Oslo Science Park
Gaustadalleen 21
NO-0349 Oslo
Norway

HumiStat Manual

Contents

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1 Introduction to HumiStat

HumiStat is a precision gas mixer. Mixtures are formed from gas(es) and fluid(s) by accurately controlling the input amounts. The made mixture is optionally heated and kept above the vaporization temperature of the fluid component.

1.1 Unpacking

The manual section 'Unpacking' is printed as separate sheet and included with the shipment. Un case not available check the same in this manual.

1.2 The three components

HumiStat consists of the physical humidifier, the heated gas supply line and the software.

1.3 Humidifier

The humidifier is a compact desktop box of roughly 20 x 20 x 30 cm.

On the front panel are inputs for gases A and B, and input for liquid C , and a PID controller for the heated gas line.

All HumiStat components operate at 24 VDC, and the mixer comes with mains power supply suitable for the end users region.

1.3.1 Input gas(es)

Input gases are selected from mass flow controllers A and B on the time of placing the order, according the specifications sheet of the product. At the factory the mass flow controllers are calibrated with real gas for improved accuracy. The gas line A is the one to be diluted the most, and gas line B is the dilutant.

The standard HumiStat can mix two input gases simultaneously, but these two gases can be selected from a pool of up to 10 gas calibrations per gas line. For more complicated mixtures it is possible to use more than one HumiStats connected together.

1.3.2 Input fluid

Most low viscosity fluids are possible. The used liquid should be high purity as any impurities will clog the gas line where the liquid vaporizes. For example water must be deionized or distilled. The tubing in contact with the fluid is brass, copper, stainless steel and PTFE. Other materials are possible on request. External fluid container is not included. The fluid tube C has inner diameter of ~ 0.5 mm (other dimensions on request).

1.3.3 PID controller

The controller allows setting and maintaining temperature of the heated gas line. The controller uses PID algorithm, on a thermocouple feedback from the heated gas line to regulate the power to the heated gas line. The selected temperature should be high enough to ensure the added fluid is vaporized, for example >100°C for H_2O.

1.4 Heated gas line

The heated gas line of 1.22 m length is somewhat flexible. The sharpest bending radius 25 cm, e.g. curve diameter 50 cm, any sharper turns will damage both the convoluted gas line and the insulation around it. The heated gas line has stainless steel, 1/4 inch Swagelok tube fitting connects at each end to connect the mixer to the process or sample holder such as ProboStat (adapter for ProboStat included).

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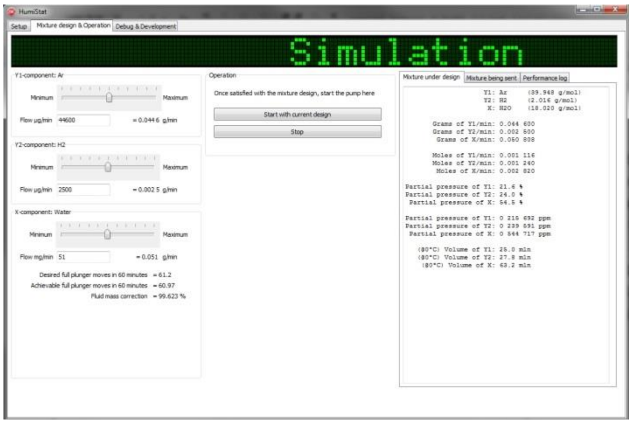
The heated gas line is equipped with plugs to connect to the humidifier for power and thermocouple feedback. The surface temperature is about 40°C, and the maximum inside temperature is limited to 150°C. Higher temperatures are possible on request.

1.5 Power supply

CE marked power supply is included in the system. It supplies 24 volts DC and is capable of 10 A current, enough to power the instrument and heat up the heated gas line. The 4 pin connector is a snap-on model, connects to the back side of HumiStat by pushing in from the wire slightly back of the connector, and will not disconnect from the mixer without pulling back the plug release mechanism, or from the socket with flat area.

1.6 Software



The HumiStat software connects to the humidifier from a Windows PC (not included) with an USB cable (included). The software allows user to select gases from the available pool, and allows the user to design a mixture with specific partial pressures of the components and a segment program.

1.6.1 Setup tab

The setup tab is used to verify the connection between the software and the HumiStat, and to select the gases used.

1.6.2 Pump & fluid details

The Pump & fluid details tab allows defining properties of the fluid, and limiting the maximum fluid contribution to the mixer (artificial upper limit). The options for the pump volume and gear ratios are pre-defined and depend on the type of the pump used in the mixer. The software automatically creates a file with .ini ending, and keeps all settings stored in that file.

