HygroPalm HP23 Hand-Held Indicator
User Guide

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Applicability:

This manual is valid for the HP23 with firmware version 1.x, where 1.x can be 1.0, 1.1 etc. Changes to the last digit of the version number reflect minor firmware changes that do not affect the manner in which the instrument should be operated.

1 Overview

The HP23 is a multifunction hand-held indicator with data logging capability. The HP23 can be used in many different applications such as the spot check measurement of HVAC installations and manufacturing processes, the measurement of seeds, pharmaceutical powders and other materials in bulk, the measurement of paper stacks and rolls, etc. The HP23 is also a calibrator that can be used to read and adjust other instruments from ROTRONIC that are based on the AirChip 3000 technology.

Each of the two probe inputs can be configured to accept either a digital HygroClip 2 humidity-temperature probes (factory default) or an analog probe measuring any signal such as barometric pressure, air velocity, etc (user configuration). The HP23 has a real time clock to keep track of the date and time when recording data and is powered with either a standard 9 V alkaline battery or with a rechargeable battery.

The HP23 features two distinct operating modes:

► **Standard Mode**: in this mode the HP23 can be used as a general purpose indicator, as a data logger or as a calibrator for verifying and adjusting other instruments from ROTRONIC. The standard mode offers the following functionality (availability of some of the functions depends on the HP23 model):

- **Display of Measured and Calculated Values**
  - Relative humidity and temperature data measured by up to two HygroClip 2 digital probes
  - Calculated humidity parameter such as dew / frost point or other, for up to two HygroClip 2 probes
  - Difference between the values measured by two probes (the probes must be of the same type: digital or analog)
  - Any parameter measured by up to two analog probes (user defined)
- **Manual Data Capture**
  - To facilitate the spot checking of humidity and temperature conditions, the HP23 features eight data bins (non-volatile memory) each capable of retaining up to 250 humidity temperature values measured by a HygroClip 2 probe (analog probe data is not recorded). Each record is stamped for date and time. The data bins can be given a user defined name.
  - Probe selection, bin selection, data capture and data viewing are done from the keypad.
- **Data Logging**
  - The HP23 can automatically record up to 10,000 humidity-temperature values measured by a single HygroClip 2 probe or up to 20,000 values measured by a single 1-channel analog probe. Each record is stamped for date and time. The calculated parameter (HygroClip 2 probe only) cannot be recorded. When recording data from two probes at the same time, the recording capacity per probe is cut in half.
  - The HP23 features two data logging mode: start-stop (recording ends when the memory is full) and loop (when the memory is full, the oldest record is dumped to make room for a new record)
  - Except for the log file format, all log settings can be selected from the keypad. Data logging can be started and stopped from the keypad
  - The HW4 software is required to download and view the recorded data

- **Calibrator function:**

  Using cable AC2001, any probe input of the HP23 that is configured to accept a digital probe can be connected to the service connector (or UART interface) of the HF3, HF4, HF6 and HF7 transmitters, the HP21 indicator and any similar AirChip 3000 product that has a non removable probe or sensors.

  NOTE: The HP23 is not compatible with the HF5 and HF8 transmitters, the MP102H and MP402H meteorological probes and in general with any product that is designed for use with any of the HygroClip 2 plug-in probes.

  When the HP23 is connected to a compatible device, the following can be done:

  - Display the measurement data from the device on the HP23.
  - 1-point humidity and/or temperature adjustment of the device connected to one of the HP23 probe inputs against the HygroClip 2 probe connected to second probe input of the HP23 (reference probe).
  - 1-point or multi-point humidity adjustment as well as a 1-point or 2-point temperature adjustment: against a known reference environment.

► **Aw Mode**: this specialized mode is available only with model HP23-AW and is meant to be used exclusively with the HygroClip 2 digital probes and is used for measuring the water activity (Aw) of product samples and materials in bulk such as powders, seeds, etc. When set to operate in the water activity mode, the HP23 automatically displays humidity as Aw (1.000 a_w = 100 %RH). When measuring water activity, the HP23 offers the following options:

- **Accelerated water activity measurement (AwQuick):** permits measuring the water activity of most products in typically 5 minutes. The measurement starts simultaneously for both probe inputs and is ended automatically.

- **Conventional water activity measurement (AwE):** the measurement starts simultaneously for both probe inputs. The HP23 automatically detects full equilibrium conditions and ends the measurement at that time.

Data logging and probe adjustment are available in the water activity mode, but when using these functions humidity is shown as %RH as opposed to a_w. The other standard mode functions are not available.

The HP23 is available with a wide assortment of HygroClip 2 humidity-temperature probes to meet almost any requirement. The HygroClip 2 probes feature well proven, durable sensors. Digital signal processing ensures consistent product performance and also facilitates the task of field maintenance with features such as potentiometer free – digital calibration.

Depending on the probe model, the HP23 can measure conditions within the range of 0 to 100 %RH and -100 to 200°C (-148 to 392°F). The temperature operating range of the HP23 electronics is limited to -10…60°C.

The ability for the user to easily update both the HP23 and HygroClip 2 probe firmware means that the indicator and probes can be kept up-to-date regarding any future functionality improvement.

2 General description

2.1 Configuration software

Most of the HP23 settings can be configured directly from the keypad. Configuring some of the settings and accessing some of the functions requires connecting the HP23 to the USB port of a PC running the HW4 software. For instructions see the following HW4 manual: **E-M-HW4v2-F2-012**

2.2 Power supply

The HP23 uses either a standard 9V alkaline battery (factory default) or a 9V rechargeable Ni-MH battery (user configuration).

The rechargeable battery is charged either by connecting the service connector to a USB port or by plugging a battery charger (part number AC1212) to the service connector. The typical charge current is 17 mA.

Important: the HP23 is shipped with a regular 9V battery and is factory preset with the battery charge function turned off. If you plan on using a rechargeable battery, you should turn on the battery charge function (see Function Menu – Settings). Before using a regular battery again, be sure to turn off the battery charge function. Trying to charge a regular battery may cause the battery to burst and may damage the instrument.

With the default display refresh rate is 1 second the probes are permanently powered. To conserve battery power, the display refresh rate can be set from the HP23 keypad to one of the following: 10 sec, 1 min or 10 min. (MENU > Device Settings > DataUpdate). The autonomy of the HP23 with a fully charged battery depends on factors such as the display backlight, the number of probes, the display refresh rate, the functions being used, etc. As an indication, the typical current consumption is as follows: 6.5mA with 1 probe and 20mA with 1 probe + backlight.

WARNING: the display refresh rate setting can affect the data logging function of both the HP23 and probe

2.3 Probe inputs

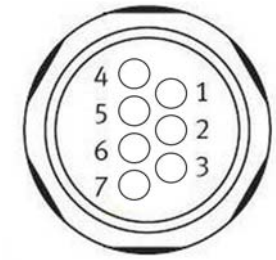
The HP23 has two probe inputs. Using the HW4 software (Device Manager), each probe input can be configured to accept one of the following:

- HygroClip 2 humidity-temperature digital probe. Any input configured to accept a HygroClip 2 digital probe can also be used to read and adjust an instrument or device that is based on the AirChip 3000 technology (use service cable AC2001).

