HygroPalm HP22 Hand-Held Indicator
User Guide

Table of contents

1 Overview 3
2 General description 3
2.1 Power supply 3
2.2 Measured parameters 3
2.3 Calculated parameters 3
2.4 Service connector 4
3 User configurable settings and functions 4
3.1 Function overview 4
3.2 Factory default settings 5
3.3 Interaction between the HP22 and probe functions 7
4 Operation 8
4.1 Display 8
4.2 Keypad 8
4.3 Internal menu 9
4.4 Changing the parameters shown on the display 10
4.5 Changing the unit system 10
4.6 Low battery indicator 10
4.7 Practical advice for measuring humidity 10
5 Maintenance 11
5.1 Replacing the battery 11
5.2 Service cable 11
5.3 Location of the service connector (mini USB type) 11
5.4 Periodic calibration check of the probe 12
5.5 Cleaning or replacing the probe dust filter 13
6 Firmware updates 13
7 Technical data 14
7.1 Specifications 14
7.2 Dew point accuracy 15
8 Accessories 15
9 Supporting documents 15
10 Document releases 16

Applicability:

This manual is valid for the HP22 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 HP22 is a highly accurate hand-held indicator that displays relative humidity, temperature and a calculated parameter such as the dew or frost point. The HP22 operates with a regular 9V alkaline battery and 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 HP22 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 HP22 electronics is limited to -10…60°C.

Based on the ROTRONIC AirChip 3000 digital technology the HP22 indicator and HygroClip 2 probes offer the following user functions:

- User configurable settings
- Calculation of psychrometric parameters such as the dew or frost point
- Humidity temperature calibration and adjustment
- Simulator mode
- Automatic humidity sensor test and drift compensation
- Sensor failure mode
- Data recording

The ability for the user to easily update both the HP22 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 Power supply

The HP22 operates with a regular 9V alkaline battery

2.2 Measured parameters

The probes used with the HP22 measure relative humidity with a ROTRONIC Hygromer® IN1 capacitive sensor and temperature with a Pt100 RTD.

2.3 Calculated parameters

Using the ROTRONIC HW4 software, the HP22 can be configured by the user to calculate one of the following parameters:

- 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: some of the above parameters depend on the value of the barometric pressure. Using the ROTRONIC HW4 software, a fixed barometric pressure value can be specified. For instructions see the following HW4 manual: **E-M-HW4v2-F2-006**

2.4 Service connector

The service connector is a UART digital interface (Universal Asynchronous Receiver Transmitter) with a mini-USB type connector. This allows connecting the HP22 either to a PC running the ROTRONIC HW4 software or to a probe input of another instrument that is compatible with the HygroClip 2 (HC2) probes. In both cases a service cable is required. See “Maintenance” for the location of the service connector and for the type of service cable to be used.

- Connecting the HP22 to a PC is used to configure the HP22, gain access to the HP22 and probe functions such as humidity and temperature adjustment, read data from the HP22 on the PC and update the firmware of either the HP22 or probe.

- Connecting the HP22 to another instrument is useful only when the other instrument has its own display and keypad, and has a more powerful internal menu than the HP22 (example HP23 hand-held calibrator). This allows showing the data measured by the HP22 on the other instrument display and also allows using the other instrument internal menu to do for example a humidity and temperature adjustment of the HP22.

3 User configurable settings and functions

The HP22 can be used just as any conventional humidity and temperature indicator and most users will never need to use the HP22 configurable settings and functions.

Making use of the HP22 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 HP22 functions and also indicated the factory default settings.

3.1 Function overview

MEASUREMENT ACCURACY AND RELIABILITY (PROBE FUNCTIONS)	
AirChip 3000 Functions	**Description**
► Humidity / temperature adjustment	○ 1-point or multi-point humidity calibration or adjustment ○ 1-point or 2-point temperature calibration or adjustment ○ Generate a time stamp for calibrations and adjustments ○ Retain and view last adjustment date and adjustment values ○ Generate calibration and adjustment protocols
► Automatic humidity sensor test and optional drift compensation	Tests the humidity sensor for drift caused by contaminants and can be used to automatically apply a correction. The test is automatically carried out at regular intervals of time. Can be configured, enabled, or disabled The humidity sensor status can be verified either with the HW4 software or with the instrument display and is shown as Good, SQ-tuned (corrected for drift) or Bad (defective)

