

HygroClip M33 Series

**3-wire
humidity temperature transmitter
with computed output**

Instruction Manual

v3



Contents

Overview	3
General Description.....	5
Power Requirements	5
HygroClip S Digital Probe	5
Temperature Operating Range and Temperature Limits	5
Humidity Limits	5
Probe Temperature Compensation	6
Configurable Analog Outputs	6
Changing the Type of Analog Signal	7
Changing the Output Parameters, Output Scaling and Unit System	7
Networking.....	8
Installation	8
General Recommendations.....	8
Installation and Wiring of the Base Plate.....	9
Network Configuration and Wiring.....	10
Installation and Removal of the HygroClip S Probe	11
Installation of the Electronics Module.....	12
Maintenance.....	12
Cleaning or Replacing the Dust Filter of the HygroClip S	12
Periodic Calibration Check of the Probe	12
Service Connector	13
Errors and Status Messages	14
Accessories and Options.....	15
Extension cable for the HygroClip S (for use with M33W)	15
Calibration cable for the HygroClip S	15
Service cable	15
Configuration cable.....	16
Probe simulators.....	16
Optional Display	17
HW3 Software	17
Specifications	18
Appendix 1: Practical Advice for Measuring Humidity	20
Appendix 2: Resolution of the Analog Signals.....	20
Appendix 3: Calibration	21
Appendix 4: Remote Mode.....	21
Appendix 5: Humidity Definitions.....	26
Appendix 6: Dew Point Accuracy	29
Appendix 7: RS232 Communication Protocol	30
Appendix 8: Accessories for the M33 Series	33

Version number: this manual is valid for instruments of version number 3.x, where 3.x can be 3.0, 3.1, etc. (see Function Menu, SYS STATUS). Changes in the last digit of the version number reflect minor changes in the internal software of the instrument that do not affect the manner in which the instrument should be operated.

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 HygroClip M33 series are 3-wire humidity temperature transmitters designed for use in industrial and scientific applications within the temperature limits of -40 to 85°C (-40 to 185 °F) at the probe. Humidity and temperature are measured with the HygroClip S digital plug-in probe. From these two values, the M33 series can compute a variety of psychrometric parameters such as dew point, enthalpy, mixing ratio, etc. The combination of microprocessor based electronics and digital probe, provides the M33 with unparalleled accuracy, stability and versatility.

Main Features:

- relative humidity, temperature, dew point (or wet bulb, mixing ratio, enthalpy, etc) or user defined calculation such as the difference between temperature and dew point ¹⁾
 - fully interchangeable ROTRONIC HygroClip S digital plug-in probe
 - software-based probe calibration and transmitter configuration (except output signal type)
 - two linearized analog outputs, signal type (mA, V) configurable by means of solder pads ²⁾
 - test connector for communication with a PC (RS232) ³⁾ or with the HygroPalm 3 indicator ⁴⁾
 - optional LC display
 - Networkable through RS485 digital port ⁵⁾
- 1) a fixed barometric pressure value is used for those computed parameters that require pressure as an input. The pressure value can be changed with the optional HW3 software.
 - 2) 0..1V, 0..5V, 0..10V, 0..20 mA, 4..20 mA - corresponding to any two of relative humidity, temperature and computed parameter
 - 3) allows configuration and calibration of the transmitter with a PC
 - 4) allows the HygroPalm 3 to read and / or calibrate the transmitter
 - 5) requires the use of another instrument (such as the HygroFlex 3) to establish an RS232 connection with the COM port of a PC and the conversion to RS485. Thereafter, up to 31 HygroClip M33 transmitters can be connected to the network. Use of the HW3 software on the PC facilitates both networking and instrument configuration

The M33 series features a unique installation method that is both convenient and problem free. Each M33 series transmitters includes a base plate and a plug-in electronics module. During installation, the base plate is mounted first and wired without the electronics module. This is done at the same time as general electrical work. During that time, the electronics module and probe can safely be stored away.

The M33 series was designed for simple field maintenance and to minimize any downtime:

- Operation of the M33 transmitter can be easily verified in the field by connecting a HygroPalm 3 indicator to the M33 service connector. This is done without interrupting the output signals. Probe simulators are also available to validate the entire measuring loop.
- Calibration is entirely digital, without any potentiometer. In addition, the HygroClip S digital probe is 100% interchangeable: calibration data, sensor characteristics, serial number, etc. are retained within a non-volatile memory. Should the probe require maintenance, it can be replaced in seconds without any

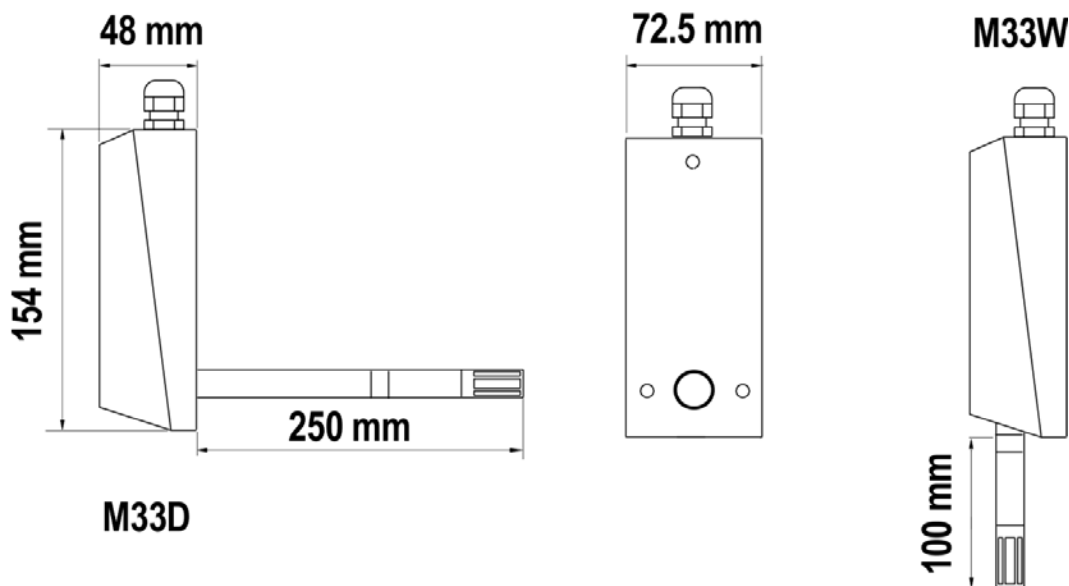
loss of accuracy and without requiring a recalibration of the M33 transmitter. ROTRONIC offers easy-to-use software and accessories for in-house calibration of the HygroClip S. If you do not wish to calibrate, or if the HygroClip S has to be replaced, use our unique exchange program. This plan is supported by the ROTRONIC worldwide distribution network. The replacement probe is either a brand new HygroClip S or a reconditioned probe with a brand new humidity sensor and dust filter.

- Should the electronic module develop a problem, it can easily be removed from the base plate and replaced with another module without any wiring work.

The M33 series is available in the following configurations:

Model	Measurement	Circuit Type	Installation
M33W	%RH + Temperature	3-Wire	Wall mount (surface) or remote probe ^{*)}
M33D	%RH + Temperature	3-Wire	Duct mount (through Wall)

^{*)} remote probe requires an extension cable (see accessories)



General Description

Power Requirements

The M33 series operates with 15 ... 35 VDC (maximum 65 mA) or with 24 VAC.

