E+E

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technology.

Datasheet HTS401

Modular Humidity and Temperature Sensor for Demanding Climate Control

Modbus

www.epluse.com

HTS401

Modular Humidity and Temperature Sensor for Demanding Climate Control

The HTS401 humidity (RH) and temperature (T) sensor is the perfect balance of precision, durability, and simplicity for reliable climate control. With a modular design, it keeps operations running smoothly while reducing downtime and maintenance costs. From energy-efficient HVAC systems to modern data centres and industrial facilities, the device ensures the optimal environment.

Reliable in Any Environment

Built for endurance, the HTS401 in IP66 / NEMA 4(X)-rated enclosure features an E+E sensing element with proprietary protective coating and encapsulated connections that prevent from failure caused by condensation or contaminants. Even outdoors or in challenging industrial environment, the sensor delivers stable and accurate measurement data, lowering the risk of costly system inefficiency.

Easy Maintenance, Lower Costs

With the RapidX modular design, servicing the HTS401 is quick and effortless. The sensing module can be replaced within seconds, without recalibration, reconfiguration, or accuracy loss while operations experience nearly no downtime. Both, the HTS401 and the replacement module feature an inspection certificate, providing full documentation of quality and compliance.

Accuracy that Pays Off

With accuracy up to ±0.95 %RH and ± 0.1 °C, the sensor provides reliable measurements. That accuracy allows to fine-tune climate systems, optimise energy use, reduce operating costs and deliver a substantial return on investment over the sensor’s lifetime.

Flexibility and Smart Features for Demanding Applications

Built for demanding applications, the HTS401 combines flexibility with intelligent features. Available in wall, duct, and with remote probe, it offers multiple output options and a wide choice of filter caps to fit any setup. The Automatic ReCovery (ARC) function ensures stable performance in chemically exposed environment, while the Condensation Guard (CG) protects during temporary condensing conditions. With its broad operating range and clear graphic display, the HTS401 brings simplicity and reliable efficiency into complex climate control systems.

Configurable and Adjustable

The free PCS10 Product Configuration Software and the optional configuration stick facilitate the configuration and adjustment of the HTS401.

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HTS401 wall mount (Type T1),
with polycarbonate enclosure

HTS401 with remote probe HTS401P (Type T3),
with polycarbonate enclosure

HTS401 duct mount (Type T2),
with polycarbonate enclosure

HTS401 duct mount (Type T2),
with die-cast aluminium enclosure

HTS401M rapidX intelligent exchangeable sensing module

HTS401 with remote probe HTS401P (Type T3),
mounted in radiation shield HA010514

Features

Measurement performance
- RH/T accuracy up to ±0.95 %RH and ± 0.1 °C (0.18 °F)
- Working range up to -40...+80 °C (-40...+176 °F)
- Heating functionality
  - Automatic ReCovery (ARC)
  - Condensation Guard (CG)
- All RH related physical quantities

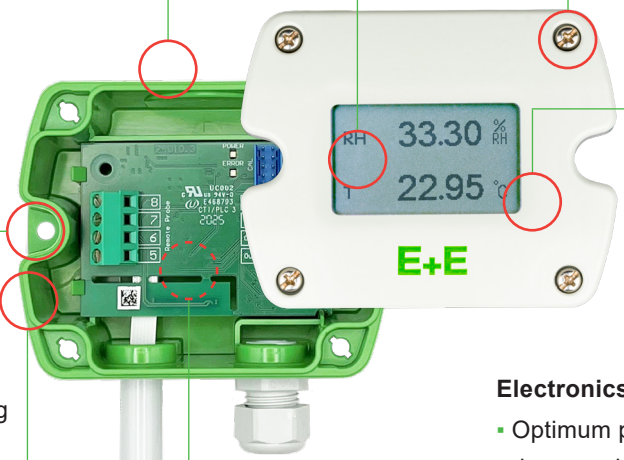
Display
- Configurable display layout
- Freely selectable measurands

Bayonet Screws
- Open/close with a ¼ rotation

Knockout for ½" conduit fitting (US)

