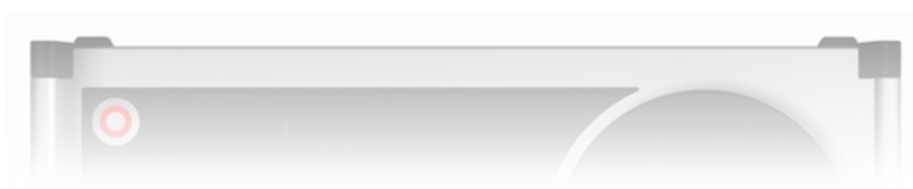


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HYGROGEN2



Instruction Manual

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HygroGen2 - IMPORTANT NOTICE BEFORE FIRST USE:

Congratulations on purchasing the HygroGen2 humidity and temperature generator. To get the most out of your instrument and ensure accurate and rapid humidity and temperature calibrations over many years, please familiarize yourself and adhere to the best practices and procedures as detailed in this manual.

Please carefully remove the HygroGen2 from the packaging and visually inspect for any signs of damage. Check the contents against the list on page iv (Contents of the Standard Supply Package). Report any damage or missing parts immediately to your supplier.

Please note the following important information:



DO NOT transport the HygroGen2 without first emptying the water reservoir

The HygroGen2 is designed to be portable, but it is vitally important to empty the water reservoir - using the HGFill syringe - before transporting it. The full procedure is described in section 2.4. Failure to do this will damage the instrument.



Follow correct Shutdown Procedure

Please be aware that incorrect shutdown of the HygroGen2 can lead to failure of the instrument. Please adhere to the Shutdown Procedure Advisory on pages ii-iii.

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ADVISORY NOTICE - SHUTDOWN PROCEDURE Version 1.1

This Document describes how to correctly switch off a HygroGen2.

Introduction:

Incorrectly powering down or unplugging the HygroGen2 while in use may cause a software corruption. This may mean the HygroGen2 will not start.

To correctly shutdown the HygroGen2 during normal operation:



Temperature (°C)
23.00
23.0
0.43

Relative Humidity (%)
35.0
35.0
-3.21



1) Press "Power Off" button on screen.

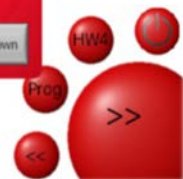


Temperature (°C)
33.0
35.0
-3.21

Relative Humidity (%)

If you do nothing the HygroGen will start shut down in 51 seconds.

Cancel Transit Shut Down



2) Select "Shut Down".
3) Allow the HygroGen2 to shutdown. The HygroGen2 will isolate the humidifier and cool/dry to ensure excess water is removed. This may take several minutes.

Alternative procedures including force, transit and fast shutdown are detailed on the next page.



DO NOT switch off at the back of the HygroGen2 or remove power from the HygroGen2 before it has shutdown.

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Summary of Shutdown Procedure

Standard Shutdown:

“Power Off” button on screen

Use to shutdown the HygroGen2 gracefully in normal operating conditions.

The HygroGen2 will isolate the humidifier from the chamber and cool/dry to ensure excess water is not left in the chamber. This process may take several minutes.

Transit Shutdown:

“Power Off” button on screen

Use to shutdown HygroGen2 gracefully if the HygroGen2 is to be transported.

The HygroGen2 will ask for the humidifier to be emptied of water. It will isolate the humidifier from the chamber and then cool/dry the chamber to ensure excess water removed. This process may take several minutes.



Fast Shutdown:

Front Panel Power button, 1 second push

This switches the HygroGen2 off without saving any settings. It does not allow the HygroGen2 to dry the chamber or isolate the humidifier. After pushing the button it will take about 15 seconds for the HygroGen2 to switch off.

Force Shutdown:

Front Panel Power button, 5 second push

This forces the HygroGen2 to shutdown immediately. The HygroGen2 does not dry, isolate the humidifier or save any settings.

This process should only be used if all the other shutdown options fail.



DO NOT switch off at the back of the HygroGen2 or remove power from the HygroGen2 before it has shutdown.

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Contents of the Standard Supply Package:

- HG2-S HygroGen2 generator
- HG2-DES Desiccant cell filled with molecular sieve (pre-installed).
- IEC mains cable
- HG2-FILL Water fill syringe (with tube)
- HC2-S HygroClip control probe (pre-installed) with calibration certificate¹
- Sample Loop connector cover plugs
- This Manual
- Chamber door (according to customer's order)²
- HW4 software ID number
- USB memory stick including saved test data and user manual.

¹ The calibration certificate included will vary according to the country of supply.

² In some countries, the chamber door is delivered with the HygroGen2. Due to the diversity of chamber doors and bungs, these are normally ordered separately and may be delivered in separate packaging.

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1 Scope of Document

This instruction manual refers to HygroGen2 running software version 2.0.x. To determine the software version your instrument is running please refer to the Settings screen as shown in section 3.3.4. For version 1.x.x the software revision number is displayed by pressing the 'HGInfo' button, for version 2.0.x select 'Info' from the 'Service' drop down menu. An equivalent manual is available on www.rotronic.com for HygroGen2 instruments running software version 1.x.x.

1.1 Introducing the HygroGen2

The HygroGen2 is a generator of controlled relative humidity and temperature environments, primarily for use in calibrating humidity instrumentation, but also well suited to the calibration of temperature instrumentation, particularly those used for the measurement of temperature in air.

It is a completely self-contained, portable unit requiring no external resources except mains power. This allows technicians to perform calibrations in the laboratory, workshop or on-site.

The HygroGen2 uses a mixed flow method for generating the %rh required by the user. A desiccant cell provides a source of low humidity, and a piezoelectric humidifier generates high humidity. A Peltier element is used for heating and cooling the chamber. Measurement and control is provided by a combination of a ROTRONIC HygroClip probe, an embedded Platinum Resistance Thermometer (PRT) and a multi-loop controller. Set-points are entered using the touch screen front panel display.

1.2 Enhanced Features : AutoCal and Range Extensions

With the introduction of software version 2.0.x the HygroGen2 comes with optional Enhanced Feature upgrades: AutoCal and RH/Temperature Range Extensions. These are activated by the application of a licence key, available via your ROTRONIC dealer.

AutoCal allows you to pre-program a series of set points and times, and record the instrument's progression through them in a PDF Calibration Certificate which is written to an external USB disk drive. Any values recorded on ROTRONIC HygroClip probes attached to the HygroGen2 via USB adaptors are recorded in the certificate. Probes can be set to automatically adjust to match the HygroGen reference probe at predetermined values.

With optional **Range Extensions**, the instrument is capable of creating chamber conditions down to -5°C and 2%rh and up to 99%rh.

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1.3 Temperature and Humidity References

The HygroGen2 creates stable temperature and humidity conditions uniformly within its test chamber. Instruments under test (IUTs) are inserted into the chamber and compared to a reference to calibrate and monitor their performance so that any appropriate adjustments can be made.

There are three main relative humidity (RH) calibration reference types that can be used with the HygroGen2. Each has its own advantages and disadvantages, so the reference chosen should be determined by the uncertainty of measurement required.

- Internal control RH probe reference
- External RH probe reference
- Chilled Mirror Hygrometer reference

Corresponding temperature references integrated in the above may be used, or additional external temperature references employed, for example platinum resistance thermometers (PRTs).

It is vital to consider the comparison of temperatures measured by the reference, the HygroGen2 and instruments under test. Because RH is significantly dependent on temperature, temperature measurement should be optimised to get meaningful RH results.

For more details please see Appendix A1: Calibration Reference Options and Uncertainty.

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2 Setting up the HygroGen2

2.1 Physical Location

To ensure correct operation please ensure that:

1. The unit is level and stable;
2. There is at least 15 mm clearance underneath and at least 100 mm at the back of the unit to enable adequate air flow;
3. There is adequate access to the electrical mains connection at the rear of the unit.

Note: The feet on the rear panel are for standing the unit for service purposes, and to ensure a sufficient air gap behind the unit. The unit will not operate in the vertical position.

2.2 Electrical Supply

Power Isolation

The unit is supplied with a mains cord set. The unit should be disconnected from the electrical supply before the unit is moved, cleaned or has water added or removed.

Earthing

This unit must be earthed. Provision for the safety earth is made through the electrical mains connection (Figure 2, 8) to which all parts of the unit requiring earthing are internally connected. An earthed electrical supply is required.

Earth Leakage Current

Due to RF filtering there is an earth leakage current, within the limits specified in EN 61010-1:2001. This may affect mains power circuits protected by Residual Current Device (RCD) or Ground Fault Detector (GFD) type circuit breakers (particularly if used in multiples or with other equipment with an earth leakage current on the same supply circuit).

Over Current Protection

To protect the internal circuitry against excess currents, the mains supply to the unit must be connected with the mains cord set provided with the unit and to an appropriate mains supply.

Voltage Rating

The unit is designed to work within the limits of a 110-230 VAC 50-60 Hz mains supply with voltage fluctuations up to $\pm 10\%$ of the nominal voltage. The unit is rated impulse withstand (over voltage) category II of IEC 60364-4-443. Where occasional voltage transients over 2.5 kV are expected or measured, it may be necessary that the power installation to the unit includes a transient limiting device.

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Mains Filtration

If there is risk of power spikes or breaks, it is recommended that an Uninterruptable Power Supply (UPS) is used to provide continued power and mains filtration. This should be rated according to the HygroGen2 power specifications (see Appendix B2) and the time required to run/shutdown during power outage.

Conductive Pollution

The unit is rated Pollution Degree 2 and must not be operated in environments where conductive pollutants (for example carbon) may enter the unit (this includes excessive moisture ingress).

2.3 HygroGen2 Assembly

- 1) Power switch
- 2) USB ports
- 3) Touch screen controller
- 4) Water port
- 5) Desiccant cell
- 6) Chamber door
- 7) Probe aperture bung
- 8) Handle



Figure 1: Front of HygroGen2

- 1) Sample loop return
- 2) Sample loop outlet
- 3) USB ports
- 4) DVI monitor interface
- 5) Ethernet socket (service use)
- 6) Type label
- 7) Fan outlet
- 8) Electrical mains connection
- 9) Power switch

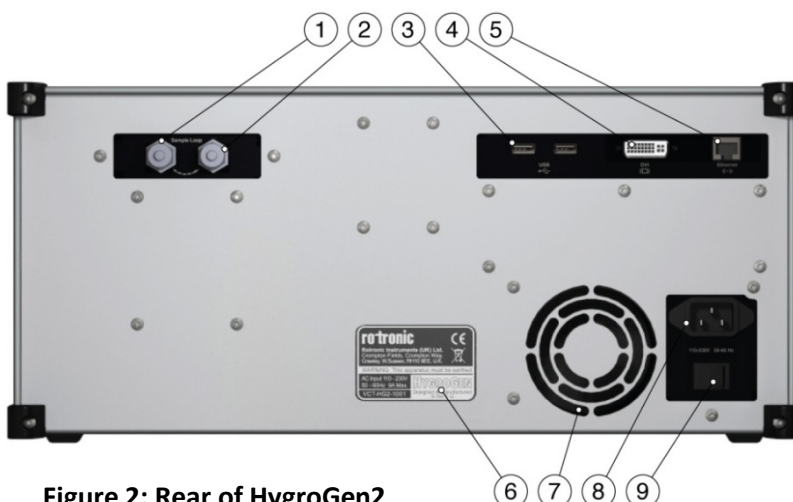


Figure 2: Rear of HygroGen2

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HygroGen2 Chamber and Door

The HygroGen2 does not come supplied with a door. There are various standard and customized versions available, depending on the intended use for the instrument, the use of an external reference (see Appendix A1.2), and the instruments under test. Figure 1,6 shows the 30mm 5-port version (part code: HG2-D-8888). Other options are listed in Appendix B3.

