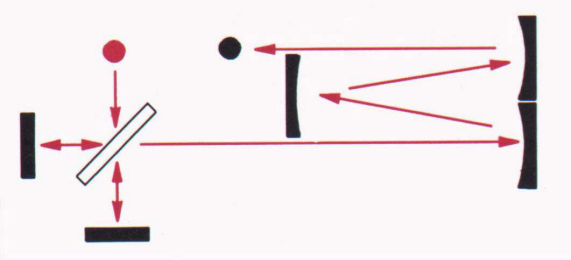
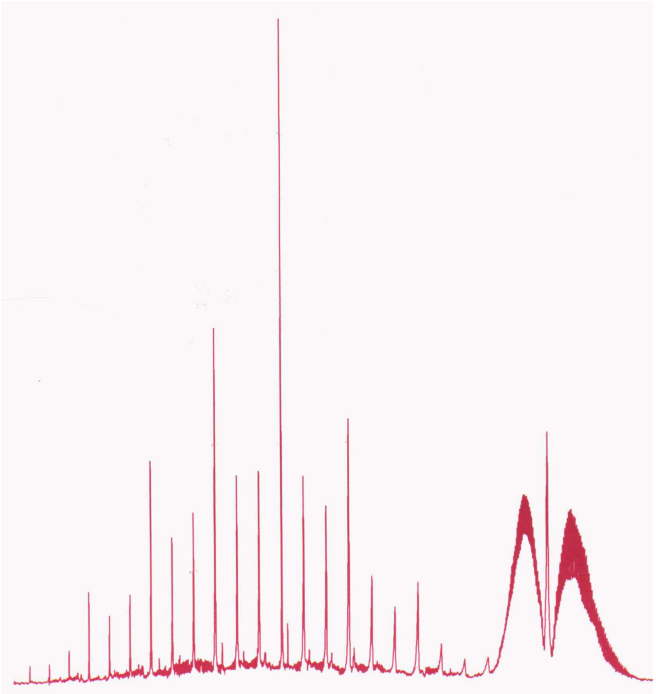


# Infrared Analysis, Inc.

## *Gas Cells and Accessories for FT-IR Gas Analysis*

***CATALOG 2010***

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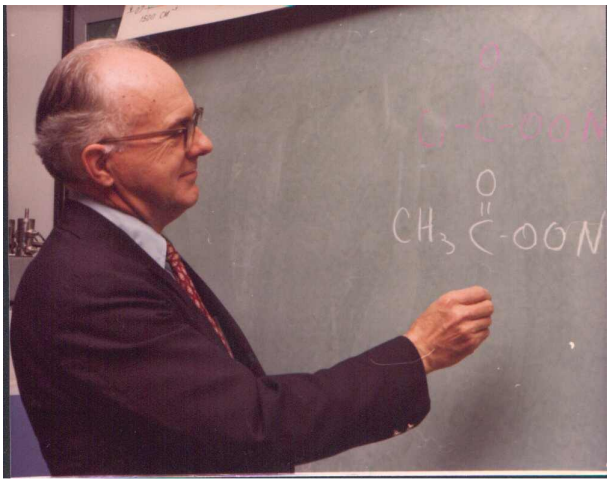
# CONTENTS PAGE FOR INFRARED ANALYSIS, INC. CATALOG 2010

**Infrared Analysis, Inc. offers solutions of problems in gas analysis.**
**There are three aspects of those solutions: (1) instruction, (2) hardware, and (3) software.**
**Instructions are in our book, our catalog, and our instruction manuals.**
**Hardware consists of our long path gas cells and our sampling components.**
**Software consists of our database of quantitative reference spectra and our operating programs that automatically carry out the quantitative analysis.**



## THE COMPANY AND ITS PRODUCTS

**Infrared Analysis, Inc.** is a company that specializes in the measurement of gases. The company was founded in 1985 by Dr. Philip L. Hanst (1924-2007) to promote the use of infrared absorption in gas analysis and to provide the needed hardware and software. During a 50 year career in spectroscopy, including positions with NASA and EPA, Dr. Hanst had a major role in the application of the infrared technique to atmospheric analysis. Using infrared spectroscopy, he and Dr. E. R. Stephens helped explain the chemistry of the urban "smog" and discovered the important family of peroxy nitrate air pollutants. Dr. Hanst was the discoverer of carbonyl sulfide in the atmosphere and identified it as the principal sulfur-carrying atmospheric molecule. For a number of years he was also involved in pollution measurement from satellites and in the study of the stratospheric ozone depletion.

Over the past 25 years, **Infrared Analysis, Inc.** has had the benefit of working with over a thousand different customers at many of the world's major universities, research institutes and commercial enterprises. That experience has been applied in optimizing the design of the products offered in this catalog. Long path cell designs have been developed that are simple, reliable and fully effective, while keeping prices low. An unmatched database of digitized reference spectra has been developed, along with computer programs for automatic quantitative analysis that can handle the most difficult of gas analysis problems.

The gas analysis systems that we recommend consist of three main components:

(1) A Fourier transform infrared spectrometer.
(2) A multiple-pass long path absorption cell.
(3) The needed quantitative analysis software.

**APPLICATIONS:**

Ambient air pollution measurements
Stack gas analysis
Engine exhaust analysis
Release of pollutants in painting.
Studies in photochemistry and kinetics
Analyzing gases for semi-conductor industry
Monitoring industrial chemical processes
Measuring air quality in the work place
Analyzing effluents in chromatography
Analyzing gases from materials pyrolysis
Measuring trace impurities in reagent gas
Measuring volatile pollutants in soil and water
Studies on greenhouse and ozone effects

Technical details of our gas measurement technique are discussed in our book entitled **Procedures in Infrared Analysis of Gases.**

**SIMPLIFICATIONS**

In addressing difficult gas measurement problems, the approach of **Infrared Analysis, Inc.** is to seek simplifications

We simplify quantitative sample acquisition by using syringes for capturing and diluting static samples and controlled flow with dilution for moving samples. This eliminates the need for heated absorption cells and high temperature reference spectra.

We remove water and CO2 interferences by means of spectra that are easily prepared.

We provide action buttons that prompt the computer to remove the water and CO2 lines and carry out the quantitative analysis automatically.

We have created the technique of **Photolysis Assisted Pollution Analysis** that in many cases will eliminate the requirement for removal of water and carbon dioxide bands.

We base our quantitative measurements only on bands with low absorbance values, where there is no deviation from the absorbance law.