► Data recording	The data recording function differs from a true data logging function in the sense that the AirChip 3000 does not time stamp the data. The data recording function can be use to investigate events such as a sensor malfunction as well as to retrieve data that would otherwise be lost ○ Start or stop data recording - up to 2000 value pairs (%RH and temperature) ○ Starting a recording session erases all previously recorded data ○ The recording mode and log interval can be specified ○ When the device is powered off, the recording session is paused but not ended As long as the recording session has not been ended, the device automatically resumes recording data when powered up again ○ The recorded data can be downloaded to a PC with the HW4 software, time stamped and viewed

MEASUREMENT LOOP VALIDATION	
Functions	**Description**
► Simulator mode	Used to make the HP22 generate fixed values for the humidity, temperature and calculated parameter. Can be configured, enabled or disabled

DEVICE SAFEGUARDS	
Functions	**Description**
► Device write protection	Used to protect the HP22 with a password to prevent unauthorized digital access by a digital user. Can be configured, enabled or disabled
► Internal menu access from keypad	Used to prevent accidental changes to the HP22 settings and temperature-humidity adjustment by disabling the MENU key on the optional keypad. Can be enabled or disabled

3.2 Factory default settings

Notes:

- Configuration of the HP22 and probe by the user and access to its functions requires a PC with the ROTRONIC HW4 software (version 2.1.1 or higher) installed. Service cable AC3006 is used to connect the HP22 service connector to a USB port of the PC.

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

Configurable Settings		Factory default
Unit system (Metric or English)	**K**	Metric, except USA: English
Psychrometric calculation		Dew / frost point
Fixed pressure value		1013.25 hPa or 29.92 In Hg
Data refresh rate		1 sec.
Display resolution		1 decimal
Display backlight (optional)	**K**	On Key Press
Displayed parameters	**K**	%RH and temperature
Trend indicator (display)		Enabled
Communication protocol		RO-ASCII
RS-485 address		0
Device name		Instrument model

Functions		Factory default
Humidity / temperature adjustment	**K**	
Device write protection		Disabled (HP22 and probe)
Menu access from keypad		Enabled
Limit humidity output to 100 %RH		Enabled (probe)
Out-of-limit value digital / display alarm		Disabled (HP22 and probe)
Data recording (probe)	**K**	Enabled (loop mode – 10 min. interval)
Automatic humidity sensor test		Disabled (probe)
Humidity sensor drift compensation		Disabled (probe)
Monitor probe alarms		Enabled
Loss of communication with probe		Disabled
Simulator mode		Disabled (HP22 and probe)

- For a detailed description of all AirChip 3000 / HP22 main functions see document **E-T-AC3000-DF-V1**

- Instructions regarding the configuration of the HP22 and probe as well as access to the functions are provided in the following manuals:

  E-M-HW4v2-F2-006
  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
  .

- The factory default setting for dew / frost point calculation is frost point below freezing

3.3 Interaction between the HP22 and probe functions

It is important to note that when used together, the HP22 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 HP22 indicator and HygroClip 2 probe (HC2) operate together as indicated below:

Function / Setting	HP22	HC2	Notes
Device protection	**X**	**X**	Individual to the HP22 and HC2 probe
RS-485 address	**X**	**X**	Individual to the HP22 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 HP22 Input Name
Calculation	**X**	**X**	Psychrometric calculation HP22 setting overrides HC2 probe setting
Data refresh rate	**X**		When set above 1 s, causes the HC2 probe not to be powered in between measurements
Simulator function	**X**	**X**	Generates fixed humidity and / or temperature value When enabled, the HP22 settings override the HC2 probe settings
Unit system	**X**	**X**	The HP22 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 HP22 and probe.**
Out-of-limits value alarm	**X**	**X**	The HP22 settings are independent from the HC2 probe settings. The HC2 probe settings have an effect only when the HP22 is enabled to monitor alarms generated by the probe When out-of-limit values have been defined for the same parameter for both the HP22 and probe, alarms are triggered based on the narrowest set of limits.
Analog outputs	**X**	**X**	Parameter and scale The HC2 probe settings have no effect on the HP22

4 Operation

4.1 Display

The LC display of the HP22 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.

The upper line corresponds to relative humidity or dew / frost point and the bottom line corresponds to temperature.

