Technical Specifications

**Weight**
- Balance capacity: 1 g (standard), or 5 g (optional)
- Weighing range: 0 – 200 mg (standard)
- Resolution: 0.1 µg (0.2 µg with optional 5 gram balance)
- Stability: ± 1 µg long term (± 0.1 µg short term)

**Pressure**
- Design pressure: 10 bar (standard), or 20 bar (optional)
- Typical accuracy: ± 0.05 % of range
- Transducer ranges: 1, 10, 20 bar (up to 3 per system) 2, 10, 100 mbar
- Base Vacuum: < 10⁻⁶ mbar
- Typical regulation accuracy: ± 0.02 % of range

**Temperature**
- Measurement range: 77 – 1273 K
- Temperature sensors: Platinum Resistance Thermometer (Pt100), or Type-K Thermocouple
- Measurement accuracy: ± 0.1 K (Pt100) or ± 1 K (Type-K)
- Typical regulation accuracy:
  - Water bath: ± 0.05 K
  - Furnace options: ± 0.1 – 1 K
  - Balance temperature regulation accuracy: ± 0.1 K
- Linear ramp option: 0.05 – 20 K/min (depending upon system accessories)

**Mass**
- Coupling method: Heated Quartz Inert Capillary (2 m)

**Spectrometer**
- Atomic mass range: 1 – 200 amu standard (1-300 amu optional)
- Detection limit: 0.1 to 1 ppm, subject to spectral interference
- Better than 20 ppb (Triple Mass Filter option)
- Detector: Dual Faraday/Electron Multiplier
- The IGA-100 is designed for gravimetric mixed gas sorption, as well as single component vapor sorption analysis, and powerful multi-accessory options. The multiple download mass flow controller system allows mixed gas experimentation with 0.1 % precision and sorption control. Anti-condensation protection to -50 °C is also included to allow operation with water and other extended range of hygroscopic vapors. As for the IGA-002, an optional vapor generator extends dynamic functionality to include gas and vapor mixtures.

**Integrated Dynamic System Options**

**Breakthrough Reactors**
The Automated Breakthrough Reactor (ABR) for dynamic IGA systems allows the analysis of gas and vapor sorption and purification processes from breakthrough curves. The ABR design features a minimized dead volume for rapid response times and an integral temperature regulation system for high performance thermal control. Other key features include:
- 2 cm³ nominal bed volume, with maximized length-to-width ratio
- Operation throughout the range 0 – 500 °C and 0 – 20 bar
- Fully integrated control and datalogging from the IGASwin software

**Quadrupole Mass Spectrometers**
Hiden's range of quadrupole mass spectrometers can be interfaced to all dynamic IGA systems. The combination of gas analysis and gravimetric sorption measurement provides an invaluable tool for materials characterization. These hyphenated systems can also be used to study thermal decomposition and derivatization processes.
- Broad atomic mass unit (amu) range with triple mass filter options
- Heated capillary transfer with high and atmospheric pressure sampling options
- Bypass pumping arrangements
- Mobile cart for standalone operation
- Fully integrated, automated control from the IGASwin software

**Other Accessories**
The IGA series is available with a wide range of accessories to suit individual application requirements. Systems are fully upgradable and bespoke solutions can be provided.
- Additional low pressure measurement and control ranges
- Humidity generator module for delivery of humid gas with feedback control
- Reactivating water bath and environment jacket for optimum near-ambient thermostabilization, with integrated heater option
- Range of furnaces from set point control to high temperature TG linear ramp applications, including unique programmable controller for operation at user-specified ramp rates
- Enhanced temperature rating (800 °C) at pressure for high temperature and pressure studies
- BZT (Base Zone Transfer) option including automatic cell option
- Unique sample loader to allow an air or moisture sensitive sample to be transferred to the IGA-100 in a controlled inert or anhydrous atmosphere
- Actuated sample environment arm to replace standard lab stands

It is Hiden Isochema's policy to continually improve product performance and therefore specifications are subject to change.
IGA - The Intelligent Gravimetric Analyzer

The IGA range from Hiden Isochema provides the ultimate tool for sorption science...