Our **RIAS** quantitative analysis technique calls on the computer to carry out band area measurements, which the computer does much better than the operator could do in former times. We do not try to measure everything at once. Instead, we have the computer "peel down" a complex spectrum one compound at a time, measuring concentrations as it goes.

## MAIN POINTS FROM DISCUSSION IN BOOK

Here is a summary of main points that should be observed in using infrared absorption for quantitative measurements of gases.

**Work in the fundamental infrared region where molecules have their strong bands.**

**Use high spectral resolution. (0.5 or 1.0 wavenumbers)**

**Use zero-filling to create well-shaped spectral lines.**

**Use the mercury-cadmium-telluride detector.**

**Use the "White" multiple-pass cell, preferably with a glass cell body.**

**Make water and carbon dioxide subtraction spectra on the same spectrometer that is used to make the sample spectra.**

**Use the region integration and subtraction (RIAS) method of quantitative analysis.**

**Do not include any bands of high absorbance in the integration region chosen for quantitative measurement.**

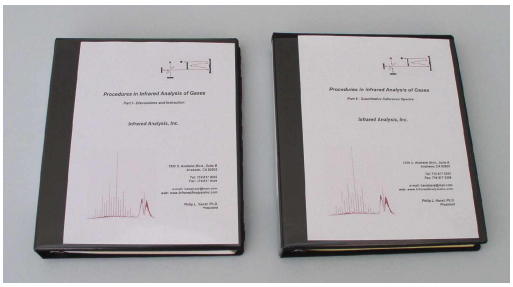
**Analyze samples at room temperature and one atmosphere total pressure.**

**Make proper choices of pathlength, integration region and sample dilution so that you can use a single reference spectrum in covering a concentration range of one atmosphere down to parts-per-billion.**

**DETAILED EXPLANATIONS OF THESE MAIN POINTS ARE GIVEN IN OUR BOOK PROCEDURES IN INFRARED ANALYSIS OF GASES.**

## BOOK: Procedures in Infrared Analysis of Gases **Book Price : $375.00**

Much information on measuring gases is contained in our book entitled Procedures in Infrared Analysis of Gases. The book comes in two parts: Part 1, named Discussions and Instruction, and Part 2, named Quantitative Reference Spectra. Part 1 contains 100 pages of instruction and technical data on gas measurement, while Part 2 presents print-outs of the 386 quantitative reference spectra that are the calibration and foundation of our method of quantitative analysis..



The book contains a glossary of terms used in analytical spectroscopy, comments on past uses of infrared absorption in the measurement of gases, and instructions in the use of QASoft, which is the quantitative analysis program of Infrared Analysis, Inc. Shipping is included in the price of the book.

**TABLE OF CONTENTS of Part 1, Discussions and Instruction.**

Here is a list of the compounds whose Quantitative Reference Spectra are presented in the book, Part 2.

## ALPHABETICAL INDEX - With Chapter and Spectrum Letters and Molecular weights

Diethyl ketone, IF - 86.13
Diethyl sulfate, OF - 154.18
Difluoroethane, QJJ - 66.05
Difluoromethane, PO - 52.02
Di-isopropyl amine, HD - 101.19
Di-isopropyl ether, LE - 102.17
Diketene, TK -84.07
Dimethoxy methane, NG - 76.10
N,N-Dimethyl acetamide, HE - 97.12
Dimethyl amine, HF- 45.09
2,2-Dimethyl butane, BD - 86.18
Dimethyl ether, LF - 46.07
N,N-Dimethyl formamide, HG - 73.10
1,1-Dimethyl hydrazine, NH - 60.10
Dimethyl sulfate, OG - 126.13
Dimethyl sulfide, OH - 62.13
Dimethyl sulfoxide, OI, 78.13
Dinitrogen pentoxide, MA - 108.01
Dinitrogen tetroxide, MB - 92.02
1,4-Dioxane, FCC - 88.10
Dodecane, CE - 170.41
Enfluorane, LFF - 184.49
Epichlorohydrin, TL - 92.53
1,2-Epoxybutane, FD - 72.11
Ethane, AI - 30.07
Ethanol, JK - 46.07
2-Ethoxy ethanol, JL - 90.12
2-Ethoxy ethyl acetate, KC - 132.16
Ethyl acetate, KD - 88.11
Ethyl acetylene, AJ - 54.09
Ethyl acrylate, KE - 100.12
Ethyl amine, HH - 45.09
Ethyl benzene, DB - 106.17
Ethyl butyrate, KF - 116.1
Ethyl cyanide (nitrile), NI - 75.07
Ethylene, AK - 28.05
Ethylene diamine, HI - 60.10
Ethylene glycol, JM - 62.07
Ethylene oxide, FE - 44.05
Ethylene sulfide, OK - 60.12
Ethyl formate, KG - 74.08
2-Ethyl-1-hexanol, JN - 130.23
2-Ethyl hexyl acrylate, KH - 184.28
Ethyl iodide, QK - 155.97
Ethyl mercaptan, OJ - 62.13
Ethyl nitrite, NJ - 75.07
Ethyl propionate, KI - 102.13
2-Ethyl toluene, DC - 120.20
3-Ethyl toluene, DD - 120.20
Ethyl vinyl ether, LG - 72.11
Exxon 87 gasoline, CF
Fluoro benzene, SJ - 96.11
2-Fluoro ethanol, JO - 64.06
Formaldehyde, GR - 30.03
Formic acid, monomer, GG - 46.03
Furan, FF - 68.07
Germane, ED - 76.62
Glyceryl trinitrate, NK - 227.09
Halothane, QKK - 197.39
n-Heptane, CG - 100.21
1-Heptene, CH - 98.90
Hexachloro-1,3-butadiene, RN - 260.76
Hexachlorocyclopentadiene, RO - 272.77
Hexachloroethane, QL - 236.74
Hexafluoro acetone, IFF - 166.0
Hexafluoropropene, RO - 150.02
Hexamethyl phosphoramide, HJ - 179.20
n-Hexane, BE - 86.18
Hexafluoro ethane, QLL - 138.01
Hexanoic acid, GH - 116.16
2-Hexanone, IG - 100.16
1-Hexene, BF - 84.16
Hexyl acetate, KJ - 144.21
Hydrazine, EE - 32.05
Hydrogen bromide, EF - 80.92
Hydrogen chloride, EG - 36.46
Hydrogen cyanide, MC - 27.06
Hydrogen fluoride, EH - 20.01
Hydrogen Iodide, EI - 127.92
Hydrogen peroxide, FG - 34.02
Hydrogen sulfide, OM - 34.08
Iodomethane, PP - 141.94
2-Iodopropane, RQ - 169.99
Iron pentacarbonyl, TM - 195.0
Isoamyl alcohol, JP - 88.15
Isobutane, AL - 58.12
Isobutanol, JQ - 74.12
Isobutyl acetate, KK - 116.16
Isobutylene, AM - 56.10
Isocyanic acid, MD - 43.03
Isofluorane, LGG - 184.49
Isooctane, CI - 114.23
Isophorone, IH - 138.21
Isoprene, BG - 68.12
Isopropanol, JR - 60.10
Isopropyl acetate, KL - 102.13
Isopropyl amine, HK - 59.11
Isopropylbenzene, DF - 120.20
Isopropyl chloride, RR - 78.54
K-1 Kerosene, CJ
Limonene, DF - 136.24
Maleic anhydride, FH - 98.06
Mesitylene, DG - 120.20
Methacrolyl chloride, TN - 104.54
Methane, AN - 16.04
Methane sulfonyl chloride, ON - 114.55
Methanol, JS - 32.04
Methyl acetate, KM - 74.08
Methyl acrylate, KN - 86.09
Methyl acrylo nitrile, NL -
Methyl amine, HL - 31.06
2-Methyl butane, BH - 72.15
2-Methyl-2-butene, BI - 70.14
3-Methyl-1-butene, BJ - 70.14
Methyl chloro disilanes - TO
Methyl chloro formate, KP - 94.50
Methyl fluoride, PQ - 34.04
Methyl formate, KQ - 60.05
Methyl hydrazine, NM - 46.07
Methyl isoamyl ketone, II - 114.19
Methyl isobutyl ketone, IJ - 100.16
Methyl isocyanate, NN - 57.05
Methyl isothiocyanate, OO - 73.12
Methyl mercaptan, OP - 48.11
Methyl methacrylate, KR - 100.12
Methyl nitrite, NO - 61.04
2-Methyl pentane, BK - 86.18
3-Methyl pentane, BL - 86.18
2-Methyl-1-pentene, BM - 84.16
2-Methyl-2-pentene, BN - 84.16
cis-4-Methyl-2-pentene,BN- 84.16
Methyl trichloro silane, TP - 149.48
Methyl tert-butyl ether, LH - 88.15
Methyl vinyl ether, LI - 58.08
Methyl vinyl ketone, IK - 70.09
Naphthalene, DH - 128.17
Nickel carbonyl, TQ - 170.75
Nitric acid, ME - 63.02
Nitric oxide, MF - 30.01
Nitro benzene, NP - 123.11
Nitro ethane, NQ - 75.07
Nitrogen dioxide, MG - 46.01
Nitrogen dioxide (and N2O4), MH
Nitro methane, NR - 61.04
Nitrogen trifluoride, MI - 71.01
1-Nitropropane,NS - 89.09
2-Nitropropane, NT - 89.09
Nitroso benzene, NU - 107.11
N-Nitroso dimethyl amine, HM -