To access the HygroGen2 chamber, remove the door. Grip firmly and twist the door anti-clockwise. In the event that this proves difficult, cool the chamber first (see later sections). Occasional application of silicone grease around the door "O" ring seal will ease movement.

Replacement can be in any position, and requires only a gentle clockwise twist.

Before using your HygroGen2, make sure that the door is secured and that all probe apertures that are not in use are sealed with a bung (Figure 1,7) or appropriate alternative seal.

Desiccant Cell

The unit should be supplied with the desiccant cell (Figure 1,5) in place. For further details and best practice for desiccant handling please see section 7.2.

External Sample Loop

Unless an external sampling system is to be used (see Appendix A1.3), ensure the sample loop caps (Figures 2,1 and 2,2) are firmly secured.

HygroClip Control Probe

The HygroGen2 chamber conditions are monitored and controlled by a ROTRONIC HygroClip RH and temperature probe. Depending on the circumstances and external references employed (see Appendix A1.2 – External Reference Guidelines) this probe may be removed for regular calibration (see section 7.1).



Note: For speed of response, this probe must be employed without protective filters.

2.4 Water Reservoir

The HygroGen2 requires 50 - 80 ml of distilled water in the internal reservoir. Insufficient water will deactivate the humidification system. As long as extreme care is taken not to overfill the water reservoir the HygroGen2 may be filled and emptied either with the unit powered up or shut down.

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To fill the HygroGen2

1. Insert the tube of the dosing syringe, with the plunger fully depressed, 10 mm into the water port and extract any residual water by drawing out the plunger.
2. Depress the collar on the water port (Figure 1,4), remove the dosing syringe tube. Wipe up any spilt water with an absorbent cloth immediately.
3. Fill the dosing syringe with 80 ml of distilled water. Insert the end of the dosing syringe tube firmly back into the water port and discharge the syringe steadily. (If water leaks during this operation the filler tube is not correctly inserted in the water port.)
4. Depress the collar on the water port to remove the dosing syringe tube. Wipe up any spilt water with an absorbent cloth immediately.
5. A water level indicator is shown in the Settings screen (see section 3.6.7).



Figure 3: How to fill and empty the Water Reservoir

Caution: Do not overfill the HygroGen2

Overfilling of the unit will result in poor humidification and in extreme cases water may be pumped into the chamber. If the HygroGen2 is overfilled the humidifier should be fully emptied and then refilled with 50 –80 ml of water (as described above). If there is water present in the chamber of the HygroGen2, this should be removed using an absorbent cloth. Ensure the HygroGen2 is switched off and the mains power unplugged before manually drying the chamber.

To empty the HygroGen2:

1. Insert the tube of the dosing syringe, with the plunger fully depressed, 10 mm into the water port and extract any water by drawing out the plunger.
2. Depress the collar on the water port to remove the dosing syringe tube. Wipe up any spilt water with an absorbent cloth immediately.
3. Distilled water discharged from the HygroGen2 may be stored safely and reused at a later date.



Note: The HygroGen2 should always be emptied if it is being shipped or stored (see section 3.8 Preparing the Unit for Transit or Storage). This will prevent ingress of water into the chamber should the unit be inverted, and prevent possible frost damage.

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Water Quality

The HygroGen2 should only be filled with distilled water.

As a precaution against any microbial and algae water contamination, HygroGen2 incorporates an Ultra Violet (UV) sterilisation lamp within the water reservoir. No user intervention is required; HygroGen2 auto cycles the process.



Under no circumstance should the water reservoir be opened by non-qualified personnel. Direct exposure to UV lamps can cause burns or blindness.

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3 HygroGen2 Operation

3.1 Switching On

1. Ensure the electrical mains supply is correctly plugged in and switched on.
2. Switch the unit on by pressing the Power Switch (see figure 1,1) once.
3. The fans within the unit will switch on giving an immediate audible indication the unit is powered.
4. The controller will power up and display the controller primary screen (as shown in figure 6).

On power up:

- The temperature and humidity set-points default to the last set values.
- The temperature control defaults to automatic mode (controlling the temperature).
- The humidity control defaults to manual mode.

If the “Low Water Level” alarm is displayed then the unit should be filled as described in the “**How to Fill the Water Reservoir**” Section 2.4. Humidification is disabled until water is filled.

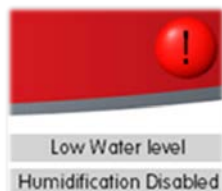


Figure 4: Low Water Level Alarm

3.2 Upgrading From Previous Versions

If you have upgraded your HygroGen2 software from version 1.x.x, the installation process installs HW4 version 3.1. If you do not wish to activate the upgrade features (AutoCal and Range Extension) and you wish to use or only have an HW4 version 2.x licence, please email hygrogen@rotronic.co.uk for instructions to downgrade the HW4 software back to its original version, or contact your ROTRONIC dealer for HW4 upgrade options.

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3.3 HygroGen2 Touchscreen Interface

The HygroGen2 controller consists of four top level screens that are accessed using the forward or back buttons in a loop:

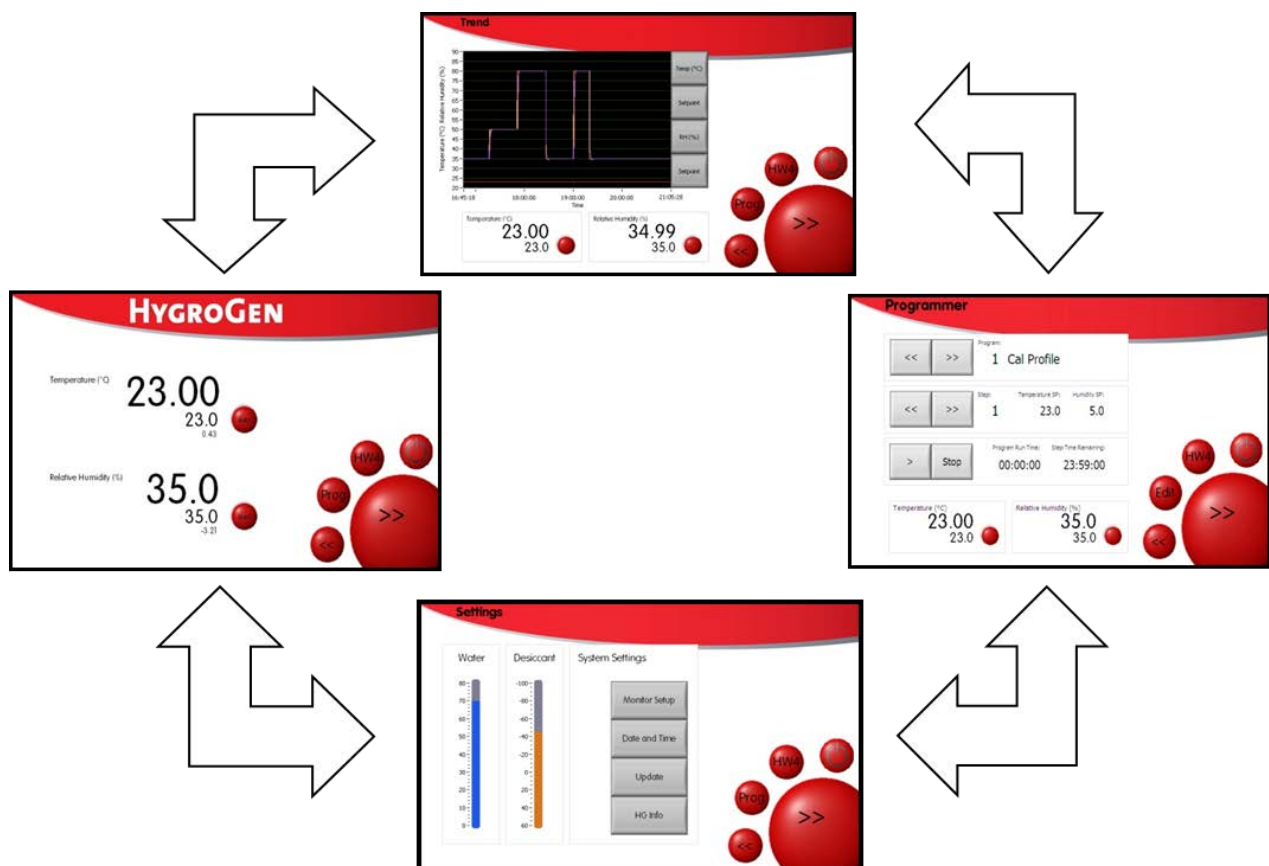


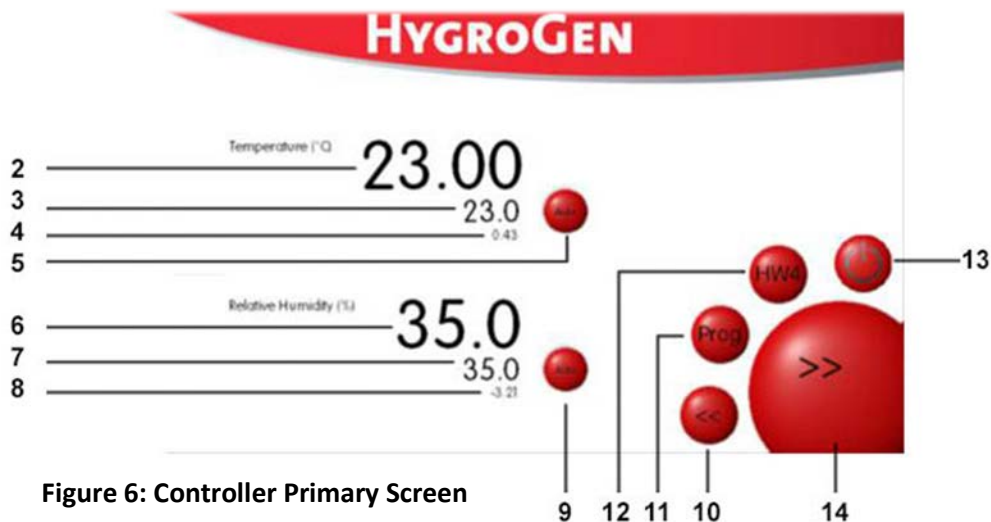
Figure 5: HygroGen2 Screens

NB Programmer Screen Functionality is different when AutoCal functionality is activated.