1.6.3 Mixture design and operation

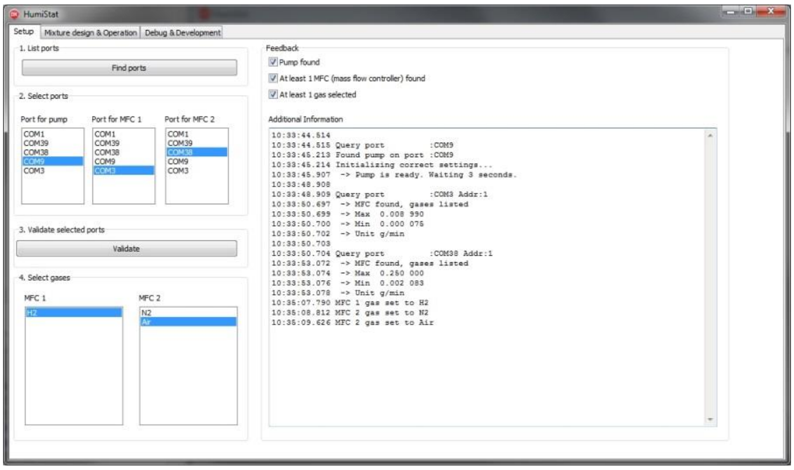
This tab is for designing mixtures and segment programs as well as executing them, in short, operating the mixer.

1.6.4 Debug & Development

This tab allows demonstrating the software even when no mixer is connected to the computer, by defining virtual gases to be used for calculations. Additionally this tab allows sending direct commands to the fluid pump while the HumiStat is not in use. End user should not need this tab, but it is useful for testing and troubleshooting purposes.

2 Setup

Connect the HumiStat USB cable to the computer, and the 24 VDC adapter to the HumiStat and to the mains power, and execute the HumiStat software. The software is just a single .exe file requiring no installation. The .exe file can be downloaded from [NORECS website]() -> Humistat



The software will write files and folders directly under its own location so the windows user account must have file writing permissions to the location in question. In other words; do not place the .exe file under 'program files' or 'system' folders.

The setup tab allows the user to connect the HumiStat to a new computer in an easy way and to verify the connections in case USB cables have been changed since last use.

The mixer uses two types of USB to virtual com port drivers. The correct drivers for the MFC ports are identified automatically by Windows in most cases. The software should show three or more separate ports on the list boxes. If less than three ports are shown, it may be necessary to install the drives manually:

- https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers
- http://www.ftdichip.com/Drivers/VCP.htm Use VCP, not D2XX

The areas of this tab are numbered and correspond to the order things should be done. First click should be 'Find ports'. This will list all existing serial ports, real or virtual, in the three list boxes. USB devices often display themselves as 'virtual serial ports' (aka virtual COM ports), and this is the case also with the hardware of HumiStat. Inside the HumiStat the USB cable is split, and the mass flow controllers and the pump are all connected to USB and thus to virtual COM ports. The user must select port for each device and then click 'Validate selected ports'. This checking process lasts about 10 seconds during which the software will check if the instruments can be found on the assigned ports. The process will give feedback if the selected ports were wrong, or if the instruments were found and initialized. Until both types (pump and MFC(s)) are found, the user cannot proceed further. Regardless, the software can be operated in 'simulation' mode. The simulation mode allows user to feel and try around the software, but will not do anything real or physical.

Once all instruments are found and confirmed by the two checkboxes, it is time to select the gas(es) to be used. The mass flow controllers (MFCs) may be calibrated for more than one type of gas. Even in the case the MFC only includes one gas, the gas(es) must be selected before the mixer is ready for real use. The gases selected must correspond to the gases physically connected to the mixer; otherwise the calculation about the mixture will not be accurate.

For mixer with serials < 1708008, the .ini file settings are not automatically correct, and the ini file should be edited by hand:

	For high steam concentration mixers	For low steam concentration mixers
Text in the .ini file	[Syringe] Volume Index=0 Steps=3000 MaxSpeed=6000	[Syringe] Volume Index=0 Steps=192000 MaxSpeed=48000

If not known which type of mixer you have, or how to edit the .ini file, please contact robert.jalarvo@norecs.com with the mixer serial number.

On first use the mixer will have air in the fluid line. 'Pump fluid only' button on the debug tab is to pump water (or any other fluid) without any flow of gas, this is to remove any possible air bubbles in the lines prior to real use. The fluid input tube should be connected to front panel C_{in}-connection and submerged in fluid reservoir or fluid supply system[1]. The user should observe the 1/16" gas line on the backside and click 'Pump fluid only' button one click and wait until the pump falls silent, the pump will perform two full syringe strokes and it will take a while. The click-and-wait cycle needs to be repeated multiple times until the line is full of fluid and some fluid comes out from the back of the mixer. This will take about 6 full cycles but depends on the pump configuration and the syringe volume. The pump (and the MFCs) must have been validated and gases selected on the Setup tab for the 'pump fluid only' button to have any affect. Operation is easily confirmed by the sound the pump makes when it is operating.