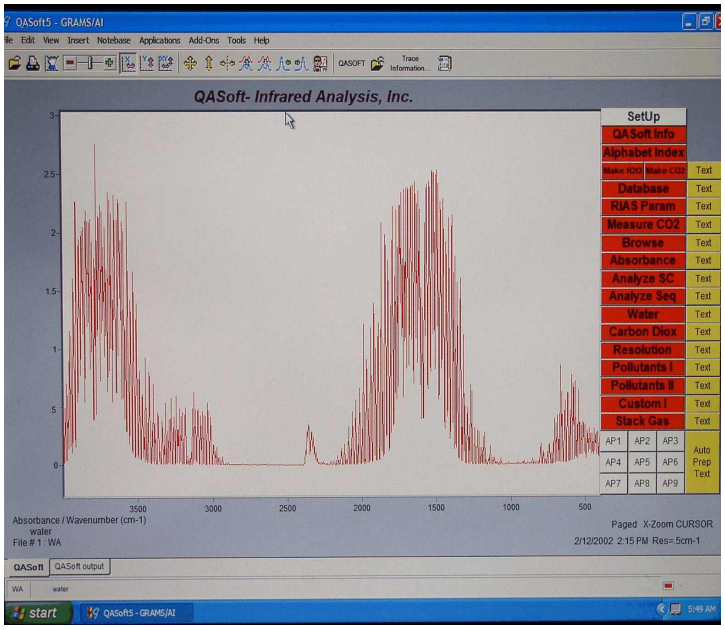
74.08
Nitroso morpholine, NV - 117.12
Nittrosyl Chloride, MJ
Nitrous acid, MK - 47.02
Nitrous oxide, ML - 44.02
1-Nonanol, JT - 144.26
1-Nonene, CK - 126.24
Octafluoro propane, RS - 188.0
Octafluorocyuclebutane, RT - 200.04
n-Octane, CL - 114.2
Octamethylcyclotetrasiloxane, TR - 296.62
Octamethyltrisiloxane, TS - 236.0
Ozone, FI - 48.00
Pentaborane, EJ - 63.12
Pentafluoroethane, QM - 120.02
n-Pentane, BD - 72.15
1-Pentanol, JU - 88.15
2-Pentanol, JV - 88.15
2-Pentanone, IL - 86.13
1-Pentene, BQ - 70.14
2-Pentene, BR - 70.14
Pentafluoroethane, QM - 120.02
Pentafluoro sulfur methyl trifluoride, OR
Perfluorobutane, RU - 214.02
Perfluoropentane, RV - 288.05
Peroxy acetyl nitrate, NW - 121.03
Phenol, JW - 94.11
Phosgene (Carbonyl chloride), TT - 98.92
Phosphine, EK - 34.00
Phosphorus trichloride, TV - 137.35
Phosphoryl chloride, TW - 153.35
Propane, AO - 44.10
n-Propanol, JX - 60.10
1-Propane thiol, OS - 76.16
b-Propiolactone, IM - 72.06
Propionaldehyde, GS - 58.08
Propionic acid, mon. and di., GJ
Propionic acid, mostly monomer, GI - 74.09
n-Propyl acetate, KS - 102.13
n-Propylbenzene, DI - 120.20
Propylene, AP - 42.08
Propylene glycol m,e Acetate, KT
Propylene imine, NX - 57.09
Propylene oxide, FJ - 58.08
n-Propyl nitrate, NY - 105.09
Propyne (Methyl acetylene), AQ - 42.08
Pyridine, NZ - 79.10
Quinoline, NAA - 129.16
Sevofluorane, LJ - 200.06
Silane, EL - 32.09
Silicon tetrachloride, TX - 169.89
Silicon tetrafluoride, TY - 104.06
Styrene, DJ - 104.15
Styrene oxide, FK - 120.15
Sulfur dioxide, OT - 64.07
Sulfur hexafluoride, OU - 146.07
Sulfur monochloride, OV - 135.03
Sulfuryl chloride (SO2Cl2), OW - 134.97
Sulfuryl fluoride (SO2F2), Ox - 102.07
Tertiary butyl benzene, DK - 134.22
1,1,1,2 Tetrachloroethane, QN - 167.85
1,1,2,2-Tetrachloroethane, QO - 167.85
Tetrachloroethylene, RW - 165.83
1,1,1,2-Tetrafluoroethane, QP - 102.02
1,1,2,2-Tetrachloroethane, QPP - 102.02
Tetrafluoromethane, PR - 88.00
Tetrahydrofuran, FL - 72.11
Tetrahydrothiophene, OY - 88.17
Thio glycol, OZ
Thionyl chloride, OAA - 118.98
Thiophene, OBB - 84.14
Thiophosgene, OCC - 114.99
Thiophosphoryl chloride, ODD - 169.42
Toluene, DL - 92.14
2,4-Toluene diisocyanate, NBB - 174.16
o-Toluidine, NCC - 107.16
Tribromomethane, PS -252.77
Tributyl phosphate, TZ - 266.32
Trichloro acetyl chloride, TAA -181.83
1,2,4-Trichlorobenzene, SK - 181.45
1,1,1 Trichloroethane, QQ - 133.41
1,1,2 Trichloroethane, QR - 133.41
Trichloroethylene, RX - 131.39
Trichlorofluoromethane, PT - 137.4
Trichloronitromethane, NDD - 164.38
2,4,5-Trichlorophenol, JY - 197.45
2,4,6-Trichlorophenol, JZ - 197.45
1,2,3-Trichloropropane, RY - 147.43
Trichlorotrifluoroethane, QS - 187.38
Triethylamine, HN - 101.19
Trifluoroacetic acid, mon. and di., GL -144.02
Trifluoroacetic acid, mostly mon., GK -144.02
Trifluoroacetic anhydride, TBB - 210.03
1,1,1-Trifluoro acetone, IN - 112.05
Trifluoroacetyl fluoride, TR
Trifluoroethane, QT - 84.02
Trifluoro methyl iodide, PV - 195.9
Trifluoromethane, PU - 70.01
Trimethyl amine, HO - 59.11
1,2,4-Trimethyl benzene, DM - 120.20
2,2,4-Trimethyl pentane, CM - 114.23
Tungsten hexafluoride, TDD - 297.86
Vinyl acetate, KU - 86.09
Vinyl bromide, RZ - 106.96
Vinyl chloride, RAA - 62.50
Vinylidene chloride, RBB - 96.94
Vinylidene fluoride, RCC - 64.04
Water, EM - 18.02
m-Xylene, DN - 106.17
o-Xylene, DO - 106.17
p-Xylene, DP - 106.17