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3.3.1 Primary Controller Screen

1. Menu access (top left corner HOME)
2. Actual chamber temperature
3. Temperature set point
4. Temperature control status indicator
5. Automatic/Manual selection
6. Actual chamber humidity
7. Humidity set-point
8. Humidity control status indicator
9. Automatic/Manual selection
10. Back to previous screen
11. Access programmer function
12. Access HW4 software
13. Power off
14. Forward to next screen



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Automatic/Manual Mode

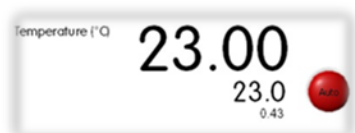


Figure 7: Temperature and Humidity Control

Both temperature and humidity control can be set to automatic or manual. Automatic mode results in the unit attempting to adjust to the temperature (or humidity) in the chamber to match the set-point value. Manual mode (automatic/manual selection displays “Off”) prevents the unit from trying to control the chamber.

Setting Temperature and Humidity Set-Points

At any time, the user can change humidity or temperature set-points by simply touching the set-point on screen. A pop-up will appear, and either the touch screen or, where connected, the keyboard/mouse used to input desired values.



Figure 8: Set-Point Entry Pop-Up

Note: To aid a smooth and efficient transition between temperature set-points the controller is programmed to suspend humidification during changes in temperature. Once the chamber temperature is within 0.7°C of the temperature set-point, the humidity control is activated.

When set-point combinations that resolve a low dew point condition (i.e. 0°C, 5%rh = -36°C dew point) are programmed, make sure that the desiccant is dry enough to achieve the desired value. Check the desiccant condition on screen (Figure 12) and consult maintenance records to establish when the desiccant was last changed. Stabilisation time to low RH conditions will be longer than normal as the chamber and internal surfaces need to be very dry.

Note: Once the HygroGen2 has reached a stable condition, the Auto/Manual button will change colour to green.

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3.3.2 Trend Screen

The Trend Screen shows the instrument's conditions and the set-points the instrument is programmed to reach. The y axis is self-scaling; the x axis (time) can be adjusted by tapping anywhere along it and typing in the desired timescale.



Figure 9: Trend Screen

3.3.3 Programmer Function Screen

The HygroGen2 programmer function enables the user to automate a sequence of RH and/or temperature set-points.

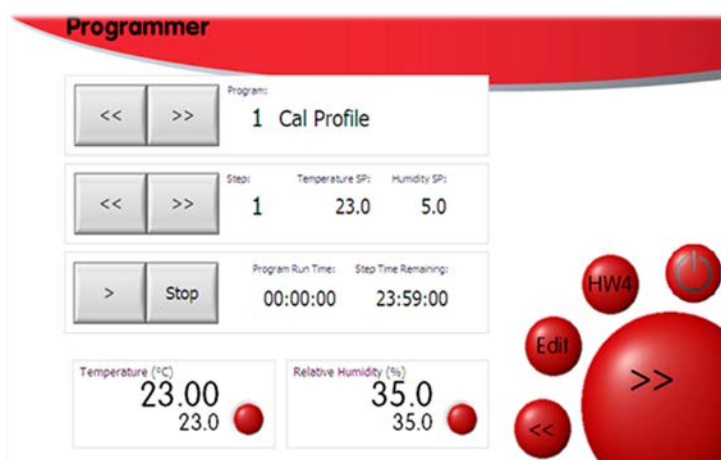


Figure 10: Programmer

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Program – Identifies the program number and its description. You can use the “<<” and “>>” buttons to scroll through the saved programs.

Step – Identifies the set-point within the program and its values. You can use the “<<” and “>>” buttons to scroll through the steps. (SP = Set-Point)

Play/stop – Starts or stops the program and displays the Run and Step timing information.

Program Run Time – reports how long the current program has been running.

Step Remaining – reports how long the current program step has left to run.

Current control value and set-points are displayed at the bottom of the screen.

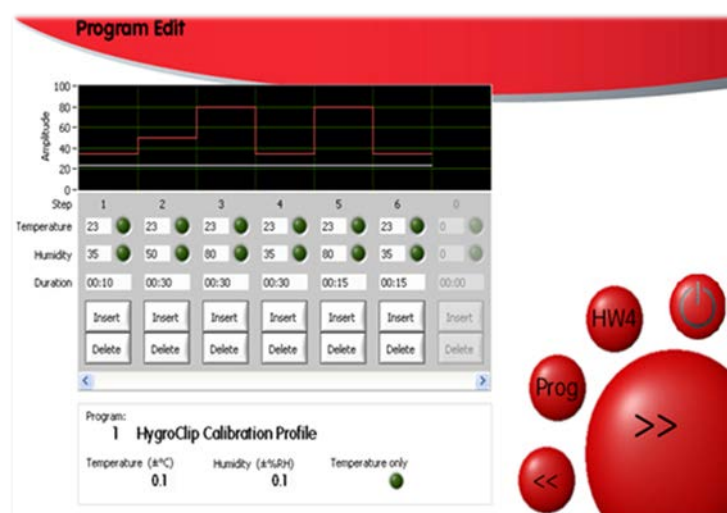


Figure 11: Edit Program

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Defining Programs

To define the programs, either press/click a set-point value or the “Edit” key. This opens the Program Edit screen as shown.

The step-point steps are numbered, and set-point values and step duration can be defined below. Steps can also be inserted or deleted as required.

A graphical representation of the program is shown above each point.

A title for each program can be entered at the bottom of the screen (using an attached USB keyboard).

Intermediate steps to achieve ‘incremental’ changes between each set-point can be programmed by selecting the green button next to each parameter; otherwise the instrument will attempt to reach the set-point as quickly as possible.

For each program temperature and humidity stabilisation values can be defined. Once the chamber conditions are within this tolerance the step duration timing begins. If set to zero, no stabilisation criteria are applied, and the timing of the step duration begins immediately.

NB This functionality is only available through the HOME menu when AutoCal feature is activated. Please see section 3.4.

3.3.4 Settings Screen

1. Water level display
2. Desiccant condition display
3. Settings->
 - Monitor Setup
 - Water Level
 - [AutoCal]
 - Date and time
 - Touch Screen
4. Updates->
 - Update Software
 - Upgrade Features
5. Service Menu->
 - Service
 - Info

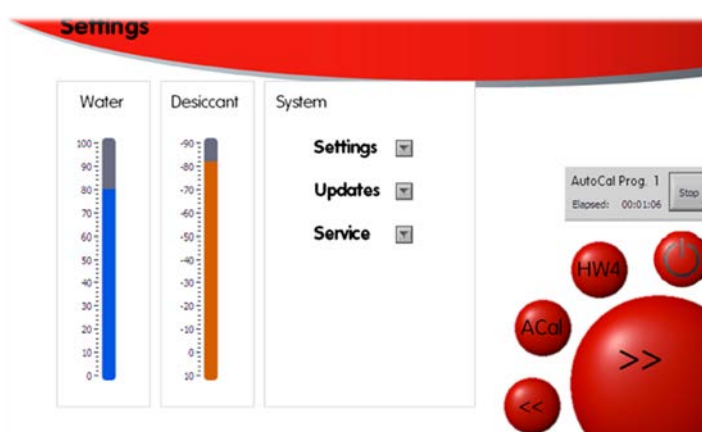


Figure 12: Setting Screen

See later sections for further details on the operation of these features.

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3.4 AutoCal (optional)

3.4.1 Activation

To upgrade your HygroGen2 with the AutoCal feature, please purchase an activation key via your ROTRONIC dealer. Enter the code via the Settings Screen. Select “Upgrade Features” from the “Updates” drop down menu, enter the feature code and press OK.

With AutoCal activated, the top level Programmer Function Screen is replaced by the AutoCal screen below. The standard Programmer functionality is still available via the drop down menu in the top left hand corner of the screen.

3.4.2 AutoCal Reference

AutoCal uses the internal control HygroClip as the reference. External references are not supported. For a more in-depth discussion on references and calibration traceability, please see Appendices A1 and A2.

3.4.3 AutoCal Screen

As ROTRONIC probes are added via the USB ports, the individual probe slots are populated within the AutoCal Screen. During an AutoCal calibration run, probes can be adjusted or not as desired for each probe. Select individual probes by selecting the “Adjust” button.

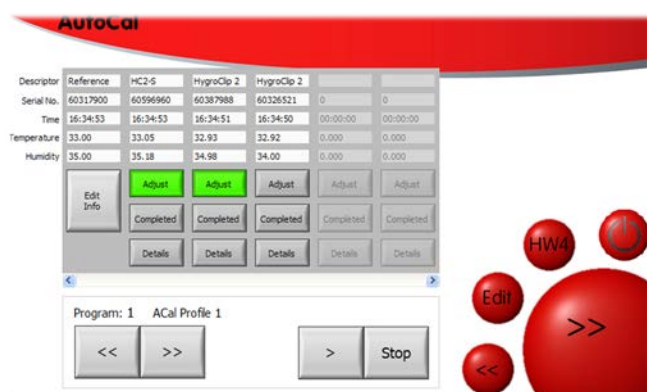


Figure 13: AutoCal Screen

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3.4.4 AutoCal Program Edit

Pressing the Edit button calls up the AutoCal Program Edit screen.

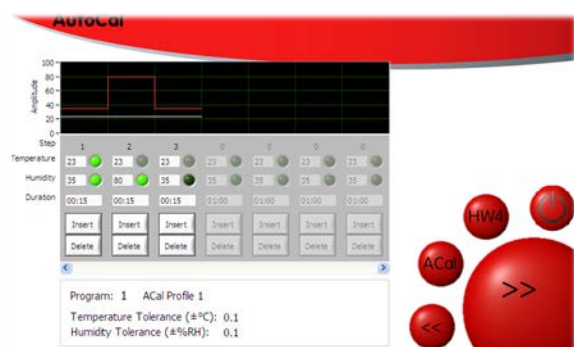


Figure 14: AutoCal Program Edit Screen

Set-points are programmed in an identical way to the standard Programmer. However, the green buttons take on a different function; they are now used to determine the adjustment points. Probes that are selected for adjustment within the AutoCal screen (3.4.3) will be adjusted at points that are selected here. Only one temperature point can be selected, and must be selected as the first adjustment point. This is because of the way the HygroClip probes work: if temperature is adjusted, corresponding adjustments for RH are made at the same time. This policy is enforced by the software: greyed out buttons refer to options that are not possible, a dark green button is a point not selected for adjustment, and bright green is a point selected for adjustment.

It is not possible to select different adjustment points for different probes. If this is desired, please run a new program at a later time. Tolerance for set-points to be considered stable is set in the same way as for the Standard non-AutoCal version (section 3.3.3).

Points can be set for a minimum duration of 15 minutes; please ensure sufficient time is allowed for the probe to stabilise. A duration of at least an hour is strongly recommended, longer for extremes of temperature or RH. The timing of a set point will begin when the *chamber* is within the set tolerance. Take particular care to allow sufficient time to allow for stabilisation of probes with particular filters applied.