HygroClip S Digital Probe



HygroClip S

operating range -40 to 85°C (-40 to 185°F)
wire mesh filter ¹⁾
length: 100mm (3.9"), d: 15mm (0.6")

1) Special environments may require using a foam filter (consult ROTRONIC).

M33W



The HygroClip S measures relative humidity with a ROTRONIC HYGROMER™ C94 capacitive humidity sensor. This well proven sensor offers exceptional durability and stability in all kinds of environments. Temperature is measured with a precision RTD Pt100 sensor.

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

With the M33W (wall mount model), the probe can be separated from the transmitter with extension cable MOK-xx-DAT05: (xx = 2 or 5 meters / 6.5 or 16.4 ft). The maximum separation is 5 meter.

Temperature Operating Range and Temperature Limits

The M33 series can operate within -40 to 60°C (-40 to 140°F) at the electronics. Units with the optional LC display operate within -30 to 60°C (-22 to 140°F)

The temperature operating range of the HygroClip S probe is -40...85°C (-40...185°F).

Operating the transmitter and/or its probe outside of the temperature limits can result in permanent damage.

Humidity Limits

As far as possible, avoid sudden condensation at the sensors. When measuring at high humidity, condensation may occur on the humidity sensor due to a sudden difference in temperature with the environment. This does not damage the sensor. However, this will produce an overflow reading (an output signal of more than 100 %RH) for as long as condensation is present on the humidity sensor.

Probe Temperature Compensation

Practically every make of relative humidity sensor requires a compensation for the effect of temperature on the humidity output signal in order to measure accurately over a wide range of temperature conditions. In the specific case of an instrument using a capacitive sensor, compensation is required because the dielectric characteristics of both the water molecule and the hygroscopic polymer used in the sensor vary with temperature.

The HygroClip S probe uses the temperature data from the Pt100 RTD to provide automatic compensation for the effect of temperature on the humidity sensor. The temperature compensation uses normal room temperature as a reference. Because of this, calibration of the HygroClip S is done at normal room temperature rather than at the temperature of operation at the sensor.

Configurable Analog Outputs

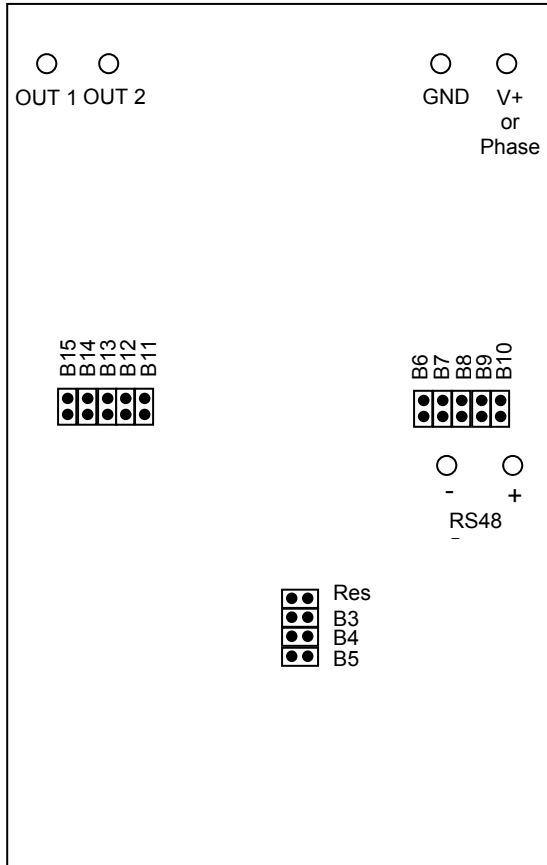
The two analog outputs of the M33 series (OUT 1 and OUT 2) are factory configured depending on the parameters, output scaling and unit system specified when ordering (see identification labels (a) on shipping box and (b) inside electronics module under the printed circuit board). A common combination of output signals is temperature and dew point.

The analog output signals are linear and are consistent with the requirements of most data/signal processing instrumentation (panel meter, controller, computer card, etc.).

analog outputs ¹⁾	Two analog outputs corresponding to any combination of the following: - relative humidity - temperature - computed parameter (dew point, etc.) or user defined calculation
output signals ²⁾ configurable with solder pads	0...1 V 0...5 V 0...10 V 0...20 mA 4...20 mA
D/A output resolution ³⁾	Output 1: 13-bit Output 2: 16-bit

- 1) *The M33 is set at the factory as specified when ordering. These settings can be changed with the optional HW3 software.*
- 2) *Both outputs provide the same type of signal (4 .. 20 mA or 0 ..5 V, etc.). The output signals are set at the factory according to the type and range specified when ordering. The type of signal can be changed with the solder pads located on the M33 circuit board.*
- 3) *In order to ensure proper resolution and stability of the analog signal, we recommend not to exceed a span of 280 to 300 units when scaling output 1.*

Changing the Type of Analog Signal



The **type of output signal** is the same for both outputs and can be selected by means of solder pads located on the PCB of the electronics module.

The solder pads are accessible after separating the electronics module from the base plate.

Solder Pad Settings														
	B3	B4	B5	Res	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
0 .. 1V	X			X	X				X	X			X	
0 .. 5 V		X		X		X			X		X		X	
0 .. 10V	X	X					X		X			X	X	
0 .. 20 mA			X	X	X			X		X				X
4 .. 20 mA	X		X		X			X		X				X

Changing the Output Parameters, Output Scaling and Unit System

The parameters corresponding to output 1 and 2, the scaling of each output and the unit system (metric or English) can be reconfigured by the user. Reconfiguration requires a PC with the Rotronic HW3 software installed as well as service cable ACML232 (see **Accessories**) to connect the service connector of the transmitter (see **Maintenance**) to the COM port of the PC.

Instructions are provided in a separate manual which is on the HW3 CD.

Networking

Up to 32 transmitters can be connected to a network. The master - (unit 0) - is the unit that is directly connected to the COM port of the PC by means of the RS232 port. The master is normally not an M33 transmitter (the only RS232 port of the M33 is the service connector). For the master, we recommend using either a HygroFlex 2 or HygroFlex 3. Some planning is required before connecting the transmitters on a network: each unit on the network must be given a unique network address with the HW3 software (0 to 31). See Network Configuration and Wiring for details.

Installation

Do not unnecessarily remove the dust filter that protects the sensors on the HygroClip S probe. The sensors can easily be damaged when not protected.

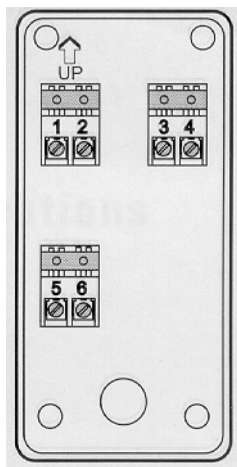
General Recommendations

Relative humidity is extremely dependent on temperature. Proper measurement of relative humidity requires that the probe and its sensors be at exactly the temperature of the environment to be measured. Because of this, the location where you choose to install the probe can have a significant effect on the performance of the instrument. The following guidelines should guarantee good instrument performance:

- a) **Select a representative location:** install the probe where humidity, temperature and pressure conditions are representative of the environment to be measured.
- b) **Provide good air movement at the probe:** air velocity of at least 200 ft/ minute (1 meter/second) facilitates adaptation of the probe to changing temperature.
- c) **Avoid the following:** (1) Close proximity of the probe to a heating element, a cooling coil, a cold or hot wall, direct exposure to sun rays, etc. (2) Close proximity of the probe to a steam injector, humidifier, direct exposure to precipitation, etc. (3) Unstable pressure conditions resulting from excessive air turbulence.
- d) **Immerse as much of the probe as possible in the environment to be measured.**
- e) **Prevent the accumulation of condensation water at the level of the sensor leads.** Install the probe so that the probe tip is looking downward. If this is not possible, install the probe horizontally.

