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HygroLog HL20 and HL21 Data Logger

User Guide



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Applicability:

This manual is valid for instruments with firmware version 3.x or higher. Changes in the last character of the version number reflect minor changes in the internal software of the instrument that do not affect the manner in which the instrument should be operated.

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1. Overview

1.1 General

The HygroLog HL20 data logger can record up to 20,000 pairs of relative humidity and temperature values within the range of 0 to 100 %RH and -10 to 60°C (14 to 140°F).

The HygroLog HL21 data logger can record up to 20,000 temperature values within the range of -10 to 60°C (14 to 140°F). Models with the optional LC display are limited 0 to 50°C (32 to 122°F).

Temperature is measured with a Pt100 RTD. Relative humidity is measured with a ROTRONIC Hygromer IN1 capacitive sensor. Both sensors are internal and there is no apparent probe.

Both the HL20 and HL21 require three AA batteries (1.5V) for power. Depending on both the log interval and the display option, these data loggers can record data over a time period of up to 20 months without replacing the batteries.

Configuration of the HL20 and HL21, as well as the downloading and viewing of recorded data, requires a PC with the ROTRONIC HW4 software installed as well as a service cable such as the AC3006

Based on the ROTRONIC AirChip 3000 digital technology the HL20 and HL21 offer the following features:

- Unit system: metric or English
- Real time clock (runs for up to 4 hours without the 3 AA batteries after initial charge)
- Calculation of the dew or frost point (calculated parameter can be displayed but not recorded)
- Optional LC display (%RH, temperature) with battery charge indicator and message bar
- Function key: starts and stops data logging, turns optional LC display on and off
- Status indicator (LED): flashes green when logging, flashes red for out-of-limit values or a logger problem
- Humidity temperature calibration and adjustment
- Simulator mode (used to validate the data recording function)

Note:

Instructions for using the HW4 software are not included in this manual. These instructions are shipped separately on the software CD ROM.

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2. General description

2.1 Models

Basic models without display

- HygroLog HL-20: relative humidity and temperature logger, function key, status indicator (LED), internal sensors protected by a slotted cover.
- HygroLog HL-21: temperature data logger, function key, status indicator (LED), internal Pt100 RTD

Models with display

- HygroLog HL-20D: same as HL20, LC display with backlight, message bar and battery charge indicator
- HygroLog HL-21D: same as HL21, LC display with backlight, message bar and battery charge indicator

2.2 Required accessories

The following accessories are required in order to be able to configure the logger and to download and view the recorded data:

- Cable AC3006 or equivalent (plugs into a USB port of the PC)
- PC with the ROTRONIC HW4 software installed (version 2.4.0 or higher)

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2.3 Batteries

All models ship with three AA batteries which must be inserted first (see battery replacement).

Note:

To conserve battery power, models with the LC display are shipped with the Display Sleep function enabled and set to 1 minute (see Software Functions). When the function key has not been pressed for some time (in this case 1 minute), the display sleep function automatically turns the display off. The display can be temporarily turned on at any time by pressing on the function key.

2.3.1 Battery lifetime

The battery lifetime depends on the manner in which the HL20 or HL21 is being used. The following examples are based on the following assumptions:

- Fresh set of AA batteries (2900 mAh)
- Display backlight turned off (if applicable)
- Log interval set to 30 minutes

| | Battery lifetime in months |
|--|----------------------------|
| Models w/o LC display | 20 |
| Models with LC display, display sleep function set to 1 minute | 13 |
| Models with LC display, display sleep function disabled | 5 |

2.4 Real time clock

After inserting a fresh set of batteries for the first time, the real time clock must be adjusted prior to using the HL20 or HL21 (see "Operation"). The real time clock is powered from a large capacitor and can run for up to 4 hours without the batteries. Removing the battery for an extended period of time will cause the logger to completely lose track of the date and time.

Because of the requirement to always keep track of the date and time, the HL20 and HL21 do not have a power on/off switch.