The IGA system uses the most advanced gravimetric technique to accurately measure the magnitude and dynamics of gas and vapor sorption on materials. The IGA design integrates precise computer-control and measurement of weight change, pressure, temperature, gas flow and composition. The system can automatically and reproducibly measure sorption isotherms/loops as well as investigating thermal desorption in diverse operating conditions. The unique IGA method exploits the relaxation behaviour of the interaction process after pressure/gas composition/temperature changes to simultaneously determine highly accurate kinetic parameters and predict the exact point of equilibrium uptake Eeq.

- Weight data is acquired and analyzed in real-time to determine kinetic parameters and predict the exact point of equilibrium uptake Eeq.
- Equilibrium points are collected and plotted as an isotherm. The IGA method provides a consistent reproducible analysis method point-to-point on the isotherm whilst making the optimum use of laboratory time.

IGA-001 High Accuracy Gas Sorption Analyzer

The IGA-001 system is specifically designed as a variable gravimetric analysis system. The system can be configured to study general gas sorption processes from vacuum to high pressures as well as being used at a high pressure thermobalance with mass spectrometer interface. The data shows adsorption isotherms for a freon/air mixture of 4% concentration. Such information is required when understanding the non-equilibrium sorption behaviour of materials held constant during sorption at the set point Pn. The kinetic response shown above (the response for the sorption of a freon on activated carbon.) is of great importance for understanding the rate of sorption, or uptake, of gas molecules into a porous material.

Typical Application
- Gas sorption
- Equilibrium behaviour
- TG studies
- True carbon area analysis in in situ pore size analysis

Materials
- Zeolites
- Zeolites/metallic catalysts
- Polymeric
- Metal Organic Frameworks

The IGA-001 system can be used to study gas sorption processes from ultra high vacuum to high pressures as well as being used at a high pressure thermobalance with mass spectrometer interface. The data shows adsorption isotherms for a freon/air mixture of 4% concentration. Such information is required when understanding the non-equilibrium sorption behaviour of materials held constant during sorption at the set point Pn. The kinetic response shown above (the response for the sorption of a freon on activated carbon.) is of great importance for understanding the rate of sorption, or uptake, of gas molecules into a porous material.

IGA-002 Gas & Vapor Sorption Analyzer

The IGA-002 system is specifically designed to study general vapor sorption processes across a wide vacuum range from Hiden Isochema as the features of the IGA-001 model but additionally incorporates anti-condensation protection rated to 50°C. An additional high range pressure sensor is included. The system can be used with a UHV pump isolation valve to achieve the best possible vacuum at the sample position and a vapor delivery system is incorporated with the pressure control. The IGA-002 can be used to study water and hydrocarbon vapor sorption on porous materials such as pharmaceuticals, carbons, catalysts, zeolites, clays and polymers.

The IGA-002 system can be used to determine the water content in pharmaceuticals and foods at a specific humidity. The data shows inter-laboratory sorption isotherms measured at 22.8°C and below. The system can be used to determine the water content in pharmaceuticals and foods at a specific humidity. The data shows inter-laboratory sorption isotherms measured at 22.8°C and below.
**IGA - The Intelligent Gravimetric Analyzer**

The IGA range from Hiden Isochema provides the ultimate tool for sorption science...

The IGA system uses the gravimetric technique to accurately measure the magnitude and dynamics of gas and vapor sorption on materials. The IGA design integrates precise computer control and measurement of weight change, pressure, temperature and flow and manipulation. The system can automatically and reproducibly measure sorption isotherms/loops as well as investigating thermal desorption in diverse operating conditions. The unique IGA method exploits the relaxation behaviour of the interaction process after pressure/gas composition/temperature changes to simultaneously determine equilibrium. The unique measurement of weight change, pressure, temperature, gas flow and composition. The system can be used to accurately measure the magnitude and dynamics of gas and vapor sorption on materials. The example above shows a kinetic method used to study the relaxation behaviour of the interaction process after pressure/gas composition/temperature changes to simultaneously determine equilibrium.