Installation and Wiring of the Base Plate

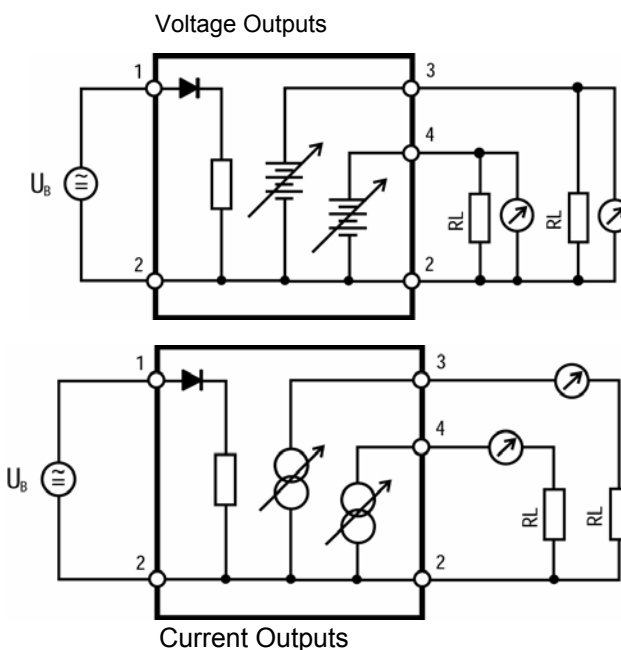
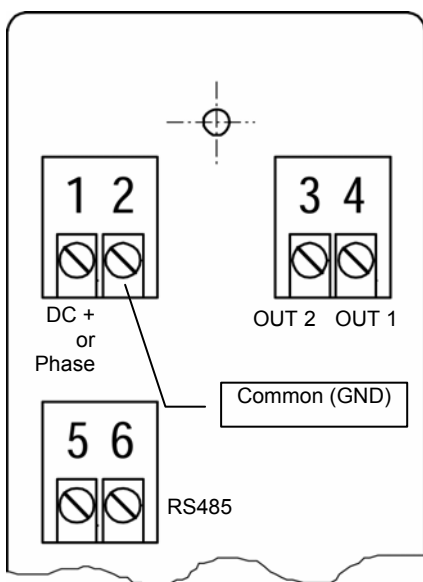
The base plate should be installed first, using screws with an approximate diameter of 5/32".



Installation Note (through wall installation)

You may want to provide an orifice at a distance of about 3" from the probe of the transmitter for future use by a reference probe and HygroPalm indicator.

The base plate of the M3 transmitter is supplied with one sealing cable grip (normally, the base plate is installed with the cable grip on top). This cable grip provides effective sealing only with cables having the proper outside diameter. Preferably, use a cable with an outside diameter of 0.236 to 0.275 inch (6 to 7 mm) and with 18 AWG wires. Avoid running the cables connecting the unit in the same conduit as 110 VAC power cables. Depending on the installation, you may have to use a cable with twisted pairs or a shielded cable to avoid electromagnetic interference.



Base Plate Terminals	Description
1	10...35 VDC (+) or 24 VAC
2	common (-) ¹⁾
3	OUT 2 (+)
4	OUT 1 (+)
5 (+) and 6 (-)	RS485 ²⁾

1) We generally recommend grounding, especially if the electronics will be subjected to a low humidity environment (35 %RH or less).

2) for further instructions, see Network Configuration and Wiring

In order to determine the maximum length of cable that can be used to connect the transmitter to other devices, the first step is to find out what is the resistance per unit of length of the cable that you plan on using.

- Current outputs: the maximum permissible cable length, connecting the unit to other devices, is determined by the total resistance resulting from the addition of the cable resistance and that of the devices connected in series with the unit. This resistance should not exceed 250 ohms.
- Voltage outputs: the maximum cable length can be determined under consideration of the voltage drop caused by the current flowing to the devices connected to the unit. The voltage drop in the cable depends both on cable resistance and on the equivalent resistance of the devices connected in parallel to the unit. The total resistance connected to each unit output must at least be equal to 1000 ohms. Cable resistance should not be more than 1/1000 of the load resistance.

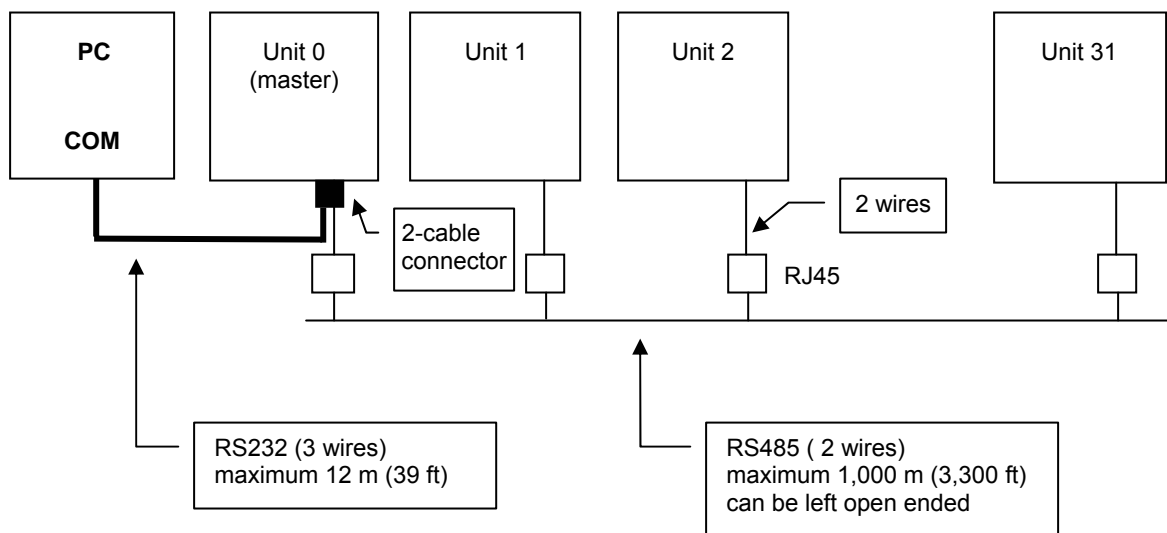
Network Configuration and Wiring

Up to 32 transmitters can be connected to a network. The master (unit 0) is always the unit that is connected to the COM port of the PC by means of the RS232 port. Since the M33 transmitter does not have RS232 terminals, the master unit is normally not an M33 transmitter (unless RS232 communication with the PC is established with the service connector). For the master, we recommend using either a HygroFlex 2 or HygroFlex 3. Some planning is required before connecting the transmitters on a network since each unit on the network must be given a unique network address with the HW3 software (0 to 31).

The RS232 connection between the first unit on the network and the PC requires 3 wires: RX, TX and GND¹⁾. Without a signal booster, our recommendation is to limit the maximum cable length to 12 m (39 ft). It may be possible to use up to 150 m (490 ft) of cable, but this not guaranteed.

1) GND is internally connected to the power ground of the transmitter

The RS485 wiring can be done with a twisted pair (2-wire, telephone type). During installation, it may be convenient to connect terminals 5 and 6 of the M33 base plate to a wall mounted RJ45 receptacle. No shielded cable and no terminator should be required for the RS485 wiring.