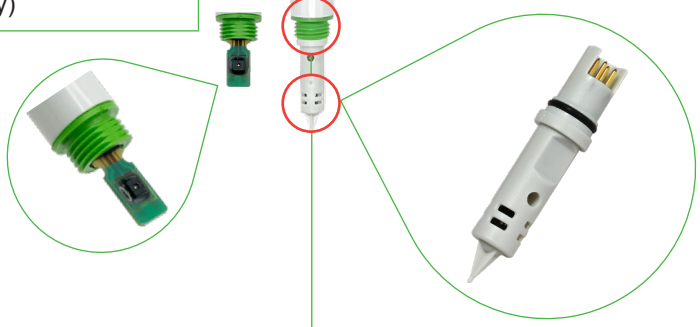
Smooth cover surface
- No accumulation of dust in protruding edges

External mounting holes
- Mounting with closed cover
- Electronics protected against construction site pollution
- Easy and fast mounting



Electronics on the backside of the PCB
- Optimum protection against mechanical damage during installation

Enclosure
- IP66/NEMA 4X protection rating
- Polycarbonate
- Die-cast aluminium with stainless steel probe (duct mount only)



rapidX Technology
- Quick and easy field exchange
- Hot-swap capable
- High mechanical stability
- Easy handling

Inspection certificate
according to DIN EN 10204-3.1

Test report
according to DIN EN 10204-2.2

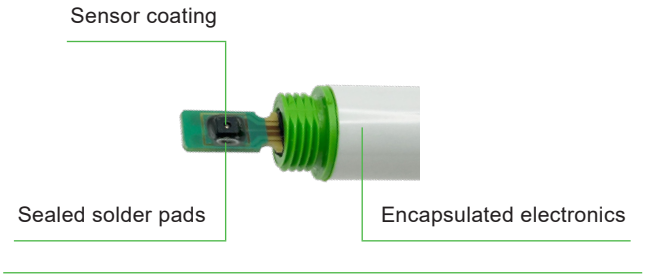
Digital E+E Certificate Service
https://certificates.epluse.com/

Sensing Element and Protection
- State-of-the-art E+E RH/T sensing element with proprietary coating and sealed solder pads
- Patented sensor technology
- Encapsulated electronics
- Rugged construction

Features

Protective Sensor Coating

The E+E proprietary sensor coating is a protective layer applied to the active surface of the sensing element. The coating substantially extends sensor lifetime and ensures optimal measurement performance in corrosive environment (salts, off-shore applications). Additionally, it improves the sensors' long term stability in dusty, dirty or oily applications by preventing stray impedance caused by deposits on the active sensor surface.
Encapsulated connections and sealed solder pads provide optimal protection, ensuring operational safety and reducing maintenance costs.



rapidX Technology

The HTS401 with rapidX option features an intelligent RH/T sensing module that enables easy on-site exchange. The rapidX module can be replaced within seconds, even during operation, with no need for configuration, adjustment or calibration. An inspection certificate according to DIN EN 10204-3.1 is digitally provided with every HTS401M module and can be downloaded using the E+E Certificate Service https://certificates.epluse.com/.

Automatic ReCovery (ARC) Function

Automatic ReCovery (ARC) is used to outgase chemical pollution and thus eliminate possible drift effects, especially outdoors. This is achieved with an intense heating of the RH/T sensing element. The function can be perfectly tailored to the application requirements being triggered:

- Manually via PCS10
- By a certain cyclic time interval configurable via PCS10, or ex works
- Via RS485 digital interface

Condensation Guard (CG)

HTS401 sensors with activated Condensation Guard (CG) are designed for applications with variable humidity where condensation may occur for short periods of time. The CG protects the RH/T sensing element by targeted heating and prevents temporary condensation and its negative effects on the measurement results. The CG heating is triggered by a predefined RH threshold, factory set via order code and configurable with PCS10.

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Features

Accredited Traceable Calibration Certificate

Internationally recognised certificates for the calibration of measuring instruments from accredited laboratories document the traceability of the measurements to the International System of Units (SI). The E+E Elektronik calibration laboratory offers two levels of traceable calibrations.