Once the system has been 'de-aired', add the heated gas line, plug its power and thermocouple cables to the HumiStat as well. The mixer is now ready.

The other end of the heated gas line has narrow gas adapter suitable to be connected to ProboStat gas input. However, the line is stiff, and has notable mass. The mass of the heated gas line must be supported in a fashion that the whole weight and pull of the line does not rest on this fragile gas adapter. Add suitable box, laboratory suspension clamps, pile of books etc. to reliably remove any strain from the adapter connection to ProboStat or to any other process.

2.1 External fluid container

The external fluid container is not included, but a short PTFE fluid input line is included. This line is to be connected to the C_{in} and the other end of the line submerged in the fluid to be used. The line should be submerged in the fluid container in a reliable way so that it is not possible accidentally to remove the line.

Depending on the container design, the fluid may or may not be in contact with ambient air, which will dissolve into the fluid, and corresponding amount of dissolved gases will end up into the made mixture in proportion to the amount of fluid added. Oxygen has solubility of 0.009 g O_2/ liter of H_2O at 25°C and 1013 mbar. Solutions such as boiling or using protective gas reduce the amount of dissolved oxygen in the fluid.

For long term tests using lot of fluid, in case the fluid is stored in closed vessel, a solution to compensate for the reducing volume/pressure must be considered, such as using IV bags with purified water.

2.2 Priming or changing the fluid

While the heated gas line still disconnected (alternatively remove it), ensure the fluid input line is in air. Open the software and proceed through the setup as instructed elsewhere. From the "Debug & Development"-tab click the

[1] Container with fluid, where the fluid input line is submerged.

"Pump fluid only" button and wait (until the mixer falls silent), repeat, until nothing comes out at the 1/32 inch fluid line on the back of the instrument. It can take up to ten cycles of click and wait until the volume is mostly clear of fluid.

Now submerge the fluid input line into the desired fluid, and proceed to 'click & wait' until the fluid comes out of the 1/32 inch fluid line at the back. Also this step can take up to ten cycles of click and wait. Once new fluid is seen, connect the heated gas line back to the mixer and tighten slightly.

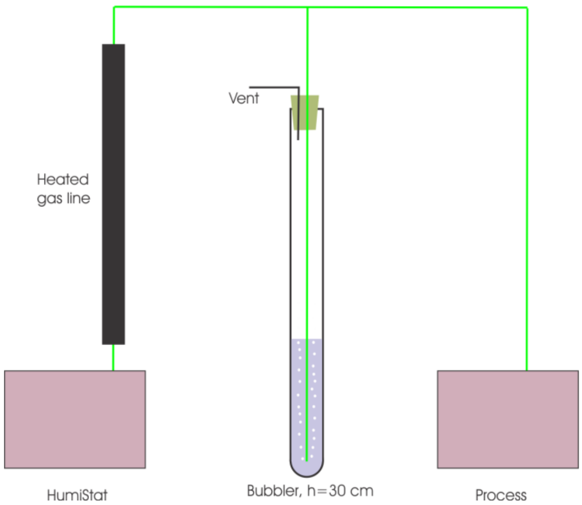
2.3 Bending the fluid line

It is advised to slightly bend the fluid supply line so that it rests against the inside of the heated gas line wall. This ensures that all pumped fluid is in immediate contact with the hot gas line wall, and evaporates evenly. Consider the fluid supply line not touching the wall; the result would be fluid droplet building at the end before dropping, causing less stable mixture consistency.

2.4 Pressure relief

Some instruments that can be used with HumiStat have their own mass flow controllers limiting the amount of ingoing gas. The output of the HumiStat must be unobstructed. The output amount of gas mixture varies, so the mixer cannot be connected directly to instrument that regulates the amount of ingoing gas. In such case a pressure relief valve must be installed between the two instruments, and the vented gas is led to ventilation system.

In the case where the process pressure is atmospheric, a simple relief valve system is just glass tube with some low-vapor pressure fluid such as mineral oil. Increasing the bubbler height and/or the fluid density allows for higher pressure and driving force. NORECS sells such simple pressure reliefs with inert, high density (1.86 g/cm^3) mineral oil.



For example 30 cm column with fluid of 1.86 density gives $0.3m * 9.81 m/s^2 * 1860kg/m^3$ = pressure in pascals = 0.055 bar over atmospheric pressure.

The 0.055 bar overpressure is enough to force the made mixture into the process, but if the process gets blocked, or something restricts the flow of the made mixture (such as separate flow controller in the instrument), the excess mixture will escape out of the bubbler into the vent, without disturbing the operation of the HumiStat or the process.

In case explosive gases are used, such bubbler should be made of non-shattering material and not from glass. The bubbler vent must be connected to appropriate ventilation system that corresponds to the types of used gases.

The pressure relief bubbler described here is not suitable to be used with high steam content; such use requires another type of pressure relief design.

