EVVOS RHTP PROBE USER'S MANUAL
NMEA-0183 OVER RS422 INTERFACE
NMEA-0183 OVER UART INTERFACE

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RELATIVE HUMIDITY, TEMPERATURE, AND BAROMETRIC PRESSURE PROBE

Evvos RHTP probe combines meteorological grade sensors for relative humidity, air temperature, and barometric pressure measurements. It is designed to provide high-quality environmental data, real-time measurements, and calculation of multiple derivative parameters. An additional measurement of CO_2-percentage (in air) compensated for relative humidity and air temperature is available in the RHTP+CO2 version of the probe.

Applications

- Environmental monitoring
- Weather forecasting solutions
- Industrial data acquisition
- Precision agriculture/farming
- Cold chain and HVAC applications
- Internet of things (IoT)
- CO_2-monitoring in industry/agriculture/farming (RHTP+CO2 version)

Primary parameters

- Relative humidity
- Air temperature
- Barometric pressure
- CO_2-percentage in air (RHTP+CO2 version)

Secondary parameters

- Absolute humidity
- Dew point
- Wet-bulb temperature
- Vapour pressure
- Saturated vapour pressure
- Atmospheric pressure at sea level
- Heat index
- Mixing ratio
- Specific enthalpy
- Boiling point of water
- Speed of sound in air
- Water activity in air

Highlights

- Stainless steel enclosure and filter cap engineered to shield sensing elements in harsh environments
- Waterproof protection, and internal electronics sealed in resin, coated electrical parts
- Multiple electrical interfacing options - SDI-12 (v.1.4), RS-485 (Modbus), RS-422 (NMEA-0183), UART (Modbus, NMEA-0183), USB
- Low-power consumption suitable for battery-powered applications. On-board heater included
- Extensive command sets for operational options and probe diagnostics
- UV-protected and oil-resistant flexible cable (optional)

Description

RHTP is a high-accuracy, digital probe. It measures multiple environmental parameters. Due to its low power consumption, versatile electrical interfacing options, and wide-range power supply, the probe is compatible with a variety of battery-operated dataloggers and industrial data acquisition systems. A stainless-steel enclosure in combination with weatherproof electronic circuitry, and durable cable, ensures proper long-term operation even in harsh outdoor and demanding industrial conditions. All primary parameters are sensed by physical sensors. The secondary parameters are calculated, based on values measured by the probe's physical sensors. For optimal results in outdoor applications, it is recommended to install an RHTP probe in a solar shield.

Measured Parameters and Units

Table 1. ERHTP Environmental Parameters

Parameter	Unit	Description
air_ temperature	°C	Air temperature (dry-bulb temperature)
relative_humidity	%	Relative humidity of air
barometric_pressure	Pa	Barometric pressure
sea_level_pressure	Pa	Reduced to sea level atmospheric pressure
dew_point	°C	Dew point (Dew temperature)
absolute_humidity	kg/m^3	Absolute humidity of air
vapor_pressure	Pa	Vapor pressure in humid air
saturated_vapor_pressure	Pa	Saturated vapor pressure in humid air
heat_index	°C	Physiological heat index in humid air
speed_of_sound	m/s	Speed of sound in humid air
mixing_ratio	g/kg	Mixing ratio of moisture in air
specific_enthalpy	kJ/kg	Thermodynamic specific enthalpy of humid air
water_activity	-	Water activity in humid air
water_boiling_point	°C	Boiling point of water
wet_bulb_temperature	°C	Thermodynamic wet-bulb temperature
CO2_percentage	%	**RHTP-CO2 version only:** concentration (percentage) of CO_2 in air

Table 2. ERHTP Diagnostic Parameters

Parameter	Unit	Description
MCU_voltage	V	Internally regulated voltage supply for the on-board microcontroller
SEN_voltage	V	Internally regulated voltage supply for the sensor circuits
VIN_voltage		Unregulated voltage supply fed to the probe
MCU errors	-	A register of errors occurred in the MCU of a probe
reset_cause	-	A register of the most recent MCU reset cause code
power_errors	-	A register of error in the power circuitry of a probe
sensor_errors	-	A register of errors occurred during sensing
errors_count	-	Total count of errors occurred in a probe

NOTE: MCU_errors, power_errors, sensor_errors, errors_count reset to 0 at power-up.

ERHTP Quick Start (NMEA-0183)

1. Wire an RHTP-NMEA probe to an NMEA LISTENER device (see ERHTP Connector). The LISTENER device must be configured for the same communication settings as the RHTP probe (see ERHTP Configuration).
2. Power the RHTP-NMEA probe (see ERHTP Electrical and Timing Specification for supply voltage range). Upon successful power-up the RHTP probe automatically starts transmission of NMEA-0183-formatted sentences in TALKER mode (see NMEA-0183 Sentences Supported by ERHTP for sentence content).

