HUMIDITY • DEW POINT • AIR VELOCITY

2009 / 2010

YOUR PARTNER IN SENSOR TECHNOLOGY

E+E ELEKTRONIK® Ges.m.b.H.

TEMPERATURE • CO_2 • CALIBRATION

Our quality policy is the guide to all our business dealings

The customer is our raison d'etre. Our motivation is the recognition and fulfilling of specific customer demands in a competent and reliable fashion with a view to establishing long-term partnerships.
For the owner, we want to be a future-oriented company which achieves good returns through its products and services in the field of sensor technology, and which, as such, forms an economically healthy element within the group of companies.

We want to ensure our competitiveness through supplier relations based on partnerships. We aspire, therefore, to long-term co-operations with reliable and competent suppliers from whom we expect products and services at optimal value for money. Every employee should regard his or her responsibilities as an important contribution towards fulfilling the clients' and owner's expectations. We want competent, committed and responsible employees whom we offer a long-term view within the company.

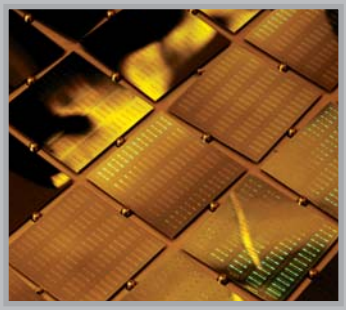
We want to be proud of ourselves. We want to contribute towards society through our activities. During development and production we deal with the environment and resources in a responsible manner by use of an integrated management system.

YOUR PARTNER IN SENSOR TECHNOLOGY

E+E ELEKTRONIK® Ges.m.b.H.

High-Tech Products - Our Market

- **Automobile industry**
- **Heating, ventilation and air conditioning**
- **Industrial dryers**
- **Measurement and control technology**
- **Climate control in agriculture**
- **Process and environmental control**
- **Meteorology**
- **Home appliances / white goods**



Based on the wide range of standard products and on the know-how in HVAC and industrial applications, E+E ELEKTRONIK entered the market of mass applications and became a reliable and internationally recognized partner of the industry.
Customization of our standard products to fulfill specific customers requirements is one of our main strengths.
Continuous investments in manufacturing facilities and innovative technology for both humidity and air velocity measuring instrumentation are guaranteeing that E+E ELEKTRONIK will master all future development requirements.

New clean rooms, state-of-the-art machinery for thin film production and a reliable quality assurance system are the conditions for the high quality of all our products.

Our accredited calibration laboratory for relative humidity, dew point and temperature offers documented checks and calibration of measuring instruments.

CERTIFICATE

The Certification Body of TÜV SÜD Management Service GmbH certifies that

E+E Elektronik Ges.m.b.H.
Langwiesen 7
A-4209 Engerwitzdorf

has established and applies an Environmental Management System for

Development, Manufacturing and Distribution of Sensors and Transmitters.

An audit was performed, Report No. 70007292
Proof has been furnished that the requirements according to

ISO 14001: 2004

are fulfilled. The certificate is valid in conjunction with the main-certificate until 2011-11-27
Certificate Registration No. 12 104 14421/06 TMS

OQS-CERTIFICATE

qualityaustria

E+E Elektronik Gesellschaft m.b.H.
A-4209 Engerwitzdorf , Langwiesen 7

QUALITY MANAGEMENT SYSTEM
complying with the requirements of standard
ISO/TS 16949:2002,
incl. product design

Scope of application: Design, production and sales of sensors and transmitters
NACE: 31.2.0 EAC: 19
Remote supporting function: not applicable

Registration No.: 00042/0
IATF-Registration No.: 0036523
Date of initial issue: 23. September 2003
Valid until: 23. September 2009

Vienna, 9. October 2006

Federal Ministry for Economics and Labour
Österreichischer Kalibrierdienst (ÖKD)

CERTIFICATE OF ACCREDITATION

We confirm that the Calibration Laboratory of
E + E Elektronik GmbH
Langwiesen 7, A-4209 Engerwitzdorf,
is accredited for the following quantities:

humidity of air and temperature

The accreditation was given with the document No. BMWA-96.113/0040-II/11/2006 dated 17 March 2006.

The scope of accreditation is included in the accreditation document and in the directory of accredited calibration laboratories of Austria.

The registration number of this calibration laboratory is ÖKD 23.

Vienna, 17 March 2006

Humidity Measurement

Air Velocity Measurement

CO_2 - Measurement

Temperature Measurement

Hand-Helds

Calibration / Calibration Services

Appendix

NEWS

Compact Dew Point Transmitter / Switch

EE371 / EE372 / EE375 page 66

Compact Transmitter / Switch for Moisture Content in Oil

EE381 page 59

HVAC Miniature Air Velocity Transmitter

EE575 page 95

Condensation Monitor

EE45-01 page 71

Small Size Humidity/Temperature Transmitter for OEM Applications

EE06 with current output page 43

Temperature Transmitter with interchangeable Probes

EE22-T page 113

Humidity Measurement

- Industrial transmitters
- Transmitters for intrinsically safe applications
- Transmitters for demanding applications in climate control systems
- Transmitters for HVAC applications
- Hygrostats
- OEM transmitters
- Transmitters for dew point / condensation measurement
- Transmitters for measurement of moisture content in oil
- Hand-helds
- Humidity monitoring
- Humidity sensor elements

Air Velocity Measurement

- Industrial transmitters
- Transmitters for HVAC applications
- Air velocity switches
- Hand-helds

CO_2 Measurement

- Transmitters for HVAC applications
- Transmitters for agriculture applications

Temperature Measurement

- Transmitters
- Hand-helds

Hand-Helds

- Hand-helds for the measurands: RH, T, Td, dv, r, v, aw, x

Calibration / Calibration Services

- High-precision humidity calibrator
- Humidity calibration set
- Accredited E+E calibration services

Appendix

- Accessories
- Product selection guide
- Scaling of T-outputs
- Humidiy measurement basics
- Air velocity measurement basics
- CO_2 measurement basics
- Temperature measurement basics
- Humidity calibration basics

Humidity
Measurement

Humidity / temperatur transmitters
- EE32 / EE33
- EE29 / EE31
- EE30EX
- EE23
- EE22
- EE21
- EE16
- EE14
- EE10
- EE08
- EE06
- OEM Products
- EE99-1

Dewpoint / condensation measurement
- EE35
- EE371/EE372/EE375
- EE31
- EE33
- EE45-01

Measurement of moisture content in oil
- EE36
- EE381
- OMNIPORT 20

Hand-helds
- HUMIPORT 05/10/20
- OMNIPORT 20

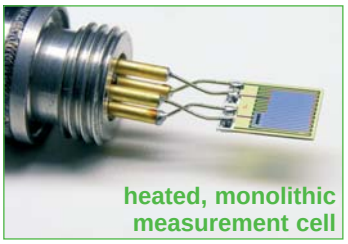
Humidity monitoring
- HUMIMAP 20
- HUMLOG 10
- EE02

Humidity sensor elements
- General information
- HC105 / HC109
- HC104-Kxx
- HC201
- HC103M2
- Handling instructions

EE32/33 Series

Humidity / Temperature Transmitter for High Humidity and Chemical Applications

The highly accurate EE32/33 series are designed for fast and reliable measurement of relative humidity / dew point temperature / absolute humidity / ...under the most demanding conditions.
Neither condensation nor heavy chemical pollutions will affect prompt and reliable measurements. Process pressures as high as 100 bar (1450 psi) and continuous high humidity are also no problem for the EE32/33 series.
The core of the EE32/33 series is the new monolithic measurement cell type HMC1, manufactured in thin-film technology by E+E Elektronik.
Chemical contamination and also condensation will actually evaporate due to the innovative design of the HMC1 measurement cell. The monolithic construction of the sensor allows a fast return to normal conditions and a continuation of the measurement.
Additionally, with the inimitable E+E sensor coating the HMC1 measurement cell is even better protected against corrosive and short-circuit-causing conductive soils.
Distinctive models and mounting versions allow the EE32/33 series to be utilized in numerous applications:


heated, monolithic measurement cell


EE32/33-MFTA

- **Measurement of relative humidity during temporary condensation:**
  the measurement cell is briefly heated, but very intense
- **Measurement of dew point temperature at continuous high humidity** (EE33 only)**:**
  the measurement cell is controlled and heated continuously
- **Measurement of relative humidity at continuous high humidity:**
  the measurement cell is controlled and heated continuously;
  an additional temperature sensor is added
- **Measurement of relative humidity at high chemical exposure and average humidity:**
  the measurement cell is briefly heated, but very intense
- **Measurement of relative humidity at process pressure up to 100bar (1450psi) and average humidity:**
  the measurement cell is installed in a special high pressure probe


EE32/33-MFTC
EE32/33-MFTD
EE33-MFTK
EE32/33-MFTE
EE32/33-MFTI
EE32/33-MFTJ

The configuration software included in the scope of supply allows user friendly setup of the operation / sensor heating mode as well as selection and adjustment of the electrical outputs.

Model	Environmental Conditions
A - wall mounting	chemical pollution, temporary condensation
B - duct mounting	chemical pollution, temporary condensation
C - remote sensing probe up to 120°C (248°F)	chemical pollution, temporary condensation
D - remote sensing probe up to 180°C (356°F)	chemical pollution, temporary condensation
E - remote sensing probe, pressure tight up to 20bar (300psi)	chemical pollution, temporary condensation
I - remote sensing probe, pressure tight up to 100bar (1450psi)	chemical pollution, temporary condensation
J - 2 remote sensing probes (RH-measurement), pressure tight up to 20bar (300psi)	continuous high humidity and condensation
K - remote sensing probe (Td-measurement) pressure tight up to 20bar (300psi)	continuous high humidity and condensation

Typical Applications

pharmaceutical and food industry
dryers for ceramics, wood, concrete, polyester, etc
mushroom farms
high-humidity storage rooms
climate, test and curing chambers
meteorology

Features

heated, monolithic measurement cell
working range 0...100% RH / -40...+180°C (-40...356°F)
measurement near condensation
fast recovery after condensation
chemical purge after chemical exposure
pressure tight up to 100bar (1450psi)
calculation of additional physical quantities
optional sensor coating
traceable calibration

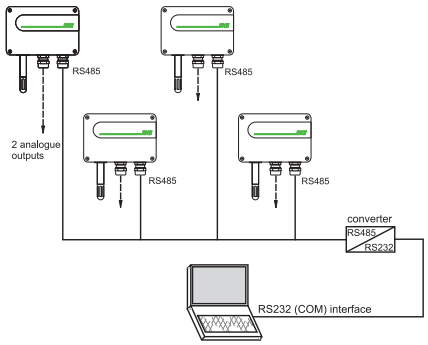
Product Comparison EE32 - EE33

Functions	Comment	EE32	EE33
Measurement of humidity and temperature		✓	✓
Calculation h, r, dv, Tw, Td, Tf, e			✓
2 freely scaleable and configurable analogue outputs		✓	✓
Remote sensing probe up to 20m (65.6ft)		✓	✓
On-site adjustment for relative humidity and temperature		✓	✓
LED indication of transmitter status / error diagnosis of probes		✓	✓
RS232 for transmitter configuration via PC		✓	✓
Configuration software	standard supply	✓	✓
Alternating display with MIN/MAX indication	optional	✓	✓
2 freely configurable alarm outputs	optional	✓	✓
Removeable sensing probe	optional	✓	✓
Sensor protection with coating	optional	✓	✓
Pluggable electrical connections	optional	✓	✓
Data output via RS232 interface			✓
Data output via RS485 interface	optional		✓
Network for up to 32 transmitters via RS485 bus	optional		✓
Ethernet interface for networking and remote monitoring	optional		✓
Data logging and analysis PC software	optional		✓

Networkability / Ethernet Interface

The optional RS485 interface (order code N) allows for building a network of up to 32 transmitters.
The measurement data can be collected in a shared database and made available for all kinds of further processing.

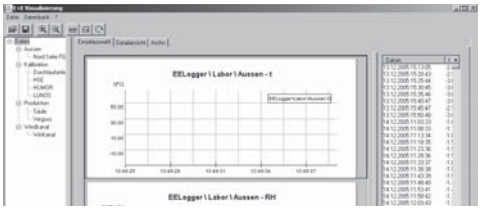
Additionally, the transmitters can be networked with an Ethernet module (order code E) for remote monitoring.



Software

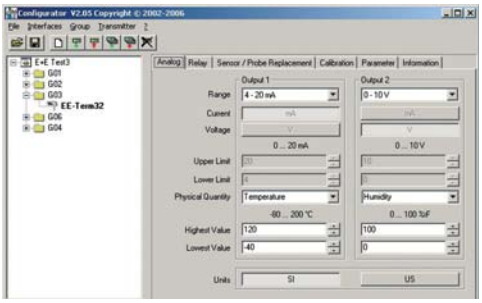
Configuration Software: (included in the scope of supply)

The configuration software allows flexible and simple adjustment of the analogue and alarm outputs in accordance with the requirements. The adjustment / calibration of the humidity and temperature outputs is possible as well. Furthermore the settings of the start and duration of the heating of the measurement cell can be defined.



Data Logging / Analysis Software: (**EE33 only** ordering code HA010602)

An additional software package enables data recording and management, including alerts by e-mail or text message when set points are triggered.
It is also possible to present the collected measurement data on a PC in graphs or tables. If the option N (RS485) or E (Ethernet) is selected in the ordering code, the data logging and analysis software will be included in the scope of supply.



Integrated Display

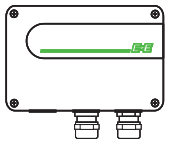
The actual measurement data and the corresponding Min/Max values can be indicated in an optional display (order code D05). The physical quantity to be displayed is selected by the push buttons next to the display.

Alarm Outputs

An optional alarm module with 2 relay outputs is available for control and alarm purposes (order code SW). The selection of the physical quantity and the setting of threshold and hysteresis can be made with the configuration software included in the scope of supply.

Connection Versions

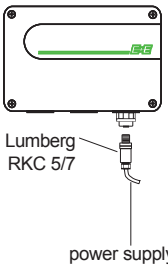
standard



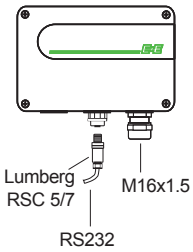
M16 x 1.5

Transmitter: 2xM16
Transmitter incl. alarm output: 3xM16

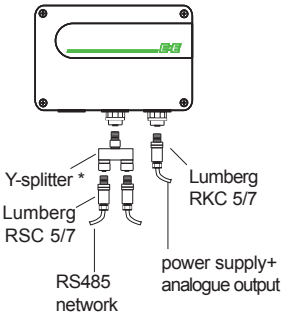
plug option C03



plug option C06



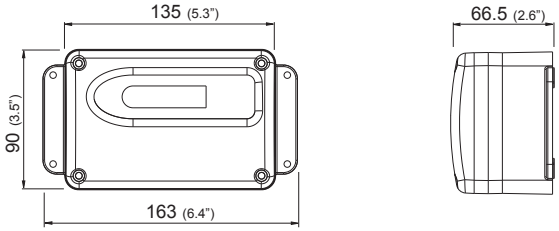
plug option C08



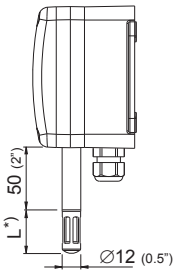
* Siemens 6ES7 194-1KA01-0XA0

Dimensions (mm)

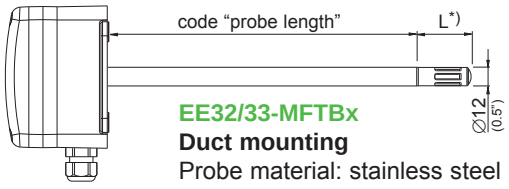
Housing:



Models:

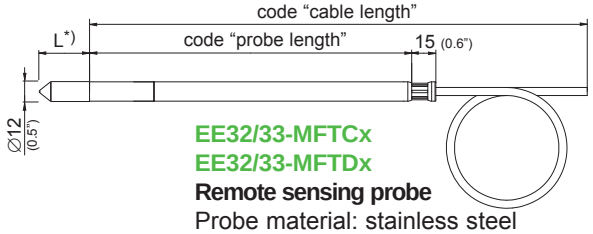


EE32/33-MFTAx
Wall mounting
Probe material: PC



EE32/33-MFTBx
Duct mounting
Probe material: stainless steel

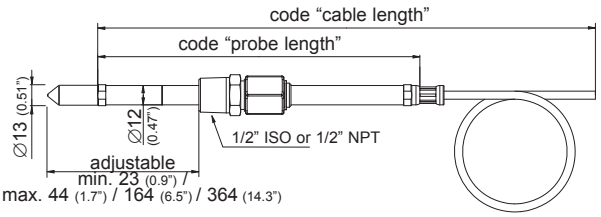
Sensing probes:



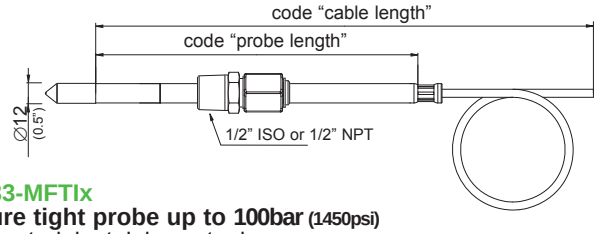
EE32/33-MFTCx
EE32/33-MFTDx
Remote sensing probe
Probe material: stainless steel

*) L = Filter length: refer to data sheet "Accessories" page 138

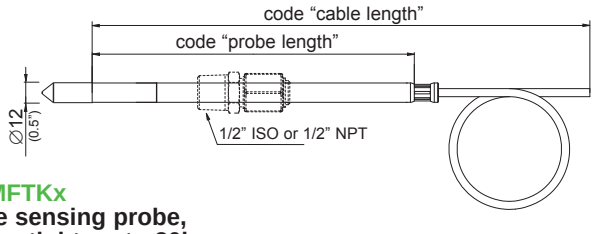
Sensing probes:



EE32/33-MFTEx
Pressure tight probe up to 20bar (300psi)
Probe material: stainless steel

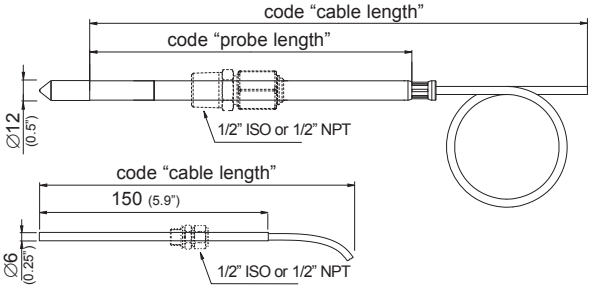


EE32/33-MFTIx
Pressure tight probe up to 100bar (1450psi)
Probe material: stainless steel



EE33-MFTKx
Remote sensing probe,
pressure tight up to 20bar (300psi)
(screw connection is not included in the scope of supply)
Probe material: stainless steel

screw connection:	order code:
1/2" ISO ∅12mm	HA011102
1/2" NPT ∅12mm	HA011103



EE32/33-MFTJx
Two remote sensing probes,
pressure tight up to 20bar (300psi)
(screw connections are not included in the scope of supply)
Probe material: stainless steel

screw connection:	order code:
1/2" ISO ∅12mm	HA011102
1/2" NPT ∅12mm	HA011103
1/2" ISO ∅6mm	HA011104
1/2" NPT ∅6mm	HA011105

Technical Data EE33

Measurement values

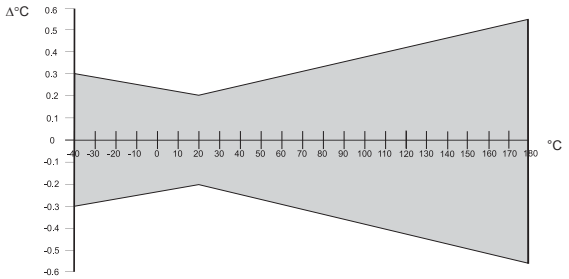
Relative humidity

Humidity sensor[1)]		heated, monolithic measurement cell HMC1
Working range[1)]		0...100% RH
Accuracy[*)] (including hysteresis, non-linearity and repeatability, traceable to intern. standards, administrated by NIST, PTB, BEV...)		
-15...40°C (5...104°F)	≤90% RH	± (1.3 + 0.3%*mv) % RH
-15...40°C (5...104°F)	>90% RH	± 2.3% RH
-25...70°C (-13...158°F)		± (1.4 + 1%*mv) % RH
-40...180°C (-40...356°F)		± (1.5 + 1.5%*mv) % RH
Temperature dependence of electronics		typ. ± 0.01% RH/°C (0.0055% RH/°F)
Response time with metal grid filter at 20°C (68°F) / t_{90}		< 15s

Temperature

Temperature sensor element		monolithic measurement cell HMC1
Working range sensing head	EE33-MFTA: -40...60°C (-40...140°F)	EE33-MFTB: -40...80°C (-40...176°F)
	EE33-MFTC: -40...120°C (-40...248°F)	EE33-MFTD/E/I/J/K: -40...180°C (-40...356°F)

Accuracy



Temperature dependence of electronics	typ. ± 0.005°C/°C
External temperature probe	Pt1000 (DIN A)

Outputs[2)]

Two freely selectable and scaleable analogue outputs	0 - 1V	-1mA < I_L < 1mA
	0 - 5V	-1mA < I_L < 1mA
	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm
	0 - 20mA	R_L < 500 Ohm
Digital interface	RS232	optional: RS485 or ethernet

Max. adjustable measurement range[2)3)]

		from	to					unit
			EE33-A	EE33-B	EE33-C	EE33-D/E/I/J	EE33-K	
Humidity	RH	0	100	100	100	100	/	% rF
Temperature	T	-40 (-40)	60 (140)	80 (176)	120 (248)	180 (356)	/	°C (°F)
Dew point temperature	Td	-40 (-40)	60 (140)	80 (176)	100 (212)	100 (212)	100 (212)	°C (°F)
Frost point temperature	Tf	-40 (-40)	0 (32)	0 (32)	0 (32)	0 (32)	0 (32)	°C (°F)
Wet bulb temperature	Tw	0 (32)	60 (140)	80 (176)	100 (212)	100 (212)	/	°C (°F)
Water vapour partial pressure	e	0 (0)	200 (3)	500 (7.5)	1100 (15)	1100 (15)	/	mbar (psi)
Mixture ratio	r	0 (0)	425 (2900)	999 (9999)	999 (9999)	999 (9999)	/	g/kg (gr/lb)
Absolute humidity	dv	0 (0)	150 (60)	300 (120)	700 (300)	700 (300)	/	g/m³ (gr/f³)
Specific enthalpy	h	0 (0)	400 (50000)	1000 (375000)	2800 (999999)	2800 (999999)	/	kJ/kg (lbf/lb)

General

Supply voltage		8...35V DC 12...30V AC (optional 100...240V AC, 50/60Hz)
Current consumption	- 2x voltage output	for 24V DC/AC: typ. 40mA / 80mA
	- 2x current output	typ. 80mA / 160mA
Pressure range for pressure tight probe		EE33-MFTEx/Jx/Kx: 0.01...20bar (0.15...300psi) EE33-MFTIx: 0...100bar (0...1450psi)
System requirements for software		WINDOWS 2000 or later; serial interface
Housing / protection class		Al Si 9 Cu 3 / IP65; (Nema 4)
Cable gland		M16 x 1.5 cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection		screw terminals up to max. 1.5mm² (AWG 16)
Working and storage temperature range of electronics		-40...60°C (-40...140°F) -20...50°C (-4...122°F) - housing with display
Electromagnetic compatibility according to		EN61326-1 EN61326-2-3 ICES-003 ClassB Industrial Environment FCC Part15 ClassB

CE

1) Refer to the working range of the humidity sensor. 2) Can be easily changed by software. 3) Refer to accuracies of calculated values (page 152)

*) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).

Technical Data EE32

Measurement values

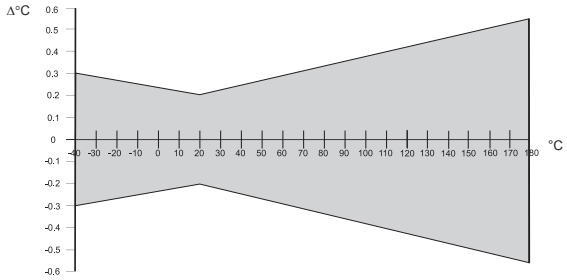
Relative humidity

Humidity sensor[1]		heated, monolithic measurement cell HMC1
Working range[1]		0...100% RH
Accuracy[*] (including hysteresis, non-linearity and repeatability, traceable to intern. standards, administrated by NIST, PTB, BEV...)		
-15...40°C (5...104°F)	≤90% RH	± (1.3 + 0.3%*mv) % RH
-15...40°C (5...104°F)	>90% RH	± 2.3% RH
-25...70°C (-13...158°F)		± (1.4 + 1%*mv) % RH
-40...180°C (-40...356°F)		± (1.5 + 1.5%*mv) % RH
Temperature dependence of electronics		typ. ± 0.01% RH/°C (0.0055% RH/°F)
Response time with metal grid filter at 20°C (68°F) / t_{90}		< 15s

Temperature

Temperature sensor element		monolithic measurement cell HMC1
Working range sensing head	EE32-MFTA: -40...60°C (-40...140°F)	EE32-MFTB: -40...80°C (-40...176°F)
	EE32-MFTC: -40...120°C (-40...248°F)	EE32-MFTD/E/I/J: -40...180°C (-40...356°F)

Accuracy



Temperature dependence of electronics	typ. ± 0.005°C/°C
External temperature probe	Pt1000 (DIN A)

Outputs[2]

Two freely selectable and scaleable analogue outputs	0 - 1V	-1mA < I_L < 1mA
	0 - 5V	-1mA < I_L < 1mA
	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm
	0 - 20mA	R_L < 500 Ohm

Max. adjustable measurement range[2)3)]

		from	to			unit
			EE32-A	EE32-B	EE32-C	EE32-D/E/I/J	
Humidity	RH	0	100	100	100	100	% RH
Temperature	T	-40 (-40)	60 (140)	80	120 (248)	180 (356)	°C

General

Supply voltage		8...35V DC 12...30V AC (optional 100...240V AC, 50/60Hz)
Current consumption	- 2x voltage output	for 24V DC/AC: typ. 40mA / 80mA
	- 2x current output	typ. 80mA / 160mA
Pressure range for pressure tight probe		EE32-MFTEx/Jx: 0.01...20bar (0.15...300psi) EE32-MFTIx: 0...100bar (0...1450psi)
System requirements for software		WINDOWS 2000 or later; serial interface
Housing / protection class		Al Si 9 Cu 3 / IP65; (Nema 4)
Cable gland		M16 x 1.5 cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection		screw terminals up to max. 1.5mm² (AWG 16)
Working and storage temperature range of electronics		-40...60°C (-40...140°F) -20...50°C (-4...122°F) - housing with display
Electromagnetic compatibility according to		EN61326-1 EN61326-2-3 ICES-003 ClassB Industrial Environment FCC Part15 ClassB

CE

1) Refer to the working range of the humidity sensor. 2) Can be easily changed by software. 3) Refer to accuracies of calculated values

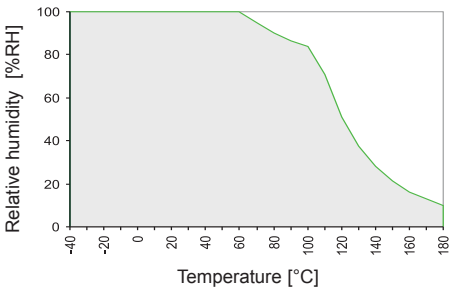
*) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).

Technical Data for Options

Display	graphical LC display (128x32 pixels), with integrated push-buttons for selecting parameters and MIN/MAX function
Alarm outputs	2 x 1 switch contact 250V AC / 6A 28V DC / 6A threshold + hysteresis: can be adjusted with configuration software switching parameters:

freely selectable between		EE32-MFTA/B/D/E/I/J	EE32-MFTK
RH	Relative humidity	✓	
T	Temperature	✓	
Td	Dew point temperature	✓ (EE33 only)	✓
Tf	Frost point temperature	✓ (EE33 only)	✓
Tw	Wet bulb temperature	✓ (EE33 only)	
e	Water vapour partial pressure	✓ (EE33 only)	
r	Mixture ratio	✓ (EE33 only)	
dv	Absolute humidity	✓ (EE33 only)	
h	Specific enthalpy	✓ (EE33 only)	

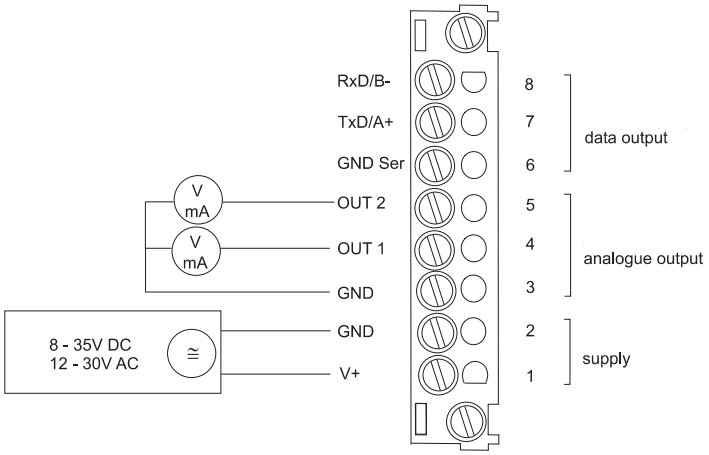
Working Range Humidity Sensor



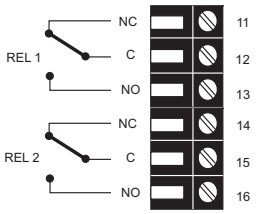
The grey area shows the allowed measurement range for the humidity sensor.

Operating points outside of this range do not lead to destruction of the sensor, but the specified measurement accuracy cannot be guaranteed.

Connection Diagram



Terminal configuration - Alarm output
(order code SW)



Accessories / Replacement Parts

(For further information, see data sheet "Accessories", page 138)

- Filter caps (HA0101xx)
- Display + housing cover (D05M)
- Interface cable for PCB (HA010304)
- Interface cable for plug C06 (HA010311)
- 1/2" NPT-adapter for configuration (HA011101)
- Mounting flange 12mm (RH probe) (HA010201)
- Mounting flange 6mm (T probe) (HA010207)
- Adapter M16x1.5 to NPT ½" (HA011101)
- Drip water protection (HA010503)
- 1% Calibration (EE90/3H)
- Calibration set (HA0104xx)
- Pressure tight screw connections
  - 1/2" ISO ∅12mm (HA011102)
  - 1/2" NPT ∅12mm (HA011103)
  - 1/2" ISO ∅6mm (HA011104)
  - 1/2" NPT∅6mm (HA011105)

EE33 only:
- RS485 Kit (HW + SW) for networking (HA010601)
- Data logging / analysis software (HA010602)

Ordering Guide EE33

		EE33-	EE33-	EE33-	EE33-	EE33-	EE33-	EE33-	EE33-
Hardware Configuration									
Housing	metal housing	M	M	M	M	M	M	M	M
Type	humidity + temperature	FT	FT	FT	FT	FT	FT	FT	FT
Model		A	B	C	D	E	I	J	K
Filter	PTFE stainless steel filter							2	
	stainless steel sintered filter	3	3	3	3	3	3		
	PTFE filter	5	5	5	5	5	5		
	stainless steel grid filter (up to 180°C / 356°F)	9	9	9	9	9	9	9	9
Cable length	2m (6.6ft)			02	02	02	02	02	02
(incl. probe length)	5m (16.4ft)			05	05	05	05	05	05
	10m (32.8ft)			10	10	10	10	10	10
	20m (65.6ft)			20	20	20	20	20	20
Probe length	65mm (2.6") (for model E: 80mm (3.1"))			2	2	2			2
	200mm (7.9")		5	5	5	5	5	5	5
	400mm (15.8")		6	6	6	6			6
Pressure tight	1/2" male thread					HA03	HA03		
feedthrough	1/2" NPT thread					HA07	HA07		
Interface	RS232								
	RS485	N	N	N	N	N	N	N	N
	ethernet interface[1]	E	E	E	E	E	E	E	E
Display	without display								
	with display	D05	D05	D05	D05	D05	D05	D05	D05
Alarm output[2]	without relay								
	with relay	SW	SW	SW	SW	SW	SW	SW	SW
Plug	cable glands								
	1 plug for power supply and outputs	C03	C03	C03	C03	C03	C03	C03	C03
	1 cable gland / 1 plug for RS232	C06	C06	C06	C06	C06	C06	C06	C06
	2 plugs for power supply / outputs and RS485 network	C08	C08	C08	C08	C08	C08	C08	C08
Sensing probe	fixed								
	connectable in the housing			P03	P03	P03	P03	P03	P03
Coating sensor	no								
	yes	HC01	HC01	HC01	HC01	HC01	HC01	HC01	HC01
Supply voltage	8...35V DC / 12...30V AC								
	integrated power supply 100...240V AC, 50/60Hz[3]	V01	V01	V01	V01	V01	V01	V01	V01

Software Configuration											
Physical parameters of outputs	Relative humidity	RH	[%]	(A)	Output 1	Select according to Ordering Guide (A - J)					C
	Temperature	T	[°C]	(B)							
	Dew point temperature	Td	[°C]	(C)	Output 2	Select according to Ordering Guide (A - J)					D
	Frost point temperature	Tf	[°C]	(D)							
	Wet bulb temperature	Tw	[°C]	(E)							
	Water vapour partial pres.	e	[mbar]	(F)							
	Mixture ratio	r	[g/kg]	(G)							
	Absolute humidity	dv	[g/m³]	(H)							
	Specific enthalpy	h	[kJ/kg]	(J)							

		EE33-	EE33-	EE33-	EE33-	EE33-	EE33-	EE33-	EE33-
Type of output signal	0-1V	1	1	1	1	1	1	1	1
	0-5V	2	2	2	2	2	2	2	2
	0-10V	3	3	3	3	3	3	3	3
	0-20mA	5	5	5	5	5	5	5	5
	4-20mA	6	6	6	6	6	6	6	6
Measured value units	metric / SI								
	non metric / US	E01	E01	E01	E01	E01	E01	E01	E01

T-Scaling	-40...60	(T02)	-20...100	(T14)	Output T	Select according to Ordering Guide (Txx)
Td-Scaling	-10...50	(T03)	+20...120	(T15)		
Tf-Scaling	0...50	(T04)	0...120	(T16)	Output Td	Select according to Ordering Guide (Tdxx)
Tw-Scaling	0...100	(T05)	0...80	(T21)		
(in °C or °F)	0...60	(T07)	-40...80	(T22)	Output Tf	Select according to Ordering Guide (Tfxx)
	-30...70	(T08)	-20...80	(T24)		
	-30...120	(T09)	-40...160	(T33)	Output Tw	Select according to Ordering Guide (Twxx)
	-20...120	(T10)	+20...180	(T40)		
	-40...120	(T12)	-40...180	(T52)		Other T/Td/Tf/Tw-scaling refer to page 146

1) Combination ethernet and alarm output is not possible / combination ethernet and integrated power supply is not possible
2) Combination alarm output and plugs is not possible (with cable glands only) / combination alarm output and integrated power supply is not possible
3) Integrated power supply includes 2 plugs for power supply and outputs / further plug options are not possible

Order Example

EE33-MFTD5025ND05SW/BC3-T02-Td07

Hardware Configuration:

Housing:	metal	Display:	with display
Type:	humidity + temperature	Alarm output:	with relay
Model:	remote sensing probe	Plug:	cable glands
Filter:	PTFE filter	Sensing probe:	fixed
Cable length:	2m (6.6ft)	Coating sensor:	no
Probe length:	200mm (7.9")	Supply voltage:	8...35V DC / 12...30V AC
Interface:	RS485		

Software Configuration:

Output 1:	T
Output 2:	Td
Output signal:	0-10V
Measurand value unit:	metric / SI
T-Scaling:	-40...60°C
Td-Scaling:	0...60°C

Ordering Guide EE32

		EE32-	EE32-	EE32-	EE32-	EE32-	EE32-	EE32-
Hardware Configuration								
Housing	metal housing	M	M	M	M	M	M	M
Type	humidity + temperature	FT	FT	FT	FT	FT	FT	FT
Model		A	B	C	D	E	I	J
Filter	PTFE stainless steel filter							2
	stainless steel sintered filter	3	3	3	3	3	3	
	PTFE filter	5	5	5	5	5	5	
	stainless steel grid filter (up to 180°C / 356°F)	9	9	9	9	9	9	9
Cable length	2m (6.6ft)			02	02	02	02	02
(incl. probe length)	5m (16.4ft)			05	05	05	05	05
	10m (32.8ft)			10	10	10	10	10
	20m (65.6ft)			20	20	20	20	20
Probe length	65mm (2.6") (for model E: 80mm (3.1"))			2	2	2		
	200mm (7.9")		5	5	5	5	5	5
	400mm (15.8")		6	6	6			
Pressure tight	1/2" male thread					HA03	HA03	
feedthrough	1/2" NPT thread					HA07	HA07	
Display	without display							
	with display	D05	D05	D05	D05	D05	D05	D05
Alarm output[1]	without relay							
	with relay	SW	SW	SW	SW	SW	SW	SW
Plug	cable glands							
	1 plug for power supply and outputs	C03	C03	C03	C03	C03	C03	C03
	1 cable gland / 1 plug for RS232	C06	C06	C06	C06	C06	C06	C06
Sensing probe	fixed							
	connectable in the housing			P03	P03	P03	P03	P03
Coating sensor	no							
	yes	HC01	HC01	HC01	HC01	HC01	HC01	HC01
Supply voltage	8...35V DC / 12...30V AC							
	integrated power supply 100...240V AC, 50/60Hz[2]	V01	V01	V01	V01	V01	V01	V01

Software Configuration						
Physical parameters	relative humidity	RH [%]	(A)	Output 1	Select according to Ordering Guide (A or B)	
of outputs	temperature	T [°C]	(B)	Output 2	Select according to Ordering Guide (A or B)	
Type of	0-1V				1	
output signal	0-5V				2	
	0-10V				3	
	0-20mA				5	
	4-20mA				6	
Measured value units	metric / SI				E01	
	non metric / US					
T-Scaling	-40...60 (T02)	-20...100 (T14)		Output T	Select according to Ordering Guide (Txx)	
(in °C or °F)	-10...50 (T03)	+20...120 (T15)				
	0...50 (T04)	0...120 (T16)			Other T-scaling refer to page 146	
	0...100 (T05)	0...80 (T21)				
	0...60 (T07)	-40...80 (T22)				
	-30...70 (T08)	-20...80 (T24)				
	-30...120 (T09)	-40...160 (T33)				
	-20...120 (T10)	+20...180 (T40)				
	-40...120 (T12)	-40...180 (T52)				

1) Combination alarm output and plugs is not possible (with cable glands only) / combination alarm output and integrated supply voltage is not possible
2) Integrated power supply includes 2 plugs for power supply and outputs / further plug options are not possible

Order Example

EE32-MFTJ9025D05SW/AB3-T02

Hardware Configuration:

Housing:	metal	Display:	with display
Type:	humidity + temperature	Alarm output:	with relay
Model:	remote sensing probe	Plug:	cable glands
Filter:	stainless steel grid filter	Sensing probe:	fixed
Cable length:	2m (6.6ft)	Coating sensor:	no
Probe length:	200mm (7.9")	Supply voltage:	8...35V DC / 12...30V AC

Software Configuration:

Output 1:	RH
Output 2:	T
Output signal:	0-10V
Measurand value unit:	metric / SI
T-Scaling:	-40...60°C

Accessories:

Pressure tight screw connections: **HA011102** (1/2" ISO ∅12mm)
HA011104 (1/2" ISO ∅6mm)

EE29/EE31 Series

Multifunctional Industrial Transmitter for Humidity / Temperature / Dew Point / Absolute Humidity...

The precise and reliable measurement of humidity in industrial processes is gaining more and more importance. The multifunctional transmitters series EE29/31 offer the ideal solution.

The result of many years of experience in humidity measurement technology for industrial applications, the EE29/31 series builds on the E+E high-quality HC series capacitive humidity sensor elements.

The optimal hardware structure for varying applications is achieved by combining various standard mechanical and electronic modules. User friendly MS Windows software tools simplify the configuration of the transmitter, the data recording, visualization and processing.

The measured values are available on two freely configurable and scaleable analogue outputs and on the serial RS232 interface. With an optional RS485 module or Ethernet module up to 32 EE31 transmitters can be connected to a network and one single PC interface allowing easy remote monitoring.

Two freely configurable optional alarm outputs can be set by software. The measured data and the corresponding MIN/MAX values can be viewed on the optional LC display.

Other features especially tailored for harsh industrial applications are the new housing concept consisting of three modules, the easy on-site adjustment and calibration, and the interchangeable sensor option. These features allow for very fast and easy servicing of the transmitter.

By selecting a suitable housing version the EE29/EE31 series can be used for the entire range of humidity measurement applications:

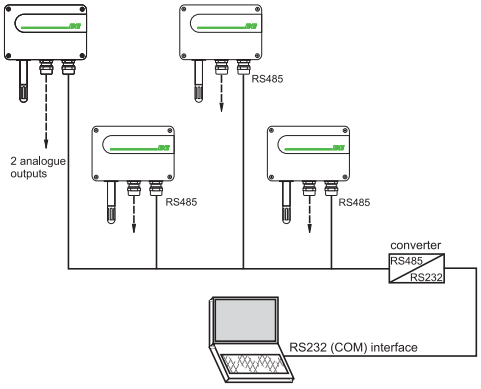
- Model A for wall mounting
- Model B for duct mounting
- Model D with remote sensing probe for measurements in the extended temperature range -40...180°C (-40...356°F).
- Model E with remote sensing probe for pressure tight applications between 0.01...20 bar (0.15...300psi).
- Model H (EE31 only) with remote miniature probe for concealed mounting (e.g. in museums) or in tight spaces.

Product comparison EE29 - EE31

Functions	Comment	EE29	EE31
Measurement of relative humidity and temperature		✓	✓
two freely scaleable and configurable analogue outputs		✓	✓
Remote miniature probe			✓
Remote sensing probe up to 20m (65.6ft)		✓	✓
On-site adjustment for relative humidity and temperature		✓	✓
LED indication of transmitter status		✓	✓
RS232 for transmitter configuration via PC		✓	✓
Configuration software	standard supply	✓	✓
Alternating display with MIN/MAX indication	optional	✓	✓
two freely configurable alarm outputs	optional	✓	✓
Interchangeable sensor cable	optional	✓	✓
Sensor protection (coating)	optional	✓	✓
Plug connection	optional	✓	✓
Calculated values h, r, dv, Tw, Td, Tf, e			✓
Digital data output via RS232 interface			✓
Digital data output via RS485 interface	optional		✓
Network of up to 32 instruments via RS485 bus	optional		✓
Ethernet interface for networking and remote monitoring	optional		✓
Data logging and analysis PC software	optional		✓

EE31 - Network with up to 32 transmitters

Up to 32 EE31 transmitters can be connected in a RS-485 bus system to a single PC interface.
The measured and calculated data is stored in a PC database which is available for further processing by using the E+E data-logging and analysis software.
The data base can also be stored in ASCII format or in a data-base with ODBC interface.



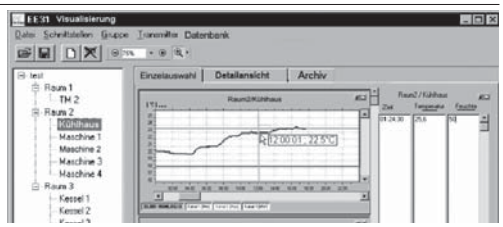
EE31 - Ethernet interface

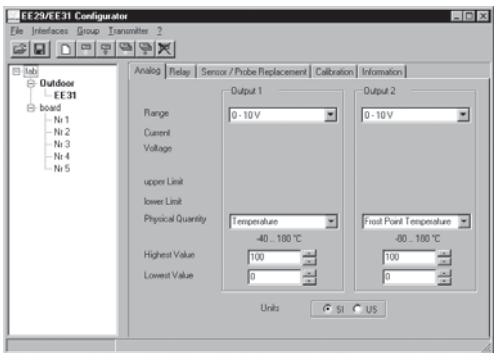
EE31 transmitters can be connected through a standard Ethernet-port for easy remote monitoring (ordering code E). The software-tools are in the standard scope of supply.

Software Tools

The following software tools are available for the EE29/31 series:

	EE29	EE31
Configuration Software (standard supply)	✓	✓
datalogging and analysis Software (optional)		✓





Configuration Software:
The Configuration Software is used for:
- flexible, easy and fast setup of the analogue and alarm outputs.
- adjustment of the humidity and temperature outputs.
- exchange of the sensing probe or of the sensors.

Datalogging and Analysis Software:
This user friendly software tool is a great help for easy data analysis in graphical or spreadsheet format on a PC as well as for data and alarms management by e-mail or SMS.

Easy calibration and adjustment of the transmitter

The modular housing of the EE29/EE31 enables a fast and easy on-site adjustment and calibration. Using the optional extension cable one can adjust or calibrate the entire measurement loop without interrupting the measurement. No need for time-consuming dismounting and wiring of the instrument. This feature makes the EE29/31 series suitable for use in regulatory environments (e.g. FDA, GAMP).
The adjustment of humidity and temperature (2 points or 1 point) is performed either with a simple routine using two push buttons on the printed circuit board or with the configuration software.

2 Status LEDs

Two status LEDs on the printed circuit board indicate the transmitter status and eventual errors, especially useful during installation or service operations.

Sensor Coating

Operation in heavily polluted and/or corrosive environments is typical for many industrial processes and can lead to drift or damage of the humidity sensor and thus to false measured values. The unique protective coating developed by E+E for the sensing probe brings a significant improvement on the long-term stability of the transmitter in very dirty and aggressive environments. (ordering code: HC01)

Integrated Display

The actual measured and calculated values as well as the corresponding Min/Max values can be indicated on an optional display. The physical quantity to be displayed is choosen with the push buttons on the housing. (ordering code: D05)

Interchangeable sensing probe

The interchangeable sensing probe with plug connection can be easily exchanged in the versions D and E. The installation of the probe cable (up to 20m / 65ft) is significantly simplified and can be installed prior to fitting the transmitter. (ordering code: P01)

Alarm outputs

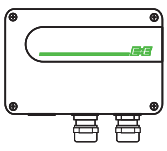
An optional alarm module with 2 relay outputs is available for control and alarm purposes. The selection of the physical quantity for the relay ouputs and the setting of threshold and hysteresis can be easily made with the configuration software included in the standard scope of supply.

Integrated power supply

A power supply, integrated in the back module of the housing, can be ordered optionally (100...240V AC, 50/60Hz; ordering code V01). The power supply V01 is available for both polycarbonate and metal housing and comes standard with two plugs for supply and outputs to allow an easy connection.

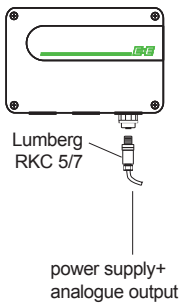
Connection versions

standard

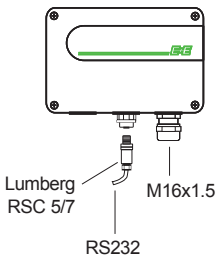


transmitter incl. alarm output:
EE29: 2xM16
EE31: 3xM16

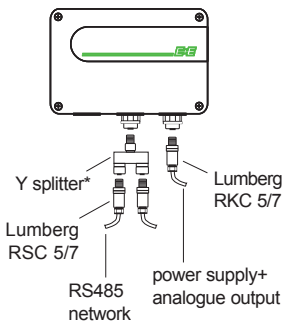
plug option C03



plug option C06



plug option C08

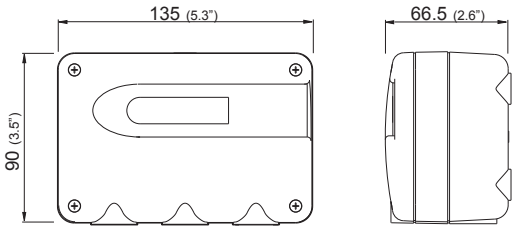


* Siemens 6ES7 194-1KA01-0XA0

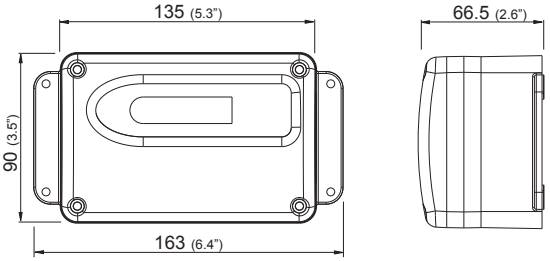
Dimensions in mm

Housing:

polycarbonate housing

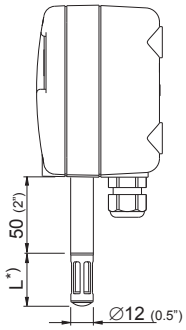


metal housing

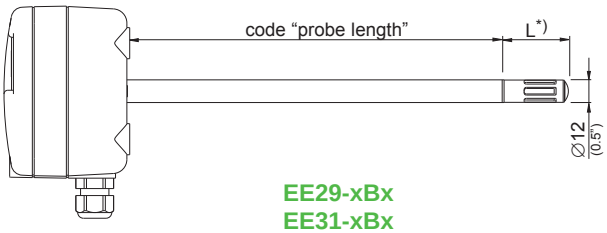


For use in harsh industrial environments all models of the EE29/31 are available in a robust metal housing.
The very smooth surface and the rounded outlines allow for the use in clean rooms as well.

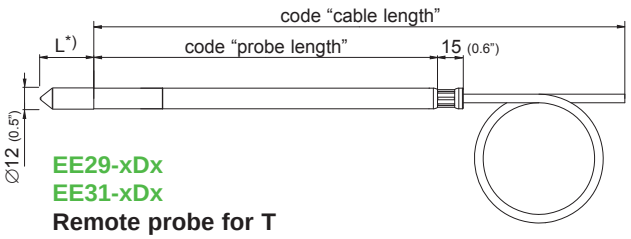
Models:



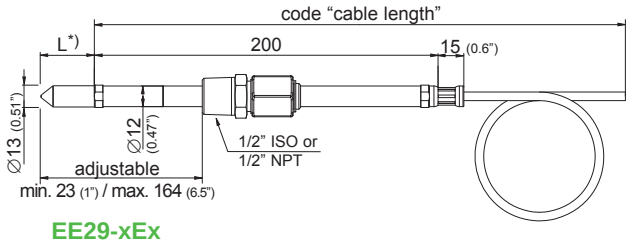
EE29-xAx
EE31-xAx
Wall mounting
Probe material: PC



EE29-xBx
EE31-xBx
Duct mounting
Probe material: stainless steel

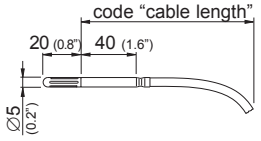


EE29-xDx
EE31-xDx
Remote probe for T
up to 180°C (356°F)
Probe material: stainless steel



EE29-xEx
EE31-xEx
Pressure tight probe
up to 20bar (300psi)
Probe material: stainless steel

EE31-xHx
Remote miniature probe
Probe material: stainless steel



*) L = Filter length: refer to data sheet "Accessories page 138

Technical Data EE31

Measurement values

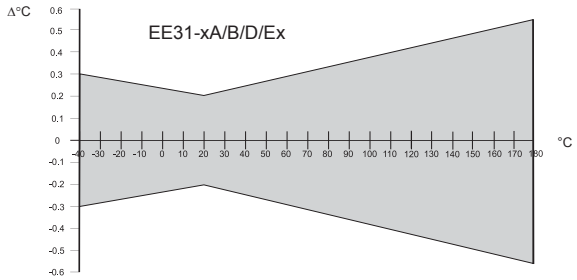
Relative humidity

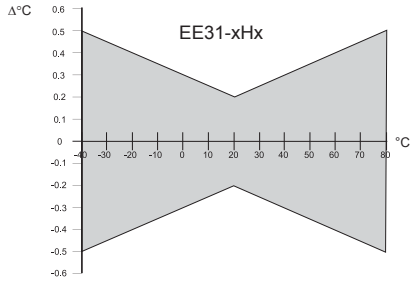
Humidity sensor[1]		HC1000-400 / HC105
Working range[1]		0...100% RH
Accuracy[*] (including hysteresis, non-linearity and repeatability, traceable to intern. standards, administrated by NIST, PTB, BEV...)		
-15...40°C (5...104°F)	≤90% RH	± (1.3 + 0.3%*mv) % RH
-15...40°C (5...104°F)	>90% RH	± 2.3% RH
-25...70°C (-13...158°F)		± (1.4 + 1%*mv) % RH
-40...180°C (-40...356°F)		± (1.5 + 1.5%*mv) % RH
Temperature dependence of electronics		typ. ± 0.01% RH/°C (0.0055% RH/°F)
Response time with metal grid filter at 20°C / t_{90}		< 15s

Temperature

Temperature sensor element	EE31-xA/B/D/Ex	Pt1000 (Tolerance class A, DIN EN 60751)	
	EE31-xHx	Pt1000 (Tolerance class B, DIN EN 60751)	
Working range sensing head	EE31-xAx	-40...60°C (-40...140°F)	EE31-xEx -40...180°C (-40...356°F)
	EE31-xBx	-40...80°C (-40...176°F)	EE31-xHx -40...80°C (-40...176°F)
	EE31-xDx	-40...180°C (-40...356°F)	

Accuracy





Temperature dependence of electronics	typ. ± 0.005°C/°C

Outputs[2]

Two freely selectable and scaleable analogue outputs	0 - 5V	-1mA < I_L < 1mA
0...100% RH / xx...yy°C respectively	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm
	0 - 20mA	R_L < 500 Ohm
Serial interface	RS232C	
	RS485 optional	

Max. adjustable measurement range[2)3)]

		from	up to *EE31-A*	*EE31-B, H*	*EE31-D,E*	units
Humidity	RH	0	100	100	100	% RH
Temperature	T	-40 (-40)	60 (140)	80 (176)	180 (356)	°C (°F)
Dew-point temperature	Td	-40 (-40)	60 (140)	80 (176)	100 (212)	°C (°F)
Frost-point temperature	Tf	-40 (-40)	0 (32)	0 (32)	0 (32)	°C (°F)
Wet-bulb temperature	Tw	0 (32)	60 (140)	80 (176)	100 (212)	°C (°F)
Water vapour partial pressure	e	0 (0)	200 (3)	500 (7.5)	1100 (15)	mbar (psi)
Mixture ratio	r	0 (0)	425 (2900)	999 (9999)	999 (9999)	g/kg (gr/lb)
Absolute humidity	dv	0 (0)	150 (60)	300 (120)	700 (300)	g/m³ (gr/ft³)
Specific enthalpy	h	0 (0)	400 (50000)	1000 (375000)	2800 (999999)	kJ/kg (lbf/lb)

General

Supply voltage	8...35V DC	
	12...30V AC	(optional 100...240V AC, 50/60Hz)
Current consumption - 2x voltage output	for 24V DC/AC: typ. 40mA	
- 2x current output	typ. 80mA	
Pressure range for pressure tight probe	0.01...20bar (0.15...300psi)	
System requirements for software	WINDOWS 2000 or later; serial interface	
Housing / protection class	PC or Al Si 9 Cu 3 / IP65; Nema 4	
Cable gland	M16 x 1.5 cable Ø 4.5 - 10 mm (0.18 - 0.39")	
Electrical connection	screw terminals up to max. 1.5mm² (AWG 16)	
Working and storage temperature range of electronics	-40...60°C (-40...140°F)	
	-20...50°C (-4...122°F) - housing with display	
Electromagnetic compatibility according to	EN61326-1 EN61326-2-3 Industrial Environment	ICES-003 ClassB FCC Part15 ClassB

1) Refer to the working range of the humidity sensor. 2) Can be easily changed by software. 3) Refer to accuracies of calculated values (page 152)
*) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).

Technical Data EE29

Measurement values

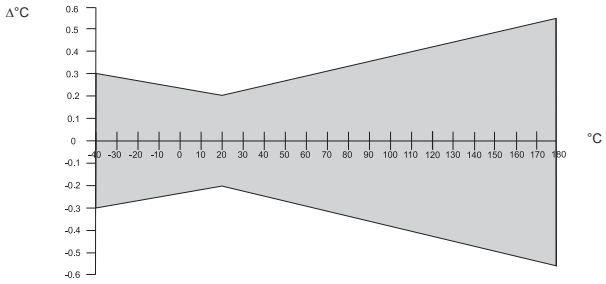
Relative humidity

Humidity sensor[1)]		HC1000-400
Working range[1)]		0...100% RH
Accuracy[*)] (including hysteresis, non-linearity and repeatability, traceable to intern. standards, administrated by NIST, PTB, BEV...)		
-15...40°C (5...104°F)	≤90% RH	± (1.3 + 0.3%*mv) % RH
-15...40°C (5...104°F)	>90% RH	± 2.3% RH
-25...70°C (-13...158°F)		± (1.4 + 1%*mv) % RH
-40...180°C (-40...356°F)		± (1.5 + 1.5%*mv) % RH
Temperature dependence of electronics		typ. ± 0.01% RH /°C (0.0055% RH / °F)
Response time with metal grid filter at 20°C / t_{90}		< 15s

Temperature

Temperature sensor element		Pt1000 (Tolerance class A, DIN EN 60751)		
Working range sensing head	EE29-xAx	-40...60°C (-40...140°F)	EE29-xBx	-40...80°C (-40...176°F)
	EE29-xDx	-40...180°C (-40...356°F)	EE29-xEx	-40...180°C (-40...356°F)

Accuracy



Temperature dependence of electronics	typ. ± 0.005°C/°C

Outputs[2)]

Two freely selectable and scaleable analogue outputs	0 - 5V	-1mA < I_L < 1mA
0...100% RH / xx...yy°C respectively	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm
	0 - 20mA	R_L < 500 Ohm

General

Supply voltage	8...35V DC	
	12...30V AC	(optional 100...240V AC, 50/60Hz)
Current consumption - 2x voltage output	for 24V DC/AC:	typ. 40mA
- 2x current output		typ. 80mA
Pressure range for pressure tight sensor	0.01...20bar (0.15...300psi)	
System requirements for software	WINDOWS 2000 or later; serial interface	
Housing / protection class	PC or Al Si 9 Cu 3 / IP65; Nema 4	
Cable gland	M16 x 1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection	screw terminals up to max. 1.5mm² (AWG 16)	
Sensor protection	stainless steel sintered filter, PTFE filter or metal grid filter	
Working and storage temperature range of electronics	-40...60°C (-40...140°F)	
	-20...50°C (-4...122°F) - housing with display	
Electromagnetic compatibility according to	EN61326-1 EN61326-2-3 Industrial Environment	ICES-003 ClassB FCC Part15 ClassB

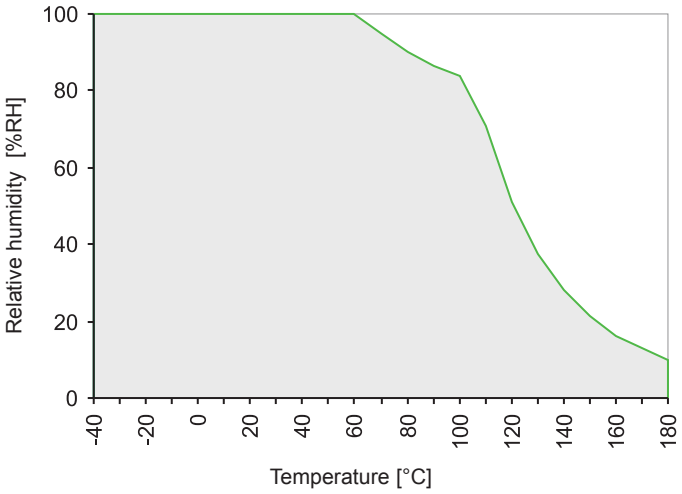
CE

1) Refer to the working range of the humidity sensor.
2) Can easily be changed by software.
*) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).