![Diagram of IGA system](image)

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**IGA Method**

- Pressure/gas composition is changed and then held constant during sorption at the set point $P_0$.
- Weight data is acquired and analyzed in real time to determine kinetic parameters and predict the exact point of equilibrium uptake $E$.
- Equilibrium points are collected and plotted as an isotherm. The IGA method provides a consistent reproducible analytical method point-to-point on the isotherm while making the optimum use of laboratory time.

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**IGA-001 Gas Sorption Analyzer**

The IGA-001 is specifically designed as a versatile gravimetric analyzer system. The system can be configured to study either single gas sorption such as nitrogen at a high pressure or the increase with time of the adsorption of a gas at a given pressure. The IGA-001 system is specifically designed to study general vapor sorption processes from vacuum to high pressure. The system incorporates a multiple stage mass flow control system. An essential gas delivery system supplies the gas stream below the sample and extracts above enabling a defined gas composition to be established at the sample position. Flow and pressure control are independent allowing different gas compositions to be generated at different pressures. A balance position and a vapor delivery system is incorporated with the pressure controller. A balance position while protecting the integrity of the weighing system. An optional humidifier or vapor generator allows delivery of defined vapor compositions to the sample reactor. The system can be used to study mixed gas/vapor sorption on materials such as carbons, zeolites, polymers and catalysts. The system can be used to measure hydrocarbon vapor sorption on porous materials. Such data can be used to designing filtration systems.

![Diagram of IGA-001](image)

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**IGA-002 Gas & Vapor Sorption Analyzer**

The IGA-002 system is specifically designed to study general vapor sorption processes from vacuum to high pressure. The system incorporates a multiple stage mass flow control system. An essential gas delivery system supplies the gas stream below the sample and extracts above enabling a defined gas composition to be established at the sample position. Flow and pressure control are independent allowing different gas compositions to be generated at different pressures. A balance position and a vapor delivery system is incorporated with the pressure controller. A balance position while protecting the integrity of the weighing system. An optional humidifier or vapor generator allows delivery of defined vapor compositions to the sample reactor. The system can be used to study mixed gas/vapor sorption on materials such as carbons, zeolites, polymers and catalysts. The system can be used to measure hydrocarbon vapor sorption on porous materials. Such data can be used to designing filtration systems.

![Diagram of IGA-002](image)

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**IGA-003 Dynamic Mixed Gas Sorption Analyzer**

The IGA-003 system is specifically designed to study general mixed gas sorption processes from vacuum to high pressure. The system incorporates a multiple stage mass flow control system. An essential gas delivery system supplies the gas stream below the sample and extracts above enabling a defined gas composition to be established at the sample position. Flow and pressure control are independent allowing different gas compositions to be generated at different pressures. A balance position and a vapor delivery system is incorporated with the pressure controller. A balance position while protecting the integrity of the weighing system. An optional humidifier or vapor generator allows delivery of defined vapor compositions to the sample reactor. The system can be used to study mixed gas/vapor sorption on materials such as carbons, zeolites, polymers and catalysts. The system can be used to measure hydrocarbon vapor sorption on porous materials. Such data can be used to designing filtration systems.

![Diagram of IGA-003](image)
**IGA - The Intelligent Gravimetric Analyzer**

The **IGA** range from Hiden Isochema provides the ultimate tool for sorption science...

