



Automated, gravimetric, water vapor sorption analyzers



# AQUADYNE <sup>DVS-1</sup><sub>DVS-2</sub>

For pharmaceuticals, food, construction materials, fuel cell research, papers, carbons, and advanced materials.



# AQUADYNE *DVS-1* *DVS-2*

Aquadyne *DVS-1* has one balance  
Aquadyne *DVS-2* has two balances

Peltier-based temperature control

Balance head(s) purge

Status display



Balance head(s) cover

Heated sample(s) chamber door

Sample chamber accommodates one (*DVS-1*) or two (*DVS-2*) samples.

Water reservoir

Water sorption behavior plays an important role in the development and use of many common and advanced materials. Some examples include:

- Stability of pharmaceutical excipients and drug actives
- Drying and storage of grains
- Texture and shelf life of food products
- PEM fuel cell components
- Mortar, grout and other cementitious materials
- Paper and coatings
- Hydrophobic surface treatments
- Microporous and nanostructured carbons

The Aquadyne *DVS* instruments are fully automated, gravimetric, one or two sample water vapor sorption analyzers. They measure adsorption and desorption isotherms of water vapor both accurately and sensitively, including sorption kinetics, with minimal operator involvement. The weight(s) of one or two sample(s) is / are constantly monitored and recorded as the relative humidity is automatically varied by the blending of dry carrier gas with a saturated gas stream using precision mass flow controllers. The dual balance design of the Aquadyne *DVS-2* allows increased analysis throughput, side-by-side comparison with known or reference materials, or an extended mass range for a single sample.

The independently temperature-controlled balance head environment ensures long term stability. The small sample chamber ensures rapid changes in sample atmosphere conditions when the relative humidity is altered during an analysis. Sample(s) can be pre-dried in situ up to 80° C in a flow of dry gas. The software is available in a 21CFR Part-11 compliant version, and runs under Windows® XP, 2000 and Vista.

## MEASUREMENT CAPABILITIES

### Isotherms:

Mass change as a function of changing relative humidity, increasing mass during adsorption (increasing RH%), decreasing mass during subsequent desorption (decreasing RH%).

### Kinetics:

Time-dependent studies give the rate of sorption.