2.5 Tubing for cooling

When the mixer is used with C-component, the heated gas line is always necessary and must be set notably above the evaporation temperature of the fluid to ensure all the added fluid is in gaseous form. If this temperature is above the temperature that the process or the instrument downstream is capable of tolerating, additional tubing is required for allowing the mixture to cool down before entering the process or the instrument. Such tubing is to be added after the heated gas line and before the possible bubbler and the process.

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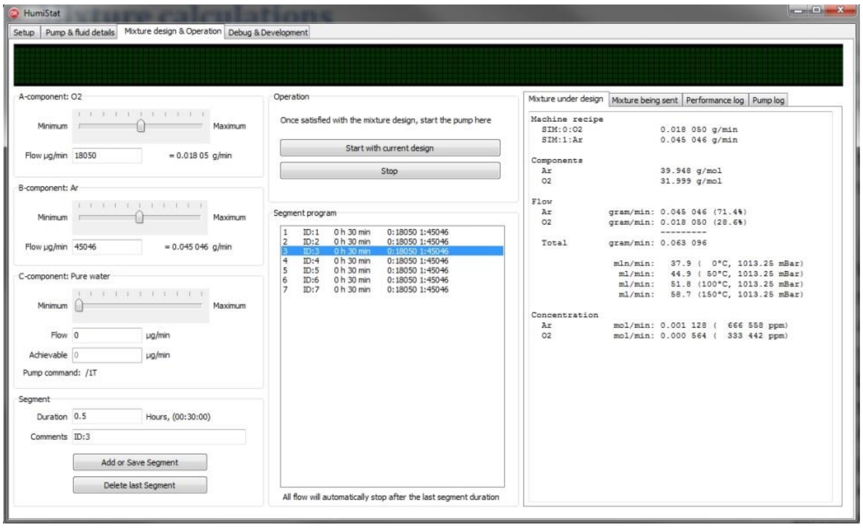
Too high concentrations of component C will condense in the cooling tubing, so it is best to avoid adding too much component C in the first place. For this purpose the “Pump and fluid details” tab has “Artificial upper limit for fluid component in the mixture” field with unit ppm. This will not allow construction of mixtures with component C more than the limit set here. For example, tubing and instruments downstream, in room temperature, should never have more than 20 000 ppm of H_2O.

If the process or instrument is sensitive to condensation, in addition to the artificial ppm limit the user should consider “cold trap” before the process or instrument.

3 Mixture calculations



The desired mixture is designed and executed on this view. It is possible to change the amount of any of the three components within the range specific for the instruments, as defined during order.

Values for gases A and B, and fluid C can be changed using the sliders or by typing into the corresponding text field. Unit of these contributions are given as µg/min. The 0 value is used to specify that none of the component in question should be added to the mixture. The A component can be freely selected to any value between 0 and the maximum flow of the mass flow controller A. With slider the value is between minimum and maximum of the mass flow controller, but values below the minimum can be entered by hand eg. [0-max]. The flow for B is 0, or between the minimum and maximum flow for the mass flow controller B, eg. [0, min-max]. The flow for component C has some restrictions and closest flow to the desired flow is shown in the 'Achievable' field.

The pump requires time for periodically retracting the syringe, and additionally the pump only understands pumping speeds given in full integer frequencies. As result the exact amount of fluid pumped is not same as the desired amount, but slightly off. The correction is applied automatically and the value in the field 'Achievable' is used in the calculations.

On the right side are the details of the mixture. On the 'Under design' tab is what is being selected currently, and on the 'Being sent' tab is what the mixer is currently producing. This allows user to design new mixture while the previous mixture is still being sent, as well as reliably knowing what mixture is being currently made in case accidental or unintended changes of the values on the designer tab.

On the 'Mixture under design' the components A, B and C and their molar mases, and how many grams of each is being added to the mixture per minute are shown. Total amount of moles is calculated from this information. Partial pressure of each component is calculated and displayed. Partial pressure, partial volume and mole fraction are identical physical quantities, and are the most precise way to define a gas mixture.

For reference and convenience, the total volume of the mixture per minute is also displayed (for several conditions). The first unit is mln/min, aka 'Normalized' volume, meaning in this case, that if the mixture was at 0°C, and in case the fluid was a gas at that temperature, and in case the pressure was 1013.25 mbar, the mixture would occupy the given volume. Note that this is only one of the two dozen 'standard' volumetric definitions, and in this context means: 0°C at 1013.25 mbar pressure, designated here as 'normalized'; mln aka millilitres normalized.

The volume is also displayed for 50, 100 and 150°C and the aforementioned pressure.

The software is available at: http://www.norecs.com/work/_files/__PUBLIC_FILES__/software/HumiStat/

It can also be used to check and demonstrate the operation without a physical mixer.