## ***QASOFT Version 4.0--- GAS ANALYSIS SOFTWARE WITH THE DATABASE OF REFERENCE SPECTRA***

QASoft is the automatic quantitative analysis program developed by Infrared Analysis, Inc. that enables the measurement of practically all infrared-active gases. The program can be operated with many types of FT-IR spectrometers and long path optical systems.

QASoft uses the spectroscopist's traditional method of comparing band areas in sample and reference spectra. With a computer doing the comparisons rather than a human operator, the analyses are faster and more accurate, and the computer can immediately subtract the measured spectrum from the sample spectrum. The data system then can proceed to the measurement of other designated compounds.

QASoft is written in the Array Basic programming language of **GRAMS AI** software from **Thermo-Fisher Scientific**. Operations are carried out through the Infrared Analysis, Inc. Workbook page, shown here.




There are two main parts to QASoft: (1) the database and (2) the operating programs. The database contains spectra of 386 compounds at resolutions of 0.5, and 1.0 cm-1. These spectra permit computation of concentrations from a sample spectrum without the need for any other calibration. In analyzing for the 386 compounds, the only chemical that the user will need to handle is his sample.
The compounds were previously listed in the discussion of our book: PROCEDURES IN INFRARED ANALYSIS OF GASES.

The analytical technique used in QASoft is called RIAS – for Region Integration and Subtraction. RIAS can succeed when other quantitative analysis methods will fail, because RIAS takes advantage of fine structure in the spectra. RIAS works when measuring narrow spectral features--spikes (Q-branches), shoulders of bands, small bundles of lines, or even individual lines. This use of sharp features allows accurate measurements on mixtures of compounds with overlapping spectra, even when there are unknown contributors to the absorption. Gases can be measured even when their spectral features are below the noise level in the spectrum.

The operating programs do the automatic quantitative analysis with two stages of automation.

Automation Stage l is the quantitative analysis for designated compounds, chosen one at a time, with interaction between operator and computer.
Automation Stage 2 is the measurement of a list of many compounds with the operator only being required to start the run and call for a print-out of the results.

Much more detail on the software is given in the discussions of the book: **PROCEDURES IN INFRARED ANALYSIS OF GASES**, Part 1. All of the quantitative reference spectra are printed out in Part 2 of the book.