- As a Designated Institute (DI) of the Republic of Austria, the E+E calibration laboratory maintains Austria's national measurement standards for humidity, dew point temperature, air velocity and CO_2. This authorises the E+E calibration laboratory to issue calibration certificates at the level of a National Metrological Institute (NMI).
- The E+E calibration laboratory is accredited by Akkreditierung Austria in accordance with DIN EN ISO/IEC 17025 with the identification number 0608. This allows the laboratory to issue ISO 17025 certificates for the measurands humidity, temperature, dew point temperature, air velocity, flow, pressure and CO_2.

Visit www.eplusecal.com for detailed information on calibration and to enquire a certificate of accredited traceable calibration for the HTS401 from the Designated Institute.

ISO 9001 Calibration Certificate

An ISO 9001 calibration certificate documents the comparative measurement of a device against high quality reference equipment (factory level standard). The comparison is performed in accordance with internal procedures that comply with ISO 9001 and provides information on the specimen's measuring accuracy. The reference equipment is traceable to national standards, however, the calibration process is not accredited. Therefore, an ISO 9001 calibration is neither traceable nor internationally comparable.

Visit www.epluse.com/iso9001cal for detailed information on calibration and to enquire an ISO 9001 calibration certificate.

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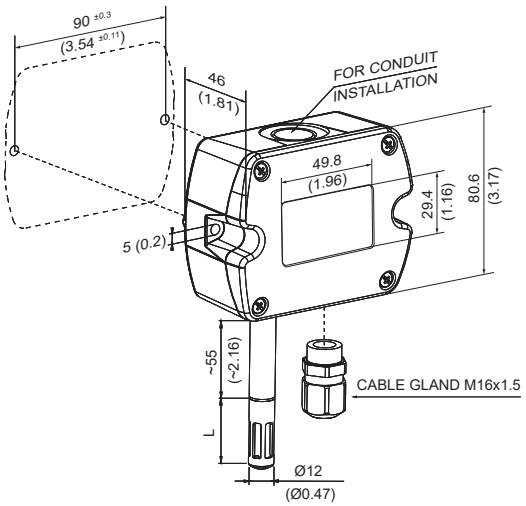
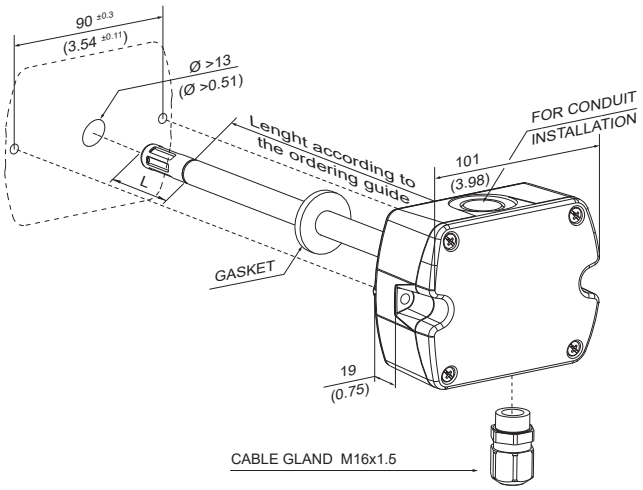
Dimensions

Values in mm (inch)

Type T1



Type T2

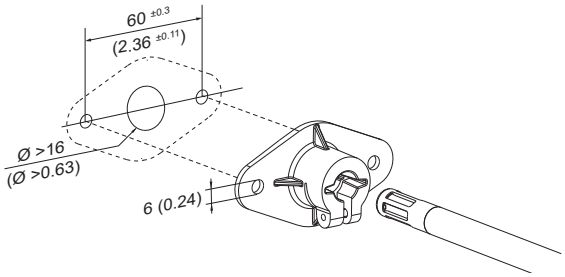


L = filter cap length	mm (inch)
Membrane	34 (1.4)
Stainless steel	33 (1.3)
Stainless steel	34 (1.4)[1)]
Metal grid	33 (1.3)

