

HygroPalm

Portable Humidity Temperature Indicator

Instruction Manual

v 1.5



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Note: functions such as instrument configuration with a PC as well as the calibration of HygroClip probes with a PC require the optional HW3 software. Instructions for using the HW3 software are not included in this manual. These instructions are shipped separately on the same CD ROM as the HW3 software.

Overview

The HygroPalm is a portable humidity temperature indicator that is available with a wide variety of probes for use 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 HygroPalm operates with a regular 9V alkaline battery or with a rechargeable 9V battery.

The HygroPalm is available in 3 different models:

HygroPalm 1 – basic indicator

- single probe input, compatible with any ROTRONIC HygroClip digital probe
 - indication of relative humidity, temperature, dew point or wet bulb temperature
 - 1-point software-based probe calibration
 - remote mode reads the measurements from any ROTRONIC HygroFlex transmitter ¹⁾
- 1) this is especially useful when the transmitter does not have a display - optional connecting cable required

HygroPalm 2 – standard indicator

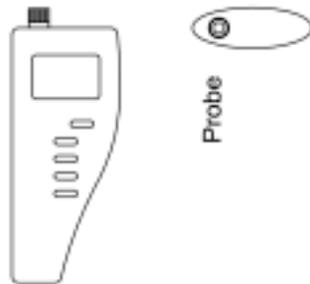
- accepts up to 2 ROTRONIC HygroClip digital probes
 - indication of relative humidity, temperature, dew point, wet bulb, mixing ratio, enthalpy, etc ¹⁾
 - software-based probe calibration (1-point or multi-point)
 - remote mode reads the measurements, configuration and status from any ROTRONIC HygroFlex transmitter ²⁾
 - remote mode allows a 1-point calibration of a ROTRONIC HygroFlex 2 or 3 transmitter, using any probe connected to the HygroPalm as a reference ^{2) 3)}
 - RS232 digital port for connecting to the COM port of a PC ⁴⁾
- 1) uses a fixed barometric pressure value for those parameters that require pressure as a computational input. The fixed pressure value can be changed with the optional HW3 software.
2) this is especially useful when the transmitter does not have a display - optional connecting cable required – this function is not available with the HygroFlex 1
3) applies only to the ROTRONIC HygroClip digital probes
4) requires optional connecting cable and HW3 software

HygroPalm 3 – calibrator

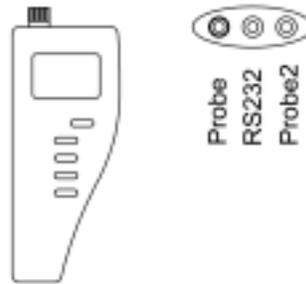
- accepts up to 2 probes: ROTRONIC HygroClip digital probes or analog probes¹⁾
- indication of relative humidity, temperature, dew point, wet bulb, mixing ratio, enthalpy, water activity, etc²⁾
- software-based probe calibration (1-point or multi-point)³⁾
- remote mode reads the measurements, configuration and status from any ROTRONIC HygroFlex transmitter⁴⁾
- remote mode allows a 1-point calibration of a ROTRONIC HygroFlex 2 or 3 transmitter, using any probe connected to the HygroPalm as a reference³⁾⁴⁾
- remote mode permits the full calibration of any digital probe connected to a ROTRONIC HygroFlex transmitter³⁾⁴⁾
- RS232 digital port for connecting to the COM port of a PC⁵⁾

- 1) pressure probe or ROTRONIC analog probe – restrictions apply
- 2) uses either a fixed barometric pressure value or the measurements from an analog pressure probe for those parameters that require pressure as a computational input. The fixed pressure value can be changed with the optional HW3 software.
- 3) applies only to the ROTRONIC HygroClip digital probes
- 4) this is especially useful when the transmitter does not have a display - optional connecting cable required – this function is not available with the HygroFlex 1
- 5) requires optional connecting cable and HW3 software

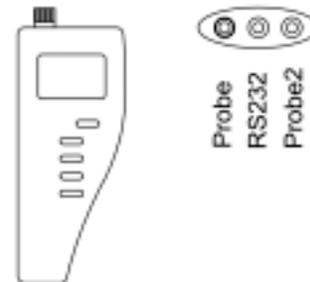
HygroPalm 1



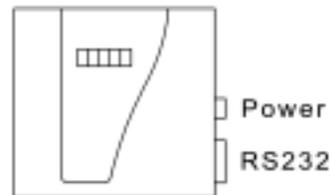
HygroPalm 2



HygroPalm 3



Docking Station (PalmDock)



General Description

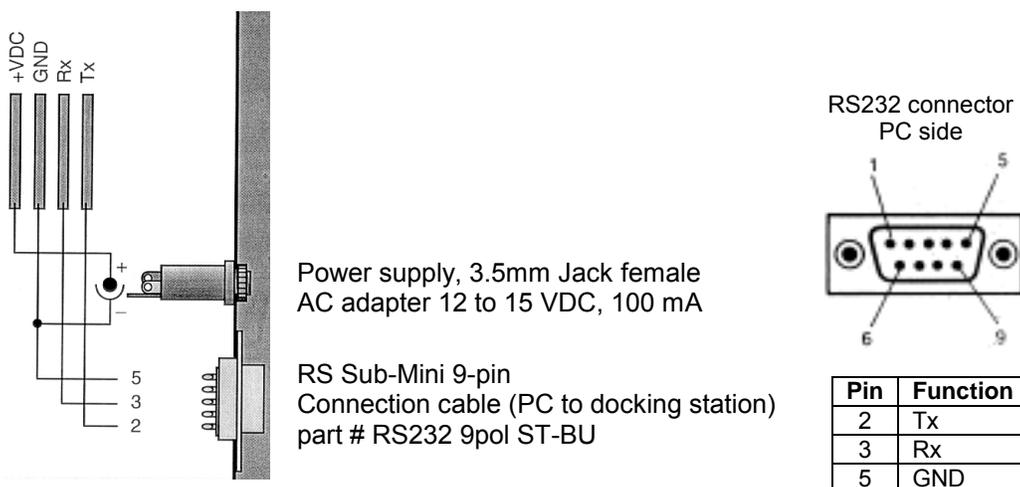
Power Requirements

The HygroPalm operates with a regular 9V alkaline battery or with a 9V rechargeable battery. ¹⁾

Important: the HygroPalm 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 (requires docking station), you should turn on the charge function (see Functions – Sys Status). 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.

Optional Docking Station (PalmDock)

The HygroPalm is available with an optional docking station. The docking station accepts an external AC adapter for recharging the battery. Models with an RS232 port can be connected to the COM port of a PC via the docking station.



Probes and Probe Inputs

Model	HygroPalm 1	HygroPalm 2	HygroPalm 3
Number of probe inputs	1	2	
Probe types ¹⁾	ROTRONIC Digital		ROTRONIC Digital ROTRONIC Analog Third-Party Analog
Number of digital input channels	1	2	
Number of analog inputs channels	N/A		2 x 2
Analog input A/D resolution	N/A		10-bit

1) HygroPalm 3: unless otherwise specified when ordering, all probe inputs are factory programmed to accept a HygroClip digital probe. Prior to using any analog probe, the corresponding probe input should be re-programmed. This can be done with the HW3 software after connecting the RS232 port to a PC (see separate HW3 manual).

HygroClip Digital Probes

The HygroPalm is primarily designed for use with the ROTRONIC HygroClip digital humidity temperature probes. These probes permit to take full advantage of all the features and functions of the HygroPalm.

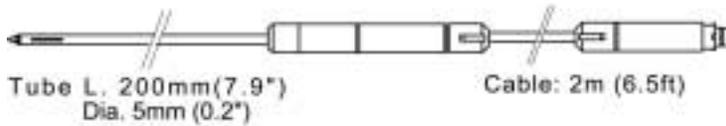
The ROTRONIC HygroClip digital probes are highly accurate and are calibrated entirely by means of software (no adjustment potentiometers). Because calibration and other data are stored in the probe non-volatile memory, the probes are fully interchangeable. When a probe requires calibration or has to be repaired, it can be replaced with another probe in a few seconds.