A 2-cable, 5-pin connector is supplied with the HygroFlex 2 or 3 transmitter (master) - see HygroFlex instruction manual. On the HygroFlex, both the RS232 and RS485 wiring share this connector. Be sure to observe the polarity for each connection.

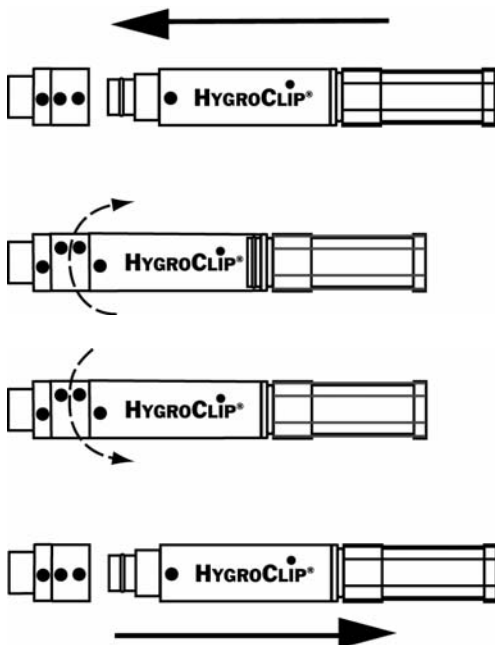
Prior to networking, each transmitter should be individually configured with the HW3 software (see separate instructions on the HW3 CD ROM). Proceed as follows:

- 1) Connect each transmitter, including the master, one at a time to the COM port of the PC (for the M3 transmitter, this can be done with the service connector and cable ACML232)
- 2) **Assign to each transmitter a unique network address** (a number between 0 and 31). By default, all transmitters are shipped by the factory with address 0.

Note: if you assign address 1 to the first transmitter, you can connect a second transmitter (with the 0 default address) to the network and then use the network to directly change its address from 0 to 2. Proceed in this manner to add more transmitters one at a time, using addresses 3, 4, 5, etc.

- 3) For easier identification, you may also want to give at that time a descriptive name (maximum 30 characters) to each transmitter.

Installation and Removal of the HygroClip S Probe



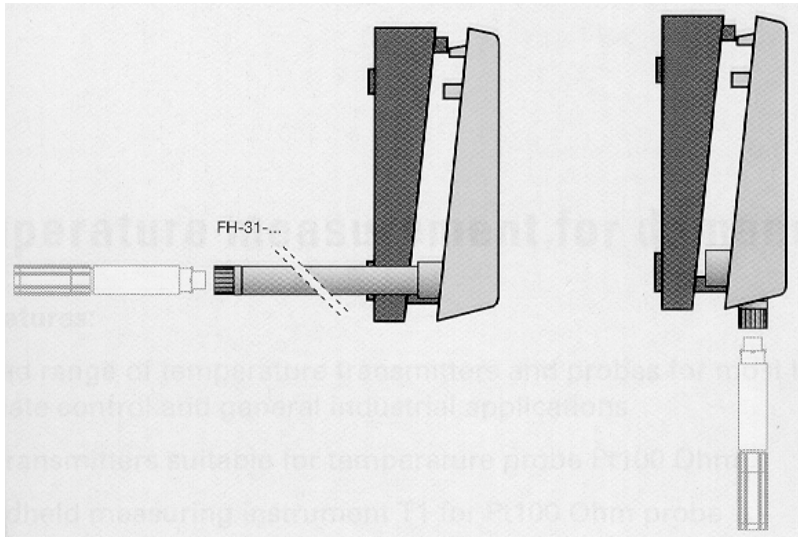
Both the HygroClip S and the base of the connector on the transmitter are marked with a dot. The locking ring is marked with 2 dots.

The probe can be inserted straight into the connector (or removed from the connector) when all dots are aligned. If necessary, rotate the locking ring to align the 2 dots of the ring with the dot at the base of the connector.

WARNING: do not rotate the HygroClip as this may damage the connector.

After inserting the probe, turn the locking ring clockwise to secure the probe.

Installation of the Electronics Module



Once the base plate has been installed and wired, the electronics module can be inserted and secured with the screws provided. The transmitter is ready to operate.

Maintenance

Cleaning or Replacing the Dust Filter of the HygroClip S

The dust filter should be cleaned from time to time, depending on the conditions of measurement. Cleaning should be done without removing the filter from the probe. Clean the filter with a fine brush. If this is not sufficient, the filter should be replaced. To do this, unscrew the filter from the probe.

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 need be, correct the alignment by holding the sensor very gently with a pair of small flat nosed pliers.

Periodic Calibration Check of the Probe

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.

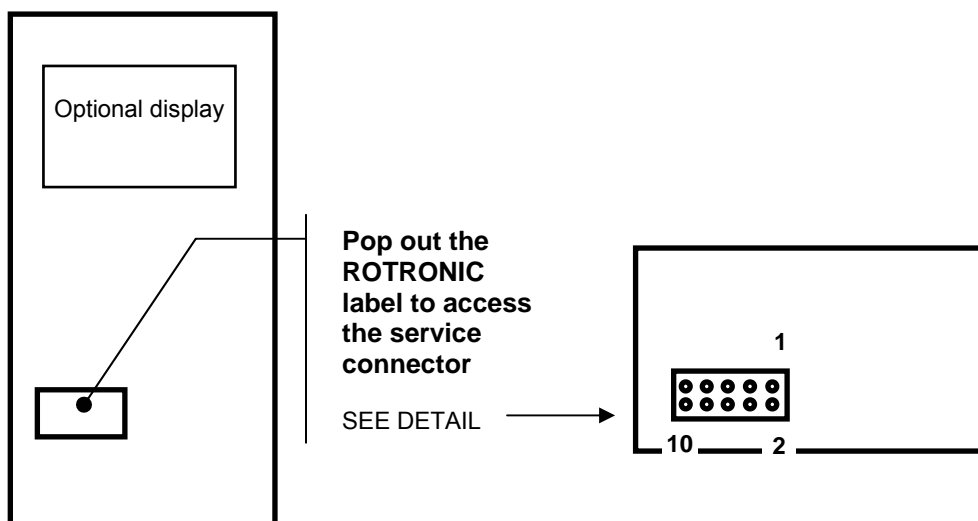
Both the Pt 100 RTD temperature sensor and associated electronics are very stable and should not require any calibration after the initial factory adjustment.

For routine calibration checks, the probe should be verified at one or two values of humidity. For more details, see **Appendix 3 - Calibration** and **Appendix 4: Remote Mode – ADJUST M.PT, ADJUST 1PT and ADJUST REF.**

Note: the electronics module of the M33 transmitter should not require any field calibration and it can be easily validated by using a probe simulator (see **accessories and options**). The electronics module cannot be serviced in the field and should be returned to the factory if there is any problem.

Service Connector

Transmitters of the M33 series feature a keyed 10-pin service connector. Depending on the model of connecting cable, the service connector is used to connect the M33 transmitter to the COM port of a PC (instrument configuration, etc.) or to one of the probe inputs of the HygroPalm 3 indicator (see Remote Mode).



Service Connector Pin #	Wire Color	Signal
1		OUT 2 Lo ¹⁾
2		OUT 2 Hi ¹⁾
3		OUT 1 Lo ¹⁾
4		OUT 1 Hi ¹⁾
5		Ground
6		V ⁺ (power to service cable)
7		TX (RS232)
8		GND
9		RX (RS232)
10		DIO

1) see note below:

Voltage outputs: pins 1 and 2 have the same voltage to ground and this is equal to the voltage of output 2 (same for pins 3 and 4 and output 1).