1) With rapidX sensing module

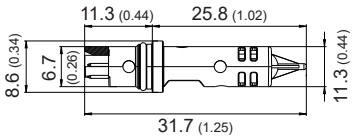
Plastic mounting flange

in the scope of supply for types T2 and T3 with polycarbonate enclosure



HTS401M sensing module

in the scope of supply for types with rapidX technology



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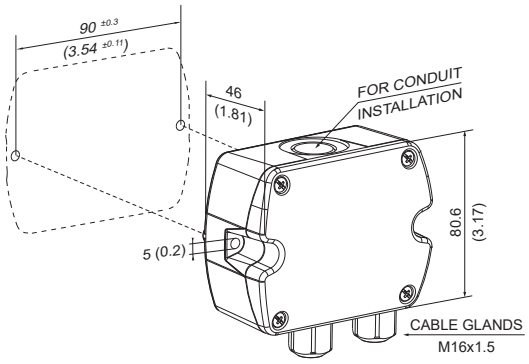
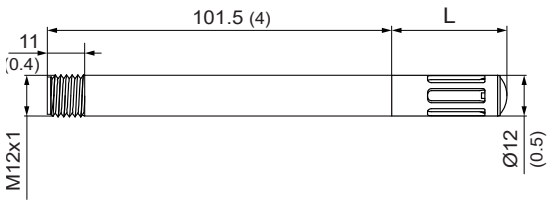
Dimensions

Values in mm (inch)

HTS401P remote probe



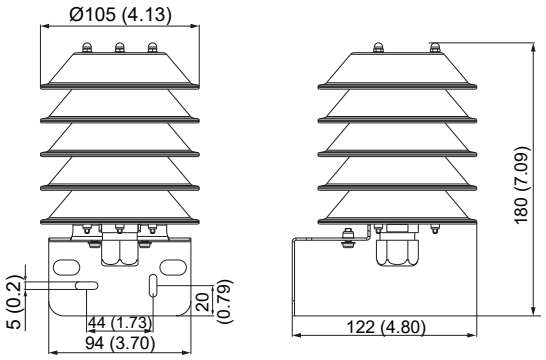
Type T3 (for remote probe)



Radiation shield HA010514 for Type T3

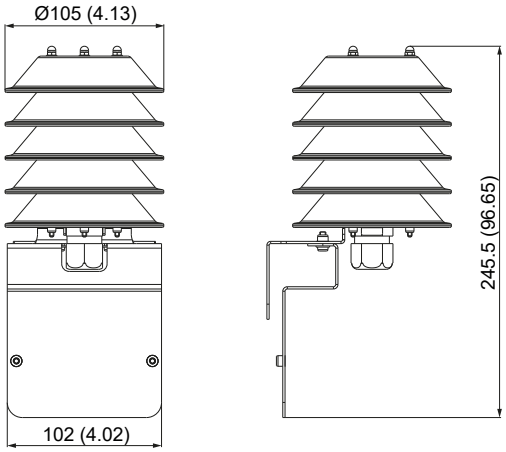
needs to be ordered separately

basic plate for wall mount or pole[1] mount



1) Mounting ring in the scope of supply of radation shield HA010514

with mounting plate[1] for sensor enclosure



1) In the scope of supply of radation shield HA010514

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Technical Data

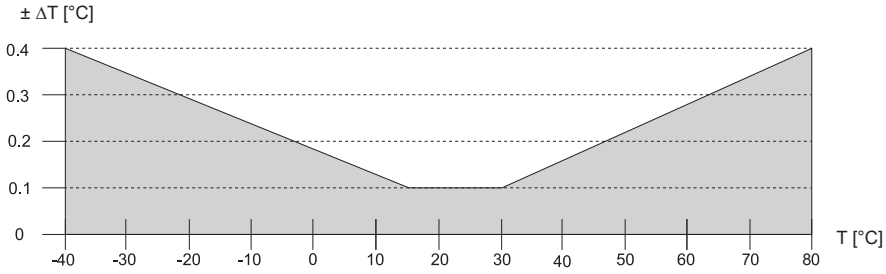
Measurands

Relative humidity (RH)

Measuring range	0...100 %RH	
Accuracy[1] incl. hysteresis, non-linearity and repeatability		
@ -15…40 °C (-5...+104 °F), ≤90 %RH	±(0.95 + 0.0013 • mv) %RH	
>90 %RH	±1.8 %RH	
@ -40…60 °C (-40...+140 °F), 0…100 %RH	±(1.15 + 0.013 • mv) %RH	mv = measured value
@ >60...80 °C (>140...176 °F), 0…100 %RH	±1.9 %RH	
Factory calibration uncertainty[2]		
0...90 %RH	±(0.7 + 0.003 • mv) %RH	
90...100 %RH	±1 %RH	mv = measured value

1) Defined against E+E calibration reference.
2) Defined at 23 °C (73 °F) with a coverage factor k=2, corresponding to a confidence level of 95 %.