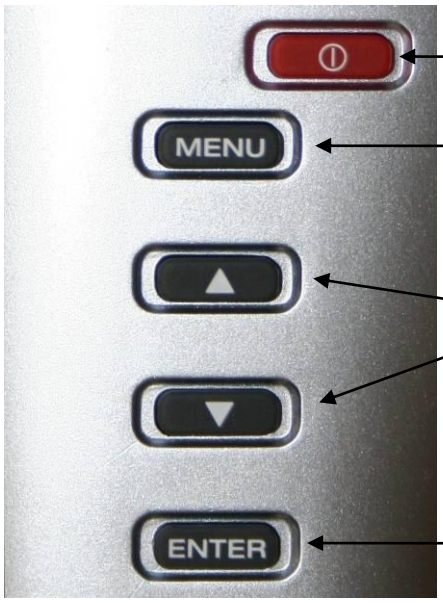
The display can be configured to show a trend indicator on each line:

▲: increasing value
▼: decreasing value

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

For instructions see the following HW4 manual: **E-M-HW4v2-F2-006**.

4.2 Keypad



ON/OFF:	Turns the instrument on or off
MENU:	Press this key to activate the internal menu. Press this key again to exit the menu
UP / DOWN:	When the menu is active, use these keys to navigate the menu, make a selection or change a value
ENTER:	When the menu is active, press this key to confirm a selection.

4.3 Internal menu

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

Main Menu	Menu Items	Selections / Information	Notes
Device Settings			
	Units	Metric / English	
	Back Light	Key Press / On / Off	Display backlight mode
	Contrast		LC display contrast adjustment
	Trend	On / Off	Trend indication on the display
Device Information			
	Version	Firmware version	
	Serial Nbr	Serial number	
	Address	RS-485 address	
	Type	Device type	
	Name	Device name	User defined
Probe Information			
	Version	Firmware version	
	Serial Nbr	Serial number	
	Address	RS-485 address	
	Name	Device name	User defined
	SensorTest	Humidity sensor status	Off / Good / SQ-Tuned / Bad
	Record	On / Off	Data recording by the probe (max. 2000 values)
Humidity Adjust			
	RefValue	Humidity reference value	± 0.1 %RH steps
	Acquired		Number of cal. points in probe memory
	<Acquire>		Save cal. point to probe memory
	<Delete>		Erases all calibration points
	<Adjust>		Effect depends on number of calibration points
Temperature Adjust			
	RefValue	Temperature reference value	± 0.1 ˚C steps
	<Adjust>		1-point adjustment only (offset)

- **Record:** both the recording mode (start / stop and the log interval cannot be changed from the menu and are as configured with the ROTRONIC HW4 software
- **SensorTest:** Off means that the humidity sensor has not been tested due to the configuration settings of the test. For a description of the automatic humidity sensor test and drift compensation (SQ-tuning) see documents **E-T-AC3000-DF-V1** and **E-M-HW4v2-F2-006**

4.4 Changing the parameters shown on the display

When the menu is not active, press the ENTER key to change which parameters are shown on the display:

- Relative humidity and temperature
- Relative humidity, temperature and calculated parameter (when calculated parameter is enabled)

4.5 Changing the unit system

The unit system of the HP22 (metric or English) can be changed from the keypad (Menu > Settings > Unit).

- Press the MENU key to show the internal menu on the display
- With the menu item Settings highlighted, press the ENTER key
- With the menu item Unit highlighted, press the ENTER key
- Use the UP or DOWN key to change the unit system as desired
- Press the MENU key twice to exit the menu and return the HP22 to normal operation

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

4.6 Low battery indicator

When the battery is down to about 20% of its initial charge, “Low Battery” appears at the bottom of the display.

4.7 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 Maintenance

5.1 Replacing the battery

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

5.2 Service cable

- Cable AC3006 converts UART (service connector) to USB and is used to connect the HP22 to a USB port of a PC running the ROTRONIC HW4 software. Prior to using this cable, 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.
- As an alternative, cable AC2001 is used to connect the HP22 to a probe input of the HP23 hand-held calibrator. For service purposes, the HP23 offers essentially the same functionality as the HW4 software.

5.3 Location of the service connector (mini USB type)

WARNING: the service connector is a UART interface with a mini-USB connector type. Do not connect the service connector directly to the USB port of a PC or hub.

The service connector (UART interface) can be accessed without opening the enclosure after removing the protective red round cover.

5.4 Periodic calibration check of the 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.

a) Procedure for adjusting the probe from the HP22 keypad

Temperature adjustment

The keypad of the HP22 allows only a 1-point adjustment of temperature. The effect of a 1-point temperature adjustment is to add the same offset to all measured values.