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3.1 Pump log tab

The syringe periodically will refill, this takes some seconds, and will affect the mixture stability. On the mentioned tab some calculation info is shows, and the value for 'Syringe refill interference cycle' will give the frequency of the syring refill event in minutes.

3.2 Fluid content

The ppm fluid content can be limited on the settings tab, to avoid accidentally introducing more fluid than the process can handle.

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4 Operation

4.1 Modes

The mixer can be in few distinct modes as follows: Simulation, Stopped, and Running. In simulation the software can be tested even without the physical instrument. When instrument is present and validated the mixer can be either stopped or running. Stopped does nothing, and when running, the mixer performs the assigned segment program and then goes to stopped mode after the program is finished.

4.2 Segment program

Each designed mixture can be added to segment program with notes and duration. Segments can be edited and deleted. Once the full segment program is ready, clicking the 'Start with current program' will start performing it from the first segment. The mixer will form a mixture as designed and keep producing this until the duration of that segment is reached. If another segment exists afterwards it is performed, otherwise the mixer is stopped. Editing segments that are already performing will not have effect on the made mixture anymore.

4.3 Stop

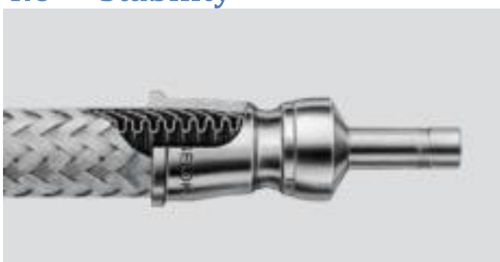
Clicking the stop button will stop performing the segment program. In case of communication failure, software error or emergency, all flow will stop when power to the mixer is turned off.

4.4 Accuracy, stability and settling times

4.5 Accuracy

The HumiStat uses high accuracy fluid pump and real gas calibrated mass flow controllers for precision control of inputs. The MFC is self-regulating with PID algorithm and the pumps speed is calculated and kept constant. There is no feedback loop; knowing accurately what is added to the mixture is more accurate than measuring the output and having feedback loop. Measuring the output can be done by the end user to validate the made mixture, but as the mixer can have various gases, gas ranges, fluids, and mixture temperatures, it is not possible to have all possible combinations covered by a sensor.

4.6 Stability



Every now and then the syringe needs to retract to pull more fluid in, this step takes some seconds. This pulsing of input does affect the stability of the mixture somewhat, but by the time the mixture reaches the process or the sample in the ProboStat the local variations caused by the pulsing have largely evened out as result of gas diffusion while the gas is in the line. The tube itself if corrugated with lot of small nooks and coves to buffer the mixture, and the sample holder volume and high temperature will further dilute and stabilize any possible variations.

4.7 Settling times

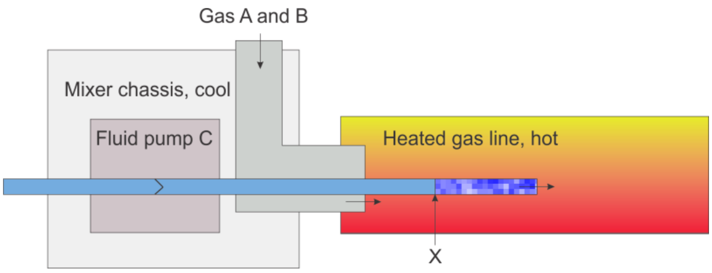
While added gas supply line length and volume help improving the stability of the mixture, the same also increase the time required for the mixture to settle into a new setpoint.

Good practice is to use the mixer with long initial flush step at the beginning, and start with the most diluted segments first and advance towards richer mixtures. If it is necessary to go down on A- or fluid concentration, add a dilution segment into the program between the real steps. Few minutes of 100 mln/min flow of gas B already brings down the concentrations significantly in the % range. For ppm range the flush must be longer and/or larger flow.

If instant transition from one mixture to another is paramount, this can be achieved by using two HumiStat mixers both producing different mixtures, and a with a crossover valve selecting which mixture is led to the process.

When a mixture is designed and applied, the produced mixture at the output of the heated gas line will not instantly be what is specified. The liquid pumping speed and the gas line heating must first reach equilibrium, before that the humidity may be less or more than expected. This delay and fluctuation is visible from other process parameters and will settle in some minutes, depending on a number of things. One can speed this transition by adding a transition-step into the program, with high flows and same or exaggerated properties of the target mixture, for example to go to 1% RH first send 5 minutes of completely dry gas.

4.8 Low fluid concentrations (<2%RH)



The fluid (component C) is injected to the heated gas through 1/16 inch stainless steel tube. This tiny tube enters the heated gas line tube and the two tubes overlap in the hot zone. When adding large amounts of fluid, the fluid flows into the heated gas line and evaporates there.