Temperature (T)

Measuring range	
Wall mount (T1)	-40...+60 °C (-40...+140 °F)
Duct mount (T2)	-40...+80 °C (-40...+176 °F)
With remote probe (T3)	-40...+80 °C (-40...+176 °F)
Accuracy[1]	
Factory calibration uncertainty[2]	±0.1 °C

1) Defined against E+E calibration reference.
2) Defined at 23 °C (73 °F) with a coverage factor k=2, corresponding to a confidence level of 95 %.

Calculated quantities

		from		up to		unit	
Dew point temperature	Td[1]	-40	(-40)	80	(176)	°C	(°F)
Frost point temperature	Tf[2]	-40	(-40)	0	(32)	°C	(°F)
Wet bulb temperature	Tw	-10	(14)	80	(176)	°C	(°F)
Ice bulb temperature	Ti[3]	-40	(-40)	0	(32)	°C	(°F)
Water vapour partial pressure	e	0	(0)	475	(6.9)	mbar	(psi)
Mixing ratio	r	0	(0)	550	(4125)	g/kg	(gr/lb)
Absolute humidity	dv	0	(0)	270	(108)	g/m^3	(gr/ft^3)
Specific enthalpy	h	-40	(-10)	1590	(640)	kJ/kg	(BTU/lb)

1) Td accuracy according to RH and T uncertainties, please use the E+E Humidity Caclulator for details.
2) Equals Td above 0 °C (32 °F).
3) Equals Tw above 0 °C (32 °F).

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Technical Data

Outputs

Analogue

Two freely selectable and scalable outputs	0 – 5 V / 0 – 10 V 4 – 20 mA (2-wire) 4 – 20 mA (3-wire)	-1 mA < I_L < 1 mA R_L ≤ 500 Ω R_L ≤ 500 Ω	I_L = load current R_L = load resistance

Digital

Digital interface	RS485 (HTS401 = 1 unit load)
Supported measurands	RH, T, Td, Tw, Tf, Ti, e, dv, r, h
Protocol **Factory settings** **Supported Baud rates** **Data types for measured values**	Modbus RTU Baud rate according to ordering guide, parity even, 1 stop bit, Modbus address 49 (0x31) 9600, 19200, 38400, 57600, 76800 and 115200 FLOAT32 and INT16

General

Power supply class III USA & Canada: Class 2 supply necessary, max. voltage 30 V DC	**4 – 20 mA (2-wire)**	(10 V + R_L • 20 mA) < V+ < 35 V DC	
	4 – 20 mA (3-wire) **0 – 5 V / 0 – 10 V** **RS485**	15 – 35 V DC or 24 V AC ±20%	
Current consumption at 24 V	**Current output 2-wire**	DC supply max. 40 mA	with display max. 40 mA
	Current output 3-wire	DC supply typ. 5 mA AC supply typ. 8 mA_{rms}	with display typ. 47 mA with display typ. 75 mA_{rms}
	Voltage output	DC supply typ. 2 mA AC supply typ. 4 mA_{rms}	with display typ. 27 mA with display typ. 43 mA_{rms}
	Digital interface	DC supply typ. 5 mA AC supply typ. 15 mA_{rms}	with display typ. 25 mA with display typ. 41 mA_{rms}
	With ARC / CG active	DC supply max. 110 mA AC supply max. 110 mA_{rms}	
Electrical connection	Screw terminals max. 1.5 mm^2		
Cable gland	M16x1.5		
Cable length for Type T3 with remote Probe, max.	10 m (32.8 ft)		
Display[1]	1, 2 or 3 lines, user configurable Active area 48 x 28 mm (1.9 x 1.1") Optional backlight		
Temperature ranges		**Without display**	**With display**
	Operation **Type T1** **Types T2/T3**	 -40...+60 °C (-40...+140 °F) -40...+80 °C (-40...+176 °F)	 -20...+50 °C (-4...+122 °F) -20...+50 °C (-4...+122 °F)
	Storage	-40...+60 °C (-40...+140 °F)	-20...+60 °C (-4...+140 °F)
Enclosure **Material** **Protection rating**[2]	 PC (Polycarbonate), UL94 V-0 (with Display UL94 HB) approved Die-cast aluminium PC: IP66 / NEMA 4X Die-cast aluminium: IP66 / NEMA 4		
Electromagnetic compatibility	EN 61326-1:2013 FCC Part15 Class A	EN 61326-2-3:2013 ICES-003 Class A	Industrial environment
Conformity	CE UKCA		