Current Outputs: pins 1 and 2, as well as pins 3 and 4, are connected to each side of a precision 49.9 ohm resistor (0.1 %) which is in series with the output current. In the case of a 4 ... 20 mA current output the voltage measured across pins 1 and 2 (or pins 3 and 4) is within the range of 200 ... 998 mV

In both cases, the signals can be measured with a DVM.

For cables matching the service connector, see **Accessories and Options – Service cable and Configuration cable**.

Errors and Status Messages

The following is a list of coded messages (101, etc.) that may appear on the bottom line of the optional LC display or on the PC screen when the M33 is connected by way of the service connector.

Errors:		
101	checksum error	the checksum 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)

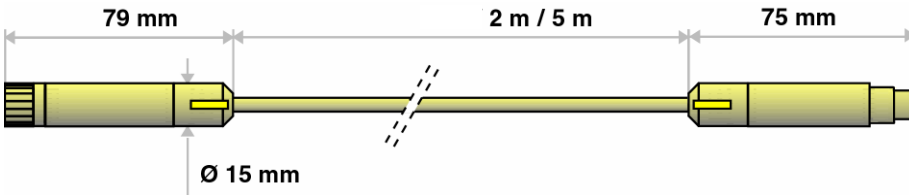
Warnings:		
120	no adjustment	calibration
121	No HygroClip probe is connected	

Status:		
130	the probe was adjusted	calibration

Accessories and Options

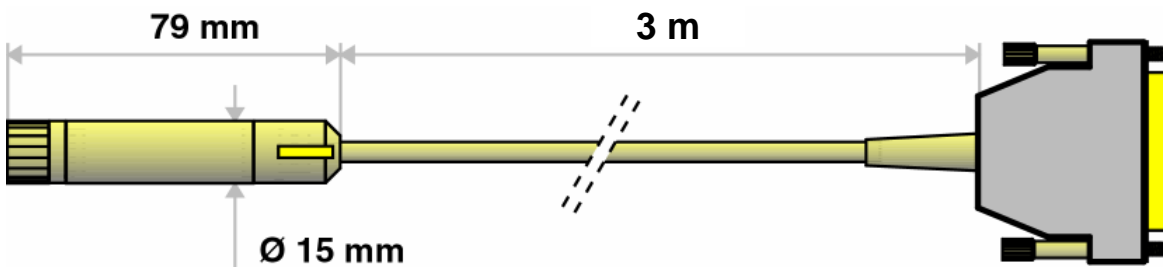
Extension cable for the HygroClip S (for use with M33W)

- MOK-xx-DAT05: (xx = 2 or 5 meters)



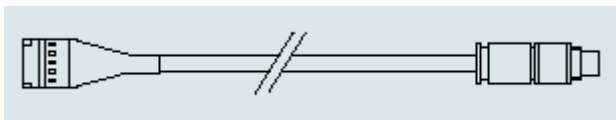
Calibration cable for the HygroClip S

The MOK-03-WIN cable is used to connect the HygroClip S probe to the COM port of a PC. This cable is shipped together with the ROTRONIC HW3 software (see further down) which is used to read and calibrate the probe from the PC, independently of the M33 transmitter.

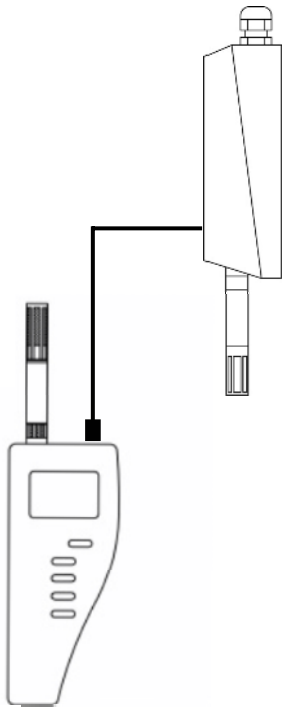


For customers who do not have a humidity generator, ROTRONIC offers a wide range of certified humidity standards and a calibration chamber that fits the HygroClip S.

Service cable



Service cable ACRLXB5 is used to connect the service connector of the M33 transmitter to probe input 2 of the HygroPalm 3 portable indicator. As soon as the two instruments are connected, the HygroPalm detects the transmitter and enters in the “remote mode” (see Appendix 4). The remote mode is indicated by a flashing star on each side of the HygroPalm LC display.



The ACRLXB5 service cable allows to do any of the following:

a) Display locally the signals of the M33 transmitter with the HygroPalm 3. This makes it possible to validate the entire measuring loop: probe, transmitter, wiring and central processing unit. If so desired, the HygroClip probe can be replaced with a certified probe simulator that generates known fixed humidity and temperature values.

Note: the HygroPalm should be configured to read temperature in the same unit as the M33 transmitter. This can be done directly on the HygroPalm.

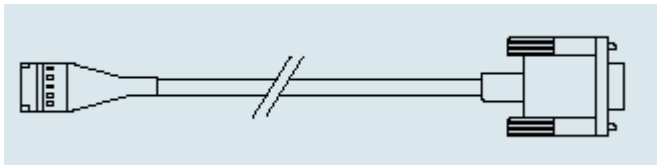
b) 1-point adjustment of the HygroClip S probe with the HygroPalm 3 or single/multi-point adjustment against a reference environment.

A 1-point adjustment can be done against a reference probe connected to probe input 1 of the HygroPalm. See separate HygroPalm manual for detailed instructions.

A known reference environment is required for a multi-point adjustment. In that case it is not necessary to connect a reference probe to the HygroPalm. See separate HygroPalm manual for detailed instructions.

Note: both probe inputs of the HygroPalm should be configured for a digital HygroClip probe.

Configuration cable



Cable ACML232 is used to connect the service connector of the M33 transmitter to the COM port of a PC on which the HW3 software has been installed. The cable has a SUB D9 connector on the PC side. HW3 allows programming the M33 such as for example changing the unit system and the range of the output signals. Changing the type of analog signal is done with solder pads located on the M33 circuit board.

Probe simulators

For validation purposes, a probe simulator can be plugged in place of the HygroClip S probe to generate fixed humidity and temperature values. In principle, any combination of humidity and temperature can be ordered. The following are some of the most common combinations:

HygroClip S35/25: 35%RH and 25°C (77°F).

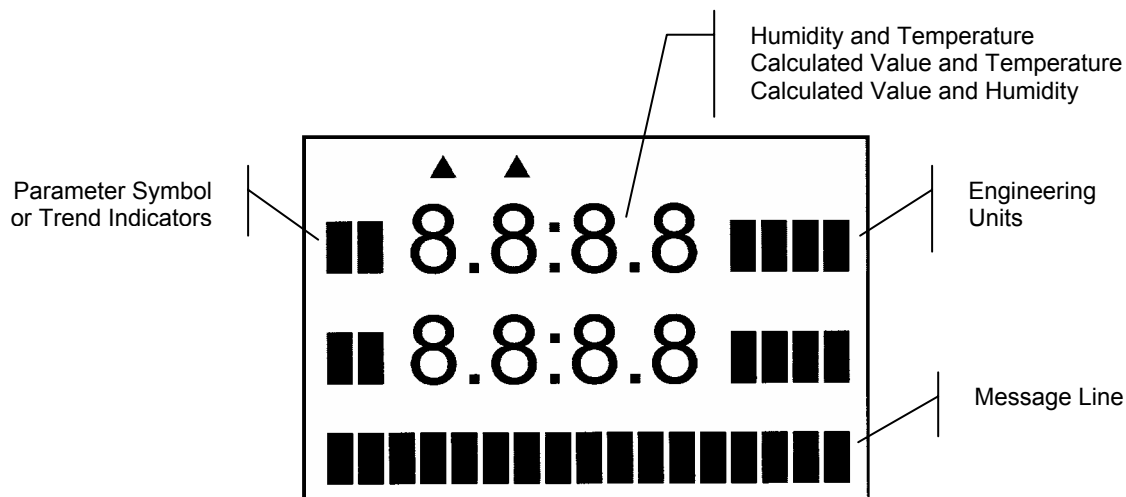
HygroClip S50/25: 50%RH and 25°C (77°F).