3.4.5 AutoCal Operation and Best Practices

Once the program and adjustment points are determined, programs are started by pressing the "Play" (>) button. After a successful run, AutoCal saves a time-stamped PDF calibration certificate to a USB drive plugged into the HygroGen2. Included in the PDF is the program name, set and adjustment points, probe serial numbers and relevant calibration reference information. It is further possible to upload a custom logo and other user and reference information (see section 3.4.6). A separate PDF

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is generated for each probe. NB AutoCal will not run unless a USB drive is detected by the HygroGen2.

Before selecting a probe for adjustment, it is recommended to perform an initial assessment calibration run without adjustment selected. At the end of the run, examine the PDF calibration certificate saved to the USB drive and determine whether you want to re-run the program with adjustment selected.

For each set-point values for temperature and humidity are recorded on the calibration certificate every 2 minutes for the last 10 minutes of the set-point.

At the first adjustment point to be applied, AutoCal will initially delete any previously saved calibration points stored on the probe. This is recorded on the certificate. It will then apply the values of the reference probe as a corrected value. This value is determined at the instant the correction is saved and is not an average of the previously recorded 5 points as shown in the calibration certificate; these are shown in the certificate to give the user an estimate of stability.

Please note, for probes with adjustment selected, AutoCal will *always* attempt to make an adjustment. If the correction is smaller than the resolution of the probe itself, the adjustment may not be applied.

If at end of the run the probe has acknowledged all instructions it has been sent, the “Completed” button will turn green on the AutoCal screen and the PDF is saved to the USB drive. Details of the probes’ progress throughout the run can be viewed via the “Details” button. If for any reason the run is not successful – e.g. if a probe is unplugged mid-run - a csv file is saved instead with a log of the points that were recorded.

Please note, the performance of a HygroClip2 within its stated specification is based on temperature adjustment being made at 23°C. AutoCal *does* permit the adjustment to be made at other temperatures. However, this is only recommended when the operational environment of the probe being adjusted is only ever at another specific temperature, e.g. a stability cabinet at 40°C. Adjustments made at temperatures other than 23°C risk comprising the probes ability to meet its specification between the range of optimal performance: 18 and 28°C .

Please note that HW4 cannot be used at the same time as AutoCal.

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3.4.6 Customising the PDF Calibration Certificate

The PDF certificate can be customised by selecting 'Edit Info' from the AutoCal screen (figure 13) or selecting 'AutoCal' from the Settings menu on the Settings screen. It is possible to enter user and company information, reference/standard information (including the last and due calibration dates) and to upload a custom logo.

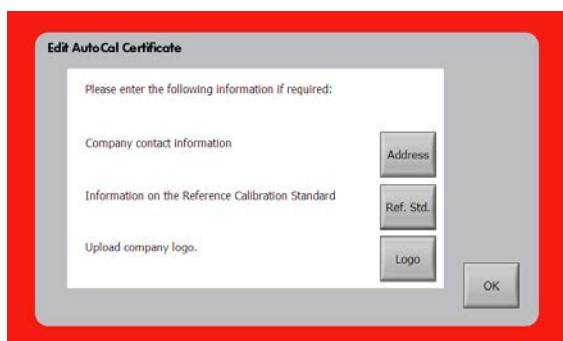


Figure 15: Edit AutoCal Certificate



Figure 16: Edit AutoCal Certificate Contact Information

To upload a logo, save it as a file 'logo.jpg' to the root directory of a USB stick. Insert the USB into the HygroGen2. The HygroGen2 will detect the file and display your image. Select 'Upload Logo'. The logo will be uploaded to the unit and will appear automatically sized and positioned on the PDF certificate below the "Rotronic HygroGen" logo.

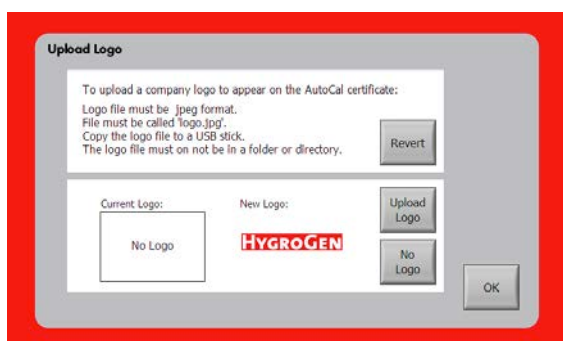


Figure 17: Upload Logo

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Information about the calibration of the reference probe itself can be entered by pressing 'Ref Std':

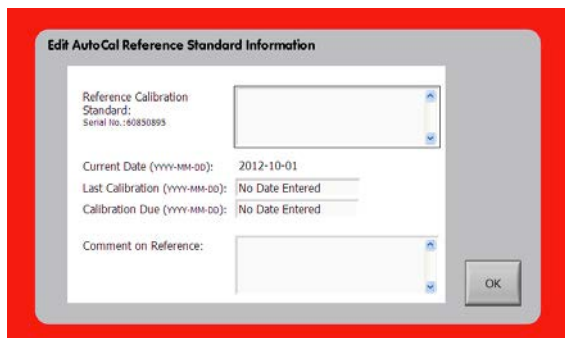


Figure 18: Edit AutoCal Standard Information

When an AutoCal run is started, the user is warned should the reference calibration be out of date and prompted to update the reference information should the reference probe have been swapped out. The user is further asked to confirm that the operator name to be printed on the certificate does not require changing.

3.5 Range Extension (optional)

Range Extension can be bought at the same time and included with the same activation code as AutoCal, or it can be purchased separately. Activate the feature code in the same manner as AutoCal (section 3.4.1). Range extension allows the unit to operate down to -5°C and 2%rh and up to 99%rh (between 10°C and 45°C). The unit is able to reach 90%rh above 45°C and below 10°C.

Please be aware that it may take a long time to reach set-points at these extremes of temperature and humidity, and the unit may need to be individually adjusted to optimise performance. Expert knowledge of PID parameters is required to do this. Access is via the Service Menu, which is locked down for standard operation. For further information please contact hygrogen@rotronic.co.uk.

The unit can be configured to produce conditions lower than 2%rh, but the performance and stability of the instrument below this RH is not guaranteed. Furthermore, the accuracy of the control probe needs to be borne in mind.

3.6 Operation Precautions

3.6.1 Water in the Chamber

Before using the HygroGen2, check that there is no visible water inside the chamber. If the last condition run by the HygroGen2 was at high humidity, and the unit not correctly shut down (see below), condensation may have formed. Remove excess water using absorbent tissue and initially run the HygroGen2 at an elevated temperature (40°C) and low RH set-point to dry the system before calibrations are run.

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3.6.2 Below Ambient Temperature Operation

If the chamber is cooling (or maintaining a temperature below ambient), then the heat pump assembly inside the chamber will necessarily be below the chamber temperature. If the humidity in the chamber is high, the cool heat pump assembly can bring the local air temperature below the dew point, causing condensation to occur on the internal heat pump assembly. If run under these conditions for extended periods condensation will collect in the chamber. This will not affect chamber performance within normal operating ranges (though it will increase the time to achieve low humidity). Water in the chamber can be removed using an absorbent tissue. Ensure the HygroGen2 is switched off before manually drying the chamber.

When operating the unit at high humidity and chamber temperatures of more than a few degrees below ambient, the following procedure will minimise condensation in the chamber during stabilisation.

1. Set the set-point temperature to approximately ambient.
2. Set the set-point humidity to 10%rh and allow the HygroGen2 to stabilise.
3. Set the humidity control to Manual (as described in **Automatic/Manual Mode** Section 3.3.1).
4. Apply the temperature set-point to that desired and allow the HygroGen2 to stabilise.
5. Wait for the Humidity reading to fully stabilise (may take 15 to 20 minutes).
6. Set the humidity control loop to Automatic.

It is recommended that the chamber door is not opened when the chamber temperature is below the ambient temperature as water vapour from the atmospheric air introduced will condense out into the chamber. The dehumidification of the chamber takes longer at lower chamber temperatures.

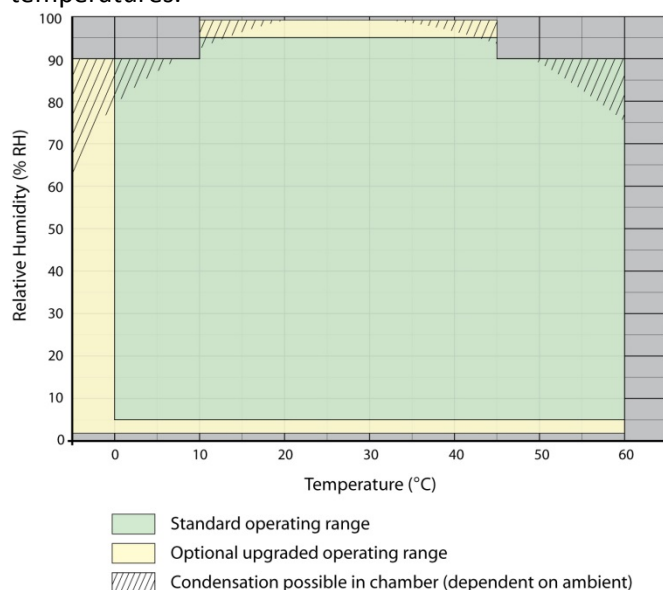


Figure 19: Humidity Map – standard and extended ranges

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3.6.3 Above Ambient Temperature Operation

At high temperature and high relative humidity conditions it is necessary to allow the unit to stabilize to ensure minimal condensation. It is recommended that for making measurements over 45°C and 80%rh that the HygroGen2 temperature be permitted to equilibrate for 20 minutes before high humidity is introduced. It is also recommended that under these conditions the desired RH level is achieved in incremental steps, allowing stabilisation at each. If the unit is operated at high temperature and high humidity for prolonged periods it is strongly recommended that the chamber is thoroughly dehumidified prior to switching the unit off.

3.6.4 Probe Insertion Depth

When adjusting or calibrating probes against a reference, make sure the insertion depth of each instrument is the same for each probe. Using the same immersion depth substantially reduces the effect of any temperature and humidity gradients in the chamber.

The immersion depth of any probe inserted in the HygroGen2 should be within the limits of 100 to 150 mm (4" to 6"), measured from the inner side of the door. This will reduce the effect of room temperature via stem conduction on the probe.

3.6.5 Protective filters

Make sure you allow appropriate extra time for probes with particular protective filters. These probes require longer time than the HygroGen2 to stabilise.

The Trend Screen displays the measured values over time (10 minute default on the x axis), so the user is able to observe whether the HygroGen2 is stable within the acceptance criteria.

3.6.6 Low Water Level Alarm

The unit will inform the operator if the water level in the reservoir is too low with a visual "Low Water Level" prompt on the controller screen. This prompt may be dismissed by following the on-screen instructions.

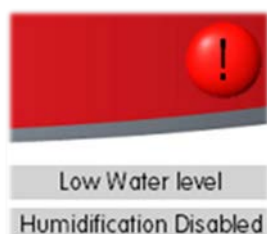


Figure 20: Low-Water Level Alarm

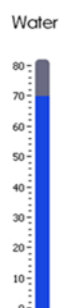


Figure 21: Water Level Indicator

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If the water level in the saturator falls below 20 ml, humidification is disabled to prevent damage to the humidifier. Humidification will not be re-activated until the water level is restored.