For low amounts of added fluid; it will take a while to reach equilibrium. While the speed of injection of fluid is regulated and known, the evaporation of the already present fluid in the fluid delivery line may back up in the tube (marked with point X) and cause higher than desired C-content of the made mixture. The inner volume of the fluid delivery line is small, but not insignificant. Dry gases, their flow rate, and heat contribute to the point-X moving left while the pumped additional fluid contributes to point-X moving right. Mixture will not be accurate until equilibrium between these forces is reached. Again, good policy is to move towards elevated C-contents in the segment program to avoid this issue.

For completely dry gas mixture the evaporation point-X will keep traveling back left until it reaches the mechanical valve at the fluid pump. This may take some time and it is advised to use long durations for flush and regular segments for experiments where low component C mixtures are used.

For quick transitions between two mixtures with different C-contributions, consider a setup of two mixers and a crossover valve to the experiment/process. When both mixtures are constant and ran for a long time, flip of the switch will introduce new mixture to the process immediately.

For high stability extra heated gas line or other volumes before process should be considered.

4.9 Normal humidity (2-90%RH)

No special arrangements required.

4.10 High fluid concentrations (>90%RH)

In general steam can be wet or dry steam, wet meaning mist (floating droplets). The mixture is wet steam at first, as the injected fluid boils on the wall of the gas line. These tiny droplets are carried away in the flow. The less fluid is added to the mixture the quicker the small droplets evaporate completely and form dry steam.

If the made mixture is led to a ProboStat sample holder or in other high temperature process where the temperature is significantly higher, all droplets evaporate by the time the mixture reaches the process.

Cold areas on the gas line before the process form condensation, and may end up causing the flow of gas mixture to be erratic. In such cases add insulation or external heating where condensation is suspected or observed.

4.11 Junction insulation

The junction between the heated gas line and the ProboStat is a potential weak point in the system. By default there is no heating, and no insulation cover in the area. Stainless steel itself does not conduct heat very well, and the amount of energy carried by the steam is not enough to heat this exposed area. Therefore it is necessary to insulate this area well after attaching the heated gas line to ProboStat. In case junctions require better insulation use additional insulation such as glass fibre, or contact NORECS for insulation pads and/or loose glass fibre. If the connection is unmade and made repeatedly it is advisable to acquire more consumables for this insulation. Pieces of rock wool and thick aluminium foil make for easy and cheap although not so good-looking insulation. Gloves and mask are advisable when handling any insulation fibres, as the fibres irritate skin and are harmful if inhaled.

It may even be necessary to add external heating to this point in case condensation here is observed.

4.12 Flushing the mixer

In some cases the gas A can alternatively be calibrated for both the fuel and the oxidant, such as H_2 and O_2. With such mixer the used gas should not be switched directly from one to the other, but instead inert intermediate gas should be used in between to flush the mixer, as follows:

1. Connect inert gas such as N_2 to the gas inlets A and B
2. Start the mixer software, and select gases for A and B from what is available, even if the list does not match the connected gases.
3. When asked to confirm the gas A and B, click OK.
4. Design a mixture using maximum amount of gas A and gas B, and run the mixture for a few minutes. The gas lines are now filled with N_2 as and the gas in the convoluted heated gas line is sufficiently diluted.
5. Turn off the mixture, and start over, this time with the intended gases and correct gas lines connected.

5 Advanced features in the .ini file

5.1 Logging

The software can create a log of events and save it as a file to HumiStat home folder. This feature requires CSDispatcher.exe to be located in the same folder as HumiStat. The aforementioned can be downloaded in from the Tools folder from http://www.norecs.com/work/_files/__PUBLIC_FILES__/software/HumiStat/

The feature is enabled by changing the ini file [Logging] section Type[Off|File|Live] value to File

5.2 Moving average of flow of gas A

Moving average describes well the buffers of gas line volume and process volume. The size of this moving average can be defined as samples. The default value is 358 samples, and one sample with HumiStat on average computer takes less than a second. To help the user, the software displays the resulting moving average value and the duration (once all the 358 samples have been taken).

5.3 Flow graph

Flow of gas A and B as well as the moving average is displayed on a graph on a separate tab. The amount of visible points is kept to a default of 700, changeable in the ini file, in order to keep the software running fast.

5.4 Minimum flow range limit

The DynamicRangeCull settings narrow down the available flow range area each MFC has, from the lower side. Increasing those values in the .ini file may help establishing smoother flow for the gases, when other means such as lower gas line pressure does not help. The values should not be changed without consulting NORECS. In any values outside 0 to 50 will cause errors or unwanted mixer behaviour.

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6 Specification

The exact specifications depend on the end user requirements, and are given in more detail in the HumiStat specification brochure, what follows is generic.

6.1 Mass flow controllers

In general the mass flow controllers used (Vögtlin) are real gas calibrated and considered the most accurate in the market with absolute accuracy better than 0.3% FS and 0.5% reading.

