

# Versatile Gravimetric Analyzer, V-GA

*Designed, built, and supported by InstruQuest Inc.*

The high capacity V-GA gravimetric analyzer is a continuous flow system designed for sorption/desorption, kinetics, and permeability studies at ambient pressures using more representative samples. Many proprietary solutions incorporated in this design resulted in a high performance and fully automated system, with no limit on the balance dynamic range, and the ratio of balance resolution to the mass of sample rivaling the other much more expensive gravimetric analyzers. The modular design allows for addressing variety of custom applications and utilizing each module separately. For example, the V-Gen or HumiSys LF with its own software can be also used as a RH generator for other applications.



The main components of the modular V-GA flow system are:

- High capacity Sartorius semi-microbalance (e.g.100g/220g – CPA225D)
- V-GA isothermal chamber
- V-Gen (Model 2) or HumiSys LF humidity generation modules (please see separate brochures)

## **Sartorius semi-microbalance:**

- High capacity
- Excellent ratio of resolution to capacity
- Electromagnetic force compensation
- Thermal compensation
- Adaptable to noisy environments
- Overload protection
- Superior accuracy and stability
- Readability (model dependent), typically 10 or 100 micrograms
- Integrated calibration weight
- World-wide availability and support
- Inexpensive

## **V-GA isothermal chamber:**

- Temperature range from sub-ambient to 95 °C
- Temperature of experiment, from sub-ambient to 60 °C (standard model), at full range of RH
- Different sample chamber sizes (e.g. 5.2 cm x 5.2 cm x 12.8 cm)
- High temperature digital RH probe inside the chamber (RH and T data w/ 16 bit resolution)
- Additional internal temperature probe (RTD)
- Proprietary design of vapors exhaust system and anti-condensation protection
- Uniform RH distribution (special diffuser)
- USB/Serial communication port for RH probe data
- Small size of instrument 23 x 27 x 38 cm
- Variety of custom options

The principle of measurements is typical to flow type gravimetric systems. One end of the hang-down assembly is attached to the balance from the bottom and the other end accepts the sample holder.

The RH stream from V-Gen is delivered via heated transfer line at the back of the chamber and is diffused uniformly. The miniature, high temperature, digital RH probe (located on the right hand side) measures RH and temperature values that are displayed on the LCD screen and they are transferred to V-Gen (or to PC). Additional temperature probe (RTD) is provided for situations when RH probe cannot be used (organic vapors). The sample holder can have a fine mesh bottom for easy transfer of moisture to the sample but any construction can be used.

The stream leaves the chamber via regulated diaphragm orifice. A special system takes some air from under the balance (via filter), passes it via heated tube, mixes it with the stream leaving the chamber, and the whole mixture is exhausted out of the instrument. Typically, a 0.5" I.D. tubing can be attached to the exhaust adapter and the vapors can be redirected to a hood.



#### **Operational software (Windows® based) for combined modules:**

- Intuitive design of experiment protocols and saving them for reuse
- Up to 1000 RH steps per run, variety of RH profiles
- Ability to modify any parameter at any stage of experiment
- Ability to combine several equilibrium criteria
- Graphing, recording, generating reports, viewing of previous data
- Extensive diagnostics,
- Balance calibration, tarring, data processing
- Variety of hardware configurations
- Recording of all sensors data
- Easy modifications for customized applications and multi-mode operation
- Calculation utility "RH Calculator" useful for experiment planning
- Multitasking
- USB/Serial communication
- Automated installation
- Windows (95 – XP)
- Macro for data transfer to Excel®

#### **Custom options:**

##### **A. Accommodation of large samples**

Larger sample chamber machined from solid aluminum block per customer specifications.

##### **B. Permeability**

Special permeation cells for study of vapors transport through membranes.