Replenish the reservoir according to the instructions in section 2.4.

Note: If the “Low Water Level” message appears on the controller screen during use, the HygroGen2 can be topped up with 50 ml of distilled water. This will bring the total water content of the reservoir to approximately 80 ml.

3.6.7 Water Level Indicator Calibration

The water level sensor may behave differently for different qualities of water. To ensure accuracy of the water level indicator, period calibration is advised. To access this feature, go to the Settings Screen, and select “Water Level” from the “Settings” drop down menu. Follow the on-screen instructions.

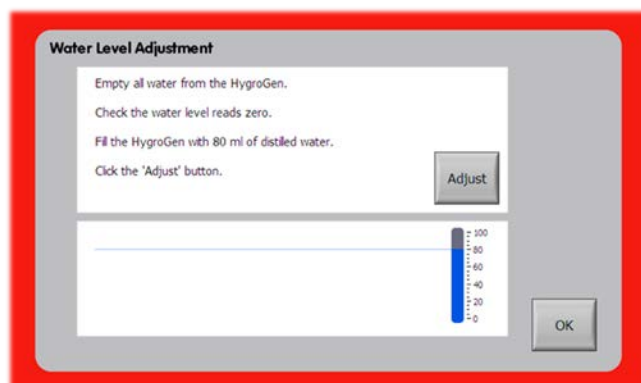


Figure 22 : Water Level Adjustment

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3.7 Switching off the HygroGen2



There are two Shutdown procedures; these are presented after you press the on-screen power button. It is highly important that these are observed; instrument faults attributable to incorrect Shutdown are not covered by the warranty.



Figure 23: Water Level



In normal circumstances use Shutdown. This dries the chamber to prevent residual water and isolates the humidifier from the chamber. Once correctly shutdown, the HygroGen2 is in a suitable condition for short to medium term periods without use. It is also put into a condition where it can be moved carefully in a horizontal position (e.g. on a trolley) to a different location (say, within a building).

Shutdown Procedure:

1. Press "Power Off" button on-screen.
2. Select "Shut Down".
3. Allow the HygroGen2 to shutdown. The HygroGen2 will isolate the humidifier and cool/dry to ensure excess water is removed. This may take several minutes.



**DO NOT switch off at the wall before the HygroGen2 has shutdown.
DO NOT switch off at the back of the HygroGen2 before it has shutdown.**



Use "Transit" to shutdown and condition the HygroGen2 if the unit is to be transported or stored for an extended period. The HygroGen2 will ask for the unit to be emptied of water. It will isolate the humidifier from the chamber and then cool/dry the chamber to ensure excess water is removed. This process may take several minutes.

Transit Procedure

1. Press "Power Off" button on-screen.
2. Select "Transit".
3. Empty water as prompted on-screen.
4. Allow the HygroGen2 to shutdown. The HygroGen2 will isolate the humidifier and cool/dry to ensure excess water is removed. This may take several minutes.



**HygroGen2 will not switch off if the water is not emptied as requested!
DO NOT switch off at the wall before the HygroGen2 has shut down. Failure to do this may cause software corruption.**

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3.8 Preparing the Unit for Transit or Storage



Shutdown the HygroGen2 according to the Transit Shutdown Procedure above.

If the HygroGen2 needs to be shipped, always use the original double-layer cardboard packaging. The HG-TB transit bag is suitable for hand carrying only; for air or truck shipping supplement the HG-TB with a sturdy cardboard box with at least 100 mm of foam or other shock protection surrounding all sides.



When shipping involves air transportation, either remove the chamber door, or at least one probe bung to prevent condensing of any residual moisture when exposed to low aircraft hold temperatures.



Figure 24: HG-TB Transit Bag

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4 HW4 Embedded

HygroGen2 comes with HW4 ROTRONIC device control software on its embedded PC. This provides the user with access to HW4 functionality to access ROTRONIC USB devices without the need for a separate PC.

HW4 features include:

- Instrument configuration
- Data acquisition
- Measurement display and graphing
- Calibration adjustment

HW4 does not work with other manufacturers' USB probes.

4.1 HW4 Set Up and Getting Started

For full functionality, HW4 requires an external monitor, keyboard and mouse to be connected to the HygroGen2 (see section 5). To start HW4, touch the HW4 icon. Drag the HW4 window on to the second monitor if available.

Any ROTRONIC USB probes that are connected to the HygroGen2's USB ports can be connected to HW4 using the "Search for USB Masters" command. For a full overview of the use and features of HW4, please refer to the full HW4 manual. This can be obtained from the Downloads section of www.rotronic.com.

4.2 HW4 Installation and Registration

HW4 is preinstalled and activated during HygroGen2 manufacture. The unique HW4 serial key number for the machine can be identified via HG Info button on the Settings page of the HygroGen2; please have this information available in the event that you require technical support.

To register your HW4 software and to assign your full contact details, visit www.rotronic.com and go to the "Software" Section. Software registration will ensure that you receive full support and notification of upgrades available.

4.3 HW4 Support

Support for HW4 is available via email. Please contact support@rotronic.ch including your full contact details, the HygroGen2 serial number and HW4 product key, and a description of your query or problem. You will receive a response within a maximum of two working days.

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4.4 HW4 Updates and Upgrades

The version of HW4 installed on the HygroGen2 is a customised version; standard versions are not compatible. For details of upgrades and updates please refer to section 6.

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5 Peripherals and Settings

5.1 USB Keyboard and Mouse

All standard user functions may be accessed using the HygroGen2 touch screen. However, if desired, any standard USB keyboard and mouse may be plugged in via front or rear USB ports to facilitate operation.

This is particularly useful for operating the embedded HW4 ROTRONIC device control software.

5.2 External Monitor

Running the embedded HW4 software on the integrated screen is possible, but not practical, so an external DVI monitor connection is available on the rear of the HygroGen2. DVI monitors are widely available; no special configuration or size is required.

To configure the DVI monitor, use the following procedure:

1. Connect the HygroGen2 to the DVI monitor.
2. Plug in USB keyboard and mouse.
3. Go to the Settings page on the HygroGen2.
4. Select Monitor Set-Up – Display Properties appears.
5. Click on monitor 2 icon.
6. Select “Extend my Windows desktop onto this monitor”.
7. Click on “Apply”.
8. Screen resolution should be adjusted to suit the monitor connected.
9. Apply any changes and click “OK” to exit the Display Properties.
10. Click on the HW4 icon.
11. HW4 will open on the HygroGen2 screen.
12. Using the mouse, drag the HW4 window so that it displays on the monitor.
13. You can now size the HW4 window to suit the connected monitor.

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5.3 Configuration Mode Settings

Certain settings: Date/Time and Touch Screen calibration require the HygroGen2 to reboot into Configuration/Update Mode. Selecting either option from the drop down menu will bring up the reboot screen.

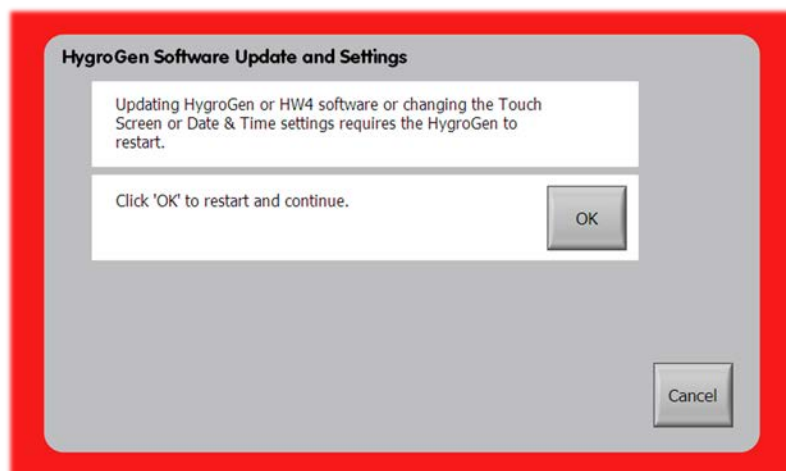


Figure 25: HygroGen2 Software Update and Settings

After rebooting, the configuration/update mode page will be displayed.

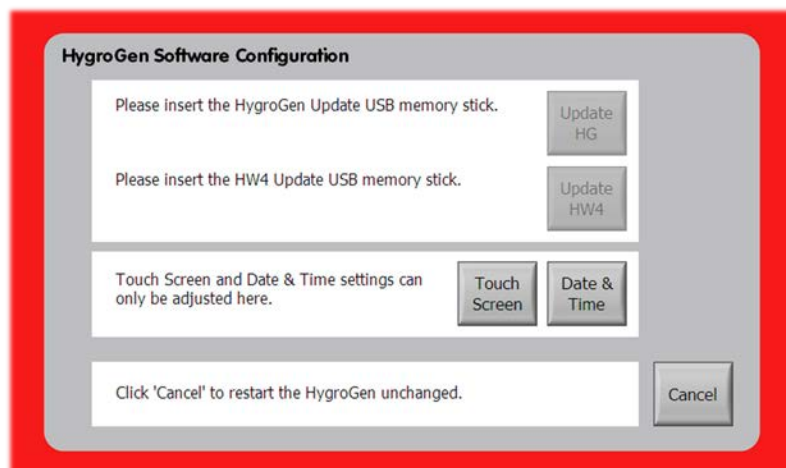


Figure 26: HygroGen2 Configuration/Update mode

At the end of the configuration/update process, press OK to reboot back into normal operation mode.

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5.3.1 Date and Time Settings

Date and time stamps are included in AutoCal and HW4 logged data.
To change these settings, click the Date and Time button on the Update/Configuration page.

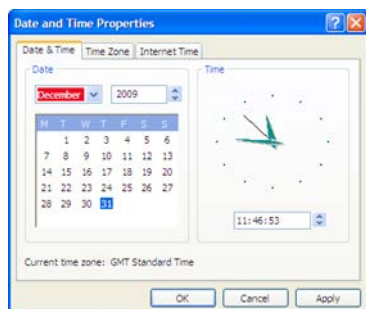


Figure 27: Date and Time Properties

5.3.2 Touch Screen Calibration

Pressing the touch screen button will begin a four point calibration. Press the cross in each corner of the screen as directed.

6 HygroGen2 and HW4 Feature Upgrades and Software Updates

Feature upgrades and updates for HygroGen2 and HW4 software can be ordered from your ROTRONIC dealer and are applied via a USB memory stick inserted **into the rear USB ports of the HygroGen2**.

Applying HygroGen2 and HW4 updates requires the unit to reboot into update/configuration mode (section 5.3). Select the Update option from the Settings screen and press OK to reboot.

After the restart, insert the USB memory stick containing the update and select the upgrade option required.

Once the selection is made, the HygroGen2 will load the software and run through file structure diagnostics before restarting. The diagnostics can take up to 15 minutes; under no circumstances switch off the HygroGen2 during this process.

Once complete, the HygroGen2 will automatically restart and return the unit to its normal operational state. For feature upgrades, a screen will appear requesting the appropriate activation code.