The ROTRONIC HygroClip digital probes are available in different configurations so as to meet the requirements of each application:



L. 100mm (3.9")
Dia. 15mm (0.6")

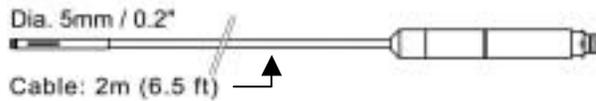
HygroClip S
measurement in air
max. 85°C (185°F) – wire mesh filter



Tube L. 200mm (7.9")
Dia. 5mm (0.2")

Cable: 2m (6.5ft)

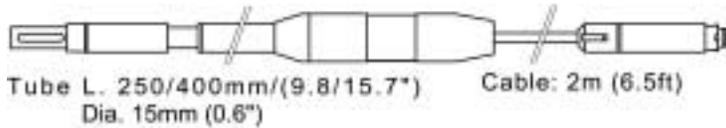
HygroClip SP05
measurement in air ducts
max. 85°C (185°F)



Dia. 5mm / 0.2"

Cable: 2m (6.5 ft)

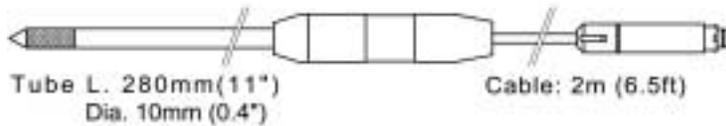
HygroClip SC05
measurement in tight spaces
max. 100°C (212°F)



Tube L. 250/400mm/(9.8/15.7")
Dia. 15mm (0.6")

Cable: 2m (6.5ft)

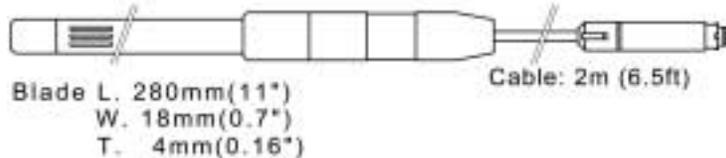
HygroClip HK25 / HK40 air probe
measurement at high temperature
HK25: max. 150°C (302°F)
HK40: max. 200°C (392°F)
wire mesh filter



Tube L. 280mm (11")
Dia. 10mm (0.4")

Cable: 2m (6.5ft)

HygroClip HP28 insertion probe
measurement of materials in bulk
max. 85°C (185°F)
sintered steel filter



Blade L. 280mm (11")
W. 18mm (0.7")
T. 4mm (0.16")

Cable: 2m (6.5ft)

HygroClip HS28 sword probe
measurement of paper stacks/rolls
max. 85°C (185°F)

Analog Probes

Depending on the model and options, the HygroPalm can be used with one or two analog probes. Both the scale and unit of the analog input signals can be defined with the HW3 software. For example, an analog pressure probe may be used to provide the local value of barometric pressure for the computation of parameters such as the wet bulb temperature, mixing ratio or enthalpy.

Use of analog probes is subject to the following restrictions and limitations:

- a. ROTRONIC analog humidity-temperature probes with the standard temperature output signal of $-0.5...2.0\text{ V} = -50...200^{\circ}\text{C}$: because the HygroPalm cannot read a negative voltage signal, temperature measurement is generally limited to values above freezing.
- b. Third-party analog probes: single channel probes (one signal), output signal within the range of 0 to 2.5 VDC, supply voltage: 7.6...9 VDC (direct from HygroPlam battery), maximum current consumption: 10 mA.
- c. Resolution is limited by the 10-bit A/D converter used for the analog inputs. This converter provides a theoretical maximum of 1024 counts for an input voltage span of 2.5 VDC. In theory, this gives a resolution of $2.5 / 1024 = 0.00244\text{ V}$. In practice, it is not possible to get 100% of the counts from an A/D converter and the actual resolution should be about 0.0027 V (typical). For example, if a probe with a temperature signal of $0..1\text{ V} = 0...100^{\circ}\text{C}$ is being used, the signal resolution will be about $100 \times 1 \times 0.0027 = 0.27^{\circ}\text{C}$

RS232 Serial Output

Both the HygroPalm 2 and HygroPalm 3 feature a serial (RS232) port that can be connected to the COM port of a PC. In principle, any communication software can be used to interrogate and read the HygroPalm with the commands described in appendix 6 (RS232 communication protocol). It is important to note that the computed parameter (dew point or other) is not part of the digital communication. Use of the HW3 software (optional) allows real time computation of the dew point (or other) by the PC while providing additional functionality such as:

- full access to instrument configuration (unit system, etc.)
- calibration of the ROTRONIC HygroClip digital probes independently of the HygroPalm (requires the MOK-02-WIN calibration cable to connect the probe to a PC)
- data logging to a PC disk file
- graphic functions (both on and off-line)

For more details see separate instruction manual provided with the HW3 software.

Unit System

The unit system of the HygroPalm (Metric or English) is factory programmed as specified when the instrument was ordered. The unit system can be easily be changed by the user with the HW3 software (optional).

To change the unit system:

Changing the unit system requires a PC with the HW3 software installed.

HygroPalm 1: connect the internal service connector to the COM port of the PC or use the PalmDock docking station

HygroPalm 2 and 3: connect either the RS232 port (cable #AC1622) or the docking station to the COM port of the PC and change the instrument configuration with HW3.

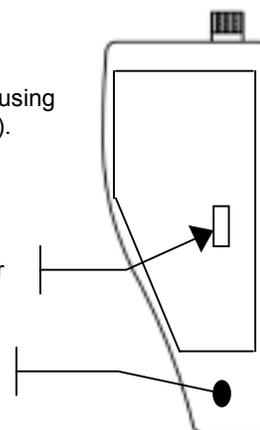
HygroPalm 1:

To access the service connector, open the housing (back of the instrument).