## Infrared Analysis, Inc. - Software Products - Descriptions and Prices

**QASoft Version 4.0** - Program for quantitative analysis of gases when working with spectra either obtained in GRAMS or imported into GRAMS, with reference spectra of 386 compounds at two degrees of spectral resolution: 0.5, and 1.0 cm-1. Includes book.
**Price : - SEND EMAIL**

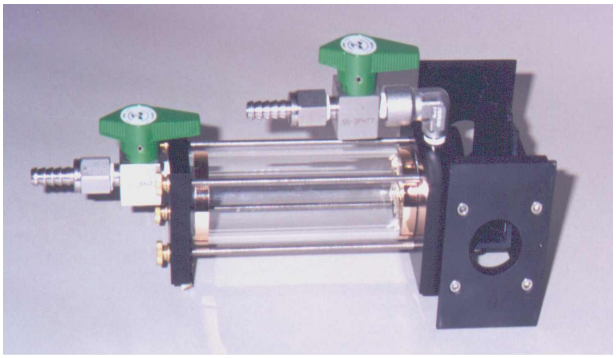
**GRAMS AI Version 8** - Laboratory Software by Thermo-Fisher Scientific. Visit Thermo.com/grams for more information on this amazing software package.
**Price : SEND EMAIL**

**QASoft Package 4.0 -** Version 4.0 together with GRAMS AI Ver. 8
**Price : SEND EMAIL**

**QASoft Library - (4.0 Database Only)** - Library of Reference spectra of 386 compounds at two degrees of spectral resolution : 0.5, and 1.0 cm-1. Includes book. Available in .SPC (default format) or other formats (eg. JCAMP)
**Price: SEND EMAIL**

**Custom "Mini" Spectral Database** - User's choice of 30 compounds from the larger database. (On CD-ROM - book not included)
**Price: SEND EMAIL**

## PERMANENTLY ALIGNED LONG PATH CELL



**Model Number:** **2.4-PA** (Ultra-mini Cell)

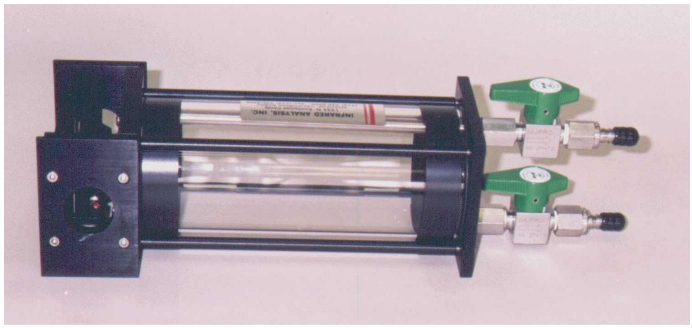
**Price: SEND EMAIL**

(Heatable version : Model 2.4-H - see page 18)

Special characteristics:
Smallest cell offered by Infrared Analysis, Inc., with the highest path-to-volume ratio.

| Specifications: | | |
|---|---|---|
| | Standard pathlength: | 2.4 meters (may be set for pathlengths between 1.2 meters and 3.2 meters, in steps of .4 meters, on request) |
| | Body material: | Borosilicate glass |
| | Mirror coating: | Protected gold |
| | Body dimensions: | Length, 11.5 cm.; I.D., 3.3 cm. |
| | Volume: | 0.1 liter |
| | Transfer mirrors: | Two plane mirrors on mounts for finger grip adjustment. |
| | Mounting: | Slides for standard sample holder |
| | Valves: | Two stainless steel plug valves |

## PERMANENTLY ALIGNED LONG PATH CELL



**Model Number:** **6-PA**

**Price:** **SEND EMAIL**

(Heatable version : model 6-PA-H - see page 18)

Special characteristics: Relatively small cell, but capable of high throughput.

| Specifications: | | |
|---|---|---|
| | Standard pathlength: | 6 meters (other pathlengths are available on request) |
| | Body material: | Borosilicate glass |
| | Mirror coating: | Protected gold |
| | Body dimensions: | Length, 17 cm.; I.D., 6.3 cm. |
| | Volume: | 0.5 liters |
| | Transfer mirrors: | Two plane mirrors on mounts for finger grip adjustment. |
| | Mounting: | Slides for standard sample holder. |
| | Window material: | Potassium chloride |
| | Valves: | Two stainless steel plug valves |

**OTHER MODELS : MODEL 8-PA** - same as 6-PA but with an 8 inch base path and an 8 meter total path in a volume of .6 liters approx. **Price : SEND EMAIL**

## PERMANENTLY ALIGNED LONG PATH CELL

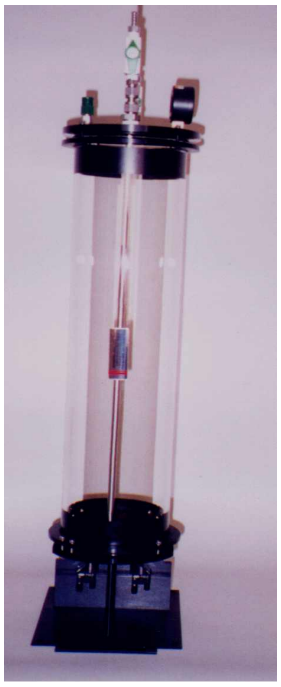
**Model Number:** **10-PA and 16-PA**
**Price:** **SEND EMAIL**

(heatable version - model 10-PA-H - see page 18)

Special characteristics: Capable of high throughput; easy transfer mirrors; complete hardware

| Specifications: | | |
|---|---|---|
| | Standard pathlength: | 10 meters or 16 meters |
| | Body material: | Borosilicate glass |
| | Mirror coating: | Protected gold |
| | Body dimensions: | Length, 30 cm; ID, 10 cm. |
| | Volume: | 2.3 liters |
| | Transfer mirrors: | Two plane mirrors on mounts with fine-pitch screw adjustments |
| | Mounting: | Bottom plate with supports that put the transfer optics at the beam height. |
| | Window material: | Potassium chloride |
| | Valves: | Two stainless steel plug valves and pressure release valve |
| | Other Hardware: | Compound gauge and flow tube |

## PERMANENTLY ALIGNED LONG PATH CELL



**Model Number:** **22-PA and 33-PA**
**Price :** **SEND EMAIL** (see heatable versions on pg.18)

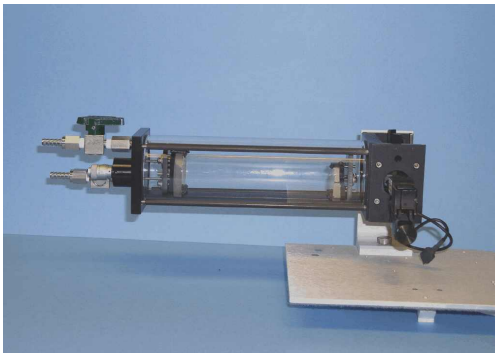
Special characteristics: Capable of high throughput; easy transfer mirrors; complete hardware; long path; stands easily in sample compartment

| Specifications: | | |
|---|---|---|
| | Standard pathlength: | 22 meters or 33 meters |
| | Body material: | Borosilicate glass |
| | Mirror coating: | Protected gold |
| | Body dimensions: | Length, 60 cm.; I.D., 12.5 cm. |
| | Volume: | 8.5 liters. |
| | Transfer mirrors: | Two plane mirrors on mounts with fine-pitch screw adjustments |
| | Mounting: | Bottom plate with supports that put the transfer optics at the beam height |
| | Window Material | Potassium chloride |
| | Valves: | Two stainless steel plug valves and pressure release valve |
| | Other Hardware: | Compound gauge and flow tube |