Technical Data for Options EE29/EE31

Display	graphical LC display (128x32 pixels), with integrated push-buttons for selecting parameters and MIN/MAX function			
Alarm outputs	2 x 1 switch contact 250V AC / 6A 28V DC / 6A			
Threshold + hysteresis	can be adjusted with configuration software			
Switching parameters	freely selectable between:		EE29	EE31
	RH	Relative humidity	✓	✓
	T	Temperature	✓	✓
	Td	Dew-point temperature		✓
	Tf	Frost-point temperature		✓
	Tw	Wet-bulb temperature		✓
	e	Water vapour partial pressure		✓
	r	Mixture ratio		✓
	dv	Absolute humidity		✓
	h	Specific enthalpy		✓

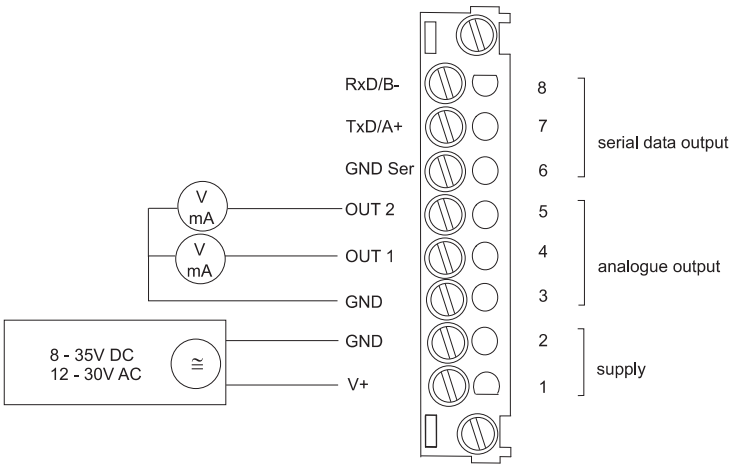
Working range humidity sensor



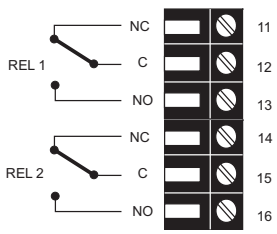
The gray area shows the allowed measurement range for the humidity sensor.

Operating points outside of this range do not lead to destruction of the element, but the specified measurement accuracy cannot be guaranteed.

Connection diagram



Terminal configuration - Alarm output



Ordering Guide EE31

		EE31-	EE31-	EE31-	EE31-	EE31-
Hardware Configuration						
Housing	metal housing	M	M	M	M	M
	polycarbonate housing	P	P	P	P	P
Type	humidity + temperature	FT	FT	FT	FT	FT
Model		A	B	D	E	H
Filter	membrane filter 5mm (0.2")					1
	stainless steel sintered filter	3	3	3	3	
	PTFE filter	5	5	5	5	
	stainless steel grid filter (up to 180°C / 356°F)	9	9	9	9	
Cable length	2m (6.6ft)			02	02	02
(incl. probe length)	5m (16.4ft)			05	05	05
	10m (32.8ft)			10	10	10
	20m (65.6ft)			20	20	20
Probe length	65mm (2.6")			2		
	200mm (7.9")		5	5	5	
	400mm (15.8")		6	6		
Pressure tight	1/2" male thread				HA03	
Feedthrough	1/2" NPT thread				HA07	
Interface	RS232					
	RS485	N	N	N	N	N
	ethernet interface[1]	E	E	E	E	E
Display	without display					
	with display	D05	D05	D05	D05	D05
Alarm output [2]	without relay					
	with relay	SW	SW	SW	SW	SW
Plug	cable glands					
	1 plug for power supply and outputs	C03	C03	C03	C03	C03
	1 cable gland / 1 plug for RS232	C06	C06	C06	C06	C06
	2 plugs for power supply/outputs and RS485 Network	C08	C08	C08	C08	C08
Sensing probe	fixed					
	interchangeable			P01	P01	
Coating sensor	no					
	yes	HC01	HC01	HC01	HC01	
Supply voltage	8...35V DC / 12...30V AC					
	integrated power supply 100...240V AC, 50/60Hz[3]	V01	V01	V01	V01	V01

Software Configuration						
Physical parameters of outputs	relative humidity	RH [%]	(A)	Output 1	Select according to Ordering Guide (A - H,J)	
	temperature	T [°C or °F]	(B)			
	dew point temperature	Td [°C or °F]	(C)	Output 2	Select according to Ordering Guide (A - H,J)	
	frost point temperature	Tf [°C or °F]	(D)			
	wet bulb temperature	Tw [°C or °F]	(E)			
	water vapour partial pres.	e [mbar]	(F)			
	mixture ratio	r [g/kg]	(G)			
	absolute humidity	dv [g/m³]	(H)			
	specific enthalpy	h [kJ/kg]	(J)			
Type of output signals	0-5V		(2)		Select according to Ordering Guide (2,3,5,6)	
	0-10V		(3)			
	0-20mA		(5)			
	4-20mA		(6)			
Measured value units	metric / SI				E01	E01	E01	E01	E01
	non metric / US								

Scaling of T-output	-40...60 (T02)	-20...80 (T24)	0...350 (T89)	Output T	Select according to Ordering Guide (Txx)
Scaling of Td-output	0...50 (T04)	0...180 (T26)	32...120 (T90)		
in°C or °F	0...100 (T05)	-40...180 (T52)	32...140 (T91)	Output Td	Select according to Ordering Guide (Tdxx)
	0...60 (T07)	-40...100 (T79)	32...180 (T92)		
	-40...120 (T12)	-40...350 (T82)	32...250 (T94)		Other T and Td-scaling refer to page 146
	0...120 (T16)	-40...140 (T83)	32...300 (T95)		
	0...80 (T21)	-40...300 (T84)	32...132 (T96)		
	-40...80 (T22)	0...250 (T88)	32...350 (T101)		

1) Combination ethernet and alarm output is not possible / combination ethernet and integrated power supply is not possible
2) Combination alarm output and plugs is not possible (with cable glands only) / combination alarm output and integrated power supply is not possible
3) Integrated power supply includes 2 plugs for power supply and outputs / further plug options are not possible

Order Example

EE31-PFTB55SW/BC2-T07-Td03

Housing:	polycarbonate housing		
Type:	humidity + temperature	Output 1:	T
Model:	duct mounting	Output 2:	Td
Filter:	PTFE Filter	Output signal:	0-5V
Probe length:	200mm (7.9")	Scaling of T-output:	0...60°C
Alarm output:	yes	Scaling of Td-output:	-10...50°C

Ordering Guide EE29

		EE29-	EE29-	EE29-	EE29-
Hardware Configuration					
Housing	metal housing	M	M	M	M
	polycarbonate housing	P	P	P	P
Type	humidity + temperature	FT	FT	FT	FT
Model		A	B	D	E
Filter	stainless steel sintered filter	3	3	3	3
	PTFE Filter	5	5	5	5
	stainless steel grid filter (up to 180°C / 356°F)	9	9	9	9
Cable length	2m (6.6ft)			02	02
(incl. probe length)	5m (16.4ft)			05	05
	10m (32.8ft)			10	10
	20m (65.6ft)			20	20
Probe length	65mm (2.6")			2	
	200mm (7.9")		5	5	5
	400mm (15.8")		6	6	
Pressure tight	1/2" male thread				HA03
feedthrough	1/2" NPT thread				HA07
Display	without display				
	with display	D05	D05	D05	D05
Alarm output [1]	without relay				
	with relay	SW	SW	SW	SW
Plug	cable glands				
	1 plug for power supply and outputs	C03	C03	C03	C03
	1 cable gland / 1 plug for RS232	C06	C06	C06	C06
Sensing probe	fixed				
	interchangeable			P01	P01
Coating sensor	no				
	yes	HC01	HC01	HC01	HC01
Supply voltage	8...35V DC / 12...30V AC				
	integrated power supply 100...240V AC, 50/60Hz[2]	V01	V01	V01	V01

Software Configuration							
Physical parameters	Relative humidity	RH [%]	(A)			Output 1	Select according to Ordering Guide (A or B)
of outputs	Temperature	T [°C or °F]	(B)			Output 2	Select according to Ordering Guide (A or B)
Type of	0-5V		(2)				Select according to Ordering Guide (2,3,5,6)
output signals	0-10V		(3)				
	0-20mA		(5)				
	4-20mA		(6)				
Temperature unit	°C						E01 E01 E01 E01
	°F						
Scaling of T-output	-40...60	(T02)	-20...80	(T24)	0...350	(T89)	Output T	Select according to Ordering Guide (Txx)
in°C or °F	0...50	(T04)	0...180	(T26)	32...120	(T90)		Other T-scaling refer to page 146
	0...100	(T05)	-40...180	(T52)	32...140	(T91)		
	0...60	(T07)	-40...100	(T79)	32...180	(T92)		
	-40...120	(T12)	-40...350	(T82)	32...250	(T94)		
	0...120	(T16)	-40...140	(T83)	32...300	(T95)		
	0...80	(T21)	-40...300	(T84)	32...132	(T96)		
	-40...80	(T22)	0...250	(T88)	32...350	(T101)		

1) Combination alarm output and plugs is not possible (with cable glands only) / combination alarm output and integrated power supply is not possible
2) Integrated power supply includes 2 plugs for power supply and outputs / further plug options are not possible

Accessories / Replacement Parts

(For further information, see data sheet "Accessories", page 138)

- Filter caps (HA0101xx)
- Display + housing cover in metal (D05M)
- Display + housing cover in polycarbonate (D05P)
- Replacement sensor (Pxx)
- Humidity sensor (FE10)
- Interface cable for PCB (HA010304)
- Interface cable for plugs C06 (HA010311)
- Mounting flange stainless steel (HA010201)
- Mounting flange 5mm (HA010208)
  (for EE31, model H only)
- Bracket for installation onto mounting rails (HA010203)
- Drip water protection (HA010503)
- 1% Calibration (EE90/3H)
- Calibration set (HA0104xx)
- Datalogging and analysis software (HA010602)
  (for EE31 only)
- RS485 Kit (HW + SW) for networking (HA010601)
  (for EE31 only)

EE30EX Series

Humidity/Temperature Transmitter for Intrinsically Safe Applications

EE30EX series transmitters from E+E Elektronik are designed for the accurate measurement of humidity and temperature in the range between 0...100% RH and -40...180°C (-40...356°F). Models for pressure tight installations from 0.01...15 bar (0.15...218psi) complete the range of products.


Model A

EE30EX meets the **ATEX requirements** and **IECEx standards** of intrinsically safe machinery:

Applied standards for ATEX:	Applied standards for IECEx:
EN60079-0:2004	**IEC 60079-0:2004**
EN60079-11:2007	**IEC 60079-11:2006**
EN60079-26:2007	**IEC 60079-26:2006**

The EC type examination was carried out by Physikalisch-Technische Bundesanstalt (PTB), the German national institute for science and technology.


Model D

The transmitters of EE30EX series consist of:

- EE30EX supply and evaluation unit, classified according to **II (1) G [EEx ia] IIC** subject to EC-type examination certificate **PTB 99 ATEX 2042** and **[EEx ia] IIC** according to **IECEx PTB 05.0031**.
- sensor driver unit and sensor probe, classified according **II 1/2 G EEx ia IIC T6** subject to EC-type examination certificate **PTB 99 ATEX 2043 X** and **EEx ia IIC T6** according to **IECEx PTB 05.0032X**.


Model E

The sensor probe can be employed in zone 0 and in temperature class T6 (apparatus group II, category 1). For EE30EX versions D and E the cable length between sensing probe and sensor driver unit can be up to 10m (32.8ft). The maximum length of the cable between the supply and evaluation unit and the sensor driver unit is 100m (328ft).

The analogue output signals for humidity and temperature are available as current or as voltage.
State-of-the-art microprocessor technology makes both analogue outputs free selectable and scaleable via RS232 serial interface.

Besides measurement of humidity and temperature EE30EX series calculate the values of the following physical quantities:

- dew point temperature	Td
- frost point temperature	Tf
- wet bulb temperature	Tw
- water vapour pressure	e
- mixing ratio	r
- absolute humidity	dv
- specific enthalpy	h

These are available on the RS232 serial interface, on the analogue outputs and on the integrated LC display.

The communication with a PC is assisted by an user friendly software, running under MS Windows™ which enables the user to change original factory settings easily.

Configuration Software

The Configuration Software is used for:

- flexible, easy, and fast setup of the analogue outputs resp. of the RS232 serial interface.
- adjustment of the humidity and temperature outputs.
- exchange of the sensor.

Typical Applications

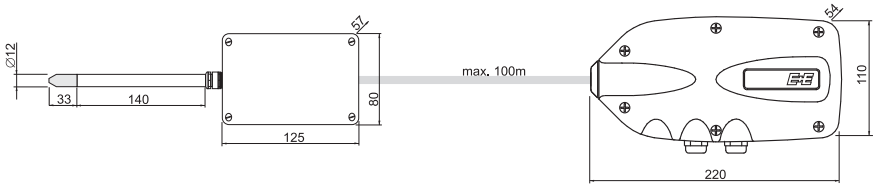
chemical processes
pharmaceutical applications
explosive endangered storage rooms

Features

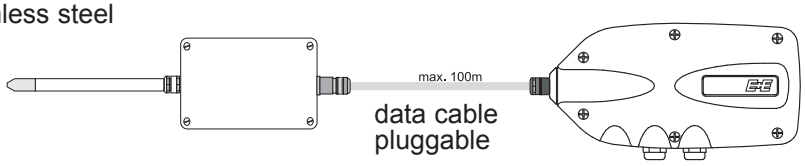
EC-Type examination according to ATEX
approved to IECEx
approved for zone 0
highest accuracy up to 180°C (356°F)
traceable calibration
dew point, absolute humidity,... measurement
incl. MS Windows™ Software

Housing Dimensions (mm)

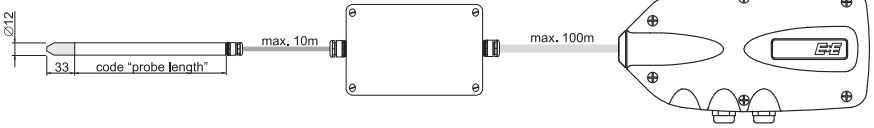
1m = 3.28ft / 1ft = 0.30m
1 mm = 0.03937" / 1" = 25.4 mm

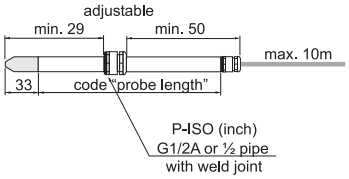


wall mounting
EE30EX-A
probe material: stainless steel



remote probe up to 180°C (356°F)
EE30EX-D
probe material: stainless steel





pressure tight probe up to 15 bar (218psi)
EE30EX-E
probe material: stainless steel

Classifications

Europe:

EU (94/9/EG, ATEX 100a)

- supply and evaluation unit:
  Ex II (1) G [EEx ia] IIC
  PTB 99 ATEX 2042
- sensor unit:
  Ex II 1/2 G EEx ia IIC T6
  PTB 99 ATEX 2043 X
- environmental specifications:
  T_{amb}: -20...+60°C (-4...140°F)
  P_{amb}: 0.8...1.1bar (11.6...16psi)

International:

- supply and evaluation unit:
  Ex [EEx ia] IIC
  IECEx PTB 05.0031
- sensor unit:
  Ex EEx ia IIC T6
  IECEx PTB 05.0032X
- environmental specifications:
  T_{amb}: -20...+60°C (-4...140°F)
  P_{amb}: 0.8...1.1bar (11.6...16psi)

Technical Data EE30EX

Measuring values

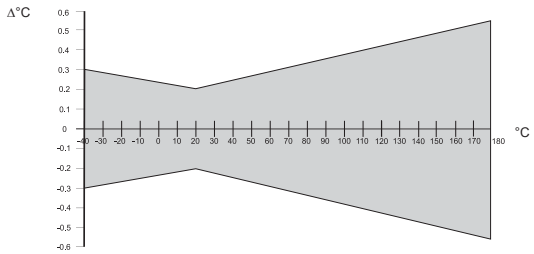
Relative humidity

Humidity sensor[1]		HC1000-400
Measuring range[1]		0...100% RH
Accuracy[2] (including hysteresis, non-linearity and repeatability, traceable to international standards, administrated by NIST, PTB, BEV...)		
-15...40°C (5...104°F)	≤90% RH	± (1.3 + 0.3%*mv) % RH
-15...40°C (5...104°F)	>90% RH	± 2.3% RH
-25...70°C (-13...158°F)		± (1.4 + 1%*mv) % RH
-40...180°C (-40...356°F)		± (1.5 + 1.5%*mv) % RH
Temperature dependence electronics		typ. 0.08% RH/°C
Response time with filter at 20°C / t_{90}		< 30 sec.

Temperature

Temperature sensor		Pt1000 (DIN EN 60751, class A)	
Measuring range sensor head	EE30EX-A	-20...60°C	(-4...140°F)
	EE30EX-D	-40...180°C	(-40...356°F)
	EE30EX-E	-40...180°C	(-40...356°F)

Accuracy



Temperature dependence	typical 0.005°C/°C

Max. adjustable Measurement Range[3]

		from	to		unit	
			EE30EX-A	*EE30EX-D/E*		
Humidity	RH	0	100	100	%RH	
Temperature	T	-40 (-40)	60 (140)	180 (356)	°C	(°F)
Dew point temperature	Td	-40 (-40)	60 (140)	100 (212)	°C	(°F)
Frost point temperature	Tf	-40 (-40)	0 (32)	0 (32)	°C	(°F)
Wet bulb temperature	Tw	0 (32)	60 (140)	100 (212)	°C	(°F)
Water vapour pressure	e	0 (0)	200 (3)	1100 (15)	mbar	(psi)
Mixing ratio	r	0 (0)	425 (2900)	999 (9999)	g/kg	(gr/lb)
Absolute humidity	dv	0 (0)	150 (60)	700 (300)	g/m³	(gr/ft³)
Specific enthalpy	H	-50 (-15000)	400 (150000)	2800 (999999)	kJ/kg	(lbf/lb)

Outputs

Two freely selectable and scalable outputs	0 - 5 V	-1 mA < I_L < 1 mA
	0 - 10 V	-1 mA < I_L < 1 mA
	4 - 20 mA	R_L < 360 Ohm
Serial interface	RS232C	

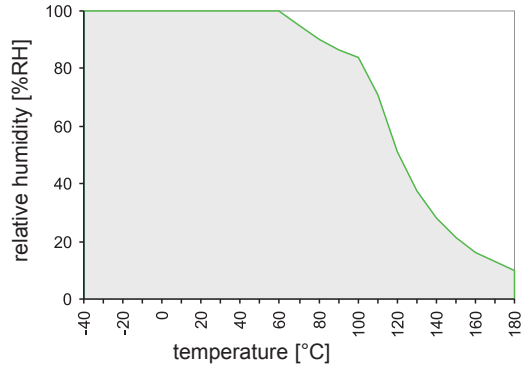
General

Supply voltage	24V DC/V AC ± 15%		
Current consumption	≤ 150mA (24V DC); ≤ 280mA (24V AC)		
Pressure range with pressure tight sensor probe	0.01...15 bar (0.15...218psi)		
System requirements for software	WINDOWS 2000 or later; serial interface		
Housings	supply- and evaluation unit	ABS-plastic / IP65	
	sensor driver unit	AlSi12 / IP65	
Cable gland	PG 7 and PG 9; for cable diameter 5 - 9 mm (0.2 - 0.35")		
Electrical connection	screw terminals max. 1.5 mm² (AWG 16)		
Sensor protection	sintered stainless steel filter, PTFE-filter or metal grid filter		
Temperature range	sensor probe:	according measuring range	
	electronic sensor driver device:	-20...60°C	(-4...140°F)
	electronic supply- and evaluation device:	-40...60°C	(-40...140°F)
	electronic with display:	0...40°C	(32...104°F)
Storage temperature range	electronics and sensor head	-30...60°C	(22...140°F)
Electromagnetic compatibility according	EN61326-1	EN61326-2-3	ICES-003 ClassB
	Industrial Environment		FCC Part15 ClassB

CE

1) Refer to the working range of the humidity sensor.
2) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).
3) Refer to accuracies of calculated values.

Working Range Humidity Sensor



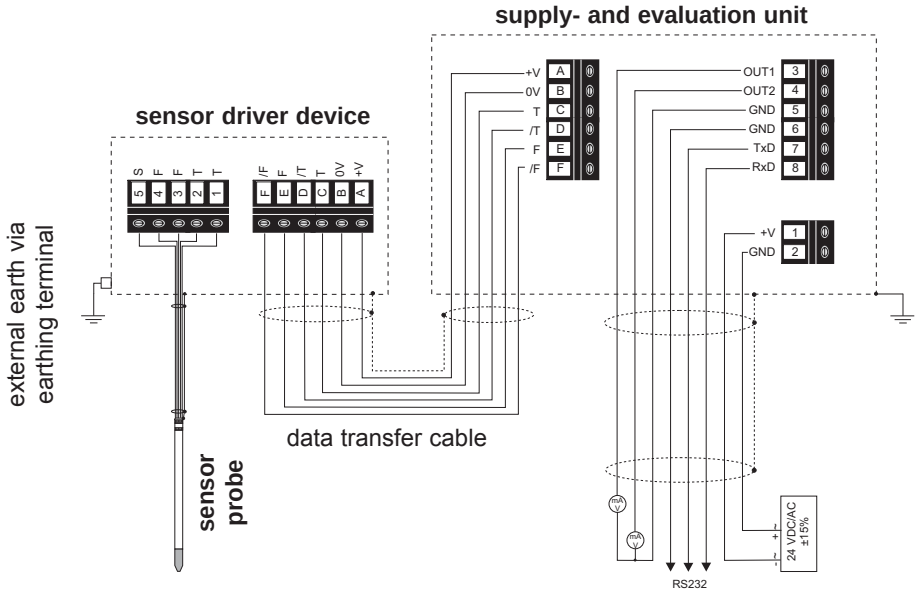
The specified working range for the humidity sensor element is shown in terms of humidity/temperature limits.

Although the sensors would not deteriorate beyond the limits, their performance can only be specified within the limits for the working range.

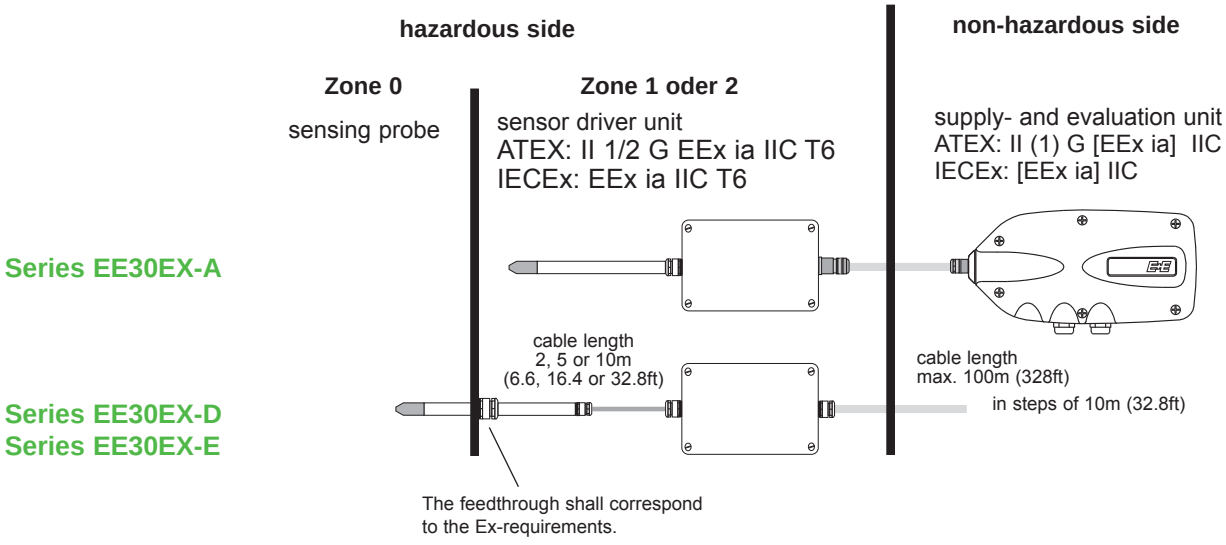
Sensing head with protective coating

For use in heavy polluted or aggressive environment E+E has developed a special protective coating process (order code: HC01). Both humidity and temperature sensor elements are covered with a polymer film. Extensive tests have proved an amazing improvement of the resistance to chemical pollutants which leads to a much better long term stability of the transmitter.

Connection Diagram



Installation



Ordering Guide EE30EX

Position 1 - Transmitter

					EE30EX-A	EE30EX-D	EE30EX-E
Hardware Configuration							
Filter	stainless steel sintered filter				3	3	3
	PTFE Filter*)				5	5	5
	metal grid filter (up to 120°C / 248°F)*)				6	6	6
	stainless steel grid filter (up to 180°C / 356°F)				9	9	9
Cable length	2m (6.6ft)					02	02
	5m (16.4ft)					05	05
	10m (32.8ft)					10	10
Probe length	200mm (7.9")					5	5
	400mm (15.8")					6	6
Pressure tight Feedthrough	1/2" male thread					HA03	HA03
	1/2" pipe weld joint					HA05	HA05
	1/2" NPT thread					HA07	HA07
Data cable	not pluggable						
	pluggable				P02	P02	P02
Display	without display						
	with display				D01	D01	D01
Coating sensor	no						
	yes				HC01	HC01	HC01
Software Configuration							
Physical parameters of outputs	Relative humidity	RH [%]		(A)	Output 1	Select according to Ordering Guide (A - H,J)	
	Temperature	T [°C or °F]		(B)			
	Dew point temperature	Td [°C or °F]		(C)			
	Frost point temperature	Tf [°C or °F]		(D)	Output 2	Select according to Ordering Guide (A - H,J)	
	Wet bulb temperature	Tw [°C or °F]		(E)			
	Water vapour partial pres.	e [mbar]		(F)			
	Mixture ratio	r [g/kg]		(G)			
	Absolute humidity	dv [g/m³]		(H)			
	Specific enthalpy	h [kJ/kg]		(J)			
Type of output signals	0-5V			(2)		Select according to Ordering Guide (2,3,6)	
	0-10V			(3)			
	4-20mA			(6)			
Measure value units	metric / SI				E01	E01	E01
	not metric / US						
Scaling of T-output Scaling of Td-output in°C or °F	-40...60 (T02)	-40...120 (T12)	-40...160 (T33)		Output T	Select according to Ordering Guide (Txx)	
	-10...50 (T03)	-20...100 (T14)	-40...180 (T52)				
	0...50 (T04)	+20...120 (T15)	-40...140 (T83)				
	0...100 (T05)	0...120 (T16)	32...120 (T90)		Output Td	Select according to Ordering Guide (Tdxx)	
	0...60 (T07)	0...80 (T21)	32...140 (T91)				
	-30...70 (T08)	-40...80 (T22)	32...180 (T92)			Other T or Td-scaling refer to page 146	
	-30...120 (T09)	-20...80 (T24)	32...132 (T96)				
	-20...120 (T10)	-20...60 (T25)					

Position 2 - Data cable

Data cable	maximal 100m (328ft) / transmitter	xxxm	xxxm	xxxm

*) to be used for the apparatus group II B only

Order Example

Position 1 - Transmitter: **EE30EX-E3056HA03P02/BC3-T05-Td14**
Humidity/Temperature Transmitter Series EE30EX

Model:	For pressure tight installations
Filter:	stainless steel sintered filter
Cable length:	5m (16.4ft)
Probe length:	400mm (15.8")
Feedthrough:	1/2" male thread
Data cable:	pluggable
Output 1:	T
Output 2:	Td
Output signal:	0-10V
Scaling of T-output:	0...100°C
Scaling of Td-output:	-20...100°C

Position 2 - Data cable: **Data cable 60m (196.8ft)**

EE23 Series

Humidity / Temperature Transmitter for Industrial Applications

Calculation of Dew Point and Frost Point Temperature

The EE23 series stands for multifunctionality, highest accuracy, easy mounting and service.
The new IP65 water proof housing concept is based on three modules:
- back module with connectors
- middle module which accommodates the electronics
- cover module with optional display

It offers easy installation and the possibility for fast exchange of the sensor unit for service purposes.

For use in harsh industrial environments all models of the EE23 are available in a robust metal housing.

The EE23 can be employed in all common applications by choosing the appropriate housing combination.

- **Model A / B:** wall / duct mounting
- **Model C:** remote sensing probe has a working temperature range –40...120°C (-40...248°F)
- **Model G:** version with optional radiation shield is dedicated for outdoor and meteorological applications.
- **Model H**: with remote miniature probe for concealed mounting (e.g. in museums) or in tight spaces.

The high quality HC series humidity sensor elements and newest microprocessor technology are the guarantee for:
- best accuracy over the whole working range
- display and output of relative humidity, temperature, dew point and frost point temperature
- small hysteresis
- excellent long term stability
- highest resistance to pollutants.

Easy configuration of the humidity and temperature outputs is made possible by the innovative design of the EE23 electronics. One can select between various current or voltage output signals.

One can very easily perform a two point humidity and temperature adjustment on site by using two push buttons on the PCB.
The three modules concept makes it also possible to perform a loop calibration according to FDA (Food and Drug Administration) recommendations.

Further options are the integrated display, cable outlets via connectors, sensor coating and an hygrostate output for control and alarm purposes.


Model A


Model B


Model C


Model G
(radiation shield is not included in the scope of supply)


Model H

Typical Applications

high end HVAC
climate chambers
process technology
dryers
meteorology
clean rooms
green houses
stocks

Features

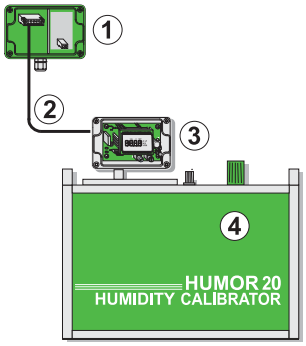
temperature range -40...120°C (-40...248°F)
traceable calibration
calculation of dew point / frost point temperature
two point humidity and temperature calbration
very easy mounting and maintenance
on site calibration
best accuracy over whole temperature range
remote sensing probe up to 20m (65.6ft)
alarm output

Field Calibration

The three modules housing design allows a fast and easy dismounting of the EE23 for humidity field calibration. No interruption of the measurement is necessary for loop calibration which is essential for the calibration procedure recommended by FDA (Food and Drug Administration).

① EE23 back module mounted on the wall
② EE23 extension cable (can be ordered separately)
③ EE23 middle module mounted in the calibrator
④ Humidity reference system (e.g. HUMOR 20)

Utilization of the extention cable enables the user to perform full loop calibration as recommended by FDA.



Two Point Adjustment

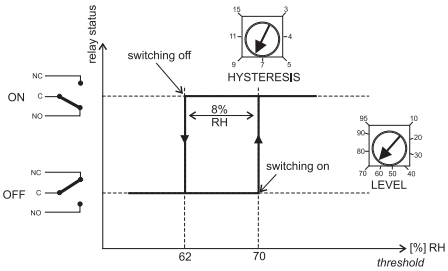
With an easy routine the user can perform a fast and accurate two point adjustment of relative humidity and temperature.

Display

The actual measured data can be indicated on the optional integrated display. It is possible to choose between relative humidity (RH), temperature (T), dew point (Td), frost point (Tf) or an alternating display of two values.

Alarm Output

Simple control applications can be solved by the optional alarm output of the EE23. The user can set threshold and hysteresis by potentiometers.



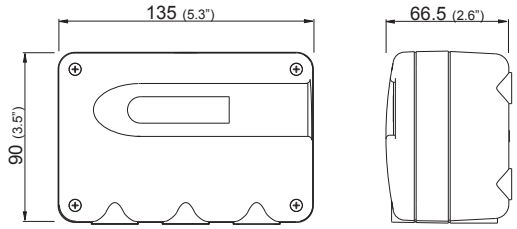
Integrated power supply

A power supply, integrated in the back module of the housing, can be ordered optionally (100...240V AC, 50/60Hz; ordering code V01). The power supply V01 is available for both polycarbonate and metal housing and comes standard with two plugs for supply and outputs to allow an easy connection.

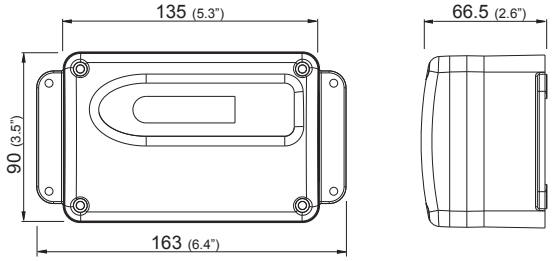
Dimensions in mm

Housing:

polycarbonate housing

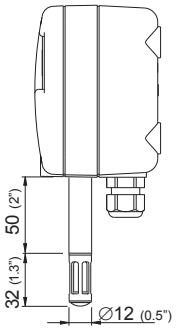


metal housing

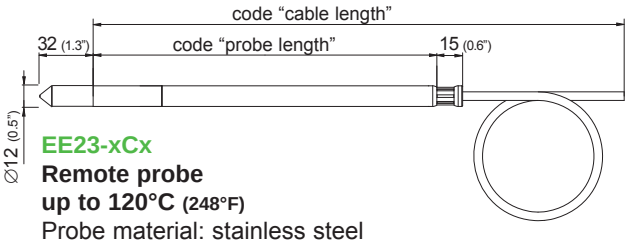


For use in harsh industrial environments all models of the EE23 are available in a robust metal housing.
The very smooth surface and the rounded outlines allow for the use in clean rooms as well.

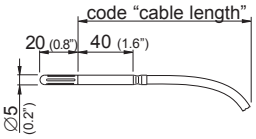
Models:



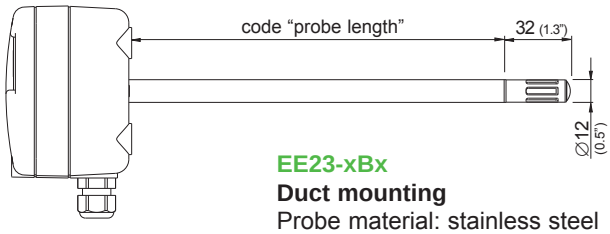
EE23-xAx
Wall mounting
Probe material: PC



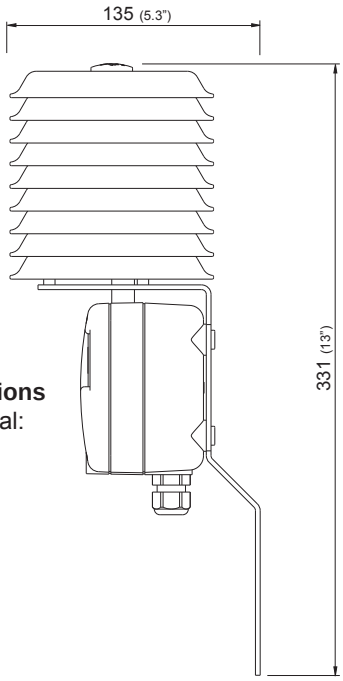
EE23-xCx
Remote probe
up to 120°C (248°F)
Probe material: stainless steel



EE23-xHx
Remote miniature probe
Probe material: stainless steel



EE23-xBx
Duct mounting
Probe material: stainless steel



EE23-xGx + radiation shield HA010504
Meteorology applications
Probe / housing material:
PC

Technical Data EE23

Measured quantities

Relative humidity

Humidity sensor[1]	EE23-xA/B/C/Gx	HC1000-200
	EE23-xHx	HC105
Working range[1]		0...100% RH

Accuracy[2] (including hysteresis, non-linearity and repeatability, traceable to intern. standards, administrated by NIST, PTB, BEV...)

-15...40°C (5...104°F)	≤90% RH	± (1.3 + 0.3%*mv) % RH
-15...40°C (5...104°F)	>90% RH	± 2.3% RH
-25...70°C (-13...158°F)		± (1.4 + 1%*mv) % RH
-40...120°C (-40...248°F)		± (1.5 + 1.5%*mv) % RH

Temperature dependence electronics	typ. ± 0.015% RH/°C
Response time with metal grid filter at 20°C / t_{90}	< 15 sec.

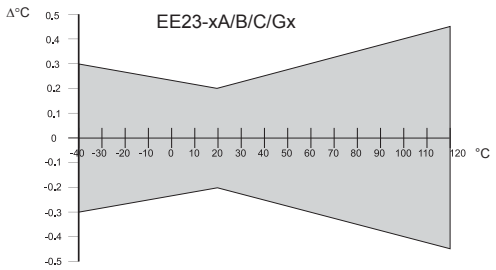
Temperature

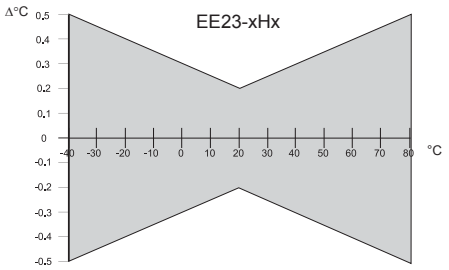
Temperature sensor element	EE23-xA/B/C/Gx	Pt1000 (class A, DIN EN 60751)
	EE23-xHx	Pt1000 (class B, DIN EN 60751)

Working range sensing head

EE23-xAx	-40...60°C	(-40...140°F)	EE23-xBx	-40...80°C	(-40...176°F)
EE23-xCx	-40...120°C	(-40...248°F)	EE23-xHx	-40...80°C	(-40...176°F)
EE23-xGx	-40...60°C	(-40...140°F)			

Accuracy





Temperature dependence of electronics	typ. 0.002°C/°C

Outputs

0...100% RH / xx...yy°C[3]	0 - 1 V	-0.5 mA < I_L < 0.5 mA
(temperature output scale adjustable by E+E or	0 - 5 V	-1 mA < I_L < 1 mA
with configuration kit)	0 - 10 V	-1 mA < I_L < 1 mA
	0 - 20mA	R_L < 350 Ohm
	4 - 20 mA	R_L < 350 Ohm

Max. adjustable output scaling[4]

		from	up to *EE23-A,G*	*EE23-B, H*	*EE23-C*	units
Humidity	RH	0	100	100	100	% RH
Temperature	T	-40 (-40)	60 (140)	80 (176)	120 (248)	°C (°F)
Dew-point temperature	Td	-40 (-40)	60 (140)	80 (176)	100 (212)	°C (°F)
Frost-point temperature	Tf	-40 (-40)	0 (32)	0 (32)	0 (32)	°C (°F)

General

Supply voltage		
for 0 - 5 V outputs		10.5 - 35V DC or 12 - 28V AC
for 0 - 10 V, 0 - 20 mA and 4-20 mA outputs		15.0 - 35V DC or 15 - 28V AC (optional 100...240V AC, 50/60Hz)
Current consumption for voltage output		
for DC supply ≤ 25 mA	with alarm module:	for DC supply ≤ 35 mA
for AC supply ≤ 35 mA_{eff}		for AC supply ≤ 60 mA_{eff}
Current consumption for current output		
for DC supply ≤ 50 mA	with alarm module:	for DC supply ≤ 60 mA
for AC supply ≤ 90 mA_{eff}		for AC supply ≤ 110 mA_{eff}
Housing / protection class		PC or Al Si 9 Cu 3 / IP65; Nema 4
Cable gland[5]		M16x1.5 cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection[5]		screw terminals max. 1.5 mm² (AWG 16)
Working temperature range of electronics		-40...60°C (-40...140°F)
Working temperature range with display		-30...60°C (-22...140°F)
Storage temperature range		-40...60°C (-40...140°F)

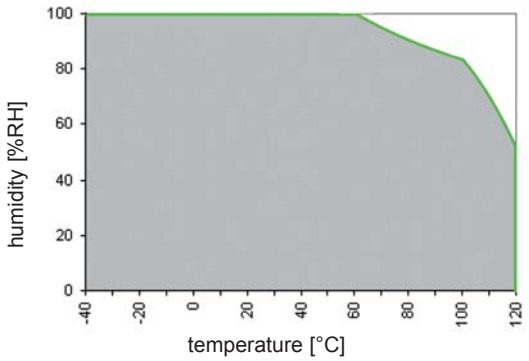
1) Refer to the working range of the humidity sensor
2) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).
3) Refer to ordering guide
4) Refer to accuracies of calculated values (page 152)
5) Connection plugs refer to ordering guide

CE compatibility according	EN61326-1 Industrial Environment	EN61326-2-3	ICES-003 ClassB FCC Part15 ClassB

Alarm Module - optional

Output	SPDT-Switch up to 250V AC/8A or 28V DC/8A	
	threshold	hysteresis
Setting range	10...95% RH	3...15% RH
Setting accuracy	± 3% RH	

Humidity Sensor - Working Range



The working range of the humidity sensor element is shown in terms of humidity / temperature limits.

Although the sensors would not deteriorate beyond the limits, their performance can only be specified within the limits of the working range.

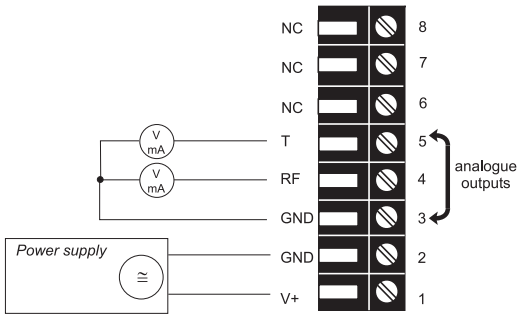
Sensor Coating

Operation in heavily polluted and/or corrosive environments is typical for many industrial processes and can lead to drift or damage of the humidity sensor and thus to false measured values. The unique protective coating developed by E+E for the sensing probe (ordering code: HC01) brings a significant improvement on the long-term stability of the transmitter in very dirty and aggressive environments.

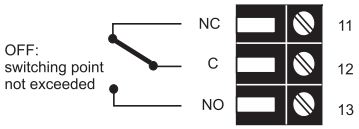
Connecting Diagram

output and supply

with active temperature output



alarm output



Ordering Guide

		EE23-	EE23-
Hardware Configuration			
Housing	metal housing	M	M
	polycarbonate housing	P	P
Type	humidity + temperature	FT	FT
Model	wall mounting	A	
	duct mounting	B	
	remote probe up to 120°C (248°F)	C	
	wall mounting - for meteorology[1]	G	
	remote miniature probe		H
Filter	membrane filter 5mm		1
	stainless steel sintered filter	3	
	PTFE filter	5	
	metal grid filter	6	
Cable length (incl. probe length; models C and H only)	2m (6.6ft)	02	02
	5m (16.4ft)	05	05
	10m (32.8ft)	10	10
	20m (65.6ft)	20	20
Probe length (models B and C only)	65mm (2.6")	2	
	200mm (7.9")	5	
	400mm (15.8")	6	
Display (refer to software-code)	no display		
	with display	D03	D03
Alarm output[2] (not available for model F)	no alarm output		
	with alarm output	SW	SW
Plug	standard cable 1 gland M16x1.5; cable Ø 4.5 - 10 mm (0.18 - 0.39")		
	2 glands M16x1.5	C11	C11
	1 plug for supply + outputs	C03	C03
Coating Sensor	no		
	yes	HC01	
Supply voltage	15...35V DC / 15...28V AC		
	integrated power supply 100...240V AC, 50/60Hz[3]	V01	V01

Software Settings						
Physical parameters of outputs	relative humidity	RH	[%]	(A)	Output 1	Select according to Ordering Guide (A - D)
	temperature	T	[°C or °F]	(B)		
	dew-point temperature	Td	[°C or °F]	(C)	Output 2	Select according to Ordering Guide (A - D)
	frost-point temperature	Tf	[°C or °F]	(D)		
Type of output signals	0 - 1V			(1)		Select according to Ordering Guide (1 - 6)
	0 - 5V			(2)		
	0 - 10V			(3)		
	0 - 20mA			(5)		
	4 - 20mA			(6)		
Temperarture unit	°C					E01 / E01
	°F					
Scaling of T-output	-40...60 (T02)	-40...120 (T12)	-40...248 (T78)		Output T	Select according to Ordering Guide (Txx)
Scaling of Td-output	-10...50 (T03)	20...120 (T15)	0...140 (T85)			
Scaling of Tf-output	0...50 (T04)	-30...60 (T20)	0...248 (T87)		Output Td	Select according to Ordering Guide (Tdxx)
in°C or °F	0...100 (T05)	0...80 (T21)	32...120 (T90)			
	0...60 (T07)	-40...80 (T22)	32...140 (T91)		Output Tf	Select according to Ordering Guide (Tfxx)
	-30...70 (T08)	-20...80 (T24)	32...248 (T93)			
	-30...120 (T09)	-20...60 (T25)	32...132 (T96)			Other T/Td/Tf-scaling refer to page 146
	-20...120 (T10)	-30...50 (T45)				
	-10...70 (T11)	-20...50 (T48)				
Display mode	measurand output 1+2 alternating					M12 / M12
	measurand output 1					M01 / M01
	measurand output 2					M02 / M02

1) Model G is not available in combination with metal housing!
2) Combination alarm output and plugs is not possible (with cable glands only) / combination alarm output and integrated power supply is not possible / alarm output for RH only
3) Integrated power supply includes 2 plugs for power supply and outputs / further plug options are not possible

Accessories (additional information see data sheet "Accessories", page 138)

- filter caps (HA0101xx)
- radiation shield (HA010504)
- external power supply unit (V02)
- display + housing cover in metal (D03M)
- display + housing cover in polycarbonate (D03P)
- mounting flange (HA010201)
- mounting flange 5mm (for model H only) (HA010208)
- bracket for installation onto mounting rails (HA010203)
- replacement humidity sensors (FE09)
- drip water protection (HA010503)
- calibration set (HA0104xx)
- extension cable for field calibration (HA010302)
- 1% calibration (EE90/3H)

Order Example

EE23-MFTC6025D03/AC2-Td04-M01

housing:	metal housing
type:	humidity + temperature
model:	remote sensor probe
filter:	metal grid
cable length:	2 m (6.6ft)
probe length:	200 mm (7.9")
display:	with display
output 1:	rF
output 2:	Td
output signal:	0-5V
scaling of T-output:	0...50°C
display mode:	measurand output 1

EE22 Series

Humidity / Temperature Transmitter with interchangeable probes

Unique for the EE22 series are the interchangeable sensing probes with connector.
The calibration data is stored in the probes, which are therefore interchangeable and probe replacement does not affect the performance of EE22.
The outstanding accuracy over the entire temperature range is based on very precise calibration methods and on the latest microprocessor technology. Well-proven E+E humidity sensor elements ensure excellent long-term stability.
For high temperature applications (up to +80°C / +176°F) or in case of limited space availability, the sensing probes can be connected to EE22 housing with cables (2m, 5m or 10m / 6.6ft, 16.4ft or 32.8ft) without any repercussions for the overall accuracy of the instrument.
Voltage 0 - 1 / 10V or current 4 - 20mA (2 wire) outputs are available, of which the temperature output can be scaled according to the application (see ordering guide).

EE22 is suitable for direct wall mounting and for installation on rails according to DIN EN 50022.
The optional display indicates the actual RH and T values.
Duct mounting can be done easily with the optional duct mounting kit.

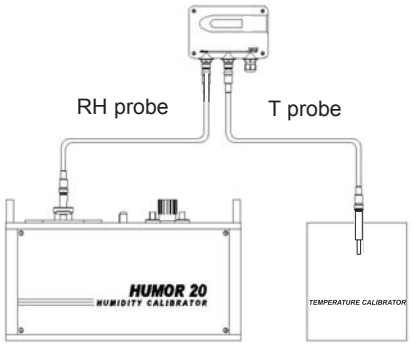

polycarbonate housing


metal housing

Field calibration of humidity and temperature

In the pharmaceutical and biotechnology industry a Loop-Calibration of the RH and T outputs, recommended by the FDA (Food and Drug Administration), can easily be performed utilizing separate RH and T probes (Type: EE22-xFTx2x).

The RH and T outputs can be adjusted with push buttons on the printed circuit board.



Reference probes

As useful accessories reference probes (incl. test report) representing fixed humidity and temperature values are available.

They shall be installed instead of the measuring probes to check function and accuracy of the evaluation unit.

One probe simulates high humidity and low temperature, the other low humidity and high temperature, to check the upper and lower end of both analogue outputs.

Typical Applications

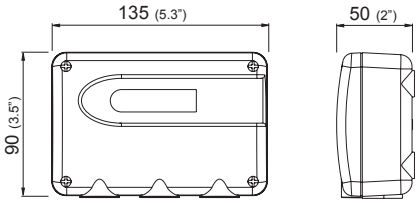
pharmaceutical industry
clean rooms
storage rooms
green houses
cooling chambers

Features

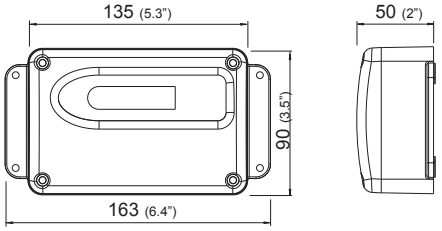
interchangeable probes
remote sensing probe up to 10m (32.8ft)
measuring range 0...100% RH / -40...80°C (-40...176°F)
optional display
traceable calibration
cost saving, easy loop-calibration of RH and T probes

Housing dimensions (mm)

polycarbonate housing



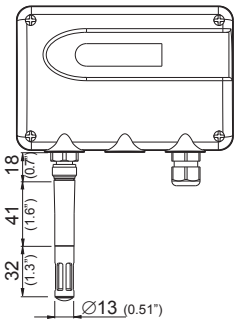
metal housing



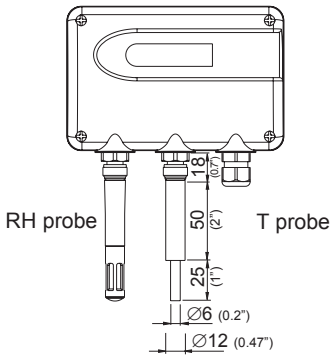
For use in harsh industrial environments all models of EE22 series are available in a robust metal housing.
Code "M" in the ordering guide indicates a metal housing for the EE22 evaluation unit, as well as for the interchangeable probe(s).
The smooth surface and the rounded outlines allow for the use in clean room applications.

Probe dimensions (mm)

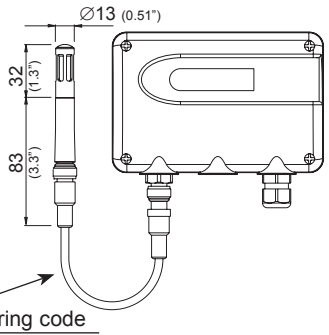
with one RH&T probe
EE22-xFTx1x



with two separate probes for RH and T
EE22-xFTx2x

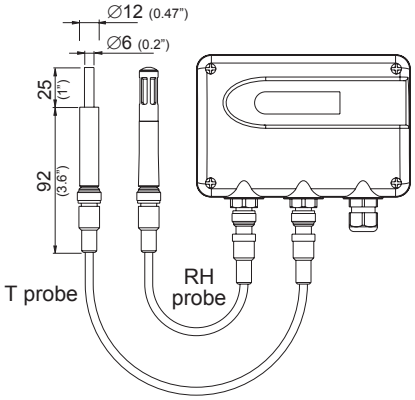


with one remote RH&T probe
EE22-xFTx1x
+HAxxxx

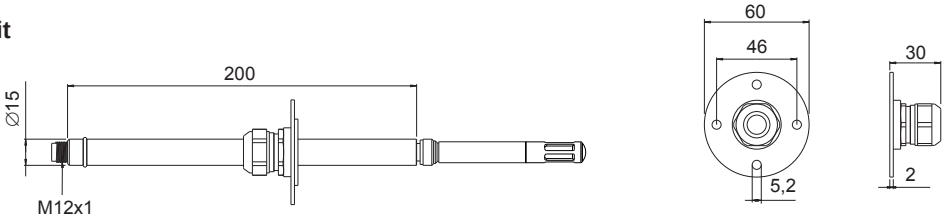


cable length	ordering code
2m (6.6ft)	HA010801
5m (16.4ft)	HA010802
10m (32.8ft)	HA010803

with two remote separate probes for RH and T
EE22-xFTx2x
+2x HAxxxx



duct mounting kit
HA010209



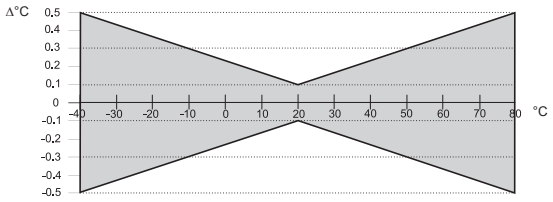
Technical Data

Measuring values of sensing probe

Relative Humidity

Sensor element[1]	HC105		
Working range[1]	0...100% RH		
Accuracy[2] (including hysteresis, non-linearity and repeatability, traceable to international standards, administrated by NIST, PTB, BEV...)			
	-15...40°C (5...104°F)	≤90% RH	± (1.5 + 0.5%*mv) % RH
	-15...40°C (5...104°F)	>90% RH	± 2.5% RH
	-40...80°C (-40...176°F)		± (1.7 + 1.5%*mv) % RH
Temperature dependence of electronics	typ. ± 0.006% RH/°C		
Response time with metal grid filter	< 15s (at 20°C / t_{90})		

Temperature

Sensor element	Pt1000 (tolerance class A, DIN EN 60751)		
Working range sensing probe	fixed sensing probe: -40...60°C (-40...140°F)		
	remote sensing probe: -40...80°C (-40...176°F)		
Accuracy (at 20°C: ±0,1°C)			
Temperature dependence of electronics	typ. ± 0.007°C/°C		
Response time	with combined RH/T probe:		t_{63}: typ. < 3min
	with seperated RH and T probes:		t_{63}: typ. < 6min

Outputs

0...100% RH/ xx...yy°C[3]	0 - 1V		-0.5mA < I_L < 0.5mA
(temperature output scale according to	0 - 10V		-1mA < I_L < 1mA
Txx ordering code)	4 - 20mA (two wire)		R_L < 500 Ohm
Temperature dependence of analogue outputs	max. 0.2 $\frac{mV}{°C}$ resp. 1 $\frac{\mu A}{°C}$		

General

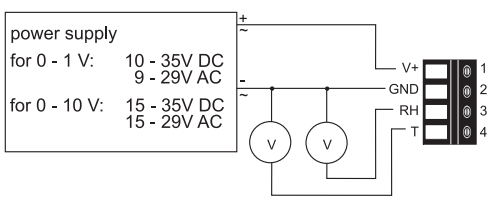
Supply voltage			
for 0 - 1V output	10 - 35V DC	or	9 - 29V AC
for 0 - 10V output	15 - 35V DC	or	15 - 29V AC
for 4 - 20mA output	10 - 35V DC		
Load resistor for 4 - 20mA output	$R_L < \frac{U_V - 10V}{0.02\,A}$ [Ω]		
Current consumption	typ. 10mA for DC supply		typ. $20mA_{eff}$ for AC supply
Electrical connection	screw terminals max. 2.5mm²		
Cable gland	M16x1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")	
	(optional connector; type: Lumberg, RSF 50/11)		
Sensor protection	membrane filter, PTFE filter, metal grid filter (polycarbonate), metal grid filter (stainless steel)		
Material	housing: PC or Al Si 9 Cu 3		probe: PC or stainless steel
Protection class of housing	IP65; Nema 4		
Electromagnetic compatibility	EN61326-1	EN61326-2-3	ICES-003 ClassB
	Industrial Environment		FCC Part15 ClassB
Working temperature range of probe	-40...60°C (-40...140°F) / 80°C (176°F) for remote sensing probe		
Working temperature range of electronics	-40...60°C (-40...140°F)		
Storage temperature range	-40...60°C (-40...140°F)		

CE

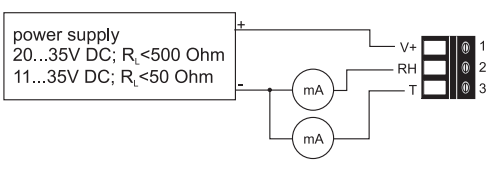
1) Refer to working range of humidity sensor HC105
2) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).
3) Refer to ordering guide

Connection Diagram

EE22-FT1,3xx



EE22-FT6xx



Ordering Guide

Position 1 - Transmitter **EE22-**

Hardware Configuration				
Housing	metal housing			M
	polycarbonate housing			P
Type	humidity + temperature			FT
Output	0-1V			1
	0-10V			3
	4-20mA			6
Model	wall mounting - cable gland M16x1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")		A
	wall mounting - rear cable outlet			F
Probe	1 probe RH&T			1
	2 separate probes for RH and T			2
Filter	membrane filter			1
	stainless steel sintered filter			3
	PTFE filter			5
	metal grid filter (polycarbonate)			6
	metal grid filter (stainless steel)			9
Display	without display			
	with display			D07
Plug	without plug			
	1 plug for power supply and outputs			C03
Sensor coating	without coating			
	with coating			HC01
Software Configuration				
T-Unit	°C			
	°F			E01
Scaling of T-output in°C or °F	-40...60 (T02)	0...120 (T16)	-20...50 (T48)	Select according to Ordering Guide (Txx)
	-10...50 (T03)	-30...60 (T20)	-40...176 (T80)	
	0...50 (T04)	0...80 (T21)	0...140 (T85)	
	0...60 (T07)	-40...80 (T22)	0...176 (T86)	
	-30...70 (T08)	-20...80 (T24)	32...120 (T90)	Other T-scaling refer to page 146
	-10...70 (T11)	-20...60 (T25)	32...140 (T91)	
	-40...120 (T12)	-30...50 (T45)	32...132 (T96)	
Position 2 - Probe cable				
Cable length	2m (6.6ft)			HA010801
	5m (16.4ft)			HA010802
	10m (32.8ft)			HA010803

Accessories / Replacement Parts

(For further information see data sheet "Accessories", page 138)

- Replacement probe RH&T in polycarbonate (EE07-PFTx)
- Replacement probe T in polycarbonate (EE07-PTx)
- Replacement probe RH&T in metal (EE07-MFTx)
- Replacement probe T in metal (EE07-MT)
- Display + housing cover in metal (D07M)
- Display + housing cover in polycarbonate (D07P)
- Duct mounting kit (HA010209)
- Probe cable 2m (6.6ft) / 5m (16.4ft) / 10m (32.8ft) (HA0108xx)
- Bracket for rail installation (HA010203)
- External supply unit (V02)
- RH calibration set (HA0104xx)
- Reference probes (HA010403)
- Filter caps (HA0101xx)

Order Example

Position 1 - Transmitter:

EE22-MFT3A26C03/T07

housing:	metal housing
type:	humidity + temperature
output:	0-10V
model:	wall mounting - cable gland M16x1.5
probe:	2 separate probes for RH and T
filter:	metal grid filter (polycarbonate)
display:	without display
plug:	1 plug for power supply and outputs
sensor coating:	without coating
T-Unit:	°C
scaling of T-output:	0...60°C

Position 2 - Probe cable:

2x HA010802

cable length: 2x 5m (2x 16.4ft)

EE21 Series

High-Precision Humidity / Temperature Transmitter for HVAC Applications

Transmitters of the EE21 series have been developed for high-precision measurement of relative humidity and temperature.
EE21 transmitters are available for wall and duct mounting with or without the very useful snap in-mounting kit, which allows a quick and easy exchange of the transmitter. Outputs can be selected between voltage and current.
An optional radiation shield providing a forced ventilation is recommended for use in outdoor applications.
Special protection coating for the sensing element (code - HC) permits the permanent use in very polluted environments.
High humidity calibration is recommended for applications in high lasting humidities > 90% RH (Code - CA01).