- 1-channel analog probe (general): To be compatible with the HP23 the analog probe must meet the following requirements: supply voltage: max. 5 VDC, current consumption: max. 10 mA, output signal: 0 to max. 3.3 VDC. The HP23 uses a 12-bit A/D converter to digitize the probe analog signal and can be configured to measure practically any parameter.

- Analog pressure probe: this is a special case of analog probe and is subject to the same compatibility requirements. When analog pressure probe is selected, the HP23 automatically uses the signal from the probe to calculate any humidity parameter that requires barometric pressure as an input value (example: mixing ratio).

Pin-Out Diagram



1: RXD (UART- digital probe)
2: GND (digital and power)
3: V+: digital pbe: 3.3 VDC nominal, analog pbe: maximum 5.0 VDC, 10 mA
4: AGND (analog ground)
5: Not used
6: 1-channel analog probe signal : + 0.0 to 3.3 VDC
7: TXD (UART – digital probe)

2.4 Measured parameters

Depending on the configuration of the probe inputs, the HP23 can measure the following:

- HygroClip 2 probe: humidity and temperature. The HC2 probes measure relative humidity with a ROTRONIC Hygromer® IN1 capacitive sensor and temperature with a Pt100 RTD.
- Analog probe (general): any parameter measured by the probe. The parameter unit must be specified with the HW4 software (Device Manager).
- Analog pressure probe: the unit used for barometric pressure is set with the HW4 software > Device Manager > Unit System.

2.5 Calculated parameters

When a probe input is configured to accept a HygroClip 2 digital probe, the HP23 can calculate any of the following parameters based on the humidity and temperature values measured by the probe (to select the calculated parameter, use either the keypad or the HW4 software > Device Manager):

- Dew point (Dp) above and below freezing
- Frost point (Fp) below freezing and dew point above freezing
- Wet bulb temperature (Tw)
- Enthalpy (H)
- Vapor concentration (Dv)
- Specific humidity (Q)
- Mixing ratio by weight (R)
- Vapor concentration at saturation (Dvs)
- Vapor partial pressure (E)
- Vapor saturation pressure (Ew)

Note: calculating some of the above parameters requires barometric pressure as an input parameter. When no pressure probe is connected to the HP23, a fixed barometric pressure value can be specified using either the keypad or the ROTRONIC HW4 software.

2.6 Alarm Indication on the display

Depending on the type of alarm, the display shows either a symbol or a text when the HP23 detects an alarm condition:

- Out-of-limits value (defined with the HW4 software for each probe input, includes measured values and calculated parameter).
- No communication with the probe.
- Display of fixed values when no probe is connected the input. Easily identified humidity and temperature values can be specified with the HW4 software for each probe input.
- Bad RH sensor or major sensor failure (open or shorted sensor – humidity and temperature)
- Low battery charge

2.7 Real time clock

The HP23 clock keeps track of the date and time and can be adjusted from the keypad. Using the HW4 software, the clock can be synchronized with the PC date and time. The clock does not automatically adjust for daylight saving time (DST).

2.8 Service connector

The service connector of the HP23 is a USB port. Any standard cable equipped with a mini-USB type connector at one end can be used to connect the HP23 to a PC running the ROTRONIC HW4 software. See “Maintenance” for the location of the service connector. The service connector is used for the following:

- Configuration of the HP23
- Downloading data recorded on the HP23
- Access to the HygroClip 2 probe functions
- Firmware updates

3 User configurable settings and functions

The HP23 can be used just as any conventional humidity and temperature indicator. Making use of the HP23 configurable settings and functions is entirely up to the user and the appropriate settings depend on the user application. We have provided below a short description of the HP23 functions and also indicated the factory default settings.

3.1 Factory default settings

Notes:

- Configuration of the HP23 and probe by the user and access to its functions requires a PC with the ROTRONIC HW4 software (version 2.3.0 or higher) installed. A standard USB cable with a mini-USB connector at one end is used to connect the HP23 service connector to a USB port of the PC.

- Settings and functions that can also be accessed from the keypad are marked with the letter **K** (see also Operation > Internal Menu).

HP23 Configurable Settings		Factory default
Device write protection		Disabled
RS-485 address		0
Device name		Instrument model
Fixed barometric pressure value	K	1013.25 hPa (29.92 In Hg or 14.70 PSI)
Display refresh rate	K	1 sec.
Battery type / Battery charge	K	Standard (non rechargeable)
Date and time	K	Time zone dependent
Unit system (Metric or English)	K	Metric, except USA: English
Date and time format, date separator	K	European format (except North America)
Input configuration		HygroClip 2 digital probe
Input name		Probe 1 or Probe 2
Psychrometric calculation for the input	K	No calculation
Display backlight	K	On Key Press
Displayed parameters / display mode	K	%RH and temperature + date and time
Display resolution	K	1 decimal
Trend indicator (display)	K	Enabled
Menu access from keypad		Enabled
Delta Probe (difference Pbe1 – Pbe 2)	K	Disabled
Humidity / temperature calibration	K	Enabled
Humidity / temperature adjustment	K	Enabled
Manual data capture	K	Enabled
Data Logging	K	Disabled
Aw Mode (water activity measurement)	K	Disabled
Device write protection		Disabled
Menu access from keypad		Enabled
Out-of-limit values alarm		Disabled
Monitor sensor alarms		Enabled (this function cannot be disabled)

HP23 Configurable Settings		Factory default
Loss of communication with probe alarm		Disabled
Simulator mode (fixed values)		Disabled

For a detailed description of all HygroClip 2 probe (AirChip 3000) functions see document
E-T-AC3000-DF-V1

Instructions regarding the configuration of the HP23 and probes as well as access to the functions are provided in the following manuals:

E-M-HW4v2-F2-012
E-M-HW4v2-F2-001
E-M-HW4v2-Main (§ 6.5)
E-M-HW4v2-DR-001
E-M-HW4v2-A2-001
E-M-AC3000-CP

3.2 Interaction between the HP23 and HygroClip 2 probe functions

It is important to note that when used together, the HP23 indicator and HC2 probe (HygroClip 2) constitute a 2-component system. Each system component has its own microprocessor, firmware and functions. Some of these functions are unique to each system component. Other functions are found in both components.

The functions and settings of the HP23 indicator and HygroClip 2 probe (HC2) operate together as indicated below:

Function / Setting	HP23	HC2	Notes
Device protection	X	X	Individual to the HP23 and HC2 probe
RS-485 address	X	X	Individual to the HP23 and HC2 probe
Device Name	X	X	User defined description The device name of the HC2 probe is not displayed by HW4 and is replaced with the HP23 Input Name
Calculation	X	X	Psychrometric calculation HP23 setting overrides HC2 probe setting
Data refresh rate	X		Refresh interval for the LC display. When set above 1 s, this setting causes the HC2 probe not to be powered in between display refreshes so as to conserve battery power. Note: when the HP23 is recording data, the probe is powered as required by the log interval, regardless of the display refresh interval.
Simulator function	X	X	Generates fixed humidity and / or temperature value When enabled, the HP23 settings override the HC2 probe settings
Unit system	X	X	The HP23 setting overrides HC2 probe setting. The HC2 probe settings still apply when the probe is used alone Make sure to use the same humidity symbol and the same temperature unit for both the HP23 and probe.