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7 Servicing and Maintenance

7.1 Control HygroClip Calibration

To remove the control HygroClip for calibration, turn off the HygroGen2 auto Control and remove the door. Reach into the chamber and unscrew the HygroClip from its mounting connector. Take care not to cross the threads on the collar when refitting.

To minimise HygroGen2 downtime, alternative calibrated probes can be fitted in place of the existing probe.

7.2 Desiccant

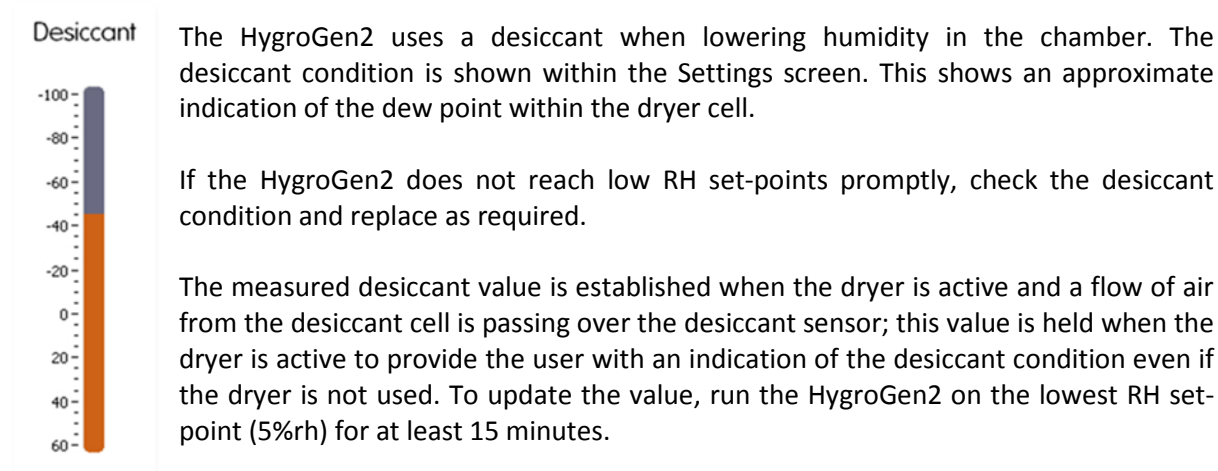


Figure 28: Desiccant Condition

Changing Desiccant

Remove the desiccant cell from the HygroGen2 by pulling firmly on the cell cap (figure1,5). The cell is held in place securely to maintain an air-tight seal; a gentle twist will help removal. Changing the desiccant should be undertaken in a ventilated area.

Observing the diagram below, remove the cap and pour out the used desiccant material and replace with new or regenerated material. Avoid exposing the replacement desiccant unduly to the atmosphere.

Ensure that the cell is filled with as much desiccant as possible to ensure there are no air gaps. Remember to replace the foam insert (that fits between the cell cap and the desiccant) before

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replacing the cell cap and spring clip. Application of silicone grease on the desiccant cell cap "O" ring will help ease removal and refitting.



Figure 29: Desiccant Cell



Caution: Do not use dusty desiccants as the dust may be passed into the chamber.

Choice of Desiccant

The HygroGen2 is supplied from the factory filled with molecular sieve desiccant. Molecular sieve is preferred due to its higher performance in all temperature and humidity conditions, and is longer lasting and can be regenerated through heating. Other desiccants including self-indicating silica gel and drierite can be used if desired; for further information please contact hygrogen@rotronic.co.uk. Dusty desiccants should be avoided as particles may be passed into the HygroGen2 chamber. Replace or regenerate the desiccant whenever the drying performance of the HygroGen2 is deteriorating.

Material Safety Sheets for the desiccants supplied by ROTRONIC are available on request.

Regeneration of Molecular Sieve Desiccant

To regenerate molecular sieve remove it from the desiccant cell and heat it at 175 °C for 3-5 hours in a dry environment (do not use a gas oven). After heating, allow to cool in a dry or sealed environment.

Performance of the regenerated desiccant can be measured in the HygroGen2 according to the method described above. Alternatively, replacement new desiccant can be ordered from ROTRONIC. Please contact your local dealer.

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7.3 HygroGen2 Cleaning

Prior to cleaning, the unit should be disconnected from the electrical mains supply.

External surfaces

The external surfaces of the HygroGen2 may be cleaned with a lint-free cloth dampened with a mild soap solution. Care must be taken not to allow fluids into any of the apertures on the unit. The fan inlet filter can be cleaned using a vacuum cleaner to remove any particulates. The filter material is replaced during servicing.

Chamber

Periodically it is recommended that the internal surfaces of the HygroGen2 chamber sleeve are inspected and wiped clean of any visual residues using a lint-free cloth moistened with distilled water. Care should be taken to avoid mechanical damage to the control probe and sampling tubes inside the chamber.



Figure 30: HG2-S Chamber

Purging internal pipes

Some humidity instruments are used in environments where chemical contaminants may be present. Should these transfer to the HygroGen2, this may result in drift of the RH control probe which would become apparent during calibration. To purge the internal pipe work and chamber of the HygroGen2, replace the desiccant with Granular Activate Charcoal (GAC) and run the unit at 40°C and 5%rh for 6 hours. Any volatile compounds within the HygroGen2 will be absorbed into the GAC.

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7.4 Annual Servicing of HygroGen2

The unit does not require routine user maintenance beyond that described in this Section.

For optimum performance ROTRONIC recommend that the HygroGen2 is serviced every 12 months at an approved HygroGen2 service centre, details of which can be found in Appendix C2 of this manual.



Under no circumstance should the unit be opened by personnel unauthorised by the manufacturer. Doing so will void the manufacturer's warranty, and expose potentially dangerous electrical hazards.

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A1: Calibration Reference Options

Various calibration references can be used with the HygroGen2. These include the internal control probe, other RH probes, dew point chilled mirrors and platinum resistance thermometers (PRTs).

For traceable calibration, these references are themselves calibrated by accredited laboratories traceable to national standards.

For more information, please refer to The Guide to Uncertainty of Measurements (GUM) published by the UK National Physical Laboratory (or equivalent national standards documentation) and ISO/IEC 17025:2005 "General Requirements for the Competence of Testing and Calibration Laboratories".

Appendix D1 provides examples of uncertainty budgets for the HygroGen2 when using different calibration references. These are for guidance only, and ROTRONIC accepts no liability in relation to their use.

A1.1 Internal RH Probe Reference

The display values on the HygroGen2 (which are derived from the control probe - as described in appendix A2) can be used as the reference.

Advantages:

- No supplementary instruments are required.
- Fastest response - control is based on the reference value.
- Stability during calibration – the reference is continually optimising the control value.
- The reference probe can be easily replaced with another calibrated probe.
- HygroClip probes have the facility to be adjusted to agree with a calibration reference, meaning no corrections of the HygroGen2 display value need to be made in routine use.

Disadvantages:

- RH probes can drift over time, so regular checks need to be performed to achieve best measurement capability and a larger drift component included in an overall uncertainty calculation.
- Probe characteristics such as hysteresis or temperature coefficients must be included within the overall uncertainty budget.
- RH probes are less accurate than chilled mirrors.

Using the internal probe as your reference provides the most convenient option, but routine checks of the probe's stability are required to ensure the quality of the calibration. Interim calibration checks against a traceable reference (e.g. ROTRONIC non-saturated salt solutions) should be carried out regularly and the results recorded in a probe calibration history.

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Annual recalibration of the control probe by an accredited laboratory should be the minimum calibration regime. Interim calibration checks in combination with the annual calibration results will allow the key drift component of an uncertainty budget to be defined and documented.

A1.2 External RH Probe Reference

Any RH instrument placed through the HygroGen2 door can be used as the reference. This may be desired if your quality system employs a particular RH probe with a long history. It may not be desirable to adjust this probe and use it as the control probe – a separate adjusted control probe may be more convenient.

The same disadvantages apply when using an external RH probe as a reference as when using the RH control probe: i.e. accuracy, susceptibility to drift, hysteresis, regular calibration requirement.

A1.3 Chilled Mirror Reference

To reduce calibration uncertainty, a chilled mirror instrument can be employed as the reference. This type of instrument is generally accepted as a secondary humidity transfer standard. Instruments should be maintained with an accredited (ISO17025) calibration certificate. A chilled mirror can be used to validate the HygroGen2 calibration before and after on-site calibration using the internal RH probe as a reference.

Chilled mirrors measure “dew point”, which is a measure of water vapour concentration and is the temperature at which dew will form on a surface. Relative humidity can be derived from this value with a corresponding temperature measurement.

There are two types: an all-in-one probe which can be inserted through the HygroGen2 door, with integrated PRT temperature probe, e.g. MBW 473 with RP2 measuring head, and an external sampling head, for which the HygroGen2 external sample loop is employed (see section below).



Figure 31: MBW RP2 Measuring Head

Advantages of chilled mirror references:

- Best measurement capability.
- Instruments do not drift significantly.
- Operates over a broad range of humidity conditions.

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Disadvantages:

- Regular mirror cleaning is required to maintain best possible performance.
- Mirror measuring heads generate heat when cooling the mirror. Certain older chilled mirror probes fitted through the HygroGen2 door can introduce temperature gradients.
- For dew points above ambient conditions, sample lines must be heated to avoid condensation which can introduce instability.
- Chilled mirrors may be more expensive to calibrate than RH probes.
- Longer stabilisation time.

Without doubt, a chilled mirror reference can obtain the best possible calibration uncertainty, but they do require a good level of user expertise to ensure the best possible results. Always follow the chilled mirror manufacturer's best practice recommendations and check the instrument's compatibility with the HygroGen2 operating specifications.

Practical Guidance - Chilled Mirror Reference

Depending on the conditions being measured, some chilled mirrors do require a longer time to stabilise, sometimes up to 90 minutes.

Attention should be paid to the following:

- some types of chilled mirror sensors have the tendency to over or under shoot, to "hunt" and can be off-the-mark for quite a long period of time.
- at values below freezing, the indications of chilled mirror instruments without a force frost feature can be ambiguous; readings may correspond to either the dew point or the frost point.
- whenever measuring conditions result in a dew point that is higher than the laboratory conditions, heat the entire external sample loop, including the sensor head. Heating is required to avoid condensation.

For advice on choosing the most appropriate chilled mirror instrument please consult your ROTRONIC dealer.

Chilled mirror probes

Chilled mirror probes of diameters up to 50mm can be directly fitted through the HygroGen2 door. Depending on the diameter of the probe, a special adapter or custom HygroGen2 door may be required, please contact your ROTRONIC dealer for guidance.

Chilled mirror probes are convenient for dew point ranges above ambient as they are immersed in the conditions and therefore condensation in sample lines need not be considered.

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Figure 32: RP2 Head fully inserted into HygroGen2 door

Make sure the mirror is positioned so that moving air within the chamber flows over the mirror surface. Figure 32 shows an example where the mirror sample cell clears the internal edge of the HygroGen2 door.