Humidity Two-point Adjustment

With an easy routine via the push-buttons “UP” and “DOWN” on the circuit board the user can perform a fast and accurate two-point adjustment of relative humidity.

Typical Applications

green houses
storage rooms
swimming halls
meteorology

Features

measuring range 0...100% RH
accuracy ±2% RH
traceable calibration
working range -40...60°C (-40...140°F)
wettable
excellent long term stability

Technical Data

Measuring values

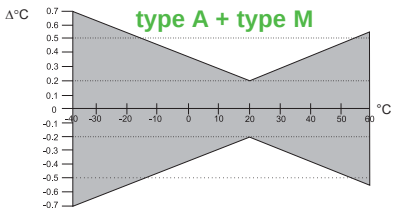
Relative Humidity

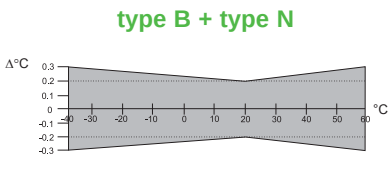
Sensor	HC1000 or HC1000C (with coating)	
Analogue output appropriate 0...100% RH	0-1V	-0.5mA < I_L < 0.5mA
	0-5V / 0-10V	-1mA < I_L < 1mA
	4-20mA (two wires)	R_L < 500 Ohm
Working range[1)]	0...100% RH	
Accuracy at 20°C (68°F)	± 2% RH (0...90%)	± 3% RH (90...100%)
	Traceable to international standards, administrated by NIST, PTB, BEV...	
Hysteresis 10% - 80% - 10%	< 2% RH	
Temperature dependence of electronics	typ. 0.03% RH/°C	(0.02% RH/°F)
Temperature dependence of probe	typ. 0.03% RH/°C	(0.02% RH/°F)

Temperature

Sensor	Pt1000 (tolerance class A, DIN EN 60751)	
Analogue output -40...60°C (-40...140°F)	0-1V	-0.5mA < I_L < 0.5mA
	0-5V / 0-10V	-1mA < I_L < 1mA
	4-20mA (two wires)	R_L < 500 Ohm

Accuracy





Temperature dependence of electronics	typ. 0.01°C /°C

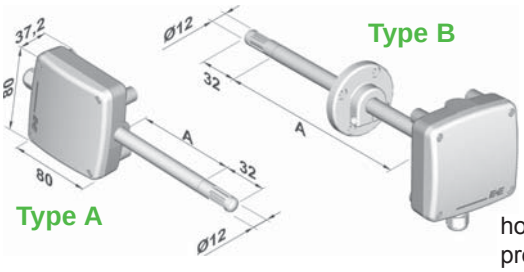
General

Supply			
for 0 - 1V	10 - 35V DC	or	9 - 29V AC
for 0 - 5V	12 - 35V DC	or	15 - 29V AC
for 0 - 10V	15 - 35V DC	or	15 - 29V AC
for 4 - 20mA	10V +R_L x 0,02 < U_V < 35V DC; R_L < 500 Ohm		
Current consumption	for DC supply: typ. 5mA		for AC supply: typ. 15mA_{eff}
Electrical connection	screw terminals max. 1.5 mm^2 (AWG 16)		
Cable gland	M16x1.5 or connection plug (only snap-in models N + M) cable Ø 4.5 - 10 mm (0.18 - 0.39")		
Sensor protection	membrane filter, sintered stainless steel filter, metal grid filter, PTFE filter		
Electromagnetic compatibility	EN61326-1 Industrial Environment	EN61326-2-3	ICES-003 ClassB FCC Part15 ClassB
Temperature ranges	working temperature probe: working temperature electronics: storage temperature:		-40...60°C (-40...140°F) -40...60°C (-40...140°F) -25...60°C (-13...140°F)

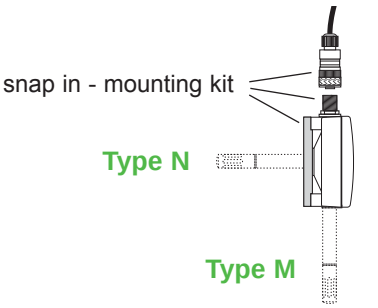
1) Please refer to working range of HC1000!

Dimensions (mm)

1 mm = 0.03937" / 1"= 25.4 mm

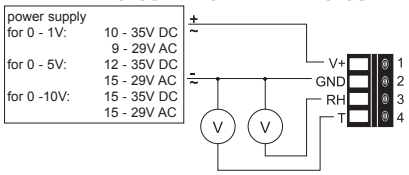


housing: PC
protection class: IP65, Nema 4

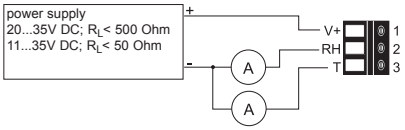


Connection Diagram

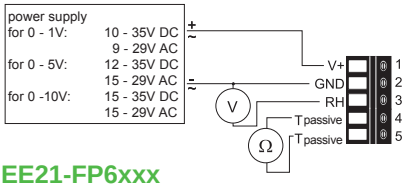
EE21-FT1/2/3xxx / EE21-F1/2/3xxx



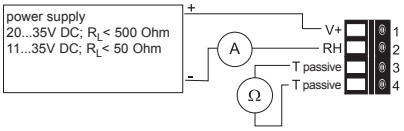
EE21-FT6xxx / EE21-F6xxx



EE21-FP3xxx



EE21-FP6xxx



Ordering Guide

MODEL	OUTPUT	T-SENSOR (only passive)	HOUSING TYPE	PROBE LENGTH (see dimensions "A")	FILTER
humidity + temperature (FT)	0 - 1 V (1)	Pt 100 DIN A (A)	wall mounting (A)	50 mm (1.9") (2)	membrane filter (1)
humidity (F)	0 - 5 V (2)	Pt 1000 DIN A (C)	duct mounting (B)	200 mm (7.9") (5)	sintered stainless steel filter (3)
humidity+temp. passive (FP)	0 - 10 V (3)		snap in - wall mounting[1] (M)		metal grid filter (6)
	4 - 20 mA (6)		snap in - duct mounting[1] (N)		
EE21-					

COATING	CALIBRATION	T-UNIT	SCALING OF T-OUTPUT
no (no code)	standard (no code)	°C (no code)	-40...60 (T02) -40...140 (T83)
yes (HC01)	high humidity (CA01)	°F (E01)	-30...70 (T08) 0...176 (T86)
			-20...80 (T24) 32...132 (T96)
			other (Txx)

1) Combination snap - in mounting and model FP is not possible

Order Example

EE21-FT3A26/T24

model:	RH/T transmitter
output:	0 - 10V
housing type:	wall mounting
probe length:	50 mm (7.9")
filter:	metal grid filter
sensor coating:	no
calibration:	standard
T-unit:	°C
Scaling of T-output:	-20...80°C

Accessories

- radiation shield (HA010501)
- filter caps (HA0101xx)

EE21

EE16 Series

Humidity / Temperature Transmitter for HVAC Applications

EE16 transmitters are the ideal solution for accurate measurement of relative humidity and temperature at a reasonable price in HVAC applications. The appropriate filter cap enables employment in heavily polluted environment.

The new developed E+E humidity sensors HC101 guarantee excellent long term stability and resistance against chemical pollutants. Their excellent reproducibility allows a simple low-cost-one-point calibration for very good accuracy over the entire working range.

EE16 transmitters are available as wall or duct mounted, with current or voltage output signals.

Typical Applications

building-automation
storage rooms
climate and ventilation control

Features

excellent price/performance ratio
wettable
long term stable
traceable calibration

Technical Data

Measuring values

Relative Humidity

Sensor	HC101	
Output appropriate 0...100% RH	0-10 V	-1 mA < I_L < 1 mA
	4-20 mA (two wire)	R_L < 500 Ohm
Working range[1)]	10...95% RH	
Accuracy at 20°C (68°F)	±3% RH	
	Traceable to intern. standards, administrated by NIST, PTB, BEV...	
Temperature dependence at 45% RH	typ. -0.05% RH /°C (-0.03% RH / °F)	

Temperature

Sensor	Pt1000 (class A, DIN EN 60751)	
Output appropriate 0...50°C (32...122°F)	0-10 V	-1 mA < I_L < 1 mA
	4-20 mA (two wire)	R_L < 500 Ohm
Accuracy at 20°C (68°F)[2)]	±0.3°C (±0.5°F)	

General

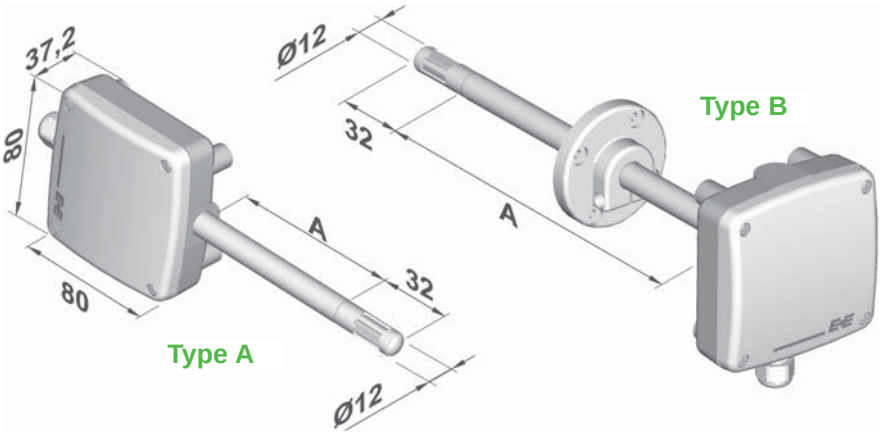
Supply voltage		
for 0 - 10 V	15 - 35V DC or 24V AC ±20%	
for 4 - 20 mA	10V + R_L x 20 mA < Uv < 35V DC	
Current consumption	for DC supply	typ. 8 mA
	for AC supply	typ. 20 mA_{eff}
Electrical connection	screw terminals max. 1.5 mm^2 (AWG 16)	
Housing / protection class	Polycarbonat / IP65; Nema 4	
Cable gland	M16 x 1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")
Sensor protection	membrane filter, metal grid filter, stainless steel sintered filter	
Electromagnetic compatibility	EN61326-1	CE
	EN61326-2-3	
Temperature range	working temperature:	-5...50°C (23...122°F)
	storage temperature:	-25...60°C (-13...140°F)

1) Please refer to working range of HC101

2) Please note: temperature accuracy EE16-x6xx2x: ±0.5°C (±0.9°F)

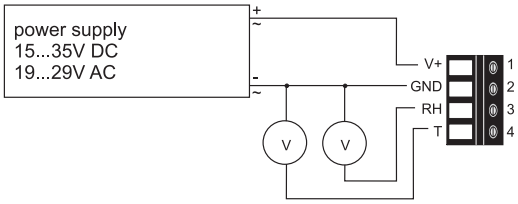
Housing Dimensions (mm)

1 mm = 0.03937" / 1" = 25.4 mm

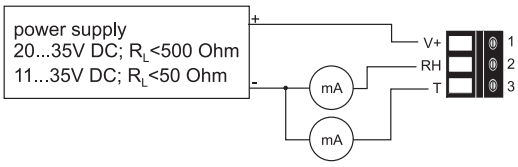


Connection Diagram

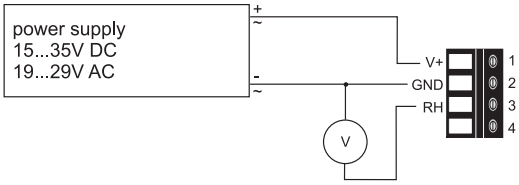
EE16-FT3xxx



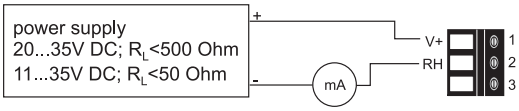
EE16-FT6xxx



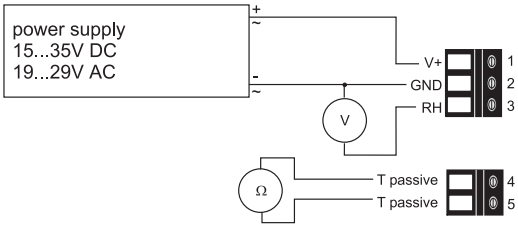
EE16-F3xxx



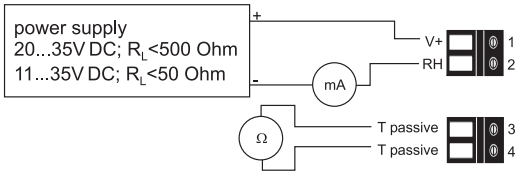
EE16-F6xxx



EE16-FP3xxx



EE16-FP6xxx



Ordering Guide

MODEL	OUTPUT	T-Sensor (only model FP)	HOUSING	PROBE LENGTH (according to "A")	FILTER
humidity + temperature (FT)	0-10V (3)	Pt 100 DIN A (A)	wall mounting (A)	50 mm (1.9") (2)	membrane filter (1)
humidity (F)	4-20 mA (6)	Pt 1000 DIN A (C)	duct mounting (B)	200 mm (7.9") (5)	sintered stainless steel filter (3)
humidity + temperature passive (FP)		NTC 10k (E)			metal grid (6)
		others on request			
EE16-					

Order Example

EE16-F3A21

model:	humidity transmitter
output:	0-10V
housing:	wall mounting
probe length:	50 mm (1.9")
filter:	membrane filter

EE14 Series

Hygrostats for Wall and Duct Mounting Applications

The EE14 hygrostat is based on the well proved E+E humidity sensors of the HC series, which guarantee excellent long term stability, low hysteresis and high resistance to pollutants. The switching threshold is freely adjustable in the range of 10...95% RH with a hysteresis which can be set independently between 3% and 15% RH.

EE14 hygrostat is available for wall or duct mounting, the right choice of protection filter cap enables maintenance free function in heavily polluted environment.

Typical Applications

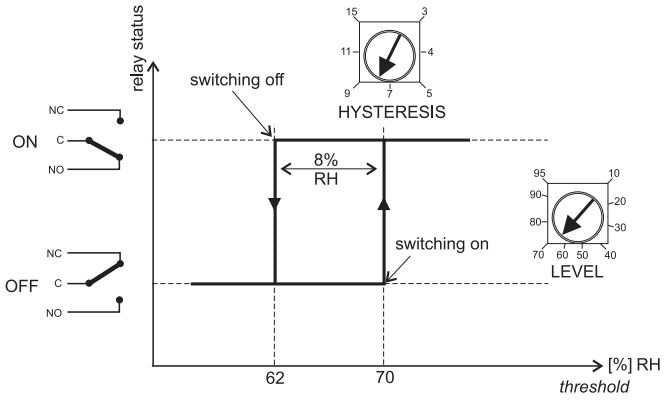
refrigeration
swimming halls
climate- and ventilation controls

Features

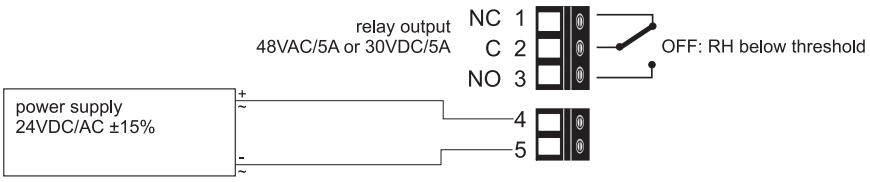
maintenance free operation
easy adjustment via poti
working range 10...95% RH
wettable

Working Principle

With a potentiometer it is possible to adjust the threshold between 10 and 95% RH. A second potentiometer is setting the switching-hysteresis between 3 and 15% RH.



Connection Diagram



Technical Data

Measuring value

Humidity sensor	HC101	
Output	centre-zero relay up to 30V DC / 5A or 48V AC / 5A	
	threshold	hysteresis
Setting range	10...95% RH	3...15% RH
Setting accuracy	± 3% RH	

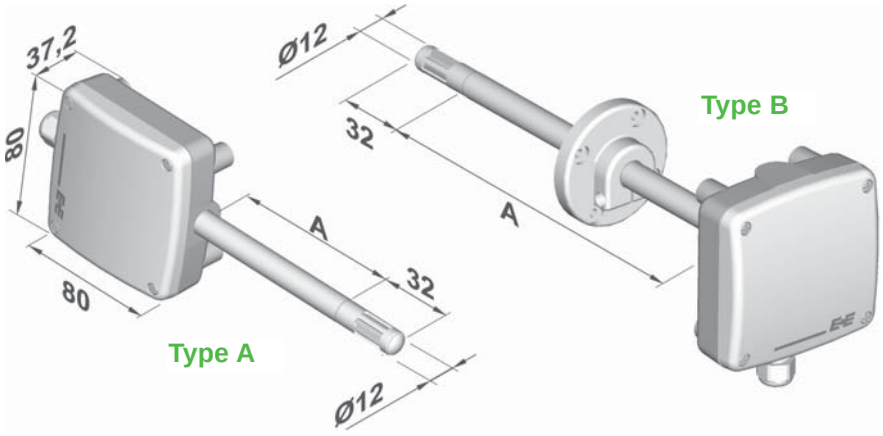
General

Supply voltage	24V DC / V AC ± 15 %	
Current consumption for DC supply	typ. 12 mA	
for AC supply	typ. 20 mA_{eff}	
Summer-/winter switch (option)	switch off the hygrostat for 25 h ± 10%	
Electrical connection	screw terminals max. 1.5 mm^2 (AWG 16)	
Housing/ protection class	Polycarbonat / IP65, Nema 4	with S/W switch IP40
Cable gland	M16x1.5; cable Ø 4.5 - 10 mm (0.18 - 0.39")	
Sensor protection	membrane filter, metal grid filter	
Electromagnetic compatibility	EN 50081-2	EN 50081-1
	EN 50082-2	
Temperature range	working temperature:	-5...50°C (23...122°F)
	storage temperature:	-30...60°C (-22...140°F)

CE

Housing Dimensions (mm)

1 mm = 0.03937"/ 1" = 25.4 mm



Ordering Guide

HOUSING		PROBE LENGTH (according to "A")		FILTER	
wall mounting	(A)	20 mm (0.7")	(1)	membrane filter	(1)
duct mounting	(B)	200 mm (7.9")	(5)	metal grid filter	(6)
EE14-					

Order Example

EE14-A1

housing: wall mounting
probe length: 20 mm (0.7")
filter: membrane filter

EE10 Series

HVAC Humidity / Temperature Transmitter for Indoor Applications

EE10 room transmitters are the ideal solution for indoor applications such as HVAC in residential and official buildings.
The very stylish, functional housing makes easy installation and fast exchange of the sensing unit for service purposes possible. The high quality E+E humidity sensor and state-of-the-art microprocessor controlled electronics are the guarantee for best accuracy and a wide range of options.
The standard humidity output of EE10 transmitters is 4 - 20 mA or 0 - 10 V. The temperature output signal can be active or passive.
All EE10 versions can be equipped with a good legible LC display. For EE10-FT versions the displayed values for humidity and temperature will alternate.

Typical Applications

building management for residential and office areas
air conditioning
switching cabinets
climate control in hotels and museums

Features

excellent price / performance ratio
easiest installation
modern design
long term stable
optional display
traceable calibration

Technical Data

Measuring Quantities

Relative Humidity

Humidity sensor	HC103	
Analogue output 0...100% RH	0-10 V	-1 mA < I_L < 1mA
	4-20 mA (two wires)	R_L < (U_V-10)/0.02 < 500 Ohm
Working range[1]	0...95 % RH	
Accuracy at 20°C (68°F) and U_V=24VDC	±2% RH (40...60% RH)	±3% RH (10...90% RH)
	Traceable to intern. standards, administrated by NIST, PTB, BEV...	
Temperature dependence at 60% RH	typical 0.06% RH /°C (0.03% RH / °F)	

Temperature (active output)

Analogue output 0...50°C (32...122°F)[2]	0-10 V	-1 mA < I_L < 1mA
	4-20 mA (two wires)	R_L < (U_V-10)/0.02 < 500 Ohm
Accuracy at 20°C (68°F) and U_V=24VDC	FT3: ±0.25°C (±0.45°F)	FT6: ±0.4°C (±0.72°F)

Temperature (passive output)

Type of T-Sensor	please see ordering guide

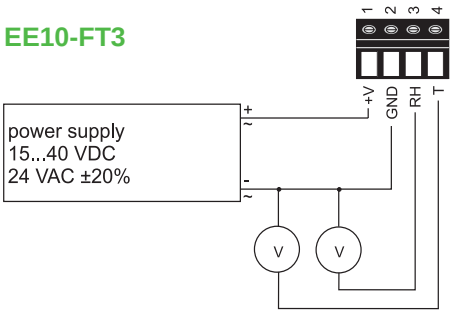
General Data

Voltage supply (U_V)		
for 0 - 10 V	15 - 40 VDC or 24 VAC ±20%	
for 4 - 20 mA	28V DC > U_V > 10 + 0.02 x R_L (R_L < 500 Ohm)	
Current consumption	for DC supply:	typical 4 mA
	for AC supply:	typical 15 mA_{eff}
Electrical connection	screw terminals max. 1.5 mm^2 (AWG 16)	
Display	for EE10-FTx version	Humidity / Temperature alternating
	for EE10-Fx and EE10-FPx version	Humidity
CE compatibility according	EN61326-1	
	EN61326-2-3	
Temperature ranges	working temperature range:	-5...55°C (23...131°F)
	working temperature with display:	-5...55°C (23...131°F)
	storage temperature range:	-25...60°C (-13...140°F)

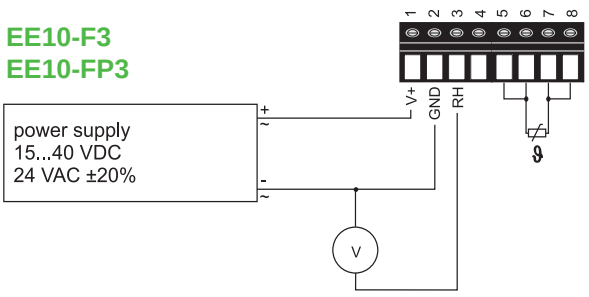
1) Please refer to the working range of the HC103
2) Other T-scaling refer to page 146

Connection Diagram

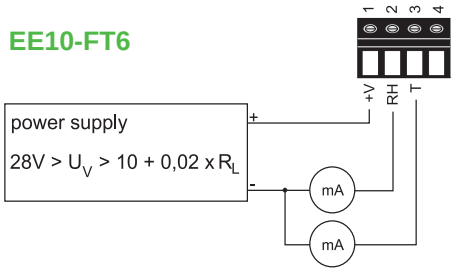
EE10-FT3



EE10-F3
EE10-FP3

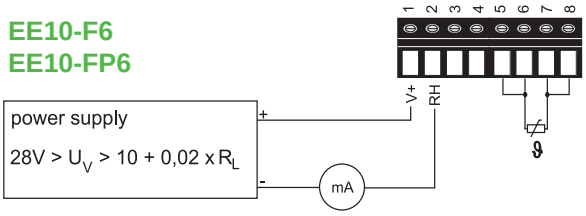


EE10-FT6



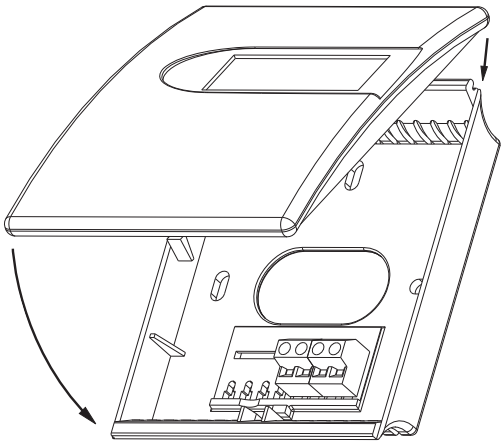
R_L < 500 Ohm

EE10-F6
EE10-FP6



R_L < 500 Ohm

Dimensions (mm)



W x H x D = 85 x 100 x 26mm
(3.3 x 3.9 x 1")

Housing: PC
Protection class: IP30

Housing colour: Cover: RAL 9003 (signal white)
Back: RAL 7035 (light grey)

Order Example

EE10-FT3-D04-T04

Model:	humidity + temperature
Output humidity:	0-10V
Output temperature:	0-10V
Display:	with display
T-Unit:	°C
T-Scale:	0...50°C

Ordering Guide

MODEL	OUTPUT	T-SENSOR (only passive)	DISPLAY	T - UNIT (only for (D04))	T-SCALE (only for FT)
humidity + temperature (FT)	0-10V (3)	Pt 100 DIN A (A)	without display (--)	°C (--)	0...50 (T04)
humidity (F)	4-20 mA (6)	Pt 1000 DIN A (C)	with display (D04)	°F (E01)	-5...55 (T31)
humidity + temperature passive (FP)					0...40 (T55)
					other (Txx)
EE10-					

EE08 Series

High-Precision Miniature Humidity / Temperature Transmitter

Accurate humidity / temperature measurement over a wide working range, fitted in a small-sized housing and high flexibility have been the main goals for the development of the EE08 series.
Low power consumption and short start-up time support efficient energy management for battery operated systems.
For this application an additional version (V10) with supply voltage 4.5-15V DC has been developed.
Calibration data and other relevant functions like linearization or temperature compensation are stored in the probe. This feature, together with the optional connector, allows for easy replacement of the probe without a need for re-adjustment of the reading device (interchangeability).

The humidity and temperature measurement are available as analogue outputs (0-1/2.5/5V) and as a digital interface (E2-interface). Easy implementation and data processing is warranted.
Humidity and temperature reading can be re-adjusted using the calibration software; available as an accessory.

Typical Applications

meteorology / weather stations
humidity / temperature data logging
incubators
fermentation chambers
green houses
snow machines
dry storage facilities

Features

small dimensions
wide working range, high accuracy
traceable calibration
customer adjustment possible
interchangeable in seconds
low power consumption / short start-up time
analogue outputs / digital interface

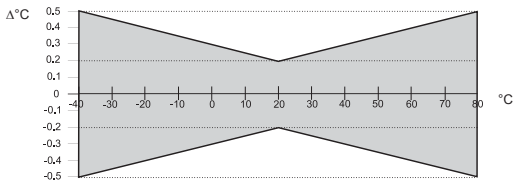
Technical Data

Measuring values

Relative Humidity

Sensor	HC101	
Working range[1)]	0...100% RH	
Digital output (2 wire)[2)]	output value: 0.00...100.00% RH	
Analogue output 0...100% RH	0-1/2.5/5/10V	-0.2mA < I_L < 0.2mA
Accuracy at 20°C (68°F) and 10/24V DC	±2% RH (0...90% RH)	±3% RH (90...100% RH)
	Traceable to intern. standards, administrated by NIST, PTB, BEV...	
Temperature dependence	typ. 0.03% RH/°C (typ. 0.02% RH/°F)	

Temperature

Sensor	Pt 1000 (DIN A)	
Digital output (2 wire)[2)]	output value: -40.00...+80.00°C (-40...176°F)	
Analogue output	0-1/2.5/5/10V	-0.2mA < I_L < 0.2mA
Accuracy at 10/24V DC		

General

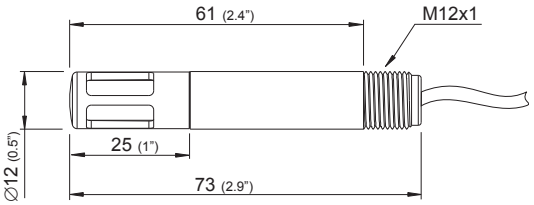
Supply voltage	output 0-1V / 0-2.5V	4.5-15V DC or 7-30V DC
	output 0-5V	7-30V DC
	output 0-10V	12-30V DC
Current consumption	typ. < 1.3mA	
Digital interface	E2-interface	level = 3.3V / ±0.1V
Housing	polycarbonate / IP65	
Sensor protection	metal grid filter	
Electromagnetic compatibility	EN61326-1	EN61326-2-3
	Industrial Environment	
Temperature ranges	working temperature: -40...80°C (-40...176°F)	
	storage temperature: -40...80°C (-40...176°F)	

CE

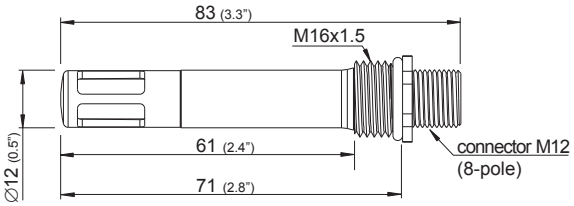
1) refer to the working range of the humidtiy sensor HC101
2) serial protocol refer to www.epluse.com

Dimensions (mm)

EE08 with cable (Type E)



EE08 with connector (Type D)



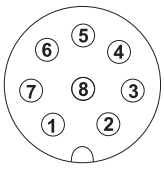
Connection Diagram

Type E:

	Temp. active	Temp. passive, 4-wire
T-passive	white (not connected)	white, black
T-passive	blue (not connected)	blue, violet
GND	pink	pink
T-out	grey	grey (not connected)
RH-out	yellow	yellow
SCL } E2-interface	green	green
SDA } E2-interface	brown	brown
+UB	red	red

Type D:

1	T-passive	
2	SDA	} E2-interface
3	SCL	} E2-interface
4	RH-out	
5	T-out	
6	GND	
7	T-passive	
8	+UB	



Ordering Guide

HOUSING	MODEL	OUTPUT	SUPPLY	T-SENSOR (passive, 4-wire)	TYPE
polycarbonate (P)	humidity active / temperature active (FT) humidity active / temperature passive (FP)	0 - 1V [1] (1) 0 - 2.5V [1] (7) 0 - 5V [2] (2) 0 - 10V [2] (3)	4.5 - 15V DC (V10) 7 - 30V DC (V11)	Pt 100 DIN A (A) Pt 1000 DIN A (C)	with connector (D) with cable (E)
EE08-					

1) possible with supply 4.5 - 15V DC (V10) or 7 - 30V DC (V11)
2) possible with supply 7 - 30V DC (V11) only

FILTER	COATING	CABLE LENGTH (Type E only)	T-SCALING
metal grid filter (6)	without coating (no code) with coating (HC01)	1m (3.3ft) (01) 2m (6.6ft) (02) 5m (16.4ft) (05)	-40...80 (T22) -40...60 (T02) -30...70 (T08) -20...80 (T24) -20...50 (T48) other (Txx)

Order Example

EE08-PFT2V11E602T22

housing:	polycarbonate	filter:	metal grid filter
model:	humidity active / temp. active	coating:	without
output:	0 - 5V	cable length:	2m (6.6ft)
supply:	7 - 30V DC	T-scaling:	-40...80°C (-40...176°F)
type:	with cable		

Accessories / Replacement Parts

- M12 connection cable for type D, length 1,5m (5ft) (HA010322)
- M12 connection cable for type D, length 3m (10ft) (HA010323)
- M12 connection cable for type D, length 5m (16.4ft) (HA010324)
- M12 connection cable for type D, length 10m (32.8ft) (HA010325)
- E2-interface - RS232 converter (incl. calibration software) for testing purposes and customer adjustment (HA011005)
- radiation shield (HA010506)
- M12 female socket with wires (HA010703)
- M12 female cable connector assembly possible (HA010704)
- metal grid filter (HA010113)

EE06 Series

Small Size Humidity / Temperature Transmitter for OEM Applications

The analogue humidity output provides according to model type, a current signal with 4-20mA or a voltage signal with 0-1V. A passive temperature output signal is available for both versions.
The voltage version can be ordered also with an active output.

Wide temperature and supply voltage ranges, excellent long term stability and the optional sensor coating allow the use in many applications.

Typical Applications

stables
green houses
humidifiers and dehumidifiers
monitoring of storage rooms

Features

very small dimensions
excellent price/performance ratio
very good long term stability
easy installation
optional sensor coating

Technical Data

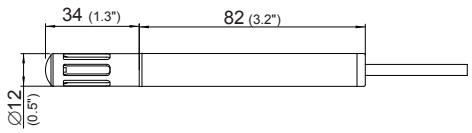
Measuring values	EE06-x1 (voltage output)	EE061-x6 (current output)
Relative humidity		
Sensor	HC101	HC105
Working range[1)]	0...100% RH	0...100% RH
Analogue output 0...100% RH	0-1 V -0.2 mA < I_L < 0.2 mA	4...20mA (two wire) R_L<500Ohm
Accuracy at 20°C (68°F), 12V DC	±3% RH (10...90% RH) ±5% RH (<10% RH and >90% RH)	±3% RH (10...90% RH) ±5% RH (<10% RH and >90% RH)
Temperature dependence [% RH/°C]	model F/FT: -0.00035 x RH x (T-20°C) model FP: typ. (-0.003 x RH + 0.01) x (T-20°C)	model F/FP: typ. ±0.03
Temperature active		
Sensor	Pt1000 (class A, DIN EN 60751)	
Analogue output -40...60°C (-40...140°F)	0-1 V -0.2 mA < I_L < 0.2 mA	
Accuracy at 12V DC, 20°C (68°F)	±0.3°C (±0.5°F)	
Temperature passive		
Output	resistive, 2 wire	resistive, 4 wire
Type of T-Sensor	refer to ordering guide	refer to ordering guide
General		
Supply voltage	4.5V DC - 30V DC	9V DC - 28V DC
Current consumption	typ. 1.5 mA	
Electrical connection	cable with 0.5m (1.6ft) or 3m (9.8ft)	cable with 0.5m (1.6ft) or 3m (9.8ft)
Housing	polycarbonate / IP65 in vertical mounting (filter cap upside)	polycarbonate IP65
Sensor protection	membrane filter, metal grid filter	membrane filter, metal grid filter
Electromagnetic compatibility	EN61326-1 EN61326-2-3	EN61326-1 EN61326-2-3
Temperature ranges	working temperature: -40...60°C (-40...140°F) storage temperature: -40...65°C (-40...149°F)	working temperature: -40...60°C (-40...140°F) storage temperature: -40...70°C (-40...158°F)

1) Refer to the working range of the humidity sensor

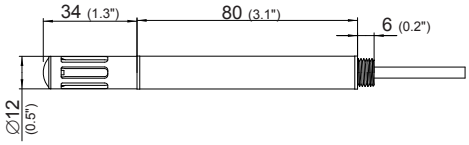
Dimensions (mm)

EE06-x1 (voltage output)

Type A:

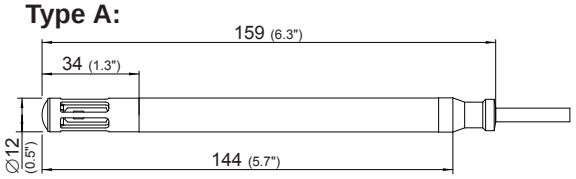


Type C:



EE061-x6 (current output)

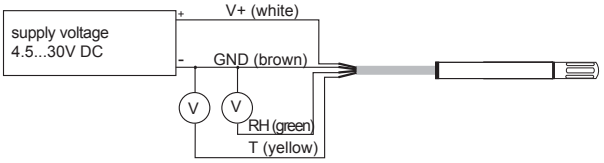
Type A:



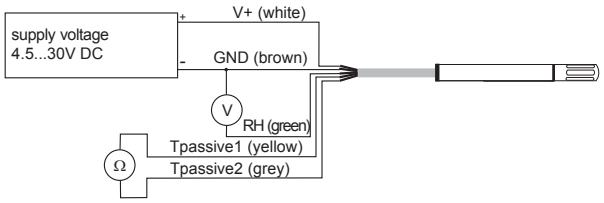
Connection Diagram

EE06-x1 (voltage output):

with active T-output:

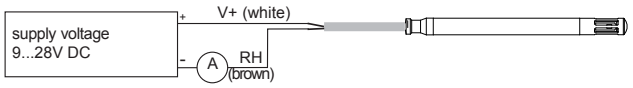


with passive T-sensor:

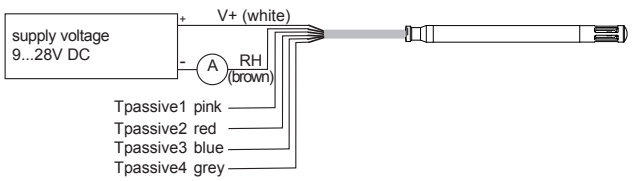


EE061-x6 (current output):

with active humidity output:



with passive T-sensor:



Ordering Guide

Voltage Output:

MODEL	OUTPUT	T-SENSOR (passive only)	TYPE	FILTER	COATING	CABLE LENGTH
humidity + temperature (FT) humidity (F) humidity+temperature passive (FP)	0 - 1V (1)	Pt 100 DIN A (A) Pt 1000 DIN A (C) NTC 10K at 25°C (E)	with housing (A) with thread (C)	membrane filter (1) metal grid filter (6)	without coating (no code) with coating (HC01)	0.5m (1.6ft) (co code) 3m (9.8ft) (K300)
EE06-						

Current Output:

MODEL	OUTPUT	T-SENSOR (passive only)	FILTER	COATING	KABELLÄNGE
humidity (F) humidity+temperature passive (FP)	4 - 20mA (6)	Pt 100 DIN A (A) Pt 1000 DIN A (C) NTC 10K at 25°C (E)	membrane filter (1) metal grid filter (6)	without coating (no code) with coating (HC01)	0.5m (1.6ft) (co code) 3m (9.8ft) (K300)
EE061-					

Order Example

EE061-FP6A6HC01K300

model: humidity+temperature passive
output: 4 - 20mA
T-sensor: Pt 100 DIN A
filter: metal grid filter
coating: with coating
cable length: 3m

Accessories

For more information please refer to data sheet "Accessories"

EE02 Series

High-Precision Thermo - Hygrometer

The new hygrometer EE02 is the combination of high accuracy measurement technology with modern design. The relative humidity and temperature values with trend indication are alternating on the large display.

High quality E+E sensor technology and state of the art microprocessor based electronics result in highest accuracy and long term stability. The very low power consumption allows battery operation and independence from external power supply.
The standard batteries, replaceable by the user, have a life time about 5 years.

The modern housing concept makes the wall mounting very easy. EE02 can be used as bench mount as well, the free standing kit is included in the scope of supply.

EE02 is available upon request as OEM thermo - hygrometer with your company logo.

EE02

Typical Applications

climate monitoring for:
- **office spaces**
- **private areas**
- **laboratories**
- **food stores**

gift article

Features

easiest mounting
modern design
highest accuracy
traceable calibration
long battery life time
available as OEM meter

Technical Data

Measuring Quantities

Relative Humidity

Humidity sensor type	HC103	
Working range[1)]	10...95% RH	
Resolution	0.1% RH	
Accuracy at 20°C (68°F)	±2% RH (40...60% RH)	±3% RH (10...95% RH)
	Traceable to intern. standards, administrated by NIST, PTB, BEV...	
Trend indication	yes	

Temperature active

Working range	-5...55°C (23...131°F)	
Resolution	0.1°C	
Accuracy at 20°C (68°F)	±0.3°C (±0.54°F)	
Trend indication	yes	

General Data

Sampling rate	10s	
Current supply	2x 1.5V AAA Alkali battery (included in the scope of supply)	
Battery life time	typ. 5 years	
Display	°C or °F (selectable by jumper)	
CE compatibility according	EN61326-1	CE
	EN61326-2-3	
Temperature ranges	Working temperature range:	-5...55°C (23...131°F)
	Storage temperature range:	-20...60°C (-4...140°F)
Dimensions	85 x 100 x 26 mm (3.3 x 3.9 x 1")	
Housing / protection class	PC, IP20	

1) Please refer to the working range of the HC103

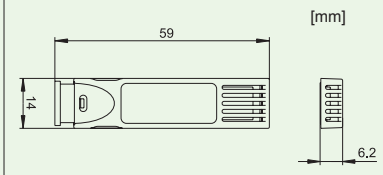
Ordering Guide

MODEL	
EE02 with E+E logo	**(EE02-FT01)**
EE02 without E+E logo	**(EE02-FT01-L01)**

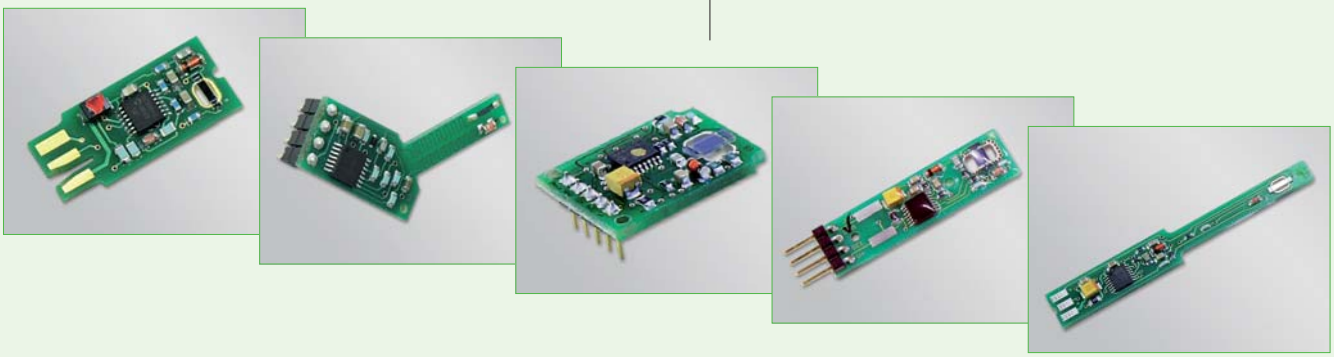
OEM Products

E+E Elektronik is your reliable partner for customised OEM products in sensor technology for measurement of humidity, dew point, air velocity, CO_2 and temperature. We develop and produce your customer-specific solutions - from simple sensor elements to complete transmitters.
You can save time if you come to us with your requirements. Our team of experts can fall back on a host of existing solutions and therefore developement time can be kept to a minimum.
Our knowhow in product design and calibration helps you to avoid expensive investments and brings your product to the market faster. Our longtime experience as an automotive supplier guarantees the best product quality and reliability.

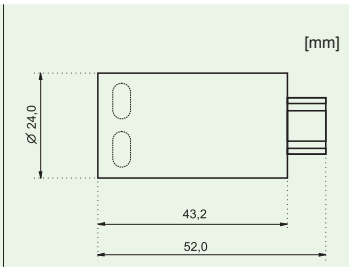
EE03 Series



Measuring range:	0...100% RH / -40...85°C (-40...185°F)
Accuracy at 20°C (70°F):	±3% RH (10...100% RH) / ±0.3°C (±0.54°F)
Output:	digital (2-wires)
Supply:	2.5...5.5V DC

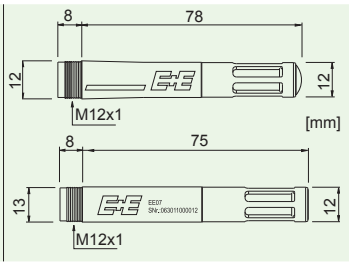


EE04 Series



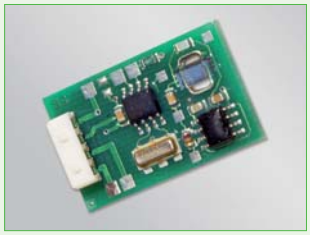
Measuring range:	0...100% RH / -40...85°C (-40...185°F)
Accuracy at 20°C (70°F):	±3% RH (40...60% RH) / ±0.3°C (±0.54°F)
Humidity output:	linear analogue output: 0...100% RH △ $0.1xU_V$...$0.9x\ U_V$
Temperature output:	voltage divider: NTC with pull down resistor
Supply:	5.5V DC ±10%

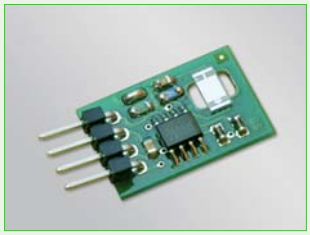
EE07 Series

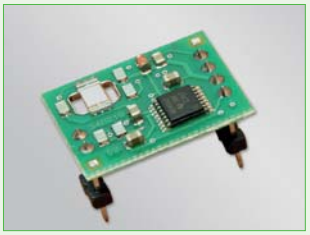


Measuring range:	0...100% RH / -40...80°C (-40...176°F)
Accuracy at 20°C (70°F):	±2% RH (0...90% RH) / ±0.3°C (±0.54°F)
Output:	digital (2-wires)
Supply:	3.8...5.5V DC
Housing:	polycarbonate or stainless steel

Example pictures of customised products







EE99-1 Series

OEM - Humidity / Temperature Modules

The EE99-1 OEM - RH/T modules are designed to meet the specific requirements of RH/T monitoring in climate chambers.
High-end E+E humidity sensor elements of the HC series and accurate temperature compensation of the humidity reading result in an excellent accuracy over a broad measurement range.
The analogue output for relative humidity is 4 - 20mA / 3-wire. The passive temperature output can be connected via 3-wire to an external readout.
Easy mounting and service is possible with a plug-in screw terminals block and by push buttons for field calibration.


EE99-1

Sensor Coating

Operation in heavily polluted and/or corrosive environments is typical for many industrial processes and can lead to drift or damage of the humidity sensor and therefore to incorrect measurements. The unique protective coating developed by E+E for the sensing probe (ordering code: - HC01) means a significant improvement of the long-term stability of the transmitter in very dirty and aggressive environments.

Typical Applications

climate chambers
drying chambers

Features

remote sensing probe up to 10m (32.8ft)
accuracy ±2% RH
traceable calibration
working range humidity 0...100% RH
working range temperature -50...180°C (-58...356°F) / up to 200°C (392°F) short term
passive 3-wire temperature output
easy field calibration

Technical Data

Measured quantities

Relative humidity

Humidity sensor[1]	HC1000-400	
Working range	0…100% RH	
Accuracy incl. hysteresis and nonlinearity with		
- special calibration against certified standards	±1% (0…90% RH)	±2% (90…100% RH)
- standard calibration	±2% (0…90% RH)	±3% (90…100% RH)
	Traceable to intern. standards, administrated by NIST, PTB, BEV...	
Output signal	4 - 20mA (3-wire)	
Response time with filter at 20°C (68°F) / t_{90}	< 15 sec.	

Temperature

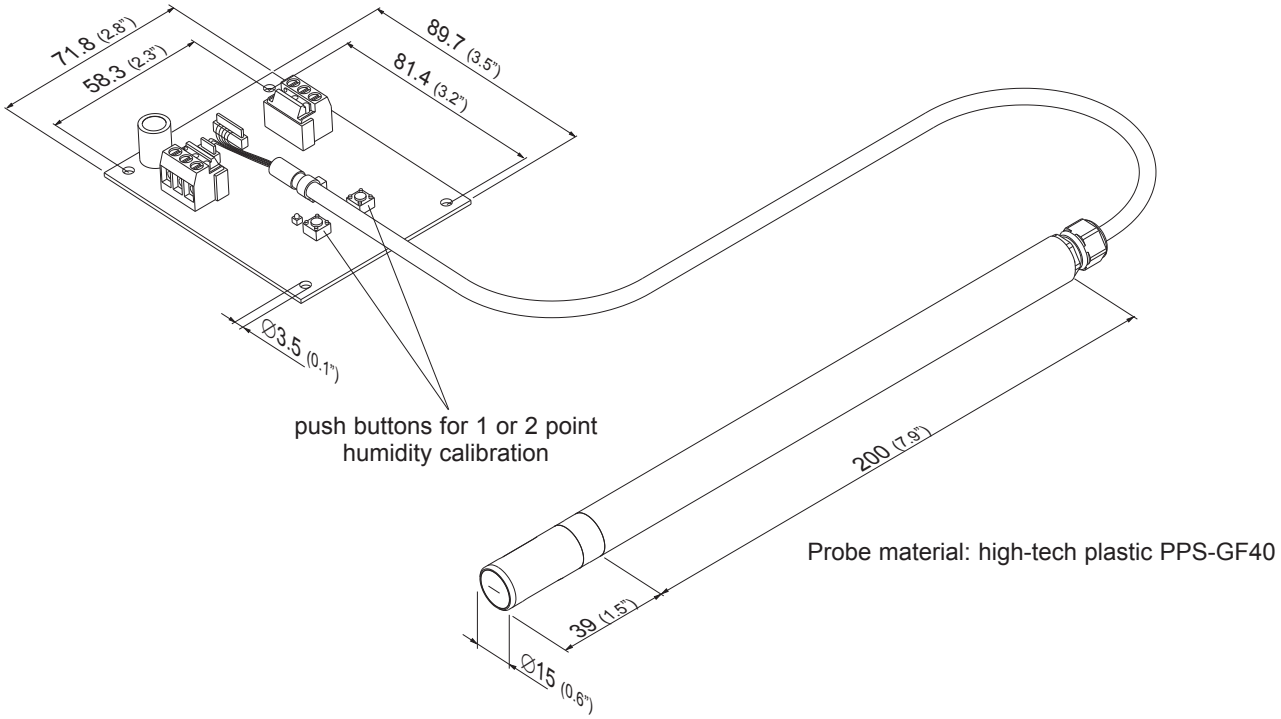
Temperature sensor element[2]	Pt100 resp. Pt1000 (class A, DIN EN 60751) see Ordering Guide	
Working range	-50...180°C (-58...356°F) / up to 200°C (392°F) short term	

General Data

Supply voltage	10 - 35V DC or 10 - 28V AC	
Load resistor for 4 - 20 mA output	10 - 35V DC	$R_L < \frac{U_V - 5V}{0.02\ A}$ [Ω] (max. 350 Ω)
	10 - 28V AC	R_L < 350 Ω
Current consumption	for DC supply < 32mA	for AC supply < 60mA$_{eff}$
Working temperature range electronics	-40…60°C (-40...140°F)	
Storage temperature range	-40…60°C (-40...140°F)	
Electrical connection	pluggable screw terminals up to max. 1.5mm² (AWG 16)	
Sensor protection	stainless steel grid filter	
Electromagnetic compatibility	Designed for installment in and with other equipment (OEM)	
	Measurements according to EN61000-4-3 and EN61000-4-6	
	FCC Part15 ClassB	ICES-003 ClassB

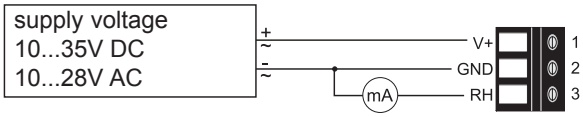
1) Refer to the working range of the humidity sensor
2) max. power dissipation 1mW

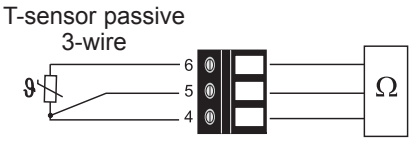
Mounting Dimensions (mm)



Probe material: high-tech plastic PPS-GF40

Connection Diagram





Ordering Guide

MODEL	OUTPUT	T-SENSOR	VERSION	FILTER	CABLE LENGTH
Humidity + Temperature passive (FP)	4 - 20 mA (6)	Pt100 DIN A (A) Pt1000 DIN A (C)	remote sensing probe (D)	stainless steel grid filter (8)	2m (6.6ft) (02) 5m (16.4ft) (05) 10m (32.8ft) (10)
EE99-1-					

PROBE LENGTH	SENSOR COATING
200mm (7.9") (5)	without coating (--) with coating (HC01)

Order Example

EE99-1-FP6AD8025

Model:	Humidity + Temperature passive
Output:	4 - 20mA
T-Sensor:	Pt100 DIN A
Version:	remote sensing probe
Filter:	stainless steel grid filter
Cable length:	2m (6.6ft)
Probe length:	200mm (7.9")
Coating sensor:	without coating

Accessories

Metal grid filter **(HA010108)**

HUMIMAP 20 Series

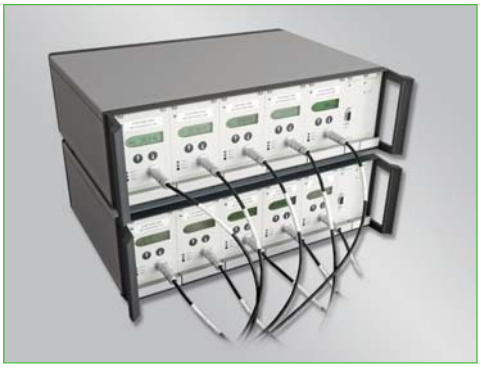
Multi-channel measuring system for measurement of relative humidity, temperature, dew point, absolute humidity…

Accurate monitoring of the humidity and temperature profile in a climatic chamber is increasingly important for quality assurance systems becoming more and more stringent. The multi-channel measuring system HUMIMAP 20 is an optimal solution to comply with these requirements.

The modular design of the system can easily be customized and warrants a cost effective solution to monitor the humidity and temperature profile and the occurring changes over time.

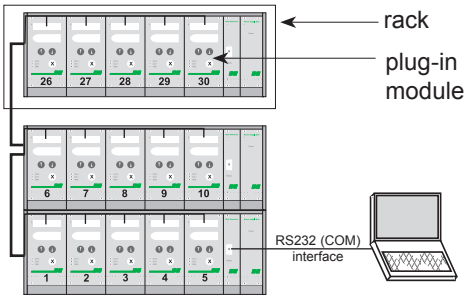
In addition to the relative humidity and temperature the HUMIMAP 20 can calculate and output related psychometric values, like dew point temperature, mixing ratio, absolute humidity etc.

The measured values are available on the serial RS232 interface and on the freely configurable and scaleable analogue output on the front and back side of the HUMIMAP 20.



Modular design

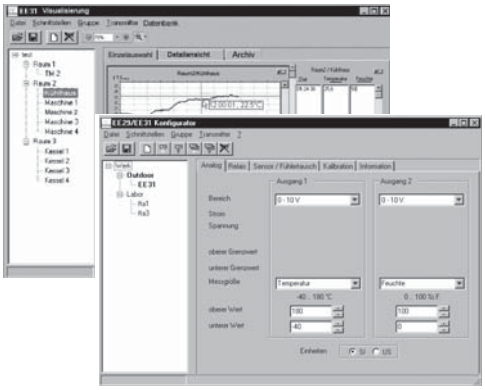
HUMIMAP 20 consists of single plug-in modules, which can be grouped together (max. 5 modules) in a 19” rack.
The modules are networked, even with modules in several other racks, to allow building a system for processing up to max. 32 measurement channels.



Software

Configuration software:
The user friendly configuration software is included in the scope of supply. It allows easy setup and customizing of the measurement system, such as the number of channels, assignment and scaling of analogue outputs, calibration, etc.

Data logging and analysis software:
Measurement data can be saved and processed by using the data logging und visualisation software.
Data can be displayed in graphs or tables, alarm levels set and alarm signals sent by email or SMS.



Functions HUMIMAP 20

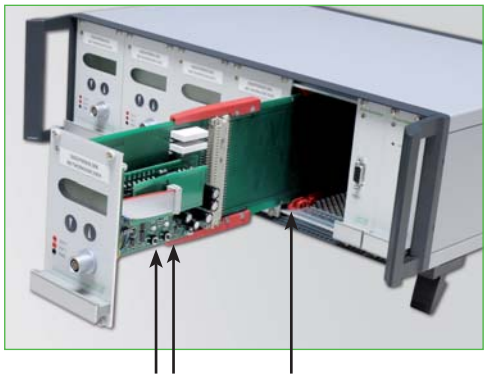
measurement of relative humidity and temperature
calculated values h, r, dv, Tw, Td, Tf, e
expandable up to 32 channels (also later on)
two freely scaleable and configurable analogue outputs per plug-in module
remote sensing probe up to 20m (66ft), interchangeable
on-site adjustement for relative humidity and temperature
LED indication of status
local displays, selectable measurand incl. MIN/MAX indication
configuration and data output via RS232 interface
configuration software
data logging and analysis software

Interchangeable sensing probe

The HUMIMAP 20 sensing probes have a maximum cable length of 20m (66ft) and a quick connector.
The configuration software allows easy probe replacement without the need of recalibration.
A metal grid filter, specially designed for high humidity (even condensation) and high temperature, protects the sensor elements against mechanical stress and pollution.