ERHTP Electrical and Timing Specification (NMEA-0183 over RS422 Version)

Table 3. ERHTP Electrical and Timing Specification (Specific for NMEA-0183 over RS422)

Parameter	Condition[1]	Min	Typ	Max	Unit
Supply voltage (Vin)	Single-wire (NMEA-0183)	3.3 (7.0)[2]	12	24	Vdc
Current consumption (continuous mode)	Vin = 12Vdc. Heater OFF. **Wired for NMEA-0183 or single-wire interface.**	5.9	6.5	7.9	mA
Idle current consumption (one-shot mode)	Vin = 12Vdc. Heater OFF. **Wired for NMEA-0183 or single-wire interface.**	180	300	500	uA
Measurement current consumption (one-shot mode)	Vin = 12Vdc. Heater OFF. **Wired for NMEA-0183 or single-wire interface.**	5.9	6.5	7.9	mA
Current consumption (sleep mode)	Vin = 12Vdc. Heater OFF. Enabled low-power mode. **Wired for NMEA-0183 only.**	180	300	500	uA
RS422 Differential Driver Output	Vin = 12Vdc	1.5	5	5.5	V
RS422 Driver Common-Mode Output Voltage	Vin = 12Vdc	1	-	3	V
RS422 Receiver-Input Resistance	$-7V < V_{CM} < +12V$	95	-	-	kΩ
RS422 Receiver Differential Threshold Voltage	$-7V < V_{CM} < +12V$	-200	-	-50	V
Power-up time	-	1700	2000	2200	ms

(1) NOTE: No termination resistor on the RS422 line

(2) NOTE: power supply below 7.0 Vdc on start-up automatically disables the NMEA TALKER functions. Only single-wire interface remains accessible.

ERHTP Electrical and Timing Specification (NMEA-0183 over UART Version)

Table 4. ERHTP Electrical and Timing Specification (Specific for NMEA-0183 over UART Version)

Parameter	Condition	Min	Typ	Max	Unit
Supply voltage (Vin)	V_{UART}= 3V (V_{UART} = 5V)	3.3 (5.0)	12.0	24	Vdc
Current consumption (continuous mode)	Vin = 12Vdc. Heater OFF. **Wired for NMEA or single-wire interface.**	0.8	1.6	2	mA
Idle current consumption (one-shot mode)	Vin = 12Vdc. Heater OFF. **Wired for NMEA or single-wire interface.**	0.2	0.7	1	mA
Measurement current consumption (one-shot mode)	Vin = 12Vdc. Heater OFF. **Wired for NMEA or single-wire interface.**	2.8	3	3.5	mA
Current consumption (sleep mode)	Vin = 12Vdc. Heater OFF. Enabled low-power mode. **Wired for NMEA only.**	100	300	500	uA
UART logic high input	V_{UART}= 3V and V_{UART} = 5V	V_{UART} - 1	-	V_{UART} +0.7	V
UART logic high output	V_{UART}= 3V and V_{UART} = 5V	V_{UART} - 0.3	-	V_{UART}	V
UART logic low input	V_{UART} = 5V	-0.7	-	0.8	V
UART logic low output	V_{UART} = 5V	-	-	0.6	V
Power-up time		1700	2000	2200	ms

ERHTP Configuration (All NMEA-0183 Versions)

Table 5. ERHTP NMEA-0183 TALKER Default Settings

Parameter	Default Value
Baud rate	4800
Data bits	8
Parity	N
Stop bits	1
Flow control	None
Size of input buffer	80 bytes
Size of output buffer	Dynamic (applicable for LISTENER mode only)
Data transmission	MSB first
NMEA-0183 mode[1]	Standard (configuration 4800/8/N)
Probe operation mode	Continuous
Sample rate	0.5 S/s
Calibration	Disabled for all parameters
Logic voltage level	5V (NMEA-0183 over RS422) 3V (NMEA-0183 over UART)
Heater	OFF

NOTE: to lower the overall power consumption the RS422 driver in ERHTP is switched ON only during NMEA transmission. When in OFF state both communication pins of the RS422 driver are kept at the same constant voltage of app. 2.5 Vdc.