1) For display operation with HTS401-xA6 (4 – 20 mA, 2-wire) both outputs must be connected.
2) According to NEMA 250.

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Ordering Guide

	Feature	Description	Code		
			HTS401-		
Hardware Configuration	**Model**	RH + T	M1		
	Type	Wall mount	T1		
		Duct mount		T2	
		Remote probe[1]			T3
	Enclosure material	PC (Polycarbonate)	No code	No code	No code
		Die-cast aluminium (AlSi9Cu3)		HS3	
	Probe length	50 mm (2")		L50	
		200 mm (7.8")		L200	
	rapidX technology	Without exchangeable sensing module	No code	No code	No code
		With exchangeable sensing module	RX1	RX1[2]	
	Output	0 – 5 V	A2		
		0 – 10 V	A3		
		4 – 20 mA (2-wire)	A6		
		4 – 20 mA (3-wire)	A19		
		RS485	J3		
	Filter	Membrane	F2	F2	
		Metal grid	F3	F3	
		Stainless steel sintered	F4	F4	
	Display[3]	Without display	No code	No code	No code
		Without backlight	D1	D1	D1
		With backlight[4]	D2	D2	D2
Setup Analogue Outputs	**Output 1 measurand**	Relative humidity RH [%]	No code		
		Other measurand (*xx* see measurand code)	MA*xx*		
	Output 1 scaling low	0	No code		
		Value	SAL*Value*		
	Output 1 scaling high	100	No code		
		Value	SAH*Value*		
	Output 2 measurand	Temperature T [°C]	No code		
		Other measurand (*xx* see measurand code)	MB*xx*		
	Output 2 scaling low	-40	No code		
		Value	SBL*Value*		
	Output 2 scaling high	60	No code		
		Value	SBH*Value*		
RS485 Setup	**Protocol**	Modbus RTU [5]	P1		
	Baud rate	9 600	BD5		
		19 200	BD6		
		38 400	BD7		
		57 600	BD8		
		76 800	BD9		
		115 200	BD10		
	Units	Metric (SI)	No code		
		Non-metric (US/GB)	U2		
SW Config Options[4]	**ARC**	Off or manual trigger (via RS485 only)	No code		
		Cyclic automatic time trigger (24 h)	ARC1		
		@ power on + cyclic automatic time trigger (24 h)	ARC2		
	Condensation Guard (CG)	Disabled	No code		
		Enabled, no lock time	CG1		
		Enabled, lock time 30 min.	CG2		
	CG trigger	CG level 99 %RH	No code		
		CG level 95 %RH	SFT95		
	Accredited Traceable Calibration Certificate in accordance with DIN EN ISO/IEC 17025		see www.eplusecal.com		
	ISO 9001 Calibration Certificate		see www.epluse.com/iso9001cal		

1) The HTS401P probe and the probe connection cable have to be ordered as separate positions.
2) Not with option HS3 (die-cast aluminium enclosure).
3) Factory setup: For analogue output versions, the display shows the measurands selected for output 1 and output 2. For versions with digital interface, the display shows RH and T.
4) Not with output A6 and not with probe length L50 plus enclosure HS3.
5) Modbus Map and setup instructions: See User Manual and Modbus Application Note AN0103 at www.epluse.com/hts401.