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2.5 Memory

All models use a non-volatile EEPROM internal memory to hold the measurement data. The memory cannot be removed from the data logger.

Memory capacity is as follows:

HL20: 20,000 pairs of relative humidity and temperature values

HL21: 20,000 temperature values

2.6 Function key

The function key is used as follows:

- Long key press: press the key for a few seconds to start or stop data logging.
- Short key press: depending on the configuration settings of the display (display sleep function) a short key press turns on and off the optional LC display.

For more details, see “Operation”

2.7 Status indicator (LED)

The status indicator consists of a green and red LED. The green side of the LED flashes every 5 seconds when logging is active. The red side of the LED flashes every 5 seconds when a measured value is out of limits (see “Configurable settings”) or when the logger requires attention (low battery, memory full, major sensor failure – such as open or shorted sensor)

2.8 Service and data connector

The service / data connector (mini-USB type) can be accessed after removing the back cover (see Operation). The connector gives access to the data logger UART digital interface (Universal Asynchronous Receiver Transmitter).

Configuring the data logger or retrieving the recorded data requires cable AC3006 or equivalent. One end of the cable plugs into the service / data connector. The other end plugs into the USB of a PC with the ROTRONIC HW4 software installed. See “Initial start-up” for the location of the service / data connector.

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2.9 *Optional display*

The optional LC display has a backlight which can be enabled or disabled when configuring the data logger.

- HL20D: depending on the configuration of the logger, the LC display shows relative humidity and temperature or the dew / frost point and temperature. The top line displays humidity (%RH or the dew / frost point)
- HL21D: the LC display shows temperature.

The LC display can be configured to show the measured or calculated values with either one or two decimals.

Note:

The LC display is automatically turned on when the data logger is connected to the USB port of a PC by means of cable AC3006 or equivalent.

2.10 *Operating limits*

Models without display:

- -10...60 °C with the factory supplied alkaline batteries
- 0...100 %RH, non condensing

Models with display:

- 0...50 °C with the factory supplied alkaline batteries
- 0...100 %RH, non condensing

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2.11 Configurable settings

Configuration of the data logger by the user and access to its functions requires a PC with the ROTRONIC HW4 software (version 2.4.0 or higher) installed. Service cable AC3006 is used to connect the service / data connector to a USB port of the PC.

Instructions regarding the configuration of the data logger and access to its functions are provided in the following manuals:

E-M-HW4v3-F2-018
E-M-HW4v3-Main (§ 7.5)
E-M-HW4v3-A2-001

2.11.1 Relative humidity symbol and temperature unit

Both the symbol representing relative humidity and the temperature can be configured to suit local requirements.

2.11.2 Calculated parameter

HL20: the data logger can be set to compute one of the following psychrometric parameters.

- Dew point (Dp)
- Frost point (Fp)

Note:

- When the optional display is configured to show the calculated parameter, either the symbol Dp or the symbol Fp appear to the left of the numerical value, depending on whether the dew point or frost point was selected. For values below freezing, the symbol Fp indicates that the value is a frost point (above ice) as opposed to being a dew point (above liquid).
- The data logger cannot be used to record either the dew point or the frost point

2.11.3 Alarm function (out-of-limit value)

The alarm function can be enabled or disabled for each of the measured or calculated parameters. High and low value can be associated with each parameter so as to define out-of-limits values. A hysteresis value can also be entered for each parameter. The hysteresis value is used for both the low and the high alarm conditions.

The data logger has a red LED which flashes when the value of any parameter is out-of-limits. The LED stops flashing when the value returns to normal.

Log files do not record the existence of an alarm condition. However, when the contents of a log file are viewed as a data table with the HW4 software, values that correspond to an alarm condition are printed over a red background, based on the alarm settings that HW4 downloaded from the logger.

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2.11.4 Display-Sleep function

Using the Display Sleep function can substantially extend the lifetime of the battery. When the Display Sleep function is active, the LC display of the data logger stays blank.