External sample loop operation

To use a HygroGen2 with a chilled mirror that has an external sampling head, connect via the heated sample loop points on the back panel. The HygroGen2 sample ports and internal tubing are automatically controlled to 5°C above the chamber temperature to eliminate the possibility of condensation formation.



Figure 33: HygroGen2 sample Ports

The connecting lines to the mirror must also be heated if the set chamber conditions create a dew point temperature higher than the ambient conditions. Make sure that your chilled mirror operating capability is within the required range. For humidity values with a dew point below ambient temperature, heated sample lines are not required.

Remove the blanking caps fitted to the sample loop Swagelok fittings and use nuts and olives to connect the sample tubes from the chilled mirror. 6 mm OD FEP or stainless tubing should be used to connect the sample loop out and return ports to the chilled mirror unit. If the mirror instrument does not have a built-in pump, flow meter and regulator, we recommend including these in the sample loop (after the mirror) to confirm the air flow rate required by the chilled mirror instrument (typically 0.5l/min).

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Caution:



When tightening or releasing the Swagelok connectors do not apply torque to the nut/caps without using a spanner on the connector body to counteract it. Finger tighten and then apply a quarter turn with a spanner.

Replace the blanking caps when not using the sample loop.



Figure 34: HygroGen2/Chilled Mirror Set

If the chilled mirror instrument is being used in conjunction with a thermometer (in order to calculate relative humidity), the temperature probe should be positioned in the chamber. Care should be taken to ensure that insertion depth and stem conduction effects do not induce measurement errors.

A typical HygroGen2/Chilled Mirror set up is shown; note the heated sample lines to the rear.

Set the flow rate through the sample loop according to the mirror instrument manufacturer's specifications. A lower flow rate will improve stability criteria but may influence measurement response time.

A2: Temperature Control

Temperature control within the HygroGen2 is performed by a fast response PT100 thermometer which is continuously referenced against the HygroClip control probe. The chamber is not considered stable (as indicated by the control indicator being coloured green) unless the reported temperature values are within the resolution of the control HygroClip.

If a replacement HygroClip reference is put into the HygroGen2, and it gives a significantly different temperature reading, it may take a while - roughly 20 minutes for every 0.1°C discrepancy - the first time stability control is engaged, as the self-adjustment algorithm runs.

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B1: HygroGen2 / Screen Messages

On Screen Message:	Fault/Action:
HygroClip NC	HygroClip not connected or faulty. Check and replace as required. Contact service centre if message persists.
HygroClip error	Temperature or RH values are incorrect within the HygroGen2's programming. Remove Probe and check values. Replace if found to be faulty. Contact service centre if message persists.
HC null data	HygroClip communication; invalid data output. Check HygroClip and replace. Contact service centre if message persists.
Desiccant probe NC	Desiccant probe connection failure. Service centre repair only. Manual control of desiccant condition enables use to continue.
Desiccant probe null data	Desiccant probe communication; invalid data output. Service centre repair only. Manual control of desiccant condition enables work to continue.
Low Water level	Check water level, empty and refill as required, see Section 2.4. If message persists, manual control of water level allows use to continue until next service
High Water level	Water level is too high; fully empty and refill in accordance with Section 2.4. Contact service centre if message persists.
Humidification Disabled	Displays when temperature is changing. Wait for temperature to stabilise.
Desiccant wet	Desiccant condition warning. Replace desiccant (Section 7.2).
Heating Disabled	Over temperature event. Heating shut down for safety reasons. Contact service centre.
Sample Loop error	Temperature fault (sample loop temperature sensor or heater). Operation can continue at dew points below ambient temperature.
Water Sensor error	Fault with level sensor. Manual supervision of water level allows use to continue until next service.
UV error	UV Lamp failure. Contact service centre.
Service Due	More than 3000 hours in use since last service. Contact your service centre to arrange for the HygroGen2 to be serviced.

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B2: HygroGen2 Specification

HygroGen2 Specification		
	Relative Humidity	Temperature
Control		
Sensor	HygroClip2-S, capacitive RH sensor, Pt100 temperature sensor	
Control type	Embedded multiple PID controller, touch screen graphical user interface	
Range	5....95%rh	0...60°C
(with Range Extension option/s)	2...99%rh	-5...60°C
Stability at equilibrium	<0.1%rh	<0.01°C
Chamber temperature gradients	<0.05°C (15...50 °C), <0.1°C (5...60°C), <0.15 (0...5°C)	
Generation method	Mixed flow with desiccant dryer cell and piezoelectric humidifier	Peltier thermoelectric element with radial chamber mixing fan
Performance		
Response time	3 minutes (35 to 80% change)	5 minutes (20 to 30°C change)
Control probe specification	±0.8%rh(23°C ±5) ±2%rh (0...60°C)	±0.1K (23°C ±5) ±0.3K (0...60°C)
Typical calibration uncertainty	±1.5%rh (k=2) at 23°C	±0.15°C (k=2) 15...50°C
Standard Features		
Water level	Low and high alarm, bar graph status indication	
Water quality	UV sterilisation, auto time cycling	
Desiccant condition	Condition monitored during control operation	
USB ports	7 front, 2 rear	
Reference connection	Temperature controlled outlet and inlet, 6mm fittings	
Programmer function	20 user program memory, up to 200 set-point changes per program	
Mechanical & Electrical		
Chamber volume	2 litres, effective working volume 1.5 litres	
Power	110...240VAC 50/60Hz, 3A	
Enclosure	Powder coated aluminium, IP20, 450 x 406 x 205mm (Max)	
Operating Conditions	10-35°C	
Weight	13 kg	
CE	Safety: EN 61010-1:2001 EMC: EN 61326-1:2006EN 61326-1:2006 &EN 61000-6-1:2007	

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B3: HygroGen2 Order Codes:

Order code:	Description
HG2-S	HygroGen2 with touch screen user interface, set-point control and programmer function, heated sample loop, 1x desiccant cell, 1x fill syringe, embedded HW4-P software. Order chamber door separately.
	Doors & Fittings
HG2-D-11111	HG2 door 5 x 15mm ports (for 5 HygroClip2-S) with 5 bungs, order specific B1 sleeves for smaller probe diameters
HG2-D-88888	HG2 door 5 x 30mm ports with 5 bungs, order specific B8 sleeves to suit smaller probe diameters
HG2-D-HFW	HygroGen2 probe door for HF3 & HF4 wall mount transmitters
HG2-DP-00000	HG2 clear acrylic door (no ports) for instruments with displays
HG2-D-xxxxx	HG2 fully custom door for > 30mm, see xx diameter codes below
HG2-B1	15mm Bung
HG2-B1-xx	B1 probe sleeves (15mm external, internal probe diameter see xx codes below)
HG2-B8	30mm Bung
HG2-B8-xx	B8 probe sleeve (30mm external, internal probe diameter see xx codes below)
	Spares
HG2-DC	Additional desiccant cell, pre-filled with molecular sieve
HG2-FILL	Fill tube and syringe
HG2-DES-3	Molecular sieve desiccant (3kg)
	Accessories
HG2-TB	Transit bag, lightweight
HG2-AC3001-L/050	HygroClip2 calibration cable, 50cm, USB
HG2-AC3001-L/050(5)	HygroClip2 calibration cable, 50cm, USB: Bundle of 5 pieces HG2-AC3001-L/050
AC3015	Mini USB transfer cable, 30cm, with 90° coupling for transmitters with fixed probe
	Extended Features
HG2-V2.X-UPGRADE	HG2-V2.x Software and HW4-V3.x upgrade USB-stick
HG2-AutoCal-Code	HG2 AutoCal function, licence code only
HG2-TempExt-Code	HG2 Temperature Extension -5...60 °C, licence code only
HG2-HumiExt-Code	HG2 Humidity Extension 2...99 %RH, licence code only
HG2-AutoC/RangeE-C	HG2 AutoCal and Range Extension T/RH bundle, licence code only

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xx probe diameter codes

0		Q	not used
1	15mm (HygroClip)	R	13.5mm
2	20mm	S	26mm
3	25mm	T	34mm
4	10mm	U	14mm
5	5mm	V	20mm cable gland
6	12mm	W	32mm cable gland
7	18mm	X	not used
8	30mm	Y	15 mm angled Vaisala HMD
9	Cable gland to accept 9...17mm diameter probes	Z	not used
A	6mm	-A1-	24mm
B	4mm	-A2-	12.5mm
C	22mm	-A3-	24.7mm
D	23mm	-A4-	General Eastern 32mm Chilled Mirror probe
E	13mm	-A5-	16 mm
F	19mm	-A6-	26.5 mm
G	21mm	-A7-	36 mm
H	18.5mm (Vaisala HMP45AD)	-A8-	47 mm
I	18.2mm (Aanderaa 3445)		
J	9mm		
K	19.75mm (no "O" rings)		
L	Cable gland to accept 3 - 7mm diameter probes		
M	12.7mm		
N	6.35mm (1/4 inch)		
O	not used		
P	3mm		

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C1: HygroGen2 Warranty Statement

ROTRONIC will grant a warranty for the HygroGen2 for a period of 12 months from the date of delivery in respect of any evidenced faulty workmanship and materials. The warranty period is extended by a further 12 months when the unit is serviced at a ROTRONIC approved service centre 12 months after the date of supply. Should the instrument be proven not to meet the published specifications or to be contrary to contract upon inspection, the customer shall grant ROTRONIC the opportunity hereunder of repairing the fault by returning the unit carriage paid to ROTRONIC.

Should the supply or delivery of any improvement or replacement not prove possible, the customer may choose between having the purchase price reduced or in demanding the contract of sale to be rescinded (conversion). Damage resulting from natural wear and tear, an act of God or non compliance with the operating instructions shall be excluded from the warranty as well as mechanical interference by the customer or by third parties with plant and equipment of ROTRONIC without its written permission. No liability will be accepted for defects, damage or injury caused due to installation not carried out in accordance with the manufacturer's installation instructions.

The instrument maintains a record of the usage and this may only be reset by an authorised service centre; this will determine the warranty period granted.

