experiments



Nicolet
INSTRUMENTS OF DISCOVERY

ISO 9001

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*Nicolet has direct subsidiary offices in North America, Europe and Japan. To complement these direct subsidiaries, Nicolet maintains a network of representative organizations in countries throughout the world.*

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