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Measurand Code

For Output 1 and 2 in the Ordering Guide

Measurand		Unit	Code
			MAxx / MBxx
Dew point temperature	Td	°C °F	52 53
Frost point temperature	Tf	°C °F	65 66
Wet bulb temperature	Tw	°C °F	54 55
Ice bulb temperature	Ti	°C °F	118 119
Water vapour partial pressure	e	mbar psi	50 51
Mixing ratio	r	g/kg gr/lb	60 61
Absolute humidity	dv	g/m^3 gr/ft^3	56 57
Specific enthalpy	h	kJ/kg BTU/lb	62 64

PLEASE NOTE

No mix of SI/US units allowed.

Ordering Guide Remote RH/T Probe

	Feature	Description	Code
			HTS401P-
Configuration	Model	RH + T	M1
	Filter	Membrane	F2
		Metal grid	F3
		Stainless steel sintered	F4
	Electrical connection	M12 connector, 4 poles	No code

Ordering Guide rapidX RH/T Sensing Module

	Feature	Description	Code
			HTS401M-
	Packaging	Single packed	PK4
		Multipackage (Tray)	PK6

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Order Example

HTS401-M1T2HS3L200J3F4P1BD7

Feature	Code	Description
Model	**M1**	RH + T
Type	**T2**	Duct mount
Enclosure material	**HS3**	Die-cast aluminium
Probe length	**L200**	200 mm (4")
rapidX technology	**No code**	Without exchangable sensing module (not available with die-cast aluminium enclosure)
Output	**J3**	RS485
Filter	**F4**	Stainless steel sintered
Display	**No code**	Without display
Output 1 measurand	**No code**	Not applicable for RS485
Output 1 scaling low	**No code**	Not applicable for RS485
Output 1 scaling high	**No code**	Not applicable for RS485
Output 2 measurand	**No code**	Not applicable for RS485
Output 2 scaling low	**No code**	Not applicable for RS485
Output 2 scaling high	**No code**	Not applicable for RS485
Protocol	**P1**	Modbus RTU
Baud rate	**BD7**	38400
Units	**No code**	Metric (SI)
ARC configuration	**No code**	Off or manual trigger
Condensation Guard (CG)	**No code**	Disabled
CG trigger	**No code**	CG level 99 %RH

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Order Example

Type T3

Position 1: Basic Device

HTS401-M1T3A19D2MB2SBL40SBH120

Feature	Code	Description
Model	M1	RH + T
Type	T3	Remote probe
Enclosure material	No code	PC (Polycarbonate)
Probe length	No code	Not applicable
rapidX technology	No code	Not applicable (not available with remote probe)
Output	A19	4 – 20 mA (3-wire)
Filter	No code	Remark: Filter to be selected with remote probe
Display	D2	With display with backlight
Output 1 measurand	No code	Relative humidity RH [%]
Output 1 scaling low	No code	0
Output 1 scaling high	No code	100
Output 2 measurand	MB2	Temperature T [°F]
Output 2 scaling low	SBL40	40
Output 2 scaling high	SBH120	120
ARC configuration	No code	Off or manual trigger
Condensation Guard (CG)	No code	Disabled
CG trigger	No code	CG level 99 %RH

Position 2: Remote Probe

HTS401P-M1F3

Feature	Code	Description
Model	M1	RH + T
Filter	F3	Metal grid
Connection	No code	M12 connector, 4 poles

Position 3: Sensor Connection Cable

HA010831

Feature	Code	Description
Sensor Connection Cable	HA010831	Sensor connection cable PVC, 5 poles, M12x1 socket ←→ wire ferrules, 0.5 m (1.64 ft)

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Accessories

For further information please refer to the Accessories datasheet.

Description	Code
PCS10 Product Configuration Software (free download: www.epluse.com/pcs10)	**PCS10**
USB-C configuration stick	**HA011070**
Stainless steel mounting flange Ø12 mm (0.47")	**HA010201**
Sensor connection cable PVC, 5 poles, M12x1 socket ←→ wire ferrules	
0.5 m (1.6 ft)	**HA010831**
2 m (6.6 ft)	**HA010832**
5 m (16.4 ft)	**HA010833**
10 m (32.8 ft)	**HA010834**
Protection cap for Ø12 mm probe	**HA010783**
Radiation shield for HTS401P	**HA010514**
Power supply adapter 24 V DC	**V03**

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