The optional display of the data logger can be set to be always on. In this case, the display can be turned on and off manually with the function key. The display can also be set to automatically go blank after 1, 5, 10 or 20 minutes.

The data logger suspends the Display Sleep function whenever the function key is pressed. The function is also suspended when the data logger is connected to the USB port of a PC by means of cable AC3006.

2.12 Factory default settings

| Configurable Settings | Factory default |
|---------------------------|---|
| Unit system | Metric, except USA: English |
| Psychrometric calculation | No calculation |
| Display resolution | 1 decimal |
| Display Sleep function | Enabled, display automatically turns off after 1 minute |
| Display backlight | Off |
| Displayed parameters | %RH and temperature or temperature only |
| Communication protocol | RO-ASCII |
| Device name | Instrument model |

| Functions | Factory default |
|-----------------------------------|--|
| Humidity / temperature adjustment | Enabled |
| Device write protection | Disabled |
| Limit humidity to 100 %RH | Enabled |
| Out-of-limit value alarm | Disabled |
| Data recording | Stopped (loop mode – 10 min. interval) |
| Major sensor failure alarm | Enabled (cannot be disabled) |
| Simulator mode | Disabled |

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2.13 Data logging

Function overview:

The main characteristics of the data logging function are as follows:

- Relative humidity values are recorded with a resolution of 0.1%RH
- Temperature values are recorded with a resolution of 0.05°C / 0.09°F
- Memory capacity: 20,000 single values or value pairs
- Adjustable log interval: from 5 seconds to 1 hour, in increments of 5 seconds
- Two data recording modes: Loop and Start-Stop

Note:

Any recorded data present in the data logger memory is automatically erased whenever a new recording session is started.

Data recording modes:

- Loop:** when the memory is full the logger dumps the oldest data sample and keeps recording. The memory retains the most recent data.
- Start-Stop:** the logger stops recording data as soon as the memory is full

Data recording can be stopped at any time by pressing on the function key (long key press) or with the ROTRONIC HW4 software.

Recorded parameters:

Depending on the model, the data logger records either temperature only or relative humidity and temperature. A calculated value such as dew point cannot be recorded by the HL20 but it can be added to the humidity and temperature data after downloading the recorded data to a PC with the HW4 software. See the following HW4 manual: **E-M-HW4v3-F2-018**

Date and time:

The data logger has an internal real time clock that is used to associate a date and time stamp with each data record.

When data recording is either started or stopped using the ROTRONIC HW4 software, the real time clock is automatically synchronized with the PC clock.

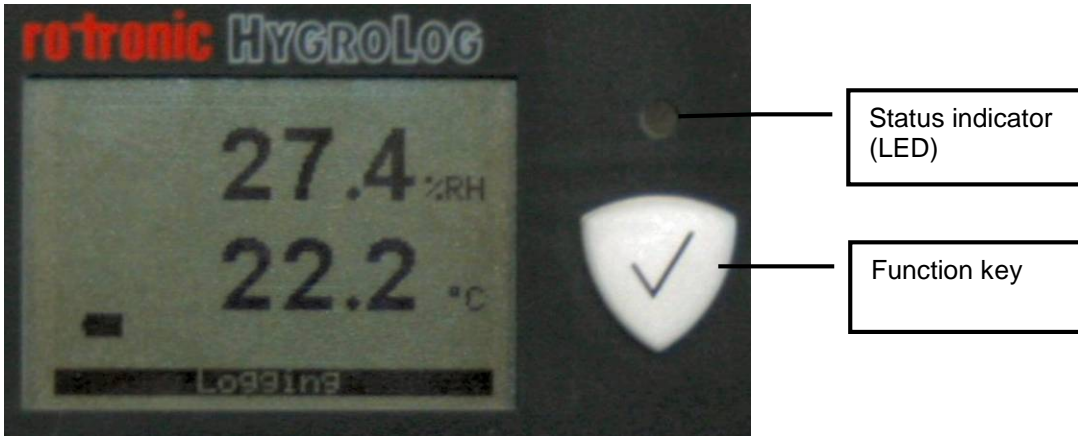
Log file format (data download to a PC with HW4):

The recorded data can be saved as a file to a PC using either HW4 or another communications software. When using HW4, the file can be either formatted as a text file (extension TXT) or as an encrypted binary file (extension LOG). The LOG file format can only be read with HW4 and complies with the FDA / GAMP rules regarding electronic records and electronic signatures.

