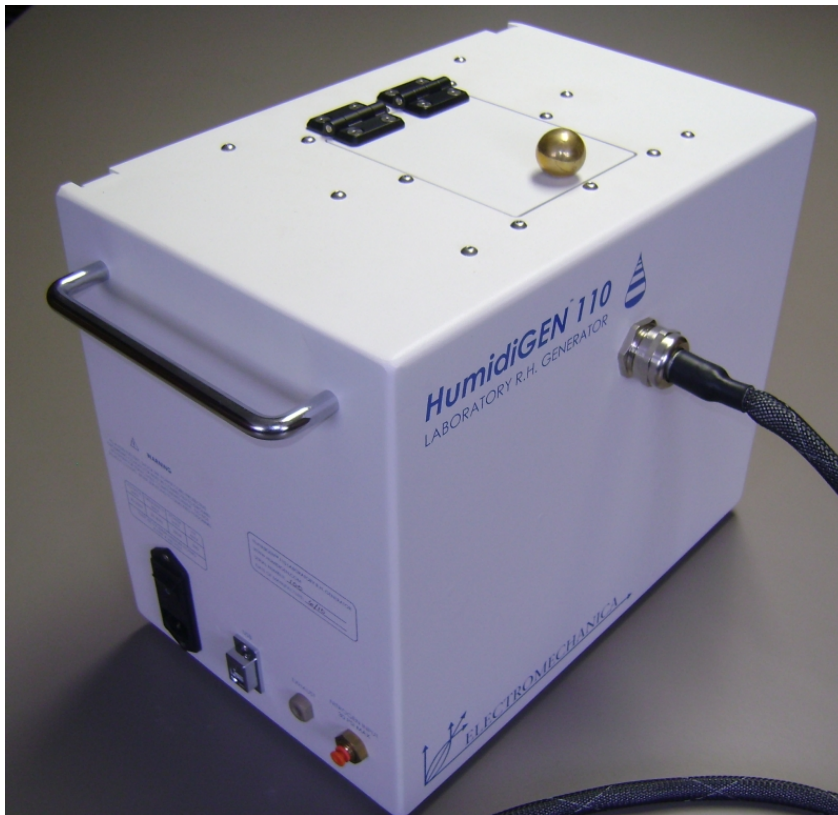


HumidiGEN® Laboratory Humidity Generator

Installation & Operation Manual

R1.0



Electromechanica, Inc.
13R Industrial Dr., Unit 2
Mattapoisett, MA 02739

Tel: 508.967.0424
Email: kedminster@electromechanica.com

www.humidigen.com

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1. **Safety**

Read & understand manual before using the HumidiGEN® system. Failure to follow manual instructions and warnings may result in injury or death.

There are no user serviceable parts inside the HumidiGEN® system. Please contact Electromechanica, Inc. for service or repair.

Surfaces on the humidifier chamber accessible by the fill port covers and the heated line may be hot. Allow the system to cool before touching these surfaces or accessing ports.

Do not expose the HumidiGEN® system to water or corrosive chemicals. Do not immerse the system in water

The HumidiGEN® system must be connected to a 120VAC receptacle with a properly grounded line cord. Do not use a damaged line cord or one that does not have a proper ground conductor.

The HumidiGEN® system is not designed to operate in combustible or explosive atmospheres. Only dry inert gasses such as nitrogen and air shall be connected to the HumidiGEN® system. Not for use with oxygen or flammable gasses.

Input line pressure is 30PSI max. Do not exceed this pressure.

2. **Installation**

WARNING: Installation of the system software and drivers may adversely affect other instruments connected to a computer. Electromechanica, Inc. strongly recommends installing the software on a dedicated computer without other National Instruments (NI) hardware or software previously installed. Electromechanica, Inc. is not responsible for damages caused by software installation conflicts.

1.1. Host Computer Requirements

PC with Windows® XP Service Pack 2 or later operating system
Available USB 2.0 port
Approx. 2Gb free hard drive space

1.2. Software Installation

Install software BEFORE connecting the hardware!