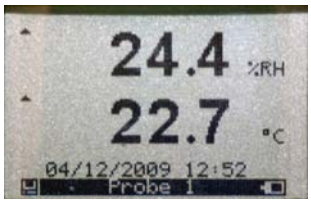
Function / Setting	HP23	HC2	Notes
Out-of-limits value alarm	X	X	The HP23 settings are independent from the HC2 probe settings. The HC2 probe settings have no effect on the HP23 and out-of-limits values defined at the probe level do not generate a HP23 alarm.
RH sensor test		X	The RH sensor is not tested when the refresh interval for the LC display is set above 1 sec.
Analog outputs		X	Parameter and scale The HC2 probe settings have no effect on the HP23

4 Basic operation

4.1 Display and display modes

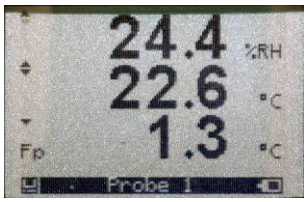
The LC display has a backlight which can be set to be on all the time or whenever a key is pressed. The backlight can also be disabled.

Using the HP23 Menu > Device Settings > Display Settings, the display mode can be changed as shown below:



Standard:

- **%RH**
- **Temperature**
- **Date and time**



3-line display:

- **%RH**
- **Temperature**
- **Calculated parameter**
- **No date and time**

Large:

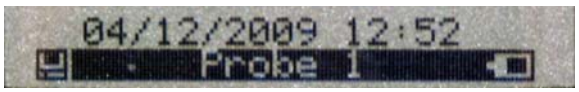
Both the parameter and probe can be changed with the UP arrow key or the DOWN arrow key

The display can also be configured to show a trend indicator on each line:

▲: increasing value
▼: decreasing value

In the event of an alarm the symbol **[!]** appears to the right of the value.

The bottom of the display shows the date and time as well as which probe is currently selected:

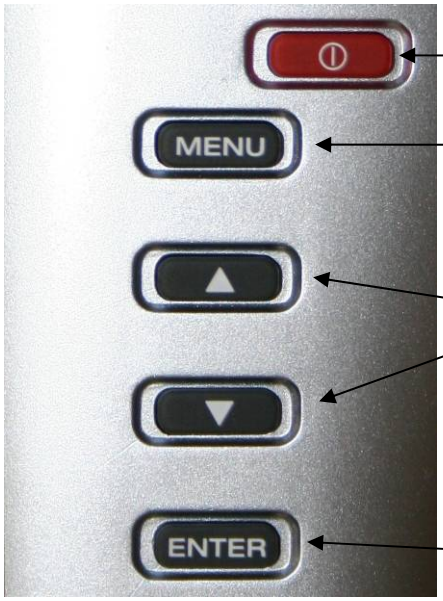


The battery charge is shown with a 7-bar icon.
A diskette icon appears when the probe data is being logged.

The humidity and temperature from probe 1 are being recorded

Battery charge indicator

4.2 Keypad



ON/OFF: Turns the instrument on or off. (Press briefly on this key)

MENU: Activates the internal menu. Press this key again to go back to the previous sub-menu or to exit the menu

UP / DOWN:

- Changes either the probe or the parameter being displayed (including the delta probe)
- Changes the data-bin used to capture data
- When the menu is active, use to navigate the menu, make a selection or change a value

ENTER:

- When the menu is active, use to confirm the selection of a menu item, effect a change of settings and confirm any change
- In the HP23 Standard Mode, use to capture the current %RH and temperature data to one of 8 data bins
- In the HP23 AW Mode, use to start, hold or stop the water activity measurement function

4.3 Internal menu

Note: Unauthorized access to the menu can be prevented by disabling "display menu"
(use the HW4 software > Device Manager > Display)

Main Menu	Menu Items	Submenu Items	Selections or Information	Notes
Device Info	Serial Nbr		Serial number	
	Version		Firmware version	
	Type		Device type	
	Name		Device name	User defined
	Battery		Battery charge status	
Device Settings	Display Settings	Trend	ON / OFF	Trend indication on the display
		Decimals	1 or 2	Display resolution
		Contrast		LC display contrast adjustment
		Back Light	Key Press/ON/OFF	Display backlight mode
		Mode	Standard H+T+Calc Large	See Display
		Delta Pbe	ON / OFF	For each parameter, displays the difference between probe 1 and probe 2
	Local Settings	Date Fmt	dd mm yyyy mm dd yyyy yyyy mm dd	Date format
		Separator	. or /	Date separator
		Time Fmt	24h / 12 h	Time format
		Unit Sys	Metric / English	Unit system
	Input 1	Pbe Type	HygroClip Analog Pressure	Probe type
		Calc	Calculation	HygroClip probe only
		U min (mV)		Analog probe voltage output range
		U max (mV)		Analog probe voltage output range
		Range Min		Analog probe measuring range
		Range Max		Analog probe measuring range
	Input 2	*See Input 1*	*See Input 1*	

Main Menu	Menu Items	Submenu Items	Selections or Information	Notes
	Pressure			Fixed barometric pressure value used as an input for some psychrometric calculations
	DataUpdate		1s/10s/1min/10 min	Display refresh interval
	BattCharge		ON / OFF	Enable or disable battery charge function
	Date			Manual date setting
	Time			Manual time setting
Probe 1 (applies to HygroClip 2 probe only)	Info	Serial Nbr		
		Version	Firmware version	
		Name		User defined (HW4)
	Humi Adjust	Acquired Points	Lists the cal. points present in the probe memory (a max. of 10 points are shown)	Additional Options: o Clear all cal. points o Clear the last point
		Acquire Ref		Saves value measured by probe 2 as a cal. point
		Acquire	Manual entry: known reference environment	Saves value entered manually as a cal. point
		Adjust	Adjusts the probe	Effect depends on number of calibration points in probe memory
		Reset to Factory		Returns the probe to the initial factory adjustment
	Temp Adjust	Acquired Points	Lists the cal. points present in the probe memory (a max. of 2 points are shown)	Additional Options: o Clear all cal. points o Clear the last point
		Acquire Ref		Saves value measured by probe 2 as a cal. point
		Acquire	Manual entry: known reference environment	Saves value entered manually as a cal. point
		Adjust	Adjusts the probe	Effect depends on number of calibration points in probe memory
		Reset to Factory		Returns the probe to the original factory adjustment
Probe 2 (applies to HygroClip 2 probe only)	*See Probe 1*	*See Probe 1*	*See Probe 1*	