Use cable # AC1623 to connect to the PC

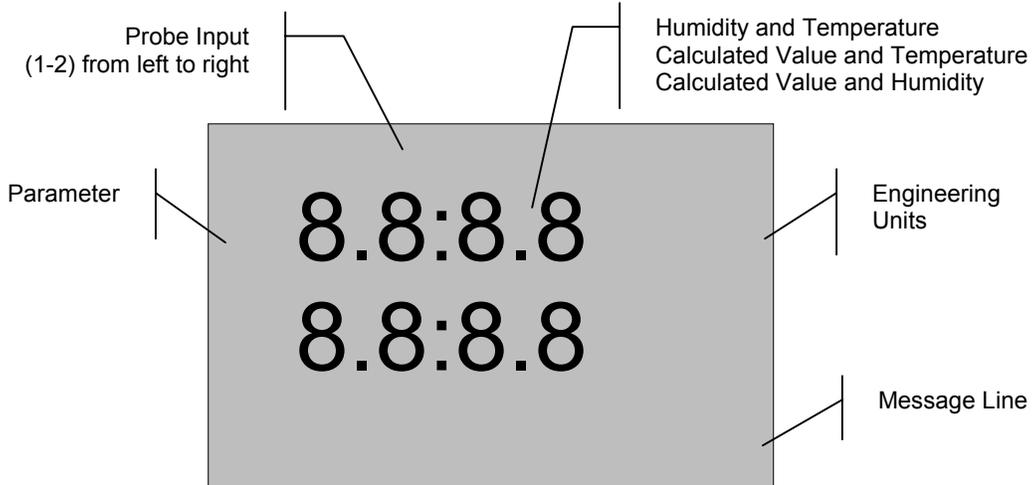
3-pin service connector

Battery compartment



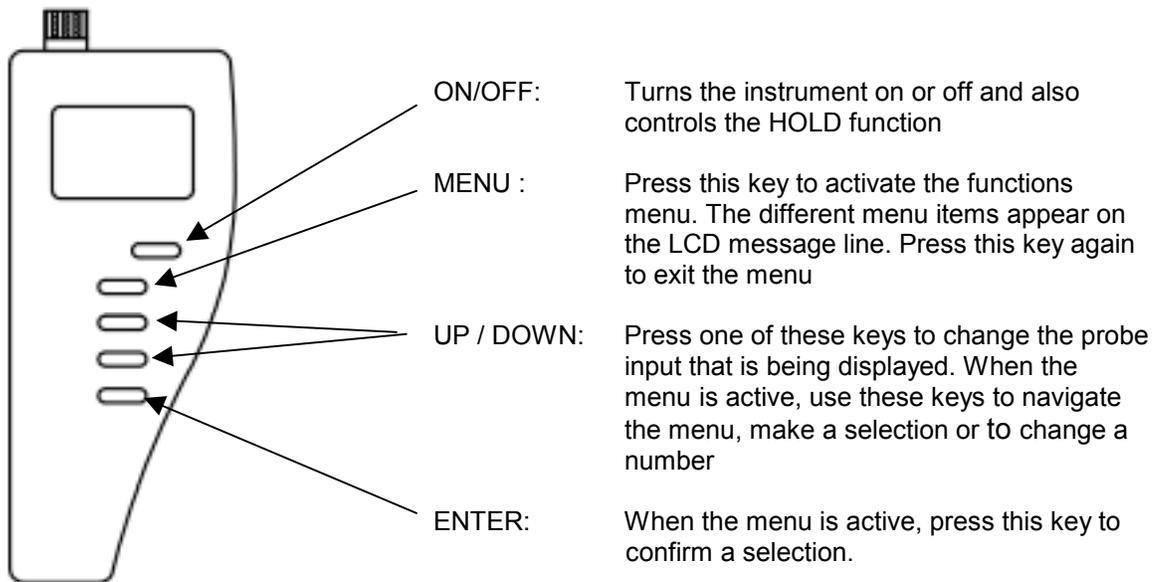
Display

The LC display shows which probe input is being displayed (small indicator on top of the display) and up to 2 parameters measured by the probe, with the associated engineering unit. When relevant, the message line provides additional information.



The display provides information regarding the battery status. When the message Low Batt appears, the instrument can typically be used for another 10 to 15 minutes.

Function Keys

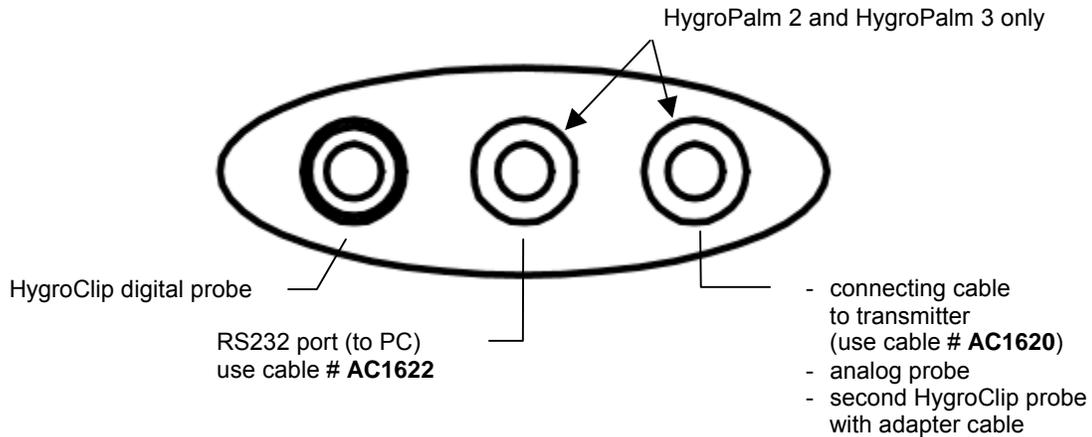


Operation

Connect a probe to the HygroPalm ¹⁾ and press on the ON/OFF key. After a brief test and introductory message, the measurements appear on the LC display. Measurements are updated to the display at the rate of 0.75 sec. x number of digital probes (HygroClip) connected to the HygroPalm.

HOLD function: to freeze the measurements press briefly on the ON/OFF key. Press again briefly on the key to return to normal operation.

1) HygroPalm 2 and 3: the probe can be connected to any probe input - the HygroPalm automatically senses the probe. HygroPalm3: unless otherwise specified when ordering, all probe inputs are factory programmed to accept a HygroClip digital probe. Prior to using any analog probe, the corresponding probe input should be re-programmed. This can be done with the HW3 software after connecting the RS232 port of the HygroPalm 3 to a PC (see separate HW3 manual).



Probe Input Selection (HygroPalm 2 and HygroPalm 3)

The display can be switched between probes with the UP or the DOWN key. The selection is confirmed on the message line of LC display as well as by an indicator located at the top of the display.

Functions

To access the function menu, press the MENU key. The first menu item appears on the message line of the LC display. Use the UP or the DOWN key to navigate the menu. When the desired menu item appears on the message line of the LC display, press the ENTER key to select. Some menu items have sub-items. These can be selected with the UP, DOWN and ENTER keys. To exit the menu and return to the normal display mode, press the MENU key. The instrument also returns automatically to the normal display mode when no key is being pressed for some time (main menu: 10 sec., submenu: 30 sec.).

CALCULATE

Definition

This function is used to select or view the humidity parameter that is calculated by the instrument. The calculated parameter is selected individually for each probe connected to the instrument ¹⁾. Prior to entering this function, select on the display the probe to programmed.

1) does not apply to third-party analog probes.

The unit system (**M**etric or **E**nglish) is factory programmed according to what was specified when the instrument was ordered. The unit system can be changed by the user with the optional HW3 software.

Selections

Parameter	M	E	HygroPalm 1	HygroPalm 2	HygroPalm 3
Dew Point / Frost Point ¹⁾	°C	°F	x	x	x
Wet Bulb Temperature	°C	°F	x	x	x
Enthalpy	J/g	BTU/lb	N/A	x	x
Vapor Concentration	g/m ³	gr/cuft	N/A	x	x
Specific Humidity	g/kg	gr/lb	N/A	x	x
Mixing Ratio	g/kg	gr/lb	N/A	x	x
Vapor Concentration at Saturation	g/m ³	gr/cuft	N/A	x	x
Partial Pressure of Water Vapor	hPa	PSI In Hg	N/A	x	x
Saturation Pressure of Water Vapor	hPa	PSI In Hg	N/A	x	x
Pressure Constant ²⁾ (Barometric Pressure)	hPa	PSI In Hg	N/A	x	x

1) The standard factory setting is frost point for values below freezing. This setting can be changed to dew point with the optional HW3 software (except HygroPalm 1)

2) This selection shows the fixed value that is used for computing the parameters that require barometric pressure as an input. The fixed pressure value can be changed with the optional HW3 software. The HygroPalm 3 can also be programmed to accept the input from a pressure probe (variable pressure value).

DISPLAY

Definition

This function is used to select which parameters are displayed by the instrument. The display mode is specified globally for all probes connected to the instrument.

Selections

- **Measurement**

Relative humidity and temperature or the parameter measured by any third party probe connected to the instrument.

- **Calculated + Temperature**

Calculated parameter (as selected under CALCULATE) and temperature. This selection is not available with third-party probes.

- **Calculated + Humidity**

Calculated parameter (as selected under CALCULATE) and relative humidity. This selection is not available with third-party probes.

ADJUST M.PT (full calibration against a reference environment)

Note: this function is not available with the HygroPalm 1

Definition

The Adjust M.PT function permits the full calibration of any ROTRONIC HygroClip digital probe against a known reference environment. This function is designed to permit calibration at 2 temperature values and at up to 4 relative humidity values.