**OTHER MODELS : 24-PA (SMALLER)- ONLY 3.5 LITERS - SEND E-MAIL**

## VARIABLE-PATH LONG PATH CELL

**Model Number:** **7.2-V (Mini cell)**
**Price :** **SEND E-MAIL**



Special Characteristics: Relatively small cell, but capable of high throughput. Cell is fully adjustable. Drops easily into sample holding slide or ask for dedicated mounting. External pathlength control with path variable from 0.6 meters to 7.2 meters in steps of 0.6 meters. Laser verification of path.

| Specifications: | | |
|---|---|---|
| | Pathlength: | Variable, from 0.6 meters to 7.2 meters, in steps of 0.6 meters. |
| | Body material: | Borosilicate glass. |
| | Mirror coating: | Protected gold. |
| | Body dimensions: | Length, 18 cm., I.D., 6.3 cm. |
| | Volume: | 0.5 liters. |
| | Transfer mirrors: | Two plane mirrors on mounts for finger-grip adjustments. |
| | Mounting: | Slides for standard sample holder. |
| | Window material: | Potassium chloride. |
| | Valves: | Two stainless steel plug valves |
| | Laser: | Laser for pathlength verification and mirror alignment |

## VARIABLE-PATH LONG PATH CELL

**Model Number:** **8 -V (Formerly G-3-8-V)**
**Price :** **SEND E-MAIL**
(see heatable version - pg. 18)

For a bit more path-length and very good thru-put in a slightly larger volume we can build this model 8-V, which gives paths up to 8 meters in a volume of just .75 liters. The base path on this one is slightly longer at 8 inches. This cell has been a workhorse for IA, Inc. Since the early days. Vertically mounted with a dedicated baseplate - not mounted on a sample slide holder. Comes standard with open-air transfer optics (2 flat mirrors) Shown in picture : purgeable TO box - add 600 dollars.

| Specifications: | | |
|---|---|---|
| | Pathlength: | Variable, from 0.8 meters to 7.2 meters, in steps of 0.6 meters. |
| | Body material: | Borosilicate glass. |
| | Mirror coating: | Protected gold. |
| | Body dimensions: | Length : 26.5cm ; I.D. : 6.5 cm ; Volume : .75 liters. |
| | Transfer mirrors: | Two plane mirrors on mounts for finger-grip adjustments. |
| | Mounting: | Vertical with baseplate and transfer optics at beam height. |
| | Windows: | KCl or KBr, ask for quotes on CAF2 or BAF2 |
| | Valves: | Two stainless steel plug valves |
| | Laser: | Laser for pathlength verification and mirror alignment |

## VARIABLE-PATH LONG PATH CELL

**Model Number:** **16-V**
**Price:** **SEND E-MAIL**

(see heatable version model 16-V-H on page 18)

Special characteristics: Capable of high throughput; easy transfer mirrors; complete hardware; stands easily in sample compartment; pathlength control with path variable from 2 to 16 meters in steps of one meter; laser verification of pathlength

| Specifications: | | |
|---|---|---|
| | Pathlength: | Variable from 2 to 16 meters in steps of one meter. |
| | Body material: | Borosilicate glass |
| | Mirror coating: | Protected gold |
| | Body dimensions: | Length, 30 cm.; I.D., 10 cm. |
| | Volume: | 2.5 liters |
| | Transfer mirrors: | Two plane mirrors on mounts with fine screw adjustments |
| | Mounting: | Base plate that puts the transfer optics at beam height. |
| | Window material: | Potassium chloride |
| | Valves: | Two stainless steel plug valves and pressure release valve |
| | Other Hardware: | Pressure gauge, flow tube, path control and laser. |

## VARIABLE-PATH LONG PATH CELLS

**Model Number:** **35-V**
**Price:** **SEND E-MAIL**

(see heatable version model 35-V-H on page 18)

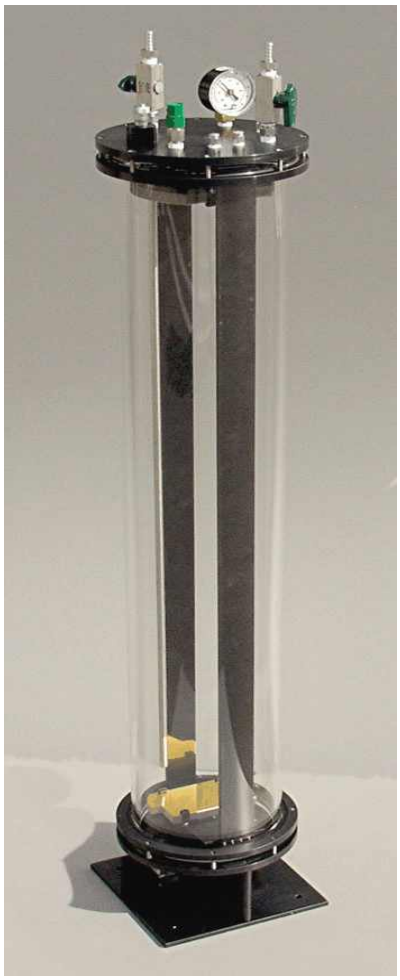
Special characteristics: Capable of high throughput; easy transfer mirrors; stands easily in sample compartment; external pathlength control with path variable from 2.2 to 35 meters in steps of 2.2 m.; laser verification of path

Specifications:

| | |
|---|---|
| Pathlength: | Variable from 4.4 to 35 meters in steps of 2.2 meters. |
| Body material: | Borosilicate glass |
| Mirror coating: | Protected gold |
| Body dimensions: | Length, 60 cm.; I.D., 12.5 cm. |
| Volume: | 8.5 liters. |
| Transfer mirrors: | Two plane mirrors on mounts with fine adjustments |
| Mounting: | Bottom plate with supports that put the transfer optics at the sample compartment beam height. |
| Window material: | Potassium chloride |
| Valves: | Two stainless steel plug valves and pressure release valve |
| Laser: | Laser for cell alignment, pathlength verification and transfer mirror alignment. |
| Other Hardware: | Compound gauge, flow tube, external path control (For custom base plate, add $400) |

**OTHER MODELS : MODEL 24-V** - same as 16-V but with a base path of 16 inches - variable from 1.6 to 24 meters. Volume 4 liters approx. **Price: SEND E-MAIL**

## VARIABLE-PATH LONG PATH CELLS



**Model Number: 64-V**
**Price: SEND E-MAIL**

Special Characteristics: Long paths up to 64 meters (and more) in a volume of only 16 liters. Stands vertically in your sample compartment for easy operation. Simple "White Cell" internal mirror design allows for easy adjustment, service and operation. Designed for detection limits as low as 10-20 ppb or better with a good system.