Main Menu	Menu Items	Submenu Items	Selections or Information	Notes
Data Capture				o Displays the names of the 8 data bins o Press on ENTER to select the highlighted data bin
	View Data			o Shows the individual data records o Use the up and down keys to navigate the records
	Summary			Shows the minimum, maximum and average values for the data bin
	Clear Data			Clears the data bin
Data Logging				o Recording (ON / OFF) o Nbr of records o Log Interval o Mode: Start Stop / Loop
	Start Recording Stop Recording		o Recording o Samples o Interval o Mode	Data logging by the HP23 (max. 10,000 H+T records per probe)
	Settings *Cannot be changed while the HP23 is recording data*	Interval		Log interval: 5 sec to 1 h
		Mode	StartStop / Loop	Start Stop: the recording stops when the memory is full Loop: when the memory is full the oldest record is dumped to make room for the new record
		Probe 1	ON / OFF	
		Probe 2	ON / OFF	
Aw Mode	Enable	ON / OFF		Enable = ON changes the display as follows: o Humidity unit changes to a_w o No calculated parameter o Large display mode is disabled
	Mode	AwQuick / AwE		o AwQuick: accelerated water activity measurement o AwE: conventional water activity measurement

Main Menu	Menu Items	Submenu Items	Selections or Information	Notes
	Dwell Time		minutes	Dwell time (AwQuick)
	AwQ Temp		°C / minute	Temperature stability definition (AwQuick)
	AwE Temp		°C / minute	Temperature stability definition (AwE)
	AwE Humi		a_w / minute	Humidity stability definition (AwE)

NOTE: use the MENU key to go back one step from any sub-menu or to exit the entire menu (this may require several key presses).

4.4 Frequently used settings

4.4.1 Unit system

Press the MENU key and select Device Settings > Local Settings > Unit Sys. Press ENTER to activate the Unit Sys menu item, use the UP or DOWN arrow key to change the unit system. Press ENTER to confirm and press MENU to exit.

The HW4 software can also be used to change the unit system.

4.4.2 Date and time

Press the MENU key and select Device Settings > Date or Time. Press ENTER to activate either the Date or the Time menu item, use the UP or DOWN arrow key to change the Date or the Time. After each change, the cursor moves to the right. When done, press ENTER to confirm and press MENU to exit.

To change either the date or the time format, Press the MENU key and select Device Settings > Local Settings > Date Fmt or Time Fmt. Press ENTER to activate either the Date Fmt or the Time Fmt menu item, use the UP or DOWN arrow key to change the Date or the Time format. When done, press ENTER to confirm and press MENU to exit.

The HW4 software can also be used to set the clock of the HP23 to the PC date and time.

4.4.3 Select the calculated parameter for a probe input

The calculated parameter is available only when the input is set for a digital HygroClip 2 probe. Press the MENU key and select Device Settings > Input 1 or Input 2 > Calc. Press ENTER to activate the Calc sub-menu, use the UP or DOWN arrow key to select the calculated parameter. Press ENTER to confirm and press MENU to exit.

4.4.4 Select which probe and/or parameters are shown on the display

Press the MENU key and select Device Settings > Display Settings > Mode. Press ENTER to activate the Mode menu item, use the UP or DOWN arrow key to select the display mode. Press ENTER to confirm and press MENU to exit.

Depending on the display mode, use the UP or DOWN arrow key to change the probe and/or parameter being displayed.

NOTE: The calculated parameter (HygroClip 2 probe only) is shown only if enabled for the probe input that is selected (MENU > Input 1 or Input 2 > Calc).

4.4.5 Set input 1 or 2 for a digital or analog probe

Press the MENU key and select Device Settings > Input 1 or Input 2 > Pbe Type. Press ENTER to activate the Pbe Type menu item, use the UP or DOWN arrow key to change the probe type. Press ENTER to confirm and press MENU to exit.

When using an analog probe, be sure to define both the voltage signal range and the measuring range of the probe. HW4 is required to define the unit of measurement of an analog probe.

The HW4 software can also be used to change the probe type for each input.

4.5 Practical advice for measuring 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 HP22 hand-held indicator, it is good practice to monitor the display for temperature stability. The probe should be given sufficient time to equilibrate with the environment to be measured. The larger the initial temperature difference between the probe and the environment to be measured, the more time temperature equilibration requires. This time can be shortened, and errors avoided, by using the probe configuration that fits best for your application.

In extreme situations, condensation may occur on the sensors when the probe 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.

5 Using the HP23 functions

5.1 Data capture

Manual data capture is available only in the HP23 standard operating mode. Data cannot be captured when the HP23 is in the AW mode.

Up to 250 relative humidity and temperature records can be manually captured to each of the 8 data-bins. The captured data is automatically date and time stamped. The calculated parameter cannot be captured. A descriptive name can be given to each data-bin with the HW4 software (laboratory, warehouse, etc.)

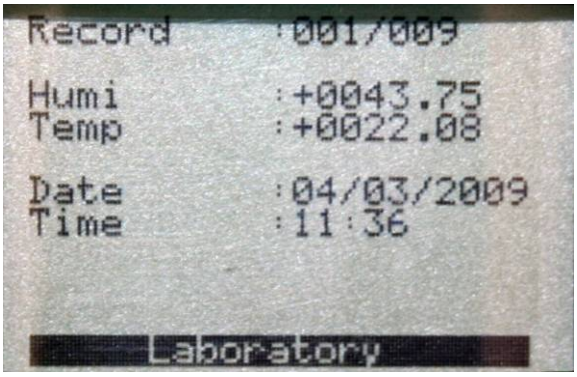
5.1.1 Capturing data

- Use the UP or DOWN arrow key to select the probe
- Select the data-bin with the UP or DOWN arrow key
- Press the ENTER key to activate the Data Capture function
- Data capture is confirmed on the HP23 display
- Wait a few seconds or press MENU to EXIT the Data Capture function

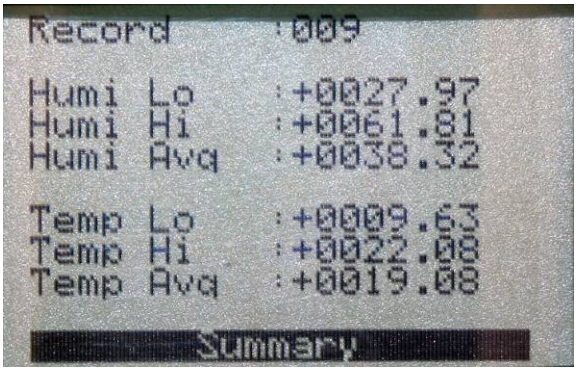
5.1.2 Viewing the captured data

Press the MENU key and select Data Capture. Press ENTER to activate the Data Capture menu item. Use the UP or DOWN arrow key to select the data-bin to be viewed. Press ENTER to confirm and open the data-bin sub-menu. Use the UP or DOWN arrow key to select a menu item and press ENTER to confirm:

- **View Data**: view individual data records



- **Summary**: view the maximum, minimum and average values



- **Clear Data**: erase the contents of the data-bin

Press MENU to exit.

5.2 Data logging

Data logging can be started or stopped both in the HP23 standard operating mode and in the AW mode.