Summary of Supported NMEA-0183 Sentences

Table 6. NMEA-0183 TALKER Sentences Supported by ERHTP

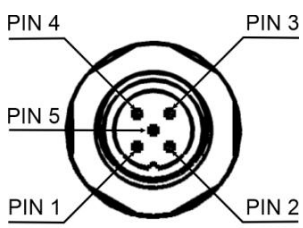
Sentence mnemonics	Description
$WIXDR	Transducer measurements by a weather instrument (RHTP Sentences 1- 8)
RHTP Sentences 1 - 5	Environmental data set: outputted in accordance with the sample rate setting
RHTP Sentence 6	Outputted once per 5 environmental data sets
RHTP Sentences 7 - 8	Outputted once per 20 environmental data sets
$WIUID	Identification of a weather instrument (on power-up and once per 100 environmental data sets)

Wiring

ERHTP Connector (All NMEA-0183 Versions)

The NMEA-0183 versions of the ERHTP probe are equipped with dual interfacing – along with the main NMEA-0183 protocol, there is an auxiliary single-wire interface used mainly for compatibility with other Evvos products.

Table 7. Pinout of the M12-connector on ERHTP probe (All NMEA Versions)

Probe's connector (front view)	Pin function	Pin number	Note
	System power supply (Vin)	Pin 1	
	System ground (GND)	Pin 2	Internally connected to casing.
	B- (for RS422) Tx (for UART)	Pin 3	2-wire differential NMEA-Talker (for RS422) Single-ended transmitter output (for UART)
	A+ (for RS422) Rx (for UART)	Pin 4	2-wire differential NMEA-Talker (for RS422) Single-ended receiver output (for UART)
	Auxiliary (AUX)	Pin 5	Single-wire interface bidirectional DATA-pin. **Leave floating when NMEA mode is in use.**

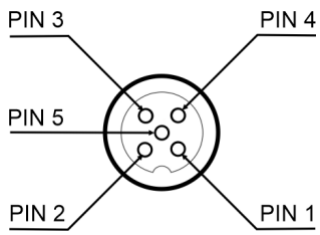
Grounding

The metal casing of the probe is internally connected to GND.

Patch Cable (optional)

The optional cable is suitable for ERHTP versions with SDI-12, single-wire, UART interfaces. Although not complying with the NMEA-0183 cabling specifications, it can be used as a service cable with ERHTP NMEA versions enabling the user to take advantage of the AUX pin. The cable is equipped with an M12x5-pin, female, A-coded, straight connector on one end and free wires on the other connector.

Table 8. Pinout of the optional patch cable

M12 cable connector (front view)	Cable wires (free end)	Pin Number	Note
	Brown	Pin 1	Mated to Pin 1 of the probe's connector
	White	Pin 2	Mated to Pin 2 of the probe's connector
	Blue	Pin 3	Mated to Pin 3 of the probe's connector
	Black	Pin 4	Mated to Pin 4 of the probe's connector
	Green/yellow	Pin 5	Mated to Pin 5 of the probe's connector

Wiring for All NMEA-0183 Versions

Table 9. Wiring of ERHTP for All NMEA Versions

Probe's Connector (front view)	Patch Cable Wires	Electrical Connection (NMEA-RS422)	Electrical Connection (NMEA-UART)
Pin 1	Brown	Vin	Vin
Pin 2	White	GND	GND
Pin 3	Blue	B-	Tx
Pin 4	Black	A+	Rx
Pin 5	Green/yellow	AUX-comm pin (floating)	AUX-comm pin (floating)

Wiring for Single-Wire Interface (All NMEA-0183 Version)

Table 10. Wiring of ERHTP for Single-Wire Interface

Probe's Connector (front view)	Patch Cable Wires	Electrical Connection
Pin 1	Brown	Vin
Pin 2	White	GND
Pin 3	Blue	Left floating
Pin 4	Black	Left floating
Pin 5	Green/yellow	Single-wire comm pin

Definitions of the Physical Parameters

Air Temperature (Dry-Bulb Temperature)

A thermodynamic parameter, quantifying the kinetic motion of gas molecules contained in air. In macroscopic scale this motion is translated in the degree of how cold or hot air is. Also, known as dry-bulb temperature this is the parameter measured by a conventional thermometer.

Relative Humidity of Air

The amount of water vapour in air, expressed as a percentage of the total possible (saturation) amount of water vapour at the same temperature. This parameter is important for many types of thermodynamic systems including all living organisms.

Barometric Pressure

The total weight of gas molecules exerted in the atmosphere at a given point on Earth. It is a fundamental environmental parameter for prediction of weather changes for hours in advance. In environmental measurements, it can also be found under the name "station pressure".

Reduced to Sea Level Atmospheric Pressure

Equivalent atmospheric pressure at sea level, introduced globally to eliminate dependence of barometric pressure values on installation height (station elevation) of a weather station. This is the parameter reported in weather forecasts.

Dew Point (Dew Temperature)

The temperature at which water vapors in air begin condensing into water. This parameter finds valuable applications in industrial processes and agriculture.

Absolute Humidity of Air

The mass of water vapour present in a unit volume of air.