Selections

The Adjust M.PT function offers the following selections:

RHS: Humidity calibration using the ROTRONIC Humidity Standards ¹⁾
Humidity: Humidity calibration using any suitable reference environment
Temperature: Temperature calibration using any suitable reference environment

1) For humidity calibration, ROTRONIC offers convenient, certified humidity standards to generate known humidity values (for more details, see Appendix 3 - Humidity Calibration).

Procedure

When more than one probe is connected to the instrument, select the probe to be calibrated prior to entering the function (this is the same as the probe that was last displayed).

Regarding the Adjust M.PT function, it is important to observe the following rules:

- a) Always calibrate temperature first (if temperature needs to be calibrated)
- b) When calibrating temperature (2 points), always calibrate at the low value first. The instrument is programmed to use the low temperature value to compute the offset and the high temperature value to compute the gain.

T-low < 70 °C (158°F) : used to compute the calibration offset

T-high ≥ 70 °C (158 °F) : used to compute the calibration gain

For best accuracy, we recommend using a T-low value close to 20°C (68°F). Preferably, the difference between T-high and T-low should be at least 50 °C (90 °F)

When calibrating relative humidity (2, 3 or 4 points) with the ROTRONIC humidity standards, always follow the sequence 35 %RH, 80 %RH, 10 %RH or 5 %RH, 0 %RH. When using a reference other than the ROTRONIC humidity standards, use reference conditions that are within the following brackets and observe the sequence:

>25 %RH...≤55 %RH ¹⁾ : used to compute the calibration offset

>55 %RH ¹⁾ : used to compute the calibration gain

>1 %RH...≤25 %RH : sensor linearity adjustment

≤ 1 %RH : sensor linearity adjustment

The HygroPalm is programmed to automatically recognize these brackets.

1) For best accuracy, we recommend using values close to 35 %RH and 80 %RH

When the probe is at equilibrium with the reference environment, activate the Adjust M.PT function and make the appropriate selections:

- a) **RHS:** press the ENTER key to select this item. The LC display shows the value of the standard (for example 35.0%RH) on the top line and "Humidity RHS" on the message line. Verify that the value agrees with the standard being used. If necessary, change the value of the standard with the UP or the DOWN key. Press the ENTER key when done.

Note: the software automatically compensates for the effect of temperature on the humidity standard. No additional correction is required.

- b) **Humidity or Temperature:** press the ENTER key to select. The LC display shows the value read by the probe at the time the ENTER key was pressed. The word "humidity" or "Temperature" is shown on the message line. Use the UP or the DOWN key to change the humidity or temperature value to match the value of the reference environment. For a faster change, keep the key pressed down. Press the ENTER key when done.

After pressing the ENTER key, the message "sure?" should appear on the LC display. Press ENTER to confirm. Next, the LC display will confirm that the probe adjustment has been successfully completed. At that time, press ENTER to exit or MENU to return to the function Adjust M.PT and do another calibration point.

Carry on in the same manner for each calibration point, following the sequence described above.

Note: you can exit the function at any time (without calibrating the probe) by pressing the MENU key.

ADJUST 1PT (1-point adjustment against a reference environment)

Definition

The Adjust 1PT function permits to do a 1-point adjustment (temperature or humidity) of any ROTRONIC HygroClip digital probe against a known reference environment. This function is limited to a simple offset adjustment that is applied across the entire measuring range.

Warning: a 1-point adjustment is no substitute for a full calibration (2 or more points). Doing a 1-point adjustment can improve accuracy over a narrow range of conditions and may also be detrimental to accuracy at other conditions.

Selections

The Adjust 1PT function offers the following choices:

RHS: Humidity calibration using the ROTRONIC Humidity Standards ¹⁾
Humidity: Humidity calibration using any suitable reference environment
Temperature: Temperature calibration using any suitable reference environment

1) For humidity calibration, ROTRONIC offers convenient, certified humidity standards that generate known humidity values (for more details, see Appendix 3 - Humidity Calibration).

Procedure

When more than one probe is connected to the instrument, select the probe to be calibrated prior to entering the function (this is the same as the probe that was last displayed).

When the probe is at equilibrium, activate the Adjust 1PT function and make the appropriate selections:

- a) **RHS:** press the ENTER key to select this item. The LC display shows the value of the standard (for example 35.0%RH) on the top line and "Humidity RHS" on the message line. Verify that the value agrees with the standard being used. If necessary, change the value of the standard with the UP or the DOWN key. Press the ENTER key when done.

Note: the software automatically compensates for the effect of temperature on the humidity standard. No additional correction is required.

- b) **Humidity or Temperature:** press the ENTER key to select. The LC display shows the value read by the probe at the time the ENTER key was pressed. The word "humidity" or "Temperature" is shown on the message line. Use the UP or the DOWN key to change the humidity or temperature value to the value of the reference environment. For a faster change, keep the key pressed down. Press the ENTER key when done.

After pressing the ENTER key, the message "sure?" should appear on the LC display. Press ENTER to confirm. Next, the LC display will confirm that the probe adjustment has been successfully completed. At that time, press ENTER to exit.

Note: you can exit the function at any time (without calibrating the probe) by pressing the MENU key.

ADJUST REF (1-point adjustment against a reference probe)

Definition

Note: this function is not available with the HygroPalm 1

When two ROTRONIC HygroClip digital probes are connected to the HygroPalm, the Adjust REF function permits to do a 1-point adjustment (both humidity and temperature) of the probe connected to input 1, using the probe connected to input 2 as a reference.

Warning: a 1-point adjustment is no substitute for a full calibration (2 or more points). Doing a 1-point adjustment can improve accuracy over a narrow range of conditions and may also be detrimental to accuracy at other conditions.

Procedure

Prior to entering the function, select the probe to be adjusted (this is the same as the probe that was last displayed). The other probe is automatically the reference probe.

Expose both probes to the same stable environment. Ventilation of the probes is highly recommended. Observe the readings from both probes for complete equilibration with the reference environment .

Press the ENTER key to enter the function. The display asks you to wait for a short time and then shows the temperature and humidity read by the reference probe at the time the ENTER key was pressed. Note that these values are not updated to the display as long as the function is active. The message line of the display shows REF = Probe 2, indicating that probe #2 is the reference.

Press the ENTER key to accept. After pressing the ENTER key, the message "sure?" should appear on the LC display. Press ENTER to confirm. Next, the LC display will confirm that the probe adjustment has been successfully completed. At that time, press ENTER to exit. Note: you can exit the function at any time (without calibrating the probe) by pressing the MENU key.

PROBE

Definition

This function displays the version number and serial number of any ROTRONIC HygroClip digital probe connected to the instrument.

Procedure

Prior to entering the function, select the probe to be displayed (this is the same as the probe that was last displayed). When entering the function, the version number of the probe is displayed first. Use the UP or the DOWN key to display the serial number of the probe.

RS STATUS

Definition

This function displays the network address of the instrument (preceded by a letter indicating the type of instrument) as well as the RS232 configuration: baud rate, parity, number of data bits, number of stop bits.

Procedure

When entering the function, the network address is displayed first. Use the UP or the DOWN key to display the RS232 configuration of the instrument.

SYS STATUS

Definition

This function displays the software version of the instrument, the serial number of the instrument and the user defined name associated with the instrument (entered with the HW3 software).

The SYS STATUS function also permits to turn on and off the battery charge function of the HygroPalm. The battery charge function should always be turned off when the instrument is powered with a regular battery.

Procedure

When entering the function, the software version number is displayed first. Use the UP or the DOWN key to display the other data.

Battery Charge Function: To enable or disable the battery charge function: select Battery and press ENTER. Select Charge Off or Charge On. Press ENTER to effect the change.

Errors and Status Messages

The following is a list of coded messages (101, etc.) that the HygroPalm may show on the bottom line of the LC display.