Calibration and adjustment of plug-in modules

An adapter PCB allows easy calibration of an entire measurement loop (sensing probe, plug-in module, rack, data logging and analysis software) without interruption.
Using push buttons on the plug-in module the user can easily perform an one or two point adjustment of humidity and temperature. The adjustment can be done by using the standard configuration software.



Scope of Supply

- 19" housing with plug-in module, power supply and RS485 to RS232 converter
- manual
- power cable
- RS232 cable
- RS485 uplink cable
- RS485 Y-splitter
- replacement fuse
- CD with configurator software
- CD with logger- and visualisation software
- CD with datasheet, manual and demo
- adapter PCB
- 19" plug-in module(s) according to order code
- calibration certificate
- 2mm plugs for analogue outputs on front side
- M12 connector for analogue outputs on back side

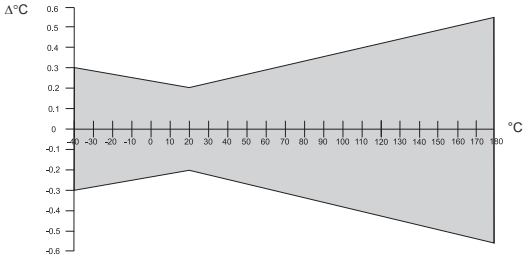
Technical Data

Measuring values

Relative humidity

Humidity sensor[1)]		HC1000-400
Working range[1)]		0...100% RH
Accuracy *) (including hysteresis, non-linearity and repeatability, traceable to intern. standards, administrated by NIST, PTB, BEV...)		
-15...40°C (5...104°F)	≤90% RH	± (1.3 + 0.3%*mv) % RH
-15...40°C (5...104°F)	>90% RH	± 2.3% RH
-25...70°C (-13...158°F)		± (1.4 + 1%*mv) % RH
-40...180°C (-40...356°F)		± (1.5 + 1.5%*mv) % RH
Temperature dependence of electronics		typ. ± 0.01% RH/°C
Temperature dependence of sensing probe		typ. ± (0.002 + 0.0002 x RH[%]) x ΔT [°C] ΔT = T - 20°C
Response time with metal grid filter 20°C (68°F) / t_{90}		< 15s

Temperature

Temperature sensor element	Pt1000 (Tolerance class A, DIN EN 60751)
Working range sensing head	-40...180°C (-40...356°F)
Accuracy	
Temperature dependence of electronics	typ. ± 0.005°C/°C

Outputs

Digital output	RS232	
Two freely selectable and scaleable analogue outputs [2)]	0 - 5V / 0 - 10V	-1mA < I_L < 1mA
	4 - 20mA / 0 - 20mA	R_L < 500 Ohm

Max. adjustable measurment range[2)3)]

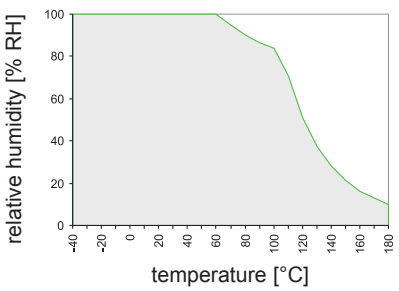
		from	up to	units
Humidity	RH	0	100	% RH
Temperature	T	-40 (-40)	180 (356)	°C (°F)
Dew point temperature	Td	-80 (-112)	100 (212)	°C (°F)
Frost point temperature	Tf	-80 (-112)	0 (32)	°C (°F)
Wet bulb temperature	Tw	0 (32)	100 (212)	°C (°F)
Water vapour partial pressure	e	0 (0)	1100 (15)	mbar (psi)
Mixture ratio	r	0 (0)	999 (9999)	g/kg (gr/lb)
Absolute humidity	dv	0 (0)	700 (300)	g/m³ (gr/f³)
Specific enthalpy	h	0 (0)	2800 (999999)	kJ/kg (lbf/lb)

General

Supply voltage	90...250V AC (50/60 Hz)	
System requirements for software	WINDOWS 2000 or later; serial interface	
Sensor protection	metal grid filter up to 180°C (356°F)	
Operating temperature range of electronics	-20...+50°C (-4...122°F)	
Storage temperature range	-40...+60°C (-40...140°F)	
Electromagnetic compatibility according to	EN61000-6-2	EN61000-6-4
	EN61010-1	
Display	graphical LC display (128x32 pixels), with integrated push-buttons for selecting parameters and MIN/MAX function	
Dimensions	463 x 150 x 362mm (18.2 x 6 x 14.3") (w x h x d)	

1) Refer to working range of the humidity sensor! 2) Can be easily changed by software. 3) Refer to accuracies of calculated values.

Working range humidity sensor



The grey area shows the allowed measurement range for the humidity sensor.

Operating points outside of this range do not lead to destruction of the element, but the specified measurement accuracy cannot be guaranteed.

Ordering Guide

						HUMIMAP20-
Hardware Configuration						
Number of plug-in modules	1 piece					01
	2 pieces					02
	3 pieces					03
	4 pieces					04
	5 pieces					05
Cable length	2m (7ft)					02
	5m (16ft)					05
	10m (33ft)					10
	20m (66ft)					20
Probe length	65mm (2.5")					2
Coating sensor	no					
	yes					HC01
Software Configuration						
Physical parameters of outputs	Relative Humidity	RH	[%]	(A)	output 1	Select according to ordering guide (A - H,J)
	Temperature	T	[°C]	(B)		
	Dew point temperature	Td	[°C]	(C)	output 2	Select according to ordering guide (A - H,J)
	Frost point temperature	Tf	[°C]	(D)		
	Wet bulb temperature	Tw	[°C]	(E)		
	Water vapour patial pressure	e	[mbar]	(F)		
	Mixture ratio	r	[g/kg]	(G)		
	Absolute humidity	dv	[g/m³]	(H)		
	Specific enthalpy	h	[kJ/kg]	(J)		
Type of output signal	0-5V					2
	0-10V					3
	0-20mA					5
	4-20mA					6
Measured value units	metric / SI					
	non metric / US					E01
Scaling of T-output	-40...60	(T02)	-20...100	(T14)		
Scaling of Td-output	-10...50	(T03)	+20...120	(T15)	output T	Select according to ordering guide (Txx)
in °C or °F	0...50	(T04)	0...120	(T16)		
	0...100	(T05)	0...80	(T21)		
	0...60	(T07)	-40...80	(T22)	output Td	Select according to ordering guide (Tdxx)
	-30...70	(T08)	-20...80	(T24)		
	-30...120	(T09)	-40...160	(T33)		Other T and Td-scaling refer to page 146
	-20...120	(T10)	+20...180	(T40)		
	-40...120	(T12)	-40...180	(T52)		

Order Example

HUMIMAP20-02052HC01/AB6-T07

Number of plug-in modules:	2 pieces	Output 1:	relative humidity
Cable length:	5m	Output 2:	temperature
Probe length:	65mm	Type of output signal:	4-20mA
Coating sensor:	yes	Measured value units:	metric / SI
		Scaling of T-output:	0...60°C

Accessories / Replacement Parts

(For further information, see data sheet "Accessories")

- replacement probe (Pxx)
- OEKD-certificate

HUMLOG 10

Humidity / Temperature Data Logger

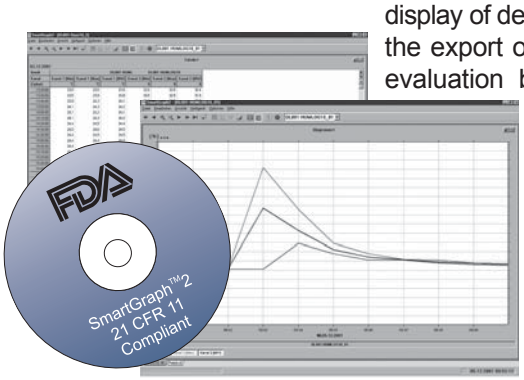
HUMLOG 10 series humidity/temperature data loggers permit the exact and professional recording of humidity and temperature values. Low power consumption and large memory size enable long-term data capture for a wide range of applications. The HUMLOG 10 can be configured very easily by means of the included software. Alarm thresholds for humidity and temperature, as well as the start time for recording, can be freely set by the user.

The 3 available HUMLOG 10 models allow optimum adaptation to any requirements.

HUMLOG 10 / HUMLOG 10TSE
The elegant 2-part housing, which consists of a display module and a plug-in sensor module, enables easy installation and a fast exchange of the sensor unit when service is required.
The current measurement data on the large display is easy to read even from a distance of several metres. Relative humidity (% RH) and temperature (°C or °F) are constantly displayed. Clock time (format hh:mm) and date (format dd.mm) are displayed in an alternating sequence. Likewise, the display also indicates alarm conditions, recording, record stop, and programmed record start.
In the basic version of the HUMLOG 10, the sensors are integrated in the sensor module. The HUMLOG 10TSE version is equipped for the connection of sensing probes. According to requirements, the two channels can be selectively connected to a combination H/T sensing probe or to 2 T sensing probes. The sensing probes can be separated; maximum distance: 8 m. The optional Professional Version of the Smartgraph™2 software enables the control of 2 combined H/T sensing probes.

HUMLOG 10THC
The compact HUMLOG 10THC version does not have a display and is equipped with internal H/T sensors.

Measurement Data - Evaluation & Configuration
Measurement data evaluation, instrument configuration and 1 point humidity and temperature calibration can be conveniently performed via the serial RS232 interface with a PC or notebook computer by means of the Smartgraph™2 software, which runs under MS Windows™.
Smartgraph™2 can display the recorded measurement data in graphical form or as a table. The layout of the display can be individually configured by the user.
The optional Professional Version of Smartgraph™2 also permits the display of dewpoint and absolute humidity, the export of measured values (e.g., for evaluation by means of MS Excel™), and the control of 2 combined H/T sensing probes.



Utilizing the SmartGraph™2 “21 CFR 11” software allows the use in applications in the pharmaceutical and food industries.

HUMLOG 10

HUMLOG 10TSE with RH/T probe

HUMLOG 10TSE with 2 T probes

HUMLOG 10THC

Typical Applications

museums and exhibition spaces
clean rooms
green houses
warehouses

Features

data memory for 120,000 values
large format display
easy installation and service
user friendly data evaluation via PC-software

Technical Data

	HUMLOG 10TSE		HUMLOG 10 / HUMLOG 10THC
Sensing probe			
Model	external RH/T or T		internal RH/T
Dimensions	RH/T-probe: length 80mm (3.1"), Ø14mm (Ø0.6") T-probe: length 50mm (1.9"), Ø6mm (Ø0.2")		
Max. cable length	8m (26.2ft)		
Measuring data	**RH/T probe external**		**RH/T probe internal**
Relative humidity			
Sensor type	capacitive - HC1000		capacitive - HC103
Measuring range	0...100% RH (non condensing)		10...95% RH
Accuracy	±2% RH + 1 digit		±2% RH + 1 digit
Resolution	0.5% RH		0.5% RH
Temperature			
Sensor type	NTC		NTC
Measuring range	-30...70°C (-22...158°F)		-20...50°C (-4...122°F)
Accuracy	±0.2°C (0.36°F) at -20...50°C (-4...122°F) ±0.5°C (0.9°F) at -30...70°C (-22...158°F)		±0.3°C (0.54°F) at 0...40°C (32...104°F) ±0.5°C (0.9°F) at -20...50°C (-4...122°F)
Resolution	0.1°C (0.18°F)		0.1°C (0.18°F)
Temperature	**T probe external**		
Sensor type	NTC		
Measuring range	-40...100°C (-40...212°F)		
Accuracy	±0.2°C (-20...50°C) / ±0.36°F (-4...122°F) ±0.4°C (-40...70°C) / ±0.72°F (-40...158°F) ±1.0°C (>70°C) / ±1.8°F (>158°F)		
Resolution	0.1°C (0.18°F)		
General			
Supply voltage	3.6V lithium battery		
Battery lifetime	typical 2 years (with a sample rate of 1min)		
Internal memory size	60,000 measured values/channel (total 120,000 values)		
Sampling interval	1/10/30sec, 1/10/30min, 1/3/6/12/24h		
Logging interval	1/10/30min, 1/3/6/12/24h		
Serial Interface	RS232; USB		
Working temperature range	housing:	-20...50°C (-4...122°F)	
CE compatibility according	EN50081-2 EN61000-4-2	EN50082-2 EN61000-4-3	EN55011
Housing / protection class	ABS / IP40		
Dimensions (WxHxD)	120x110x30mm (4.7x4.3x1.2")		resp. HUMLOG 10THC: 120x50x30mm (4.7x16.4x1.2")
Weight	250g (0.55 lbs)		resp. HUMLOG 10THC: 90g (0.2 lbs)
Display	LC display, 65x40mm (2.6x1.6")		(only HUMLOG 10 / HUMLOG 10TSE)

Scope of Supply

HUMLOG 10, RS232 interface cable, 3.6V lithium battery, operation manual
SmartGraph™2 PC-Windows™-Software for set-up and data presentation

Ordering Guide

MODEL		EXTERNAL PROBE (for HUMLOG 10TSE)		ACCESSORIES	
with internal sensors and display	(HUMLOG 10)	RH/T - probe with 2m (6.6ft) cable	(HA030201)	SmartGraph™2 Professional	(HA030301)
for external probes, with display	(HUMLOG 10TSE)	T - probe with 2m (6.6ft) cable	(HA030202)	SmartGraph™2 21 CFR 11	(HA030304)
with internal sensors, without display	(HUMLOG 10THC)	cable extension 2m (6.6ft)	(HA030203)	3.6V lithium battery	(HA030102)
				sensing module f. Humlog 10	(HA030103)
				sensing module f. Humlog 10TSE	(HA030105)
				theft-proof installation kit	(HA030104)

EE36 Series

Transmitters for Moisture Content in Oil

E+E Transmitter Series EE36 are specially designed for the measurement of water content in oil. They are certified in accordance with the regulations of the "Germanischen Lloyd (GL)" and therefore can be utilized in the maritime field as well. The Series EE36 is ideal for online monitoring of moisture in lubrication or insulation oil, which is very important for the long-term performance and adaptive maintenance of plant and machinery. For instance, moisture affects dramatically the insulation characteristics of electrical transformer oil and therefore continuous monitoring is extremely important.

Humidity measurement in oil
Similar to the humidity in the air, the water content in an oil can be described by the absolute value in ppm or by the relative value a_w:
- ppm (mass of water / mass of oil)
- a_w (actual water content as fraction of the water content in the saturated oil)

a_w = 0 corresponds to water-free oil, while a_w = 1 describes fully saturated oil. a_w measurement with EE36 transmitter series is based on the outstanding long term stability and resistance to pollution of the E+E capacitive sensor elements series HC.

Product Versions
The physical quantities measured are water activity a_w and temperature T. With these quantities EE36 calculates the water content (ppm) in mineral transformer oils. Calculation of water content in non-mineral transformer oils and lubrication oils can be accomplished by downloading specific parameters of the oil.
The measured and the calculated values are available on two free scaleable and configurable analogue outputs. In addition, an optional relay output can be used for alarms and process control.

Installation
The sensing probe is designed for inline monitoring and can be placed directly in the oil, at pressures up to 20bar (300psi). In addition to direct mounting of the sensing probe, a ball valve installation provides mounting and removal of the probe without interrupting the process.

Easy Calibration and Adjustment of EE36
The user can easily readjust or calibrate the transmitter by using either a simple procedure with two push buttons on the printed circuit board or the configuration software.

Software Tools

The configuration software is included in the scope of supply and allows an easy and fast configuration of the analogue outputs and of the alarm and control thresholds. Further features of the configuration software are adjustment and calibration of the outputs and service operations such as replacement of the sensing elements or of the entire sensing probe.

Features of EE36

Measurement of a_w and T at pressure up to 20bar (300psi)	✓
Calculation of water content in ppm for mineral transformer oil	✓
Two free scaleable and configurable analogue outputs	✓
Probe cable length up to 20m (66ft)	✓
Easy on site adjustment and calibration of a_w and T outputs	✓
LED indication for operation and sensing probe status	✓
User configuration of the instrument with PC via RS232 interface	✓
Configuration software	✓
Display of a_w, T and water content with MIN/MAX function	optional
Two free configurable relays outputs	optional
Replaceable sensing probe	optional
Connector for power supply and outputs	optional

Integrated power supply

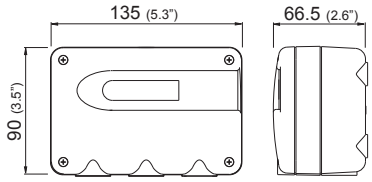
A power supply, integrated in the back module of the housing, can be ordered optionally (100...240V AC, 50/60Hz; ordering code V01). The power supply V01 is available for both polycarbonate and metal housing and comes standard with two plugs for supply and outputs to allow an easy connection.

Housing Dimensions (mm)

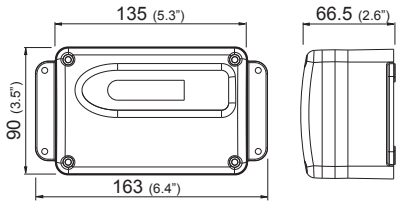
Installation Example

Housing:

polycarbonate housing

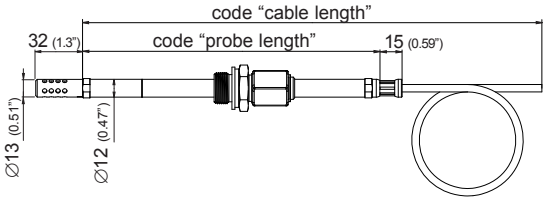


metal housing



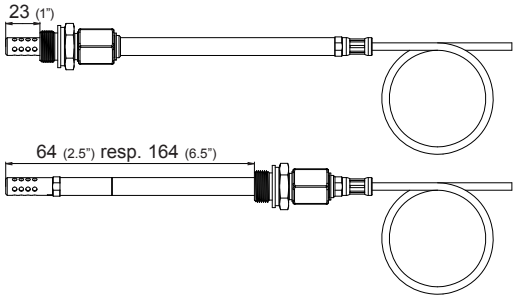
For use in harsh industrial environments the EE36 series is available in a robust metal housing.

Model:



EE36-xEx

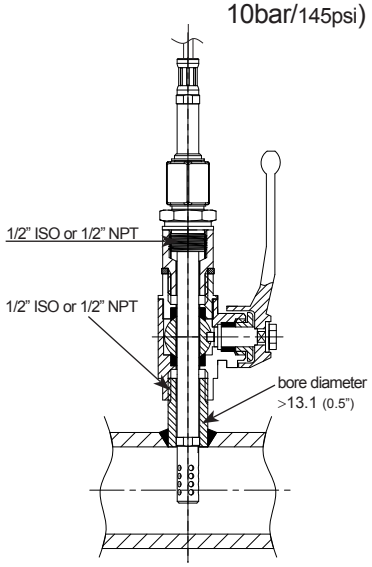
Remote probe for T -40...180°C (-40...356°F) and pressure-tight up to 20bar (300psi)
probe material: stainless steel



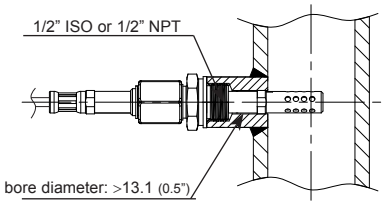
minimum installation depth

maximum installation depth

ball valve installation
(pressure-tight up to 10bar/145psi)

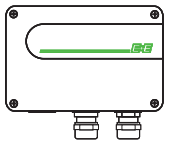


fixed installation
(pressure-tight up to 20bar/300psi)



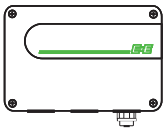
Connection Versions

Standard



2x M16x1.5

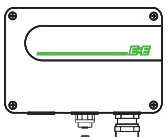
Plug Option C03



Lumberg RKC 5/7

power supply + analogue output

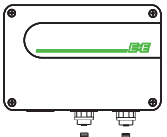
Plug Option C06



Lumberg RSC 5/7

M16x1.5

Plug Option C07



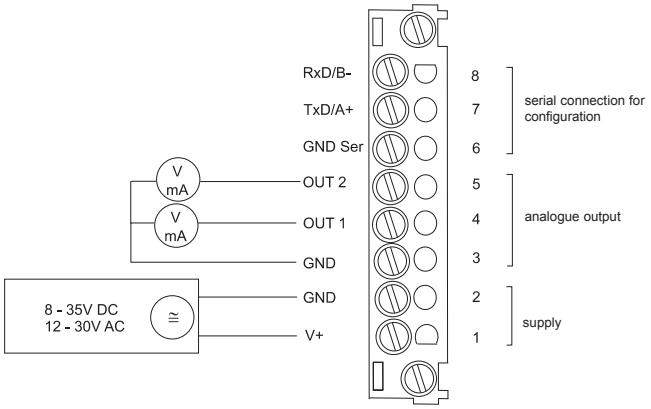
Lumberg RSC 5/7

Lumberg RKC 5/7

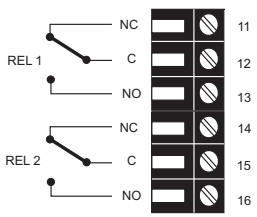
RS232

power supply + analogue output

Connection Diagram



Terminal configuration - Alarm output



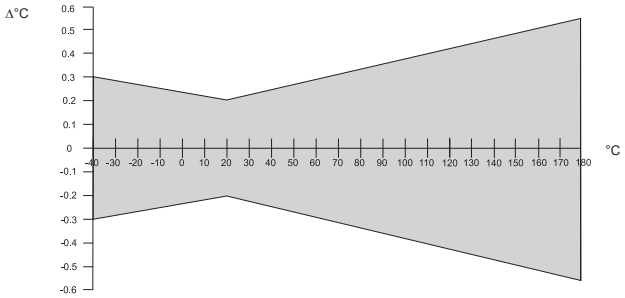
Technical Data

Measuring values

Water activity

Water activity sensor[1]		HC1000-400
Measuring range[1]		0...1 a_w
Accuracy[*] (including hysteresis, non-linearity and repeatability, traceable to intern. standards, administrated by NIST, PTB, BEV...)		
-15...40°C (5...104°F)	≤0.9 a_w	± (0.013 + 0.3%*mv) a_w
-15...40°C (5...104°F)	>0.9 a_w	± 0.023 a_w
-25...70°C (-13...158°F)		± (0.014 + 1%*mv) a_w
-40...180°C (-40...356°F)		± (0.015 + 1.5%*mv) a_w
Temperature dependence of electronics		typ. ± 0.0001 [1/°C] (typ. ± 5.6 * 10^{-5} [1/°F])
Temperature dependence of sensing probe		typ. ± (0.00002 + 0.0002 x a_w) x ΔT [°C] ΔT = T - 20°C
Response time with stainless steel filter at 20°C / t_{90}		typ. 10min in still oil

Temperature

Temperatur sensor element	Pt1000 (tolerance class A, DIN EN 60751)
Working range sensing probe	-40...180°C (-40...356°F)
Accuracy	

Temperature dependence of electronics	typ. ± 0.005°C/°C

Outputs[2]

Two freely selectable and scaleable analogue outputs	0 - 5V	-1mA < I_L < 1mA
	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm
	0 - 20mA	R_L < 500 Ohm

Adjustable measurement range[2]

		from	up to	units
Water activity	a_w	0	1	
Temperature	T	-40 (-40)	180 (356)	°C (°F)
Water content[3]	x	0	5000	ppm

General

Supply voltage		8...35V DC 12...30V AC (optional 100...240V AC, 50/60Hz)
Current consumption	- 2x voltage output	for 24V DC/AC: typ. 40mA
	- 2x current output	typ. 80mA
Pressure range sensing pobe		0.01...20bar (0.15...300psi)
System requirements for software		WINDOWS 2000 or later; serial interface
Serial interface for configuration[4]		RS232C
Housing / Protection class		PC or Al Si 9 Cu 3 / IP65; Nema 4
Cable gland		M16 x 1.5 cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection		screw terminals up to max. 1.5mm² (AWG 16)
Sensor protection		stainless steel filter
Operating temperature range of electronics		-40...60°C (-40...140°F)
Working and storage temperature range		
Housing with display		-20...50°C (-4...122°F)
Storage temperature		-40...60°C (-40...140°F)
Electromagnetic compatibility according to		EN61326-1 EN61326-2-3 ICES-003 ClassB Industrial Environment FCC Part15 ClassB
GL-Certification[5]		Environmental Category D

Options

Display	graphical LCD (128x32 pixels), with integrated push-buttons for selecting parameters and MIN/MAX function
Alarm outputs	2 x 1 switch contact: 250V AC / 6A and 28V DC / 6A threshold + hysteresis can be adjusted with configuration software
Switching parameters (freely selectable)	a_w Water activity T Temperature x Water content

1) refer to the working range of the humidity sensor. 2) can be easily changed by software 3) ppm output is valid in the range 0...100°C (32...212°F)
4) no data output 5) not for polycarbonate housing or integrated power supply (V01)

*) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation). The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).

Ordering Guide

		EE36-
Hardware Configuration		
Housing	metal housing	M
	polycarbonate housing[1]	P
Type	pressure tight	E
Cable length (incl. probe length)	1m (3.3ft)	01
	2m (6.6ft)	02
	5m (16.4ft)	05
	10m (32.8ft)	10
	20m (65.6ft)	20
Probe length	100mm (3.9")	3
	200mm (7.9")	5
Pressure-tight feedthrough	1/2" male thread	HA03
	1/2" NPT thread	HA07
Display	without display	
	with display	D05
Alarm output[2]	without relay	
	with relay	SW
Plug	cable thread	
	1 plug for power supply and output	C03
	1 cable thread / 1 plug for RS232	C06
	2 plugs for power supply/outputs and RS232	C07
Sensing probe	fixed	
	interchangeable	P01
Supply voltage	8...35V DC / 12...30V AC	
	integrated power supply 100...240V AC, 50/60Hz [1) 3)]	V01

Software Configuration						
Physical parameters of outputs	Temperature	T	[°C / °F]	(B)	Output 1	select according to Ordering Guide (B,K,L,M)
	Water activity	aw	[ ]	(K)		
	Water content in mineral transformer oil	x	[ppm]	(L)	Output 2	select according to Ordering Guide (B,K,L,M)
	Water content in lubrication or non-mineral transformer oil[4]	x	[ppm]	(M)		
Type of output signals	0-5V			(2)		select according to Ordering Guide (2,3,5,6)
	0-10V			(3)		
	0-20mA			(5)		
	4-20mA			(6)		
Temperature unit	°C					
	°F					E01

Scaling of T-output in°C or °F	-40...60	(T02)	-20...100	(T14)	-40...140	(T83)	Output T	select according to Ordering Guide (Txx)
	0...50	(T04)	0...120	(T16)	0...250	(T88)		
	0...100	(T05)	0...80	(T21)	32...120	(T90)		other T-scaling refer to page 146
	-30...70	(T08)	-20...80	(T24)	32...140	(T91)		
	-20...120	(T10)	-40...160	(T33)	32...250	(T94)		
	-40...120	(T12)	-40...250	(T81)	32...132	(T96)		
ppm Range x	0...100ppm	(X01)					Output x	select according to Ordering Guide (X01 - X03)
	0...500ppm	(X02)						
	0...1000ppm	(X03)						

1) No GL-Certification
2) Combination alarm output and plugs is not possible (with cable glands only) / combination alarm output and integrated power supply is not possible
3) Integrated power supply includes 2 plugs for power supply and outputs / further plug options are not possible
4) Input of oil specific parameters necessary

Accessories / Replacement Parts

(For further information see data sheet "Accessories", page 138)

- Stainless steel filter for EE36 (HA010110)
- Display + housing cover in metal (D05M)
- Display + housing cover in polycarbonate (D05P)
- Replacement probe (PExxxx)
- Humidity sensor (FE10)
- Bracket for installation onto mounting rails (HA010203)
- Sealing element (HA050308)
- Calibration set (HA0104xx)
- Interface cable for PCB (HA010304)
- Interface cable for plug C06, C07 (HA010311)
- Ball valve set 1/2" ISO (HA050101)
- Ball valve set 1/2" NPT (HA050104)
- Double nibble G1/2" to G3/4" (HA011107)
- Enlargement G1/2" to G3/4" (HA011106)

Order Example

EE36-PE055HA03D05P01/BL3-T08-X01

Housing:	polycarbonate housing
Type:	pressure tight
Cable length:	5m (16.4ft)
Probe length:	200mm (7.9")
Pressure-tight feedthrough:	1/2" male thread
Display:	with display
Alarm output:	without relay
Plug:	1 plug for power supply and output
Sensing probe:	interchangeable
Suppy voltage:	8...35V DC / 12...30V AC
Output 1:	T
Output 2:	x (mineral transformer oil)
Output Signal:	0-10V
Temperature unit:	°C
Scaling of T-output:	-30...70°C
Water content x:	0...100ppm

EE381 Series

Compact Transmitter / Switch for Moisture Content in Oil

E+E Transmitter Series EE381 are specially designed for the measurement of water content in oil. EE381 is ideal for online monitoring of moisture in lubrication or insulation oil, which is very important for the long-term performance and preventive maintenance of plant and machinery.
For instance, moisture affects dramatically the insulation characteristics of electrical transformer oil and therefore continuous monitoring is extremely important.


EE381

Humidity measurement in oil
Similar to the humidity in the air, the water content in oil can be indicated by the absolute value in ppm or by the relative value a_w:
- ppm (mass of water / mass of oil)
- a_w (actual water content as fraction of the water content in saturated oil)

a_w = 0 corresponds to water-free oil, while a_w = 1 indicates saturated oil. a_w measurement with the EE381 transmitter is based on the outstanding long term stability and resistance to pollution of the E+E capacitive sensor elements series HC.

The measured physical quantities are water activity a_w and temperature T. With these quantities EE381 calculates the water content x (ppm) in mineral transformer oils. Calculation of water content (ppm) in non-mineral oils and lubrication oils can be achieved by programming the specific parameters of the oil into the EE381.

Outputs

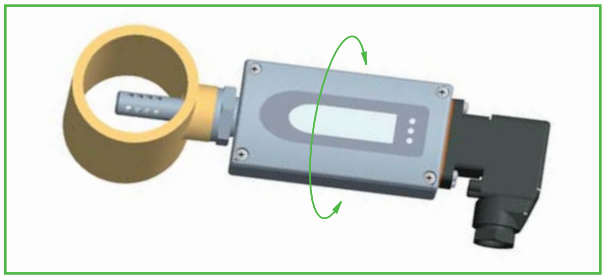
The EE381 transmitter has two freely selectable and scaleable outputs for water activity, water content or temperature.
The EE381 switch with two relay outputs is designed for control and alarm purposes. The status for early warning and main alarm is indicated by LED's.
Adjustment of the a_w/T/ppm set point and hysteresis can be achieved with the optional configuration software.

Configuration Software

The optional configuration software allows flexible and easy adjustment of the analogue resp. relay outputs to the respective requirements.
The adjustment / calibration of the transmitters can easily be performed.

Screw Connection for Mounting - 360° positionable

The construction of this screw connection enables any position / rotation of the mounted transmitter.
So an optimal position of the display resp. the cable outlet is guaranteed.



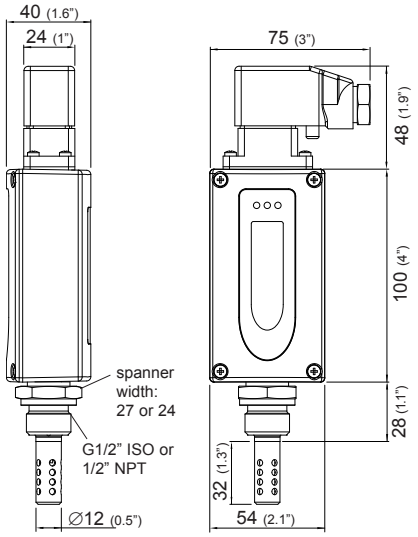
Typical Applications

monitoring of
- transformer oil
- hydraulic oil
- ship engines

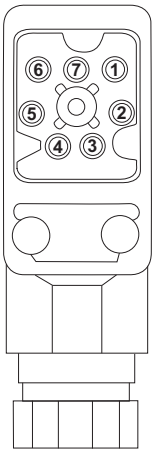
Features

measuring range 0...1 a_w
measurement of water content in ppm
medium temperature -40...80°C (-40...176°F)
two relay outputs for a_w/ppm/T

Dimensions in mm



Connection Diagram



analogue output

1	V+	10...30V DC
2	GND	
3	GND	
4	OUT1	V / mA
5	OUT2	V / mA
6	NC	
7	NC	

relay output

1	V+	10...30V DC
2	GND	
3	NC11	
4	NC12	
5	NC21	
6	NC22	
7	not connected	

Technical Data

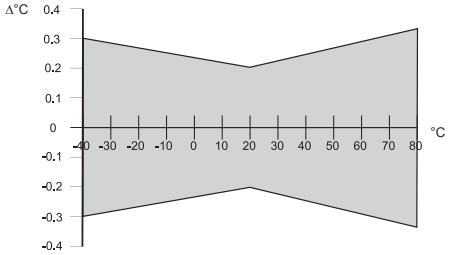
Measuring values

Water activity

Humidity sensor	HMC01
Measuring range	0...1a_w
Accuracy incl. hysteresis and nonlinearity in air	±0.02a_w (0...0.9a_w) ±0.03a_w (0.9...1a_w) Traceable to intern. standards, administrated by NIST, PTB, BEV...
Temperature dependence	a_w: ±(0.00022 + 0.0002 x a_w) x ΔT [°C] ΔT = T - 20°C T: ±(0.0003°C/°C)
Response time with stainless steel filter at 20°C / t_{90}	typ. 10min in still oil

Temperature

Temperatur sensor element	HMC01
Working range sensing probe	-40...80°C (-40...176°F)
Accuracy	



Outputs

EE381-Tx two freely selectable and scaleable analogue outputs for a_w, T, ppm	0 - 1V / 0 - 5V / 0 - 10V[1)]	-1mA < I_L < 1mA
	4 - 20mA / 0 - 20mA	R_L < 500 Ohm[1)]
EE381-Sx alarm output	2 potential-free relays (NC) 30V DC 0.6A / 35V AC 0.3A (resistive)	

General

Supply voltage	10...30V DC
Current consumption at 24V DC	voltage output: typ. 40mA / during autocalibration: 100mA current output: typ. 80mA / during autocalibration: 140mA
Pressure range	0...20bar (0...290psi) / 0...100bar (0...1450psi)
System requirements for software	WINDOWS 2000 or later; serial interface
Serial interface for configuration	RS232C
Housing / Protection class	Al Si 9 Cu 3 / IP65
Electrical connection	7-pole industrial plug: DIN VDE 0627 / IEC 61984 cable cross-section: 0.25 - 1 mm² / cable connection: PG 11
Sensor protection	stainless steel filter (punched)
Working temperature range	probe: -40...80°C (-40...176°F) electronic: -40...60°C (-40...140°F) with LC display: -20...50°C (-4...122°F)
Storage temperature range	-40...60°C (-40...140°F)
Electromagnetic compatibility according to	EN 61326-1 EN61326-2-3 ICES-003 ClassB Industrial Environment FCC Part15 ClassB

CE

1) minimum supply voltage 15V DC

Ordering Guide

							EE381-	EE381-
Hardware Configuration								
Model	transmitter						T	
	switch							S
Pressure range	up to 20bar (290psi)						E	E
	up to 100bar (1450psi)						I	I
Pressure tight feedthrough	G1/2" male thread						HA03	HA03
	1/2" NPT thread						HA07	HA07
Display	without display							
	with display						D08	D08
Software Configuration								
Physical parameters of outputs	Temperature		T	[°C / °F]	(B)	output/relay 1	select according to Ordering Guide (B,K,L,M)	
	Water activity		a_w	[ ]	(K)			
	Water content in mineral transformer oil		x	[ppm]	(L)	output/relay 2	select according to Ordering Guide (B,K,L,M)	
	Water content in lubrication or non-mineral transformer oil 1)		x	[ppm]	(M)			
Type of output signals (only for model T)	0-1V						1	
	0-5V						2	
	0-10V						3	
	0-20mA						5	
	4-20mA						6	
Temperature unit	°C							
	°F						E01	E01
Scaling of T-output (in °C or °F)	-40...60 (T02)	-20...100 (T14)	-40...140 (T83)			output/relay T	select according to Ordering Guide (Txx) other T-scaling refer to page 146	
	0...50 (T04)	0...120 (T16)	0...250 (T88)					
	0...100 (T05)	0...80 (T21)	32...120 (T90)					
	-30...70 (T08)	-20...80 (T24)	32...140 (T91)					
	-20...120 (T10)	-40...160 (T33)	32...250 (T94)					
	-40...120 (T12)	-40...250 (T81)	32...132 (T96)					
ppm Range x	0...100ppm (X01)						select according to Ordering Guide	
	0...500ppm (X02)	other measuring range: _____				output/relay x		
	0...1000ppm (X03)							
Setting of alarm output	standard							SP
	other set points:	relay 1: _____	relay 2: _____					
		hysteresis 1: _____	hysteresis 2: _____					

1) Input of oil specific parameters necessary

Accessories

- Stainless steel grid (HA010110)
- Display (D08)
- Configuration software + interface cable (HA010604)

Order Example

EE381-TEHA03D08/BL2-T05-X01

Model:	transmitter
Pressure range:	up to 20bar (290psi)
Pressure tight feedthrough:	G1/2" male thread
Display:	with display

Output 1:	T
Output 2:	x
Output signal:	0-5V
Temperature unit:	°C
Scaling of T-output:	0...100°C
ppm Range:	0...100ppm

EE381-SEHA03/KK

Model:	switch
Pressure range:	up to 20bar (290psi)
Pressure tight feedthrough:	G1/2" male thread
Display:	without display

Relay 1:	a_w
Relay 2:	a_w
Temperature unit:	°C
Setting of alarm output:	standard

EE35 Series

Industrial Transmitter for Dew Point Measurement

Exact dew point monitoring is increasingly playing a more important role in many industrial applications, such as drying processes, air pressure pipelines, etc. For these purposes the multifunctional EE35 Series offers the ideal features.

The EE35 Series is based on a functional, user-friendly housing concept and on the proven polymer humidity sensors of the HC Series.
A specially developed autocalibration process enables measurements in a measurement range of -60...60°C Td (-76...140°F Td), with a Td measurement accuracy of ±2°C (±3.6°F).
Two freely configurable and scaleable analogue outputs are available for the two measurement values (Td, T).
An optional hygrostat output, which can be set by means of a potentiometer, provides an alarm signal in a simple way when a threshold of the permitted dew point is exceeded.
An optional display for the measurement values and the associated MIN/MAX values allows a quick overview of the current situation.

Autocalibration

Dew points in the range of -60...-20°C (-76...-4°F) at room temperatures correspond to relative humidity values of 0.08...5.37% RH. The measurement of such low humidity values is not possible with conventional capacitive measurement methods. For the EE35 Series, a special autocalibration process is used to compensate for the usual drift effects and thus to achieve high accuracy measurements also at -60°C Td (-76°F Td).

Installation

In addition to the direct mounting of the dew point probe, a ball valve installation enables the mounting and removal of the probe without having to interrupt the running process.

Alarm Output

An optional alarm module with one relay output is available for control and alarm purposes. The setting of the Td threshold can be easily done with the potentiometer on the printed circuit board.

Integrated power supply

A power supply, integrated in the back module of the housing, can be ordered optionally (100...240V AC, 50/60Hz; ordering code V01). The power supply V01 is available for both polycarbonate and metal housing and comes standard with two plugs for supply and outputs to allow an easy connection.

Typical Applications

industrial processes
monitoring of air pressure pipelines
warehouses
drying processes
paper industries
chemical industries

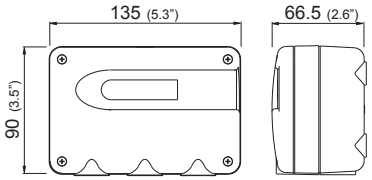
Features

measuring range -60...60°C Td (-76...140°F Td)
accuracy of measurement ±2°C Td (±3.6°F Td)
traceable calibration
alarm output for dew point
autocalibration

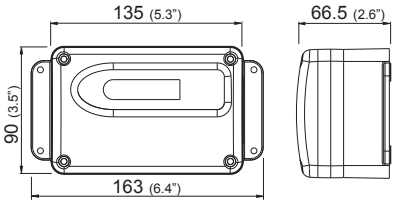
Housing Dimensions (mm)

Housing:

polycarbonate housing

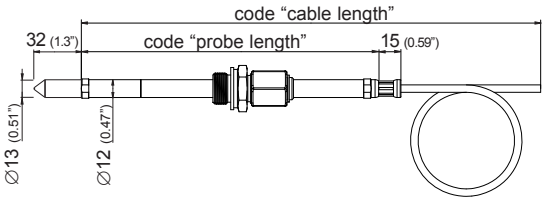


metal housing

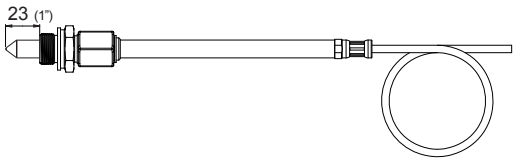


For use in harsh industrial environments the EE35 series is available in a robust metal housing.

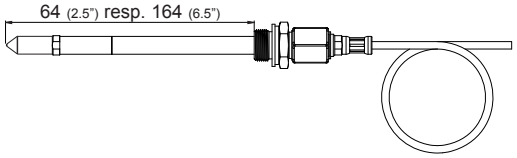
Model:



EE35-xEx
Remote probe for T up to 60°C (140°F) and pressure-tight up to 20bar (300psi)
Probe material: stainless steel



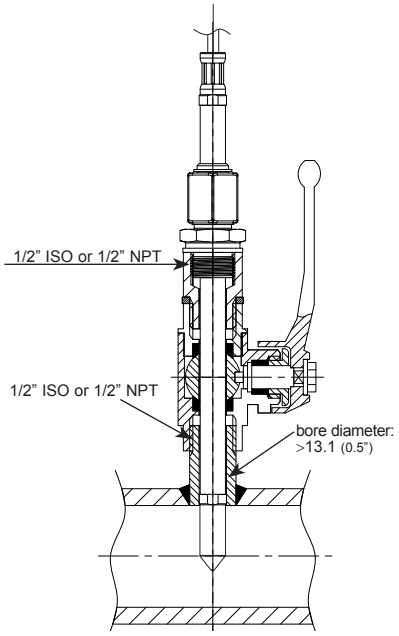
minimum installation depth



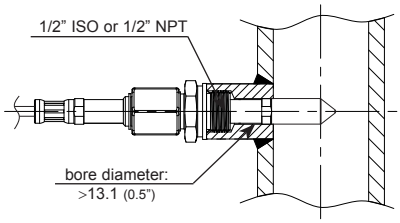
maximum installation depth

Installation Example

ball valve installation
(pressure-tight up to 10bar/145psi)

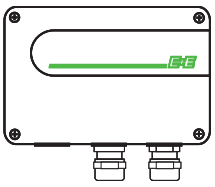


fixed installation
(pressure-tight up to 20bar/300psi)



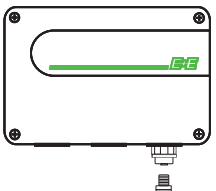
Connection Versions

Standard



2x M16x1.5

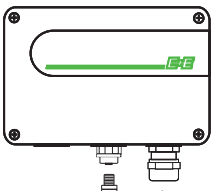
Plug Option C03



Lumberg RKC 5/7

Power supply + Analogue output

Plug Option C06



Lumberg RSC 5/7

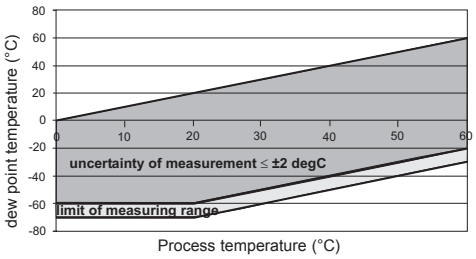
M16x1.5

Technical Data

Measuring Quantities

Dew point

Humidity sensor	HC1000-400
Measuring range	standard calibration: -40...60°C (-40...140°F)
(below 0°C / 32°F the transmitter outputs frostpoint)	special calibration: -60...60°C (-76...140°F)
Accuracy	≤ ±2°C (≤ ± 3.6°F)
Traceable to intern. standards, administrated by NIST, PTB, BEV...	



Response time t_{90}	80 sec. -20°C → -40°C (-4°F → -40°F)
	10 sec. -40°C → -20°C (-40°F → -4°F)

Temperature

Sensor	Pt1000 DIN A
Measuring range	0...60°C (32...140°F)
Accuracy of temperature measurement at 20°C (68°F)	±0.2°C (±0.36°F)
Sensitivity error at full scale	±0.1°C (±0.18°F)
Temperature dependence of electronics	< 0.005°C/°C

Outputs

Two freely selectable and scaleable analogue outputs xx...yy°C T, Td/Tf / xx...yy°C respectively	0 - 5V	-1mA < I_L < 1mA
	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm
	0 - 20mA	R_L < 500 Ohm

General

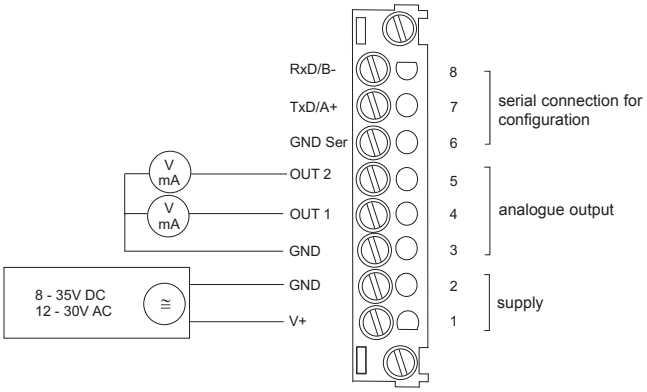
Supply voltage	8...35V DC	
	12...30V AC	(optional 100...240V AC, 50/60Hz)
Current consumption	- voltage output	typ. 40mA, with autocalibration: 100mA
	- current output	typ. 80mA, with autocalibration: 140mA
Pressure range	0...20bar (0...300psi)	
Housing / protection class	PC or Al Si 9 Cu 3 / IP65; Nema 4	
Cable gland	M16 x 1.5 (option: plug)	cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection	screw terminals up to max. 1.5mm² (AWG 16)	
Sensor protection	stainless steel sintered filter	
Working temperature range	probe:	-40...60°C (-40...140°F)
	electronic:	-40...60°C (-40...140°F)
	with LC display:	-20...50°C (-4...122°F)
	with alarm module:	-40...60°C (-40...140°F)
Storage temperature range	-40...60°C (-40...140°F)	
Electromagnetic compatibility according to	EN 61326-1 EN61326-2-3	ICES-003 ClassB
	Industrial Environment	FCC Part15 ClassB

CE

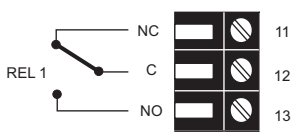
Technical Data for Options

Display	graphical LC display (128x32 pixels), with integrated push-buttons for selecting parameters Td or T and MIN/MAX functions
Alarm output for Td/Tf	- range: -60...40°C Td (-60...40°F Td) adjustable with the potentiometer on the printed circuit board - 1 switch contact - 250V AC/6A or 28V DC/6A

Connection Diagram



Terminal configuration - Alarm output



EE35

Ordering Guide EE35

						EE35-
Hardware Configuration						
Housing	metal housing					**M**
	polycarbonate housing					**P**
Type	pressure tight					**E**
Cable length	1m (3.3ft)					**01**
(incl. probe length)	2m (6.6ft)					**02**
	5m (16.4ft)					**05**
Probe length	100mm (3.9")					**3**
	200mm (7.9")					**5**
Pressure tight	1/2" male thread					**HA03**
feedthrough	1/2" NPT thread					**HA07**
Display	without display					
	with display					**D05**
Alarm output[1]	without relay					
	with relay					**SW**
Plug	cable glands					
	1 plug for power supply and outputs					**C03**
	1 cable thread / 1 plug for RS232					**C06**
Probe	fixed					
	pluggable					**P01**
Td Calibration	standard -40...60°C (-40...140°F)					
	special calibration -60...60°C (-76...140°F)					**CA02**
Supply voltage	8...35V DC / 12...30V AC					
	integrated power supply 100...240V AC, 50/60Hz[2]					**V01**
Software Configuration						
Physical parameters	temperature	T	[°C/°F]		output 1	**B**
of the outputs	dew point temperature	Td	[°C/°F]		output 2	**C**
	frost point temperature	Tf	[°C/°F]			**D**
Type of ouput signals	0-5V					**2**
	0-10V					**3**
	0-20mA					**5**
	4-20mA					**6**
T / Td / Tf Unit	°C					
	°F					**E01**
Scaling of T-output	-40...60 **(T02)**	-60...20 **(T65)**	-40...100 **(T79)**		output T	**Select accorcding to ordering guide (Txx)**
	-50...50 **(T27)**	-50...100 **(T66)**	-40...140 **(T83)**			
	-80...20 **(T63)**	-20...70 **(T73)**	-60...120 **(T97)**			**Other T-scaling refer to page 146**
	-60...60 **(T64)**	20...140 **(T77)**				
Scaling of Td/Tf-output	-40...60 **(T02)**	0...60 **(T07)**	-60...60 **(T64)**		output Td resp.Tf	**Select accorcding to ordering guide (Tdxx resp. Tfxx)**
	-10...50 **(T03)**	0...80 **(T21)**	32...120 **(T90)**			
	0...50 **(T04)**	-40...80 **(T22)**	32...140 **(T91)**			
	0...100 **(T05)**	-20...80 **(T24)**	32...132 **(T96)**			**Other Td/Tf-scaling refer to page 146**

1) Combination alarm output and plugs is not possible (with cable glands only) / combination alarm output and integrated power supply is not possible
2) Integrated power supply includes 2 plugs for power supply and outputs / further plug options are not possible

Accessories

- Ball valve set 1/2" ISO (HA050101)
- Ball valve set 1/2" NPT (HA050104)
- Display + housing cover in metal (D05M)
- Display + housing cover in polycarbonate (D05P)
- Stainless steel sintered filter (HA010103)
- Interface cable for PCB (HA010304)
- Interface cable for plug C06 (HA010311)
- Bracket for installation onto mounting rails (HA010203)
- Sealing element (HA050308)

Order Example

EE35-ME025HA03D05P01/BC5-T02-Td02

Housing:	metal housing
Type:	pressure tight
Cable length:	2m (6.6ft)
Probe length:	200mm (7.9")
Pressure tight feedthrough:	1/2" male thread
Display:	with display
Alarm output:	without relay
Plug:	cable glands
Sensing probe:	interchangeable
Td Calibration:	standard
Supply voltage:	8...35V DC / 12...30V AC
Output 1:	T
Output 2:	Td
Output signal:	0-20mA
Measured value unit:	metric
Scaling of T-output:	-40...60°C
Scaling of Td-output:	-40...60°C

EE371/EE372 Series

Compact Dew Point Temperature Transmitter / Switch

The exact monitoring of dew point temperature in compressed air systems, dryers for plastic and other industrial processes is becoming increasingly more important.
EE371 series with a measuring range -80...60°C Td (-112...140°F Td) and
EE372 series with a measuring range -40...60°C Td (-40...140°F Td) are the ideal solution for such applications.
The core of the transmitter is the monolithic measurement cell type HMC01, developed by E+E Elektronik in thin-film technology.
An autocalibration procedure which is integrated in the device and years of experience in low humidity adjustment make an accuracy of <2°C Td (±3.6°F Td) possible.
The compact construction in a robust aluminium housing and the numerous options allow easy mounting and many application possibilities.


EE37x

Autocalibration

Dew point temperatures in the range of -60...-20°C (-76...-4°F) at room temperature correspond to relative humidity values of 0.08...5.37% RH. The measurement of these low humidity values is not possible with conventional capacitive measurement methods. For the EE371/EE372 series a special autocalibration procedure is utilized to achieve high accuracy measurements at lowest dew points too.

Outputs

Model T: The transmitter has two freely selectable and scaleable outputs for dew point, frost point or ppm volume concentration.

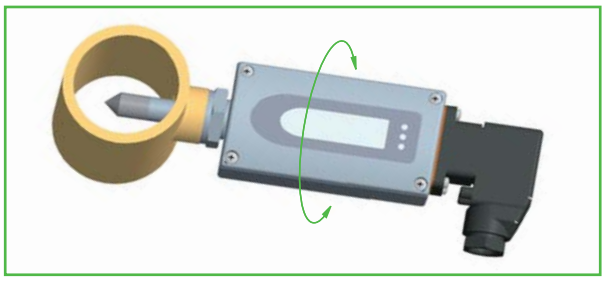
Model S: The switch with two relay outputs is designed for control and alarm purposes. The status for early warning and main alarm is indicated by LED's. Adjustment of the Td/Tf set point and hysteresis can be achieved with the optional configuration software.

Configuration Software

The optional configuration software allows flexible and easy adjustment of the analogue resp. relay outputs to the respective requirements.
The adjustment / calibration of the transmitters can easily be performed.

Screw Connection for Mounting - 360° positionable

The construction of this screw connection enables any position / rotation of the mounted transmitter.
So an optimal position of the display resp. the cable outlet is guaranteed.



Typical Applications

monitoring of compressed air systems
refrigerant type dryer
absorption dryer
plastics dryer

Features

measuring range -80...60°C Td (-112...140°F Td)
accuracy of measurement ±2°C Td (±3.6°F Td)
two Td/Tf alarm outputs
autocalibration
pressure tight up to 100 bar (1450psi)

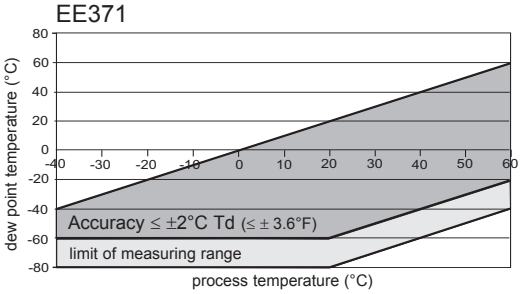
Technical Data

Measuring Quantities

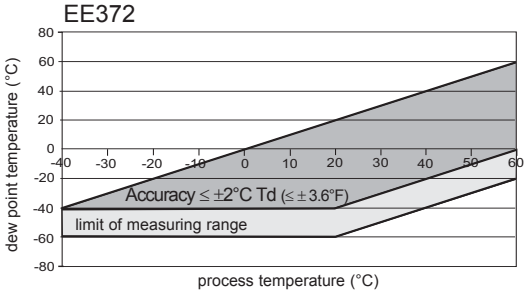
Dew point (Td)

Dew point sensor	HMC01
Measuring range EE371	-80...60°C Td (-112...140°F Td)
EE372	-40...60°C Td (-40...140°F Td)
Accuracy	Traceable to intern. standards, administrated by NIST, PTB, BEV...

EE371



EE372



Response time t_{90}	80 sec.	-20°C Td → -40°C Td	(-4°F Td → -40°F Td)
	10 sec.	-40°C Td → -20°C Td	(-40°F Td → -4°F Td)

Volume concentration

Measuring range EE371	20...200,000ppm
EE372	190...200,000ppm
Accuracy at 20°C (68°F) and 1013mbar	5ppm + 9% of reading

Outputs

EE37x-Tx two freely selectable and scaleable analogue outputs for Td, Tf, Wv	0 - 1V / 0 - 5V / 0 - 10V[1)]	-1mA < I_L < 1mA
	4 - 20mA / 0 - 20mA	R_L < 500 Ohm[1)]
EE37x-Sx Alarm output	2 potential-free relays (NC) 30V DC 0.6A / 35V AC 0.3A (resistive)	

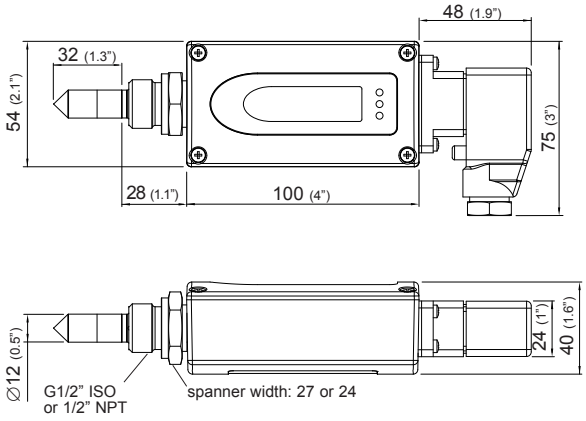
General

Supply voltage	10...30V DC
Current consumption at 24V DC	voltage output: typ. 40mA / during autocalibration: 100mA current output: typ. 80mA / during autocalibration: 140mA
Pressure range	0...20bar (0...290psi) / 0...100bar (0...1450psi)
System requirements for software	WINDOWS 2000 or later; serial interface
Serial interface for configuration	RS232C
Housing / protection class	Al Si 9 Cu 3 / IP65
Electrical connection	7-pole industrial plug: DIN VDE 0627 / IEC 61984 cable cross-section: 0.25 - 1 mm² cable connection: PG 11
Sensor protection	stainless steel sintered filter
Working temperature range	probe: -40...70°C (-40...158°F) electronic: -40...60°C (-40...140°F) with LC display: -20...50°C (-4...122°F)
Storage temperature range	-40...60°C (-40...140°F)
Electromagnetic compatibility according to	EN 61326-1 Industrial Environment; EN61326-2-3; ICES-003 ClassB; FCC Part15 ClassB

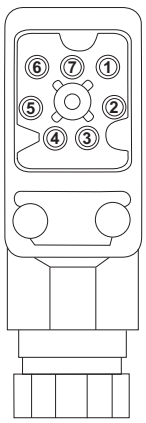
CE

1) minimum supply voltage 15V DC

Dimensions (mm)



Connection Diagram



analogue output

1	V+
2	GND
3	GND
4	OUT1
5	OUT2
6	NC
7	NC

10...30V DC

V mA

V mA

relay output

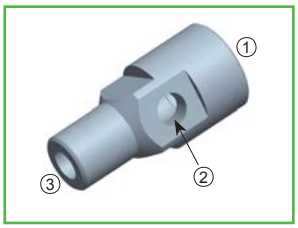
1	V+
2	GND
3	NC11
4	NC12
5	NC21
6	NC22
7	not connected

10...30V DC

Basic Sampling Cell

The basic sampling cell offers the possibility to integrate the EE371/EE372 into an existing or self-constructed sampling system.