- State-of-the-art pressure control system capable of accurately controlling the pressure of gases from high vacuum to high pressure.
- Basic models can be upgraded to extend their range of applications, as your research program develops.
- Wall Mounting Bracket
- Vacuum/Pressure Vessel
- Dewar
- Water bath
- Furnace
- Cryofurnace
- Sample Environment:
  - Cryotraps
  - Furnaces
  - Water baths
  - Dewar

**IGA-001 High Accuracy Gas Sorption Analyzer**

- The IGA-001 is specifically designed as a versatile gravimetric analysis system. The system can be configured to study general gas sorption processes from vacuum to high pressures as well as being used as a high pressure temperature cycles with ease.
- The IGA-001 provides: Gas & Vapor Sorption Analyzer
- UHV pump isolation valve to achieve the best possible vacuum at the sample position and a vapor delivery system is incorporated with the pressure controller.
- Additional low range pressure sensor is included. The system can be fitted with a UHV pump isolation valve to achieve the best possible vacuum at the sample position and a vapor delivery system is incorporated with the pressure controller.
- The IGAs-002 can be used to study water and hydrocarbon vapor sorption on anions and cations such as pharmaceuticals, carbons, catalysts, resins, clays and polymers.

**IGA-002 Gas & Vapor Sorption Analyzer**

- The IGA-002 system is specifically designed to study general vapor sorption processes from vacuum to high pressure. This model incorporates the features of the IGA-001 model but additionally incorporates advanced protection features such as an additional low range pressure sensor to protect the sample in the event of a failure.
- The IGA-002 system can be used to study water and hydrocarbon vapor sorption on anions and cations such as pharmaceuticals, carbons, catalysts, resins, clays and polymers.

**IGA-003 Dynamic Mixed Gas Sorption Analyzer**

- The IGA-003 system is designed to study mixed gas and/or vapor sorption processes from vacuum to high pressures. The system incorporates a multiple inlet mass flow control system. An internal gas delivery system inputs the gas stream before the sample and extracts above enabling a defined gas composition to be established at the sample position. Flow and pressure control are achieved allowing different gas compositions to be generated at different pressures. A balance purge can be provided in this system to allow the use of corrosive gases/vapors at the sample position while protecting the integrity of the working system.
- An optional full-range vapor generator allows delivery of defined vapor compositions to the sample reactor. The IGA-003 system can be used to study mixed gas/vapor sorption processes on materials such as carbons, catalysts, polymers and clays.

**The IGA Method**

- Pressure/volume composition is changed and then held constant during sorption at the set point Pn.
- Weight data is acquired and analyzed in real-time to determine kinetic parameters and predict the exact point of equilibrium uptake E.
- Equilibrium points are collected and plotted as an isotherm. The IGA method provides a consistent reproducible analysis method point-to-point on the isotherm whilst making the optimum use of laboratory time.

**Concentration (wt-%)**

- **Pressure (Bar)**
  - **Concentration (wt-%)**
  - **P**
  - **T**
  - **C**
  - **E**
  - **n**
  - **k**

**Sample Environment:**
- **Cryotrap**
- **Furnace**
- **Water bath**
- **Dewar**

**Sample (Internal temperature probe)**

**IGA-002 Generator**

- The IGAs-002 generator allows delivery of defined vapor compositions to the sample reactor. The IGAs-002 system can be used to study mixed gas/vapor sorption processes on materials such as carbons, catalysts, polymers and clays.

**IGA-003 Improved Vapor Delivery System**

- The IGA-003 vapor delivery and pressure control system. A broad range of liquids can be used in the reservoir to generate the vapor desired.

**IGA-001 Generator**

- The IGAs-001 generator allows delivery of defined vapor compositions to the sample reactor. The IGAs-001 system can be used to study mixed gas/vapor sorption processes on materials such as carbons, catalysts, polymers and clays.