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3. Operation

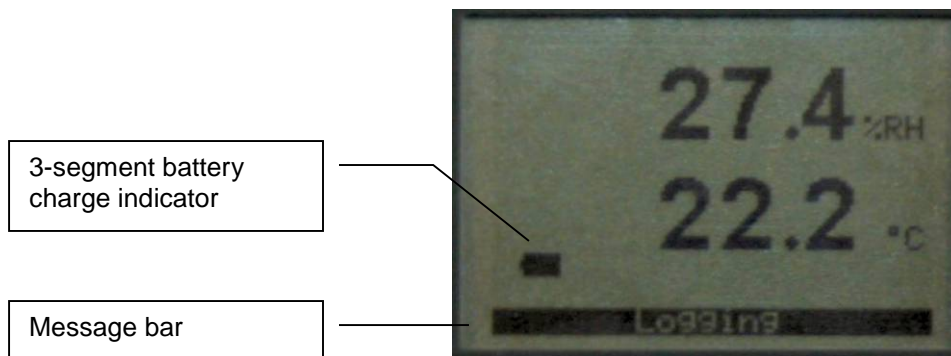
3.1 Front panel with optional display



The LC display has a backlight which can be enabled or disabled as part of the data logger configuration. When the backlight is enabled, it turns on for a few seconds after pressing on the function key.

The upper line corresponds to relative humidity or dew / frost point and the bottom line corresponds to temperature. In the event of an alarm (out-of-limit value) the display shows the symbol [!] to the right of the value and the LED indicator flashes red.

In addition to the measured values, the display also provides information such as battery charge and data logger status.



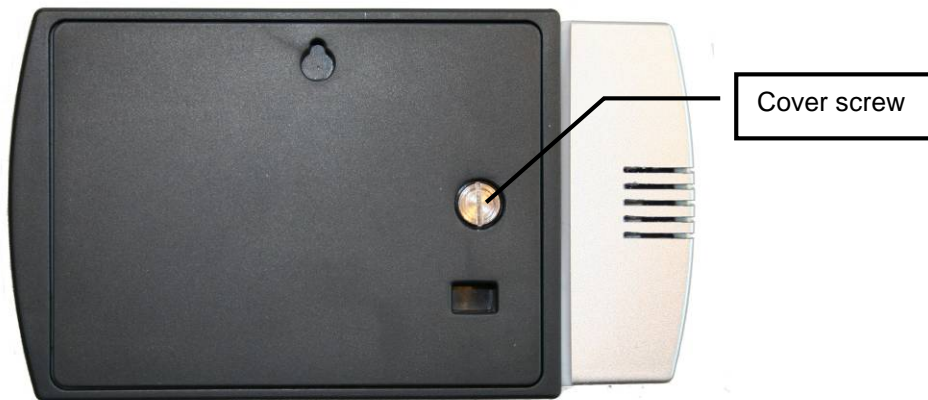
For configuration instructions see the following HW4 manual: **E-M-HW4v3-F2-018**.

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3.2 Initial start-up

3.2.1 Battery compartment

The battery compartment is located on the back panel and can be opened after loosening the screw that holds the cover in place



Insert three fresh AA alkaline batteries in the battery compartment. Be sure to observe the polarity.