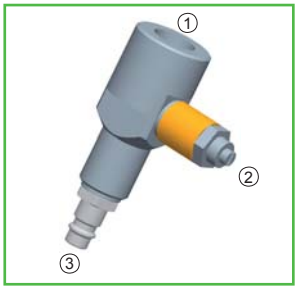
1 = G 1/2“ ISO
2 = G 1/4“
3 = G 1/4“



Sampling Cell with Quick Connector up to 10 bar (145psi)

The sampling cell is specially developed for use in compressed air lines and has a quick-connector suitable for standard compressed air connections.
It allows for the cell to be fitted and removed without interrupting the process.
The flow of gas can be adjusted using a bleed screw.

1 = G 1/2“ ISO
2 = Bleed screw
3 = Quick connector



Ordering Guide

Hardware Configuration							EE371- EE372-	EE371- EE372-
Measuring range	-80...60°C (-112...140°F) -40...60°C (-40...140°F)							
Model	transmitter switch						T	S
Pressure range	up to 20bar (290psi) up to 100bar (1450psi)						E I	E I
Pressure tight feedthrough	G1/2" male thread 1/2” NPT thread						HA03 HA07	HA03 HA07
Display	without display with display						 D08	 D08
Software Configuration								
Physical parameters of the outputs/relays	dew point temperature frost point temperature volume concentration	Td Tf Wv	[°C/°F] [°C/°F] [ppm]	(C) (D) (P)		output/relay 1 output/relay 2	select according to Ordering Guide (C, D, P) select according to Ordering Guide (C, D, P)	
Type of output signals	0-1V 0-5V 0-10V 0-20mA 4-20mA						1 2 3 5 6	
Measured value units for T / Td / Tf	metric / SI non metric / US						E01	E01
Scaling of Td/Tf-output (in °C or °F)	-40...60 (Td/Tf02) -10...50 (Td/Tf03)		-80...20 (Td/Tf63) -60...20 (Td/Tf65)		Other Td/Tf-scaling refer to page 146		select according to Ordering Guide (Tdxx / Tfxx)	
ppm range Wv	0...100ppm (X01) 0...500ppm (X02) 0...1000ppm (X03)		other measuring range: _____				select according to Ordering Guide	
Setting of alarm output	standard other set points:		relay 1: _____ hysteresis 1: _____		relay 2: _____ hysteresis 2: _____			SP

Accessories

- sampling cell with quick connector (HA050102)
- basic sampling cell (HA050103)
- configuration software + interface cable (HA010604)
- stainless steel sintered filter (HA010103)
- display (D08)

Order Example

EE372-TEHA07D08/CD2-Td03

Measuring range:	-40...60°C	Output 1:	Td
Model:	transmitter	Output 2:	Tf
Pressure range:	up to 20bar (290psi)	Output signal:	0-5V
Pressure tight feedthrough:	1/2” NPT thread	Measured value unit:	metric
Display:	with display	Scaling of output:	-10...50°C

EE375 Series

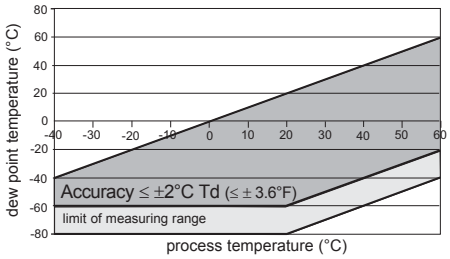
Compact Dew Point Temperature Transmitter for OEM Applications

The exact monitoring of dew point temperature in compressed air systems, dryers for plastic and other industrial processes is becoming increasingly more important.
The EE375 is designed for measurement of low dew points in OEM applications down to -60°C (-80°C).
The core of the transmitter is the monolithic measurement cell type HMC01 developed by E+E Elektronik in thin-film technology.
An autocalibration procedure which is integrated in the device and years of experience in low humidity adjustment make an accuracy of <2°C Td (±3.6°F Td) possible.
The transmitter has one analogue output for dew point, frost point or ppm volume concentration.

Technical Data

Measuring Quantities

Dew point (Td)

Dew point sensor	HMC01
Measuring range	-80...60°C Td (-112...140°F Td)
Accuracy Traceable to intern. standards, administrated by NIST, PTB, BEV...	

Response time t_{90}	80 sec.	-20°C Td → -40°C Td	(-4°F Td → -40°F Td)
	10 sec.	-40°C Td → -20°C Td	(-40°F Td → -4°F Td)

Volume concentration

Measuring range	20...200 000ppm
Accuracy at 20°C (68°F) and 1013mbar	5ppm + 20% of reading

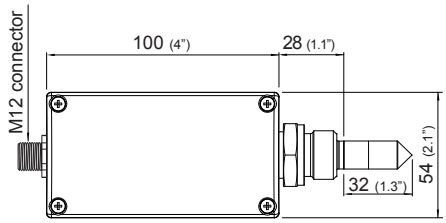
Outputs

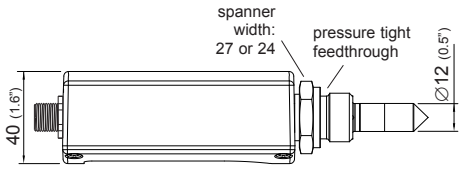
Selectable and scaleable	0 - 10V	-1mA < I_L < 1mA
analogue output for Td, Tf, Wv	4 - 20mA	R_L < 500 Ohm

General

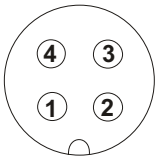
Supply voltage	21...28V DC
Current consumption at 24V DC	voltage output: typ. 40mA / during autocalibration: 100mA current output: typ. 80mA / during autocalibration: 140mA
Pressure range	0...20bar (0...290psi)
System requirements for software	WINDOWS 2000 or later; serial interface
Serial interface for configuration	RS232C
Housing / protection class	Al Si 9 Cu 3 / IP65
Electrical connection	M12 connector
Sensor protection	stainless steel sintered filter
Working temperature range	probe: -40...70°C (-40...158°F) electronic: -40...60°C (-40...140°F)
Storage temperature range	-40...60°C (-40...140°F)
Electromagnetic compatibility according to	EN 61326-1 Industrial Environment; EN61326-2-3; ICES-003 ClassB FCC Part15 ClassB; CE

Dimensions in mm





Connection Diagram



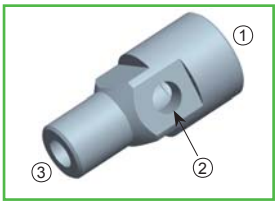
Male connector

1...V+
2...output 1
3...GND

Basic Sampling Cell

The basic sampling cell offers the possibility to integrate the EE375 into an existing or self-constructed sampling system.

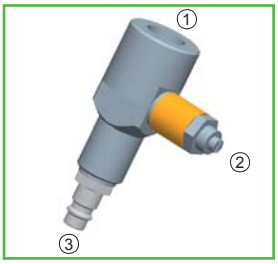
1 = G 1/2“ ISO
2 = G 1/4“
3 = G 1/4“



Sampling Cell with Quick Connector up to 10 bar (145psi)

The sampling cell is specially developed for use in compressed air lines and has a quick-connector suitable for standard compressed air connections.
It allows for the cell to be fitted and removed without interrupting the process.
The flow of gas can be adjusted using a bleed screw.

1 = G 1/2“ ISO
2 = Bleed screw
3 = Quick connector



Ordering Guide

					EE375-
Hardware Configuration					
Model	transmitter				T
Pressure range	up to 20bar (290psi)				E
Pressure tight feedthrough	G1/2" male thread				HA03
	1/2” NPT thread				HA07
	5/8”-18 UNF				HA08
Software Configuration					
Physical parameters of the output	dew point temperature	Td	[°C/°F]	output	C
	frost point temperature	Tf	[°C/°F]		D
	volume concentration	Wv	[ppm]		P
Type of output signal	0-10V				3
	4-20mA				6
Measured value units	metric / SI				
	non metric / US				E01
Scaling of Td/Tf-output (in °C or °F)	-40...60 (Td/Tf02)	-80...20 (Td/Tf63)		Other Td/Tf-scaling refer to page 146	Select accorcding to order guide (Tdxx or Tfxx)
	-10...50 (Td/Tf03)	-60...20 (Td/Tf65)			
ppm range Wv	0...100ppm (X01)				select according to Ordering Guide
	0...500ppm (X02)				
	0...1000ppm (X03)	other measuring range: _____			

Order Example

EE375-TEHA07/C3-Td03

Model:	transmitter	Output signal:	0-10V
Pressure range:	up to 20bar (290psi)	Measured value unit:	metric
Pressure tight feedthrough:	1/2” NPT thread	Scaling of output:	-10...50°C
Output:	Td		

EE45-01 Series

Condensation Monitor

EE45-01 condensation monitors are used to monitor the formation of condensation on chilled ceilings and to prevent condensation at critical spots of heating-, ventilation- and air conditioning systems. It is also used as a dew point monitor for systems operating near the dewpoint.
Because of the temperature coupling between the condensation monitor and the environment, the relative humidity is a measure for the dew point. The condensation monitor measures the relative humidity near the dew point using its high-quality capacitive RH sensor. At reaching the switching point of 90% RH the output will provide an early warning signal for the initiation of control steps (increasing the initial water temperature, reducing the cooling capacity, switching on the heating, etc...).
A special coating protects electronics and sensor against contamination.
The EE45-01 series can be mounted on pipes, ducts and walls.

EE45-01

Typical Applications

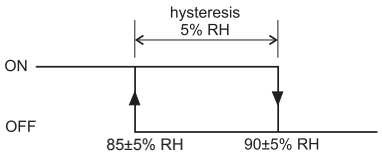
chilled ceilings
heating-, ventilation- and
air conditioning systems

Features

early detection of condensation danger
compact design
fast response time
protection against contamination for
sensor & electronics by a special coating
simple and easy mounting

Technical Data

Humidity sensor	HC103
Working range	10...100% RH
Output	Photo MOS Relays (NC)
Switching point at 25°C (77°F)	90±5% RH



Max. switch voltage	40V AC/DC
Max. switch current	200mA (peak AC and DC value)
Output ON resistance	typ. 0.8 Ohm max. 4.5 Ohm
Current consumption	< 10 mA_{eff}
Supply voltage	24V AC/DC ±20%
Response time at change of duct resp. wall temperature	t_{90} < 3 min.
Response time at change of rel. humidity	t_{90} < 25 sec.
Connection	pluggable terminal max. 1.5mm²
Sensor / electronic protection	by special coating (permeable for water vapour)
Electromagnetic compatibility according	EN61326-1 EN61326-2-3 Industrial Environment
Temperature range	working temperature range 0...50°C (32...122°F)
	storage temperature range -20...70°C (-4...158°F)

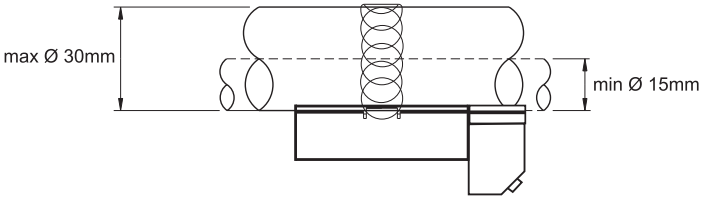
CE

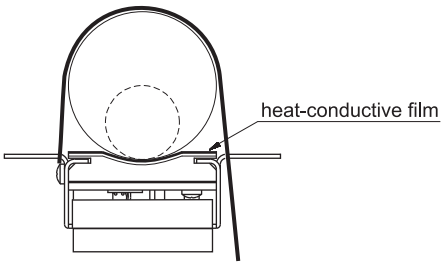
Dimensions (mm)

Installation

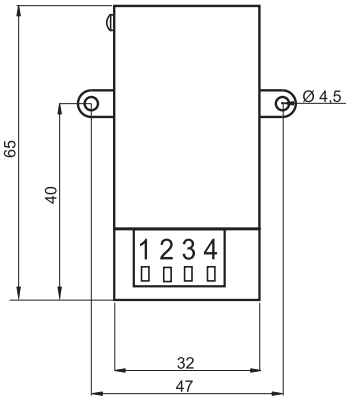
1 mm = 0.03937” / 1” = 25.4 mm

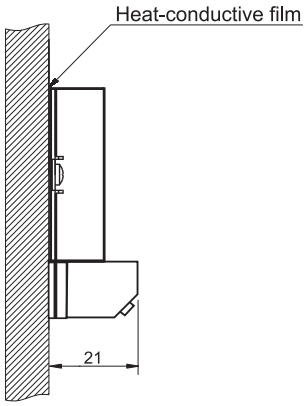
Pipe / Duct mounting



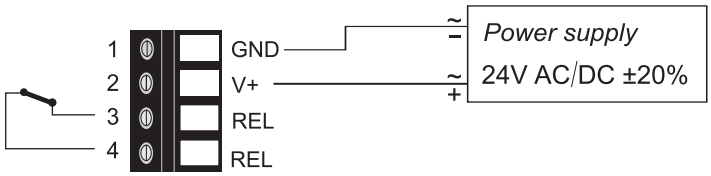


Wall mounting / versions





Connection Diagram



Ordering Guide

Condensation Monitor EE45-01 **(EE45-01)**

Humidity Sensor Elements

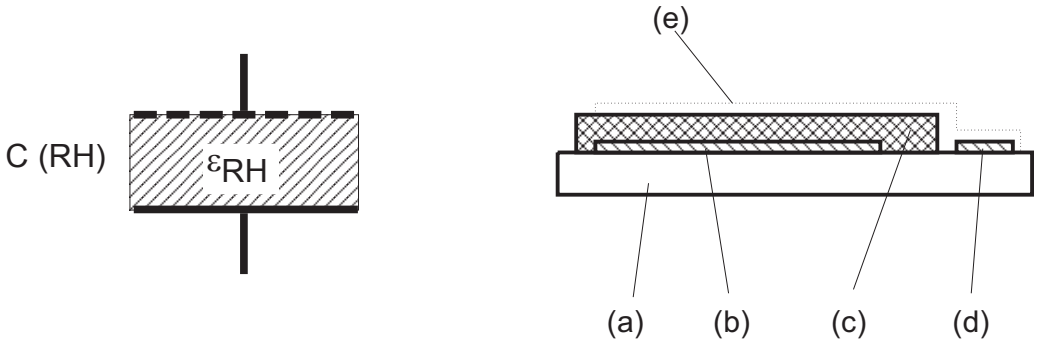
HC105/109
HC103M2
HC104-Kxx
HC201

The HC Series of E+E Elektronik are capacitive humidity sensors produced in thin film technology.
Due to careful selection of materials, to state-of-the-art production technology and to long experience of E+E in thin film technology, all HC humidity sensors show an excellent long term stability, highest reproducibility of the sensor characteristic, are wettable and very resistant to pollutants.
They are used in all E+E standard transmitter series, as well as in a large number of customised and OEM products from mass- to high-end applications.
The excellent linearity enables the use of a simple, cost-effective oscillator circuitry with an easy and accurate calibration procedure.
Extensive evaluation results such as from various long term tests or resistance to most chemicals of practical importance are available.

Construction

A capacitive humidity sensor is in fact a plate capacitor.
A polymer layer is placed between a metal electrode and a coated glass substrate. The dielectric permittivity ε of the polymer depends on its water content.

schematic construction of an E+E humidity sensor



(a) glass substrate
(b) main electrode
(c) humidity sensing polymer layer
(d) connection electrode
(e) porous metal electrode

For an optimal humidity exchange between the polymer layer and the surrounding air, the metal electrode is a porous layer of 0.1 to 1 µm produced by a special production process. The absence of additional insolation layers leads to a high sensitivity. (refer to characteristics of E+E humidity sensors)

The capacity of the sensor:

C sensor capacity at relative humidity RH
ε_{RH} relative dielectric permittivity, depending on humidity
ε_{RH} = 3 (at 0%RH)...3.9 (at 100%RH)
ε_O permittivity of vacuum
A area of the electrodes
d distance between the electrodes
RH relative humidity

$$C(RH) = \frac{\varepsilon_{RH} \cdot \varepsilon_O \cdot A}{d}$$

Definitions

Working Range

The working range is the maximum range for humidity and temperature wherein specified data and tolerances are valid. The interdependence of humidity and temperature is of importance. (refer to data for working range).

Nominal Capacitance

The nominal capacitance is the capacity of the sensor at a certain relative humidity, at temperatures of 20°C (68°F) or 30°C (86°F) and operating frequency of 20kHz.

Sensitivity

The sensitivity is the variation of the capacitance per % RH. It is measured at 33% RH and 76% RH.

Linearity Error

The linearity error is the maximum deviation of the sensor characteristic from the best linear approximation.

Hysteresis

The hysteresis is the maximum difference between two cycles 15 - 95% RH and 95 - 15% RH. The cycles are performed in steps of 10% RH with a stabilisation time of 1 hour after each step.

Temperature Dependence

The temperature dependence is the deviation in % RH per°C (°F) at different humidity and temperature values.

Response Time t_{90}

The response time t_{90} is the time the sensor needs to reach 90 % of the final value for a 0 - 80 % step of relative humidity.

Loss Tangent

The loss tangent quantifies the resistive value of the impedance. It is measured at 25°C (77°F), 76%RH and at operating frequency 20 kHz.

Maximum Supply Voltage

It is given as peak to peak voltage. DC voltage components on the sensing element are not allowed.

Operating Frequency

The HC sensors can operate within the specified frequency limits. For best results we recommend an operating frequency of 20 kHz.
All specified technical data are measured at an operating frequency 20kHz.

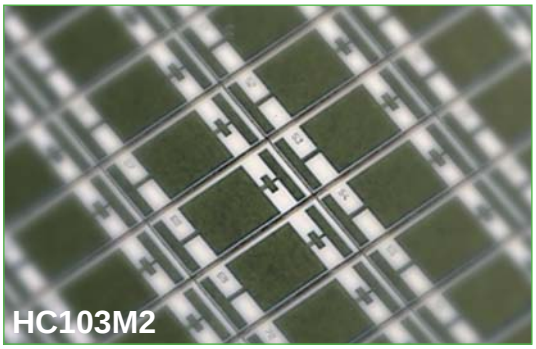
HC105/109 - SMD Version

Based on the high-end HC1000 and HC101, HC105/109 was developed to meet the demands of automatic assembly lines for mass production at a competitive price.
Typical applications are automotive or home appliances.
HC105/109 sensors are positioned on the PCB at the same time as other SMD components and soldered using the reflow soldering method. Their small dimensions allow an easy and space saving design.
They show the same advantages as HC1000 and HC101, such as high reproducibility of the sensor data and outstanding linearity over the whole humidity range.
The temperature dependence is also highly reproducible and allows software temperature compensation. This means high accuracy over a wide temperature range, which is essential for instance to calculate dew point temperature.


HC105/109

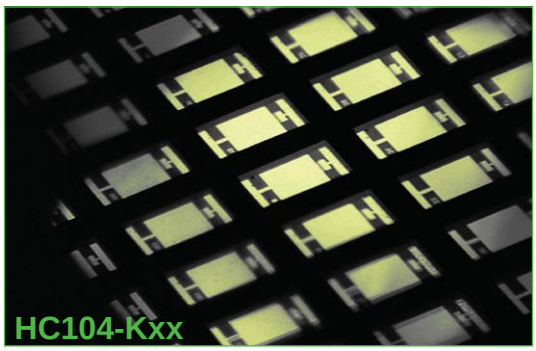
HC103M2

HC103M2 is based on the design of the HC103 series, nevertheless with relevantly shorter response time (t_{90}). This has been reduced to less than 3 seconds, which is twice faster than HC103.
The very short response time together with outstanding linearity over the entire working range and the highly reproducible temperature dependence are ideal for the use of HC103M2 in high end meteorological applications such as weather balloons.


HC103M2

HC104-Kxx - Interchangeable SMD Version

HC104-Kxx is the latest development of the well proven HC103 SMD-mounted sensor. Additionally to the HC103 features, the dispersion of nominal capacity of HC104-Kxx is reduced to a minimum by a special laser trimming process in a lot of applications. Time consuming humidity calibration is not necessary any longer. The result is an interchangeable sensor with excellent price/performance ratio, ideal for mass production in automatic assembly lines.


HC104-Kxx

HC201 - For Cost-Effective Applications

With the HC201 offers E+E Elektronik a high-quality and cost-effective humidity sensor in thin layer technology. Mass applications in indoor climate controls are only one of many possible applications of the HC201 series.
HC201/H is a version with a plastic housing which offers easy mounting on PCBs.


HC201

HC105/HC109

SMD Humidity Sensors for Mass Applications

Typical Applications

automotive - air conditioning
home appliances
photocopy machines

Features

SMD mounting
high reproducibility
wettable
very good long term stability
small size construction

Technical Data

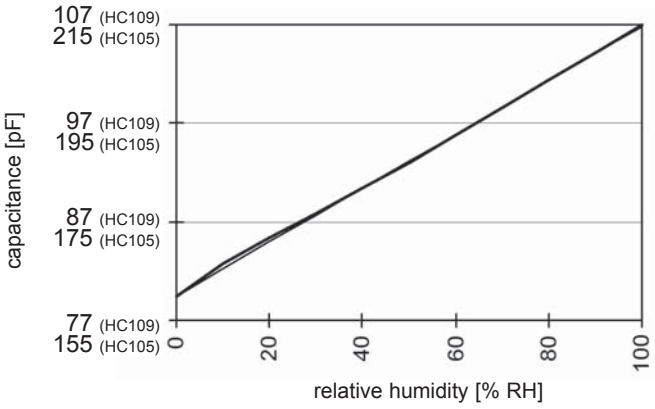
Sensor		**HC105**	**HC109**
Nominal capacitance	C_0 (at 30°C / 86°F)	160 ± 16 pF	80 ± 12 pF
	C_{76} (at 30°C / 86°F)	201.6 ± 20.3 pF	100.8 ± 15.1 pF
Response time t_{90}		< 6 sec.	< 6 sec.
Sensitivity		0.55 pF /% RH	0.27 pF /% RH
Temperature dependence		dC = -0.0019*RH*(T-30°C) [pF]	dC = -0.00095*RH*(T-30°C) [pF]
Working range	humidity	0...100% RH	0...100% RH
	temperature	-40...120°C (-40...248°F)	-40...120°C (-40...248°F)
Linearity error	(0...98% RH)	< ± 1.5% RH	< ± 1.5% RH
Hysteresis		1.7 ± 0.15% RH	1.7 ± 0.15% RH
Long term stability at 20-30°C (68-86°F) / 20-80%RH		drift < 1.5 % / year	drift < 1.5 % / year
Loss tangent		< 0.05 typical	< 0.05 typical
Maximum supply voltage (no DC voltage)		5V max (Upp)	5V max (Upp)
Maximum DC voltage		< 5mV	< 5mV
Operating frequency		10...100 kHz, recommended 20kHz	10...100 kHz, recommended 20kHz
Packaging	tray 101.6x101.6 mm (4x4")	420 sensors	not available
	tape and reel	refer to ordering guide	refer to ordering guide

Characteristics

The average increase of capacitance over the working range is 55pF (HC105) resp. 27.5pF (HC109). For the range of 0–98% RH linear approximation is possible, errors will be lower than < ± 1.5% RH.

The sensor characteristic is determined by the following linear formula:

$C(RH) = C_0 * [1+HC_0 * RH]$
with HC_0 = 3420 ± 191 ppm /% RH



For high accuracy requirements, the sensitivity is determined by the following polynomial:

$$C(RH) = C_0 * [1 + HC_0 * RH + K(RH)]$$

whereby:

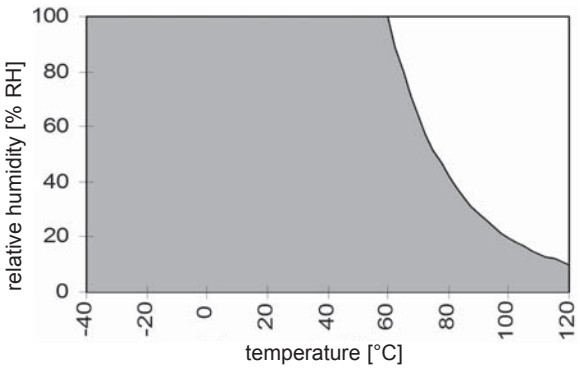
$$K(RH) = A_1*RH+A_2*RH^{1.5}+A_3*RH^2+A_4*RH^{2.5}$$

$A_1 = 2.6657E^{-3}$ $A_2 = -9.6134E^{-4}$
$A_3 = 1.1272E^{-4}$ $A_4 = -4.3E^{-6}$

Working Range

The working range of the humidity sensors HC105/ HC109 is shown with regard to the humidity / temperature limits.

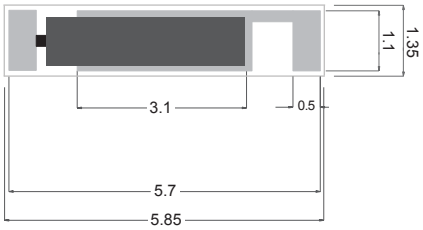
Although the sensors would not fail beyond the limits, the specification is guaranteed only within the working range.
In applications with high humidity at high temperatures the time factor shall be considered.



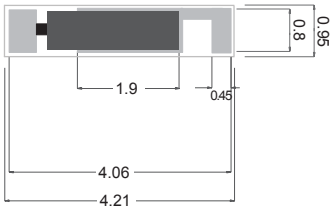
Dimensions (mm)

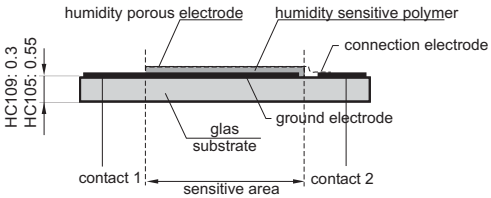
1 mm = 0.03937" / 1" = 25.4 mm

HC105

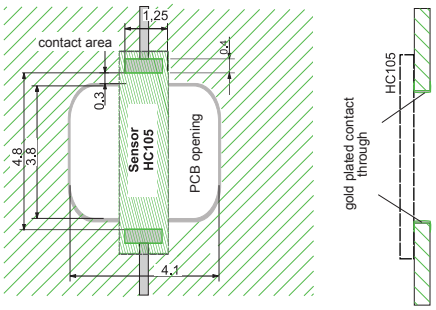


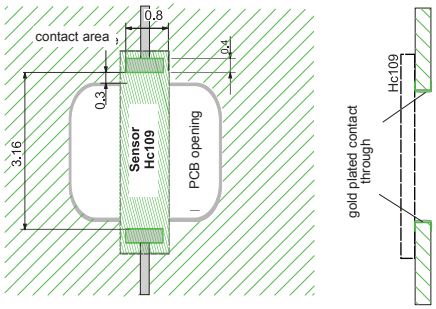
HC109





Mounting Instructions





To allow full access of the air, the humidity sensor should be positioned over an opening in the printed circuit board (PCB).
False readings because of humidity assimilation at the front side of the PCB should be avoided as much as possible by using gold-plated-through holes.

Assembling and Soldering

HC105/HC109 sensor series are designed for SMD automatic assembling with subsequent reflow-soldering.

Recommended SMD equipment:
- Automatic tooling machine with suction pipette
- Optical control for sensor identification

Ordering Guide

TYPE		PACKAGING	
capacitive humidity sensor 160 pF	(105)	tray (for HC105 only)	(no code)
capacitive humidity sensor 80 pF	(109)	500 sensors per reel	(TR0,5)
		1000 sensors per reel	(TR1)
		2500 sensors per reel	(TR2,5)
		10000 sensors per reel	(TR10)
HC			

Order Example

HC105TR1
SMD humidity sensor

Type: HC105
Packaging: 1000 sensors per reel

HC104-Kxx

xx...humidity calibration point

Interchangeable SMD Humidity Sensors for Mass Applications

Typical Applications

mass appliances
photocopy machines
automotive - air conditioning

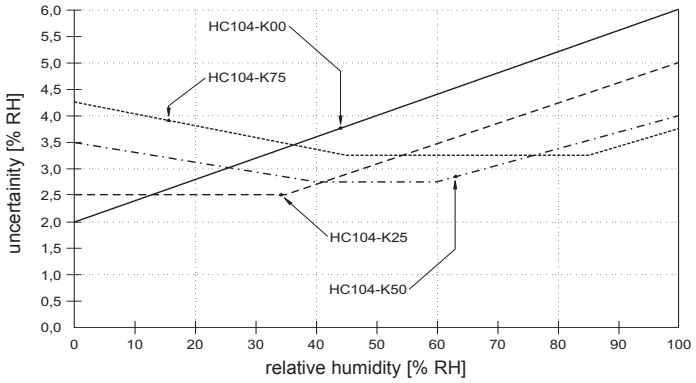
Features

interchangeable
inexpensive, easy humidity calibration
best accuracy without calibration
SMD compatible
outstanding long term stability
wettable

Technical Data

Sensor	HC104-K00	HC104-K25	HC104-K50	HC104-K75
Calibration point	0% RH	25% RH	50% RH	75% RH
Nominal capacity at calibration point [pF]	140	152.5	163.8	175.9

Interchangeability

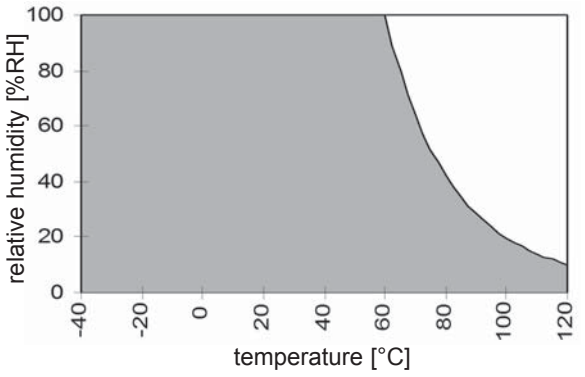


Sensitivity		0.48 pF / % RH
Temperature dependence		dC = -0.00166*RH*(T-30°C) [pF]
Working range	humidity	0...100% RH
	temperature	-40...120°C (-40...248°F)
Linearity error (0 ... 98% RH)		< ± 1.5% RH
Hysteresis		1.7 ± 0.15% RH
Response time t_{90}		< 6 s
Long term stability at 20-30°C (68-86°F) / 20-80% RH		drift < 1.5 % / year
Loss tangent		< 0.05 typical
Maximum supply voltage (no DC voltage)		5 V max (Upp)
Maximum DC voltage		< 5 mV
Operating frequency		10...100 kHz, recommended 20kHz
Packaging	tray 101.6x101.6 mm (4x4")	240 sensors
	tape and reel	refer to ordering guide

Working Range

The working range of the humidity sensors HC104-Kxx is shown with regard to the humidity / temperature limits.

Although the sensors would not fail beyond the limits, the specification is guaranteed only within the working range.
In applications with high humidity at high temperatures the time factor shall be considered.

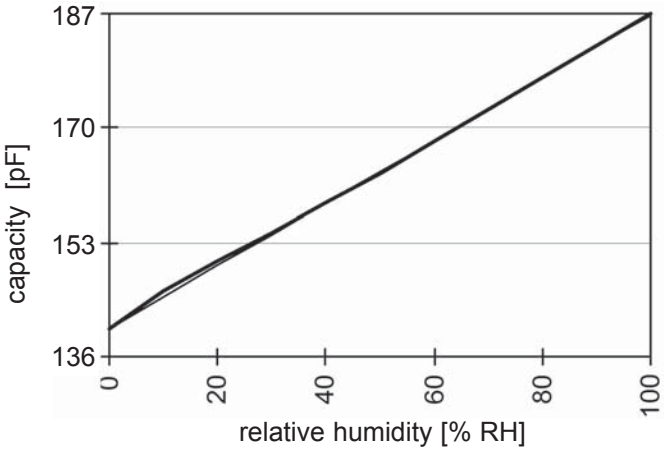


Characteristics

The average increase of capacitance over the working range is 55pF. For the range of 0–98% RH linear approximation is possible, errors will be lower than ± 1.5% RH.

The sensor characteristic is determined by the following linear formula:

$C(RH) = C_0 * [1+HC_0 * RH]$
with HC_0 = 3420 ± 191 ppm /% RH



For high accuracy requirements, the sensitivity is determined by the following polynomial:

$$C(RH) = C_0 * [1 + FK_0 * r.F. + K(RH)]$$

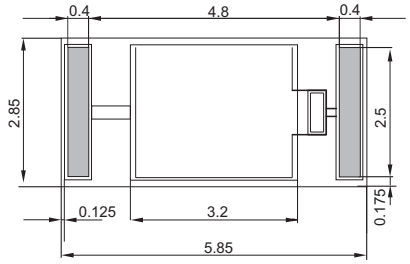
whereby: $K(RH) = A_1*RH+A_2*RH^{1,5}+A_3*RH^2+A_4*RH^{2,5}$

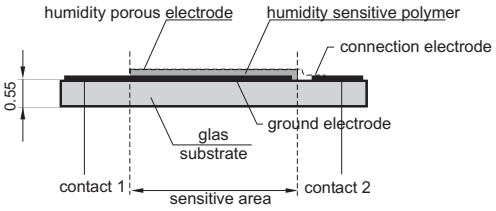
$A_1 = 2{,}6657E^{-3}$ $A_2 = -9{,}6134E^{-4}$

$A_3 = 1{,}1272E^{-4}$ $A_4 = -4{,}3E^{-6}$

Dimensions (mm)

1 mm = 0.03937” / 1” = 25.4 mm





Mounting Instructions

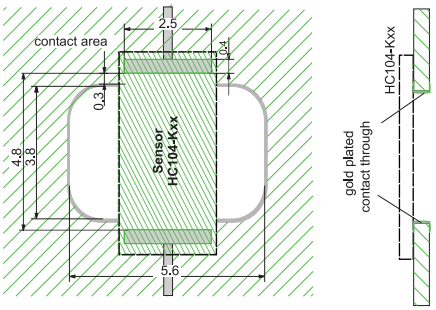


Fig.1

To allow full access of the air, the humidity sensor should be positioned over an opening in the printed circuit board (PCB). - Fig.1

False readings because of humidity assimilation at the front side of the PCB should be avoided as much as possible by using gold-plated-through holes.

Ordering Guide

TYPE		PACKAGING	
Interchangeable capacitive humidity sensor 140 pF, calibration point 0% RH	(104-K00)	tray (240 sensors)	(no code)
Interchangeable capacitive humidity sensor 152.5 pF, calibration point 25% RH	(104-K25)	500 sensors per reel	(TR0,5)
Interchangeable capacitive humidity sensor 163.8 pF, calibration point 50% RH	(104-K50)	1000 sensors per reel	(TR1)
Interchangeable capacitive humidity sensor 175.9 pF, calibration point 75% RH	(104-K75)	2500 sensors per reel	(TR2,5)
		10000 sensors per reel	(TR10)
HC			

Order Example

HC104-K50TR2,5
SMD Humidity Sensor

Type: HC104-K50
Packaging: 2500 sensors per reel

HC201

Humidity Sensors for HVAC Applications

Typical Applications

HVAC
hand helds
humidifiers
dehumidifiers

Features

high repeatability
high sensitivity
wettable
very good long term stability
good resistance to pollutants
small size construction

Technical Data

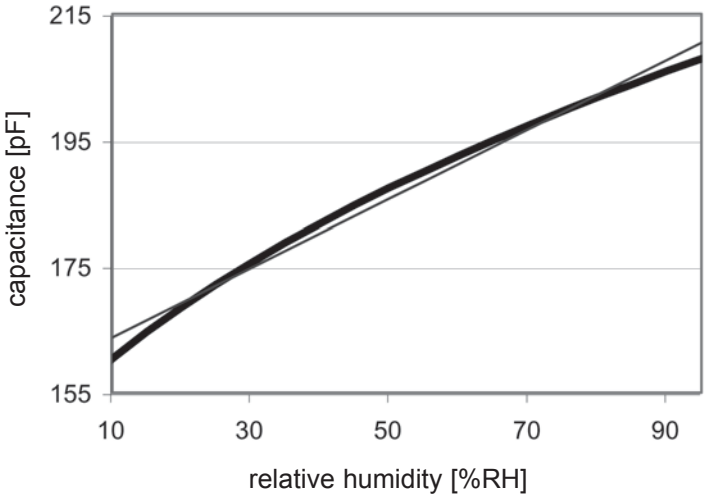
Nominal capacitance C_{76} (at 20°C / 68°F)	200 ± 30 pF	
Sensitivity	0.6 pF / % RH	
Working range	Humidity	10...95% RH
	Temperature	-40...110°C (-40...230°F)
Linearity error (20...90% RH)	< ± 2% RH	
Hysteresis	2.0 ± 0.3% RH	
Response time t_{90}	< 15 sec	
Temperature dependence [%RH /°C]	$\Delta RH = g * RH * (T - 20)$	g = -0.004 ± 10 %
Long term stability at 20-30°C (68-86°F) / 20-80% RH	drift < 1.5 % / year	
Loss tangent	< 0.1 typical	
Maximum supply voltage (no DC voltage)	5 V max (Upp)	
Maximum DC voltage	< 5 mV	
Operating frequency	10...100 kHz, recommended 20 kHz	
Material connection	phosphor bronze with tin coating	

Characteristics

The average increase of capacitance over the working range is 50pF. For the range of 20–90% RH, linear approximation is possible, errors will be lower than ± 2% RH.

The sensor characteristic is described by the following linear formula:

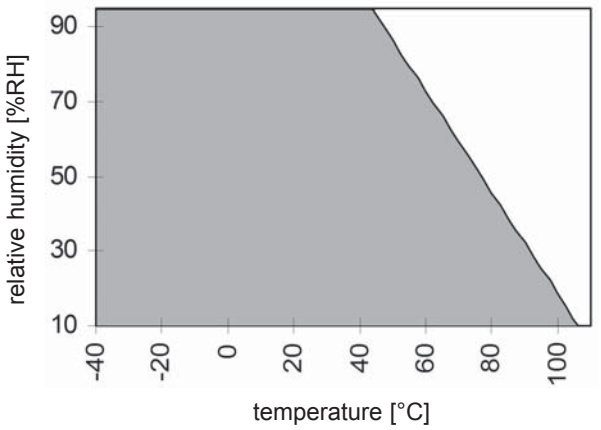
$C(RH) = C_{76} * [1 + HK * (RH – 76)]$
with HK = 2700 ± 250 ppm /% RH



Working Range

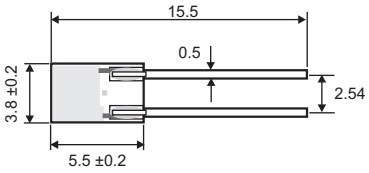
The working range for the humidity sensor HC201 is shown with regard to the humidity / temperature limits.

Although the sensors would not fail beyond the limits, the specification is guaranteed only within the working range.
In applications with high humidity at high temperature the time factor shall be considered.

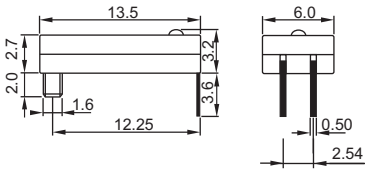


Dimensions (mm)

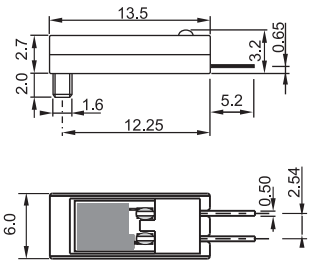
1 mm = 0.03937” / 1” = 25.4 mm



HC201



HC201/H



HC201/G

Ordering Guide

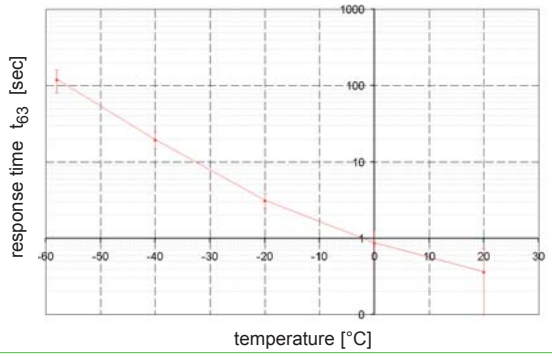
MODEL	TYPE	
HC	capacitive humidity sensor 200 pF	(201)
	capacitive humidity sensor 200 pF with PC housing for mounting on the printed ciruit board	(201/H)
	capacitive humidity sensor 200 pF with PC housing	(201/G)
HC		

HC103M2

Fast High End Humidity Sensors for Radiosondes / Registering Balloons

Technical Data

Nominal capacitance C_0 (at 30°C / 86°F)		160 ± 40 pF
Sensitivity		0.55pF /% RH
Working range	humidity	0...100% RH
	temperature	-80...120°C (-112...248°F)
Linearity error (0...98% RH)		< ± 2% RH
Hysteresis		1.9 ± 0.25% RH
Response time RH t_{63}		



Temperature dependence[1)]		dC = -0.0019*RH*(T-30°C) [pF]
Loss tangent		< 0.05
Maximum supply voltage		5V max (UPP)
Maximum DC voltage		< 5mV
Operating frequency		10...100 kHz, recommended 20kHz
Packaging	tray 101.6x101.6 mm (4x4")	240 sensors
	tape and reel	refer to ordering guide

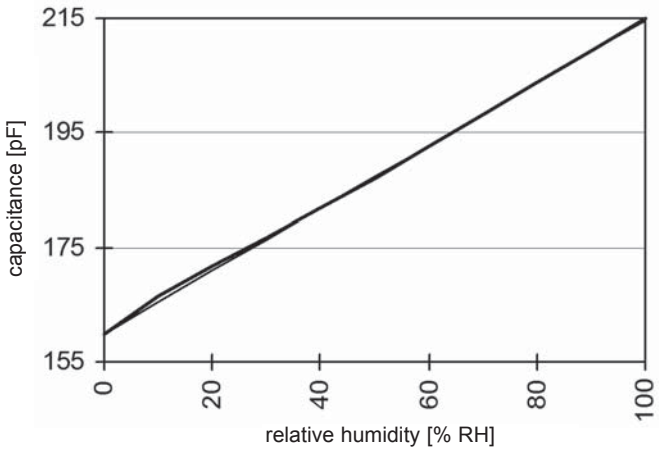
1) more details for t < -20°C on request

Characteristics

The average increase of capacitance over the working range is 55pF. For the range of 0–98% RH linear approximation is possible, errors will be lower than < ± 2% RH.

The sensor characteristic is determined by the following linear formula:

$C(RH) = C_0 * [1+HC_0 * RH]$
with HC_0 = 3420 ± 250 ppm /% RH



For high accuracy requirements, the sensitivity is determined by the following polynomial:

$$C(RH) = C_0 * [1 + HC_0 * RH + K(RH)]$$

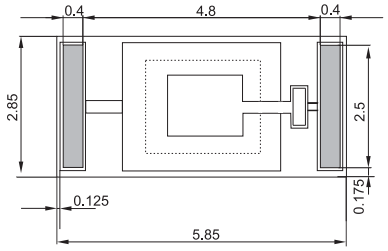
whereby:

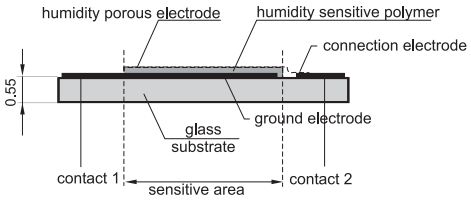
$$K(RH) = A_1*RH+A_2*RH^{1.5}+A_3*RH^2+A_4*RH^{2.5}$$

$A_1 = 2.6657E^{-3}$ $A_2 = -9.6134E^{-4}$
$A_3 = 1.1272E^{-4}$ $A_4 = -4.3E^{-6}$

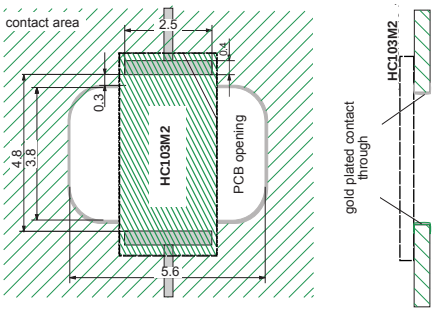
Dimensions (mm)

1 mm = 0.03937” / 1” = 25.4 mm





Mounting Instructions



To allow full access of the air, the humidity sensor should be positioned over an opening in the printed circuit board (PCB).
False readings because of humidity assimilation at the front side of the PCB should be avoided as much as possible by using gold-plated-through holes.

Assembling and Soldering

HC103M2 sensor series are designed for SMD automatic assembling with subsequent reflow-soldering. For more details please refer to mounting instructions.

Recommended SMD equipment:

- Automatic tooling machine with suction pipette
- Optical control for sensor identification

Ordering Guide

TYPE		PACKAGING	
HC103M2	(103M2)	tray (240 sensors)	(no code)
		500 sensors per reel	(TR0,5)
		1000 sensors per reel	(TR1)
		2500 sensors per reel	(TR2,5)
		10000 sensors per reel	(TR10)
HC			

Order Example

HC103M2TR1

Type: HC103M2
Packaging: 1000 sensors per reel

Handling Instructions

Cleaning

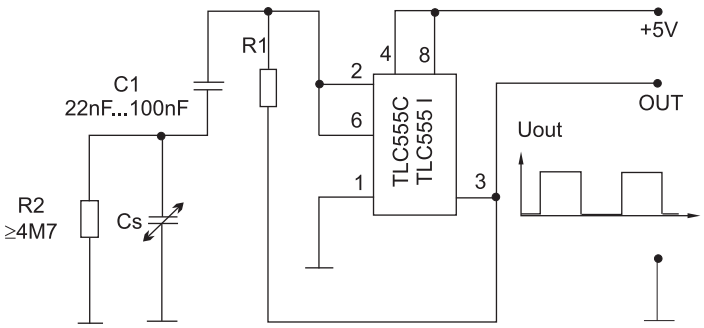
If necessary, the HC sensors can be cleaned by shaking them in pure isopropylalcohol, industrial grade. Do not touch or rub the sensor surface. After cleaning with isopropylalcohol, immerse them in water and let them dry.

Test Circuitry

This test circuitry is in fact an oscillator. Changes of the sensor capacitance modify the frequency of the output signal. The operating frequency can be selected by the R1[1)] resistor (trimmer).

For example, an operating frequency of appr. 50kHz at 76% RH can be set with the following values of R1:

HC105/HC109	R1=appr. 56kΩ...68kΩ
HC104	R1=appr. 68kΩ
HC201	R1=appr. 51kΩ...75kΩ



1) Please note that the exact value of R1 depends on the tolerances of Humidity Sensors, the PCB Layout, and the TLC555 tolerances.

Calibration

Each sensor is tested at reference conditions for humidity. The calibration point for the humidity circuitry should be chosen according to the application and typical operation range. If the circuitry has no linearisation we recommend calibration at 33 and 76%. High humidity levels should not be chosen, as wetting of the element can cause misreadings during the calibration procedure.

For reliable check the E+E special calibration set is available.
(refer to data for „Humidity Calibration Set“)

As a professional alternative for check and calibration we recommend the use of the E+E high accuracy humidity calibrator HUMOR 20.
(refer to data for „HUMOR 20“)

Air Velocity

Measurement

Transmitters

EE75
EE66
EE65
EE575
EE56
EE55

Hand-helds

OMNIPORT 20

EE75 Series

High-Precision Air / Gas Velocity Transmitter for Industrial Applications

The EE75 series air velocity transmitters were developed to obtain accurate measuring results over a wide range of velocities and temperatures.
A high-quality hot film sensor element based on cutting-edge thin film technology ensures maximum sensitivity, even at lowest mass flows. At the same time, the innovative probe design produces reliable measuring results at high flow velocities of up to 40m/s (8000ft/min).

The integrated temperature compensation minimises the temperature cross-sensitivity of the EE75 series which, combined with the robust mechanical design, allows it to be used at process temperatures between -40 to +120°C (-40 to 248°F).

In addition to air velocity and temperature values, the transmitter calculates the volumetric flow rate in m³/min or ft³/min. The cross section of the duct needs to be determined for this purpose and the volumetric flow rate can be displayed and directed to one of the analogue outputs.

The configuration software included in the scope of supply allows to choose the appropriate output parameter and freely scale the display range and signal level of the two analogue outputs. In addition user-friendly calibration of the air velocity and temperature and the adjustment of key parameters (e.g. response time of the velocity measurement, low flow cut-off points, etc.) are supported as well.

An optional illuminated display with two control buttons integrated in the cover is available. In addition, this enables changes of the configuration to be made directly on the unit.

The EE75 series has a robust metal housing to protect against possible damage in rough industrial environments. There are five different models, providing a comprehensive range of mounting options:

- **Model A** for wall mounting
- **Model B** for duct mounting
- **Model C** with remote probe
- **Model E** with remote probe, pressure-tight up to 10bar (145psi)
- **Model P** for duct mounting, pressure-tight up to 10bar (145psi)

The EE75 series can be used to measure the velocity of other gasses as well, although a correction has to be applied to the unit at the factory.


Model A


Model B


Model C

Typical Applications

- **monitoring incoming and outgoing air (energy management) in HVAC applications**
- **filter monitoring and laminar flow control in cleanrooms**
- **exhaust systems, exhaust hoods and glove boxes in the pharmaceutical, bio and semiconductor industries**
- **mass flow measurement during incineration processes**
- **monitoring and measurement of compressed air systems**
- **air conveying systems**
- **wind tunnels and climate simulators**

Features

high accuracy
working range 0...40 m/s (0...8000ft/min) and -40...120°C (-40...248°F)
measurement of air velocity and temperature
calculation of volumetric flow rate
low dependence on angle of inflow
probe diameter 8mm (0.3")
remote probe up to 10m (32.8ft)
easy mounting and maintenance
correction for pressure, humidity and media
low flow cut-off
pressure tight up to 10bar (145psi)
SI and US units selectable

Technical Data

Measuring value

Air velocity

Working range	0... 2m/s (0...400ft/min)		
	0... 10m/s (0...2000ft/min)		
	0... 40m/s (0...8000ft/min)		
Accuracy[1] in air at 25°C (77°F)[2]	0.06... 2m/s (12...400ft/min)		± 0.03m/s / 6ft/min
at 45% RH and 1013hPa	0.15...10m/s (30...2000ft/min)		± (0.10m/s / 20ft/min + 1 % of measuring value)
	0.2... 40m/s (40...8000ft/min)		± (0.20m/s / 40ft/min + 1 % of measuring value)
Uncertainty of factory calibration[1]	± (1% of measuring value, min. 0.015m/s (3ft/min))		
Temperature dependence electronics	typ. -0.005 % of measuring value / °C		
Temperature dependence probe	± (0.1% of measuring value/°C)		
Dependence	of angle of inflow:	< 3% for α < 20°	
	of direction of inflow:	< 3%	
Response time τ_{90}[3]	< 1.5...40s (configurable)		

Temperature

Working range	probe:	-40...120°C (-40...248°F)
	probe cable:	-40...105°C (-40...221°F)
	electronic:	-40...60°C (-40...140°F)
	electronic with display:	-30...60°C (-22...140°F)
Accuracy at 20°C (68°F)	±0.5°C (±0.9°F)	
Temperature dependence electronics	typ. -0.01°C / °C	
Response time τ_{90}[3]	10s	

Outputs

output signals and display ranges are freely scaleable (see ranges below)

voltage	0-10V (e.g: 0-5V, 1-5V etc.)	-1mA < I_L < 1mA
current (3-wire)	0-20mA (e.g: 4-20mA etc.)	R_L< 350 Ohm
v-scaling	0...2 / 10 / 40m/s (0...400 / 2000 / 8000ft/min)	
T-scaling	-40...120°C (-40...248°F)	
Vol-scaling	0...10000m³/min (0...353147ft³/min)	

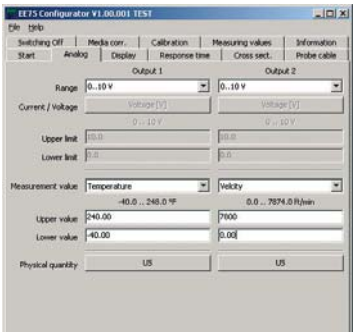
General

Supply voltage	24V DC/AC ± 20%		
Current consumption	max. 100mA; max. 160mA (with display)		
Connection	screw terminals max. 1.5mm² (AWG 16)		
Electromagnetic compatibility	EN61326-1	EN61326-2-3	ICES-003 ClassB
	Industrial Environment		FCC Part15 ClassB
Pressure range	Model E and P pressure tight up to 10bar (145psi)		
Material	housing / protection class:	metal (AlSi3Cu) / IP65; Nema 4	
	measuring probe:	stainless steel	
	measuring head:	PBT (polybuthylenterephthalat)	
System requirements			
for configuration software	Windows 2000 or Windows XP		
Interface	USB 1.1		

1) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation).
The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).
2) Accuracy refers to measurement in air
3) Response time τ_{90} is measured from the beginning of a step change to the moment of reaching 90% of the step.

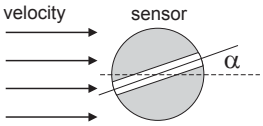
Configuration Software

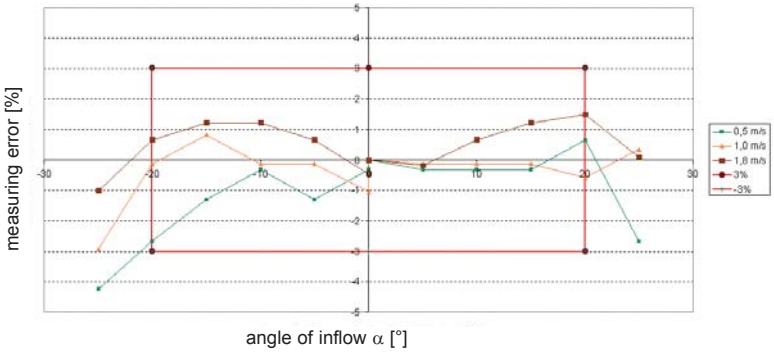
An easy setup of the EE75 can be made via standard USB interface and the software included in the scope of supply.
The user can easily set the response time, correct for the gas (air) pressure, perform an one or two point adjustment and define the duct cross section for the volumetric flow rate.



Angular Dependence

The innovative design of the probe head minimises the effect of the angle of inflow on the measuring result. The deviation of the measuring value remains < 3% up to an angle of inflow (α) of ± 20° between the direction of inflow and the sensor element's longitudinal axis.





Low flow cut-off

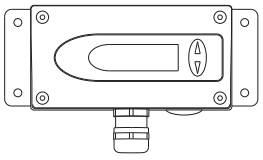
Small temperature differences in shut-off pipes and ducts can cause minimal flows. Even these would be detected and measured by the EE75. The resulting fluctuations in the output signal can be suppressed by the low flow cut-off. Cut-off point and switching hysteresis can be specified using the configuration software.

Calculation of volumetric flow

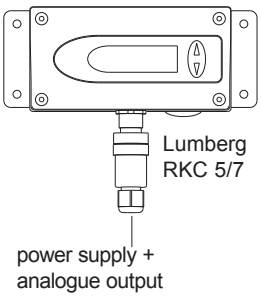
The EE75 measures air velocity in m/s or ft/min. The configuration software can be used to enter the cross-section. This enables the transmitter to calculate the volumetric flow rate in m³/min or ft³/min. The data can be displayed and directed to one of the analogue outputs.