Vapor Pressure in Air

The pressure exerted by vapors that are in thermodynamic equilibrium with their solid or liquid form in air.

Saturated Vapor Pressure in Air

Under each given set of environmental conditions, saturated vapour pressure is the maximal vapour pressure exerted by vapors in thermodynamic equilibrium with their solid or liquid form.

Heat Index

An equivalent raised value of air temperature, perceived by a human body due to the presence of relative humidity in air. Heat index is a valuable indicator for heat stroke prevention in activities, involving people exposed to high levels of relative humidity – both indoors and outdoors.

Speed of Sound in Air

The distance travelled per unit of time by a sound wave in air. Speed of sound changes with air temperature and relative humidity.

Mixing Ratio of Moisture in Air

A measure of atmospheric humidity defining the ratio of mass of water vapor contained in air to mass of dry air. Also known as specific humidity.

Specific Enthalpy

The total thermal energy (sensible heat + latent heat), contained in a unit mass of mixture of dry air and water vapour.

Water Activity in Air

A dimensionless parameter of how efficiently the water amount present in air can take part in a reaction or in a physical process.

Boiling Point of Water

The temperature at which the water vapour pressure equals barometric pressure.

Wet-Bulb Temperature

Under each given set of environmental conditions, wet-bulb temperature is the lowest temperature that can be reached through cooling by means of evaporating water (e.g., human perspiration). It is an important parameter in many industrial thermal processes as well as in agriculture and farming.

Percentage Concentration of CO_2 in Air

Abnormally high concentration of CO_2 that may be reached in an enclosed space during fire burning or because of biological or technological processes. Percentage of CO_2 in air is often monitored in safety applications.

Height Above Sea Level

Also referred to as "station elevation", this is the vertical distance above mean sea level at which a meteorological station (a RHTP probe) is installed. This elevation is adopted as the reference datum level for all measurements of reduced to sea level atmospheric pressure by the station (by the RHTP probe).

Vertical Temperature Coefficient

The rate of temperature drop every 100 meters of vertical elevation above sea level.

Table 11. Secondary – Primary Parameters Functional Dependence in the Calculations by ERHTP

Secondary parameters	**Primary parameters**		
Parameter	***Air Temperature***	***Relative Humidity***	***Barometric Pressure***
Reduced to Sea Level Atmospheric Pressure[1]	•		•
Dew Point	•	•	
Absolute Humidity of Air	•	•	
Vapor Pressure in Air	•	•	
Saturated Vapor Pressure in Air	•		
Heat Index	•	•	
Speed of Sound in Air[2]	•	•	•
Mixing Ratio of Moisture in Air	•	•	•
Water Activity in Air	•	•	
Boiling Point of Water			•
Wet-Bulb Temperature	•	•	•

(1) Parameter also dependent on input by user (*height_above_sea_level, vertical_temp_coeff*)

(2) Slight dependence on barometric pressure

NMEA Association

NMEA-0183 is a standard data transfer protocol for digital systems. It is a Talker-Listener communication type where the Listener is the data logging device, and the Talker is the ERHTP probe. The Talker continually issues measurement data without the need of explicit read-requests by the Listener. More information about NMEA-0183 here: https://www.nmea.org/

The Standard NMEA protocol can be communicated over a few electrical interfaces: RS422, UART, etc.

The 4-wire differential RS422 is the standard Talker/Listener physical layer of NMEA-0183. Universal Asynchronous Receiver-Transmitter (UART) is an on-board communication feature in most off-the-shelf microcontrollers, thus, a cost-effective and readily available interfacing solution in many data acquisition systems implementing the NMEA-0183 protocol.

NMEA-0183 Sentences Supported by ERHTP

Description of NMEA Sentences

Table 12. ERHTP NMEA Sentence 1: Air Temperature, Relative Humidity, Barometric Pressure

Sentence	`$WIXDR,C,<Value_1>,C,ATC,H,<Value_2>,P,RH,P,<Value_3>,P,BP*<CRC>CR><LF>`	
Example	`$WIXDR,C,28.7,C,ATC,H,43.5,P,RH,P,97671.0,P,BP*39`	
Mnemonic	***Description***	***Decoded example***
$	NMEA delimiter: start of sentence	
WI	NMEA TALKER identifier mnemonics: WEATHER INSTRUMENTS	
XDR	NMEA general purpose formatter: TRANSDUCER MEASUREMENTS	
C	NMEA transducer type: TEMPERATURE	
<Value_1>	Value of *air_temperature*	28.7 °C
C	NMEA unit of measure: degrees Celsius (°C)	
ATC	NMEA transducer ID: *air_temperature*	
H	NMEA transducer type: HUMIDITY	
<Value_2>	Value of *relative_humidity*	43.5 %
P	NMEA unit of measure: Percent (%)	
RH	NMEA transducer ID: *relative_humidity*	
P	NMEA transducer type: PRESSURE	
<Value_3>	Value of *barometric_pressure*	97671 Pa
P	NMEA unit of measure: Pascal (Pa)	
BP	NMEA transducer ID: *barometric_pressure*	
*	NMEA delimiter: checksum	
<CRC>	Checksum value (HEX-format)	39_{HEX}