##### **C. Low temperature option**

Water cooling option for connecting a constant temperature bath (user provided)

##### **D. High temperatures**

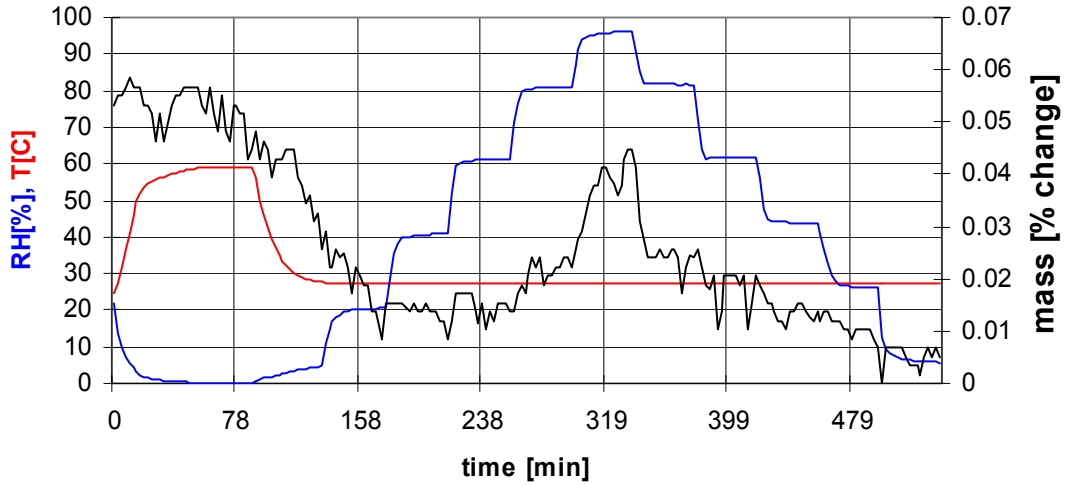
Special sample chamber can be equipped with high temperature furnace.

##### **E. Organic vapors**

Special organic vapor generator for limited number of organic substances can be provided.

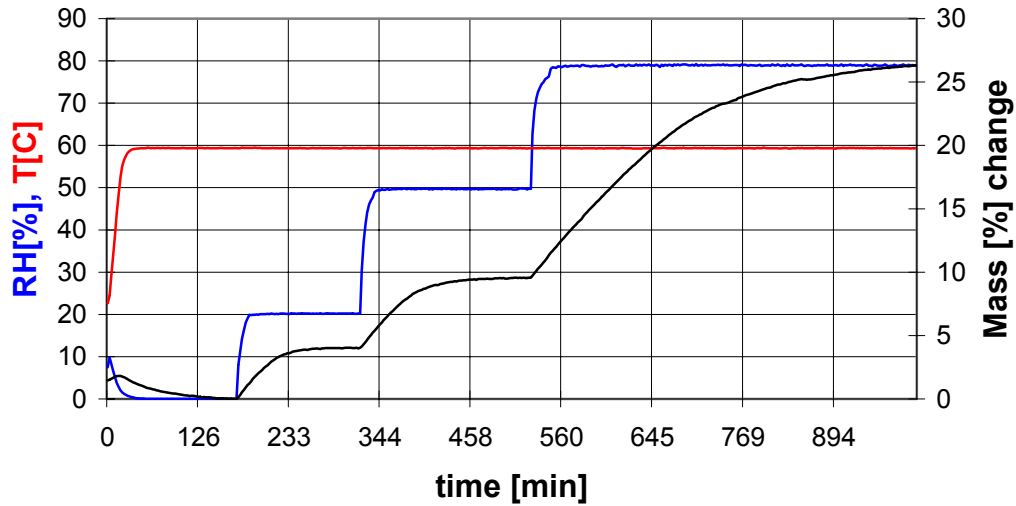
## Examples of raw (untreated) experimental data

### Mass % change of an empty (metal) sample holder, dried at 59 C, run at 27 C



As the illustration of stability, a time course of a run with empty metal holder is presented using CP 124S semi-microbalance with 100 microgram readability. The RH (Blue) and Temperature (Red) are on the left ordinate and mass percent changes (Black line) are on the right ordinate. The empty sample holder weighs 5.8254g.

### Silica gel, dried and run at 59 C



### **Advantages of the V-GA system:**

- Larger and more representative samples can be used
- High performance, state of the art design
- No limit on dynamic range (compare to 500 or 200 mg of other microbalances)
- Large selection of balances and weighing modules
- Easy installation by the user, virtually maintenance free
- Robust, easy to service and operate
- Independent modules, each with its own software
- Perfect for R&D, industrial, and QC environment
- High quality components
- Special applications can be easily addressed
- Economical to use (oil-less air compressor can be used)
- Low cost
- Only the required modules need to be purchased (the user may already have a Sartorius balance and /or computer)
- Automatic and manual operation
- Hardware, software, and installation manuals are provided.

Distributed by:



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