### Effect of Temperature:

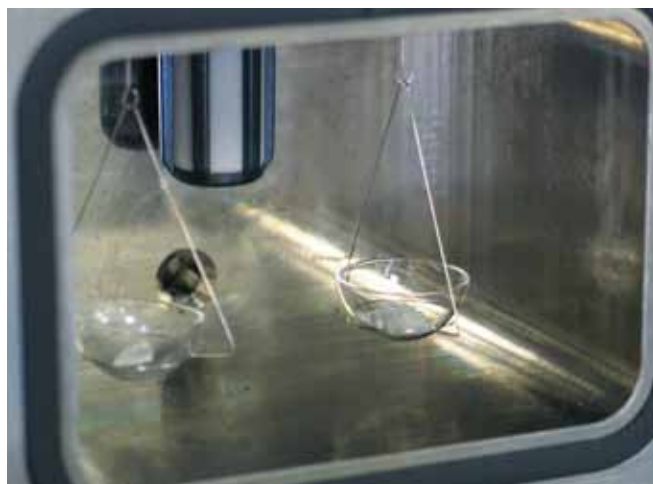
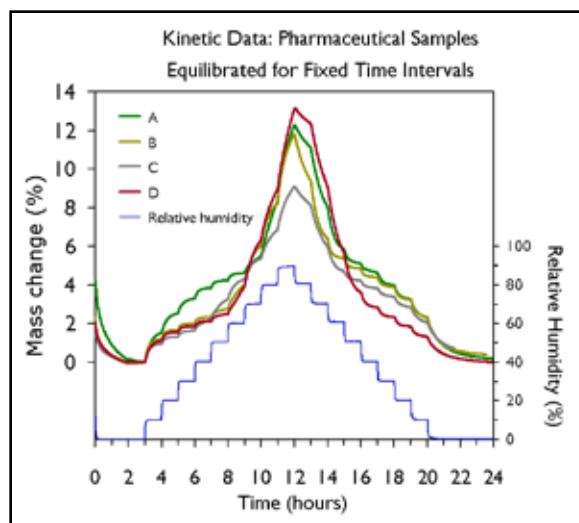
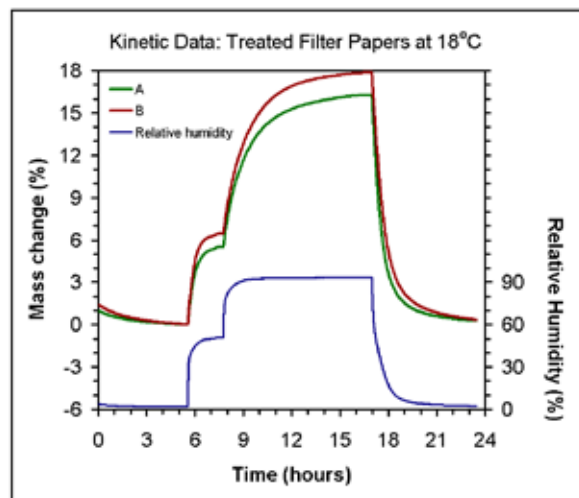
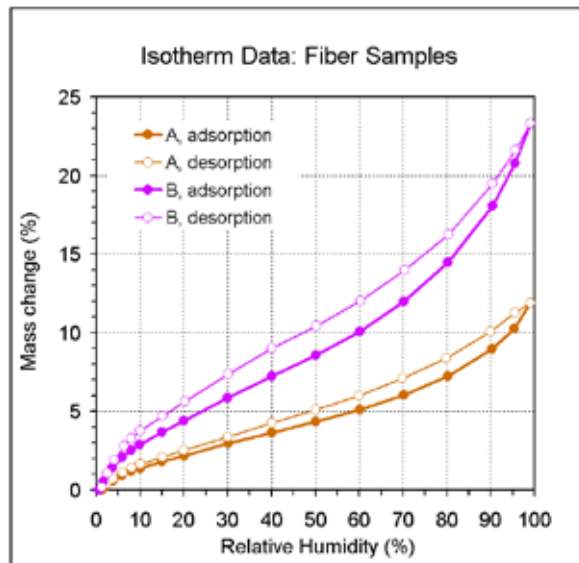
isotherms and kinetics change as a function of temperature. Can be used to yield sorption enthalpies.



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## APPLICATIONS/RESULTS

- Deliquescence: certain salts exhibit the property of dissolving in self-adsorbed water.
- Equilibrium moisture content: quantitatively the amount of water associated (adsorbed/absorbed) with the material under given atmospheric conditions of temperature and relative humidity (organic materials may be subject to molding according to atmospheric humidity, for example).
- Hysteresis working range: adsorption and desorption usually differ by hysteresis - this gives a range of stability in which subsequent sorption cycles produce no change in equilibrium moisture content.
- Hydrophobicity/philicity: the shape of the isotherm reveals relative strength of affinity between water and the surface, due to polar or other chemical interactions.
- Micropore investigations: even hydrophobic materials can take up moisture if their pores are small enough.
- Crystallization phenomena: certain amorphous materials will undergo crystallization as a function of water sorption due to, for example, shifts in glass transition points.
- Sample form: sorption kinetics can be altered by the physical form of a material - powder, granule, pellet, tablet, monolith etc.