Errors:		
101	checksum error	the ckecksum test did not pass during RS-communication.
102	bad command	an unknown command was received
103	disallowed command	a command was received that is reserved for production and service
104	unknown probe input	reference was made to a non-existing analog or digital probe input
105	argument error	error in the number of the arguments in the command or in the value of one of the arguments
106	HygroClip communication error	the HygroClip probe does not answer or is not connected
107	calibration error	the difference between the probe reading and the calibration point is larger than the maximum allowed by the INI command.
108	calibration error (overflow)	internal probe error (or the difference between the probe reading and the calibration value is too large)
110	unknown reference probe	the reference probe is not connected or the reference probe input does not exist
111	Temperature error	During humidity calibration, temperature should be within the limits of 0 and 80°C (32 and 176°F)

Warnings:		
120	no adjustment	calibration
121	No HygroClip probe is connected	
Status:		
130	the probe was adjusted	calibration

Remote Control Mode

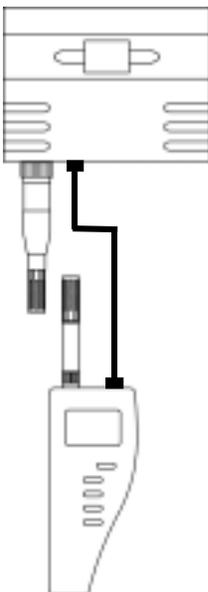
Definition

The Remote Control Mode of the HygroPalm is used in conjunction with the ROTRONIC HygroFlex transmitters, and is especially useful when the transmitter does not have the optional display and keyboard. Depending on the model of HygroPalm, the Remote Control Mode allows the following:

	HygroPalm 1	HygroPalm 2	HygroPalm 3
Display the readings from any probe connected to the transmitter	x	x	x
Display the transmitter status (configuration, serial number, etc.)	N/A	x	x
1-point adjustment of any ROTRONIC HygroClip digital probe connected to the transmitter, using the probe connected to the HygroPalm as a reference	N/A	x 2)	x 2)
Access the functions ¹⁾ of the transmitter, primarily the ADJUST M.PT function - see Functions.	N/A	N/A	x

1) except for CALCULATE and DISPLAY 2) except HygroFlex 1

Procedure



The Remote Control Mode is automatically activated by connecting any probe input of the HygroPalm to the TEST port of the HygroFlex transmitter:

HygroPalm 1: remove the probe and replace it with cable # **AC1621**,
HygroPalm 2 and 3: connect cable # **AC1620** to the second probe input.

As soon as the two instruments are connected, the HygroPalm detects the remote unit and this is indicated by a flashing star on each side of the LC display. At that time, the display of the HygroPalm shows data from the remote unit and can no longer be used to access local data from the HygroPalm. Similarly, the function keys of the HygroPalm control the remote unit and not the HygroPalm itself.

To exit the Remote Control Mode, simply disconnect the two instruments.

Note: using the Remote Control Mode does not disturb the output signals (analog or digital) of the transmitter. The outputs keep being normally updated.

Display Measurements

As soon as the Remote Control Mode is initiated, the HygroPalm displays the measurements from the probe connected to the remote unit. When the remote unit has more than one probe, the probes can be switched with the UP or DOWN key on the HygroPalm.

Functions (except ADJUST M.PT and ADJUST 1PT)

Press the MENU key to access the functions of the remote unit and use the UP and DOWN keys to navigate the function menu. Selections are confirmed by pressing the ENTER key.

Access to the functions depends on the model of HygroPalm. The functions CALCULATE and DISPLAY are generally not accessible in the Remote Control Mode.

See Functions for more details.

Functions ADJUST M.PT and ADJUST 1PT

The functions ADJUST M.PT ¹⁾ and ADJUST 1PT ¹⁾ can be accessed only with the HygroPalm 3. In the remote mode, both the display and the keyboard of the HygroPalm act like if they were the display and keyboard of the remote unit. The definition of these functions and the procedure to be followed are the same as already described under Functions.

1) applies only to the ROTRONIC HygroClip digital probes

Function ADJUST REF (not available with HygroFlex 1)

In the Remote Control Mode, the function Adjust REF can be used to do a 1-point adjustment (humidity and temperature) of any HygroClip probe ¹⁾ connected to a HygroFlex 2 or 3 transmitter against a reference probe. The following choices are available for the reference probe:

- a) REF = PALM: the reference is the probe connected to any probe input of the HygroPalm (the other probe input of the HygroPalm is already used to connect to the TEST port of the transmitter).
- b) REF = TRANS: the reference is always the probe connected to input 2 of the transmitter of the probes connected to the transmitter. Probe #1 will be adjusted to match the reference probe.

1) When no such probe is detected, the message "connect fail" will be displayed.

Press MENU and use the UP or the DOWN key to access Adjust REF from the function menu. Press ENTER to select this function.

After pressing the ENTER key, the display of the HygroPalm shows the relative humidity and temperature data from the reference probe. The message REF = PALM or TRANS should also appear on the LC display. Use the UP or the DOWN key to select one of these two choices. The data on the display is the data read by the reference probe at the time the ENTER key was pressed. This data is not updated while the function Adjust REF is active (see Notes below).

Press the ENTER key to accept the reference data. The message "sure ?" should appear on the LC display. Press ENTER to do the 1-point adjustment of both humidity and temperature or press MENU to abort and exit this process. When the message "Adjust OK" appears, press ENTER to exit.

Notes:

Expose both probes to be to the same stable environment. Ventilation of both probes is highly recommended. Observe the readings from both probes for complete equilibration (this can be done by entering and exiting a few times the function Adjust REF so as to check both probes prior to adjusting).

If the remote unit has a display, the remote display simply repeats the data or commands shown on the display of the HygroPalm.

Environmental Limits

The HygroPalm can operate in the temperature range of $-10..50^{\circ}\text{C}$ ($14...122^{\circ}\text{F}$) and should not be exposed to condensing humidity.

The operating limits at the probe depend on the probe model and are specified separately for each probe.

Maintenance

The HygroPalm should not require any routine maintenance other than replacing the battery. See **appendix 2 and appendix 3** regarding the maintenance of the humidity temperature probes used with the HygroPalm.

Specifications

Operation		9 V alkaline battery 12...15V AC adapter (100 mA) C(+) Tip 9 V rechargeable battery 110 mAh
Max. current consumption		30 mA
Operating limits at electronics		0...99 %RH (non condensing) -10...50°C (14...122°F)
<i>Measured parameters</i> ¹⁾		
relative humidity	indication range	0.0...100.0 %RH
temperature	indication range	-99.9...999.9 °C or °F
barometric pressure ²⁾	indication range	0.000...9999 hPa / PSI / In Hg
<i>Calculated parameters</i> ^{1) 3)}		
dew / frost point ⁴⁾	indication range	-99.9...999.9 °C / °F
wet bulb temperature ⁵⁾	indication range	0.0...100.0 °C / 32.0...212.0 °F
enthalpy ⁵⁾	indication range	-99.9...9999 J/g or BTU/lb
vapor concentration	indication range	0.000...9999 g/m3 or gr/cuft
specific Humidity ⁵⁾	indication range	0.000...9999 g/kg or gr/lb
mixing ratio ⁵⁾	indication range	0.000...9999 g/kg or gr/lb
vapor concentration at sat	indication range	0.000...9999 g/m3 or gr/cuft
part. pressure of water vapor	indication range	0.000...9999 hPa / PSI / In Hg
sat. pressure of water vapor	indication range	0.000...9999 hPa / PSI / In Hg
System accuracy at 23°C/73°F with HygroClip probe & 4-point calibration		± (0.5%RH + 1.5% of reading) ± 0.2°C / 0.4°F
Number of probe inputs	HygroPalm 1	1
	HygroPalm 2 and 3	2
Probe type ⁶⁾	All models	ROTRONIC HygroClip digital probe ROTRONIC analog probe ⁷⁾ Third-party analog probe ⁷⁾
	HygroPalm 3 only	Alphanumerical LC display
Display		RS 232
Serial output (except HygroPalm1)		Automatic Indication
Battery status		Briefly push the ON/OFF Button
HOLD function		ABS
Housing material		230 x 80 x 30 mm (9.05 x 3.15 x 1.18")
Housing dimensions		200 g (0.44 lb)
Weight (w/o probe)		