HygroClip S80/25: 80%RH and 25°C (77°F).

Like the HygroClip S probe, the probe simulators provide both digital and analog output signals. Prior to shipment, the digital signal is verified with the validated HW3 software and the analog outputs are verified with a traceable voltmeter.

Optional Display

The LC display shows the 2 parameters measured by the probe, with the associated engineering unit, or the computed parameter and one of the measured parameters. When relevant, the message line provides additional information.



HW3 Software

In principle, any communication software can be used to interrogate and read the M33 with the commands described in appendix 6 (RS232 communication protocol). Use of the optional HW3 software simplifies this task while providing additional functionality such as:

- instrument configuration (unit system, computed parameter, output scaling, etc.)
- calibration of the ROTRONIC HygroClip digital probes with the MOK-03-WIN cable
- display of the networked instruments on a table (up to 32 units)
- data logging to a PC disk file
- graphic functions (both on and off-line)

The requirements for using HW3 are as follows:

PC	Pentium 233MHz or better
Windows®	95/98, Me, XP or NT or 2000®
Memory	64MB
Disk Space	20MB free
Drives	CD ROM drive required
Monitor	VGA or Super VGA
Resolution	1024 x 768 or higher (set to small fonts) High Color 16Bit (256 Color minimum)
COM Port	RS232 (COM 1-4)
Software	HW3 (includes - MSIE 4.0 Browser - Adobe® Acrobat Reader) MS Internet Explorer: for best viewing, set fonts to smallest

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

Specifications

Operating Voltage		15 to 35 VDC / 65 mA max. or 12 to 24 VAC
Operating limits at electronics	w/o LC display with LC display	0...99 %RH (non condensing) -40...60°C (-40...140°F) -30...60°C(-22...140°F)
<i>Measured parameters</i> ¹⁾		
relative humidity	typical range indication range	0...100 %RH 0.0 to 100.0 %RH
temperature	typical ranges indication range	0...100 °C, 0...50°C, -30...70°C 0...100 °F, 0...200°F, -50...150°F -99.9 to 999.9 °C or °F
<i>Calculated parameters</i> ¹⁾²⁾		
dew / frost point ³⁾	typical range indication range	same as temperature -99.9 to 999.9 °C or °F
wet bulb temperature ⁴⁾	typical range	same as temperature, (no value below freezing)
enthalpy ⁴⁾	indication range typical range indication range	0.0 to 100.0°C / 32 to 212.0°F -50...150 kJ/kg or -50..150 BTU/lb -99.9 to 9999 kJ/kg or BTU/lb
vapor concentration	typical range indication range	0...500 g/m3 or 0...250 gr/cuft 0.000 to 9999 g/m3 or gr/cuft
specific humidity ⁴⁾	typical range indication range	0...500 g/kg or 0...4000 gr/lb 0.000 to 9999 g/kg or gr/lb
mixing ratio ⁴⁾	typical range indication range	0...500 g/kg or 0...4000 gr/lb 0.000 to 9999 g/kg or gr/lb
vapor concentration at saturation	typical range indication range	0...500 g/m3 or 0...250 gr/cuft 0.000 to 9999 g/m3 or gr/cuft
part. pressure of water vapor	typical range indication range	0...500 hPa / 0...10 PSI / 0...20 InHg 0.000 to 9999 hPa / PSI / InHg
sat. pressure of water vapor	typical range indication range	0...500 hPa / 0...10 PSI / 0...20 InHg 0.000 to 9999 hPa / PSI / InHg
System accuracy at 23°C/73°F with HygroClip S probe & 4-point calibration		± 1.5% RH ± 0.3°C / 0.5°F
Number of probe inputs		1
Probe type		ROTRONIC HygroClip S digital probe
Analog outputs (scalable)		2: any combination of relative humidity, temperature and computed parameter ⁵⁾ (dew point or other)
Analog signals (user selectable)		0...1V, 0...5V, 0...10V 0...20 mA, 4...20 mA
Minimum load for voltage outputs		1000 ohm
Maximum load for current outputs		250 ohm

Serial output ⁶⁾		RS232 (service connector) RS485 (terminals 5 and 6 on base plate)
Electrical Connections	power / outputs probe input	cable grip and terminals ⁷⁾ connector alphanumeric, 0.000...9999 ABS 154 x 72.5 x 48 mm (6.06 x 2.86 x 1.89") 292 g (10.3 oz) IP65 / NEMA 4
Optional LC display		
Housing Material		
Housing Dimensions (w/o probe)		
Weight		
Protection grade		

- 1) The range of the output signal may be different from the application limits of the product. These are 0 to 100%RH and -40 to 85°C / -40 to 185°F at the probe. Specify engineering units and range when ordering (both can be changed by user with optional HW3 software).
- 2) The accuracy of the computed parameter is limited by the accuracy of the measured parameters on which it is based
- 3) The standard factory setting is frost point for values below freezing. This setting can be changed to dew point with the optional HW3 software
- 4) A fixed barometric pressure value is used for the computations of this parameter. This value can be changed by the user with the optional HW3 software.
- 5) To maintain adequate resolution of the analog outputs, the span of the computed parameter should be determined under consideration of the D/A resolution of the corresponding analog output (13-bit for output 1 and 16-bit for output 2).
- 6) RS485 network: requires the first transmitter to be connected to the RS232 COM port of a PC. Since the M33 transmitter does not have RS232 terminals, use a HygroFlex 2 or 3 as the first transmitter.
- 7) Recommended cable for cable grip: 7..9 mm diameter (0.275..0.354") with 18 AWG wires. Cable for output signals should preferably be shielded.

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 the probe is mounted through a wall, avoid temperature errors by inserting as much of the probe as possible in the environment to be measured. Whenever there is a large temperature difference across the wall, you may have to insert not only the probe itself but also some of the probe cable (cables do conduct temperature).

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: Resolution of the Analog Signals

The HW3 software allows to define the range of the analog output signals of the M33 transmitter. When selecting a range, it is important to consider the fact that the resolution of the analog output signal depends on the span of the selected range.

a) Output 1: the M33 uses a 13-bit D/A converter to generate the analog output signal for output 1 and a 16-bit D/A converter for output 2. In theory, a 13-bit D/A converter can distinguish between 8,192 values (or counts). This number of counts, together with the span of the signal (%RH, °C, etc.), determines the resolution of the analog output signal.

Because of the tolerance in the analog components associated with the D/A converter, the number of counts that are effectively used tends to be less than the theoretical maximum. Typically, only about 90% of the counts (7,370) may be effectively used.

In addition, the analog output signal itself may be a partial range. For example, 4...20 mA is a partial range of 0...20 mA. With a 4...20 mA output signal, the number of useful D/A counts is further reduced by 20% ($1 - 16/20$) and only 72% of the count (5,900 counts) may be effectively available.