Software is contained in the folder 'HUMIDIFIER_CONTROL_R1-0_8-23-10'

Double click 'Setup.exe' to install the software including drivers. Follow the setup instructions during the software installation process.

1.3. Hardware connection

After the system software is installed connect the HumidiGEN® system to the host computer with a USB A to USB B cable. The host computer will show a new USB hub device has been found. Allow this device to install.

Connect the gas supply line to the orange push-to-connect fitting ensuring the tube is fully inserted and retained in the fitting. Supply dry clean N₂ (or air) to the HumidiGEN™ at 30 PSI max. Tubing connection is for 5/32" (4mm) OD polymer tubing.

Attach a line cord to the power entry jack and plug into an available 120V AC outlet. Toggle the switch to 'ON'



Figure 1- System connections

Heated gas line output connections are terminated with ¼-28 flat bottom connections. The exhaust connection also uses the same port type. Fittings are available from Upchurch scientific.

1.4. DAQ Setup

The HumidiGEN® contains two (2) NI DAQ cards that must be configured prior to use. Launch the NI Measurement and Automation Explorer program to configure the DAQ modules.

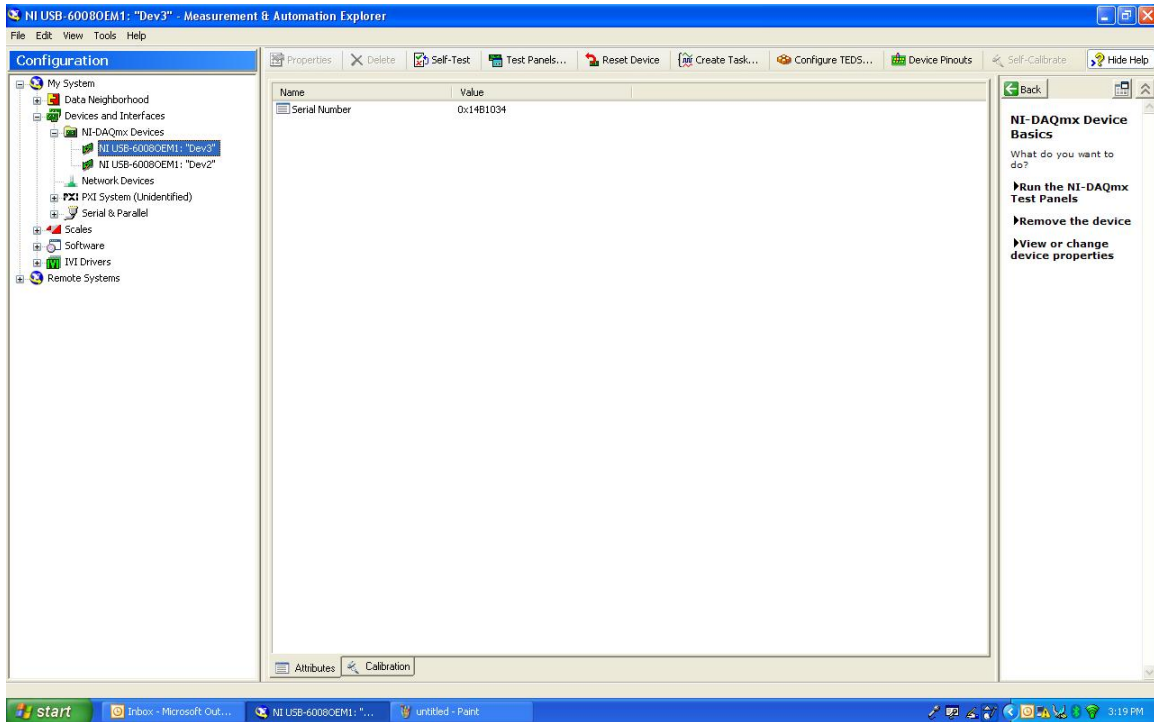


Figure 2- DAQ Setup

Access the devices in Devices and Interfaces>NI-DAQmx Devices

The 2 cards will appear as 'Dev2' and 'Dev3' or similar. The names must be changed as follows:

For HumidiGEN® S/N: 001 DOM: 6/10

'DAQ2' for NI USB-6008OEM S/N: 0x14B0FD2

'DAQ3' for NI USB-6008OEM S/N: 0x14B1034

After this has been configured close Measurement & Automation Explorer.