- 1) Specify engineering units when ordering (can be changed by user with optional HW3 software). See separate probe specifications regarding the different range limits
- 2) Not available with HygroPalm 1 and HygroPalm 2
- 3) Not available with HygroPalm 1. The accuracy of the computed parameter is limited by the accuracy of the measured parameters on which it is based
- 4) The standard factory setting is frost point for values below freezing. This setting can be changed to dew point with the optional HW3 software
- 5) A fixed value is used for the computations of this parameter. The fixed pressure value can be changed by the user with the optional HW3 software. The HygroPalm 3 can also be programmed to accept the input from a pressure probe (variable pressure value)
- 6) Accuracy, repeatability and operating limits are specified separately for each model of probe
- 7) ROTRONIC analog probes: because the HygroPalm cannot read a negative input voltage, temperature measurement with probes having a standard output is generally limited to values above freezing. Third-party probe (pressure or other): linearized voltage output signal within the range of 0..2.5 VDC, supply voltage 7.6...9 VDC (non regulated, direct from HygroPalm battery), 10 mA

Appendix 1: 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 a humidity probe with a portable 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 be noted over short distances. Air movement at the probe generally results in measurements that are both faster and more accurate.

Appendix 2: Maintenance of the ROTRONIC probes

Cleaning or Replacing the Dust Filter of the Probe

Most ROTRONIC probes come with one of the following types of dust filter: (a) protective metal base with a removable filter cartridge or (b) plastic slotted cap with built-in (not removable) filter element.

Depending on the conditions of measurement, the cleanliness of the filter should be checked from time to time. If the probe has a removable filter cartridge, this can be easily removed for cleaning.



If the probe has a plastic slotted cap with a built-in filter element, cleaning should be done without removing the filter from the probe. In that case, do not use detergents, solvents or other strong chemicals. Either brush the filter or use a little bit of clean water.

Corroded, discolored or clogged filters should be replaced. If the probe has a removable cartridge, simply replace the cartridge (leave the metal base on the probe).

If the probe has a plastic slotted cap with built-in filter element follow these instructions:

- 1) Unscrew the filter from the probe and pull it straight away, in the alignment of the probe, so as not to catch the humidity and temperature sensors.
- 2) Before putting on a new dust filter, check the alignment of both sensors with the probe. The wires that connect the sensors to the probe are very thin and bend easily. If necessary, correct the alignment by tapping the sensor very gently with a smooth object such as a small plastic rod. Do not use sharp pliers or tweezers as this could puncture the sensor and do not pull hard on the sensor.

Periodic Calibration Check of the Probes

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.

Both the Pt 100 RTD temperature sensor and associated electronics are very stable and should not require any calibration after the initial factory adjustment. For routine calibration checks, the probe should be verified at one or two values of humidity. For more details, see **appendix 3 - Calibration Basics and Functions – ADJUST M.PT.**

For users who do not want to get involved with field calibrations, our unique probe exchange program offers an attractive alternative. This program takes advantage of the interchangeability of the ROTRONIC HygroClip digital probes. Replacement probes are fully calibrated and are rehabilitated probes with a brand new humidity sensor and filter.

Appendix 3: Calibration Basics

The following choices are available to calibrate the probe(s) used with the HygroPalm:

- a) Calibration using the HygroPalm display and keypad (see Functions).
Note: The HygroPalm 1 can do only a 1-point calibration of the probe.
- b) Calibration using a PC with the optional HW3 software (see separate instructions for the HW3 software) – This choice is available only with the HygroPalm 2 and HygroPalm 3 after connecting the instrument to the COM port of the PC, either directly or via the docking station.
- c) Calibration of the probe alone (removed from the HygroPalm), using a PC with the optional HW3 software and the MOK-WIN calibration cable (see separate instructions for the HW3 software).

Note: the HygroPalm itself should not require any field calibration.

Temperature Calibration

Note: the stability of the Pt100 RTD sensor used to measure temperature is such that temperature calibration in the field is seldom required.

In order to be able to correctly evaluate the accuracy of the temperature measurements provided by the probe, you should be able to meet the following requirements:

- a) Both the probe and a reference thermometer should be ventilated with the same stream of air. Any dust filter used to protect the sensors should be carefully removed from the probe. If the probe has a protective slotted cap, this may be left on the probe.
- b) Air velocity at the sensor should be within the limits of 200 to 500 feet/minute (1 to 2.5 meters/second). Any comparison between two instruments at a velocity under 200 feet/minute may not be valid. Air velocity above 500 feet/minute may damage the unprotected humidity sensor.
- c) The temperature of the air stream should be practically constant.

If you cannot meet the above requirements, you should not attempt to calibrate temperature.

Humidity Calibration

ROTRONIC provides easy-to-use, certified humidity standards for those customer who do not have access to a humidity generator. To use these standards, you will need a calibration device that is suitable for your probe.

Calibration Device

The calibration device is a small airtight container that fits on the probe and seals around the humidity sensor. During calibration, a known reference humidity is produced inside the calibration device by means of a humidity standard (usually an aqueous salt solution).

The following calibration devices are available from ROTRONIC:

ER-15: for 15mm diameter probes

ER-05: for 5mm diameter probes.

Certified Humidity Standards

The ROTRONIC certified standards are available in boxes of 5 glass ampoules of the same value, which can be stored indefinitely. Standards in the range of 5 to 95 %RH are non-saturated aqueous salt solutions that are precisely titrated at our factory for the right concentration. The 0 %RH humidity standard is made of small granules of a highly porous ceramic that have been dried at a high temperature. A Material Safety Data Sheet is available for each standard. Since most standards are a salt solution, parts which have come in contact with the liquid should be cleaned after each use.

Each box of standards comes with a certificate that provides statistical information on the manufacturing batch of the standard. Information on the effect of temperature on each standard is provided on the cover of each box of standard. When calibrating either with the HygroPalm or with the HW3 software, the effect of temperature on the standards is compensated by the software and no further correction is required. The value of the standards is not affected by altitude.

Instructions for using the Standards

- Install the calibration device on the probe so that the receptacle (or solution holder) is under the probe. Check for a tight fit and remove the receptacle from the calibration device.
- Place one fiber disc (each box of standards includes 5 discs) in the receptacle of the calibration device. The purpose of this disc is to prevent accidental spilling of the solution inside the calibration device or on the humidity sensor.
- Tap the top of the ampoule so that all liquid drops to the bottom of the ampoule. Snap off top and empty contents on fiber disc. Since the ampoule is made of glass, exercise proper caution (gloves, safety glasses) when snapping off the top.
- Put the receptacle back on the calibration device and make sure that the solution does not come in contact with the sensor: The solution inside the calibration device should never be on top of the sensors.
- Allow at least 60 minutes to insure that the calibration device, the solution and the sensor are in a state of equilibrium. This is verified by monitoring the display.
- After adjusting the probe, remove the receptacle from the calibration device. Throw away the wet disc (non reusable). Thoroughly wash and wipe dry the receptacle.

General Recommendations

During calibration, temperature stability is the single most important requirement. If possible, calibrate the probe is room temperature (18 to 25°C). Room temperature should be stable to $\pm 0.25^\circ\text{C}$ or better during the period of time required for each calibration point. Do not calibrate close to an air vent or a heater, in direct exposure to sun rays, etc.

If using a humidity generator to calibrate the probe, make sure that the probe is as fully immersed in the generator as possible to minimize temperature effects.