Table 13. ERHTP NMEA Sentence 2: Dew Point, Heat Index

Sentence	`$WIXDR,C,<Value_4>,C,DP,C,<Value_5>,C,HI*<CRC><CR><LF>`	
Example	`$WIXDR,C,15.1,C,DP,C,29.0,C,HI*4B`	
Mnemonic	***Description***	***Decoded example***
$	NMEA delimiter: start of sentence	
WI	NMEA TALKER identifier mnemonics: WEATHER INSTRUMENTS	
XDR	NMEA general purpose formatter: TRANSDUCER MEASUREMENTS	

ERHTP NMEA Sentence 2: Dew Point, Heat Index (Continued)

Mnemonic	*Description*	*Decoded example*
C	NMEA transducer type: TEMPERATURE	
<Value_4>	Value of *dew_point*	15.1 °C
C	NMEA unit of measure: degrees Celsius (°C)	
DP	NMEA transducer ID: *dew_point*	
C	NMEA transducer type: TEMPERATURE	
<Value_5>	Value of *heat_index*	29.0 °C
C	NMEA unit of measure: degrees Celsius (°C)	
HI	NMEA transducer ID: *heat_index*	
*	NMEA delimiter: checksum	
<CRC>	Checksum value (HEX-format)	$4B_{HEX}$

Table 14. ERHTP NMEA Sentence 3: Absolute Humidity, Mixing Ratio

Sentence	`$WIXDR,B,<Value_6>,K,AH,G,<Value_7>,G,MR*<CRC><CR><LF>`
Example	`$WIXDR,B,0.012357,K,AH,G,11.162,G,MR*6C`

Mnemonic	*Description*	*Decoded example*
$	NMEA delimiter: start of sentence	
WI	NMEA TALKER identifier mnemonics: WEATHER INSTRUMENTS	
XDR	NMEA general purpose formatter: TRANSDUCER MEASUREMENTS	
B	NMEA transducer type: ABSOLUTE HUMIDITY	
<Value_6>	Value of *absolute_humidity*	0.012357 kg/m^3
K	NMEA unit of measure: kilogram per cubic meter of air (kg/m^3)	
AH	NMEA transducer ID: *absolute_humidity*	
G	NMEA transducer type: GENERIC (here: MIXING RATIO)	
<Value_7>	Value of *mixing_ratio*	11.162
G	NMEA unit of measure: gram per kilogram (g/kg)	
MR	NMEA transducer ID: *mixing_ratio*	
*	NMEA delimiter: checksum	
<CRC>	Checksum value (HEX-format)	$6C_{HEX}$

Table 15. ERHTP NMEA Sentence 4: Vapour Pressure, Saturated Vapour Pressure, Boiling Point of Water

Sentence	`$WIXDR,P,<Value_8>,P,VP,P,<Value_9>,P,SVP,C,<Value_10>,C,BPW*<CRC><CR><LF>`
Example	`$WIXDR,P,1722.0,P,VP,P,3957.0,P,SVP,C,98.9,C,BPW*5E`

Mnemonic	*Description*	*Decoded example*
$	NMEA delimiter: start of sentence	
WI	NMEA TALKER identifier mnemonics: WEATHER INSTRUMENTS	
XDR	NMEA general purpose formatter: TRANSDUCER MEASUREMENTS	
P	NMEA transducer type: PRESSURE	
<Value_8>	Value of *vapour_pressure*	1722.0 Pa
P	NMEA unit of measure: Pascal (Pa)	

ERHTP NMEA Sentence 4: Vapour Pressure, Saturated Vapour Pressure, Boiling Point of Water (Continue)

Mnemonic	*Description*	*Decoded example*
VP	NMEA transducer ID: *vapour_pressure*	
P	NMEA transducer type: PRESSURE	
<Value_9>	Value of *saturated_vapour_pressure*	3957.0 Pa
P	NMEA unit of measure: Pascal (Pa)	
SVP	NMEA transducer ID: *saturated_vapour_pressure*	
C	NMEA transducer type: TEMPERATURE	
<Value_10>	Value of *water_boiling_point*	98.9 °C
C	NMEA unit of measure: degrees Celsius (°C)	
BPW	NMEA transducer ID: *water_boiling_point*	
*	NMEA delimiter: checksum	
<CRC>	Checksum value (HEX-format)	$5E_{HEX}$