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3.2.2 Initial configuration (all models)

Required Hardware and software

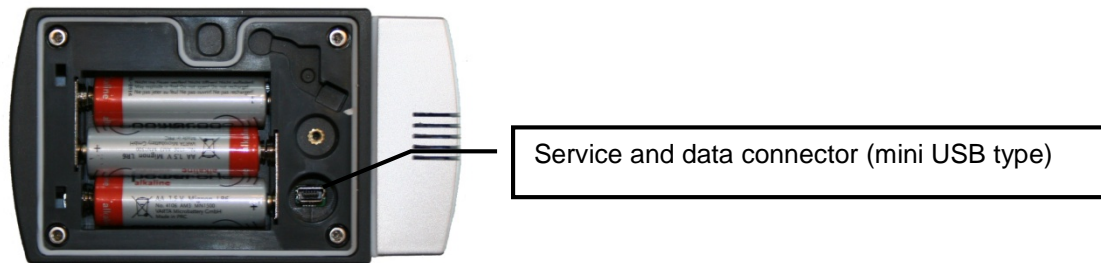
- PC with the ROTRONIC HW4 software installed (version 2.4.0 or higher)
- Cable AC3006 or equivalent (connects the data logger service / data connector to a PC USB port)

IMPORTANT:

After installing the HW4 software and prior to running HW4, connect cable AC3006 to a USB port of the PC. The PC will detect the cable and ask for the appropriate driver. The ROTRONIC USB driver (ftdibus.inf) is located in a folder named USB_Driver which is in the HW4 installation folder. For detailed instructions see documents **E-M-HW4v3-Main** (§ 7.3: USB port) and **E-M-HW4v3-F2-018**

Setting the Real Time Clock (required configuration step)

The real time clock of the data logger should be set to agree with the date and time of the HW4 PC.



Use cable AC3006 to connect the data logger to a USB port of the HW4 PC. Start HW4 and discover the data logger by selecting with the mouse the following command in the menu bar: Devices and Groups > Search for Master Devices > USB Masters.

When the Data logger icon appears, left click with the mouse on the (–) sign located to the left of the icon. This displays the functional modules available for the data logger. Click on the Device Manager module. For additional instructions, see document **E-M-HW4v3-F2-018**.

Other initial configuration steps

Other initial configuration steps include the following:

- Temperature measurement unit
- Log interval
- Recording mode (start-stop or loop)

For additional instructions, see document **E-M-HW4v3-F2-018**.

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3.2.3 Optional display configuration

To conserve battery power, models with a display are shipped with the Display Sleep function enabled (set to 1 minute) and with the display backlight disabled. When configured in this manner the data logger can record data for extended periods of time

For additional instructions regarding the configuration of the display, see document **E-M-HW4v3-F2-018**.

3.3 Recording and displaying data (models without display)



To start or stop recording data, press on the function key for a few seconds. When the data logger is recording data, the status indicator flashes green every 5 seconds

The ROTRONIC HW4 software is required to view the measured or calculated data on a PC monitor. Connect the data logger to the HW4 PC as explained under "Initial Start-up". HW4 is also required to download and save the recorded data to disk. For additional instructions, see document **E-M-HW4v3-F2-018**.

3.4 Displaying and recording data (models with display)

Displaying data

When the display sleep function is enabled, the display goes blank after some time in order to conserve battery power.



To view the measured or calculated data, press briefly on the function key. When the display sleep function is not enabled, the display can be manually turned off by pressing briefly on the function key.

Start or stop recording data



To start or stop recording data, press on this key for a few seconds. When the data logger is recording data, this is indicated by the display message bar and by the LED indicator flashes green every 5 seconds

The ROTRONIC HW4 software is required to view the measured or calculated data on a PC monitor. Connect the data logger to the HW4 PC as explained under "Initial Start-up". HW4 is also required to download and save the recorded data to disk. For additional instructions, see document **E-M-HW4v3-F2-018**.