Connection versions

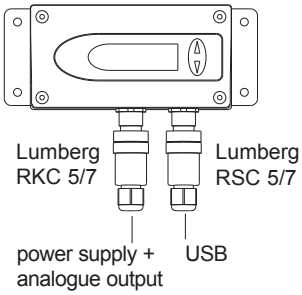
standard



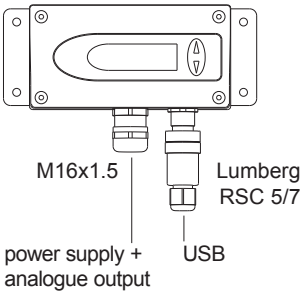
plug option C12



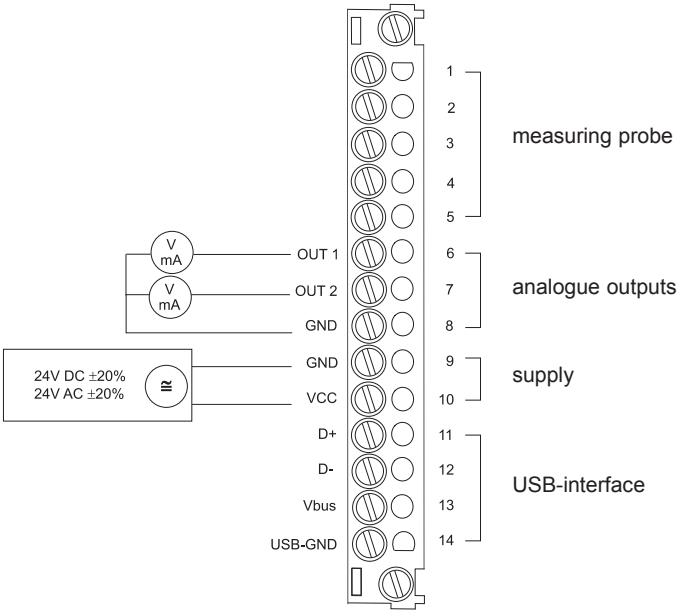
plug option C13



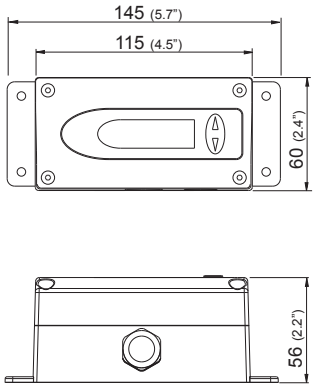
plug option C14

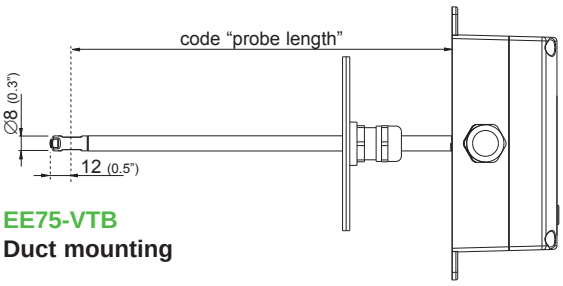


Connection Diagram

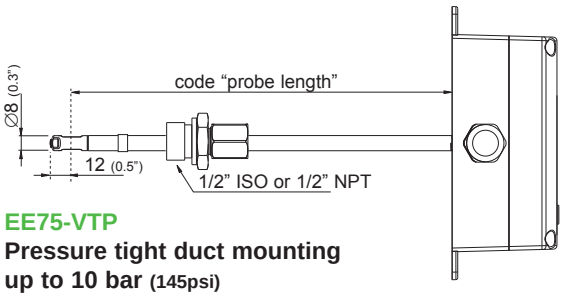


Dimensions in mm

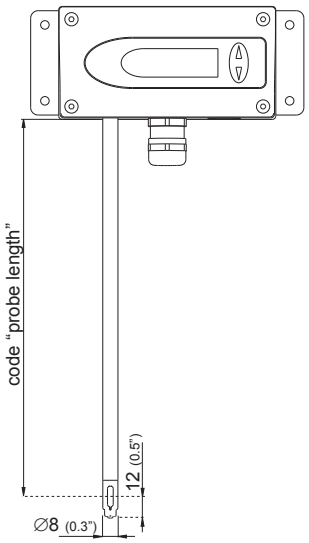




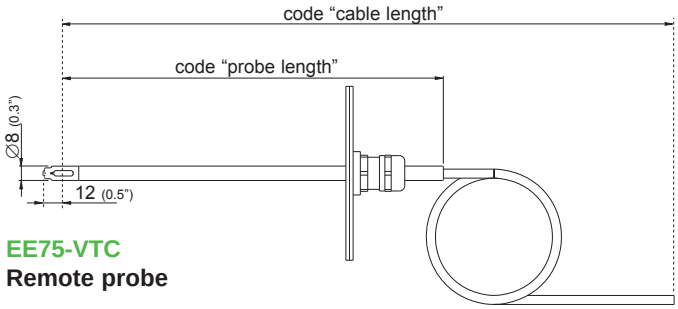
EE75-VTB
Duct mounting



EE75-VTP
Pressure tight duct mounting
up to 10 bar (145psi)

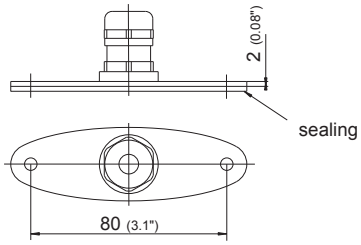


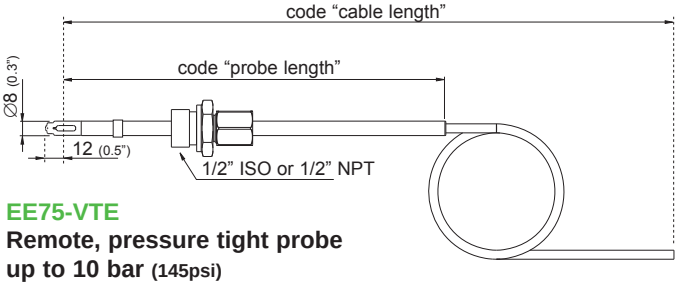
EE75-VTA
Wall mounting



EE75-VTC
Remote probe

Mounting flange (included in the scope of supply)





EE75-VTE
Remote, pressure tight probe
up to 10 bar (145psi)

Ordering Guide

		EE75-VTA	EE75-VTB	EE75-VTC	EE75-VTE	EE75-VTP
Hardware Configuration						
Output	0...10V	3	3	3	3	3
	4...20mA	6	6	6	6	6
Working range	0...2m/s (0...400ft/min)	1	1	1	1	1
	0...10m/s (0...2000ft/min)	2	2	2	2	2
	0...40m/s (0...8000ft/min)	3	3	3	3	3
Probe length	200mm (7.9")	5	5	5	5	5
	400mm (15.8")	6	6	6	6	6
	600mm (23.6")	7	7	7	7	7
Cable length	2m (6.6ft)			K200	K200	
	5m (16.4ft)			K500	K500	
	10m (32.8ft)			K1000	K1000	
Display	without display					
	with display	D06	D06	D06	D06	D06
Pressure tight feedthrough	1/2" ISO thread				HA03	HA03
	1/2" NPT thread				HA07	HA07
Plug	cable glands					
	1 plug for power supply and outputs	C12	C12	C12	C12	C12
	2 plug for power supply / outputs and USB	C13	C13	C13	C13	C13
	1 plug for USB	C14	C14	C14	C14	C14
Software Configuration						
Physical parameters of outputs	Temperature T [°C] (B) — output 1	Select according to Ordering Guide (B, N, O)				
	Velocity v [m/s] (N) — output 2	Select according to Ordering Guide (B, N, O)				
	Volume $\overline{v}$ [m³/min] (O)					
Measured value units	metric / SI	E01	E01	E01	E01	E01
	non metric / US					
Scaling of v-output in m/s or ft/min	0...0,5 (V01), 0...1 (V02), 0...1,5 (V03), 0...2 (V04), 0...5 (V05), 0...10 (V06), 0...15 (V07), 0...20 (V08), 0...25 (V09), 0...30 (V10), 0...35 (V11), 0...40 (V12), 0...100 (V13), 0...200 (V14), 0...300 (V15), 0...400 (V16), 0...1000 (V17), 0...2000 (V18), 0...3000 (V19), 0...4000 (V20), 0...5000 (V21), 0...6000 (V22), 0...7000 (V23), 0...7800 (V24), 0...8000 (V25)	Select according to Ordering Guide (Vxx)				
Scaling of T-output in °C or °F	-40...60 (T02), -10...50 (T03), 0...50 (T04), 0...100 (T05), 0...60 (T07), -30...70 (T08), -30...120 (T09), -20...120 (T10), -10...70 (T11), -40...120 (T12), 20...120 (T15), -30...60 (T20), 0...80 (T21), -40...80 (T22), -20...80 (T24), -20...60 (T25), -30...50 (T45), -20...50 (T48)	Select according to Ordering Guide (Txx) Other T scaling refer to page 146				
Measurement media	Air					
	Nitrogen N	B	B	B	B	B
	Carbon dioxide CO_2	C	C	C	C	C

Order Example

EE75-VTB325C12/BN-V05-T07

Model:	duct mounting
Output:	0...10V
Working range:	0...10m/s (0...2000ft/min)
Probe length:	200mm (7.9")
Display:	without
Plug:	1 plug for power supply and outputs
Output 1:	T
Output 2:	v
Measured value units:	metric / SI
v-Scaling:	0...5m/s
T-Scaling:	0...60°C
Measurement media:	air

EE66 Series

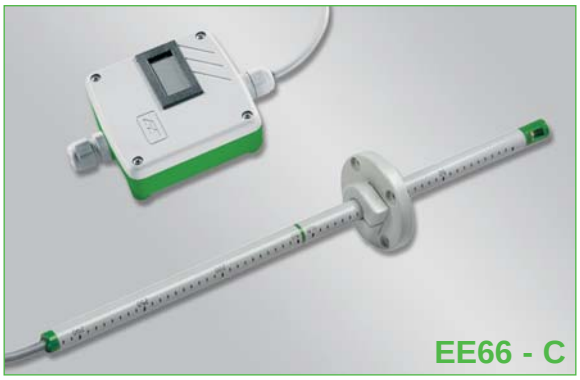
Air Velocity Transmitter for Measurement of Lowest Velocity

EE66 air velocity transmitter series are designed for high accuracy measurement of lowest air velocities. It is the ideal solution for laminar flow control and special ventilation applications. The E+E thin film sensor is operating on an innovative hot film anemometer principle. This guarantees excellent accuracy for air velocity down to almost 0.15m/s, which is not possible for conventional anemometers with commercial temperature sensors or NTC bead thermistors.
The E+E sensor is much more insensitive to pollution than all other anemometer principles. This increases reliability and reduces maintenance costs.

EE66 series are available with current or voltage output, the measuring range and the response time can be selected with jumpers by the user.

Low angular dependence enables easy, cost-effective installation.
An integrated LC display and a version with remote sensing probe are also available.


EE66 - A / B


EE66 - C

Typical Applications

clean room control
laminar flow control

Features

measurement down to 0m/s
low angular dependence
easy installation

Technical Data

Measuring values

Working range[1]	0...1m/s (0...200ft/min)	
	0...1.5m/s (0...300ft/min)	
	0...2m/s (0...400ft/min)	
Output [1]	0 - 10 V	-1mA < I_L < 1 mA
0...1m/s / 0...1.5m/s / 0...2m/s	4 - 20 mA	R_L < 450 Ω (linear, 3 wires)
Accuracy at 20°C (68°F), 45% RH	0.15...1m/s (30...200ft/min)	± (0.04m/s / 7.9ft/min + 2 % of m. v.)
and 1013 hPa	0.15...1.5m/s (30...300ft/min)	± (0.05m/s / 9.8ft/min + 2 % of m. v.)
	0.15...2m/s (30...400ft/min)	± (0.06m/s / 11.8ft/min + 2 % of m. v.)
Response time τ_{90} [1) 2)]	typ. 4 sec. or typ. 0.2 sec.	(at constant temperature)

General

Power supply	24V AC/DC ± 20 %	
Current consumption for AC supply	max. 150 mA	
for DC supply	max. 90 mA	
Angular dependence	< 3 % of measurement at | Δα | < 10°	
Cable gland	M16x1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection	screw terminals max. 1.5 mm² (AWG 16)	
Electromagnetic compatibility	EN61326-1 EN61326-2-3	CE
Housing / protecting class	Polycarbonate / IP65, Nema 4	with LC display: IP40

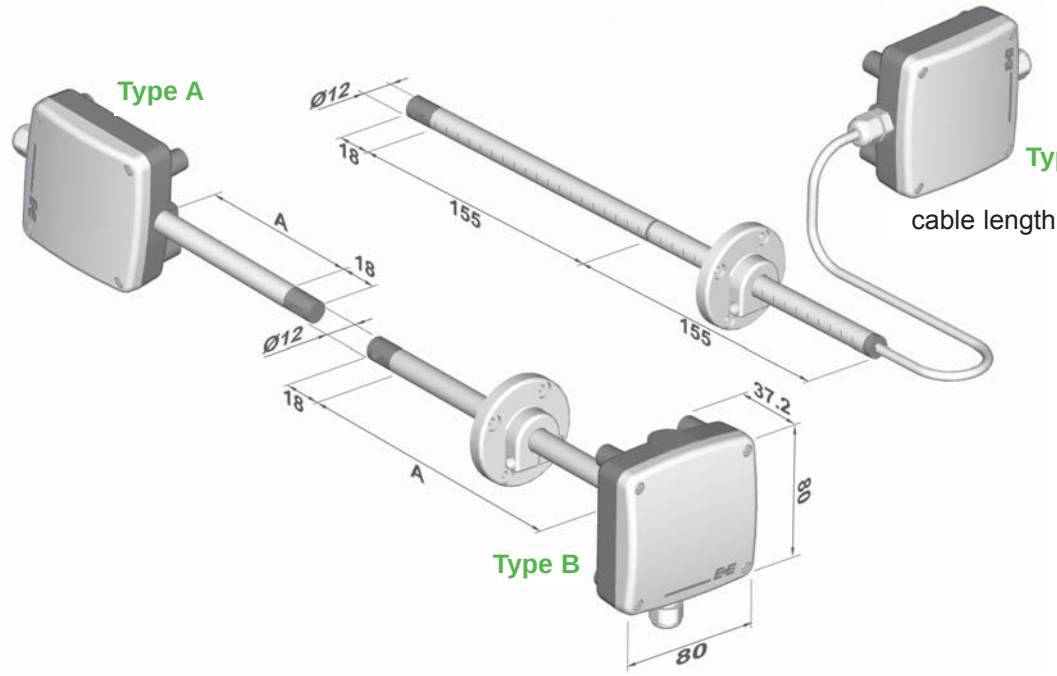
1) Selectable by jumper

2) Response time τ_{90} is measured from the beginning of a step change of air velocity to the moment of reaching 90% of the step.

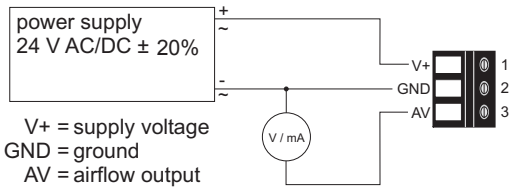
Temperature range	working temperature probe	-25...50°C (-13...122°F)
	working temperature electronic	-10...50°C (14...122°F)
	storage temperature	-30...60°C (-22...140°F)

Dimensions (mm)

1 mm = 0.03937" / 1" = 25.4 mm



Connection Diagram



Ordering Guide

MODEL	HOUSING	PROBE LENGTH (according to "A")	CABLE LENGTH (Type C only)	DISPLAY
velocity (V)	wall mounting (A)	100mm (3.9") (3)	1m (3.3ft) (no code)	without display (no code)
	duct mounting (B)	200mm (7.9") (5)	2m (6.6ft) (K200)	with display (D02)
	remote sensor probe (C)	others (x)	5m (16.4ft) (K500)	
			10m (32.8ft) (K1000)	
EE66-				

Order Example

EE66-VB5-D02

model:	velocity
housing:	duct mounting
probe length:	200mm (7.9")
display:	with LC display

EE65 Series

Air Velocity Transmitter for HVAC Applications

EE65 air velocity transmitters are ideal for accurate ventilation control applications. They are operating on an innovative hot film anemometer principle.
The E+E thin film sensor guarantees very good accuracy at low air velocity, which is not possible for conventional anemometers with commercial temperature sensors or NTC bead thermistors.
Moreover, the E+E sensor is much more insensitive to dust and dirt than all other anemometer principles. This means high reliability and low maintenance costs.

EE65 series are available with current or voltage output, the measuring range and the response time can be selected with jumpers by the user.

Low angular dependence enables easy, cost-effective installation.
An integrated LC display and a version with remote sensing probe are available.


EE65 - A / B


EE65 - C

Typical Applications

HVAC
process and environmental control

Features

low angular dependence
easy installation
adjustable to application requirements

Technical Data

Measuring values

Working range[1]	0...10m/s (0...2000ft/min) 0...15m/s (0...3000ft/min) 0...20m/s (0...4000ft/min)	
Output[1] 0...10m/s / 0...15m/s / 0...20m/s	0 - 10 V 4 - 20 mA	-1 mA < I_L < 1 mA R_L < 450 Ω
Accuracy at 20°C (68°F), 45 % RH and 1013hPa	0.2...10m/s (40...2000ft/min) 0.2...15m/s (40...3000ft/min) 0.2...20m/s (40...4000ft/min)	± (0.2m/s / 40ft/min + 3 % of m. v.) ± (0.2m/s / 40ft/min + 3 % of m. v.) ± (0.2m/s / 40ft/min+ 3 % of m. v.)
Response time τ_{90} [1) 2)]	typ. 4 sec. or typ. 0.2 sec.	(at constant temperature)

General

Power supply	24V AC/DC ± 20 %	
Current consumption for AC supply for DC supply	max. 150 mA max. 90 mA	
Angular dependence	< 3 % of measurement at | Δα | < 10°	
Cable gland	M16x1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection	screw terminals max. 1.5 mm² (AWG 16)	
Electromagnetic compatibility	EN61326-1 EN61326-2-3	CE
Housing/protecting class	Polycarbonate / IP65, Nema 4	with LC display IP40

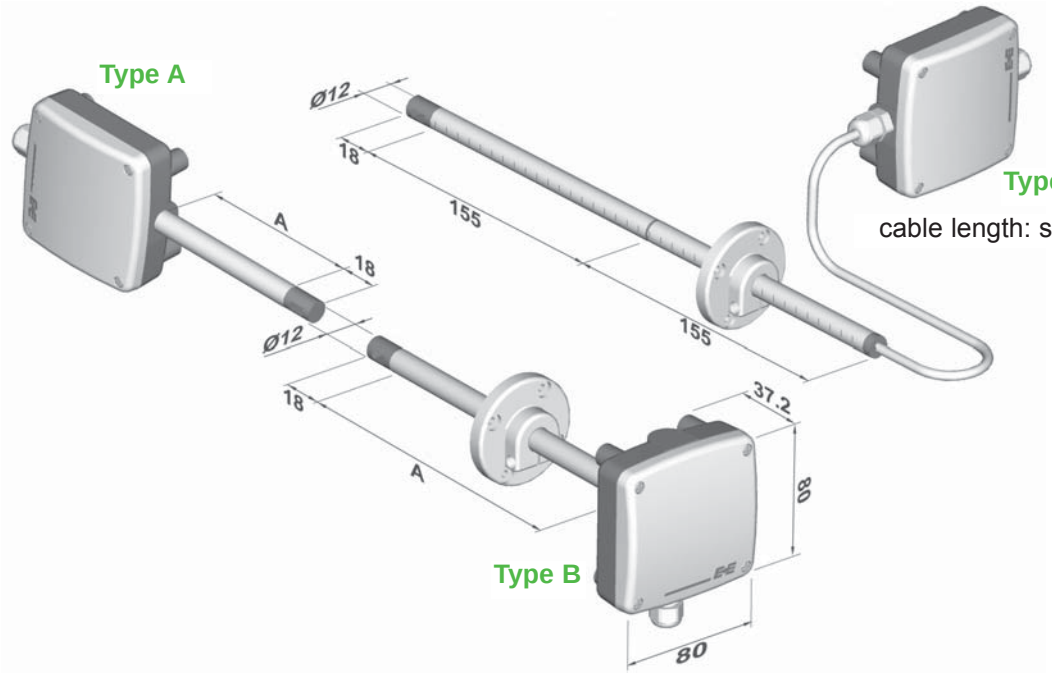
1) Selectable by jumper

2) Response time τ_{90} is measured from the beginning of a step change of air velocity to the moment of reaching 90% of the step.

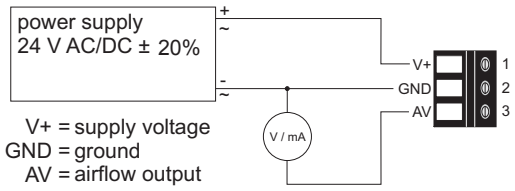
Temperature range	working temperature probe	-25...50°C (-13...122°F)
	working temperature electronic	-10...50°C (14...122°F)
	storage temperature	-30...60°C (-22...140°F)

Dimensions (mm)

1 mm = 0.03937" / 1" = 25.4 mm



Connection Diagram



Ordering Guide

MODEL		HOUSING		PROBE LENGTH (according to "A")		CABLE LENGTH (Type C only)		DISPLAY	
velocity	(V)	wall mounting	(A)	100mm (3.9")	(3)	1m (3.3ft)	(no code)	without display	(no code)
		duct mounting	(B)	200mm (7.9")	(5)	2m (6.6ft)	(K200)	with display	(D02)
		remote sensor probe	(C)	others	(x)	5m (16.4ft)	(K500)		
						10m (32.8ft)	(K1000)		
EE65-									

Order Example

EE65-VB5-D02

model:	velocity
housing:	duct mounting
probe length:	200mm (7.9")
display:	with LC display

EE575 Series

HVAC Miniature Air Velocity Transmitter

The EE575 is a compact air velocity transmitter designed for high volume applications. Due to the small design, the module can be fitted to nearly every application.
The use of a high-quality E+E thin film sensor element based on the hot film anemometer principle ensures optimal precision and maximum sensitivity.
The innovative design makes E+E velocity sensor elements less sensitive to dust and other pollution than conventional hot wire anemometers. This is reflected in the excellent reproducibility and proven long-term stability of the measuring results.


EE575

The EE575 can be mounted fast and easily.
The alignment strip along the probe's tube and the matching mounting flange determine the orientation of the sensor probe. The mounting flange allows for an infinitely variation of the depth of the sensor probe.
The electronics integrated in the probe tube provide a linear analogue signal of 0-5V or 0-10V for the velocity range 0...5m/s (0...1000ft/min) / 0...10m/s (0...2000ft/min) or 0...20m/s (0...4000ft/min).

Typical Applications

heating and ventilation systems
fan control
intake air measurement in furnaces

Features

excellent price/performance ratio
compact housing
easy and fast mounting
customization possible

Technical Data

Measuring values

Working range[1)]	0... 5m/s (0...1000ft/min) 0...10m/s (0...2000ft/min) 0...20m/s (0...4000ft/min)
Output signal[1)] 0...5m/s / 0...10m/s / 0...20m/s	0-5V (max. 1mA) 0-10V (max. 1mA)
Accuracy at 20°C / 68°F / 45%RH and 1013hPa	0.5... 5m/s (100...1000ft/min): ±(0.2m/s / 40ft/min +3% of measuring value) 1... 10m/s (200...2000ft/min): ±(0.3m/s / 60ft/min +4% of measuring value) 1... 20m/s (200...4000ft/min): ±(0.4m/s / 80ft/min +6% of measuring value)
Response time at 10m/s (2000ft/min) t_{90}	typ. 4 sec.

General

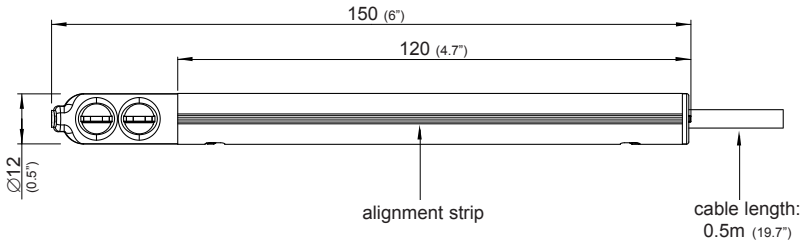
Supply voltage[1)]	10 - 19V DC or 19 - 29V DC
Current consumption	max. 70mA at 20m/s (4000ft/min)
Temperature ranges	working temperature: -20…60°C (4...140°F) storage temperature: -30…60°C (-22...140°F)
Connection	0.5m cable, PVC 3x0.25m² with cable end sleeves
Electromagnetic compatibility	EN61326-1 EN61326-2-3
Housing / Protection class	polycarbonate / IP20 (sensor); IP40 (housing)

CE

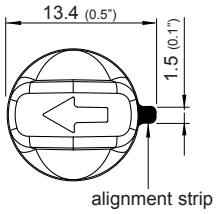
1) refer to ordering guide

Dimensions (mm)

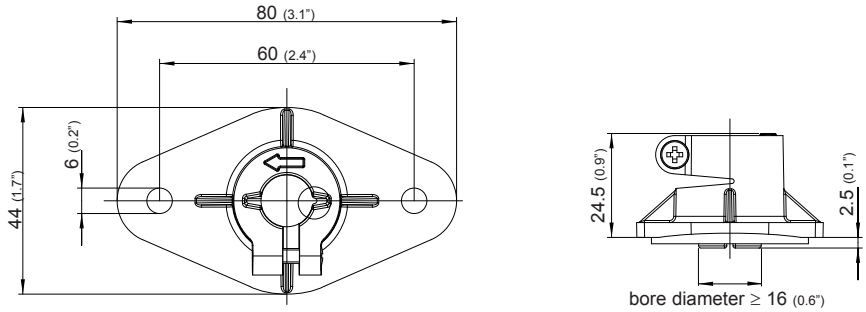
Probe:



Front view sensor head:



Flange (included in the scope of supply):



Cable Assignment

white → V+
brown → GND
green → output signal

Ordering Guide

MODEL		OUTPUT		WORKING RANGE		SUPPLY		CABLE LENGTH	
air velocity	(V)	0 - 5V	(2)	0...5m/s (0...1000ft/min)	(A)	10 - 19V DC	(1)	0.5m (1.6")	(no code)
		0 - 10V[1)]	(3)	0...10m/s (0...2000ft/min)	(B)	19 - 29V DC	(2)	2m (6.5")	(K200)
				0...20m/s (0...4000ft/min)	(C)				
EE575-									

1) with supply 19-29V DC only

Order Example

EE575-V2B1

Model:	air velocity
Output:	0 - 5V
Working range:	0...10m/s
Supply:	10 - 19V DC
Cable length:	0.5m

EE56 Series

Air Velocity Switch for low Velocity

EE56 air velocity switch is designed for special laminar flow and HVAC applications with a switching threshold between 0.2 and 2m/s (39.5...400ft/min) It is based on the innovative E+E thin film sensor working on the hot film anemometer principle. This has an outstanding accuracy at very low air velocity, which is not possible for conventional anemometers with commercial temperature sensors or NTC bead thermistors.
Moreover, the E+E sensor is much more insensitive to dust and dirt than all other anemometer principles. This means high reliability and low maintenance costs.

EE56 consists of an interchangeable sensing probe and a relay unit suitable for panel mounting. The electronics integrated in the sensing probe allow a cable length up to 10m (32.8ft) to the relays unit and ensure high immunity to electromagnetic perturbations.

Low angular dependence and an extension tube allows cost-effective, easy positioning of the sensing probe in ducts with diameter between 50 and 630mm (1.9 and 24.8"). For smooth plant start-up there is the possibility to set the delay time between 20 and 100 s.

Typical Applications

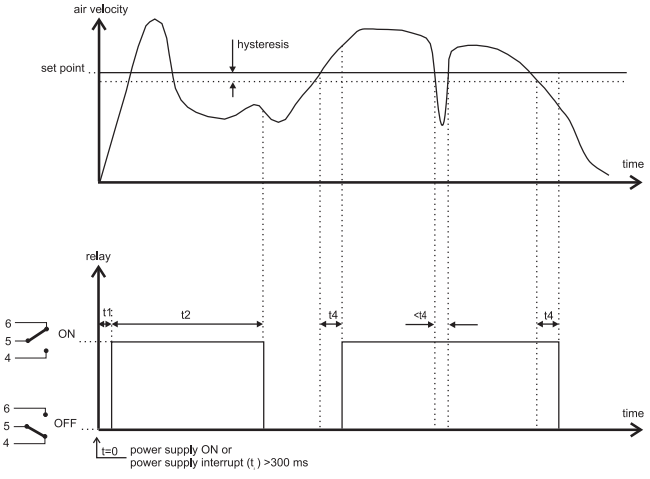
laminar flow control
clean room control

Features

measurements down to "0" m/s
compact case size
interchangeable sensing probe
easy setting of threshold and preset time
remote sensing probe up to 10m (32.8ft)
easy electric wiring
easy installation

Working Principle

The sensing probe, which can be supplied with up to maximum 10m (32.8ft) cable, gives a signal to the relay module which is proportional to the air velocity. This value is compared to the threshold value set on the front panel of the air velocity switch. The relay is released if the threshold is reached or exceeded. To start without a hitch there are fixed and variable time steps integrated.
When switching on the EE56 or in case of short failure of the main supply > 300 ms (t_3) there is a delay of about 100 ms (t_1) till the relay is switched on. Independent of the true value the relays remain in this state for a delay time (t_2) (adjustable) between 20 and 100 s. Only after that the air velocity switch reacts to the TRUE and RATED VALUE. The reaction time is limited by the response time (t_4) of the sensor probe which is about 2 s. The described function is related to continous operation, which is reached after a warm-up phase of approx. 3 min after applying the supply voltage.



Technical Data

Measuring values

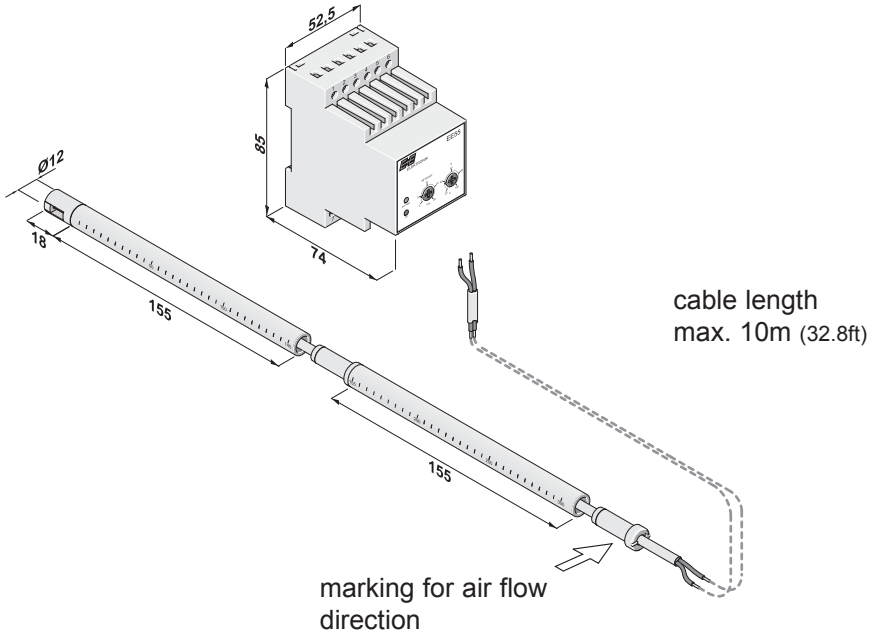
Working range threshold	0.2...2m/s (40...400ft/min)
Setting accuracy	typ. ± 6 % of end value
Repeatability at 20°C	± 5 % of measuring value
Hysteresis	3 % of measuring value, min. 0.05m/s (10ft/min)
Deviation by probe exchange	± 5 % of measuring value (max.)
Temperature dependence	typ. 0.3 % /°C (typ. 0.17 % / °F)
Switching output (relays 250 V)	10 A for ohmic load 3 A for inductive load

General

Supply voltage		
Type A	24 VAC/DC ± 10 %	
Type B	230V AC	
Current consumption		
Type A	max. 85 mA DC	max. ~150 mA_{eff}
Type B	max. 20 mA_{eff}	
Switching delay time (t_2)	adjustable 20 to 100 s	
Response time (t_4)	approx. 2 s	
Probe cable length	2.5m or 10m (8.2 or 32.8ft)	
Electrical connection	screw terminals up to 1.5 mm^2 (AWG 16)	
Protection class		
sensor probe	Polycarbonate / IP20	
housing	Polycarbonate / IP30	
Electromagnetic compatibility	EN61326-1 EN61326-2-3	CE
Temperature range		
sensor probe	-30...80°C (-22...176°F)	
housing	-20...60°C (-4...140°F)	
storage	-30...60°C (-22...176°F)	

Dimensions (mm)

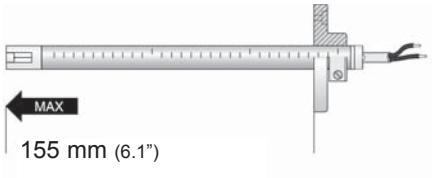
1 mm = 0.03937” / 1”= 25.4 mm



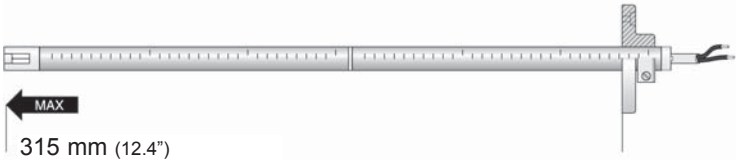
Depth of immersion

To adjust the probe length to the air duct dimensions the sensor probe consists of two parts (sensor head and extension tube). The extension tube should be used for duct diameters > 310 mm (12.2").

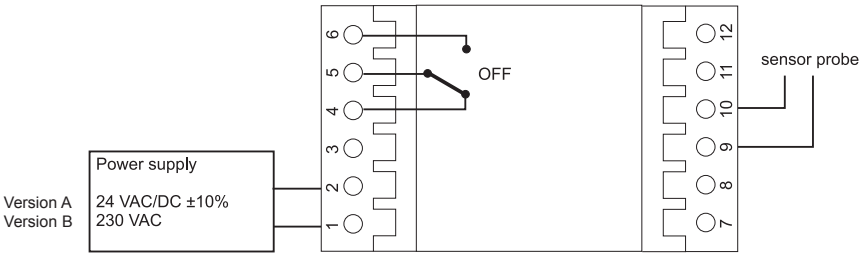
without extension tube



with extension tube



Connection Diagram



Ordering Guide

MODEL		POWER SUPPLY		PROBE CABLE LENGTH	
air velocity switch	(V)	24V DC/AC	(A)	2.5m (8.2ft)	(25)
		230V AC	(B)	10m (32.8ft)	(100)
EE56-					

Order Example

EE56-VA25

model:	air velocity switch
power supply:	24V DC/AC
probe cable length:	2.5 m (8.2ft)

EE55 Series

Air Velocity Switch for HVAC Applications

The EE55 air velocity switch is designed for standard HVAC applications with a switching threshold between 2 and 20 m/s (400...4000ft/min). It is based on the innovative E+E thin film sensor working on the hot film anemometer principle. This element is distinguished by its outstanding accuracy over the whole working range and its approved long term stability.
Moreover, the E+E sensor is much more insensitive to dust and dirt than other anemometer principles. This means high reliability and low maintenance costs.

EE55 consists of an interchangeable sensing probe and a relay unit suitable for panel mounting. The electronics integrated in the sensing probe allow a cable length up to 10m (32.8ft) to the relays unit and ensure high immunity to electromagnetic perturbations.

Low angular dependence and an extension tube allows cost-effective, easy positioning of the sensing probe in ducts with diameter between 50 and 630mm (1.9 and 24.8”). For smooth plant start-up there is the possibility to set the delay time between 20 and 100 s.

Typical Applications

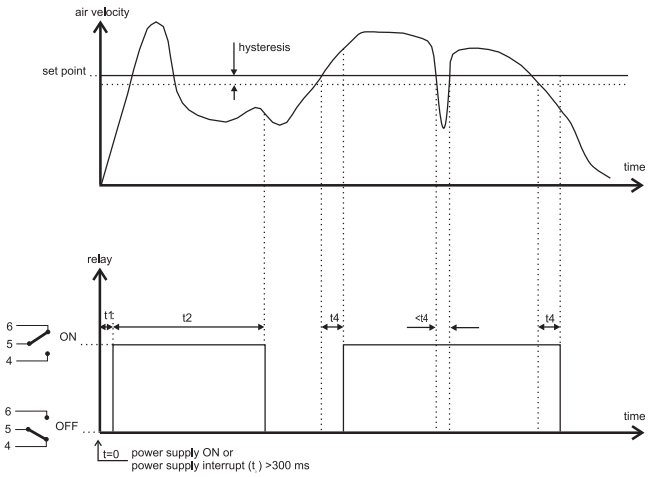
HVAC control
environmental control

Features

compact case size
interchangeable sensing probe
easy setting of threshold and preset time
remote sensing probe up to 10m (32.8ft)
easy electric wiring
easy installation

Working Principle

The sensing probe, which can be supplied with up to maximum 10m (32.8ft) cable, gives a signal to the relay module which is proportional to the air velocity. This value is compared to the threshold value set on the front panel of the air velocity switch. The relay is released if the threshold is reached or exceeded. To start without a hitch there are fixed and variable time steps integrated.



When switching on the EE55 or in case of short failure of the main supply > 300 ms (t_3) there is a delay of about 100 ms (t_1) till the relay is switched on. Independent of the true value the relays remain in this state for a delay time (t_2) (adjustable) between 20 and 100 s. Only after that the air velocity switch reacts to the TRUE and RATED VALUE. The reaction time is limited by the response time (t_4) of the sensor probe which is about 2 s. The described function is related to continous operation, which is reached after a warm-up phase of approx. 3 min after applying the supply voltage.

Technical Data

Measuring values

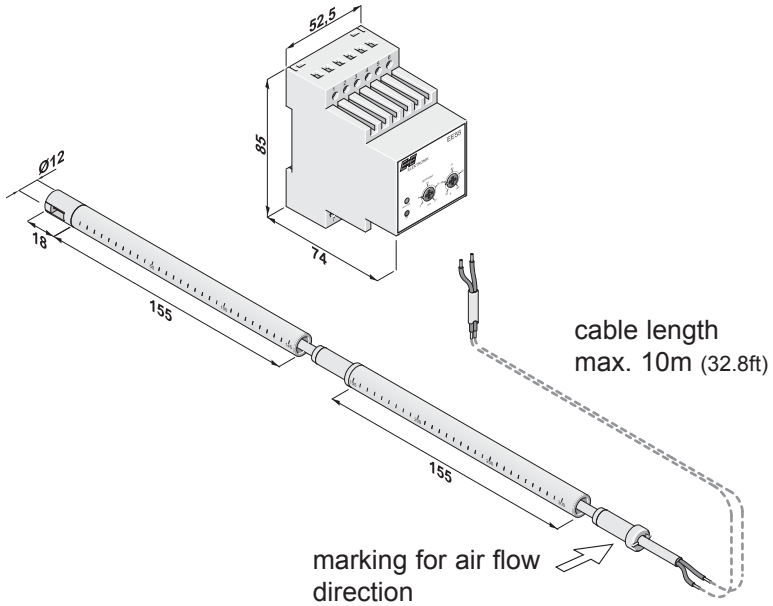
Working range threshold	2...20m/s (400...4000ft/min)
Setting accuracy	typ. ± 6 % of end value
Repeatability at 20°C (68°F)	± 5 % of measuring value
Hysteresis	3% of measuring value, min. 0.05m/s (10ft/min)
Deviation by probe exchange	± 5 % of measuring value (max.)
Temperature dependence	typ. 0.3 % /°C (typ. 0.17 % / °F)
Switching output (relays 250 V)	10 A for ohmic load 3 A for inductive load

General

Supply voltage		
Type A	24V AC/DC ± 10 %	
Type B	230V AC	
Current consumption		
Type A	max. 85 mA DC	max. ~150 mA_{eff}
Type B	max. 20 mA_{eff}	
Switching delay time (t_2)	adjustable 20 to 100 s	
Response time (t_4)	approx. 2 s	
Probe cable length	2.5m or 10m (8.2 or 32.8ft)	
Electrical connection	screw terminals up to 1.5 mm^2 (AWG 16)	
Protection class		
sensor probe	Polycarbonate / IP20	
housing	Polycarbonate / IP30	
Electromagnetic compatibility	EN61326-1 EN61326-2-3	CE
Temperature range		
sensor probe	-30...80°C (-22...176°F)	
housing	-20...60°C (-4...140°F)	
storage	-30...60°C (-22...140°F)	

Dimensions (mm)

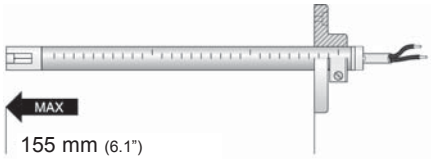
1 mm = 0.03937” / 1” = 25.4 mm



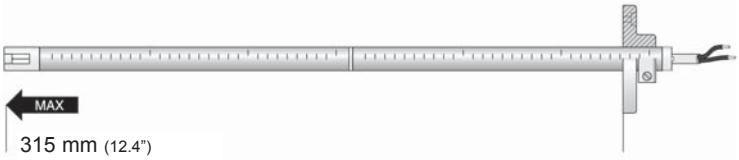
Depth of immersion

To adjust the probe length to the air duct dimensions the sensor probe consists of two parts (sensor head and extension tube). The extension tube should be used for duct diameters > 310 mm (12.2”).

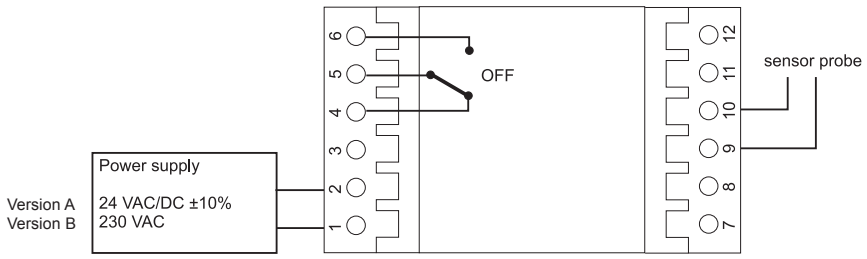
without extension tube:



with extension tube:



Connection Diagram



Ordering Guide

MODEL		POWER SUPPLY		PROBE CABLE LENGTH	
air velocity switch	(V)	24V DC/AC 230V AC	(A) (B)	2.5m (8.2ft) 10m (32.8ft)	(25) (100)
EE55-					

Order Example

EE55-VB100

model:	velocity switch
power supply:	230V AC
probe cable length:	10m (32.8ft)

CO_2 Measurement

Transmitters

EE85
EE80
EE82

Module

EE89

EE85 Series

CO_2 Transmitter and Switches for Duct Mounting

Duct mounted CO_2 transmitters and switches of the EE85 series are designed for HVAC applications. The CO_2 sensing element uses the Non-Dispersive Infrared Technology (NDIR). A patented auto-calibration procedure compensates for drift caused by the aging of the sensing element and guarantees outstanding long term stability.
Installed into a duct a small flow of air will be established by convection through the probe into the transmitter housing and back into the duct. Inside the transmitter housing the air will diffuse through a membrane into the CO_2 sensing element.
The operation in closed loop air stream avoids pollution of the CO_2 sensor.
Measuring ranges of 0...2000/5000/10000ppm correspond to an analogue interface of 0 - 5/10V or 4 - 20mA. Selectively a switching output with adjustable switching point and hysteresis is available. The instruments can be easily positioned in the duct with the standard mounting flange.

Typical Applications

building management for residental and office areas
ventilation control

Features

very simple installation
compact housing
auto-calibration
measuring ranges: 0...10000ppm
analogue or switching output

Technical Data

Measuring Values

CO_2

Measurement principle	Non-Dispersive Infrared Technology (NDIR)	
Sensing element	E+E Dual Source Infrared System	
Measuring range	0...2000 / 5000 / 10000ppm	
Accuracy at 25°C (77°F)	0...2000ppm:	< ± (50ppm +2% of measuring value)
and 1013mbar	0...5000ppm:	< ± (50ppm +3% of measuring value)
	0...10000ppm:	< ± (100ppm +5% of measuring value)
Response time τ_{63} [1)]	< 195s	
Temperature dependence	typ. 2ppm CO_2/°C	
Long term stability	typ. 20ppm / year	
Sample rate	approx. 15s	

Outputs

Analogue Output

0...2000 / 5000 / 10000ppm	0 - 5V	-1mA < I_L < 1mA
	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm

Switching Output

Max. switching voltage	50V AC / 60V DC	
Max. switching load	1A at 50V AC	1A at 24V DC
Min. switching load	1mA at 5V DC	
Contact material	Ag+Au clad	

General

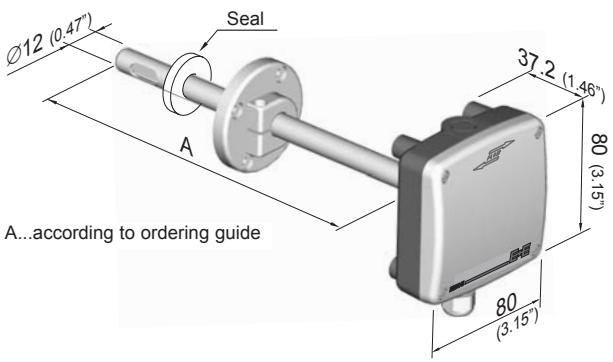
Supply voltage	24V AC ±20%	15 - 35V DC
Current consumption	typ. 10mA + output current	
	max. 0.5A for 0.3s	
Warm up time [2)]	< 5 min	
Housing / protection class	PC / housing: IP65, probe: IP20	
Cable gland	M16 x 1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")
Electrical connection	screw terminals max. 1.5 mm² (AWG 16)	
Electromagnetic compatibility	EN61326-1	FCC Part 15
	EN61326-2-3	ICES-003 ClassB
Working temperature and conditions	-20...60°C (-4...140°F)	0...95% RH (not condensating)
Storage temperature and conditions	-20...60°C (-4...140°F)	0...95% RH (not condensating)

CE

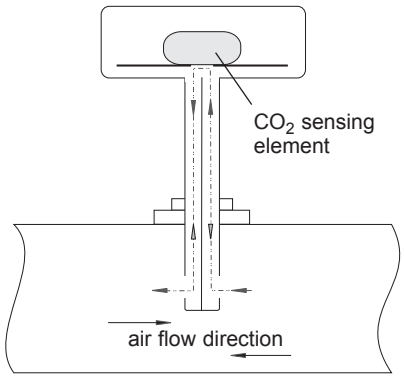
1) minimum flow speed 1m/s (200ft/min)

2) warm up time for performance according to specification

Dimensions (mm)



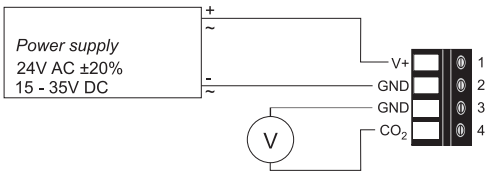
Operation Principle



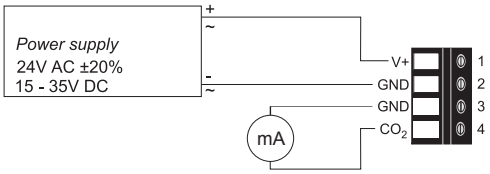
Connection Diagram

Analogue Output

EE85-xC2/3x

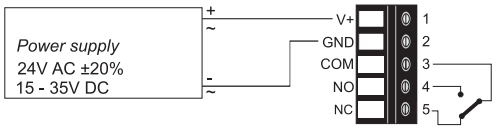


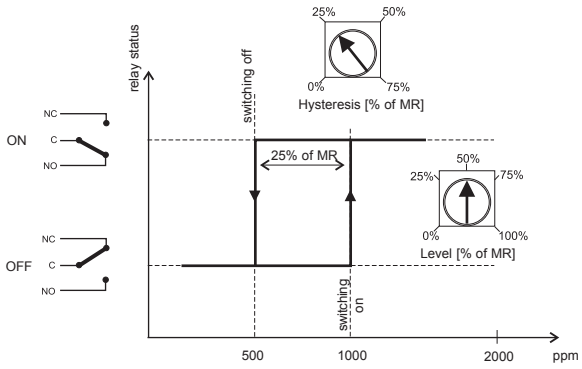
EE85-xC6x



Switching Output

EE85-xCSx





Ordering Guide

MEASURING RANGE	MODEL	OUTPUT	PROBE LENGTH (see dimensions "A")
0...2000ppm (2)	CO_2 (C)	0 - 5V (2)	50mm (2)
0...5000ppm (5)		0 - 10V (3)	200mm (5)
0...10000ppm (10)		4 - 20mA (6)	
		switching output (S)	
EE85-			

Order Example

EE85-5C35

measuring range:	0...5000ppm
model:	CO_2
output:	0 - 10V
probe length:	200mm

EE80 Series

HVAC Room Transmitter and Switches for CO_2, Relative Humidity and Temperature

EE80 series set new standards in CO_2 measurements for HVAC. The transmitters resp. switches combine CO_2, relative humidity (RH) and temperature (T) measurement in one modern and user-friendly housing.
The basic EE80 version for CO_2 and T can be easily extended with a RH plug-in module.
The CO_2 measerument is based on the infrared principle. A patented auto-calibration procedure compensates for the aging of the infrared source and ensures outstanding long term stability.
EE80 provides analogue outputs (in V or mA). The optional display indicates sequentially the actual measuring data.
As one more option a switching output with adjustable switching point and hysteresis is available.
A wide variety of models ensures an optimal adjustment for customised requirements.

Typical Applications

building management for residential and office areas
ventilation control

Features

CO_2 / RH / T measurement in one device
RH output with plug-in module
analogue or switching output
modern design
optional display
easiest installation
long-term stable

Technical Data

Measuring values

CO_2

Measurement principle	Non-Dispersive Infrared Technology (NDIR)	
Sensor	E+E Dual Source Infrared System	
Working range	0...2000 / 5000ppm	
Accuracy at 25°C (77°F)	0...2000ppm:	< ± (50ppm +2% of measuring value)
and 1013mbar	0...5000ppm:	< ± (50ppm +3% of measuring value)
Response time t_{63}	< 195s	
Temperature dependence	typ. 2ppm CO_2/°C	
Long term stability	typ. 20ppm / year	
Sample rate	approx. 15s	

Temperature

Accuracy at 20°C (68°F)	±0.3°C (±0.54°F)	version with current output 4 - 20mA: ±0.7°C (±1.26°F)

Relative Humidity

Measurement principle	capacitive	
Sensor element	HC103	
Working range[1)]	10...90% RH	
Accuracy at 20°C (68°F)	±3% RH (30...70% RH)	±5% (10...90% RH)

Outputs

Analogue Output

0...2000 / 5000ppm /	0 - 5V	-1mA < I_L < 1mA
0...100% RH / 0...50°C (32...122°F)	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm

Switching Output

Max. switching voltage	50V AC / 60V DC	
Max. switching load	1A at 50V AC	1A at 30V DC
Min. switching load	1mA at 5V DC	
Contact material	Ag+Au clad	

General

Supply voltage	24V AC ±20%	15 - 35V DC
Current consumption	typ. 10mA + output current max. 0.5A for 0.3s	
Warm up time[2)]	< 5 min	

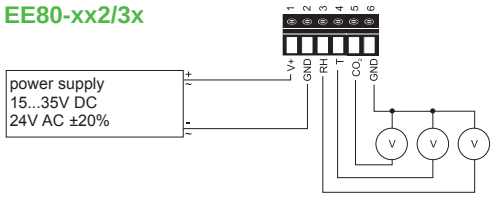
Display	LC display: alternating CO_2 (ppm) / T (°C or °F) / RH (% RH)	
Electrical connection	screw terminals max. 1.5 mm^2 (AWG16)	
Electromagnetic compatibility	EN61326-1	FCC Part 15
	EN61326-2-3	ICES-003 ClassB
Working temperature range	0...90% RH (non condensing) / -20...60°C (-4...140°F)	
Storage temperature range	0...90% RH (non condensing) / -20...60°C (-4...140°F)	

1) refer to the working range of the humidity sensor HC103!
2) warm up time for performance according specification

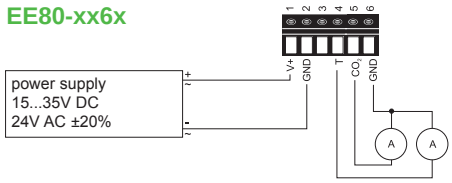
Connection Diagram

Analogue Output

EE80-xx2/3x

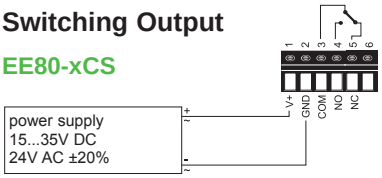


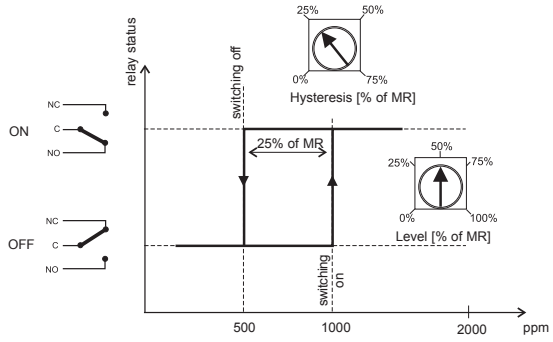
EE80-xx6x



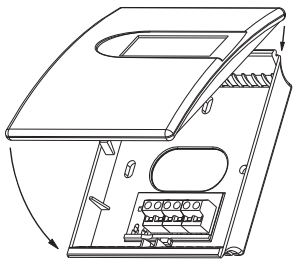
Switching Output

EE80-xCS





Housing Dimensions (mm)



W x H x D = 85 x 100 x 26mm (3.3 x 3.9 x 1")

Material of housing: PC
Protection class: IP30

Colour of housing: Cover: RAL 9003 (signal white)
Back: RAL 7035 (light grey)

Ordering Guide

EE80 voltage / current output:

WORKING RANGE	MODEL	OUTPUT	DISPLAY	T-UNIT	T-SCALE
0...2000ppm (2)	CO_2 + T (CT)	0-5V (2)	without display (--)	°C (--)	0...50 (T04)
0...5000ppm (5)	CO_2 + T + RH (CTF)	0-10V (3)	with display (D04)	°F (E01)	-5...55 (T31)
		4-20mA[1] (6)			0...40 (T55)
					other (Txx)
EE80-					

1) current output (6) not available for model CTF

EE80 switching output:

WORKING RANGE	MODEL	OUTPUT	DISPLAY
0...2000ppm (2)	CO_2 (C)	switching output (S)	without display (--)
0...5000ppm (5)			with display (D04)
EE80-			

Order Example

EE80-2CT3D04-T04

Version with voltage output:
Working range: 0...2000ppm
Model: CO_2 + T
Output: 0-10V
Display: with display
T-Unit: °C
T-Scale: 0...50°C (32...122°F)

Accessories

- humidity plug-in module (HA011003)

EE82 Series

CO_2 Transmitters and Switches for Agriculture Applications

Measuring instruments in green houses or life stock barns are exposed to a very demanding environment: high humidity levels, pollutants like fertilizers, herbicides and high ammonia concentrations are just a few of the many hazards.
The robust, functional housing of the EE82 with integrated special filter has been designed for such applications.

The air diffuses through the filter into the instrument enclosure. Then the air diffuses further through a second membrane filter integrated in the CO_2 measuring cell.

The CO_2 measurement is based on the non-dispersive infrared (NDIR) technology. The patented auto-calibration procedure compensates for aging of the infrared source and guarantees high reliability, long term stability and eliminates the need of periodical recalibration in the field.

Measuring ranges of 0...2000/5000/10000ppm correspond to an analogue interface of 0 - 5/10V or 4 - 20mA. Selectively a switching output with adjustable switching point and hysteresis is available.

The very practical snap-in mounting flange and connector for the supply voltage and outputs allow quick and easy installation of the EE82 without ever opening the housing.

Typical Applications

green houses
fruit and vegetable storage
life stock barns

Features

easy installation
compact housing
auto-calibration
measuring range 0...10000ppm
analogue or switching output

Technical Data

Measuring Values

Measuring principle	Non-Dispersive Infrared Technology (NDIR)	
Sensing element	E+E Dual Source Infrared System	
Measuring range	0...2000 / 5000 / 10000ppm	
Accuracy at 25°C (77°F)	0...2000ppm:	< ± (50ppm +2% of measuring value)
and 1013mbar	0...5000ppm:	< ± (50ppm +3% of measuring value)
	0...10000ppm:	< ± (100ppm +5% of measuring value)
Response time τ_{63}	< 195s	
Temperature dependence	typ. 2ppm CO_2/°C	
Long term stability	typ. 20ppm / year	
Sample rate	approx. 15s	

Output

Analogue Output

0...2000 / 5000 / 10000ppm	0 - 5 / 0 - 10V	-1mA < I_L < 1mA
	4 - 20mA	R_L < 500 Ohm

Switching Output

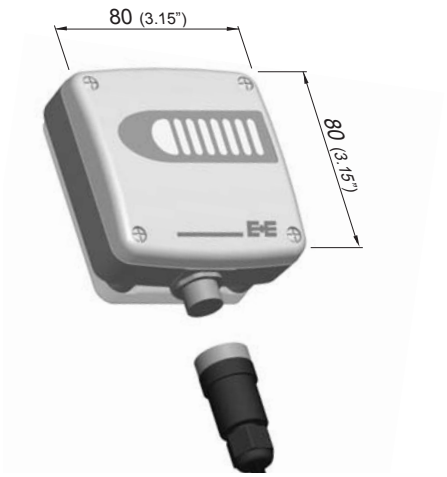
Max. switching voltage	50V AC / 60V DC	
Max. switching load	1A at 50V AC	1A at 30V DC
Min. switching load	1mA at 5V DC	
Contact material	Ag+Au clad	

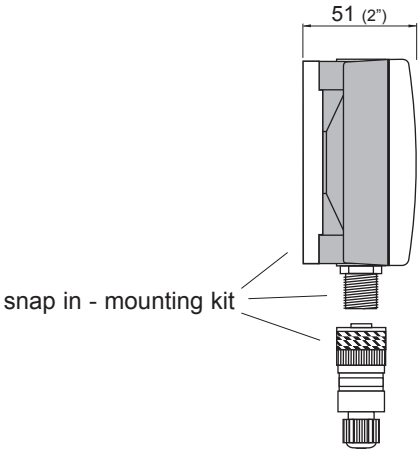
General

Supply voltage	24V AC ±20%	15 - 35V DC
Current consumption	typ. 10mA + output current	
	max. 0.5A for 0.3s	
Warm up time[1)]	< 5 min	
Housing / protection class	PC / IP54	
Electrical connection	M12 plug	
Electromagnetic compatibility	EN61326-1	FCC Part 15
	EN61326-2-3	ICES-003 ClassB
Working temperature and conditions	-20...60°C (-4...140°F)	0...100% RH
Storage temperature and conditions	-20...60°C (-4...140°F)	0...95% RH (not condensating)

1) warm up time for performance according specification

Dimensions (mm)

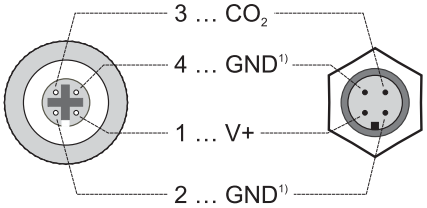




Connection Diagram

Analogue Output

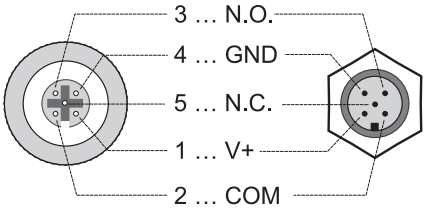
EE82-xC2/3/6

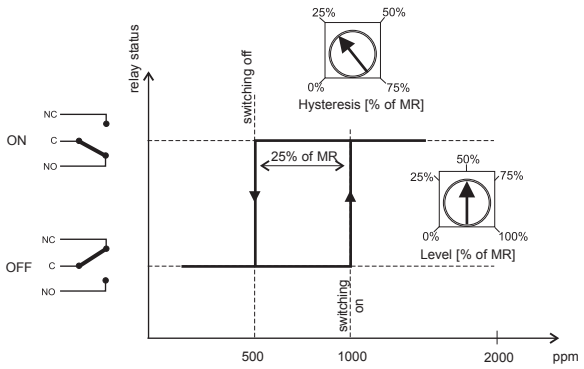


1) GND internally conected

Switching Output

EE82-xCS





Ordering Guide

MEASURING RANGE		MODEL		OUTPUT	
0...2000ppm	(2)	CO_2	(C)	0 - 5V	(2)
0...5000ppm	(5)			0 - 10V	(3)
0...10000ppm	(10)			4 - 20mA	(6)
				switching output	(S)
EE82-					

Order Example

EE82-5C3

Measuring range:	0...5000ppm
Model:	CO_2
Output:	0 - 10V

EE89 Series

Miniature CO_2 Module for OEM / HVAC Applications

alterations according to customer specifications possible

The EE89 series CO_2 miniature module is designed especially for mass production and OEM applications.

The measuring principle is based on infrared technology (NDIR).

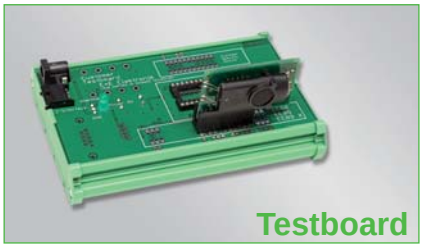
The EE89 series is maintenance free because of the patented E+E auto-calibration feature, compensating for the effects of aging and therefore warrants outstanding long term stability.