Taking the example of a 4...20 mA output, the span of the analog signal should not exceed 280 to 300 units (for example a mixing ratio of 0...300 g/kg) to maintain a resolution of 0.1 unit. With analog signal such as 0...5V or 0...20 mA, a maximum span of 360 units may be used.

The above examples are based on a resolution of 0.05 units as this prevents the analog output signal from bouncing around by ± 0.1 units.

b) Output 2: the 16-bit D/A converter used for output 2 is more than sufficient to offer 0.1 resolution for any range and any type of analog signal available with the M33 transmitter.

Appendix 3: Calibration

The following choices are available to calibrate the probe used with the M33 transmitter:

a) Calibration of the probe connected to the M33 transmitter:

This requires a HygroPalm 3 indicator and service cable ACRLXB5 (see accessories – service cables).

Power up the M33. Connect cable ACRLXB5 to the service connector of the M33 and to probe input 2 of the HygroPalm 3. This automatically triggers the remote mode of the HygroPalm (see Appendix 4: Remote Mode). When in the remote mode, select probe 1 on the display of the HygroPalm. In the remote mode, the HygroPalm displays the readings of the probe connected to the M33 transmitter as opposed to displaying the readings of any probe that might be connected to probe input 1 of the HygroPalm.

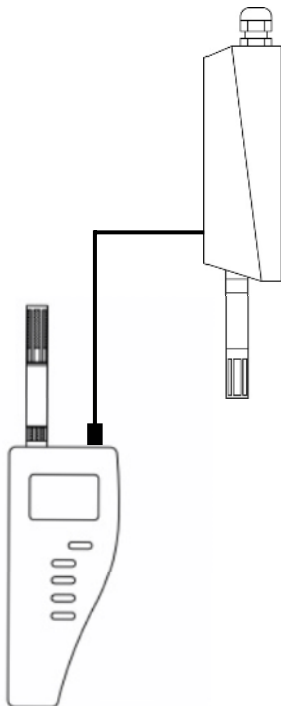
Press the MENU key of the HygroPalm to access the function menu of the transmitter and use the UP and DOWN keys to navigate the function menu. Selections are confirmed by pressing the ENTER key. Select one of the calibration functions: ADJUST M-PT, ADJUST 1-PT or ADJUST REF (see Remote Mode). Detailed calibration instructions are provided separately in the HygroPalm manual.

b) Calibration of the probe removed from the M33 transmitter:

This requires a PC with the optional HW3 software and the **MOK-03-WIN** calibration cable (separate instructions are provided with the HW3 software).

Appendix 4: Remote Mode

To initiate the Remote Mode, use service cable **ACRLXB5** to connect the service connector of the M33 transmitter to probe input 2 of the HygroPalm 3 indicator. **Note that for the remote mode to work, probe input 2 of the HygroPalm must be configured for a digital probe.**



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

Notes:

Using the Remote Mode does not affect the output signals (analog or digital) of the transmitter. The outputs keep being normally updated.

While in the Remote Mode, the HygroPalm cannot be turned off and it cannot communicate with a PC. Disconnect the transmitter and the HygroPalm if you need to turn off the HygroPalm.

If the transmitter is equipped with the optional LC display, this display repeats the information shown on the display of the HygroPalm.

The following options are available when in the Remote Mode:

1) Display the Transmitter Measurements on the HygroPalm

As soon as the Remote Mode is initiated, the HygroPalm displays the measurements (internal digital values) from the transmitter. This is especially useful when the transmitter does not have the optional LC display.

2) Access the Function Menu of the Transmitter

Press the MENU key of the HygroPalm to access the function menu of the transmitter and use the UP and DOWN keys to navigate the function menu. Selections are confirmed by pressing the ENTER key. The following functions are available:

OUTPUT

Definition

This function displays the values sent to each analog output. The display shows the values at the time the menu key was pressed and these values are not updated to the display as long as the function is active. This allows the values to be correctly compared. The analog output signals keep being updated.

Procedure

When entering the function, analog output 1 is displayed first. Use the UP or the DOWN key to display the other output.

ADJUST M.PT (2- to 4-point adjustment against a reference environment)

Definition

The Adjust M.PT function permits to calibrate and adjust the ROTRONIC HygroClip digital probe that is connected to the transmitter against a known reference environment. This function is designed to permit calibration at up to 2 temperature values and up to 4 relative humidity values. *To prevent unauthorized or accidental changes, lock the keypad (software configuration with HW3) to block out access to this function from the HygroPalm calibrator.*

Selections

The Adjust M.PT function offers the following choices (use the UP and DOWN keys):

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 2 - Humidity Calibration).

Procedure

When using 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). Because calibration is digital, it is possible to calibrate even at values that are not within the range of the transmitter analog temperature output.

- c) 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 transmitter 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:

- 1) **RHS:** press the ENTER key to select this item. The LC display of the HygroPalm shows the value read by the probe at the time the ENTER key was pressed. The letters "RHS" are displayed on the message line. Use the UP or the DOWN key to change the humidity value to match the mean value (at 23°C) written on the certificate supplied with the standard. For a faster change, keep the key pressed down. Press the ENTER key when done.

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

- 2) **Humidity or Temperature:** press the ENTER key to select. The LC display of the HygroPalm 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 (offset adjustment) of the 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. *To prevent unauthorized or accidental changes, lock the keypad (software configuration with HW3) to block out access to this function from the HygroPalm calibrator.*

Warning: a 1-point adjustment is no substitute for an adjustment at 2 or more points. Adjusting the probe at only one value 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 (use the UP and DOWN keys):

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 2 - Humidity Calibration).

Procedure

When the probe is at equilibrium with the reference environment, 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 read by the probe at the time the ENTER key was pressed. The letters "RHS" are displayed on the message line. Use the UP or the DOWN key to change the humidity value to match the mean value (at 23°C) written on the certificate supplied with the standard. For a faster change, keep the key pressed down. Press the ENTER key when done.

Note: in the RHS mode, 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

In the Remote Mode, the function Adjust REF can be used to do a 1-point adjustment of the transmitter against a **reference HygroClip probe connected to input 1 of the HygroPalm indicator** (be sure that probe input 1 of the HygroPalm is configured for a digital HygroClip probe). The function adjusts both humidity and temperature simultaneously to match the readings of the reference probe.

Note: when no 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 (connected to the HygroPalm). The message REF = PALM should also appear on the LC display. 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 transmitter has its own display, it simply repeats the data or commands shown on the display of the HygroPalm.

PROBE

Definition

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

Procedure

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.

SETTINGS

Definition

This function is used to do the following:

- turn the trend indicators on or off (applies only to units with the optional display)
- change the symbol used for relative humidity

Procedure

Trend: use the UP or the DOWN key to enable or disable the trend indicators. Press ENTER when done and ENTER again to confirm.

The trend of humidity and temperature is shown on the display by an arrow (up or down) to the left of the measured value. Both arrows are shown to indicate stable conditions. Stable conditions are defined as rate of change of less than 0.02 %RH / min or °C / min.

Signal stability is first evaluated after 60 seconds into the measurement and is updated every 30 seconds.

Note: when the trend indicator is enabled, the symbol for the calculated parameter (e.g. Dp for dew point) is no longer displayed to the left of the numerical value.

Humi Unit: use the UP or the DOWN key to select the desired symbol for relative humidity. Press ENTER when done and ENTER again to confirm.