3. Operation

3.1 Theory of Operation

The HumidiGEN® laboratory humidity generator creates a stream of gas with controlled humidity. Dry gas enters the system and the flow is split to two (2) gas mass flow controllers (MFCs). One controller is dedicated for a 'Dry' gas stream, the other for a 'Wet' gas stream. The 'Wet' gas stream is created by flowing the dry gas through a Nafion® tube in a water bath. Nafion® is highly permeable to water vapor and the gas flowing through the Nafion® becomes saturated with water vapor.

The 'Wet' and 'Dry' gas streams are mixed in proportions controlled by the upstream MFCs. The mixed gas is passed into the 'Supply' side humidity sensor chamber where %RH is measured. The humidified gas is then supplied to the end use point through a temperature controlled line to minimize temperature change and possible condensation.

A return line is available to bring exhaust gas back to the instrument to a separate 'Return' side humidity sensor before being exhausted out the side exhaust port.

3.2 Hardware

Add 15-20ml of distilled or deionized water to the humidifier chamber. Water is added to the humidifier chamber through the port in the center of the humidifier chamber. Use care in tightening the port plug screw to avoid overtightening

Water should be removed from the humidifier chamber when not in use. A syringe and blunt needle are helpful when filling and draining the system

Before startup open the condensation trap port and use a syringe to draw out any liquid collected in the trap. The trap may need to be emptied periodically during extended use. The condensation port trap plug screw must be installed for proper operation to avoid gas leaks. Use care in tightening the port plug screw to avoid overtightening