Specifications:

| | |
|---|---|
| Pathlength: | Variable from 3.2 to 64 meters |
| Body Material: | Borosilicate Glass |
| Mirror Coating: | Protected Gold |
| Body dimensions: | Length, 90cm.; I.D., 15 cm. |
| Volume: | 16 Liters |
| Transfer Mirrors: | Two plane mirrors with fine adjustments |
| Mounting: | Bottom plate with supports that put the transfer optics at the sample compartment beam-height. |
| Window Material: | Potassium Chloride |
| Valves: | Two stainless-steel plug valves and pressure relief valve |
| Other hardware: | Pressure gauge, flow tube, external path control knob and laser device. |

# HEATABLE LONG- PATH CELLS

**Infrared Analysis, Inc.** makes heatable versions of many of our long path cells which allow the cell body, window plate and sample line fittings to be heated, while transfer optics and mounting fixtures remain cool. This is accomplished with an insulating plate between the cell and transfer optics. Using a heating jacket with a silicone based heating blanket which is controlled by thermocouple, the cell chambers are heated uniformly to temperatures as high as 200 degrees Celsius.
A digital temperature control unit maintains temperature with high degree of accuracy.
We have heatable versions for most of our cells - see the standard cell page for more complete descriptions.

| Part No. | Description | Price |
|---|---|---|
| **2.4-H** | Glass-bodied Permanently-aligned Ultra-mini cell in heatable configuration. | SEND |
| **6-PA-H** | Glass-bodied Permanently-aligned cell in heatable config. | E-MAIL |
| **10-PA-H** | Glass-bodied Permanently-aligned cell in heatable config. | FOR PRICES |
| **22-PA-H** | Glass-bodied Permanently-aligned cell in heatable config. (Requires a dual-zone heating jacket with 2 temp controllers) | |
| **33-PA-H** | Glass-bodied Permanently-aligned cell in heatable config. (Requires a dual-zone heating jacket with 2 temp controllers) | |
| **8-V-H** | Glass-bodied variable cell in heatable config. | |
| **16-V-H** | Glass-bodied variable cell in heatable config. | |
| **35-V-H** | Glass-bodied variable cell in heatable config. (Requires a dual-zone heating jacket with 2 temp controllers) | |
| **M-3-8-H** | Metal-bodied variable cell in heatable config. | |
| **M-4-10-H** | Metal bodied variable cell in heatable config. | |

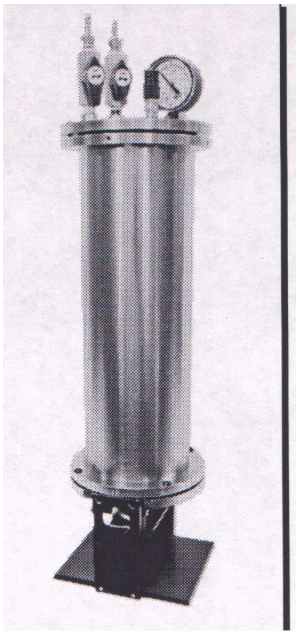
**Temp Controllers:**

| | | |
|---|---|---|
| **TC-100** | Digital temperature control unit with thermocouple. | **$850** |
| **TC-220** | 220V Digital temp control unit with thermocouple. | **$850** |

**Heating jackets :**

| | | |
|---|---|---|
| **HJ-2** | Heating jacket for 2.4-H | **$440** |
| **HJ-2.5** | Heating jacket for model 6-PA-H | **$490** |
| **HJ-3** | Heating jacket for models 8-V-H and M-3-8-H | **$490** |
| **HJ-4** | Heating jacket for model 10-PA-H | **$800** |
| **HJ-4.5** | Heating jacket for model 16-V-H and M-4-10-H | **$800** |
| **HJ-5** | Heating jacket for models 22-PA-H and 33-PA-H (dual-zone) | **$1500** |
| **HJ-5.5** | Heating jacket for model 35-V-H (dual-zone) | **$1500** |

# METAL BODY CELLS



**Infrared Analysis, Inc**. supplies cells with Anodized-aluminum or Nickel-coated cell bodies and hardware.

Cell mirrors are mounted on a removable carriage for easy access and maintenance.

High pressure configurations are available for use at pressures as high as 100 p.s.i.

Transfer optics and mounting fixture are included with each cell, except the M-80-V.

Laser device for cell alignment and pathlength verification is included.

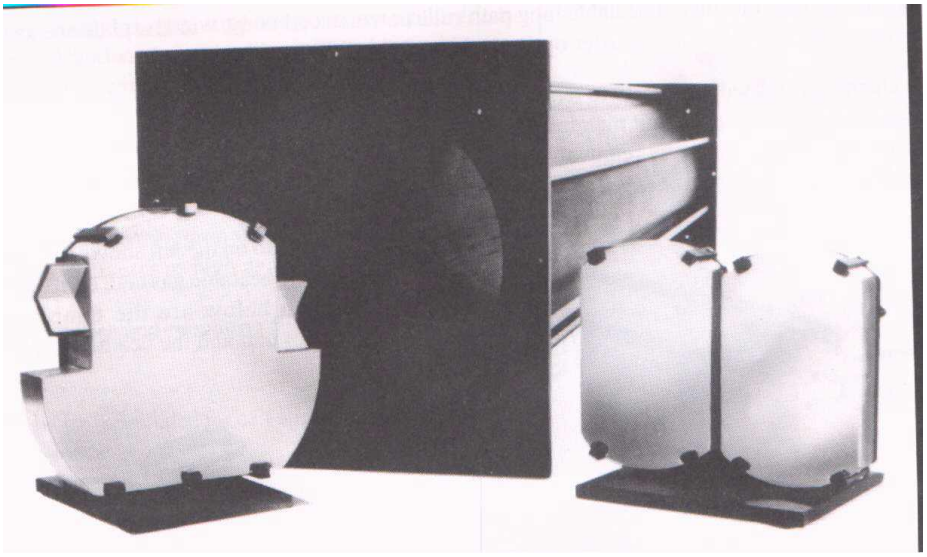
View Window is built into cell for alignment and pathlength verification. (variable cells)