SYS STATUS

Definition

This function displays the software version of the instrument, the RS232 configuration (baud rate, parity, bits and stop bit), the network address, any user defined description for the instrument and the serial number of the instrument.

This information is for display only. Some parameters such as the network address can be changed with the HW3 software, after connecting the instrument to a PC.

Procedure

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

Appendix 5: 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.

$$D_v = M_v / V, \text{ expressed in grams/m}^3 \text{ or in grains/cu ft}$$

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:

$m_w = 18.016 \text{ gram}$

p = partial pressure of water vapor [Pa]

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

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

$$D_v [\text{g} / \text{m}^3] = p / 0.4615 \times T$$

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

$$1 \text{ cu ft} = 0.0283168 \text{ m}^3$$

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

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.

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

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

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

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

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

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

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:

$$r = M_v / M_a$$

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

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

$m_w = 18.016$ gram

$m_a = 28.966$ gram

p = partial pressure of water vapor [Pa]

p_a = partial pressure of dry air [Pa]

P_b = total or barometric pressure [Pa]

$R = 8.31436$ Pa x m³ / °K x mole

T = temperature of the gas mixture in °K

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

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

1 gr (grain) = 0.0648 g (gram)

1 lb = 0.4535923 kg

r [gr / lb] = 7 x r [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 [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

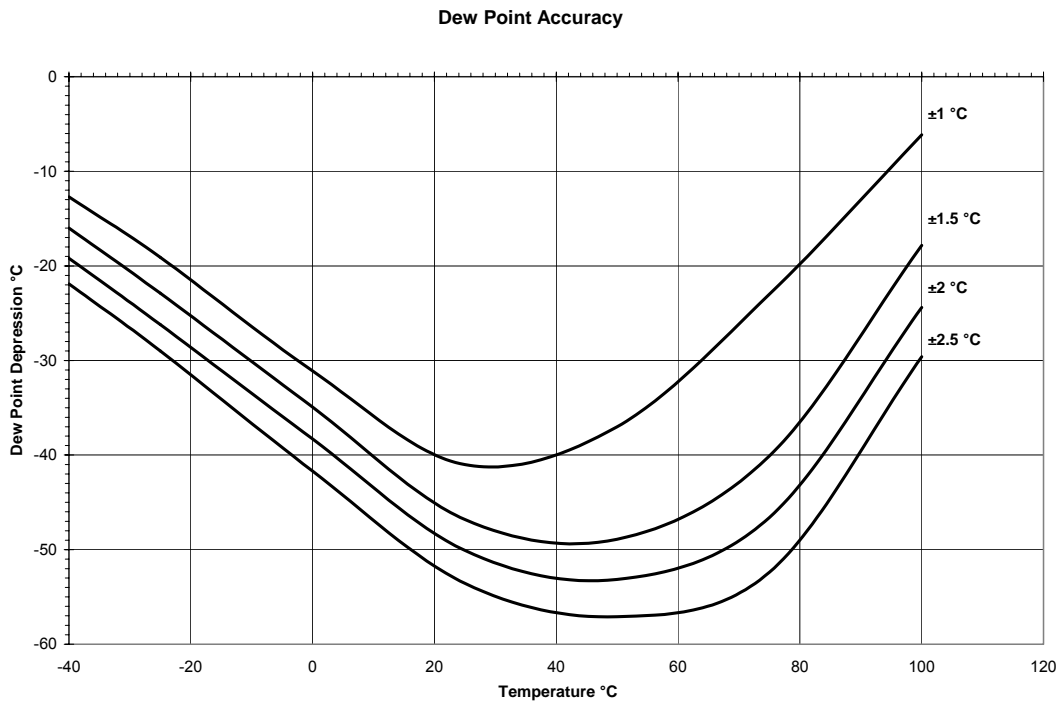
1 BTU = 1.05507 kJ

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

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

Appendix 6: Dew Point Accuracy

The M33 series uses the relative humidity and temperature measurements to compute another parameter such as dew point, 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 $-40\ldots-50^\circ\text{C}$) 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 7: 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. This information is provided for those customers who for some reason cannot use the HW3 software.

Connections

The exchange of data requires 3 wires: TXD (transmit), RXD (receive) and SG (signal ground).

RS232 Settings

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.

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.

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: {M00RDD} + CR (asks instrument M00 to send measurement data)

When several instruments are connected together (RS485 network), commands directed to instruments other than the instrument that is physically connected to the COM port of the PC should be preceded with the | character (ASCII 124)

Example: |{R01RDD} + CR

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: {R01RDD 0027.50;0067.17;#M (terminated with CR)

where:

{R01RDD : repeats the command + blank space

0027.50 : %RH

; : separator

0067.17 : °F (temperature unit depends on instrument configuration with HW3)

; : 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
w	HygroWin	Not Applicable
x	MOK-Win	{x00M} + CR
0	HygroPalm 1	Not Applicable
u	HygroPalm 2	{u00RDD}+CR – assuming the address is 0
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
b	HygroLab 2	{b00RDD}+CR – assuming the address is 0
B	HygroLab 3	{B00RDD}+CR – assuming the address is 0
R	M33 series	{R00RDD}+CR – assuming the address is 0

X	Reserved	{X00RDD}+CR – assuming the address is 0
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CR=Chr(13)

Special Situations (single instrument)

Using address 99 in a data request causes instruments with any address to answer. For this reason, address 99 should not be used when several instruments are connected to a network. Address 99 can be useful when trying to communicate with a single 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 the instrument directly connected to the COM port of the PC (RS232) as well as from any instrument that is networked (RS485). The following examples are for the M33 series. 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 M33 address 01, directly connected to the PC COM port (service connector RS232):

data request: {R01RDD}+CR

answer: {R01RDD 0025.01;0016.89;#C

note: 0025.01: humidity (%RH)

0016.89: temperature (°C as per instrument configuration)

2) read %RH, temperature and computed parameter

data request: {R01RDD0;}+CR

answer: {R01RDD 0025.90;0015.82;-003.69; S

note: 0025.90: humidity (%RH)

0015.82: temperature (°C as per instrument configuration)

-003.69: dew point (°C as per instrument configuration)

3) read %RH and temperature from the M33 with address 02, connected by RS485 to a HygroFlex 2:

data request |{R02RDD} +CR note the | character (ASCII 124) preceding the command

answer: {R02RDD 0020.41;0019.87;#E

note: 0020.41: humidity (%RH)

0019.87: temperature (°C as per instrument configuration)

Appendix 8: Accessories for the M33 Series

Order Code	Description
HW3	HW3 software (CD ROM)
HygroPalm 3	HygroPalm 3, field calibrator
ACRLXB5	Cable: service connector M33 to HygroPalm 3 (probe input 2 – remote mode)
ACML232	Cable: service connector M33 to PC COM port (transmitter configuration, etc.)
MOK-xx-DAT05	Probe extension cable for M33W (xx = 2 or 5 meter)
MOK-03-WIN	Calibration cable HygroClip probe with DAT05 connector to PC. 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 may be required (consult your local distributor)
HygroClip Sxx/yy	HygroClip S probe simulator where xx = relative humidity in %RH and yy = temperature in °C (fixed values)
EAXx-SCS	humidity std, SCS certified, pack of 5 where xx = 00 (0 %RH) = 05 (5 %RH) = 10 (10 %RH) = 11 (11 %RH) = 20 (20 %RH) = 35 (35 %RH) = 50 (50 %RH) = 65 (65 %RH) = 75 (75 %RH) = 80 (80 %RH) = 95 (95 %RH)
ER-15	calibration device for HygroClip S probe