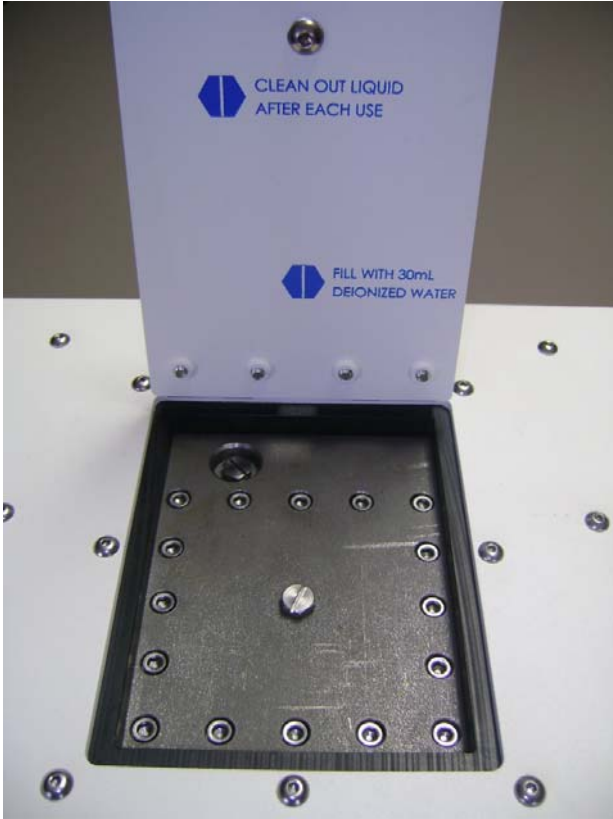


Figure 3- Fill and trap ports

3.3 Controls & Indicators



Figure 4- Main Screen

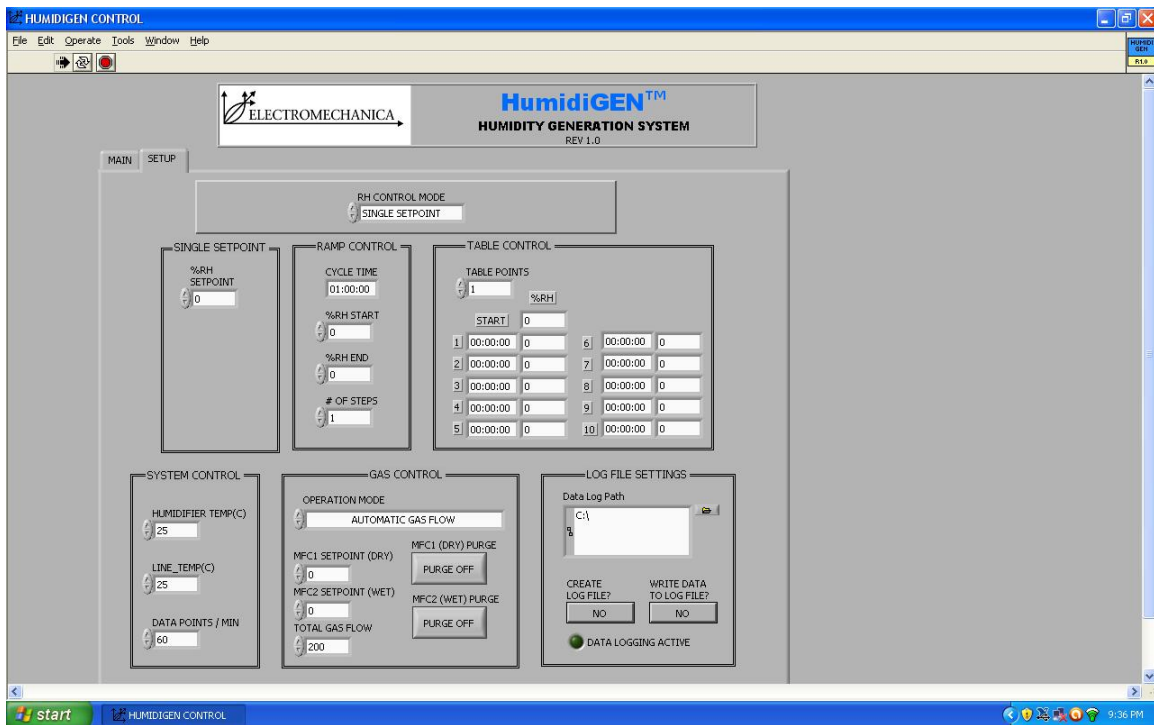


Figure 5- Setup Screen

3.4 Basic Settings

System Control

Humidifier Temp- Ambient to 75°C

This setting controls the temperature of the humidifier subassembly where humidity is generated and sensed. Temperature may be changed at any time.

Line Temp- Ambient to 75°C

This setting controls the temperature of the heated line subassembly where humidity is transported from the humidity generator to the point of use. Temperature may be changed at any time.

Data Points / Min- 1 to 60

This setting controls the rate at which the control loop is executed and data points are generated. It is recommended to leave this setting at 60 unless very long runs are anticipated. Data point rate must be set prior to starting the humidifier software and may not be changed once the software is running.

Gas Control Operation Mode

Automatic Gas Control- This setting allows the software to automatically control gas flows. This option must be selected to use any of the automatic humidity control options

Individual MFC Control- This setting allows the operator to manually control each of the MFCs independently. Dry & Wet gas flow setpoints can be selected from 0-200sccm. Total gas flow is not used in this mode

Constant Total, Setpoint MFC1 (Dry)- This setting allows a constant total flow of gas to be maintained. The entry in the MFC1 Setpoint (Dry) controls the dry gas flow. Wet gas flow is automatically calculated as the balance of Total – Dry flow.

Constant Total, Setpoint MFC2 (Wet)- This setting allows a constant total flow of gas to be maintained. The entry in the MFC2 Setpoint (Wet) controls the wet gas flow. Dry gas flow is automatically calculated as the balance of Total – Wet flow.