6.2 Fluid pump

192 000 steps to control 50 µL syringe, resolution: 0.26 nL or in case of H_2O as fluid, ~0.26 µg.

6.3 HumiStat definition

- Dynamic range gas mixer with humidity control: ratios from ppm to 100%
- Two gas inputs (A and B), one fluid input (C)
- Fluid refill during continuous operation
- Mixture calculated from input amounts
- High performance input gas controllers, accuracy 0.3% full scale & 0.5% Measured value, real gas calibrated
- Control through customer PC, software & USB cable included
- PID regulated gas line heating for 1.2 m gas line, user temperature setpoint, RT to 150°C
- Including power supply
- Any variations on request (surcharge)
- Available gases: Air, Ar, C_2H_2, C_2H_4, C_2H_6, C_3H_8, C_4H_6, C_4H_{10}, $CHClF_2$, CF_4, CH_4, CO, CO_2, D_2, H_2, He, Kr, N_2, N_2O, Ne, O_2, SF_6, Xe, i-C_4H_{10}, CCl_2F_2, R-134a, NH_3, pre-mixed gases such as 5%H_2 in Ar. Some gases such as mixtures will have price surcharge and lower accuracy.

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7 Unpacking

The mixer comes in a box of 55 x 46 x 36 cm and weight 10 kg.

Inside is packed:

- This page
- Piece of 1/16" PTFE line for fluid input C
- HumiStat mixer
- Copper piece protecting the fluid output
- Heated gas line
- Power supply
- Cable for power supply
- USB cable
- PID controller manual
- CE declaration of conformity for the mixer
- CE declaration for power supply

Before disposing of the packaging, make sure you have all the mentioned items.

The software and the manual can be downloaded from http://www.norecs.com/index.php?page=Software -> HumiStat -> Folder with the serial number of HumiStat in question.

On the back side a piece of copper tube is placed on the fluid outlet tube and secured with piece of tape. The purpose of this piece is just to protect the fluid line from bending. The copper piece and tape can be discarded. On the front side the inlets A, B and C are likewise covered with tape, to prevent dust going in the mixer (even though the gas lines A and B do have 15 µm particle filters on them).

NORECS

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EC Declaration of Conformity

Thursday, 16 August 2018

Manufacturer: NORECS AS

Address: Gaustadalleen 21, NO-0349 Oslo, Norway

We declare under our sole responsibility that the products:

Model:	HumiStat
Description:	Low pressure, mass flow controller -based gas mixing system for scientific measurements.

Are in conformity as follows:

- Compliance with this directive is under Sound Engineering Practice (SEP).
- The equipment includes external mains adapter supplying the 24 VDC required by the equipment. This adapter falls under both the EMC and LVD directives, and therefore is CE marked on the surface and a separate declaration of conformity for the adapter is included with the supplied documentation (CE Power supply GST220A24-R7B.pdf)
- The product operates at near atmospheric pressure. The total volume of the part of the mixer that may be at elevated pressures is significantly lower than 1000 cm^3 and therefore falls outside category I of the pressure equipment directive (PED 2014/68/EU), and thus does not require CE marking related to PED.
- The product operates with 24 V DC, lower than the 50 V defined in (LVD 2014/35/EU), and therefore does not require CE marking related to LVD.

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EC Declaration of Conformity

Thursday, 16 August 2018

Manufacturer: NORECS AS

Address: Gaustadalleen 21, NO-0349 Oslo, Norway

We declare under our sole responsibility that the products:

Model:	HumiStat
Description:	Low pressure, mass flow controller -based gas mixing system for scientific measurements.

Are in conformity as follows:

- Compliance with this directive is under Sound Engineering Practice (SEP).
- The equipment includes external mains adapter supplying the 24 VDC required by the equipment. This adapter falls under both the EMC and LVD directives, and therefore is CE marked on the surface and a separate declaration of conformity for the adapter is included with the supplied documentation (CE Power supply GST220A24-R7B.pdf)
- The product operates at near atmospheric pressure. The total volume of the part of the mixer that may be at elevated pressures is significantly lower than 1000 cm^3 and therefore falls outside category I of the pressure equipment directive (PED 2014/68/EU), and thus does not require CE marking related to PED.
- The product operates with 24 V DC, lower than the 50 V defined in (LVD 2014/35/EU), and therefore does not require CE marking related to LVD.