The HP 23 can log up to 10,000 relative humidity and temperature values provided by a single HygroClip 2 probe or up to 20,000 data values provided by a single 1-channel analog probe. Both probe inputs can be logged at the same time and in that case the recording capacity per probe is cut in half. Each record is automatically date and time stamped. The calculated parameter cannot be recorded.

A descriptive name can be given to each data-bin with the HW4 software (laboratory, warehouse, etc.)

5.2.1 Logging data

Notes:

- The data logging settings apply to both probe inputs
- Data logging starts and ends simultaneously for both probe inputs
- The log data function settings cannot be changed as long as data logging is active

Configure the data logging function and start recording data:

- Press the MENU key and select “Data Logging”. Press ENTER to activate the Data Logging menu.
- Use the UP or DOWN arrow key to select Settings. Press ENTER to confirm and open the Settings sub-menu. Use the UP or DOWN arrow key to select a menu item and press ENTER to confirm:
- Select Interval (log interval). Press ENTER to activate the Interval menu item and use the UP or DOWN arrow key to change the log interval. Press ENTER after each change to confirm and move the cursor to the right. When done, press ENTER to confirm and exit.
- Use the UP or DOWN arrow key to select the Mode menu item. Press ENTER to activate the Mode menu item and use the UP or DOWN arrow key to change the logging mode:
  - Start-Stop. the recording will stop when the memory is full
  - Loop: when the memory is full the oldest record will be dumped to make room for the next record

  When done, press ENTER to confirm and exit.
- Use the UP or DOWN arrow key to select each probe to be logged. Press ENTER to activate the Probe 1 or Probe 2 menu item and use the UP or DOWN arrow key to enable data logging. Press ENTER to confirm and exit.
- Press the MENU key and to use the UP arrow key to select Start Recording
- Press the MENU key and use the UP arrow key to select Start Recording
- Press the ENTER key twice to start recording data
- The HP23 automatically exits the data logging function and a diskette symbol appears at the bottom left of the display for each probe being recorded

Stop recording data:

- Press the MENU key and select Data Logging. Press ENTER to activate the Data Logging menu item.
- Use the UP or DOWN arrow key to select Stop Recording. Press ENTER twice to confirm. The HP23 automatically exits the data logging function.

5.2.2 Viewing the recorded data

Data recorded with the HP23 data logging function can be viewed only after connecting the HP23 to a PC with the HW4 software running. For instructions see the following HW4 manual: **E-M-HW4v2-F2-012**.

5.3 Calibrator function

Any compatible (see Overview > Calibrator Function) ROTRONIC transmitter or device with a UART interface can be connected to any of the two probe inputs of the HP23. See document **E-M-HC2 Probes-V1**: AC2001 service cable. The HP23 does not differentiate between a probe and a transmitter that is connected to one of its inputs.

The HP23 can be used to do the following:

- Read measurement data from the transmitter / device on the HP23 display immediately after connecting the transmitter / device to the HP23
- Do a 1-point or multi-point calibration of the transmitter / device (humidity and / or temperature) against a reference HygroClip 2 probe connected to the other input of the HP23. The calibration points are retained in the transmitter / device memory.

- Do a 1-point or a multi-point calibration of the transmitter / device (humidity and / or temperature) against a known reference environment. The calibration points are retained in the transmitter / device memory.
- Adjust the transmitter / device using the temperature and / or humidity calibration points present in the transmitter / device memory.

The procedure for calibrating and adjusting a probe, a transmitter or any other device with the HP23 is described in the Maintenance chapter of this manual.

5.4 Aw Mode

NOTE: see "Water Activity Measurement" for basic information on water activity and its applications.

When set to operate in the Aw Mode, the HP23 automatically displays humidity as Aw (1.000 a_w = 100 %RH) and offers the following options:

• **AwE option**: the HP23 waits for the full equilibration of the measured product and probe. For most products, this takes from 30 to 60 minutes. The HP23 automatically detects equilibrium conditions (humidity and temperature) and ends the measurement at that time by freezing the display.

• **AwQuick option**: the HP23 uses an algorithm to accelerate the water activity measurement and provides a result in typically 5 minutes. The measurement ends automatically and the display is frozen. When temperature conditions are stable (both at the product and probe), the value measured with the AwQuick mode is generally within ± 0.005 aw of the value that would be obtained by waiting for full equilibration of the product and probe.

5.4.1 Enabling the Aw Mode and selecting the measurement option

To set the HP23 to the water activity mode:

- Press the MENU key and select "Aw Mode". Press ENTER to activate the Aw Mode menu.
- With the "Enable" menu item highlighted, press ENTER and use the UP or DOWN arrow key to select ON. Press ENTER to confirm the selection.
- Use the DOWN arrow key to select the "Mode" menu item and press ENTER. Use the UP or DOWN arrow key to select either AwQuick or AWE. Press ENTER to confirm the selection.
- Any of the settings (see below) for either the AwQuick or AWE option can be changed after using the UP or DOWN arrow key to highlight the setting and by pressing on ENTER. Use the UP or DOWN arrow key to change each digit. Press ENTER to move the cursor to the right. When done, press ENTER to save the value.
- Press MENU twice to fully exit the menu.

Water activity mode settings:

Setting	Applies to	Notes
Dwell Time	AwQuick	The HP23 waits the specified amount of time before processing the humidity data with the AwQuick algorithm. Recommended value: 3 or 4 minutes.

Setting	Applies to	Notes
AWQ-Temp	AwQuick	The HP23 considers temperature to be stable when the rate of change of the temperature signal is less than the specified value. Recommended value: 0.01 °C / min
AWE-Temp	AwE	The HP23 considers temperature to be at equilibrium when the rate of change of the temperature signal is less than the specified value. Recommended value: 0.01 °C / min
AWE-Humi	AwE	The HP23 considers humidity to be at equilibrium when the rate of change of the humidity signal is less than the specified value. Recommended value: 0.0001 Aw / min

5.4.2 Using the AwQuick measurement option

The HP23 uses an algorithm to project the full equilibrium value (water activity) of the product sample:

1) The value of the humidity signal is constantly monitored
2) The stability of the temperature signal is constantly monitored
3) After an initial period of time (dwell time), the humidity data is used to project the end value of the equilibration process (water activity). The measurement ends automatically as soon as the projected Aw value is stable. At that time, the HP23 freezes the display.

The measurement is automatically ended and typically requires about 5 to 6 minutes.

With the default dwell time of 4 minutes, the difference between the AwQuick mode and full product equilibrium is typically 0.005 aw or less. The value of the dwell time can be set by the user (see SETTINGS). This value represents a tradeoff between speed of measurement and accuracy. Generally, a longer dwell time produces more accurate results but causes measurements to take longer.

The value of temperature shown at the end of the measurement is the average temperature during the measurement. The HP23 displays a trend indicator to the left of the temperature value. This is used to verify that temperature was stable during the measurement.