Log File Settings

A location & name for the log file is selected in the directory field

The 'Create Log File' button must be selected before running the program. This creates the log file and it's header

The ' Write to Log File' button may be selected and de-selected at any time if a log file has been created to write data to the file. This is useful if the user does not want to log data during equilibration of the system. The 'Data Logging Active' indicator illuminates when data is being written to the file.

Data is logged to a .TXT file with tab delimited fields. Each line in the data file represents one datapoint. Logged parameters include:

DATE
TIME
DATAPOINT
HUMIDIFIER_TEMP(C)
%RH_(SUPPLY)
DEW_POINT(C)_(SUPPLY)
H2O_PARTIAL_PRESS(kPa)_(SUPPLY)
LINE_TEMP(C)
MFC1(DRY)_FLOW(SCCM)
MFC2(WET)_FLOW(SCCM)
%RH_(RETURN)
DEW_POINT(C)_(RETURN)
H2O_PARTIAL_PRESS(kPa)_(RETURN)

Files will be amended with new data if a run is started with out changing the log file name. Data is never overwritten

3.5 Single Setpoint Operation

Single Setpoint may be selected to automatically control humidity to a single setpoint. This setpoint may be changed at any point during the operation of the instrument.

3.6 Ramp Operation

The ramp function creates an automatic multiple stepwise change in the humidity. Start and end humidity setpoints are specified. Cycle time and number of steps are specified. Each step time is the total time divided by the number of steps.

Ramp entries must be made before starting the humidifier software

A single setpoint may be used to equilibrate the system to a start point prior to beginning a ramp function. Select a single setpoint that is the same as the starting point of the ramp function. Once equilibration is complete select the ramp function to immediately begin the ramp step changes.