- When temperature is stable, press the MENU key to show the internal menu on the display
- Use the (-) key to select Temperature Adjust and press the ENTER key
- Make sure that the text line beginning with RefValue is highlighted and press the ENTER key
- Use the (+) or (-) key to change the reference value to match the temperature reference
- Use the (-) key to highlight the Adjust text line and press the ENTER key
- The HP22 confirms the adjustment with the message “Adjust OK”
- Press the MENU key twice to exit the menu and return the HP22 to normal operation

Notes:

- Any temperature adjustment should be done prior to adjusting humidity
- The calibration point is automatically deleted from the probe memory after an adjustment
- Because the HP22 has no real time clock, the date of the adjustment is not written to the probe. If retaining the adjustment date is important, use the HW4 software to adjust the probe.

Humidity adjustment

The keypad of the HP22 allows a multi-point adjustment of humidity. The effect of a humidity adjustment depends on the number of calibration points present in the probe memory prior to the adjustment:

- one calibration point: offset added to all measured values
- two calibration points: offset and slope
- three or more calibration points: offset, slope, linearity

For maximum accuracy use at least 3 to 4 calibration points distributed equally across the measurement range of interest. The calibration points (maximum 100) can be acquired in any order but we recommend going from low humidity values to high humidity values.

- When humidity is stable, press the MENU key to show the internal menu on the display
- Use the (-) key to select Humidity Adjust and press the ENTER key
- Make sure that the text line beginning with RefValue is highlighted and press the ENTER key
- Use the (+) or (-) key to change the reference value to match the reference humidity
- Use the (-) key to highlight the Acquire text line and press the ENTER key
- Note that the “Acquired” counter is incremented by 1 (number of calibration points in the probe memory)
- When all calibration points have been acquired, use the (-) key to highlight the Adjust text line and press the ENTER key. **Do not adjust the probe before having acquired all calibration points**.
- The HP22 confirms the adjustment with the message “Adjust OK”
- Press the MENU key twice to exit the menu and return the HP22 to normal operation

Notes:

- All calibration points are automatically deleted from the probe memory after an adjustment
- Instructions for using the ROTRONIC calibration devices and humidity standards are provided in document **E-M-CalBasics**
- Because the HP22 has no real time clock, the date of the adjustment is not written to the probe. If retaining the adjustment date is important, use the HW4 software to adjust the probe.

b) Using the HW4 software to adjust the probe connected to the HP22:

- Use cable AC3006 to connect the service connector of the HP22 to a USB port of a PC with the 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**.
- Start HW4 on the PC and search for the HP22 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the HP22 with HW4, expand the device tree to see the HP22 functions. Select Probe and Probe Adjustment.
- For further instructions see HW4 manual **E-M-HW4v2-A2-001**

5.5 Cleaning or replacing the probe dust filter

See document **E-M-HC2 Probes-V1**

6 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 HP22 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 HP22 (HW4 Main Menu Bar > Devices and Groups > Search for USB Masters).
- After finding the HP22, expand the device tree to see the HF5 functions. Select Device Manager. In the Device Manager menu bar select Tools > Firmware Update. For instructions see document **E-M-HW4v2-F2-006**

7 Technical data

7.1 Specifications

General	HP22
Device type	Humidity-temperature hand-held indicator with one probe input (HygroClip 2)
Battery type	9 V alkaline
Low battery indication	Yes

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

Calculated parameters	HP22
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	HP22
Start-up time	3 s (typical)
Data refresh rate	1 s (typical)

Service connector	HP22
Interface type	UART (Universal Asynchronous Receiver Transmitter)
Maximum service cable length	5 m (16.4 ft)

General specifications	HP22
Display	LC, 1 or 2 decimals resolution, backlight, trend, alarm and low battery indication
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”)
Probe dimensions	80 x 15 mm (3.15 x 0.59”)
Weight	About 198 g (7.0 oz)

Conformity with standards	HP22
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	HP22
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	Depends on probe model
Maximum humidity at probe	100 %RH up to 80 °C (176 °F) 75 %RH at 100 °C (212 °F) 45 %RH at 125 °C (260 °F) 15 %RH at 150 °C (302 °F)
Maximum air velocity at probe	20 m/s (3,935 ft /min)
Critical environments	Humidity sensor: as per DV04-14.0803.02 - Critical chemicals

7.2 Dew point accuracy

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

8 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**

9 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-F2-006	HW4 software version 2: HP22 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.

10 Document releases

Doc. Release	Date	Notes
_20	Apr. 14, 2009	Original release
_21	Jan. 27, 2010	Corrected environmental limits for probe