Table 16. ERHTP NMEA Sentence 5: Speed of Sound, Specific Enthalpy, Water Activity

Sentence	`$WIXDR,G,<Value_11>,M,SOS,G,<Value_12>,K,SE,G,<Value_13>,N,WA*<CRC><CR><LF>`
Example	`$WIXDR,G,349.9,M,SOS,G,57.4,K,SE,G,0.4351,N,WA*3C`

Mnemonic	*Description*	*Decoded example*
$	NMEA delimiter: start of sentence	
WI	NMEA TALKER identifier mnemonics: WEATHER INSTRUMENTS	
XDR	NMEA general purpose formatter: TRANSDUCER MEASUREMENTS	
G	NMEA transducer type: GENERIC (here: SPEED OF SOUND)	
<Value_11>	Value of *speed_of_sound*	349.9 m/s
M	NMEA unit of measure: meter per second (m/s)	
SOS	NMEA transducer type: *speed_of_sound*	
G	NMEA transducer type: GENERIC (here: SPECIFIC ENTHALPY)	
<Value_12>	Value of *specific_enthalpy*	57.4 kJ/kg
K	NMEA unit of measure: kilojoules per kilogram (kJ/kg)	
SE	NMEA transducer ID: *specific_enthalpy*	
G	NMEA transducer type: GENERIC (here: WATER ACTIVITY)	
<Value_13>	Value of *water_activity*	0.4351
N	NMEA unit of measure: none	
WA	NMEA transducer ID: *water_activity*	
*	NMEA delimiter: checksum	
<CRC>	Checksum value (HEX-format)	$3C_{HEX}$

Table 17. ERHTP NMEA Sentence 6: Wet-Bulb Temperature

Sentence	`$WIXDR,C,<Value_14>,C,WB*<CRC><CR><LF>`
Example	`$WIXDR,C,18.7,C,WB*55`

Mnemonic	*Description*	*Decoded example*
$	NMEA delimiter: start of sentence	
WI	NMEA TALKER identifier mnemonics: WEATHER INSTRUMENTS	

ERHTP NMEA Sentence 6: Wet-Bulb Temperature (Continued)

Mnemonic	*Description*	*Decoded example*
XDR	NMEA general purpose formatter: TRANSDUCER MEASUREMENTS	
C	NMEA transducer type: TEMPERATURE	
<Value_14>	Value of *wet_bulb_temperature*	18.7 °C
C	NMEA unit of measure: degrees Celsius (°C)	
WB	NMEA transducer ID: *wet_bulb_temperature*	
*	NMEA delimiter: checksum	
<CRC>	Checksum value (HEX-format)	55_{HEX}

Table 18. ERHTP NMEA Sentence 7: MCU Voltage, Sensor Voltage, Supply Voltage

Sentence	`$WIXDR,U,<Value_15>,V,MCU,U,<Value_16>,V,SEN,U,<Value_17>,V,VIN*<CRC><CR><LF>`
Example	`$WIXDR,U,4.670,V,MCU,U,2.816,V,SEN,U,9.490,V,VIN*23`

Mnemonic	*Description*	*Decoded example*
$	NMEA delimiter: start of sentence	
WI	NMEA TALKER identifier mnemonics: WEATHER INSTRUMENTS	
XDR	NMEA general purpose formatter: TRANSDUCER MEASUREMENTS	
U	NMEA transducer type: VOLTAGE	
<Value_15>	Value of *MCU_voltage*	4.670 V
V	NMEA unit of measure: volt (V)	
MCU	NMEA transducer type: *MCU_voltage*	
U	NMEA transducer type: VOLTAGE	
<Value_16>	Value of *SEN_voltage*	2.816 V
V	NMEA unit of measure: volt (V)	
SEN	NMEA transducer ID: sensor's supply voltage	
U	NMEA transducer type: VOLTAGE	
<Value_17>	Value of *VIN_voltage*	9.490 V
V	NMEA unit of measure: volt (V)	
VIN	NMEA transducer ID: RHTP supply voltage	
*	NMEA delimiter: checksum	
<CRC>	Checksum value (HEX-format)	23_{HEX}

NOTE: see Description of Diagnostic Registers

Table 19. ERHTP NMEA Sentence 8: Reset Cause, MCU Errors, Power Errors, Sensor Errors, Total Error Count

Sentence	`$WIXDR,G,<Value_18>,D,RC,G,<Value_19>,D,MCUE,G,<Value_20>,D,PE,G,<Value_21>, D,SE,G,<Value_22>,C,EC*<CRC><CR><LF>`
Example	`$WIXDR,G,2,D,RC,G,0,D,MCUE,G,0,D,PE,G,0,D,SE,G,0,C,EC*6C`