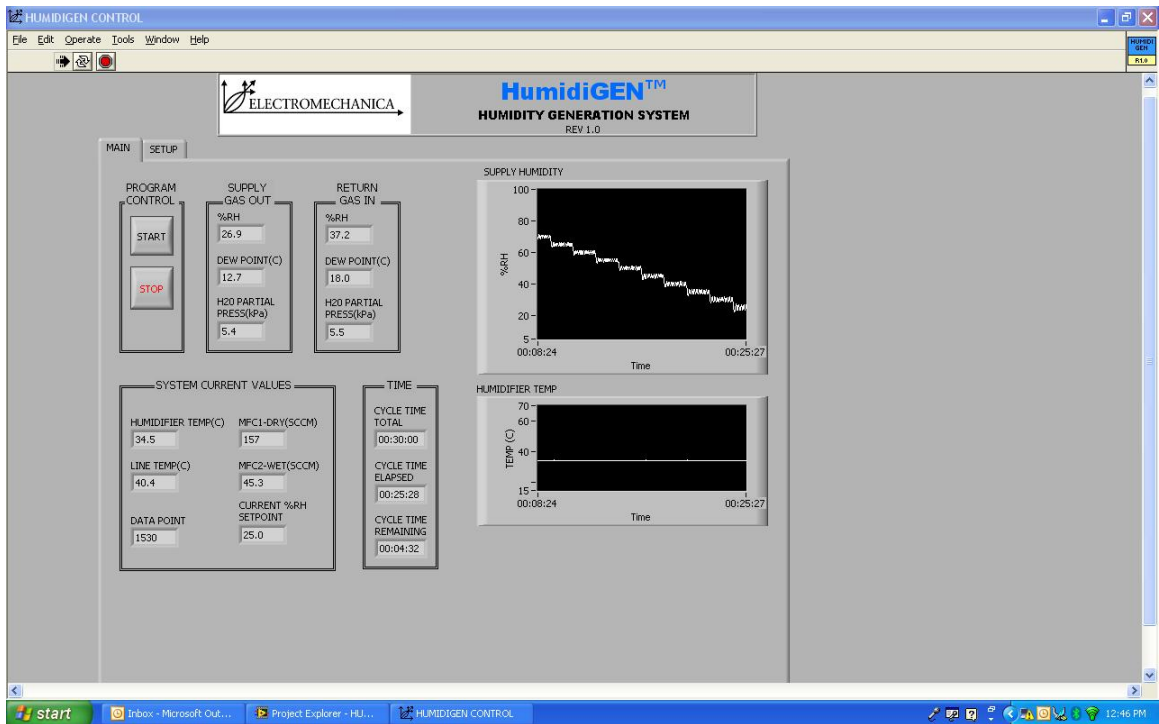


Figure 6- Example ramp function

3.7 Table Operation

The table function creates an automatic stepwise change in humidity according to the table entries. Table time is specified in absolute time from the start point. %RH is the humidity setpoint that will occur at the table time specified and will continue until the next table point. The number of table points used must also be specified.

Table entries must be made before starting the humidifier software

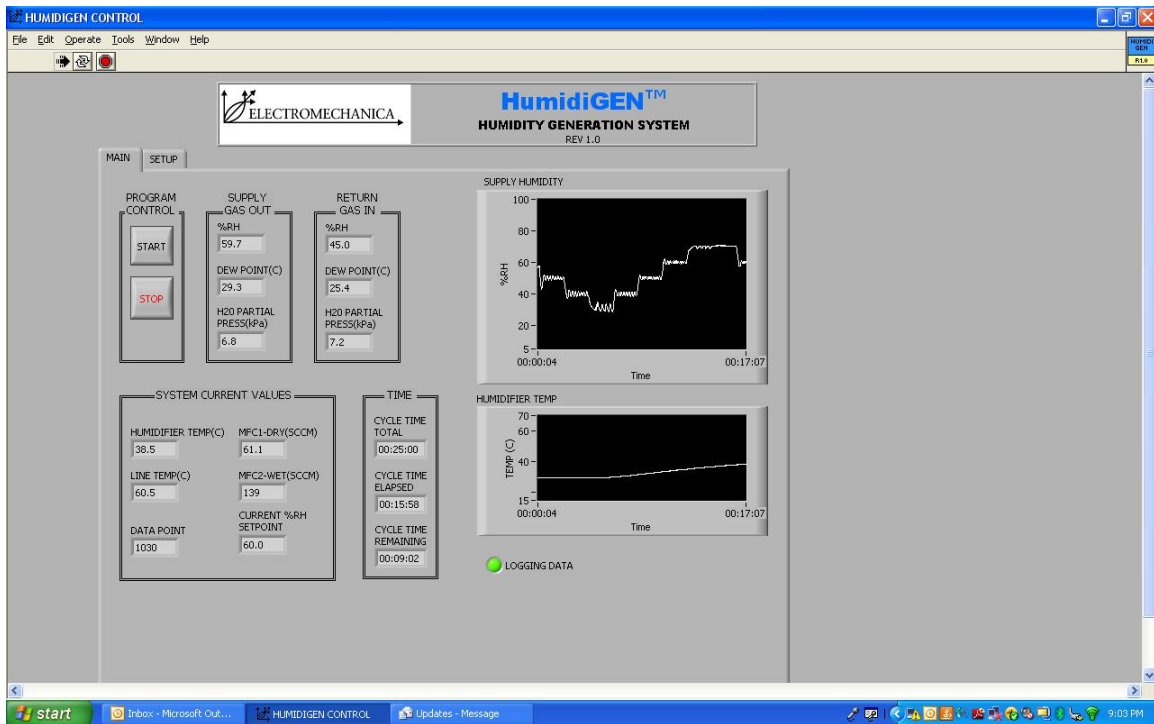


Figure 7- Example table function

3.8 Manual Operations

Purge- The purge buttons are used to flow large volumes of gas through the system to rapidly change the humidity. This is useful for clearing condensation. Purge will only work if the corresponding setpoint is set to 200sccm either in manual mode or by automatic control.

4. Maintenance

Always remove water from the humidifier when not in use.

Avoid tight bends in the heated gas line especially where it enters the humidifier enclosure.

Nafion® tubing may need to be replaced periodically depending on use. Consult Electromechanica, Inc. for further information.