| Part No. | Description | Price |
|---|---|---|
| **M-3-8-V** | Metal-bodied long path cell, 7.5 cm. inside diameter Base path 20 cm. Variable pathlength from 0.8 to 8 meters. Protected gold optics. Vol. = .75 L approx. | SEND E-MAIL |
| **M-4-10-V** | Metal-bodied long path cell, 10 cm. inside diameter, Base path 25 cm. Variable pathlength from 1 to 10 meters. Protected Gold optics. Vol. = 3 L approx. | |
| **M-2-10-SS** | SS Metal-bodied long path cell, 10 cm inside diam. Base path 25cm Fixed Total path = 10 meters Vol=2L P-Gold optics - metal mirror blanks - special "all-metal" construction designed for highly corrosive gases | |
| **M-5-22-V** | Metal-bodied long path cell. 12.5 cm. inside diameter. Base path 55 cm. Variable pathlength from 2.2 to 22 meters. Protected gold optics. Volume approximately 8.5 liters. | |
| **M-80-V** | Metal-bodied long path cell. 21.6 cm inside diameter. Base path 1 meter. Variable path-length from 8 to 80 meters. Protected gold optics. Volume approximately 39 liters. For horizontal operations. (Mounting and transfer optics quoted separately) | |

See page 18 for heatable versions of model M-3-8-V and M-4-10-V.

Infrared Analysis, Inc. will also construct "custom-built" gas cells based on customer-requested specifications. Ask for quotes on your special projects.

# ULTRA-LONG MULTI-PASS OPTICAL SYSTEMS



Multi-pass optical systems can be provided for operation at paths in excess of one kilometer, using base paths between 2 and 25 meters. These Ultra-Long Cells can be supplied for use in open air or outdoors, or they can be completely enclosed for operation under vacuum or positive pressures.

Two pairs of retro-reflectors are provided on the field mirror in order to accomodate as many as 120 passes of the infrared beam. This means a three meter base path can yield pathlengths up to 360 meters. A 10 meter base path cell achieves pathlengths over one kilometer.

Ultra-Long Multi-Pass Optical Systems are superior to single-pass or two-pass telescope systems because of the energy conservation that results from the repeated re-focusing of the optical beam.

System is Easily interfaced with all Fourier transform infrared spectrometers, or with non-dispersive or laser-based optical systems.

Protected silver optical coatings offer the highest infrared reflectivity, excellent durability and corrosion resistance.

| Part No. | Description | Price |
|---|---|---|
| **M-240-V** | Ultra-Long-Path Gas Cell, version 240. Metal- bodied cell nine inches inside diameter, 2 meter base path. Variable pathlength up to 240 meters. (and further) Volume approx. 90 liters. Black anodized aluminum hardware and protected-silver internal optics. | **ASK FOR QUOTE** |
| **O-600-V** | Ultra-Long Path Cell MIRROR SYSTEM. Open-Air optics with 8 inch diameter mirrors, 5 meters base path. Pathlengths over 500 meters can be obtained. Black anodized aluminum hardware and protected-silver optics. | **ASK FOR QUOTE** |

## LASER DEVICE

**All variable path-length cells come with a laser device for pathlength indication and alignment verification. We basically use a simple rifle laser (diode) and this serves the purpose quite well.**

**Part No.: LD Description: Diode -Laser alignment device Price: $95**

## WINDOWS

**The windows for nearly all cells are potassium chloride discs, 25 mm. in diameter and 4 mm. thick. Replacements may be purchased from Infrared Analysis, Inc. for $45 each. The window on cell 2.4-PA is a potassium chloride disc, 37.5 mm. in diameter and 4 mm. thick. A replacement for this window is available from Infrared Analysis, Inc. for $65. Windows of other crystal materials may also be purchased. Please send for quotes on CAF2, BAF2, ZNSE and others.**

## CELL RESTORATION

**Ask for our prices on recoating and refurbishing of the cell's mirrors and interior parts. If a cell interior becomes soiled or corroded, the user may dismantle, clean and re-assemble the cell. A user may also return a damaged cell to Infrared Analysis, Inc. for renovation and re-coating of the mirrors. (Ask for quotes) Cell restoration will return a cell to like-new functionality, but not necessarily to like-new condition cosmetically. If corrosion damage to the mirror surfaces needs to be removed, the mirrors will need to be re-ground or replaced, for which there is an additional charge. Call or fax for a quotation.**

## CAUTION

**Do not foul the cell with dirty samples, excessively wet samples, or excessively high concentrations of reactive materials. Most of the cells will allow measurement of gases at concentrations down to 0.05 PPM (or lower). Thus, for example, if you are seeking measurements down to 0.5 PPM, you can afford to dilute your samples 10-fold with clean nitrogen. This dilution will protect all the cell components against degradation. Whenever possible, gas samples should be studied at room temperature. One should keep in mind the chemist's rule of thumb that an increase in temperature of 10 degrees C. doubles chemical reaction rates. Reactive gases at high temperature will eat the coatings off the mirrors and degrade other cell parts.**

## WARRANTY

**Cell hardware is guaranteed to last for 5 years, in normal use (laser excluded).**

**Mirrors that are cemented into the cell body are guaranteed to hold position for 5 years.**

**Since glass cell bodies can be broken by mis-use, there is a charge for cell body replacement.**

**Mirror coatings and crystal windows can last for many years, but they can be degraded by mis-use, and therefore they are not guaranteed.**

## ORDER PLACEMENT INSTRUCTIONS

**Purchase orders may be sent by letter, FAX or e-mail.**

**Payment terms: Customers who have not yet established credit with us must pay in advance. Customers with established credit are requested to pay upon receipt of the purchased materials. Payment may be made by check, credit card or wire transfer.**

**Guarantee: If purchased hardware is found to be not satisfactory and it is still unused, it may be returned for a full refund. Software is not returnable.**

## NEW OFFERINGS

**In 2010 you will continue to see many changes in our web-site as well as new offerings in our product line which will be shown there as well. Check our web-site periodically to keep up with the new product offerings.**

**Visit us at : WWW.INFRAREDANALYSISINC.COM**