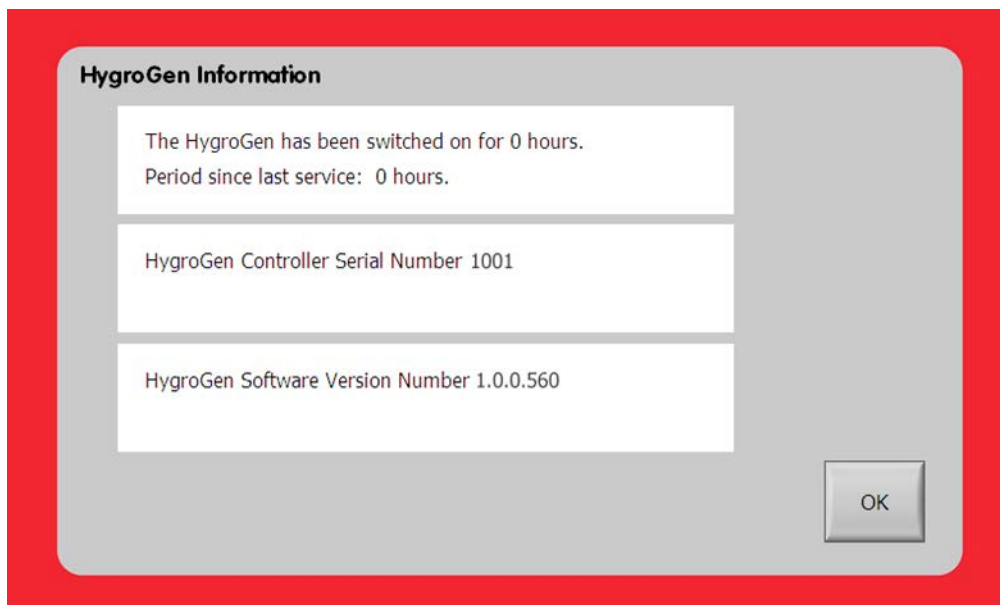


Figure 35: HygroGen Information

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C2: Manufacturer & Service Centre Contact Information

Manufacturer/UK Service Centre : Rotronic Instruments (UK) Ltd Crompton Fields Crompton Way Crawley RH10 9EE United Kingdom Phone : +44(0)1293 571000 Fax : +44(0)1293 571008 www.rotronic.co.uk instruments@rotronic.co.uk	Switzerland Service Centre: Rotronic AG Grindelstrasse 6 CH-8303 Bassersdorf Switzerland Phone +41 1 838 1144 Fax +41 1 837 0073 www.rotronic.ch humidity@rotronic.ch	USA Service Centre: Rotronic Instrument Corp. Suite 150 135 Engineers Road Hauppauge, NY 11788, USA Phone +1 631 427 38 98 Fax +1 631 427 39 02 sales@rotronic-sa.com www.rotronic-usa.com
Germany Service Centre : Rotronic Messgeräte GmbH Einsteinstrasse 17-23 76275 Ettlingen Deutschland info@rotronic.de www.rotronic.de Phone +49 7243 383 250 Fax +49 7243 383 260	France Service Centre: Rotronic s.a.r.l. 56, bd de Courcerin, F-77183 Croissy Beaubourg France humidite@rotronic.fr www.rotronic.fr Phone +33 160 95 07 10 Fax +33 160 17 12 56	China Service Centre: Rotronic Shanghai Representative Office 2B,Zao Fong Universe Building No.1800 Zhong Shan West Road, 200233 Shanghai China info@rotronic.cn www.rotronic.cn Phone +86 40 08162018 Fax +86 10 82254374

D1: HygroGen2 Uncertainty Framework - Internal RH Probe

Input values: 23 °C 80 % RH
 Temperature sensitivity 4.96 % RH/deg C

Reference	Uncertainty source	Distribution	Value	Units	Sensitivity	Equiv RH	Divisor	One SD	Squares
1	Uncertainty of reference probe	normal	0.900000	%rh	1.000000	0.900000	2.00	0.450	0.203
2	Repeatability of humidity	normal	0.100000	%rh	1.000000	0.100000	1.00	0.100	0.010
3	Reference drift	rectangular	1.000000	%rh	1.000000	1.000000	1.73	0.577	0.333
4	Reference resolution	rectangular	0.050000	%rh	1.000000	0.050000	1.73	0.029	0.001
5	Chamber temperature gradients	rectangular	0.020000	°C	4.960000	0.099200	1.73	0.057	0.003
6	Temperature stabilisation	rectangular	0.005000	°C	4.960000	0.024800	1.73	0.014	0.000
7	Repeatability of temperature	normal	0.050000	°C	4.960000	0.248000	1.00	0.248	0.062
8	Humidity stabilisation	rectangular	0.050000	%rh	1.000000	0.050000	1.73	0.029	0.001
9	Humidity fluctuations	rectangular	0.050000	% RH	1.000000	0.050000	1.73	0.029	0.001
10	Instrument Under Test (IUT) Resolution	rectangular	0.050000	% RH	1.000000	0.050000	1.00	0.050	0.003
11	Standard deviation of Ref readings	normal	0.050000	%rh	1.000000	0.050000	1.00	0.050	0.003
12	Standard deviation of IUT readings	normal	0.100000	%rh	1.000000	0.100000	1.00	0.100	0.010

Reference		Sum of squares	0.63
1	From calibration certificate - check uncertainty at input values	Standard uncertainty (vs sum of squares)	0.793
2	From Standard Deviation of 10 repeated calibration runs	Expanded uncertainty (95 % confidence)	1.59
3	Drift between two successive calibrations of the reference instrument		
4	Resolution from manufacturer's specification		
5	Measured temperature gradients from the ROTRONIC HygroGen2 Service		
6	Measured stability from the ROTRONIC HygroGen2 Service		
7	From Standard Deviation of 10 repeated calibration runs		
8	Resolution of ROTRONIC HygroGen2 Control Clip		
9	Resolution of ROTRONIC HygroGen2 Control Clip		
10	Resolution from manufacturer's specification		
11	Standard Deviation of Ref readings during calibration		
12	Standard Deviation of IUT readings during calibration		

D2: HygroGen2 Uncertainty Framework - External RH Probe

Input values: 23 °C 80 % RH
 Temperature sensitivity 4.96 % RH/deg C

Reference Uncertainty source		Distribution	Value	Units	Sensitivity	Equiv RH	Divisor	One SD	Squares
1	Uncertainty of reference probe	normal	0.900000	%rh	1.000000	0.900000	2.00	0.450	0.203
2	Repeatability of humidity	normal	0.100000	%rh	1.000000	0.100000	1.00	0.100	0.010
3	Reference drift	rectangular	1.000000	%rh	1.000000	1.000000	1.73	0.577	0.333
4	Reference resolution	rectangular	0.050000	%rh	1.000000	0.050000	1.73	0.029	0.001
5	Chamber temperature gradients	rectangular	0.020000	°C	4.960000	0.099200	1.73	0.057	0.003
6	Gradients through probe stem	rectangular	0.100000	°C	4.960000	0.496000	1.73	0.286	0.082
7	Temperature stabilisation	rectangular	0.005000	°C	4.960000	0.024800	1.73	0.014	0.000
8	Repeatability of temperature	normal	0.050000	°C	4.960000	0.248000	1.00	0.248	0.062
9	Humidity stabilisation	rectangular	0.050000	%rh	1.000000	0.050000	1.73	0.029	0.001
10	Humidity fluctuations	rectangular	0.050000	% RH	1.000000	0.050000	1.73	0.029	0.001
11	Instrument Under Test (IUT) Resolution	rectangular	0.050000	% RH	1.000000	0.050000	1.00	0.050	0.003
12	Standard deviation of Ref readings	normal	0.050000	%rh	1.000000	0.050000	1.00	0.050	0.003
13	Standard deviation of IUT readings	normal	0.100000	%rh	1.000000	0.100000	1.00	0.100	0.010

Reference

		Sum of squares	0.71
1	From calibration certificate - check uncertainty at input values	Standard uncertainty (√sum of squares)	0.843
2	From Standard Deviation of 10 repeated calibration runs	Expanded uncertainty (95 % confidence)	1.69
3	Drift between two successive calibrations of the reference instrument		
4	Resolution from manufacturer's specification		
5	Measured temperature gradients from the ROTRONIC HygroGen2 Service		
6	Stem conduction		
7	Measured stability from the ROTRONIC HygroGen2 Service		
8	From Standard Deviation of 10 repeated calibration runs		
9	Resolution of ROTRONIC HygroGen2 Control Clip		
10	Resolution of ROTRONIC HygroGen2 Control Clip		
11	Resolution from manufacturer's specification		
12	Standard Deviation of Ref readings during calibration		
13	Standard Deviation of IUT readings during calibration		

D3: HygroGen2 Uncertainty Framework - Chilled Mirror Reference

				23	°C	50	% RH			
				Temperature sensitivity		3.1	% RH/deg C			
Reference	Uncertainty source	Distribution	Value	Units	Sensitivity	Equiv RH	Divisor	One SD	Squares	
1	Uncertainty of chilled mirror reference	normal	0.200000	°C	3.100000	0.620000	2.00	0.310	0.096	
2	Repeatability of humidity	normal	0.100000	%rh	1.000000	0.100000	1.00	0.100	0.010	
3	Chamber temperature gradients	rectangular	0.020000	°C	3.100000	0.062000	1.73	0.036	0.001	
4	Temperature stabilisation	rectangular	0.005000	°C	3.100000	0.015500	1.73	0.009	0.000	
5	Repeatability of temperature	normal	0.050000	°C	3.100000	0.155000	1.00	0.155	0.024	
6	Humidity stabilisation	rectangular	0.050000	%rh	1.000000	0.050000	1.73	0.029	0.001	
7	Humidity fluctuations	rectangular	0.050000	% RH	1.000000	0.050000	1.73	0.029	0.001	
8	Instrument under test (IUT) resolution	rectangular	0.050000	% RH	1.000000	0.050000	1.00	0.050	0.003	
9	Standard deviation of Ref readings	normal	0.050000	%rh	1.000000	0.050000	1.00	0.050	0.003	
10	Standard deviation of IUT readings	normal	0.100000	%rh	1.000000	0.100000	1.00	0.100	0.010	
Reference					Sum of squares				0.15	
1	See sheet Dew Point UA					Standard uncertainty (√sum of squares)				0.385
2	From Standard Deviation of 10 repeated calibration runs					Expanded uncertainty (95 % confidence)				0.77
3	Measured temperature gradients from the ROTRONIC HygroGen2 Service									
4	Measured stability from the ROTRONIC HygroGen2 Service									
5	From Standard Deviation of 10 repeated calibration runs									
6	Resolution of ROTRONIC HygroGen2 Control Clip									
7	Resolution of ROTRONIC HygroGen2 Control Clip									
8	Resolution from manufacturer’s specification									
9	Standard Deviation of Ref readings during calibration									
10	Standard Deviation of IUT readings during calibration									

D4: Dew Point Uncertainty Analysis

Dew Point Temperature				-5 to +35	°Cdp				
Reference	Uncertainty source	Distribution	Value	Units	Sensitivity	Equiv °Cdp	Divisor	One SD	Squares
1	Calibration of Standard	normal	0.1	°Cdp	1	0.10	2.00	0.050	0.00250
2	Drift of Standard	rectangular	0.1	°Cdp	1	0.10	1.73	0.058	0.00333
3	Repeatability	normal	0.05	°Cdp	1	0.05	1.00	0.050	0.00250
4	Mirror Contamination	rectangular	0.05	°Cdp	1	0.05	1.73	0.029	0.00083
5	Mirror Temperature Fluctuations	rectangular	0.05	°Cdp	1	0.05	1.73	0.029	0.00083
6	Temp Gradients Across the Mirror/Condensate	rectangular	0.01	°Cdp	1	0.01	1.73	0.006	0.00003
9	Standard Deviation of Readings	normal	0.01	°Cdp	1	0.01	1.00	0.010	0.00010
					Sum of squares				0.01
					Standard uncertainty (√sum of squares)				0.101
					Expanded uncertainty (95 % confidence)				0.20