**IGA-002 Generator**

- The IGAs-002 generator allows delivery of defined vapor compositions to the sample reactor. The IGAs-002 system can be used to study mixed gas/vapor sorption processes on materials such as carbons, catalysts, polymers and clays.
Technical Specifications

**Weight**
- Balance capacity: 1 g (standard), or 5 g (optional)
- Weighing range: 0 – 200 mg (standard)
- Resolution: 0.1 µg (0.2 µg with optional 5 gram balance)
- Stability: ± 1 µg long term (± 0.1 µg short term)

**Pressure**
- Design pressure: 10 bar (standard), or 20 bar (optional)
- Typical accuracy: ± 0.05 % of range
- Transducer ranges: 1, 10, 20 bar (up to 3 per system) 2, 10, 100 mbar
- Base Vacuum: < 10-6 mbar
- Typical regulation accuracy: ± 0.02 % of range

**Temperature**
- Measurement range: 77 – 1273 K
- Temperature sensors: Platinum Resistance Thermometer (Pt100) or Type-K Thermocouple
- Measurement accuracy: ± 0.1 K (Pt100) or ± 1 K (Type-K)
- Typical regulation accuracy:
  - Water bath: ± 0.05 K
  - Furnace options: ± 0.1 – 1 K
- Balance temperature regulation accuracy: ± 0.1 K
- Linear ramp option: 0.05 – 20 K/min (depending upon system accessories)

**Mass**
- Coupling method: Heated Quartz Inert Capillary (2 m)

**Spectrometer**
- Atomic mass range: 1 – 200 amu standard (1–300 amu optional)
- Detection limit: 0.1 to 1 ppm, subject to spectral interference
  - Better than 20 ppb (Triple Mass Filter option)
- Detector: Dual Faraday/Electron Multiplier

The IGA-100 is designed for gravimetric mixed gas sorption, as well as single component vapor sorption analysis, and powerful mixed gas analysis. It is the perfect dual-use instrument for mass spectrometric analysis of gases and vapors. The multiple built-in mass flow control sytems allows mixed gas experiments with fast precision and recirculation control. Anti-condensation protection to 50 °C is also included to allow operation with water and an extensive range of hygroscopic vapors. As for the IGA-HDF, an optional vapor generator extends dynamic functionality to include gas and vapor mixtures.

### Integrated Dynamic System Options

#### Breakthrough Reactors
The Automated Breakthrough Reactor (ABR) for dynamic IGA systems allows the analysis of gas and vapor separation and purification performance from breakthrough curves. The ABR design features a minimized dead volume for rapid response times and an integral temperature regulation system for high performance thermal control. Other key features include:
- Variable packed bed volume, with adjustable length-to-width ratio
- Operation throughout the range 1 – 500 °C and 0 – 20 bar
- Fully integrated control and data logging from the IGAShell software

#### Quadrupole Mass Spectrometers
IGA’s range of quadrupole mass spectrometers can be interfaced to all dynamic IGA systems. The combination of gas analysis and gravimetric sorption measurement provides an invaluable tool for materials characterisation. These hyphenated systems can also be used to study thermal decomposition and degradation processes.
- Broad atomic mass range with triple mass filter options
- Heated capillary transfer with high and atmospheric pressure sampling options
- Bypass pumping arrangements
- Mobile cart for standalone operation
- Fully integrated, automated control from the IGAShell software

#### Other Accessories
The IGA series is available with a wide range of accessories to suit individual application requirements. Systems are fully upgradable and bespoke solutions can also be provided. Options include:
- Additional low pressure measurement and control ranges
- Humidity generator module for delivery of humid gas with feedback control
- Recirculating water bath and environment jacket for optimum near ambient thermostability, with integrated double wall heater option
- Range of systems from small port control to high temperature TGA linear ramp experiments, matching unique programmable temperature for operation at user-defined pressures
- Enhanced temperature range 800 °C at pressure for high temperature and pressure studies
- BPT (quartz inert) port including automatic cell options
- Unique sample loader to allow air or moisture sensitive samples to be transferred to the IGA in a controlled inert atmosphere
- Actuated sample environment arm to replace standard test stands
Technical Specifications

**Weight**
- Balance capacity: 1 g (standard) or 5 g (optional)
- Weighing range: 0 – 200 mg (standard)
- Resolution: 0.1 µg (0.2 µg with optional 5 gram balance)
- Stability: ± 1 µg long term (± 0.1 µg short term)