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NORECS AS

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MEAN WELL

220W AC-DC Single Output Desktop GS220 series

■ Features :

- Universal AC input / Full range
- 3 pole AC inlet IEC320-C14
- Built-in active PFC function, PF>0.91
- Protections: Short circuit / Overload / Over voltage / Over temperature
- Fully enclosed plastic case
- Approvals: UL / CUL / PSE / TUV / BSMI / CCC / CB / FCC / CE
- Class I power (with earth pin)
- LED indicator for power on
- No load power consumption<0.5W
- ErP step2 compliant (level V)
- NRCan compliant
- MEPS compliant
- Meet EISA 2007 (Energy Independence and Security Act)
- 2 years warranty

(except for 48V)

SPECIFICATION

ORDER NO.		GS220A12-R7B	GS220A15-R7B	GS220A20-R7B	GS220A24-R7B	GS220A48-R7B
OUTPUT	SAFETY MODEL NO.	GS220A12	GS220A15	GS220A20	GS220A24	GS220A48
	DC VOLTAGE Note.2	12V	15V	20V	24V	48V
	RATED CURRENT	15A	13.4A	11A	9.2A	4.6A
	CURRENT RANGE	0 ~ 15A	0 ~ 13.4A	0 ~ 11A	0 ~ 9.2A	0 ~ 4.6A
	RATED POWER (max.)	180W	201W	220W	221W	221W
	RIPPLE & NOISE (max.) Note.3	80mVp-p	100mVp-p	150mVp-p	180mVp-p	240mVp-p
	VOLTAGE TOLERANCE Note.4	±5.0%	±5.0%	±4.0%	±3.0%	±2.0%
	LINE REGULATION Note.5	±1.0%	±1.0%	±1.0%	±1.0%	±1.0%
	LOAD REGULATION	±5.0%	±5.0%	±4.0%	±3.0%	±2.0%
	SETUP, RISE TIME Note.7	2000ms, 20ms / 230VAC 2000ms, 20ms / 115VAC at full load				
	HOLD UP TIME (Typ.)	20ms / 230VAC 20ms / 115VAC at full load				
INPUT	VOLTAGE RANGE Note.8	90 ~ 264VAC 127 ~ 370VDC				
	FREQUENCY RANGE	47 ~ 63Hz				
	POWER FACTOR (Typ.)	PF>0.91 / 230VAC PF>0.98 / 115VAC at full load				
	EFFICIENCY (Typ.)	90%	90%	92%	93.5%	94.5%
	AC CURRENT (Typ.)	4A / 115VAC 2A / 230VAC				
	INRUSH CURRENT (max.)	120A / 230VAC				
	LEAKAGE CURRENT(max.)	1.5mA / 240VAC				
PROTECTION	OVERLOAD	105 ~ 135% rated output power Protection type : Hiccup mode, recovers automatically after fault condition is removed				
	OVER VOLTAGE	105 ~ 135% rated output voltage Protection type : Shut down o/p voltage, re-power on to recover				
	OVER TEMPERATURE	95℃ ±5℃ (TSW1) detect on heatsink of power transistor Protection type : Shut down o/p voltage, recovers automatically after temperature goes down				
ENVIRONMENT	WORKING TEMP.	-30 ~ +60℃ (Refer to "Derating Curve")				
	WORKING HUMIDITY	20% ~ 90% RH non-condensing				
	STORAGE TEMP., HUMIDITY	-40 ~ +85℃, 10 ~ 95% RH				
	TEMP. COEFFICIENT	±0.03% / ℃ (0~50℃)				
	VIBRATION	10 ~ 500Hz, 2G 10min./1cycle, period for 60min. each along X, Y, Z axes				
SAFETY & EMC (Note. 6)	SAFETY STANDARDS	UL60950-1, TUV EN60950-1, BSMI CNS14336, CCC GB4943, J60950-1(except for 48V) approved				
	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC				
	ISOLATION RESISTANCE	I/P-O/P:100M Ohms / 500VDC / 25℃ / 70% RH				
	EMC EMISSION	Compliance to EN55022 class B, EN61000-3-2,3, FCC PART 15 / CISPR22 class B, CNS13438 class B, GB9254, GB17625.1				
	EMC IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11, light industry level, criteria A				
OTHERS	MTBF	191.3K hrs min. MIL-HDBK-217F(25℃)				
	DIMENSION	210*85*46mm (L*W*H)				
	PACKING	1.1Kg; 12pcs/14.2Kg/0.73CUFT				
CONNECTOR	PLUG	See page 2 ; Other type available by customer requested				
	CABLE	See page 2 ; Other type available by customer requested				
NOTE	1. All parameters are specified at 230VAC input, rated load, 25℃ 70% RH ambient. 2. DC voltage: The output voltage set at point measure by plug terminal & 50% load. 3. Ripple & noise are measured at 20MHz by using a 12" twisted pair terminated with a 0.1uf & 47uf capacitor. 4. Tolerance: includes set up tolerance, line regulation, load regulation. 5. Line regulation is measured from low line to high line at rated load. 6. The power supply is considered as an independent unit, but the final equipment still need to re-confirm that the whole system complies with the EMC directives. 7. Length of set up time is measured at first cold start. Turning ON/OFF the power supply may lead to increase of the set up time. 8. Derating may be needed under low input voltage. Please check the derating curve for more details.					

File Name:GS220-SPEC 2013-05-06