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3.5 Practical advice for measuring temperature and humidity

The most common source of error when measuring relative humidity is a difference between the temperature of the probe and the temperature of the environment. At a humidity condition of 50 %RH, a temperature difference of 1°C (1.8 °F) typically results in an error of 3 %RH on relative humidity.

When using the data logger, it is good practice to allow for sufficient for temperature equilibration with the environment. The larger the initial temperature difference between the probe and the environment to be measured, the more time temperature equilibration requires. This can be monitored with the optional display.

In extreme situations, condensation may occur on the sensors when the data logger is colder than the environment. As long as the humidity / temperature limits of the humidity sensor are not exceeded, condensation does not alter the calibration of the sensor. However, the sensor has to dry out before it can provide a valid measurement.

Non-moving air is an excellent insulator. When there is no air movement, surprising differences in temperature and humidity can noted over short distances. Air movement at the probe generally results in measurements that are both faster and more accurate.

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4. Maintenance

4.1 Periodic calibration check

Both the Pt 100 RTD temperature sensor and associated electronics are very stable and should not require any calibration after the initial factory adjustment.

Long term stability of the ROTRONIC Hygromer humidity sensor is typically better than 1 %RH per year. For maximum accuracy, calibration of the HL20 should be verified every 6 to 12 months. Applications where the data logger is exposed to significant pollution may require more frequent verifications.

Note:

Calibrating and adjusting the data logger typically require a humidity-temperature generator or other specialized equipment that may not be available to all users.

Procedure for adjusting the data logger with the ROTRONIC HW4 software:

- Use cable AC3006 to connect the service connector of the data logger to the USB port of a PC with the ROTRONIC HW4 software installed. Note that the ROTRONIC USB driver must be installed on the PC as explained in the HW4 manual **E-M-HW4v3-Main**
- Start HW4 on the PC and search for the data logger (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the data logger with HW4, expand the device tree to see the data logger functions. Select **Probe Adjustment**.
- For further instructions see HW4 manual **E-M-HW4v3-A2-001**

4.2 Firmware updates

Firmware updates will be available on the ROTRONIC website for downloading. Firmware files are given a name that shows both to which device the file applies and the version number of the firmware. All firmware files have the extension HEX. Procedure for updating the firmware:

- Use cable AC3006 to connect the service connector of the data logger to the USB port of a PC with the ROTRONIC HW4 software installed. Note that the ROTRONIC USB driver must be installed on the PC as explained in the HW4 manual **E-M-HW4v3-Main**
- Copy the firmware update file from the ROTRONIC website to the PC.
- Start HW4 software on the PC and search for the data logger (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the data logger, expand the device tree to see the data logger functions. Select Device Manager. In the Device Manager menu bar select Tools > Firmware Update. For instructions see document **E-M-HW4v3-F2-018**

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5. Technical data

5.1 Specifications

| General | HL20 / HL21 |
|------------------------|--|
| Device type | Humidity-temperature data logger with internal sensor(s) |
| Battery type | 3 x AA (1.5 V) alkaline |
| Battery life time | Depends on log interval and other settings. Examples based on a 30 minutes log interval: <ul style="list-style-type: none"> - Models w/o LC display: 20 months - Models with LC display, display sleep function set to 1 minute: 13 months |
| Low battery indication | Yes (with HW4 software or with optional display) |

| Humidity measurement | HL20 |
|-------------------------------|--|
| Sensor | ROTRONIC Hygromer® IN1 |
| Measuring range | 0...100 %RH |
| Measurement accuracy at 23 °C | ±1.3 %RH @ 0...10 %RH ±0.8 %RH @ 10...60 %RH ±1.3 %RH @ 60...100 %RH |
| Repeatability | 0.3 %RH |
| Long term stability | < 1 %RH / year |
| Response time | Typical 3 min. (depends on air flow) |

| Temperature measurement | HL20 / HL21 |
|-------------------------------|---------------------------------------|
| Sensor | Pt100 RTD, IEC 751 class A |
| Measuring range | -10...60°C |
| Measurement accuracy at 23 °C | ±0.3 °C |
| Repeatability | 0.05°C |
| Long term stability | < 0.1°C / year |
| Response time | Typical 10 min. (depends on air flow) |