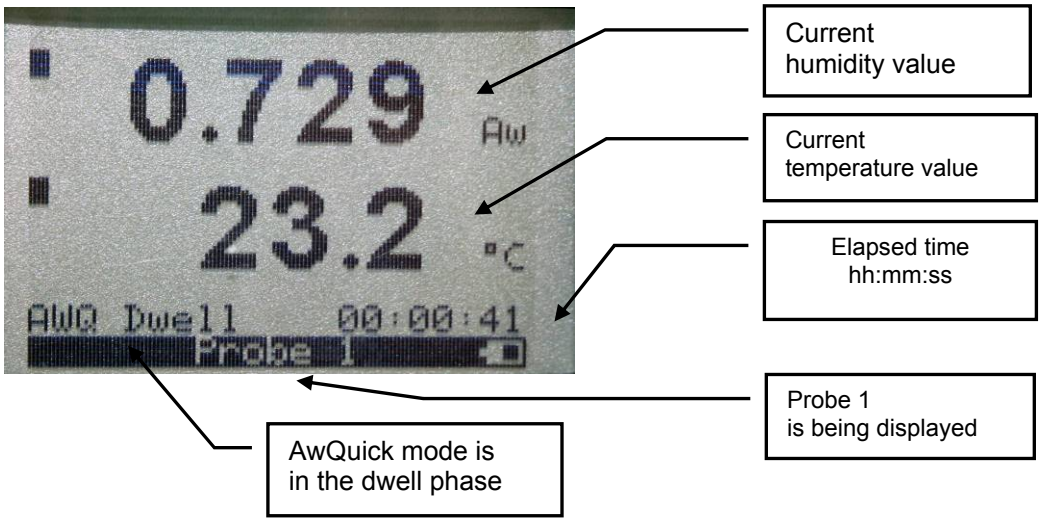
NOTES:

- The measurement starts simultaneously for both probes
- Usually, the measurement ends at a different time for each probe
- Each probe can be displayed by using the UP or the DOWN key
- Do not press on ENTER until the measurement has ended for both probes
- The HP23 can be used with one probe only

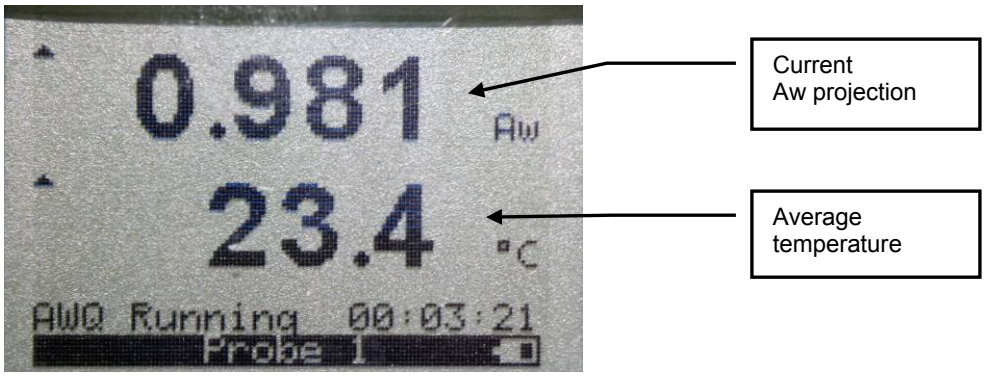
1. **AWQ Reset**: the HP23 is ready to start measuring either one or two probes

When ready to measure, press on the ENTER key.

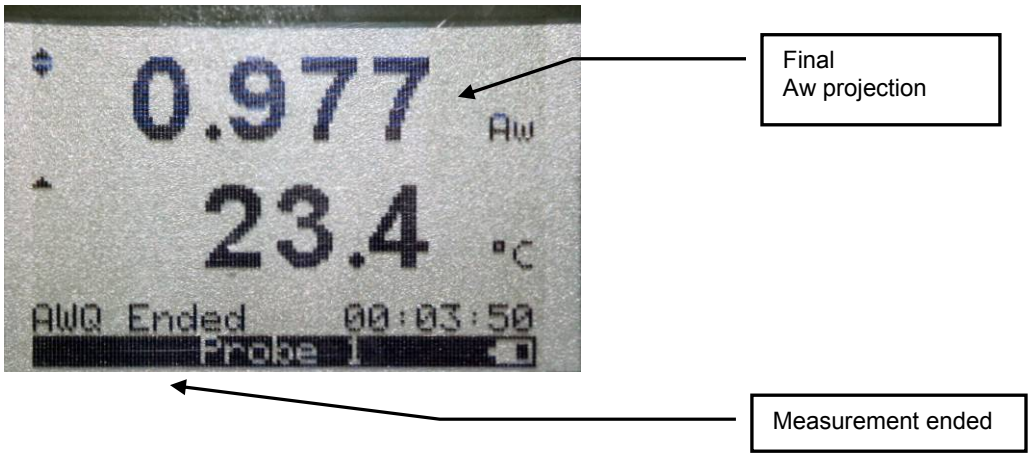
2. **AWQ Dwell**: the measurement is in the "dwell" phase



3. **AWQ Running**: at the end of the "dwell" phase the HP23 starts projecting the end result



4. AWQ Ended: when the projection is stable for the probe being displayed, the HP23 automatically ends the measurement and freezes the display for that probe. When measuring with two probes, use the UP or DOWN key to verify the status of the other probe. Do not press ENTER until the measurement is ended for both probes.



5. AWQ Reset: write down the measurement for each probe and press ENTER. The HP23 is ready to start a new measurement

5.4.3 Using the AwE measurement option

The HP23 monitors the water activity and temperature values. When both values are at equilibrium during a few minutes, the measurement is automatically ended. Depending both on the product being measured and on the stability of temperature, measurements typically require 30 to 60 minutes.

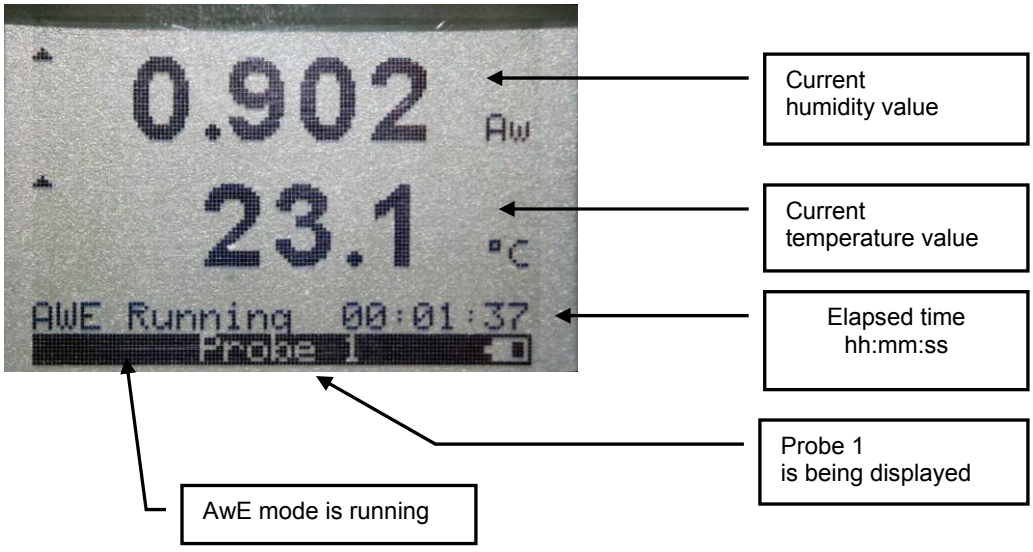
NOTES:

- The measurement starts simultaneously for both probes
- Usually, the measurement ends at a different time for each probe
- Each probe can be displayed by using the UP or the DOWN key
- Do not press on ENTER until the measurement has ended for both probes
- The HP23 can be used with one probe only

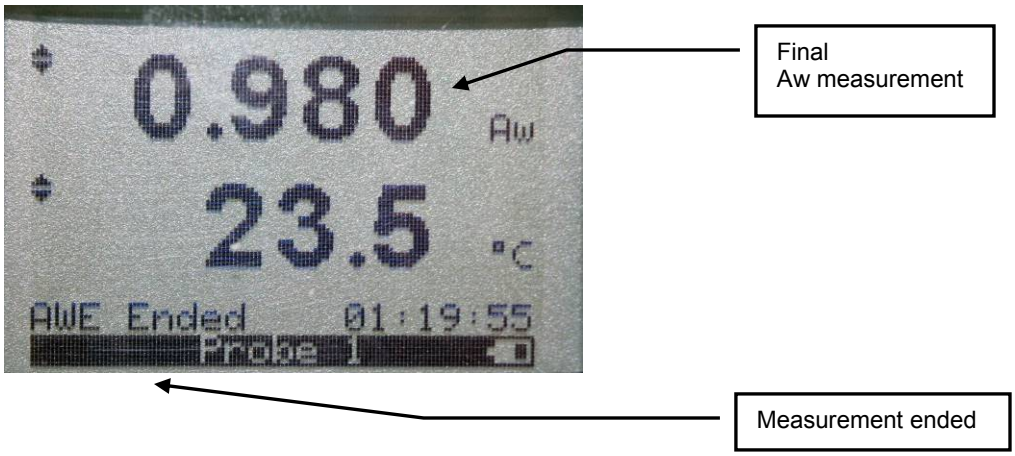
1. **AWE Reset**: the HP23 is ready to start a measurement using one or two probes

When ready to measure, press on the ENTER key.

2. **AWE Running**: the HP23 starts monitoring the humidity and temperature signals for equilibrium



3. AWE Ended: when both the humidity and temperature signals of the displayed probe are stable, the HP23 automatically ends the measurement and freezes the display for that probe. When measuring with two probes, use the UP or DOWN key to verify the status of the other probe. Do not press ENTER until the measurement is ended for both probes.



6 Maintenance

6.1 Replacing the battery

To replace the battery, turn the latching button counter-clockwise and pull out the battery holder.

6.2 Connecting the HP23 to a PC

Any USB cable (mini-USB connector at one end) can be used to connect the HP23 to a USB port of a PC running the ROTRONIC HW4 software. Prior to connecting the HP23, the ROTRONIC USB driver must be installed on the PC. Both the driver and the installation instructions (document **E-M-HW4v2-Main**) are located on the HW4 CD.

6.3 Location of the service connector (mini USB type)

The service connector is a USB port and can be accessed without opening the enclosure after removing the protective red round cover.

6.4 Periodic calibration check of the HygroClip 2 probe

Both the Pt 100 RTD temperature sensor used in the probe 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 probe should be verified every 6 to 12 months. Applications where the probe is exposed to significant pollution may require more frequent verifications.

6.5 Cleaning or replacing the probe dust filter

See document E-M-HC2 Probes-V1

6.6 About the HP23 calibration and adjustment procedures

The HP23 offers two distinct and separate procedures:

1) Acquisition and capture of calibration points to the memory of a probe or device
2) Adjustment of the probe or device based on the calibration points present in the probe or device memory

When the purpose is just to calibrate the probe or device, use only procedure 1. Up to 2 temperature calibration points and up to100 humidity calibration points can be held indefinitely in the probe or device memory. No calibration point is saved within the HP23 itself. A calibration protocol can be printed with the HW4 software. Either the HW4 software or the HP23 can be used at any time to delete unwanted calibration points from the probe or device memory.

Adjustment can be carried out at any time after calibration, even several days later. Adjustment is a purely electronic process based on memorized data and the probe or device does not need to be exposed to any specific environment.

Note: Instructions for using the ROTRONIC calibration devices and humidity standards are provided in document **E-M-CalBasics**

6.7 Calibration against a reference probe

The HP23 can be used to do a 1-point or multi-point calibration of a probe, transmitter or other device equipped with a UART interface, against a reference HygroClip 2 probe connected to the other probe input of the HP23.

Expose both the reference probe and the device to be calibrated to the same environment and wait for full equilibrium with the environment. In a still air environment, it is highly recommended to provide some ventilation that is common to both the reference probe and device to be adjusted.

- Press the MENU key and select either “Probe 1” or “Probe 2”. The reference probe is assumed to be connected to the non-selected input. Press ENTER to activate the Probe 1 or Probe 2 menu item.
- Use the DOWN arrow key to select either “Humi Adjust” or “Temp Adjust” (this can be done in any order).
- Press ENTER to confirm and open the next sub-menu. Use the DOWN arrow key to select the “Acquire (Ref = Probe)” menu item and press ENTER to confirm.
- Humi Adjust: the HP23 displays both the current humidity read by the device to be calibrated and the value provided by the reference probe. Press ENTER to accept the calibration point. Press ENTER to confirm and save the calibration point to the device memory. The HP23 automatically exits the menu.
- Temp Adjust: the HP23 displays both the current temperature read by the device to be calibrated and the value provided by the reference probe. Press ENTER to accept the calibration point. Press ENTER to confirm and save the calibration point to the device memory. The HP23 automatically exits the menu.

Note: the procedure can be repeated under different conditions so as to accumulate several calibration points (temperature: maximum 2 points, humidity: maximum 100 points).

6.8 Calibration against a reference environment

The HP23 can be used to do a 1-point or multi-point calibration of up to two probes, transmitters or other devices equipped with a UART interface, against a reference known environment.

Expose the device to be calibrated to the same known environment and wait for full equilibrium with the environment. In a still air environment, it is highly recommended to provide some ventilation that is common to the devices being calibrated.

- Press the MENU key and select either “Probe 1” or “Probe 2”. Press ENTER to activate the Probe 1 or Probe 2 menu item.
- Use the DOWN arrow key to select either “Humi Adjust” or “Temp Adjust” (this can be done in any order).
- Press ENTER to confirm and open the next sub-menu. Use the DOWN arrow key to select the “Acquire (Enter Ref)” menu item and press ENTER to confirm.
- Humi Adjust: the HP23 displays both the current humidity read by the device to be calibrated and the reference humidity (known environment). Press ENTER to activate the reference value menu item and use the UP or DOWN arrow key to change each digit. Press ENTER to move the cursor to the right. When done, press ENTER to save the value. Use the DOWN arrow key to select <Acquire>. Press ENTER to activate the Acquire function. Press ENTER to confirm and save the calibration point to the device memory. The HP23 automatically exits the menu.
- Temp Adjust: the HP23 displays both the current temperature read by the device to be calibrated and the reference temperature (known environment). Press ENTER to activate the reference value menu item and use the UP or DOWN arrow key to change each digit. Press ENTER to move the cursor to the right. When done, press ENTER to save the value. Use the DOWN arrow key to select <Acquire>. Press ENTER to activate the Acquire function. Press ENTER to confirm and save the calibration point to the device memory. The HP23 automatically exits the menu.