The dual sample capability of the Aquadyne *DVS-2* is illustrated above

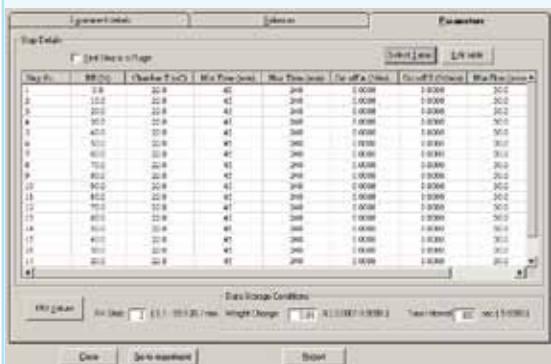


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## SOFTWARE



The Aquadyne DVS is operated through user-friendly software running under Windows®. Sample analyses are easily and quickly set up in terms of target RH with equilibration criteria based on rate of weight change and/or time. The software automatically records kinetic sorption data and isotherm points at user selectable intervals. During the run, data points yet to be recorded can be deleted, added to, or edited for different values (even sample chamber temperature) for real-time optimization.



Both kinetic and isotherm plots for points acquired can be viewed during the analysis, separately for each balance, or combined in an overlay plot. Once analyzed, results can be viewed in tabular and graphical format, and calculations such as BET surface area and heats of adsorption performed. Data can also be exported in a csv format.

## SPECIFICATIONS

DVS-1 Balance heads:	1
DVS-2 Balance heads:	2
Balances, type:	ultrasensitive electronic microbalances
Balance load capacity(each):	5g
Balance load capacity(combined):	10g ( <i>DVS-2</i> only)
Dynamic weighing range(each):	-500mg to + 500mg, 0 to +1000mg
Dynamic weighing range(combined):	-1000mg to +1000mg, 0 to + 2000mg ( <i>DVS-2</i> only)
Weighing resolution:	0.1µg
RH range:	<2% - 98% (depending on temperature).
RH resolution:	0.1%
RH accuracy :	± 0.8% RH at 25°C
Sample chamber temperature range:	<10 - 80°C ( <i>DVS-2</i> ), 15-60°C ( <i>DVS-1</i> )
Sample chamber temperature accuracy/stability:	± 0.2°C
Balance head temperature :	ambient - 85°C (independently controlled)
Gas flow rates:	0 - 200 cm <sup>3</sup> /min (mass flow controllers)
Viewing port / sample chamber door:	heated, triple-glazed
Data acquisition rate:	adjustable, up to 12 points per minute
Sample pan material:	silica (other materials can be employed)
Water reservoir capacity:	46 ml

## UTILITIES

Dimensions(W x D x H):	45cm x 60cm x 55cm(18" x 24" x 22")
Weight:	60kg(132 lbs.)
Electrical:	100-230 V~, 50/60Hz - single phase
Compressed gas:	dry air or nitrogen regulated to 8-15 psig
PC:	Windows 2000 or higher operating system with RS232 communications port and 9-pin D-sub connector.

## ACCESSORIES

A part from electricity, the only utility the Aquadyne DVS requires is dry air or nitrogen regulated to the required pressure.

Our two-stage regulator assembly includes CGA580 fitting and isolation valve.



Regulator Assembly: p/n: 01207



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- Chemisorption Studies
- Water Sorption Behavior
- Mercury Porosimetry
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**Quantachrome**  
INSTRUMENTS

**CORPORATE HEADQUARTERS**

Quantachrome Instruments  
1900 Corporate Drive  
Boynton Beach, FL 33426 USA  
Phone: +1 (561) 731-4999  
Fax: +1 (561) 732-9888  
E-mail: [qc.sales@quantachrome.com](mailto:qc.sales@quantachrome.com)

**CHINA**

Quantachrome Representative Office  
M806, Jingbao Garden  
183 Andingmenwai Street  
Beijing 100011, China  
Tel/Fax: +86 10 64400892

**EUROPE**

Quantachrome GmbH & Co. KG  
Rudolf-Diesel Str. 12  
85235 Odelzhausen, Germany  
Phone: +49 (0) 8134/93240  
Fax: +49 (0) 8134/932425

**EUROPE**

Quantachrome UK Limited  
Pale Lane Farm, Pale Lane  
Hartley Wintney  
Hook RG27 8BA, UK  
Phone: +44 (0) 1252819719  
Fax: +44 (0) 1252819901

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