| Calculated parameters | HL20 |
|----------------------------|--|
| Psychrometric calculations | Dew or frost point (user configurable setting) |

| Start-up time and data refresh rate | HL20 / HL21 |
|-------------------------------------|----------------|
| Start-up time | 1.9s (typical) |
| Data refresh rate | 1.7s (typical) |

| Data recording and download | HL20 / HL21 |
|-----------------------------|---|
| Recorded parameter(s) | HL20: relative humidity and temperature, HL21: temperature |
| Recording media | Internal EEPROM non volatile, not removable |
| Recording capacity | HL20: 20,000 value pairs, HL21: 20,000 values |
| Real time clock | Integrated, accuracy 2 s/year |
| Logging modes | Start-stop (recording stops when memory is full Loop: oldest data is dumped to make room for latest data |
| Log interval | Min. 5 sec, up to 1 hour in 5 sec. increments |
| Interface for data download | Internal connector, located under protective cover |

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|-----------------------------------|--|
| Service and data connector | HL20 / HL21 |
| Interface type | UART (Universal Asynchronous Receiver Transmitter) |
| Maximum service cable length | 5 m (16.4 ft) |

| | |
|-------------------------------|---|
| General specifications | HL20 / HL21 |
| Optional display | LC, 1 or 2 decimals resolution, backlight, alarm and low battery indication |
| LED indicator | 5 sec. green flash when recording data 5 sec. red flash for out-of-limit value or logger problem |
| Housing material | ABS |
| Housing protection grade | HL20: IP 40, HL21: IP65 |
| Overall dimensions | 130 x 72 x 32 mm (5.1 x 2.8 x 1.3") |
| Weight | About 210 g (7.4 oz) |

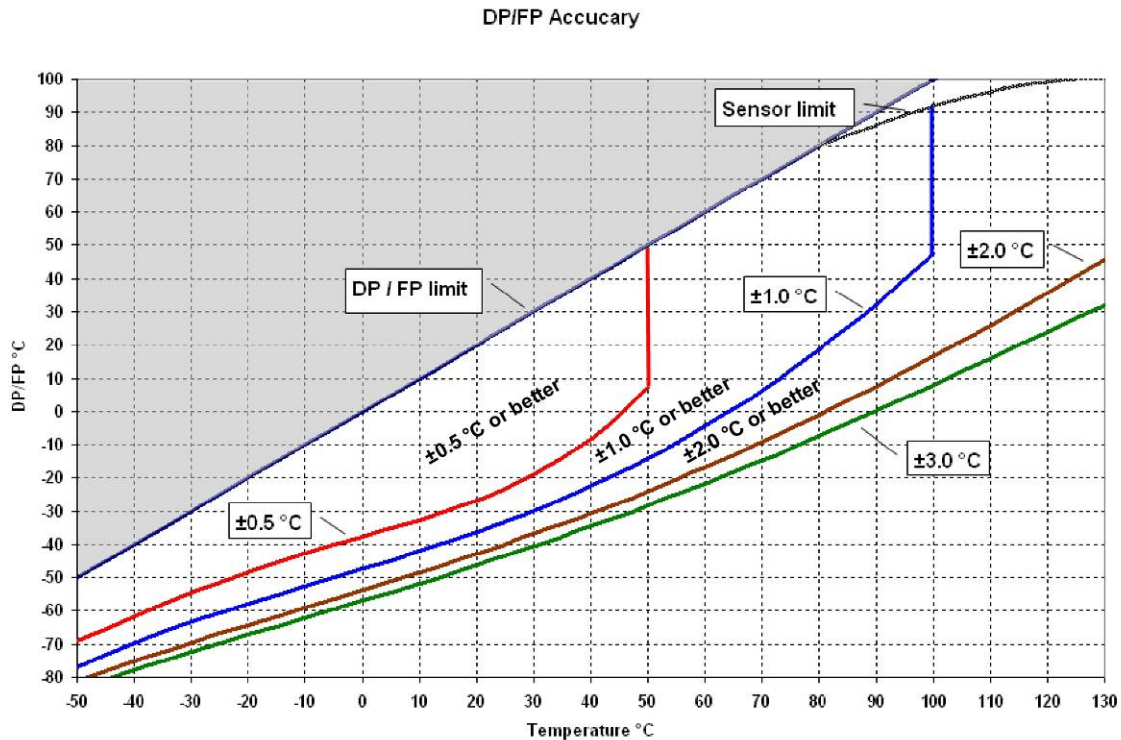
| | |
|----------------------------------|---|
| Conformity with standards | HL20 / HL21 |
| CE / EMC immunity | EMC Directive 2004/108/EG: EN 61000-6-1: 2007, EN 61000-6-2: 2005 EN 61000-6-3: 2007, EN 61000-6-4: 2007 |
| Solder type | Lead free (RoHS directive) |
| FDA / GAMP directives | compatible |