The output of the digital interface allows easy signal processing.

Contact pads at the edge or contact pins provide multiple ways of mounting the board.

With the EE89 testboard it is possible to display and save the measured values of the EE89 on the PC. An E2-RS232 adapter, a power supply unit and the EE89 evaluation software are included in the scope of supply.


EE89


Testboard

Typical Applications

OEM
building management
demand HVAC installations

Features

maintenance free
autocalibration
highest accuracy
excellent long term stability
small dimensions
digital interface

Technical Data

Measuring values

CO_2

Measurement principle	Non-Dispersive Infrared Technology (NDIR)		
Sensor	E+E Dual Source Infrared System		
Working range	0...2000 / 5000 / 10000ppm		
Accuracy at 25°C (77°F) and 1013mbar	0...2000ppm:	< ± (50ppm +2% of measuring value)	
	0...5000ppm:	< ± (50ppm +3% of measuring value)	
	0...10000ppm:	< ± (100ppm +5% of measuring value)	
Response time t_{63}	< 195s		
Temperature dependence	typ. 2ppm CO_2/°C (0...50°C / 32...122°F)		
Long term stability	typ. 20ppm / year		
Sampling rate	approx. 15s		

Output

0...2000 / 5000 / 10000ppm	digital E2 interface (details: www.epluse.com)		

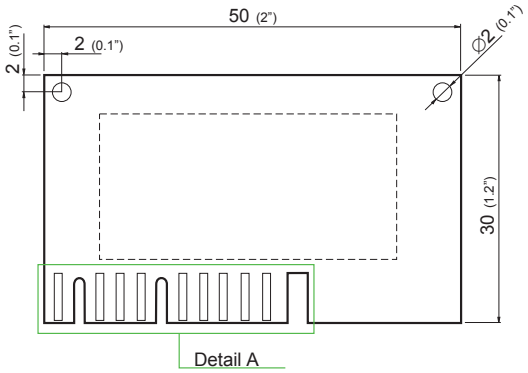
General

Supply voltage	4.75 - 7.5V DC		
Current consumption	typ. 7mA max. 0.5A for 0.3s		
Warm up time[1)]	< 5 min		
Electrical connection	contact pads or contact pins, grid 2.54mm (100mil)		
Working conditions	-20...60°C (-4...140°F)	5...95% RH (not condensating)	85...110kPa
Storage conditions	-20...60°C (-4...140°F)	5...95% RH (not condensating)	70...110kPa
Dimensions	50 x 30mm (2 x 1.2")		
Weight	approx. 15g (0.5oz)		

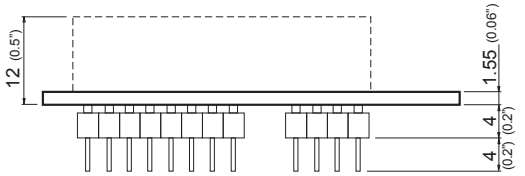
1) warm up time to reach specification values

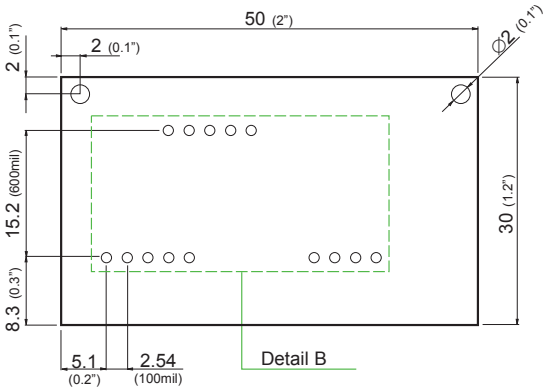
Connection Diagram / Dimensions (mm)

Mounting X (Contact Pads)

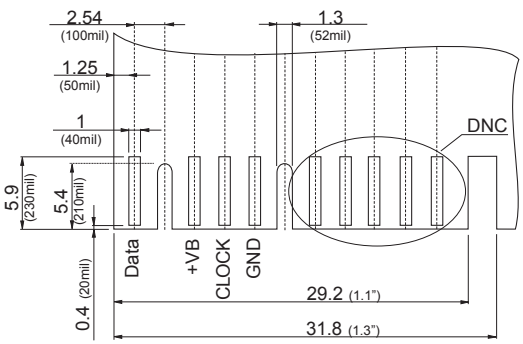


Mounting Y (Contact Pins)
designed for 28 pin socket or PCB soldering

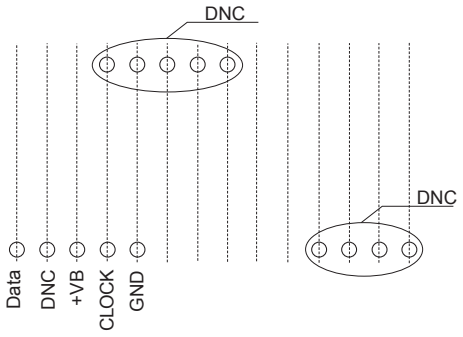




Detail A / Connection Diagram:



Detail B / Connection Diagram:



DNC...do not connect

Ordering Guide

MEASURING RANGE		TYPE		OUTPUT		MOUNTING	
0...2000ppm 0...5000ppm 0...10000ppm	(2) (5) (10)	CO_2	(C)	digital interface	(9)	contact pads contact pins	(X) (Y)
EE89-							

Order Example

EE89-2C9Y

measuring range: 0...2000ppm
type: CO_2
output: digital interface
mounting: contact pins

Accessories

EE89 testboard (HA011010)

Temperature

Measurement

Transmitters

EE22-T
EE16-T
EE10-T

Hand-helds

THERMOPORT 20
OMNIPORT 20

EE22-T Series

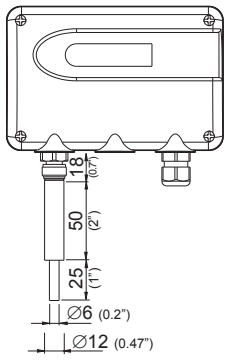
Temperature Transmitter with interchangeable probes

Unique for the EE22-T series are the interchangeable sensing probes with connector.
The calibration data is stored in the probes, which are therefore interchangeable and probe replacement does not affect the performance of EE22-T.
The outstanding accuracy over the entire temperature range is based on very precise calibration methods and on the latest microprocessor technology. Well-proven E+E humidity sensor elements ensure excellent long-term stability.
For high temperature applications (up to +80°C / +176°F) or in case of limited space availability, the sensing probes can be connected to EE22-T housing with cables (2m, 5m or 10m / 6.6ft, 16.4ft or 32.8ft) without any repercussions for the overall accuracy of the instrument.
Voltage 0 - 1 / 10V or current 4 - 20mA (2 wire) outputs are available, of which the temperature output can be scaled according to the application (see ordering guide).

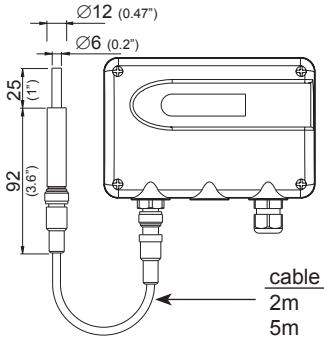
EE22-T is suitable for direct wall mounting and for installation on rails according to DIN EN 50022.
For easy duct mounting a duct mounting kit is available as an option.
An optional display indicates the actual T values.

Probe Dimensions (mm)

with plugable T probe
EE22-xTx1x

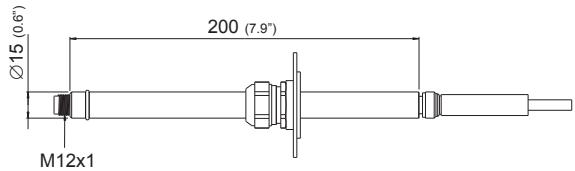


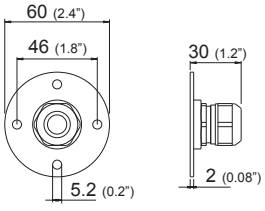
with remote T probe
EE22-xTx1x
+HAxxxx



cable length	ordering code
2m	HA010801
5m	HA010802
10m	HA010803

duct mounting kit:





Typical Applications

pharmaceutical industry
clean rooms
storage rooms
green houses
cooling chambers

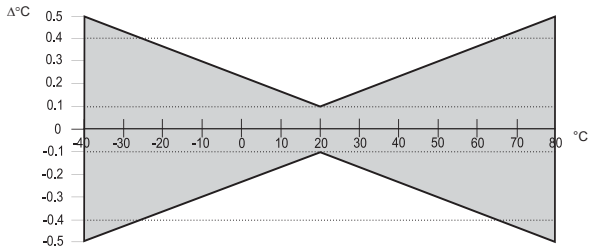
Features

accuracy ±0,1°C at 20°C
interchangeable probes
remote sensing probe up to 10m (32.8ft)
measuring range -40...80°C (-40...176°F)
optional display
traceable calibration
cost saving, easy loop-calibration of T probes

Technical Data

Measuring values of sensing probe

Temperature

Sensor element	Pt1000 (tolerance class A, DIN EN 60751)
Working range sensing probe	fixed sensing probe: -40...60°C (-40...140°F) remote sensing probe: -40...80°C (-40...176°F)
Accuracy (±0.1°C at 20°C)	
Temperature dependence of electronics	typ. ± 0.007°C/°C
Response time	t_{63}: typ. < 6min

Outputs

xx...yy°C[1)]	0 - 1V	-0.5mA < I_L < 0.5mA
(temperature output scale according to Txx ordering code)	0 - 10V	-1mA < I_L < 1mA
	4 - 20mA (two wire)	R_L < 500 Ohm
Temperature dependence of analogue outputs	max. 0.2 $\frac{mV}{°C}$ resp. 1 $\frac{\mu A}{°C}$	
Resolution voltage output	0.6mV	
current output	4.3µA	

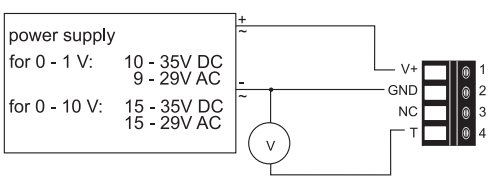
General

Supply voltage			
for 0 - 1V output	10 - 35V DC	or	9 - 29V AC
for 0 - 10V output	15 - 35V DC	or	15 - 29V AC
for 4 - 20mA output	10 - 35V DC		
Load resistor for 4 - 20mA output	$R_L < \frac{U_V - 10V}{0.02\ A}$ [Ω]		
Current consumption	typ. 10mA for DC supply		typ. $20mA_{eff}$ for AC supply
Electrical connection	screw terminals max. $2.5mm^2$		
Cable gland	M16x1.5 or connector (type: Lumberg, RSF 50/11)		
Material	housing: PC or Al Si 9 Cu 3		probe: stainless steel 1.4571 (316Ti)
Protection class of housing	IP65; Nema 4		
Electromagnetic compatibility	EN61326-1 Industrial Environment	EN61326-2-3	ICES-003 ClassB FCC Part15 ClassB
Working temperature range of probe	-40...60°C (-40...140°F) / 80°C (176°F) for remote sensing probe		
Working temperature range of electronics	-40...60°C (-40...140°F)		
Storage temperature range	-40...60°C (-40...140°F)		

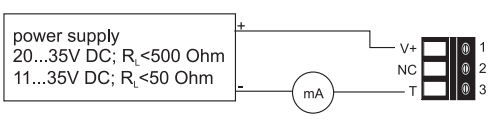
1) Refer to ordering guide

Connection Diagram

EE22-T1,3xx

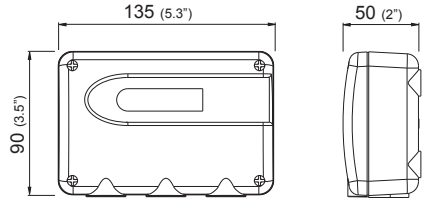


EE22-T6xx

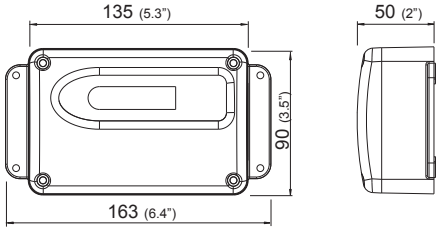


Housing Dimensions (mm)

polycarbonate housing



metal housing



For use in harsh industrial environments all models of EE22-T series are available in a robust metal housing.
The smooth surface and the rounded outlines allow for the use in clean room applications.

Ordering Guide

Position 1 - Transmitter **EE22-**

Hardware Configuration				
Housing	metal housing			**M**
	polycarbonate housing			**P**
Type	temperature			**T**
Output	0-1V			**1**
	0-10V			**3**
	4-20mA			**6**
Model	wall mounting - cable gland M16x1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")		**A**
	wall mounting - rear cable outlet			**F**
Probe	1 probe T			**1**
Display	without display			
	with display			**D07**
Plug	without plug			
	1 plug for power supply and outputs			**C03**
Software Configuration				
T-Unit	°C			
	°F			**E01**
Scaling of T-output in°C or °F	-40...60 **(T02)**	0...120 **(T16)**	-20...50 **(T48)**	**Select according to Ordering Guide (Txx)**
	-10...50 **(T03)**	-30...60 **(T20)**	-40...176 **(T80)**	
	0...50 **(T04)**	0...80 **(T21)**	0...140 **(T85)**	
	0...60 **(T07)**	-40...80 **(T22)**	0...176 **(T86)**	
	-30...70 **(T08)**	-20...80 **(T24)**	32...120 **(T90)**	**Other T-scaling refer to page 146**
	-10...70 **(T11)**	-20...60 **(T25)**	32...140 **(T91)**	
	-40...120 **(T12)**	-30...50 **(T45)**	32...132 **(T96)**	
Position 2 - Probe cable				
Cable length	2m (6.6ft)			**HA010801**
	5m (16.4ft)			**HA010802**
	10m (32.8ft)			**HA010803**

Accessories / Replacement Parts

(For further information see data sheet "Accessories", page 138)

- probe cable 2m (6.6ft) / 5m (16.4ft) / 10m (32.8ft) (HA0108xx)
- bracket for rail installation (HA010203)
- external supply unit (V02)
- Replacement probe T in metal (EE07-MT)
- Display + housing cover in polycarbonate (D07P)
- Display + housing cover in metal (D07M)
- Reference probes (HA010403)
- Duct mounting kit (HA010209)

Order Example

Position 1 - Transmitter:

EE22-MT3A1C03/T07

housing:	metal housing
type:	temperature
output:	0-10V
model:	wall mounting - cable gland M16x1.5
probe:	1probe T
display:	without display
plug:	1 plug for power supply and outputs
T-Unit:	°C
scaling of T-output:	0...60°C

Position 2 - Probe cable:

HA010802

cable length:	5m (16.4ft)

EE16-T Series

Temperature Transmitters for HVAC Applications

EE16 temperature transmitters are the ideal solution for accurate measurement of temperature in the range 0...50°C (32...122°F) in HVAC applications.

EE16 temperature transmitters are available as wall or duct mounted with current or voltage output signals.

Typical Applications

building-automation
storage rooms
climate and ventilation control

Features

excellent price/performance ratio

Technical Data

Measuring values

Temperature (active output)

Sensor	Pt1000 (class A, DIN EN 60751)	
Output appropriate 0...50°C (32...122°F)	0-10 V	-1 mA < I_L < 1 mA
	4-20 mA (two wire)	R_L < 500 Ohm
Accuracy at 20°C (68°F)[1)]	±0.3°C (±0.5°F)	

Temperature (passive output)

Type of T-Sensor	please see ordering guide

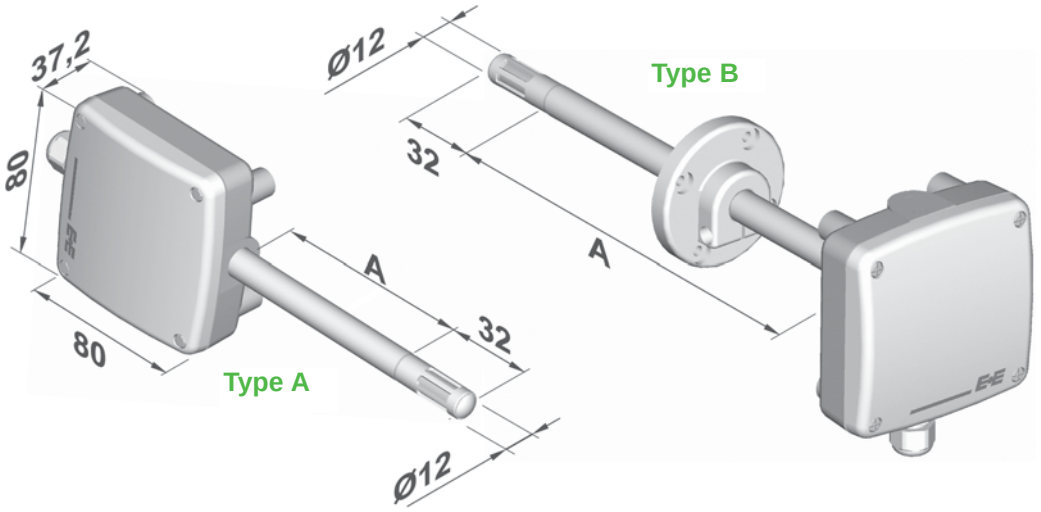
General

Supply voltage		
for 0 - 10 V	15 - 35V DC or	24V AC ±20%
for 4 - 20 mA	10V + R_L x 20 mA < U_v < 35V DC	
Current consumption	for DC supply	typ. 8 mA
	for AC supply	typ. 20 mA_{eff}
Electrical connection	screw terminals max. 1.5 mm^2 (AWG 16)	
Housing / protection class	Polycarbonate / IP65, Nema 4	
Cable gland	M16x1.5	cable Ø 4.5 - 10 mm (0.18 - 0.39")
Sensor protection	membrane filter or plastic grid	
Electromagnetic compatibility	EN61326-1 EN61326-2-3	CE
Temperature range	working temperature:	-5...50°C (23...122°F)
	storage temperature:	-25...60°C (-13...140°F)

1) Please note: temperature accuracy EE16-T6x2x: ±0.5°C (±0.9°F)

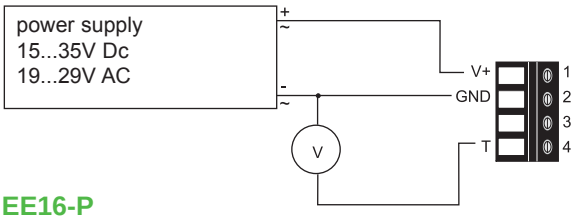
Dimensions (mm)

1 mm = 0.03937” / 1” = 25.4 mm

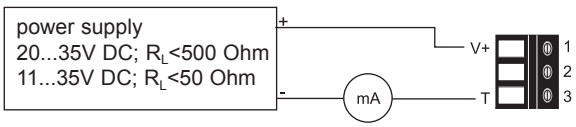


Connection Diagram

EE16-T3xxx



EE16-T6xxx



EE16-P

Ordering Guide

MODEL	OUTPUT	HOUSING	PROBE LENGTH (according to “A”)	FILTER
temperature active (T)	0-10 V (3) 4-20 mA (6)	wall mounting (A) duct mounting (B)	50mm (1.9”) (2) 200mm (7.9”) (5)	membrane filter (1) plastic grid (4)
EE16-				

MODEL	T-SENSOR	HOUSING	PROBE LENGTH (according to “A”)	FILTER
temperature passive (P)	Pt 100 DIN A (A) Pt 100 DIN B (B) Pt 1000 DIN A (C) Pt 1000 DIN B (D) others on request	wall mounting (A) duct mounting (B)	50mm (1.9”) (2) 200mm (7.9”) (5)	membrane filter (1) plastic grid (4)
EE16-				

Ordering Example

EE16-T3A21

model:	temperature transmitter
output:	0-10 V
housing:	wall mounting
probe length:	50mm (1.9”)
filter:	membrane filter

EE10-T Series

HVAC Temperature Transmitter for Indoor Applications

EE10 room transmitters are the ideal solution for indoor applications such as HVAC in residential and official buildings.
The very stylish, functional housing makes possible easy installation and fast exchange of the sensing unit for service purposes.

The temperature output signal can be active or passive.

For on site display of the measured values the EE10 with active temperature output can be equipped with an easily readable display.

EE10-T

Typical Applications

building management for residential and office areas
switching cabinets
climate control in hotels and museums

Features

excellent price / performance ratio
easiest installation
modern design
optional display

Technical Data

Measuring Quantities

Temperature (active output)

Analogue output 0...50°C (32...122°F)[1)]	0-10 V	-1 mA < I_L < 1mA
	4-20 mA (two wires)	R_L < (U_v-10)/0.02 < 500 Ohm
Accuracy at 20°C (68°F)	±0.3°C (±0.54°F)	

Temperature (passive output)

Type of T-Sensor	please see ordering guide

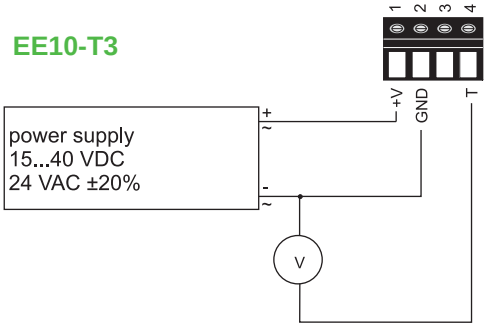
General Data

Voltage supply (U_v)		
for 0 - 10 V	15 - 40 VDC or	24 VAC ±20%
for 4 - 20 mA	28V DC > U_v > 10 + 0.02 x R_L (R_L < 500 Ohm)	
Current consumption		
for DC supply:	typical 4 mA	
for AC supply:	typical 15 mA_{eff}	
Electrical connection	Screw terminals max. 1.5 mm^2 (AWG 16)	
Housing / Protection class	PC / IP30	
Display	only for EE10-Tx version: temperature	
CE compatibility according	EN61326-1	FCC Part15 ClassB
	EN61326-2-3	ICES-003 ClassB
Temperature ranges	Working temperature range:	-5...55°C (23...131°F)
	Working temperature with display:	-5...55°C (23...121°F)
	Storage temperature range:	-25...60°C (-13...140°F)

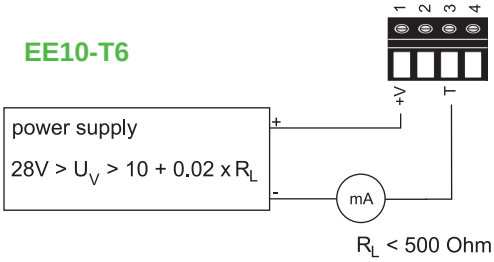
1) Other T-scalins refer to page 11

Connection Diagram

EE10-T3

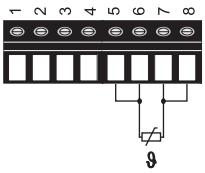


EE10-T6

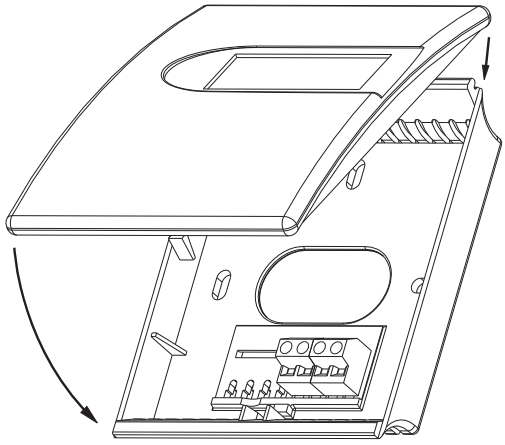


R_L < 500 Ohm

EE10-P



Dimensions



W x H x D = 85 x 100 x 26 mm
(3.3 x 3.9 x 1 inch)

Housing: PC
Protection class: IP30

Housing colour: cover: RAL 9003 (signal white)
back: RAL 7035 (light grey)

Ordering Guide

MODEL	OUTPUT	DISPLAY	T-Unit	T-SCALE
temperature active (T)	0-10V (3) 4-20 mA (6)	without display (--) with display (D04)	°C (--) °F (E01)	0...50 (T04) -5...55 (T31) 0...40 (T55) other (Txx)
EE10-				

MODEL	T-SENSOR
temperature passive (P)	Pt 100 DIN A (A) Pt 100 DIN B (B) Pt 1000 DIN A (C) Pt 1000 DIN B (D)
EE10-	

Order Example

EE10-T6-D04-T04

Model: temperature transmitter
Output: 4-20mA
Display: with display
T-Unit: °C
T-scale: 0...50°C (32...122°F)

Hand-Helds

OMNIPORT 20

HUMIPORT 05/05IR/10/20

THERMOPORT 20

OMNIPORT 20

Multifunctional Hand-Held

To measure various climate and processes values with a hand-held, user-friendly instrument requires extraordinary measurement technology. The hand-held meters of the OMNIPORT 20 series meet these multiple demands.

The selection of the appropriate sensing probe and accordingly the configuration of the hand-held meter allow for displaying the following values with the highest accuracy:

- relative humidity RH
- temperature T
- dew point temperature Td
- absolute humidity dv
- mixing ratio r
- air velocity v
- water activity aw
- water content in oil x

The robust housing of the OMNIPORT 20 allows usage in harsh industrial environments.The readability of the large illuminated display is excellent. The easy to understand menu and the practical thumbwheel navigation offer outstanding comfort.

Optional carrying cases can accommodate the basic device with up to 5 sensing probes as well as accessories (calibration device with 5 ampoules calibration fluid (80% RH), factory certificate).

The accuracies of the humidity / temperature probes are traceable to international standards, administrated by NIST, PTB, BEV...

Typical Applications

HVAC control
industry and process control
clean room control
water activity and moisture content in oil
humidity measurement in walls and floors

Features

measurands: RH, T, Td, dv, r, v, aw, x
large, illuminated display
HOLD / MIN / MAX / AVG readout
real time clock
SI/US units selectable
recalibration by user

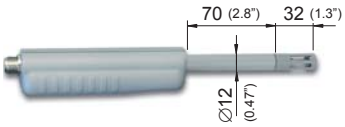
Technical Data

General

Resolution	- humidity / temperature probe (HA040201, HA040202, HA040203): humidity measurement: 0.1% RH; g/m³; Td [°C, °F]; g/Kg; gr/lb temperature measurement: 0.1°C; 0.1°F - passive temperature probe (HA040101, HA040102, HA040104, HA040105): 0.1°C; 0.1°F - air velocity probe (HA040401, HA040402, HA040403): air velocity measurement: 0.01m/s; 1ft/min temperature measurement: 0.01°C; 0.01°F - moisture in oil measurement (HA040204, HA040206): moisture measurement: aw: 0.001 [ ] or 0.01...1ppm (depending on measuring range) temperature measurement: 0.1°C; 0.1°F
Supply voltage	4x 1.5V AA alkali-manganese battery
Battery lifetime	with PT100 probe: 300h with RH/T or aw/x probe: 200h with v probe: 40h
Working temperature range	handheld and grip of sensing probe: 0...50°C (32...122°F)
CE compatibility according	EN50081-2 EN50082-2 EN55011 EN61000-4-2 EN61000-4-3
Housing / protection class	ABS / IP40
Dimensions (HxWxD)	145 x 85 x 37 mm (5.7 x 3.3 x 1.5")
Weight	ca. 400g (1lbs)
Display	LC display, 90 x 50 mm (3.5 x 2"), illuminated

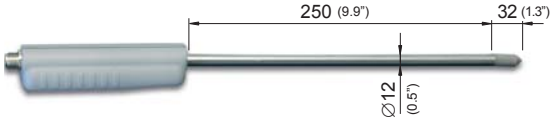
Humidity / Temperature Probes:

RH/T HVAC probe



Application: humidity and temperature measurement in HVAC applications
Working range: 0...100% RH / -20...70°C (-4...158°F)
Accuracy: ±2% RH (0...90% RH), ±3% RH (90...100% RH)
±0.2°C / ±0.36°F (20°C / 68°F),
±0.5°C / ±0.9°F (-20 resp. 70°C / -4 resp. 158°F)
Response time τ_{90}: ≤ 7 sec.
Measurand: channel 1: T [°C/°F]
channel 2: RH [%], dv [g/m³], Td [°C/°F], r [g/kg, gr/lb]
Order code: **HA040201**

RH/T high temperature probe



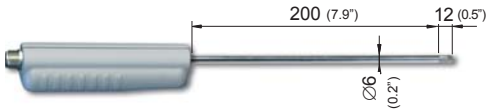
Application: humidity and temperature measurement in industrial process applications
Working range: 0...100% RH / -40...180°C (-40...356°F)
(grip of sensing probe up to 80°C)
Accuracy: ±2% RH (0...90% RH), ±3% RH (90...100% RH)
±0.2°C / ±0.36°F (20°C / 68°F),
±0.5°C / ±0.9°F (-40°C / -40°F), ±0.6°C / ±1.1°F (180°C / 356°F)
Response time τ_{90}: ≤ 30 sec.
Measurand: channel 1: T [°C/°F]
channel 2: rF [%], dv [g/m³], Td [°C/°F], r [g/kg, gr/lb]
Temperature dependence: RH: ±0.03% RH/°C (% RH/°F)
Order code: **HA040202**

RH/T miniature probe

Application: humidity and temperature measurement in small places, humidity measurement in boreholes
Working range: 0...100% RH / -40...100°C (-40...212°F)
Accuracy: ±2% RH (0...90% RH), ±3% RH (90...100% RH)
±0.2°C / ±0.36°F (20°C / 68°F),
±0.7°C / ±1.26°F (-40 resp.100°C / -40 resp. 212°F)
Response time τ_{90}: ≤ 15 sec.
Measurand: channel 1: T [°C/°F]
channel 2: RH [%], dv [g/m³], Td [°C/°F], r [g/kg, gr/lb]
Temperature dependence: RH: ±0.03% RH/°C (% RH/°F)
Order code: **HA040203**

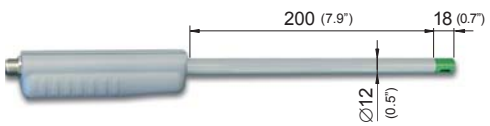
Air Velocity Probes:

Air velocity probe ∅6mm (0.24")



Application:	air velocity measurement in small places and for high accuracy requirements	
Working range:	0...2m/s (0...400ft/min) -20...70°C (-4...158°F)	0...20m/s (0...4000ft/min) -20...70°C (-4...158°F)
Accuracy: (0...50°C / 32...122°F)	0.08...2m/s (15...400ft/min): ± (0.04m/s / 8ft/min + 1% of m. v.) ± 0.7°C (±1.26°F)	0.2...20m/s (40...4000ft/min): ± (0.2m/s / 39ft/min + 2% of m. v.) ± 0.7°C (±1.26°F)
Response time τ_{90}:	≤ 1.5 sec.	≤ 1.5 sec.
Measurand:	channel 1: v [m/s, ft/min] channel 2: T [°C/°F]	channel 1: v [m/s, ft/min] channel 2: T [°C/°F]
Order code:	**HA040401**	**HA040402**

Air velocity probe ∅12mm (0.47")



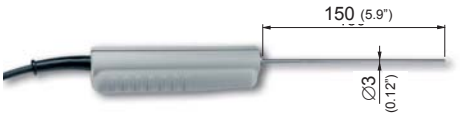
Application: air velocity measurement in HVAC applications
Working range: 0...20m/s (0...4000ft/min) / 0...50°C (32...122°F)
Accuracy: 0.2...20m/s (40...4000ft/min):
± (0.2m/s / 39ft/min + 3% of m. v.) / ± 1°C (±1.8°F)
Response time τ_{90}: ≤ 1.5 sec.
Measurand: channel 1: v [m/s, ft/min]
channel 2: T [°C/°F]
Order code: **HA040403**

Temperature Probes:

PT100 cut-in probe

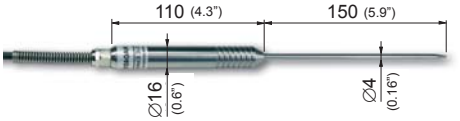
Application: temperature measurement in solid, liquid and powdery media
Working range: -40...400°C (-40...752°F) 1)
Accuracy: PT100 class B, basic device: ±0.5°C (±0.9°F)
Response time τ_{90}: 10 sec.
Cable length: 1m (3.28ft)
Order code: **HA040101**

PT100 immersion probe



Application: temperature measurement in gaseous, liquid and powdery media
Working range: -40...400°C (-40...752°F) 1)
Accuracy: PT100 class A, basic device: ±0.5°C (±0.9°F)
Response time τ_{90}: 10 sec.
Cable length: 1m (3.28ft)
Order code: **HA040102**

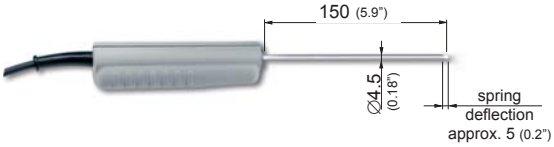
PT100 cut-in food probe



Application: temperature measurement in solid, liquid and powdery food
Working range: -40...400°C (-40...752°F) 1)
Accuracy: PT100 class A, basic device: ±0.5°C (±0.9°F)
Response time τ_{90}: 10 sec.
Cable length: 1m (3.28ft)
Order code: **HA040104**

1) Attend to working temperature range of grip of sensing probe!

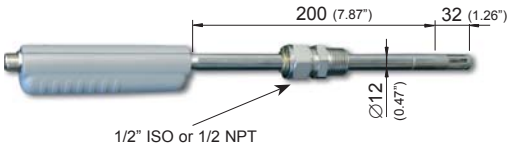
PT100 surface probe



Application: measurement probe with a spring flexure, which undergoes a defined deflection when pressed against the surface.
Working range: -50...400°C (-58...752°F) (grip of sensing probe up to approx. 80°C 176°F)
Accuracy: PT100 class B, basic device: ±0.5°C (±0.9°F)
Response time τ_{90}: 10 sec. (at even, smooth or metallic surfaces)
Cable length: 1m (3.28ft)
Order code: **HA040105**

Oil Probe:

Oil probe ∅12mm (0.47")



Application: measurement of moisture in mineral und synthetic oil
Working range: 0...1 a_w / 0...20000ppm / -40...120°C (-40...248°F)
Accuracy: ±0.02a_w (0...0.9a_w), ± 0.03a_w (0.9...1a_w)
±0.2°C / ±0.36°F (20°C / 68°F),
±0.5°C / ±0.9°F (-40 resp. 120°C / -40 resp. 248°F)
Response time τ_{90}: ≤ 10 min (in still oil)
Pressure range: 0.01...20bar (0.15...300psi)
Measurand: channel 1: T [°C/°F]
channel 2: aw [ ] oder x [ppm] oil specific parameters are adjustable at the basic device
Temperature dependence: a_w: ±0.0003a_w/°C (a_w/°F)
Order code: 1/2 ISO: **HA040204** 1/2 NPT: **HA040206**

Ordering Guide

MODEL	PROBES		ACCESSORIES	
basic device **(OMNIPORT 20)** (incl. 2m (6.6ft) probe cable)	RH/T HVAC probe	(HA040201)	stainless steel sintered filter (for ∅12mm RH/T probe)	(HA010103)
	RH/T high temperature probe	(HA040202)	PTFE - filter (for ∅12mm RH/T probe	(HA010105)
	RH/T miniature probe	(HA040203)	metal grid filter (for ∅12mm RH/T probe)	(HA010106)
	PT100 cut-in probe	(HA040101)	carrying case big (basic device + 5 probes)	(HA040902)
	PT100 immersion probe	(HA040102)	carrying case small (basic device + 1 probe)	(HA040904)
	PT100 cut-in food probe	(HA040104)		
	PT100 surface probe	(HA040105)	ball valve set 1/2" ISO for oil probe	(HA050101)
			ball valve set 1/2" NPT for oil probe	(HA050104)
	air velocity probe ∅6mm (0.24") - 0...2m/s (0...400ft/min)	(HA040401)	probe cable 2m	(HA010813)
	air velocity probe ∅6mm (0.47") - 0...20m/s (0...4000ft/min)	(HA040402)	probe cable 5m	(HA010814)
	air velocity probe ∅12mm (0.47")	(HA040403)	probe cable 10m	(HA010815)
	oil probe - 1/2" ISO	(HA040204)	humidity standards / calibration device	(refer to data sheet "humidity calibration set")
	oil probe - 1/2" NPT	(HA040206)	ISO standard calibration package	(refer to data sheet "OEKD Calibration Laboratory")

Order Example

OMNIPORT 20, HA040201, HA040202, HA040401, HA010401, HA040902
model: basic device OMNIPORT 20
probes: RH/T HVAC probe, RH/T high temperature probe, air velocity probe ∅6mm (0.24") - 0...2m/s (0...400ft/min)
accessories: calibration device for sensor probes 12mm (0.47") - horizontal mounting, carrying case big

HUMIPORT

Humidity / Temperature Hand-Helds

Hand-held measurement of relevant climatic data is becoming more and more important. Thermo-Hygrometers of the HUMIPORT series set new standards because of the combination of the latest technology and design.
Excellent readability of the large and illuminated display, the simple thumbwheel operation and the robust case allow the use in tough industrial environments. Latest technology and the well proven E+E humidity sensor guarantee highest accuracy and long term stable measurements.

The HUMIPORT measures relative humidity [% RH] and temperature [°C or °F] and calculates dew point temperature [°C or °F], absolute humidity [g/m³] and mixing ratio [g/kg or gr/lb].

HUMIPORT10/20 Thermo-Hygrometers are available in a practical carrying case. The set contains a HUMIPORT incl. an E+E factory certificate and a humidity calibration device with 5 ampoules calibration fluid (80% RH).

Thermo - hygrometer and laser pyrometer of the HUMIPORT 05 IR series provide 3 operation modes:

TH-mode:
- Temperature / humidity measurement
- In this mode the hand-held offers you all functions of the HUMIPORT 05 series.

IR-mode, infrared:
- Contact-free surface temperature measurement with measurement position marking

DP-mode:
- Dew point temperature / surface temperature measurement
- Dew point detection on walls

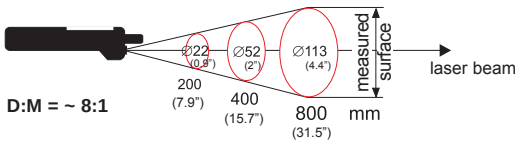
Product Comparison HUMIPORT Series

Functions	HUMIPORT 05	HUMIPORT 05 IR	HUMIPORT 10	HUMIPORT 20	Comment
measurement: - relative humidity and temperature	✓	✓	✓	✓	
- surface temperature		✓			
calculation: - dew point temperature [°C or °F]	✓	✓	✓	✓	
- absolute humidity [g/m³]	✓		✓	✓	
- mixing ratio [g/kg or gr/lb]	✓		✓	✓	
dew point detection on walls		✓			
alarm function		✓			
HOLD / MIN / MAX / AVG readout	✓	✓	✓	✓	
SI- / US- units selectable	✓	✓	✓	✓	
easy thumb-wheel operation	✓	✓	✓	✓	
1 point humidity and temperature calibration	✓	✓	✓	✓	
2 point humidity calibration			✓	✓	
illuminated display			✓	✓	
auto power off	✓	✓	✓	✓	
real time clock			✓	✓	
probe fixed	✓	✓	✓		
remote probe 1.5m (5ft)				✓	
HUMIPORT 10/20 Set (carrying case incl. HUMIPORT, humidity calibration device, 5 ampoules with calibration fluid (for 80% RH) and an E+E factory certificate)			✓	✓	optional
protection cover	✓	✓			optional

Technical Data

		HUMIPORT 05	HUMIPORT 05 IR	HUMIPORT 10/20
Measuring values				
Sensor type	relative humidity	HC101	HC101	HC101
	temperature	NTC	NTC	NTC
	surface temperature		Thermopile	
Measuring range	relative humidity	5...95% RH	5...95% RH	0...98% RH
	temperature	-20...50°C (-4...122°F)	-20...50°C (-4...122°F)	-20...50°C (-4...122°F)
	dew point at 20°C (68°F)	-15...19°C (5...66°F)		-20...19°C (-4...66°F)
	mixing ratio at 20°C (68°F)	1.18...14g/kg (8.26...98gr/lb)		0.78...14g/kg (5.46...98gr/lb)
	surface temperature		-20...60°C (-4...140°F)	
Accuracy	relative humidity	±2% RH	±2% RH	±2% RH
	temperature	±0.4°C (0...40°C) (±0.7°F at 32...104°F) ±0.7°C (-20...50°C) (±1.3°F at -4...122°F)	±0.4°C (0...40°C) (±0.7°F at 32...104°F) ±0.7°C (-20...50°C) (±1.3°F at -4...122°F)	±0.3°C (0...40°C) (±0.54°F at 32...104°F) ±0.5°C (-20...50°C) (±0.9°F at -4...122°F)
	dew point at 20°C (68°F)	± (4.46...0.64°C) ± (8.03...1.15°F)		± (4.33...0.45°C) ± (7.79...0.81°F)
	mixing ratio at 20°C (68°F)	± (0.44...0.57g/kg) ± (3.08...3.99gr/lb)		± (0.29...0.4g/kg) ± (2.03...2.8gr/lb)
	surface temperature		±2°C (±3.6°F) (T_{obj} > 0°C (32°F); T_{amb} > 10°C (50°F))	
Resolution	relative humidity	0.1% RH	0.1% RH	0.1% RH
	temperature	0.1°C (0.18°F)	0.1°C (0.18°F)	0.1°C (0.18°F)
	surface temperature		0.1°C (0.18°F)	
General				
Supply voltage		9V battery	9V battery	4x 1.5V AA battery
Battery lifetime		typ. > 150h	max. 200h - TH mode 10h - IR/DP mode	typ. > 500h
Working temperature range		housing: 0...50°C (32...122°F) probe: -20...50°C (-4...122°F)	housing: 0...50°C (32...122°F) probe: -20...50°C (-4...122°F)	housing: 0...50°C (32...122°F) probe: -20...50°C (-4...122°F)
Storage temperature range		-30...60°C (-22...140°F)	-30...60°C (-22...140°F)	-30...60°C (-22...140°F)
Display		LCD, 45x32mm (1.8x1.3")	LCD, 45x32mm (1.8x1.3")	LCD, 90x50mm (3.5x1.9") illuminated
Measuring optics[1)]			~ 8:1	
CE compatibility according		EN61000-6-2 EN50147-3	EN61000-6-2 EN50147-3	EN50081-2 EN50082-2 EN61000-4-2 EN61000-4-3 EN55011
Housing / protection class		ABS / IP40	ABS / IP40	ABS / IP40
Dimensions (HxWxD)		housing: 140 x 48 x 25mm (5.5x1.9x1")	housing: 140 x 48 x 25mm (5.5x1.9x1")	housing: 145 x 85 x 37mm (5.7x3.3x1.5") HUMIPORT 20: cable length: approx. 1.5m (4.9ft)
Weight		ca. 200g (0.5 lbs)	ca. 200g (0.5 lbs)	ca. 400g (1 lbs)

1) Distance : Measured surface (D:M)
For accurate measurements, the target must be at least twice as big as the measured surface (red spot of the laser beam). The determined temperature is the average temperature of the measured surface.



Order information

MODEL		ACCESSORIES	
HUMIPORT 05	(HUMIPORT 05)	Metal grid filter for average pollutions	(HA010106)
HUMIPORT 05 IR	(HUMIPORT 05 IR)	Stainless steel sintered filter for strong pollutions	(HA010103)
HUMIPORT 10	(HUMIPORT 10)	Protection cover for HUMIPORT 05 and HUMIPORT 05 IR	(HA040903)
HUMIPORT 20	(HUMIPORT 20)		
HUMIPORT 10 Set	(HUMIPORT 10-Set)		
HUMIPORT 20 Set	(HUMIPORT 20-Set)		

THERMOPORT 20

Temperature Hand-Held

Hand-held thermometers of the THERMOPORT series set new standards because of the combination of the latest technology and design.
Excellent readability of the very large and illuminated display, the simple thumbwheel operation and the very robust case also allow usage in tough industrial environments.

Two measuring channels, one to connect a PT100 probe and the other to connect a thermocouple probe (E/K/J/N/R/S/T type), provide measurements between -200...1200°C (-328...2192°F).

Features

PT100 + thermocouple connectors
large, illuminated display
HOLD / MIN / MAX / AVG readout
auto power off
real time clock
°C / °F selectable
recalibration by user

Technical Data

Measuring values

	Channel 1	Channel 2
Sensor type	PT100 (4-wires)	thermocouple
Measuring range	-200...500°C (-328...932°F)	-200...1200°C (-328...2192°F)
Accuracy electronics	±0.1°C (-100...200°C) otherwise ±0.2°C ±0.18°F (-148...392°F) otherwise ±0.36°F	± (0.5°C/0.9°F ± 0.2% of AVG)
Resolution	±0.01°C (-100...200°C) otherwise ±0.1°C ±0.018°F (-148...392°F) otherwise ±0.18°F	0.1°C (0.18°F)

General

Supply voltage	4x 1.5V AA alkali-manganese battery		
Battery lifetime	typ. > 500h		
Working temperature range	0...50°C (32...122°F)		
CE compatibility according	EN50081-2	EN50082-2	EN55011
	EN61000-4-2	EN61000-4-3	
Housing / protection class	ABS / IP40		
Dimensions (HxWxD)	145 x 85 x 37 mm (5.7 x 3.3 x 1.5")		
Weight	approx. 400g (1 lbs)		
Display	LC display, 90 x 50 mm (3.5 x 2"), illuminated		

Ordering Guide

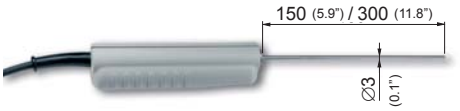
MODEL	
portable thermometer without sensing probe	(THERMOPORT 20)

Temperature Probes:

PT100 cut-in probe, short

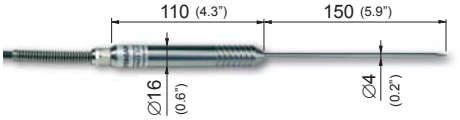
Application: solid, liquid and powdery media
Measuring range: -40...400°C (-40...752°F)[1)]
Type of sensing probe: PT100 class B in a stainless steel protection tube
Response time τ_{90}: 10 sec.
Cable length: approx. 1m (3.3ft), PUR-cable and handgrip applicable up to 80°C (176°F)
Order code: **HA040101**

Accurate PT100 immersion probe, short and long version



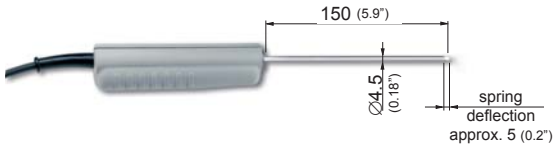
Application: gaseous, liquid and powdery media
Measuring range: -40...400°C (-40...752°F)[1)]
Type of sensing probe: PT100 class A in a stainless steel protection tube
Response time τ_{90}: 10 sec.
Cable length: approx. 1m (3.3ft), PUR-cable and handgrip applicable up to 80°C (176°F)
Order code: short (150mm): **HA040102** long (300mm): **HA040103**

Robust and accureate PT100 cut-in food probe made of stainless steel



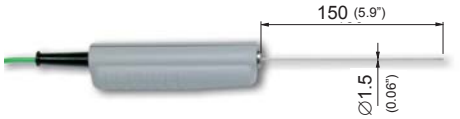
Application: solid, liquid and powdery media
Measuring range: -40...400°C (-40...752°F)[1)]
Type of sensing probe: PT100 class A
Response time τ_{90}: 10 sec.
Cable length: approx. 1m (3.3ft), PUR-cable and handgrip applicable up to 80°C (176°F)
Order code: **HA040104**

PT100 surface probe



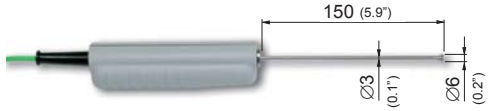
Application: measurement probe with a spring flexure, which undergoes a defined deflection when pressed against the surface.
Working range: -50...400°C (-58...752°F) (grip of sensing probe up to approx. 80°C 176°F)
Accuracy: PT100 class B, basic device: ±0.5°C (±0.9°F)
Response time τ_{90}: 10 sec. (at even, smooth or metallic surfaces)
Cable length: 1m (3.28ft)
Order code: **HA040105**

Fast thermocouple-immersion probe for temperatures up to 1100°C (2012°F)



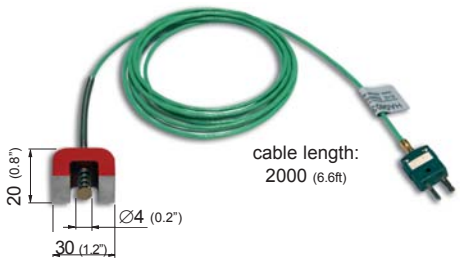
Application: liquid and powdery media
Measuring range: -50...1100°C (-58...2012°F)[1)]
Type of sensing probe: Typ K, cl. 1, Inconel
Response time τ_{90}: 4 sec.
Cable length: approx. 1m (3.3ft), cable and handgrip applicable up to 80°C (176°F)
Order code: **HA040302**

Thermocouple surface sensor for temperatures up to 600°C (1112°F)



Application: solid media
Measuring range: -50...600°C (-58...1112°F)[1)]
Type of sensing probe: Type K, cl. 1, stainless steel protection tube with nickel contact-plate
Response time τ_{90}: 5 sec.
Cable length: approx. 1m (3.3ft), cable and handgrip applicable up to 80°C (176°F)
Order code: **HA040303**

Magnetic thermocouple surface sensor, spring-mounted thermocouple, connection via 2m PTFE cable up to 150°C (302°F)



Application: solid media
Measuring range: -50...150°C (-58...302°F)[1)]
Type of sensing probe: Typ K, cl. 1
Cable length: approx. 2m (6.6ft), PTFE cable and handgrip applicable up to 150°C (302°F)
Order code: **HA040304**

1) Pay attention to the approved working temperatrue range of the probe grip!

Calibration

High-precision humidity calibrator

HUMOR 20

Accredited E+E calibration services for relative humidity, air velocity and temperature

HUMOR 20

High-precision Humidity Calibrator

The role of humidity calibrations that are accurate, reproducible, and documentable is becoming more and more important.
ISO quality guidelines and regulations according to FDA guidelines in the pharmaceutical industry, etc., require that humidity instruments have a traceable, accurate calibration.
The humidity calibrator HUMOR 20 developed by E+E is the ideal reference instrument for these requirements.

HUMOR 20


Automatic Calibration Module

The HUMOR 20 can be used in the humidity range of 10-95% RH both for monitoring cylindrical sensors (transmitters, hand-held instruments,...) and also for monitoring instruments with cubic dimensions (data loggers, wall instruments,...). A temperature sensor integrated in the measurement chamber also permits the monitoring of an optional temperature output.

The HUMOR 20 is traceable to international standards and can be delivered with an official, internationally recognised OEKD calibration certificate. Due to its high accuracy, the HUMOR 20 is the basis for accredited calibration laboratories for relative humidity.

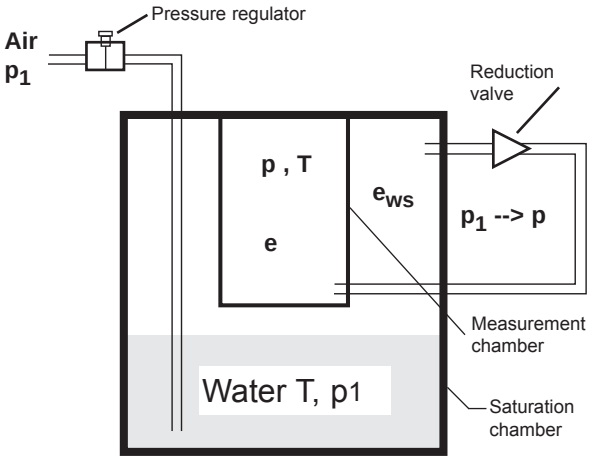
Based on its operating principle, the HUMOR 20 can be used under typical conditions in a laboratory climate. This means that expensive, fully air-conditioned rooms are not necessary. For operation HUMOR 20 requires only distilled water, filtered oil-free air with a pressure of 10 bar and a power supply between 90-230V AC. The specimen can be powered by 24V DC that is available directly on the HUMOR 20.

Operation

The operation of the HUMOR 20 is based on a fundamental two-pressure process and thus is similar to instruments used in national bureaus for standards.
Air or nitrogen at a pressure $\mathbf{p_1}$ is led through a water-filled saturation chamber and saturated to 100% RH at $\mathbf{p_1}$. By means of a reduction valve, the saturated air is reduced to the ambient pressure **p** and fed into the measurement chamber. Due to the construction, the saturation chamber and the measurement chamber are at the same temperature. Under these conditions, the water-vapour partial pressure $\mathbf{e_{ws}}$ is reduced at the same ratio as the total pressure.
Essentially, the following applies:

$$\mathbf{e = e_{ws} * p / p_1}$$

From this it follows that: $\mathbf{RH = e / e_{ws} = p / p_1}$



Schematic Illustration of a Two-pressure Reactor

Thus, the generated relative humidity essentially depends on the ratio of the two pressures.
Constructionspecific deviations from this ratio are corrected during factory adjustments. By adjusting the pressure $\mathbf{p_1}$ the relative humidity is brought to the desired value in the measurement chamber.

Typical Applications

calibration laboratories
reference device
bureau of standards
manufacturers of measurement instruments

Features

highest accuracy
traceable calibration
independent of ambient temperature
easy handling
traceable to international standards
OEKD certificatable

Automatic Calibration Module

The optional available Automatic Calibration Module enables an automatic set point adjustment of the desired reference humidity. With the software, included in the scope of supply, checkpoints, stabilisation times, etc. can be set. Furthermore the instrument allows for an automatic print out of a calibration protocol for a transmitter with analogue standard interface.

Calibration and Adjustment using HUMOR 20

24V DC electrical supply for the test sample are provided directly at HUMOR 20.
Furthermore, four inputs for the voltage or current outputs of transmitters are available when using the Automatic Calibration Module for generating calibration protocols.

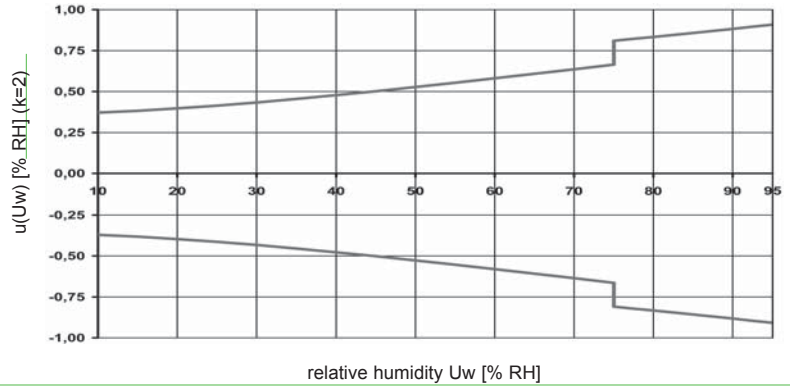
The software which is included in the scope of supply allows the user to record measurement values in a log file, to print out calibration protocols and to configure or to readjust the HUMOR 20.

Software - Features:

- Freely selectable numbers of measuring points and stabilisation times when using the Automatic Calibration Module
- Creation and print out of professional calibration protocols with:
  - Specimen number
  - Calibration date
  - Reference and actual values
- Temperature display can be switched between°C and °F
- 1-point customer humidity calibration of the HUMOR 20
- 6-point customer humidity calibration of the HUMOR 20
- 1-point customer temperature calibration
- Reset of HUMOR 20 to factory calibration

Technical Data

General

Function principle	two-pressure-reactor
Working range	10...95% RH
Accuracy of measurement[1) 2)] (Traceable to international standards, administrated by NIST, PTB, BEV...)	

Accuracy temperature measurement in measuring chamber[2)]	typ. ±0.3°C (±0.54°F)
Power supply	90...230V AC
Work equipment	• compressed air, filtered and free of oil or nitrogen N_2 with max. 10bar (145psi) • distilled water
Stabilisation time HUMOR 20	< 3 min/measuring point
Stabilisation time specimen	typ. 20 min/measuring point
Integrated power supply	24V DC, max. 200mA
Number of measuring inputs	4 (switchable between 4...20mA / 0...20mA / 0...1V / 0...5V / 0...10V)
Typ. error for display inputs	Voltage measuring: < 5mV Current measuring: < 30µA
Display	Dot-matrix display with backlight
Gas flow	3 l/min for RH > 85% the gas flow is reduced to 1.5 l/min at 95% RH
Recommended interval for recalibration	1 year
Interface for PC connection	RS232 (COM port)
System requirements for software tools	MS Windows 2000 with SP 2 / Windows XP / Windows Vista
Environmental conditions	temperature: 10...40°C (50...104°F) humidity: 10...80% RH
Applied harmonised standards	EN 61000-6-4 EN 60068-2-6 EN 61000-6-2 EN 61010-1 CE EN 61326-1 EN61326-2-3 EN 60068-2-29
Dimensions	400 x 260 x 240 mm (15.7 x 10.2 x 9.4")
Weight	HUMOR 20: about 23kg (51 lbs) HUMOR 20 incl. aluminium transport case: about 36.5kg (80.5 lbs)

Measuring Chamber

The construction of the measuring chamber allows the calibration and adjustment of cylindrical sensor probes with a diameter of 8-25.5mm (0.3-1") (hand-held instruments, duct-mounted versions, ...) as well as of cubic measuring units (room transmitters, data loggers, ...) with maximum dimensions of 100x85x40mm (3.9x3.3x1.6") or 95x95x40mm (3.9x3.9x1.6").
By using the Plexiglas cover (standard supply), it is possible to calibrate and adjust compact room devices (e.g., the EE10) with the HUMOR 20.
The overall accuracy of the calibration is influenced by the absence of the metal cover. The additional error depends on the position of the specimen in the chamber as well as on the relative humidity.

1) The extended inaccuracy of measurement results from the standard inaccuracy increased by a multiplying factor of K=2.

2) Valid for metal covers for the measuring chambers

Accessories

Compressor with oil separator

Technical Data:

Max. operation pressure	12bar (174psi)
Supply voltage	100, 120, 200 or 230V AC // 50 or 60Hz
Noise level	45dB(A)/lm
Dimensions (l x w x h)	380 x 380 x 480 mm (15 x 15 x 18,875 “)
Weight	26kg (57lbs)

Optional covers for the measuring chambers

Various covers for the measuring chamber accommodate probes of all diameters available on the market.
With these covers up to four probes can be calibrated simultaneously.