Mnemonic	*Description*	*Decoded example*
$	NMEA delimiter: start of sentence	
WI	NMEA TALKER identifier mnemonics: WEATHER INSTRUMENTS	
XDR	NMEA general purpose formatter: TRANSDUCER MEASUREMENTS	

ERHTP NMEA Sentence 8: Reset Cause, MCU Errors, Power Errors, Sensor Errors, Total Error Count (Continued)

Mnemonic	*Description*	*Decoded example*
G	NMEA transducer type: GENERIC (here: DIAGNOSTICS)	
<Value_18>	Value of *RESET_cause*	2
D	NMEA unit of measure: code	
RC	NMEA transducer ID: *RESET_cause*	
G	NMEA transducer type: GENERIC (here: DIAGNOSTICS)	
<Value_19>	Value of *MCU_errors*	0
D	NMEA unit of measure: code	
MCUE	NMEA transducer ID: *MCU_errors*	
G	NMEA transducer type: GENERIC (here: DIAGNOSTICS)	
<Value_20>	Value of *POWER_errors*	0
D	NMEA unit of measure: code	
PE	NMEA transducer ID: *POWER_errors*	
G	NMEA transducer type: GENERIC (here: DIAGNOSTICS)	
<Value_21>	Value of *SENSOR_errors*	0
D	NMEA unit of measure: code	
SE	NMEA transducer ID: *SENSOR_errors*	
G	NMEA transducer type: GENERIC (here: DIAGNOSTICS)	
<Value_22>	Value of *ERRORS_count*	0
C	NMEA unit of measure: none (count)	
EC	NMEA transducer ID: *ERROR_count*	
*	NMEA delimiter: checksum	
<CRC>	Checksum value (HEX-format)	$6C_{HEX}$

NOTE: see Description of Diagnostic Registers

Table 20. ERHTP NMEA ID Sentence: Traceability and Identification

Sentence	`$WIUID,EVVOSRHTPNMEA0183,<Value_1> <Value_2> <Value_3> <Value_4> <Value_5> *<CRC><CR><LF>`
Example	`$WIUID,EVVOSRHTPNMEA0183,001 1.1 1.0 028 1.0*29`

Mnemonic	*Description*	*Decoded example*
$	NMEA delimiter: start of sentence	
WI	NMEA TALKER identifier mnemonics: WEATHER INSTRUMENTS	
UID	NMEA general purpose formatter: USER IDENTIFICATION CODE TRANSMISSION	
EVVOS	Content of traceability register *manufacturer_name*	
RHTP NMEA0183	Content of traceability register *probe_name*	
<Value_1>	Content of traceability register *evvos_device_code*	001
<Value_2>	Content of traceability register *HW_revision*	1.1
<Value_3>	Content of traceability register *FW_revision*	1.0
<Value_4>	Content of traceability register *DAQ_version*	028
<Value_5>	Content of traceability register *NMEA_FW_revision*	1.0
*	NMEA delimiter: checksum	
<CRC>	Checksum value (HEX-format)	29_{HEX}

NOTE: see Description of Traceability Registers

Description of Diagnostic Registers

Table 21. ERHTP Description of Diagnostic Registers in NMEA ID Sentence

Parameter	Unit	Format	Description
MCU_voltage	V	Integer	Regulated DC supply voltage for the on-board MCU
SEN_voltage	V	Integer	Regulated DC supply voltage for the sensing circuits
VIN_voltage	V	Integer	Unregulated input DC supply voltage for the probe
RESET_cause	-	Integer	Most recent reset cause of the on-board MCU: RESET_cause (read): 0x0000 (0_{dec}) – unknown 0x0001 (1_{dec}) – normal power-up 0x0002 (2_{dec}) – brownout restart 0x0003 (3_{dec}) – MCLR wake-up from sleep mode 0x0004 (4_{dec}) – WDT timeout 0x0005 (5_{dec}) – WDT wake-up from sleep 0x0006 (6_{dec}) – Interrupt wake-up form sleep 0x0007 (7_{dec}) – MCLR during normal operation 0x0008 (8_{dec}) – soft reset instruction 0x0009 (9_{dec}) – stack overflow 0x000A (10_{dec}) – stack underflow 0x000B (11_{dec}) – WDT window violation
POWER_errors	-	Integer	Out-of-range event in on-board supply voltages: Bit 0 (LSb) – detected in *VIN_voltage* Bit 1 – detected in *MCU_voltage* Bit 2 – detected in *SEN_voltage* Bit 4 – error in master voltage regulator
MCU_errors	-	Integer	Error within the on-board MCU detected: Bit 0 (LSb) – write-to-EEPROM error detected Bit 1 – RAM error detected during self-test Bit 2 – on-board MCU's oscillator error detected
SENSOR_errors	-	Integer	Out-of-range in values of primary parameters: Bit 0 (LSb) – detected in air temperature Bit 1 – detected in relative humidity Bit 2 – detected in barometric pressure
ERRORS_count	-	Integer	Total number of errors in ***XXX_errors*** registers

NOTE: bits in POWER_errors, MCU_errors, SENSOR_errors set (event detected), cleared (no error).