| | |
|-----------------------------|--|
| Environmental limits | HL20 / HL21 |
| Operating limits | -10...60 °C (models w/o display), 0...50 °C (models with display) 0...100 %RH, non condensing |
| Critical environments | Humidity sensor: as per DV04-14.0803.02 - Critical chemicals |

| | |
|--|--|
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5.2 Dew point accuracy

The HL20 can be configured to calculate either the dew point or frost point based on the measurement of relative humidity and temperature. The accuracy of this conversion varies, depending on the humidity and temperature conditions as shown in the graph below:



Example: at a temperature of 20 °C, a dew point value of -37 °C is measured with an accuracy of ± 1.0 °C or better.

| | |
|---|---|
| IN-E-HL20-V1_16 <small>Document code</small> | Rotronic AG Bassersdorf, Switzerland <small>Unit</small> |
| HygroLog HL20 and HL21 data logger: User Guide <small>Document title</small> | <div style="text-align: right;"> Instruction Manual <small>Document Type</small> </div> <hr/> <div style="text-align: center;"> Page 21 of 23 </div> |

6. Accessories

For accessories and parts such as the HW4 configuration software, service cables, calibration accessories and spare dust filters, please see document **E-M-HC2-accessories**.

| | |
|---|---|
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7. Supporting documents

| Document File Name | Contents |
|----------------------------|---|
| E-M-HC2-accessories | Accessories and parts for probes, indicators and transmitters |
| E-M-HW4v3-DIR | List of the HW4 manuals |
| E-M-HW4v3-Main | HW4 software version 3: General instructions and functions common to all devices |
| E-M-HW4v3-F2-018 | HW4 software version 3: Device Manager and Data Logging – HL20 / HL21 data logger |
| E-M-HW4v3-A2-001 | HW4 software version 3: Probe Adjustment function AirChip 3000 devices |
| E-M-AC3000-CP | AirChip 3000 Communication Protocol |
| E-M-CalBasics | Temperature and humidity calibration basics Instructions for using the ROTRONIC humidity standards |
| E-T-HumiDefs | Humidity Definitions |

Note:

All document file names have an extension corresponding to the document release number. This extension is not shown in the above table.

| | |
|---|---|
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8. Document releases

| Doc. Release | Date | Notes |
|--------------|----------------|---|
| _10 | Mar. 5, 2010 | Original release |
| _11 | Jun. 20, 2010 | Updated document to HW4 software v.3 |
| _12 | Mar. 9, 2011 | Corrected typing error in document |
| _13 | Feb. 10, 2015 | Corrected accuracy, Pt100 specification |
| _14 | April 16, 2015 | General rework, related documents adapted |
| _15 | April 23, 2015 | Accuracy of RTC specified |
| _16 | June 24, 2015 | Accuracy updated |