Appendix 4: Humidity Definitions

Relative Humidity

Relative humidity is the ratio of two pressures: %RH = $100 \times p/ps$ where p is the actual partial pressure of the water vapor present in the ambient and ps the saturation pressure of water at the temperature of the ambient.

Relative humidity sensors are usually calibrated at normal room temperature (above freezing). Consequently, it is generally accepted that this type of sensor indicates relative humidity with respect to water at all temperatures (including below freezing).

Ice produces a lower vapor pressure than liquid water. Therefore, when ice is present, saturation occurs at a relative humidity of less than 100 %. For instance, a humidity reading of 75 %RH at a temperature of -30°C, corresponds to saturation above ice.

Dew Point / Frost Point Temperature

The dew point temperature of moist air at the temperature T , pressure P_b and mixing ratio r is the temperature to which air must be cooled in order to be saturated with respect to water (liquid).

The frost point temperature of moist air at temperature T , pressure P_b and mixing ratio r is the temperature to which air must be cooled in order to be saturated with respect to ice.

Wet Bulb Temperature

The wet bulb temperature of moist air at pressure P_b , temperature T and mixing ratio r is the temperature which the air assumes when water is introduced gradually by infinitesimal amounts at the current temperature and evaporated into the air by an adiabatic process at constant pressure until saturation is reached.

Vapor Concentration

The vapor concentration (density of water vapor in a mixture) or absolute humidity, is defined as the ratio of the mass of water vapor M_v to the volume V occupied by the mixture.

$D_v = M_v / V$, expressed in grams/m³ or in grains/cu ft

This can be derived as follows from the equation $PV = nRT$:

a) $M_v = n \times m_w$, where :

n = number of moles of water vapor present in the volume V
 m_w = molecular mass of water

b) $D_v = M_v / V = n \times m_w / V = m_w \times p / RT$, where:

$m_w = 18.016$ gram

p = partial pressure of water vapor [Pa]

$R = 8.31436$ Pa x m³ / °K x mole

T = temperature of the gas mixture in °K

D_v [g / m³] = $p / 0.4615 \times T$

$$1 \text{ gr (grain)} = 0.0648 \text{ g (gram)}$$
$$1 \text{ cu ft} = 0.0283168 \text{ m}^3$$

$$D_v [\text{gr / cu ft}] = 0.437 \times D_v [\text{g / m}^3]$$

Specific Humidity

The specific humidity (also known as mass concentration or moisture content of moist air) is the ratio of the mass M_v of water vapor to the mass ($M_v + M_a$) of moist air in which the mass of water vapor M_v is contained.

$$Q = M_v / (M_v + M_a)$$

$$Q = p m_w / (p m_w + (P_b - p) m_a)$$

$$Q [\text{g / kg}] = 1000 p / (1.6078 P_b - 0.6078 p)$$

$$1 \text{ gr (grain)} = 0.0648 \text{ g (gram)}$$

$$1 \text{ lb} = 0.4535923 \text{ kg}$$

$$Q [\text{gr / lb}] = 7 \times Q [\text{g / kg}]$$

Mixing Ratio by Weight

The mixing ratio r of moist air is the ratio of the mass M_v of water vapor to the mass M_a of dry air with which the water vapor is associated:

$$r = M_v / M_a$$

$$M_v = n \times m_w = m_w \times p V / RT$$

$$M_a = n \times m_a = m_a \times p_a V / RT = m_a \times (P_b - p) / RT, \text{ where:}$$

$$m_w = 18.016 \text{ gram}$$

$$m_a = 28.966 \text{ gram}$$

$$p = \text{partial pressure of water vapor [Pa]}$$

$$p_a = \text{partial pressure of dry air [Pa]}$$

$$P_b = \text{total or barometric pressure [Pa]}$$

$$R = 8.31436 \text{ Pa} \times \text{m}^3 / \text{°K} \times \text{mole}$$

$$T = \text{temperature of the gas mixture in °K}$$

$$r = m_w p / m_a (P_b - p)$$

$$r = 621.97 \times p / (P_b - p) [\text{g / kg}]$$

$$1 \text{ gr (grain)} = 0.0648 \text{ g (gram)}$$

$$1 \text{ lb} = 0.4535923 \text{ kg}$$

$$r [\text{gr / lb}] = 7 \times r [\text{g / kg}]$$

Enthalpy

The enthalpy (or energy content) of moist air at pressure P_b , temperature t (°C) and mixing ratio r (g/kg) is defined by:

$$h [\text{kJ / kg moist}] = 1.00464 t + 0.001846 r \times t + 2.5 r$$

Note: by convention, the enthalpy of dry air ($r = 0$) at 0°C is equal to zero. Negative values of enthalpy are possible and indicate that the energy content of the air / vapor mixture is less than the energy content of dry air at 0°C

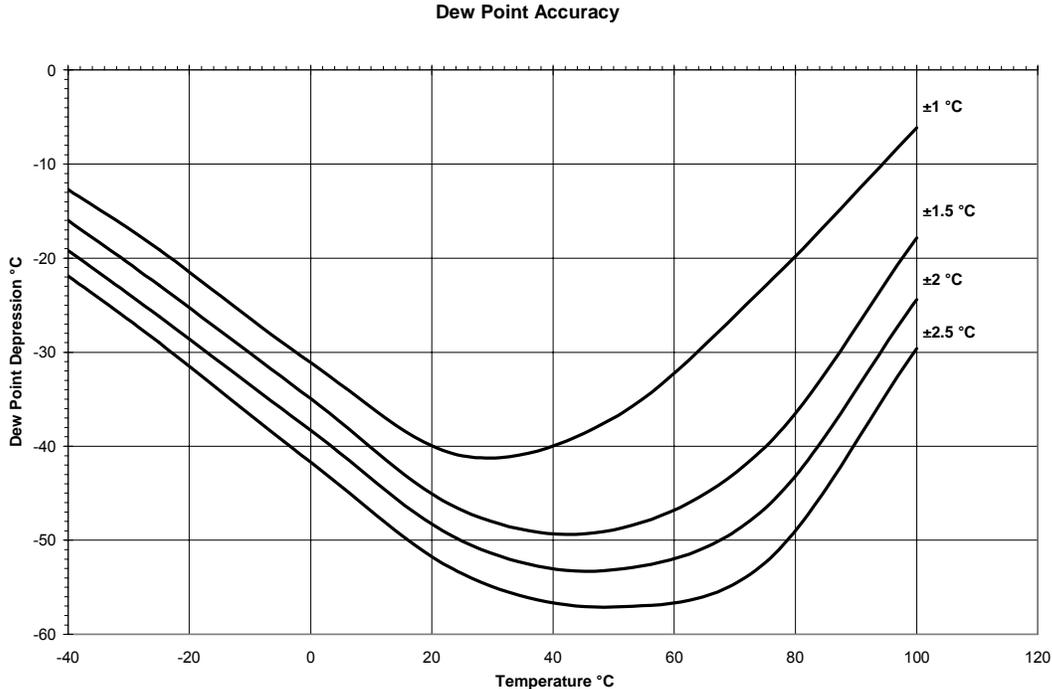
1 lb = 0.4536 kg
1 BTU = 1.05507 kJ

$$h \text{ [BTU / lb]} = 0.4299 \times h \text{ [kJ / kg]} + 7.68$$

The value 7.68 is added to reference enthalpy in BTU / lb to the temperature of 0°F.