Description of Traceability Registers

Table 22. ERHTP Description of Traceability Registers

Parameter	Format	Description
HW_revision	Float	Hardware revision of the probe
FW_revision	Float	Firmware revision of the probe
NMEA_FW_revision	Float	Revision of NMEA-0183 stack routines in the probe
DAQ_version	Integer	Manufacturer's code for internal traceability and compatibility
evvos_device_code	Integer	Manufacturer's code for internal traceability and compatibility
probe_name	String	Name of probe (including interfacing code)
manufacturer_name	String	Name of manufacturer

Maintenance

Installations in dusty environments may suffer from deposits on the sintered filter cap leading to reduced sensitivity to changes in relative humidity. The sintered filter cap should be cleaned with compressed air only when unscrewed from the body of the probe. Otherwise damage of electronic and sensing components may occur. Cleaning of probe's enclosure should be performed with a soft cloth. Do not submerge the probe into a liquid (may it be water or detergent). The electrical pins in the M12 connector of the probe may be cleaned with ethanol.

Environmental

This product contains substances that may be harmful to the environment if not disposed of properly.
At the end of its life cycle, this product must be disposed of as electronic waste.
Refer to your local authority's relevant regulations regarding disposal of electronic waste.

Dimensions

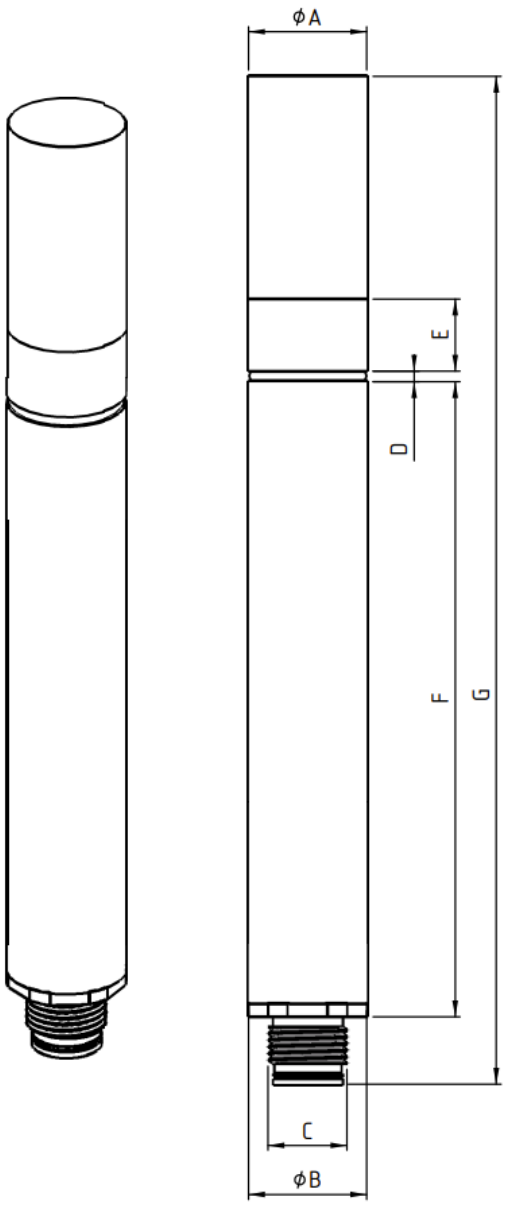


Table 23. ERHTP Geometry

Dimension	Min	Nom	Max	Unit
A	17.9	18	18.1	mm
	0.705	0.709	0.713	in
B	17.9	18	18.1	mm
	0.705	0.709	0.713	in
C	-	M12x1.5	-	mm
	-	-	-	in
D	1.1	1.3	1.7	mm
	0.043	0.051	0.067	in
E	9.9	10	10.1	mm
	3.898	3.934	3.976	in
F	102.8	103	103.2	mm
	4.047	4.055	4.063	in
G	153	155	157	mm
	6.024	6.102	6.181	in

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Document Revision

Table 24. Document Revisions and Updates

Revision	Description	Date
1.0	Initial release	10-June-2023