Note: the procedure can be repeated with different reference environments so as to accumulate several calibration points (temperature: maximum 2 points, humidity: maximum 100 points).

6.9 Adjustment of humidity and temperature

The HP23 can be used to do a 1-point or multi-point humidity and temperature adjustment of up to two probes, transmitters or other devices equipped with a UART interface. Humidity and temperature adjustment are two separate processes.

- Press the MENU key and select either “Probe 1” or “Probe 2”. Press ENTER to activate the Probe 1 or Probe 2 menu item.

- Use the DOWN arrow key to select either “Temp Adjust” or “Humi Adjust” (we recommend selecting Temp Adjust first). **The following steps are the same for a temperature or a humidity adjustment**.
- Press ENTER to confirm and open the next sub-menu.
- Optional: with the “Acquired Points” menu item selected press ENTER and review the calibration points present in memory. This submenu allows you to delete unwanted calibration points. Press MENU when done.
- Use the DOWN arrow key to select the “Adjust” menu item and press ENTER to confirm.
- Press ENTER to activate the Adjust function. This function automatically erases the calibration points in memory. When done adjusting, the HP23 automatically exits the menu.

7 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 a USB cable to connect the service connector of the HP23 to a 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-HW4v2-Main**.
Copy the firmware update file from the ROTRONIC website to the PC.
Start HW4 software on the PC and search for the HP23 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
After finding the HP23, expand the device tree to its functions. Select Device Manager. In the Device Manager menu bar select Tools > Firmware Update. For instructions see document **E-M-HW4v2-F2-012**

8 Technical data

8.1 Specifications

General	HP23
Device type	Humidity-temperature hand-held indicator with 2 configurable probe inputs (HygroClip 2 or analog probe) and real time clock (date and time)
Battery type	9 V alkaline (standard) or Ni-MH 8.4V, 170…250mAh (rechargeable)
Low battery indication	Yes (7-segment icon)
Battery charge	Yes (rechargeable battery only) via service connector (use PC USB port or AC adapter)

Operating modes	HP23
Standard mode	Display of %RH, temperature + calculated parameter Display of analog probe measurement
AW mode	Display of water activity and temperature o AwE : conventional measurement o AwQuick : accelerated measurement

Probe input options	HP23
Digital probe	HygroClip 2 probe
Analog probe (12-bit AD converter)	Supply voltage to probe: 5 VDC Maximum probe signal range: 0 to 3.3 VC Configurable measuring range and measurement unit

Humidity and temperature measurement	HygroClip 2 probe
See document **E-M-HC2 Probes** > Specifications	

Calculated parameters	HP23
Psychrometric calculations	Dew point (Dp) above and below freezing Frost point (Fp) below freezing and dew point above freezing Wet bulb temperature (Tw) Enthalpy (H) Vapor concentration (Dv) Specific humidity (Q) Mixing ratio by weight (R) Vapor concentration at saturation (Dvs) Vapor partial pressure (E) Vapor saturation pressure (Ew)

Start-up time and data refresh rate	HP23
Start-up time	3 s (typical)
Data refresh rate	1 s (typical)

Functions	HP23
Delta Probe	o %RH, temperature and calculated parameter difference (probe 1 less probe 2)
Data capture	o Manual data capture of %RH and temperature + date and time stamp (HygroClip 2 probe only) o 8 separate data bins (each can be given a specific name with the HW4 software) o Up to 250 records per data bin
Data logging	o Configurable log interval (from 5 sec to 1 hour) o Start-Stop or Loop mode o Up to 10,000 RH+T records for a single HygroClip 2 probe o Up to 20,000 records for a single 1-channel analog probe o Each data record is given a date and time stamp o Recording capacity per probe is cut in half when two probes are being simultaneously recorded

Functions	HP23
Calibrator	o Can be used to calibrate and adjust HygroClip probes, transmitters and other devices based on the AirChip 3000 technology o Fully fledged calibration and adjustment function o Calibration against reference probe or reference environment
Water activity measurement	o Conventional water activity measurement o Accelerated water activity measurement o Automatic end of measurement Simultaneous measurement of two probes (HygroClip 2 only)

Service connector	HP23
Interface type	USB
Maximum service cable length	5 m (16.4 ft)

General specifications	HP23
Display	LC, 1 or 2 decimals resolution, backlight, trend, alarm, data logging and low battery indication
Display modes	%RH and temperature + date and time %RH, temperature and calculated parameter %RH or temperature or calculated parameter + date and time Water activity and temperature
Probe material	Polycarbonate
Probe dust filter material	Polyethylene
Housing material	ABS
Housing protection grade	IP 40
Overall dimensions	270 x 70 x 30 mm (10.63 x 2.76 x 1.17”)
Weight	About 198 g (7.0 oz)

Conformance to standards	HP23
CE / EMC immunity	EMC Directive 2004/108/EG: EN 61000-6-1: 2001, EN 61000-6-2: 2005 EN 61000-6-3: 2005, EN 61000-6-4: 2001 + A11
Solder type	Lead free (RoHS directive)
FDA / GAMP directives	Compatible

Environmental limits	HP23
Storage and transit	-20…+70 °C / 0…100 %RH, non condensing
Operating limits at electronics	-10….60 °C (limited by LC display) 0…100 %RH, non condensing
Temperature limits at probe	Same as electronics
Maximum humidity at probe	Same as electronics
Maximum air velocity at probe	20 m/s (3,935 ft /min)
Critical environments	Humidity sensor: as per DV04-14.0803.02 - Critical chemicals

8.2 Dew point accuracy

See document **E-M-HC2 Probes** > Dew point accuracy

9 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**

10 Supporting documents

Document File Name	Contents
E-M-HC2 Probes-V1	HygroClip 2 (HC2) Humidity Temperature Probes, User Guide
E-M-HC2-accessories	Accessories and parts for probes, indicators and transmitters
E-T-AC3000-DF-V1	AirChip 3000 Description and Main Functions
E-M-HW4v2-DIR	List of the HW4 manuals
E-M-HW4v2-Main	HW4 software version 2: General instructions and functions common to all devices
E-M-HW4v2-F2-012	HW4 software version 2: HP23 hand-held indicator and probes Device Manager and Data Recording functions
E-M-HW4v2-A2-001	HW4 software version 2: Probe Adjustment function AirChip 3000 devices
E-M-HW4v2-DR-001	HW4 software version 2: Data Recording 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.

11 Document releases

Doc. Release	Date	Notes
_20	Jul. 1, 2009	Original release