**Pressure**
- Design pressure: 10 bar (standard), or 20 bar (optional)
- Typical accuracy: ± 0.05 % of range
- Transducer ranges: 1, 10, 20 bar (up to 3 per system) 2, 10, 100 mbar
- Base Vacuum: < 10^-6 mbar
- Typical regulation accuracy: ± 0.02 % of range

**Temperature**
- Measurement range: 77 – 1273 K
- Temperature sensors: Platinum Resistance Thermometer (Pt100) or Type-K Thermocouple
- Measurement accuracy: ± 0.1 K (Pt100) or ± 1 K (Type-K)
- Typical regulation accuracy:
  - Water bath: ± 0.05 K
  - Furnace options: ± 0.1 – 1 K
- Balance temperature regulation accuracy: ± 0.1 K
- Linear ramp option: 0.05 – 20 K/min (depending upon system accessories)

**Mass**
- Coupling method: Heated Quartz Inert Capillary (2 m)
- Spectrometer:
  - Atomic mass range: 1 – 200 amu standard (1-300 amu optional)
  - Detection limit: 0.1 to 1 ppm, subject to spectral interference
  - Better than 20 ppb (Triple Mass Filter option)
- Detector: Dual Faraday/Electron Multiplier

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IGA-100 Integrated Gas & Vapor Sorption Analyzer

The IGA-100 is designed for gravimetric real-time gas sorption, as well as single component vapor sorption analysis, and powerful Dynamic Gas and Vapor Sorption. The multiplexer lets mass flow control systems allow real-time experiments with fast response and high resolution. Anti-condensation protection to 0 °C is also included to allow operation with water and an extensive range of hygroscopic vapors. As for the IGA-002, an optional vapor generator extends Dynamic Functionality to include gas and vapor mixtures.

### Integrated Dynamic System Options

#### Breakthrough Reactors
The Automated Breakthrough Reactor (ABR) for dynamic IGA systems allows the analysis of gas and vapor separation and purification processes from breakthrough curves. The ABR design features a minimized dead volume for rapid response times and an integral temperature control system for high performance thermal control. Other key features include:
- 2 cm^3 nominal bed volume, with maximized length-to-width ratio
- Operation throughout the range 0 – 500°C and 0 – 20 bar
- Fully integrated control and data logging from the IGASwin software

#### Quadrupole Mass Spectrometers
IGA’s range of quadrupole mass spectrometers can be interfaced to all dynamic IGA systems. The combination of gas-phase and gravimetric analysis provides an invaluable tool for materials characterization. These hyphenated systems can also be used to study thermal decomposition and degradation processes;
- Broad atomic mass range and mass range with triple mass filter options
- Heated capillary transfer with high and atmospheric pressure sampling options
- Bypass pumping arrangements
- Mobile cart or in place stand-alone operation
- Fully integrated, automated control from the IGASwin software

#### Other Accessories
The IGA series is available with a wide range of accessories to suit individual application requirements. Systems are fully upgradeable and bespoke solutions can be provided:
- Additional low pressure measurement and control ranges
- Humidity generator for delivery of humid gas with feedback control
- refrigerated water bath and environment jacket for optimum near ambient temperature regulation, with integrated alloys heater option
- Range of furnace from set point control to high temperature TG linear ramp applications, including unique programmable coolers for operation at user-specified rates
- Enhanced temperature rating (800 °C) at pressure for high temperature and pressure studies
- Enhanced temperature rating (800 °C) at pressure for high temperature and pressure studies
- Unique sample loader to allow air- or moisture-sensitive samples to be transferred to the IGA in a controlled, inert atmosphere
- Actuated sample environment arm to replace standard test stands

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Hiden Isochema IGA Series
Gravimetric Gas & Vapor Sorption Analyzers

Hiden Isochema
Advancing Sorption Analysis

www.hidenisochema.com