Appendix 5: Dew Point Accuracy

The HygroPalm uses the relative humidity and temperature measurements to compute other parameters such as dew point, wet-bulb temperature, mixing ratio, enthalpy, etc. The accuracy of this conversion varies, depending on the humidity and temperature conditions. Typical accuracy for the dew point conversion is provided in the graph below:



The accuracy of the dew point conversion is less than the accuracy that is normally achieved with a chilled mirror instrument. This is especially true at low dew point values (dew point depression of more than -40...-50°C) and at low temperatures. In many applications, repeatability is more critical than accuracy. Repeatability of the dew point conversion is typically 1/3 of the accuracy shown above. Using a dew point conversion permits to measure conditions that cannot be measured with a chilled mirror instrument. Typically, the measuring head of a chilled mirror instrument is limited to a maximum of 70°C and, therefore, cannot measure a dew point temperature above 70°C. In addition to the ability to operate at high temperature, the relative humidity probe offers significant advantages for industrial applications: less maintenance and higher tolerance to contaminants, no sampling system, no uncertainty between dew and frost and better response to fast changing conditions.

Appendix 6: RS232 Communication Protocol

The following describes the RS232 communication protocol that is used by the instruments from ROTRONIC when connected to the COM port of a PC:

Connections

The exchange of data requires 3 wires: TXD (transmit), RXD (receive) and SG (signal ground). When the instrument requires power from the COM port (MOK-WIN), the RTS and DTR wires are also used.

RS232 Settings

Normally, communication is done at the rate of 19200 bps. When there is a large amount of data to be exchanged (file read), the baud rate can be increased to 38400 bps.

In principle, only 7-bit ASCII characters (ASCII 32 to 127) are being used. The exception is File Read, where 8-bit characters are being used.

Normal settings:

Baud rate : 19200
Parity : even
Data bits : 7
Stop bits : 1
Flow Control : none

Force incoming data to 7-bit ASCII.

Data Integrity

- 7-bit characters are sent with a parity bit. 8-bit characters are sent without parity bit.
- Strings (made of 7-bit characters) can be sent with or without checksum at the end of the string. When the checksum is not known – for example: when sending a command - the checksum is replaced by the } character at the end of the string.
- For the transmission of files (8-bit characters), it is planned to use predefined initialization and end-of-communication sets of characters with a checksum.

Communication

Any communications program such as Windows Hyperterminal can be used to read the data on a PC screen. Communication with the instrument is always initiated from the PC. Any string sent from the PC should begin with the { character to start the synchronization. This should be followed by a 1-character product identification (see table below). The address is next (this is a 2-digit number between 00 and 31 used to distinguish between the different instruments, probes, functions etc. that are connected to the PC). The address is followed by a command and by any values or parameters that may be required to carry out the command. Use a carriage return (CR) to terminate the command string.

Example: {U00RDD} + CR (asks instrument U00 to send measurement data)

The instrument answers with a string beginning with the { character, the product identification and the address, followed by the command that was received and any data field that may have been requested by the command. This is followed by a checksum. The length of the string may vary, depending on how much data is included. Since the string itself does not include any information about its own length, a carriage return (CR) is always used to terminate the string.

Example: {U00RDD 0027.50;0023.76;0029.31;0022.77;#M (terminated with CR)

where:

{U00RDD : repeats the command + blank space
 0027.50 : %RH – probe 1
 ; : separator
 0067.17 : °F – probe 1 (temperature unit depends on instrument configuration with HW3)
 ; : separator
 0029.31 : %RH – probe 2 (optional)
 ; : separator
 0064.27 : °F – probe 2 (optional)
 ; : separator
 #M : check sum

Note: Some instruments may insert the \$ character at the second or third position of the string.

1-character Product Identification

ID	Product	Examples (the instrument will answer the following command)
a	A1H	{a00M} + CR
d	I3000, I3000S	{d00zY + CR – assuming the address is 0
d	BT-RS	{d02z} + CR
w	HygroWin	Not Applicable
x	MOK-Win	{x00M} + CR
0	HygroPalm 1	Not Applicable
u	HygroPalm 2	{u00RDD}+CR – assuming the address is 0

ID	Product	Examples (the instrument will answer the following command)
U	HygroPalm 3	{U00RDD}+CR – assuming the address is 0
1	HygroFlex 1	Not Applicable
m	HygroFlex 2	{m00RDD}+CR – assuming the address is 0
M	HygroFlex 3	{M00RDD}+CR – assuming the address is 0
2	HygroLab 1	Not Applicable
b	HygroLab 2	{b00RDD}+CR – assuming the address is 0
B	Reserved	{B00RDD}+CR – assuming the address is 0

CR=Chr(13)

Special Situations

Using address 99 in a data request causes instruments with any address to answer. Address 99 can be useful when trying to communicate with an instrument of unknown address. The address is returned as part of the answer string.

When the product ID is unknown, it can be replaced with a blank in the command. The product ID is returned as part of the answer string.

Example: { 99RDD}+CR

Examples

Data can be read from an instrument directly connected to the COM port of the PC (RS232). The following examples are for the HygroPalm. The same commands can be used for other instruments with similar capabilities by substituting the appropriate values for the product ID and address.

1) read %RH and temperature from the HygroPalm 3 (with 2 HygroClip probes) address 00, directly connected to the PC COM port (RS232):

data request: {U00RDD}+CR

answer: {U00RDD 0025.01;0016.89;0024.57;0019.84;#C

note: 0025.01: humidity probe 1 (%RH)

0016.89: temperature probe 1 (°C as per instrument configuration)

0024.57: humidity probe 2 (%RH), etc.

2) read %RH, temperature and computed parameter

data request: {U00RDD0;}+CR

answer: {U01RDD 0025.90;0015.82;-003.69;0024.47;0019.88;-001.00;S

note: 0025.90: humidity probe 1 (%RH)

0015.82: temperature probe 1 (°C as per instrument configuration)

-003.69: dew point probe 1 (°C as per instrument configuration), etc.

Appendix 7: Accessories for the HygroPalm

Order Code	Description
HygroData-HP	HW3 software (CD ROM) and PC data cable for HygroPalm 2 and 3
PalmDock	Docking station for battery charging and RS232 communication (includes ACA-HP 9VDC adapter)
AC1620	Cable HygroPalm 2 or 3 to HygroFlex
AC1621	Cable HygroPalm 1 to HygroFlex
AC1623	Cable service connector (MTA) HygroPalm 1 to PC
MOK-02-DAT5	Extension cable to remote HygroClip probes with DAT05 connector. Cable length 2 meter (6.5 ft)
MOK-02-B5	Adapter cable for Hygroclip probes with DAT05 connector, compatible with 2 nd probe input of HygroPalm 2 or 3. Cable length 2 meter (6.5 ft)
T7-03-B5	Adapter cable for Hygroclip probes with T7 connector, compatible with 2 nd probe input of HygroPalm 2 or 3. Cable length 3 meter (9.8 ft)
MOKX-03-WIN	Calibration cable for HygroClip probes with DAT05 connector. Terminated with a 25-pin SUB-D connector. Converter 25-pin to 9-pin is supplied. Cable length 3 meter (9.8 ft). 9VDC adapter required (included with cable)
T7-03-WIN	Calibration cable for HygroClip probes with T7 connector. Terminated with a 25-pin SUB-D connector. Converter 25-pin to 9-pin is supplied. Cable length 3 meter (9.8 ft). 9VDC adapter required (included with cable)
EA00-SCS	0%RH humidity std, SCS cert., pack of 5
EA05-SCS	5%RH humidity std, SCS cert., pack of 5
EA10-SCS	10%RH humidity std, SCS cert., pack of 5
EA11-SCS	11%RH humidity std, SCS cert., pack of 5
EA20-SCS	20%RH humidity std, SCS cert., pack of 5
EA35-SCS	35%RH humidity std, SCS cert., pack of 5
EA50-SCS	50%RH humidity std, SCS cert., pack of 5
EA65-SCS	65%RH humidity std, SCS cert., pack of 5
EA75-SCS	75%RH humidity std, SCS cert., pack of 5
EA80-SCS	80%RH humidity std, SCS cert., pack of 5
EA95-SCS	95%RH humidity std, SCS cert., pack of 5
ER-15	calibration device for 15mm dia. Probes
ER-05	calibration device for 5mm dia. Probes
EM-15	calibration device for type 'IE' probes