SUITABLE FOR	NUMBER OF FEEDTHROUGHS	ORDER CODE
probe Ø 8 - 12mm (0.3 - 0.5”)	3	HA020204
probe Ø 12 - 16mm (0.5 - 0.6”)	2	HA020201
probe Ø 16 - 20.5mm (0.6 - 0.8”)	1	HA020202
probe Ø 20.5 - 25.5mm (0.8 - 1”)	1	HA020203
probe Ø 12mm (0.47 - 0.51”)	4	HA020205
probe Ø 12 - 16mm (0.5 - 0.6”)	4	HA020207
HUMLOG 10	-	HA020206
adapter for EE32/33-J[1)]	1	HA020401

1) only useable in combination with HA020204 or HA020201

Calibration certificate

To meet the requirements of Quality Management Systems such as ISO9001 regarding calibration and certification of measurement and test instrumentation, the HUMOR 20 is available with an official OEKD accredited calibration certificate.

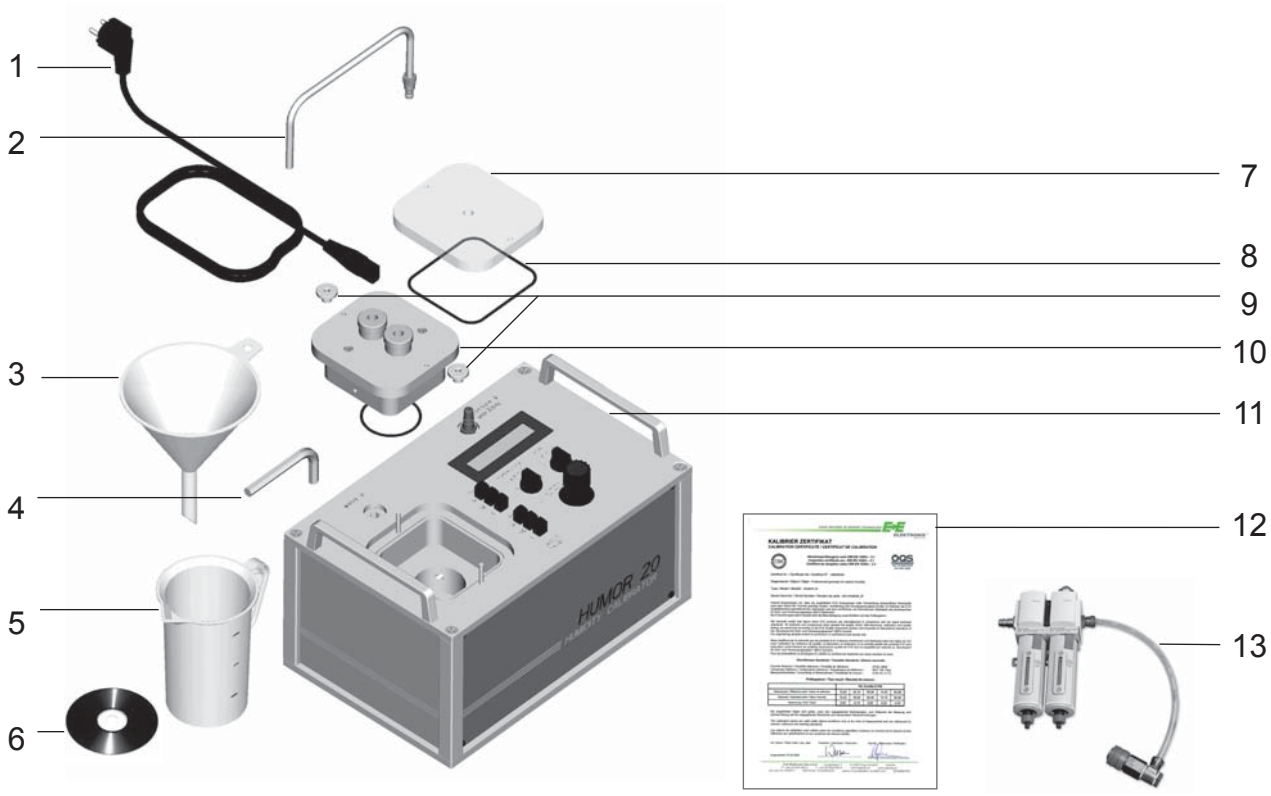
Automatic Calibration Module

For the fully automatic measurement of the characteristics of a transmitter.

Technical Data:

Weight	- weight of instrument: 9kg (20lbs) - instrument incl. aluminium transport case: 23kg (51lbs)
Dimensions	260x260x240mm (LxBxH); (10.2”x10.2”x9.4”)
Supply	90...230V
Interface to PC	RS232 (COM Port)
Compressed air supply	min. 9.8bar (142psi); max. 12bar (174bar) oil-free filtered compressed air, max. size of particle: 5µm
Protection class	IP40
Scope of supply	- automatic calibration module - power supply cable IEC Europe (230V) - power supply cable IEC Northamerica (110V) - RS232 connection cable to Humor 20 - compressed air connection cable to Humor 20

HUMOR 20 - Scope of Supply



1	Power supply cable IEC Europe (230V) + power supply cable IEC Northamerica (110V)	8	O-ring for room transmitter
2	Water drain pipe with connector	9	Knurled nut
3	Funnel	10	Cover for measuring chamber (ordering code HA0202xx) (not inlcuded in the scope of supply HUMOR 20)
4	Allen key (10mm / 0.4")	11	Fixing bracket for filter set (pre-mounted)
5	Measuring beaker	12	Works certificate acc. DIN EN 10204-3.1
6	Measuring and calibration software	13	Filter set with oil separator
7	Plexiglas cover for room transmitter testing		

Ordering Information

HUMIDITY CALIBRATOR	
HUMOR 20	HUMOR20
Automatic Calibration Module	HA020301

COVER FOR MEASURING CHAMBER	
for 8 - 12 mm (0.3 - 0.5") probe diameter	HA020204
for 12 - 16 mm (0.5 - 0.6") probe diameter	HA020201
for 16 - 20.5 mm (0.6 - 0.8") probe diameter	HA020202
for 20.5 - 25.5 mm (0.8 - 1") probe diameter	HA020203
for 4 probes with 12 - 13 mm (0.47 - 0.51") probe diameter	HA020205
for 12 - 16 mm (0.5 - 0.6") probe diameter	HA020207
for HUMLOG 10	HA020206
Adapter for EE32/33 - model J[1)]	HA020401

1) only useable in combination with HA020204 or HA020201

ACCESSORIES	
Compressor with oil separator for 220V power supply	HA020101
Compressor with oil separator for 110V power supply	HA020102
ÖKD-calibration certificate	OEKD20/xH
USB <=> RS232 converter	HA020110

Humidity Calibration Set

General

The humidity transmitters as all other measuring instruments shall be periodically checked and eventually adjusted. The most simple solution for this purpose is the E+E calibration set.
This set consists of humidity standards and different calibration devices, carefully designed for use with E+E humidity sensor probes.
It guarantees easy and reliable instrument check. The E+E calibration set does not require specially trained technical personnel.

Calibration accuracy

The RH of each humidity standard is accurately set by a titration of the chlorine ions.

humidity value in % RH	accuracy at 23 ±2°C (73.4 ±3.6 °F)
5% RH	±0.5% RH
10% RH	±0.5% RH
20% RH	±0.5% RH
35% RH	±0.5% RH

humidity value in % RH	accuracy at 23 ±2°C (73.4 ±3.6 °F)
50% RH	±0.9 % RH
65% RH	±0.9% RH
80% RH	±1.2% RH
95% RH	±1.2% RH

Calibration Procedure

The calibration device allows the sensor probes to be tightly installed so that the measurement is not influenced by the surrounding air.
A textile pad is placed in the chamber of the calibration device and is saturated with a solution of a known humidity value. In this manner the humidity transmitter can be accurately calibrated.

Humidity Standards

Non saturated lithium chloride solutions serve as humidity standards. These solutions are available in sets of five sealed ampoules, which may be stored an indefinite time. The lithium chloride solutions are non-harmful as they do not produce toxic fumes. Skin contact with them is likewise non-harmful.
They are dangerous only if swallowed in large quantities.

Ordering Guide

Calibration Device	
calibration device for sensor probes ∅ 10...15 mm (0.4...0.6") - horizontal mounting	(HA010401)
calibration device for sensor probes ∅ 10...15 mm (0.4...0.6") - vertical mounting	(HA010402)

Humidity Standards	
5 ampoules 05% RH + 5 textile discs	(HA010405)
5 ampoules 10% RH + 5 textile discs	(HA010410)
5 ampoules 35% RH + 5 textile discs	(HA010435)
5 ampoules 50% RH + 5 textile discs	(HA010450)
5 ampoules 80% RH + 5 textile discs	(HA010480)
5 ampoules 95% RH + 5 textile discs	(HA010495)

E+E Calibration Services

Increasing demands for product quality and the various guidelines for quality control such as ISO9001, QS9000, VDA6.1 and TS16949 require monitoring of measurement and test equipment on a regular basis. Calibrations performed in E+E's calibration labs guarantee the user reliable measurement results and is the metrological fundament for measurement and test equipment to be in accordance with quality assurance regulations.

Which certificates are available?

- OEKD Certificate
- ISO Calibration Certificate

OEKD CERTIFICATES

The E+E OEKD Laboratory is accredited according to DIN EN ISO/IEC 17025 standard.
The accreditation and inspection is performed by the Federal Ministry of Economy, Family and Youth of the Republic of Austria (BMWFJ). BMWFJ, the Austrian Accreditation Organisation for Calibration laboratories, is member of

- EA (European co-operation for Accreditation)

and of

- ILAC (International Laboratory Accreditation Organisation).

Federal Ministry for Economics and Labour
Österreichischer Kalibrierdienst (ÖKD)

CERTIFICATE OF ACCREDITATION

We confirm that the Calibration Laboratory of
E + E Elektronik GmbH
Langwiesen 7, A-4209 Engerwitzdorf,
is accredited for the following quantities:

humidity of air and temperature

The accreditation was given with the document No. BMWA-96.113/0040-II/11/2006 dated 17 March 2006.
The scope of accreditation is included in the accreditation document and in the directory of accredited calibration laboratories of Austria.
The registration number of this calibration laboratory is ÖKD 23.

The accreditation was performed in accordance with the requirements of the following documents: Act concerning Metrology, Federal Law Gazette No. 152/1950, last amended by Federal Law Gazette I No. 137/2004, Ordinance concerning Calibration Service, Federal Law Gazette No. 42/1994, last amended by Federal Law Gazette II No. 490/2001, Accreditation Act, Federal Law Gazette No. 468/1992, last amended by Federal Law Gazette I No. 85/2002, EN ISO/IEC 17025:2005.

Vienna, 17 March 2006

Dipl.-Ing. Freistetter Gerald
Dr. Twaroch Christoph

Based on the agreements between the members of EA and ILAC, calibration certificates issued by E+E laboratories are in accordance with worldwide recognized standards. Therefore, the OEKD Calibration Certificates have the highest acceptability and are legally recognized.
Measurement equipment, which require a high level of reliability, such as factory standards, should have an OEKD calibration certificate. Increasing
requirements with respect to traceability in pharmaceutical, biotech and medical industries require also accredited certificates. The OEKD calibration certificates are available for the following physical quantities:

- relative humidity
- temperature
- dew point
- mixing ratio
- specific humidity
- volume ratio
- water vapour density

ISO CALIBRATION CERTIFICATES

An ISO calibration is a comparison to E+E internal reference instruments or systems which are traceable with defined uncertainty to international standards. These calibrations are performed in accordance to an E+E internal procedure, conforming to ISO 9000 and TS 16949 standards.
ISO calibration uses high end measuring equipment and offers price effective information on the calibration status by stating the deviations from reference of the instrument under test.
ISO calibration certificates can cover certain requirements of standards like ISO/QS 9000 / ISO10012-1 / GMP / CFR / VDA ISO TS 16949.

KALIBRIER ZERTIFIKAT
CALIBRATION CERTIFICATE

E+E Elektronik Ges.m.b.H. Langwiesen 7 A-4209 Engerwitzdorf Austria

E+E Elektronik can issue ISO calibration certificates for:

- temperature
- relative humidity
- air velocity

Scope of Accreditation of the E+E OEKD Calibration Laboratory

The E+E OEKD Calibration Laboratory allows following calibrations and with lowest uncertainty of measurement:

- **RH / T calibrations in the range 0...98% RH / -40...180°C (-40...356°F)**
- **dew point calibration in the range -60...90°C (-76...194°F)**

Physical quantity resp. calibration object	Measuring range	Measuring conditions	Smallest measurement uncertainty (MV...Measured Value)	Notes
Relative Humidity				
hygrometer for humidity measurement	0%...98% RH	gas flow max. 5l/min; air pressure max. 1MPa; temperature range -70...200°C (-94...392°F) -70 ≤ temperature ≤ -40°C (-94 ≤ temperature ≤ -40°F) -40 ≤ temperature < 0°C (-40 ≤ temperature < 32°F) temperature ≥ 0°C (32°F)	 [0.2+0.006.MV] .exp[((-40-t)/30)³]% RH (0.2+0.006.MV)% RH (0.1+0.004.MV)% RH	comparison with 2-pressure generator in combination with temperature measurement chamber (2-pressure-2-temperature - generator)
electronic hygrometer for humidity measurement	10...95% RH	25°C ±3°C (77°F ±5.4°F)	(0.4+0.005.MV)% RH	comparison with humidity generator
electronic hygrometer for humidity measurement	10...95% RH	25°C ±10°C (77°F ±18°F)	(0.5+0.006.MV)% RH	comparison with humidity generator on site
hygrometer for humidity measurement	10...95% RH	0...90°C (32°F...194°F)	(1+0.005.MV)% RH	comparison with chilled mirror hygrometer and resistance thermometer in climate systems, on site as well
devices to generate humidity (rel. humidity generators)	-20...0°C (-4...32°F) 0...80°C (32...176°F)	dew point temperature: Td -80...95°C (Td -112...203°F) measuring temperature: -20...80°C (-4...176°F) relative humidity: 1% ≤ U_W ≤ 95%	(0.3+0.005.MV)% RH (0.15+0.005.MV)% RH	comparison with chilled mirror hygrometer and resistance thermometer in climate systems, on site as well
Dew Point				
dew point hygrometer	Td -80...-60°C (Td -112...-76°F) Td -60...-25°C (Td -76...-13°F) Td -25...70°C (Td -13...158°F) Td 70...95°C (Td 158...203°F)	gas flow max. 5l/min; air pressure 1,000 + 100 / -200 hPa; max. 1MPa in the temperature range -64.6...95°C (-84.3...203°F)	0.05-(60+MV).0.01K 0.050K 0.035K 0.045K	comparison with 2-pressure - generator; for temperature < 0°C (< 32°F) the equivalent frost point temperatures are valid
dew point hygrometer	Td -25...85°C (Td -13...185°F)	0...90°C (32...194°F)	0.25K	comparison with chilled mirror hygrometer in climate systems, on site as well
devices to generate dew point temperatures (dew point temperature generators)	Td -80...-60°C (Td -112...-76°F) Td -60...-25°C (Td -76...-13°F) Td -25...70°C (Td -13...158°F) Td 70...95°C (Td 158...203°F)	gas flow min. 1l/min; air pressure 1,000 + 100 / -200 hPa	0.07-(60+MV).0.01K 0.070K 0.05K 0.06K	comparison with chilled mirror hygrometer, on site as well
Temperature				
thermometer for measurement of air temperature	-70...200°C (-94...392°F)	comparative measurement in temperature stabilised measuring chamber, air pressure max. 1MPa	0.05K	comparison with resistance thermometer in gas flow in a temperature measurement chamber
thermometer for measurement of air temperature	-20...80°C (-4...176°F)	comparative measurement in temperature stabilised measuring chamber, air pressure ~ ambient pressure	0.05K	comparison in systems for generation of defined humidity, on site as well
thermometer for measurement of air temperature	-25...100°C (-13...212°F)	comparative measurement in block calibrator, air pressure ~ ambient pressure	0.05K	comparison with resistance thermometer, on site as well

Appendix

Accessories

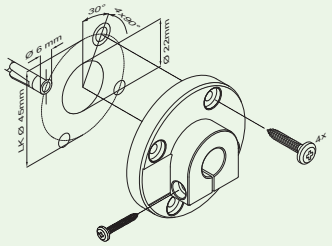
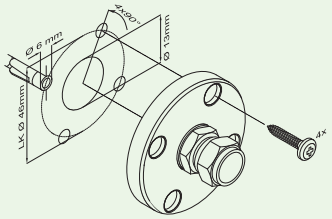
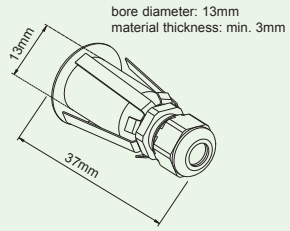
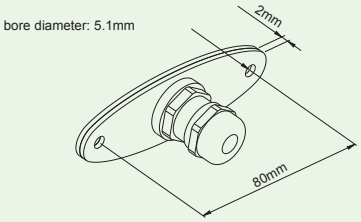
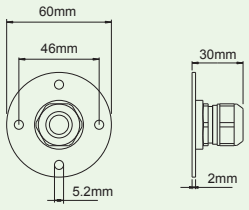
Filter

To protect the sensor elements from pollution, the transmitters are equipped with filter caps. The right choice of filters depends on the application and is very important to maintain free operation. Please ask your local E+E distributor.

NAME	ASSEMBLY	FEATURES	TYP. APPLICATIONS	ORDER CODE
membrane filter 	material: PC special PTFE foil laminated on plastic carrier size of pores: 1 µm length: 34mm (1.34“)	average filter effect temperatures up to max. 80°C (176°F) $t_{10/90}$: 15 s	building automation	HA010101
stainless steel sintered filter 	material: sintered stainless steel size of pores: 10 µm length: 33mm (1.30“)	for hard mechanical stress and strong pollutions temperatures up to 180°C (356°F) unsuitable for high humidity measurement $t_{10/90}$: 30 s	drying processes	HA010103 HA010103EX for EE30EX series
plastic grid filter 	material: PC length: 34mm (1.34“)	no filter effect - only mechanical protection quick response time $t_{10/90}$: appr. 5 s temperatures up to 120°C (248°F)	hand-held instruments data loggers	HA010104
PTFE - filter 	material: sintered PTFE size of pores: 50 µm length: 33mm (1.30“)	high chemical resistance temperatures up to 180°C (356°F) $t_{10/90}$: 14 s	drying processes in chemical applications	HA010105
metal grid filter 	material: PC with stainless steel wire mesh size of pores: 30 µm length: 34mm (1.34“)	for small mechanical stress temperatures up to 120°C (248°F) average pollution suitable for high humidity applications $t_{10/90}$: 15 s	drying processes danger of saturation or applications with RH > 90 %	HA010106
metal grid filter 	material: stainless steel with stainless steel wire mesh size of pores: 30 µm length: 39mm (1.54“)	for hard mechanical stress temperatures up to 180°C (356°F) average pollution suitable for high humidity measurement $t_{10/90}$: 7 s	drying processes	HA010109
H_2O_2 - filter 	material: sintered PTFE size of pores: 50 µm length: 33mm (1.30“); Ø12mm (0.47“)	catalytic filter for H_2O_2 environments $t_{10/90}$: 14 s	sterilization with H_2O_2	HA010115
PTFE stainless steel filter 	base body: stainless steel PTFE filter hydrophobic length: 39mm (1.54“) Ø12.5mm (0.49“)	very good filter effect against environmental influences (e.g: dust, pollutant, salt) very small pore size, pressure of water intake ≥0.5 bar fast recovery after condensation interchangeable PTFE membrane temperature range: -40...150°C (-40...302°F) $t_{10/90}$: 9s	meteorology high humidity applications with condensation	HA010114: complete filter HA010114ME: replacement membrane

Mounting Flange

Different mounting flanges make the installation of E+E sensor probes easier.

NAME	SUITABLE FOR	DIMENSIONS	ORDER CODE
plastic mounting flange 12mm (0.47") 	HVAC transmitters max. temperature: 60°C (140°F)		HA010202
stainless steel mounting flange 12mm (0.47") 	EE23, EE29, EE31, EE32, EE33		HA010201
stainless steel mounting flange 5mm (0.2") 	EE23 - model H EE31 - model H		HA010208
stainless steel mounting flange 8mm (0.3") 	EE75 EE32/33-MFTJ (temperature probe)		HA010207
duct mounting kit for EE22/EE07 	EE07		HA010209
wall mounting clip Ø12mm (0.47") 	for all probes with Ø12mm (0.47") -35...105°C (-31...221°F)		HA010211

LC Display

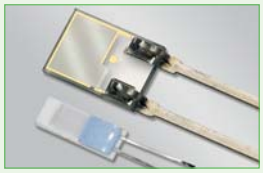
For on site reading various versions are adjustable with a display.

NAME	SUITABLE FOR		ORDER CODE
LC display + cover 	EE30EX		D01
LC display + cover 	EE22	metal polycarbonate	D07M D07P
	EE23	metal polycarbonate	D03M D03P
	EE29, EE31, EE35, EE36	metal polycarbonate	D05M D05P
	EE32, EE33	metal	D05M

Power Supply Unit

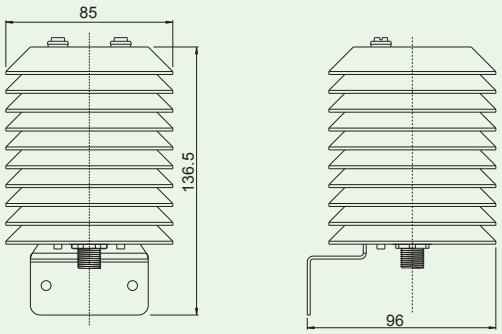
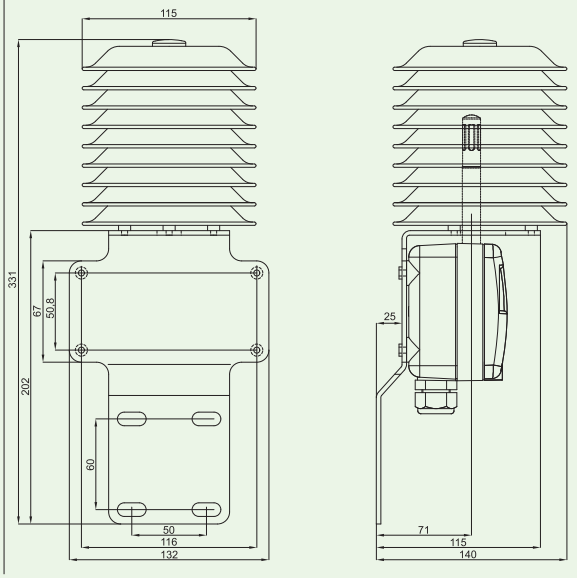
NAME	DESCRIPTION	SUITABLE FOR	ORDER CODE
power supply unit 	external plug power supply input: 100 - 240V AC 50-60Hz / 180mA output: 18V DC / 330mA	HVAC and industrial transmitters	V02

Replacement Sensors

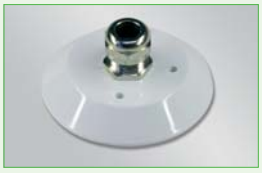
NAME	DESCRIPTION	SUITABLE FOR	ORDER CODE
replacement sensors 	replacement humidity sensor with sensor data	EE29, EE31, EE30EX	FE10 FE10-HC01 (with coating)
	replacement humidity sensor without sensor data	EE23	FE09 FE09-HC01 (with coating)
	replacement temperature sensor		TE38

Radiation Shield

For outdoor applications the transmitters must be equipped with a radiation shield. This causes a forced ventilation which largely prevents overheating of the sensing probe in the sun.
It also protects the sensing probe against dripping water.

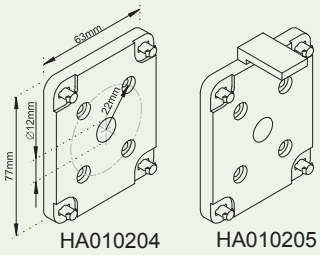
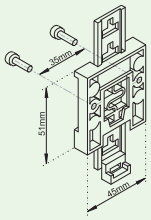
NAME	SUITABLE FOR	DIMENSIONS	ORDER CODE
radiation shield for EE21 	EE21-xA2x	example: HA010506 	HA010501
radiation shield with clamping ring 	EE29/31/32/33 with remote sensing probe EE06 EE07		HA010502
radiation shield with thread	EE08		HA010506
radiation shield with mounting bracket for wall mounting transmitters 	EE23		HA010504

Dripping Water Protection

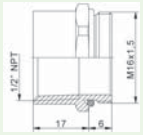
NAME	DESCRIPTION	SUITABLE FOR	ORDER CODE
dripping water protection 	Ø 85mm (3.35")	all sensor probes Ø12mm (0.47")	HA010503

Snap in

For quick and easy installation and deinstallation.

NAME	SUITABLE FOR	DIMENSIONS	ORDER CODE
snap in - mounting flange for wall and duct mounting 	EE14, EE16 EE21 EE65, EE66	 HA010204 HA010205	for wall mounting: HA010204 for duct mounting: HA010205
bracket for installation onto mounting rails 	EE22, EE23, EE29, EE31, EE35, EE36		HA010203

Screw Connection

NAME	SUITABLE FOR	DESCRIPTION	ORDER CODE
adapter M16x1.5 to ½"NPT 	general	Adapter M16x1.5 to ½"NPT (US conduit fitting) 	HA011101
pressure tight screw connection 	EE33-MFTKx, EE32/33-MFTJx	for pressure tight probe assembly up to 20bar (300psi)	HA011102: ½"ISO Ø12mm (0.47") HA011103: ½"NPT Ø12mm (0.47") HA011104: ½"ISO Ø6mm (0.24") HA011105: ½"NPT Ø6mm (0.24")

Reference Probe

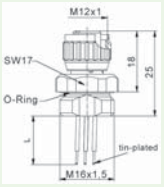
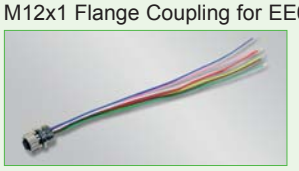
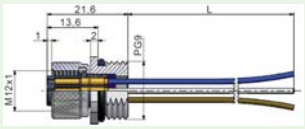
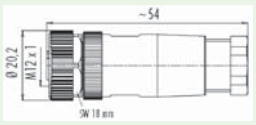
NAME	SUITABLE FOR	DESCRIPTION	ORDER CODE
reference probe 	EE22	EE07 probes with defined measuring values to check the digital/ anlogue conversion of the EE22 basic unit (with test report) Probe 1: 90% RH / 5°C (41°F) Probe 2: 10% RH / 45°C (113°F)	HA010403
replacement probe EE07 	EE22	The calibration data are stored in the probe. A fast replacement of the probe without readjustment of the evaluation electronics is guaranteed.	housing stainless steel: EE07-MFT9 housing PC / membrane filter: EE07-PFT1 housing PC / metal grid filter: EE07-PFT6 for coating of sensors add HC01

Accessories

Interface Convertor / Interface Cable

NAME	SUITABLE FOR	DESCRIPTION	ORDER CODE
RS232 to RS485 	EE31, EE33 with RS485 interface	- converter from RS232 to RS485 - supports AutoPro, i.e. automatic adjustment of the Baudrate from 300 bps to 115200 bps - enables to control 256 data acquisition modules in a RS485 network - isolation 3000 Vrms	HA010603
RS232 to USB 	general	- high speed converter from RS232 to USB - certified: Microsoft WHQL approved	HA020110
E2 to RS232 for EE07 	EE07	converter for E2-interface to RS232, incl. software for test and data recording cable length: 2m (6.6ft)	HA011001
E2 to RS232 for EE03 	EE03	converter for E2-interface to RS232, incl. software for test and data recording cable length: 2m (6.6ft)	HA011002
E2 to RS232 for EE08 	EE08	converter for E2-interface to RS232, incl. software for configuration, adjustment or test cable length: 2m (6.6ft)	HA011005
RS232 Interface Cable for Screw Terminals 	EE29, EE31, EE30Ex, EE32, EE33, EE35, EE36	RS232 interface cable for connection to screw terminals on the board cable length: 2m (6.6ft)	HA010301
RS232 Interface Cable with Pin Connector 	EE29, EE31, EE30Ex, EE32, EE33, EE35, EE36, EE371, EE372, EE381	RS232 interface cable to connect directly on the board cable length: 2m (6.6ft)	HA010304
RS232 Interface Cable with External Plug 	EE29, EE31, EE32, EE33, EE35, EE36	RS232 interface cable to plug into the external socket on the housing C06 cable length: 2m (6.6ft)	HA010311

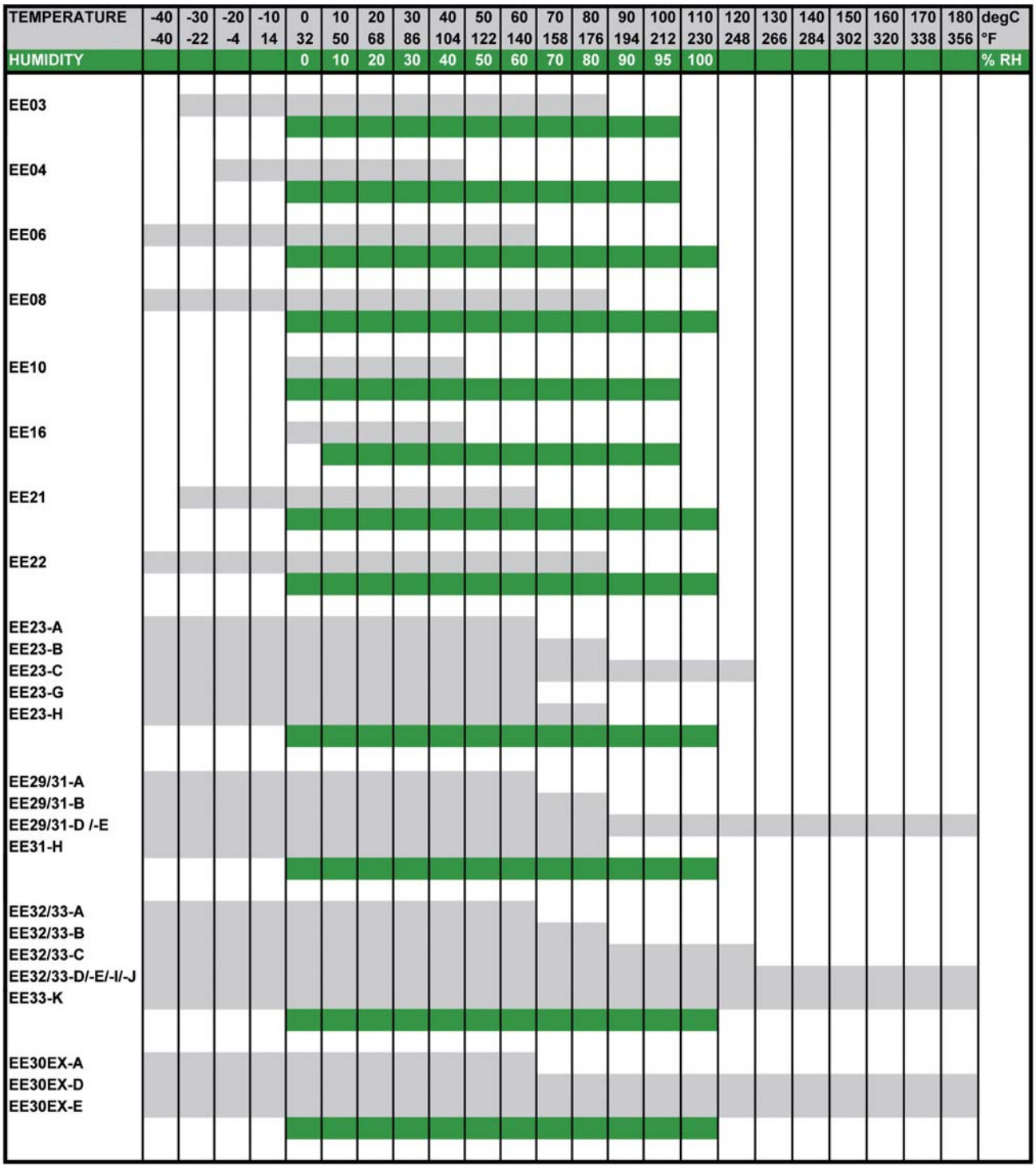
Plugs / Sockets / Connecting Cables

NAME	SUITABLE FOR	DESCRIPTION	ORDER CODE
M12x1 Flange Coupling for EE07 	EE07	 l = 50mm (2")	HA010705
M12x1 Flange Coupling for EE08 	EE08 type D	flange coupling for housing assembly, l = 200mm (8") 	HA010703
M12x1 Flange Receptacle Configurable for EE08 	EE08 type D	8 pole flange receptacle configurable, IP67 (NEMA 4) 	HA010704
Connecting Cable EE22/EE07 	EE07, EE22	connecting cable – sensing probe EE07 with EE22 transmitter	length 2m (6.6ft): HA010801 length 5m (16.4ft): HA010802 length 10m (32.8ft): HA010803
Connecting Cable EE07 	EE07	connecting cable with flying leads for sensing probe EE07	length 1m (3.3ft): HA010809 length 2m (6.6ft): HA010810 length 5m (16.4ft): HA010811 length 10m (32.8ft): HA010812
Connecting Cable EE08 	EE08 type D	connecting cable with flying leads for sensing probe EE08 type D	length 1.5m (4.9ft): HA010322 length 3m (9.8ft): HA010323 length 5m (16.4ft): HA010324 length 10m (32.8ft): HA010325
Connecting Cable VELOPORT/ OMNIPORT 20 	OMNIPORT 20	connecting cable hand-held - probe	length 2m (6.6ft): HA010813 length 5m (16.4ft): HA010814 length 10m (32.8ft): HA010815

Product Selection Guide

Choosing the right transmitter closely tuned to the application with regards to the expected relative humidity and temperature is an absolute must for a perfect operation.
The following table is a guide for the right choice of humidity and temperature transmitters, under consideration of the temperature dependency for the different models. In the marked range you will get an overall accuracy better than ±5% RH.
In case of uncertainty please get in touch with our sales team or ask your local E+E distributor.

Product Comparison - Working Ranges



Scaling of T-outputs

EE08, EE10, EE10-T, EE21, EE22, EE23, EE29, EE30EX, EE31, EE32, EE33, EE35, EE36, EE75 and EE80

Following Txx defines the scaling of the outputs for **temperature (T), dew point temperature (Td), frost point temperature (Tf) and wet bulb temperature (Tw)**. The Txx codes are to be used in the order number of EE08, EE10, EE10-T, EE21, EE22, EE23, EE29, EE30EX, EE31, EE32, EE33, EE35, EE36, EE75 and EE80 transmitter series.
Please see the ordering guide at the end of each data sheet.

The limits of the temperature scale shall be within the temperature working range of respective EExx transmitter.

For T scale in°C, please use Txx code alone:
Example :
EE29-PFTD3025AB6-**T57** T output scale: 4…20mA = -20…+140°C

For T scale in °F, please use E01-Txx:
Example:
EE31-PFTE3056AB5-**E01-T57** T output scale: 0...10V = -20...+140°F

T01	-30...+40	**T35**	+100...+180	**T69**	0...+20	**T103**	-30...+100
T02	-40...+60	**T36**	0...+150	**T70**	-10...+25	**T104**	-60...+40
T03	-10...+50	**T37**	0...+130	**T71**	+50...+130	**T105**	-40...+40
T04	0...+50	**T38**	-40...+70	**T72**	+50...+140	**T106**	+10...+50
T05	0...+100	**T39**	-30...+20	**T73**	-20...+70	**T107**	0...+200
T06	-5...+45	**T40**	+20...+180	**T74**	-40...+356	**T108**	-112...+32
T07	0...+60	**T41**	+60...+110	**T75**	+32...+212	**T109**	-40...+32
T08	-30...+70	**T42**	-10...+100	**T76**	+32...+122	**T110**	-35...+50
T09	-30...+120	**T43**	-35...+35	**T77**	+20...+140	**T111**	-60...0
T10	-20...+120	**T44**	-40...+50	**T78**	-40...+248	**T112**	0...+30
T11	-10...+70	**T45**	-30...+50	**T79**	-40...+100	**T113**	-23...+85
T12	-40...+120	**T46**	0...+75	**T80**	-40...+176	**T114**	+60...+180
T13	+15...+25	**T47**	-20...+150	**T81**	-40...+250	**T115**	+10...+40
T14	-20...+100	**T48**	-20...+50	**T82**	-40...+350	**T116**	-80...+180
T15	+20...+120	**T49**	0...+170	**T83**	-40...+140	**T117**	+15...+35
T16	0...+120	**T50**	-10...+60	**T84**	-40...+300	**T118**	-70...+180
T17	0...+70	**T51**	-50...+70	**T85**	0...+140	**T119**	-25...+25
T18	-10...+40	**T52**	-40...+180	**T86**	0...+176	**T120**	-70...+60
T19	+10...+100	**T53**	+80...+120	**T87**	0...+248	**T121**	+55...+95
T20	-30...+60	**T54**	-30...+35	**T88**	0...+250	**T122**	-20...+20
T21	0...+80	**T55**	0...+40	**T89**	0...+350	**T123**	-80...+80
T22	-40...+80	**T56**	0...+5	**T90**	+32...+120		
T23	-30...+130	**T57**	-20...+140	**T91**	+32...+140		
T24	-20...+80	**T58**	+10...+30	**T92**	+32...+180		
T25	-20...+60	**T59**	-10...+30	**T93**	+32...+248		
T26	0...+180	**T60**	-20...+40	**T94**	+32...+250		
T27	-50... +50	**T61**	-5...+100	**T95**	+32...+300		
T28	-80...+60	**T62**	-5...+50	**T96**	+32...+132		
T29	-20...+180	**T63**	-80...+20	**T97**	-60...+120		
T30	0...+160	**T64**	-60...+60	**T98**	-60...+212		
T31	-5...+55	**T65**	-60...+20	**T99**	-110...+70		
T32	-80...0	**T66**	-50...+100	**T100**	-76...+140		
T33	-40...+160	**T67**	-80...+100	**T101**	+32...+350		
T34	-70...+40	**T68**	-40...+150	**T102**	-15...+25		

Measuring Humidity - Basics

Dalton's Law

Air is a mixture of different gases. Under normal environmental conditions the gases have an ideal behaviour, i.e. each gas molecule can act independently from all others. **Dalton's law** is valid :

The total pressure of a gas is the sum of the partial pressures

$$p\ [mbar, hPa] = p_{N2} + p_{O2} + p_{Ar} + ...$$

The partial pressure p is defined as the pressure of a gas, if it would occupy alone the whole volume of the gas mixture.

Water in its gaseous phase (vapour) is also a component of air mixture. Under normal conditions it behaves like an ideal gas. With Dalton´s law p becomes:

$$p\ [mbar, hPa] = p_{N2} + p_{O2} + p_{Ar} + ...+ e$$

or

$$p\ [mbar, hPa] = p_{da} + e$$

e partial pressure of (water) vapour
p_{da} partial pressure of dry air

Vapour Pressure Above Liquid

The concentration of water vapour in air is limited. There is a maximum partial pressure of vapour which depends on temperature. Air at high temperature can take more vapour than at low temperature.

This behaviour can be explained as follows :
The molecules in a liquid are moving with different velocities (or energies) whereby the average energy is proportional to the temperature of the liquid. With respect to energy, the water molecules show a statistical distribution as in Fig. 1.
The molecules with energy lower than the binding energy of the liquid cannot leave the water surface. Those with higher energy can leave the water.
They evaporate and increase the vapour partial pressure in the air (Fig. 2).
The opposite phenomenon happens with the water vapour molecules. Those with lower energy than the binding level of the liquid condensate on the water surface and decrease the vapour partial pressure in the air.

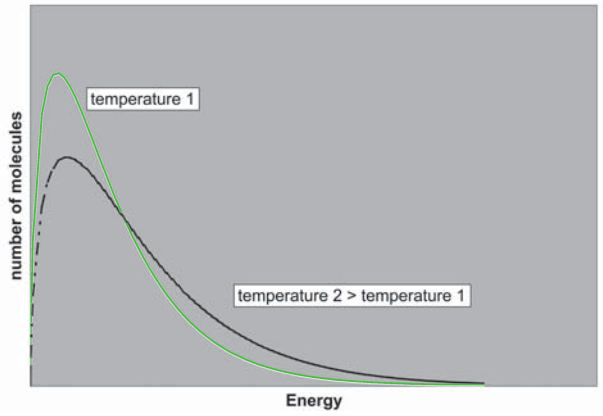


Fig.1: Statistical energy distribution of molecules in a liquid.

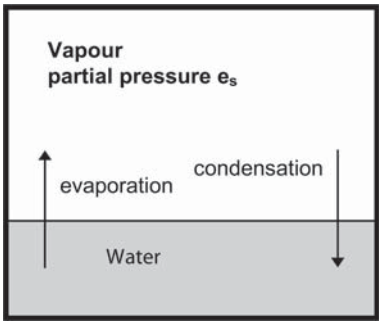


Fig.2 : Equilibrium at temperature T.

In a closed volume partly filled with water at temperature T (Fig.2) there is an equilibrium between evaporation and condensation. If there is a lack of water molecules in the moist region, more evaporation will occur and the vapour concentration will increase. In the opposite case more molecules will condense than evaporate and the vapour concentration will decrease.

The balance between evaporation and condensation leads to a vapour partial pressure (respectively concentration) which only depends on temperature.

A temperature rise will increase the energy of water molecules (Fig.1) and the balance will be shifted to higher vapour concentration.
For equilibrium at temperature T the vapour concentration (or water partial pressure e or number of water molecules per m³) is the maximum concentration which can exist at this temperature and cannot be exceeded. A higher concentration would lead to condensation again and after a short time the old balance would be reached.
This vapour concentration is called saturated concentration or in terms of partial pressure

saturation vapour pressure above water e_{ws}

at temperature T.

The saturation pressure above water e_{ws} has an exponential dependence on T and is given in Tab.1.

Vapour Pressure Above Ice

Below 0.01°C (32.018°F) (triple point of water) water can exist in a liquid phase as well as in a solid phase (ice) whereby the liquid phase is not stable. For temperatures lower than 0.01°C (32.018°F), in addition to vapour pressure above water there is also a vapour pressure above ice. (Tab 2.)

T [°C/°F]	e_{ws} [mbar]	T [°C/°F]	e_{ws} [mbar]
100/212	1014.19	0/32	6.112
90/194	701.82	-10/14	2.8652
80/176	474.16	-20/-4	1.2559
70/158	312.02	-30/-22	0.5103
60/140	199.48	-40/-40	0.1903
50/122	123.53	-50/-58	0.0644
40/104	73.853	-60/-140	0.0195
30/86	42.470	-70/-94	5.187E-03
20/68	23.392	-80/-112	1.190E-03
10/50	12.281	-90/-130	2.298E-04
0.01/32.018	6.117	-100/-148	3.622E-05

Tab.1: Saturation vapour pressure values e_{ws} above water.

T [°C/°F]	e_{is} [mbar]
0.01	6.117
0/32	6.112
-10/14	2.5989
-20/-4	1.0324
-30/-22	0.3800
-40/-40	0.1284
-50/-58	0.0394
-60/-140	0.0108
-70/-94	2.615E-03
-80/-112	5.472E-04
-90/-130	9.670E-05
-100/-148	1.402E-05

Tab.2: Saturation vapour pressure values e_{is} above ice.

Consequently there are two saturation curves below 0.01°C (32.018°F) which are given in Fig.3 in a logarithmic scale. From -100°C to 100°C (-48°F to 212°F) the saturation vapour pressure is changing over 8 orders of magnitude.

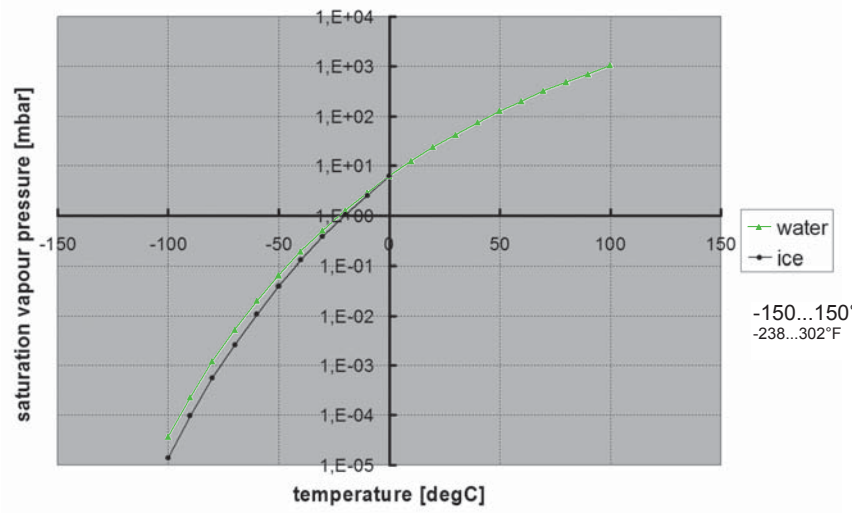


Fig.3 : Vapour saturation curves above ice and water. Below the triple point (0.01°C/32.018°F) the curve splits into two graphs.

Real Gas Correction

Up to now we have regarded water vapour as an ideal gas, i.e. water molecules act independently from each other in the air mixture.
In reality there is a small interaction between molecules which leads to a small increase of saturation vapour in air. This is described by an enhancement factor f(p,T).
For normal pressure the enhancement factor is near one and can be neglected. In this case, water vapour can be seen as an ideal gas.

Humidity Functions

Relative Humidity RH [%RH]

Tab.1 and Tab.2 give the values for saturation vapour pressure as a function of temperature. These values are maximum values and cannot be exceeded. Usually the partial vapour pressure is lower.

Relative humidity RH is defined as the ratio between the actual partial vapour pressure e and the saturation vapour pressure above water $\mathbf{e_{ws}}$:
$RH = (e / e_{ws})*100$ [%RH]

Absolute Humidity (vapour density) dv [g/m³ / gr/f³]

is the mass of water in 1 m³ moist air.
dv = mv / v **[g/m³]** mv... mass of water vapour
v... air volume

Dew Point Td [°C / °F]

When cooling air with **non saturated vapour pressure e** the partial pressure will stay constant for a while. Simultaneously the relative humidity will increase due to decreasing saturation vapour pressure:

$RH = (e / e_{ws})*100$ **$e_{ws} = e_{ws}(T)$** **[%]** T decreasing ===> e_{WS} decreasing ===> RH increasing

At 100% RH the partial pressure of vapour **e** in the air equals the saturation vapour pressure above water **$e_{ws}(T)$**:

$e = e_{ws}(T)$

If the temperature decreases further, condensation will start.

The dew point Temperature Td is the temperature where condensation begins.

Mixing Ratio r [g/kg / gr/lb]

r is the mass of water to evaporate and mix with 1 kg dry air to perform a certain relative humidity or partial vapour pressure **e**.

Specific Enthalpy h [kJ/kg / lbf/lb]

The enthalpy of 1 kg moist air with relative humidity **RH** and corresponding mixing ratio **r** at temperature **T** is the total energy you need

- to warm up dry air from 0°C/°F to T
- to evaporate the water (latent heat of water)
- to warm up the vapour from 0°C/°F up to T

The specific enthalpy is a relative quantity, i.e. only variations are of interest, not the absolute value.
The variation of enthalpy is the measure of energy required to transform the moist air from one equilibrium state to another.

example 1 :
To warm up air from 20°C to 25°C (68°F to 77°F) and humidify the air from 40% RH to 60% RH 20.2 kJ/kg would be needed.

	T [°C]	RH [%RH]	h [kJ/kg]
state 1	20	40	34.6
state 2	25	60	54.8
		difference	**20.2**

example 2 :
Warming up from 20 to 25°C (68°F to 77°F) at constant relative humidity 40% requires only 10.3 kJ/kg.

	T [°C]	RH [%RH]	h [kJ/kg]
state 1	20	40	34.6
state 2	25	40	44.9
		difference	**10.3**

example 3 :
Warming up from 20 to 25°C (68°F to 77°F) at constant partial vapour pressure (i.e. **e** = const , **r** = const , **Td** = const), the relative humidity decreases from 40% to 29.5% RH. This requires only 5.1 kJ/kg energy.

	T [°C]	RH [%RH]	h [kJ/kg]
state 1	20	40	34.6
state 2	25	29.5	39.7
		difference	**5.1**

Mollier Diagram

The Mollier diagram is a very useful instrument to solve HVAC-problems graphically. It includes all humidity functions in one chart.

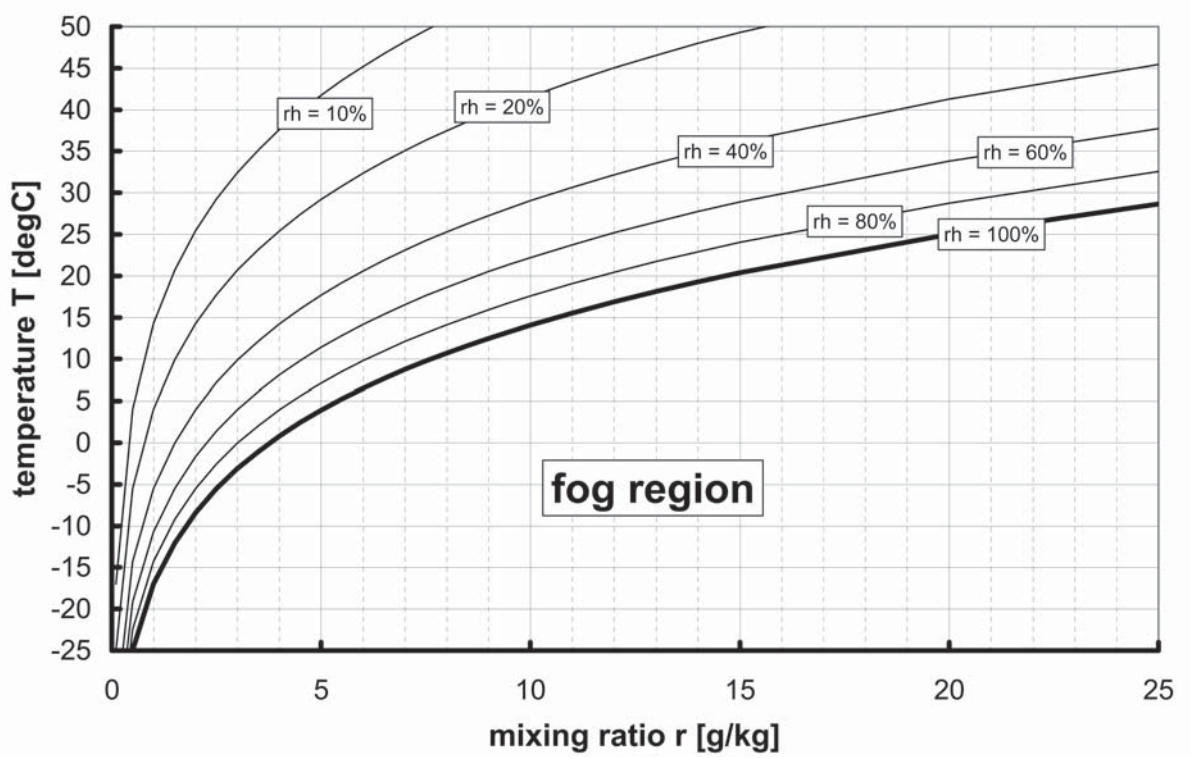


Fig. 4a : Mollier diagram: curves of constant relative humidity . The region below 100% (fog region) is not valid because condensation occurs.

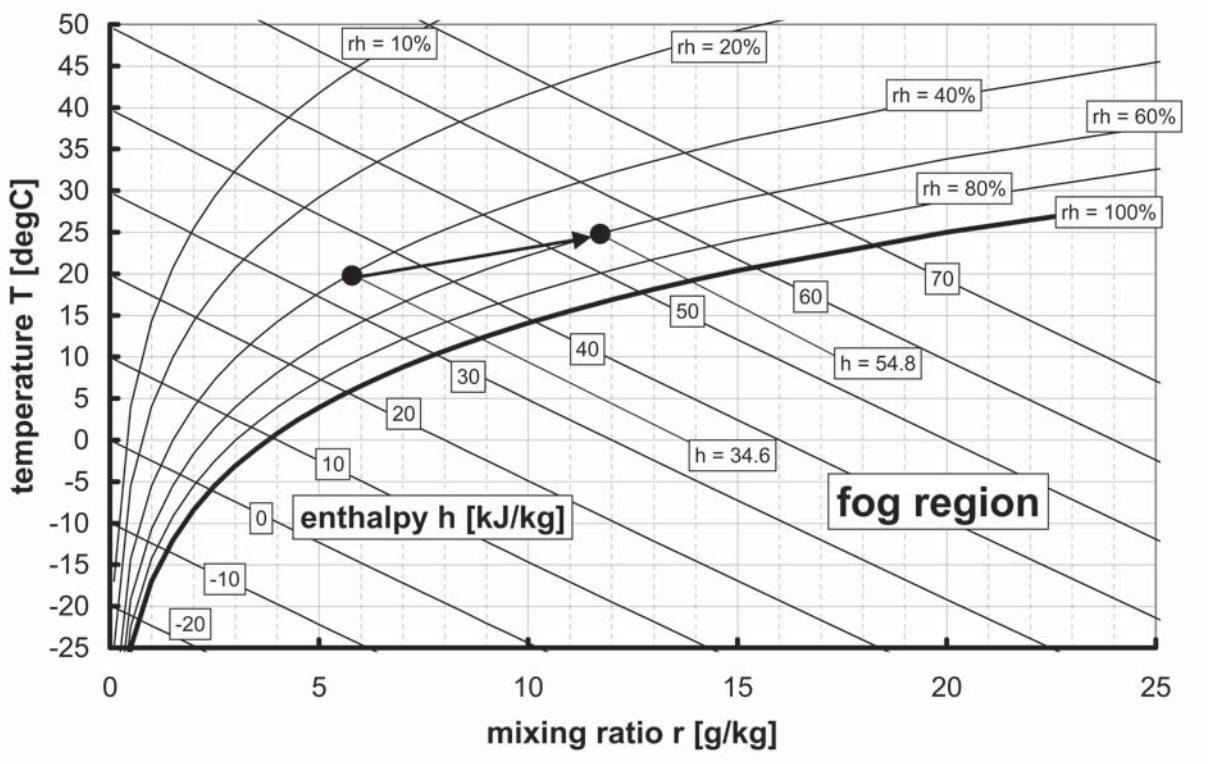
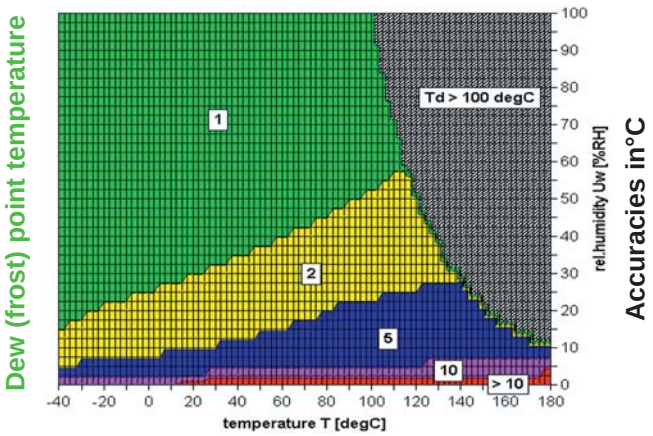


Fig. 4b : Curves of constant enthalpy are added to Fig.4a . Also example 1 is included.

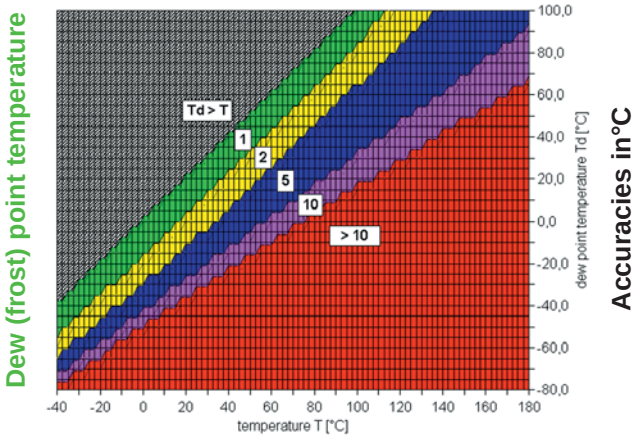
Accuracies of Calculated Variables

Dew (frost) point temperature



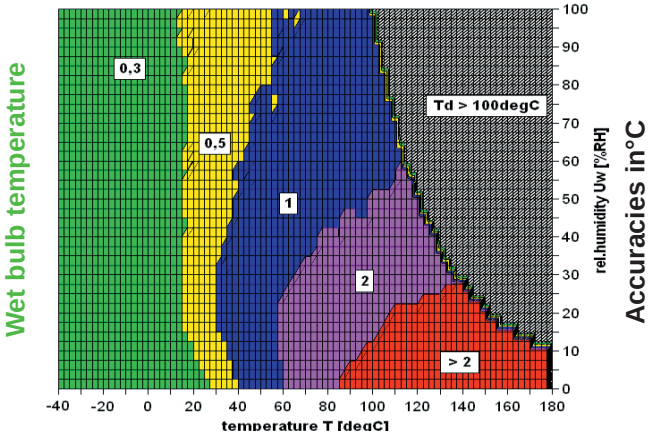
Accuracies in °C

Dew (frost) point temperature



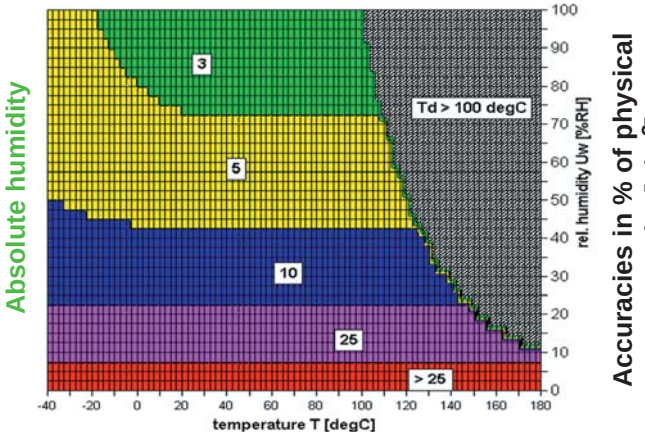
Accuracies in °C

Wet bulb temperature



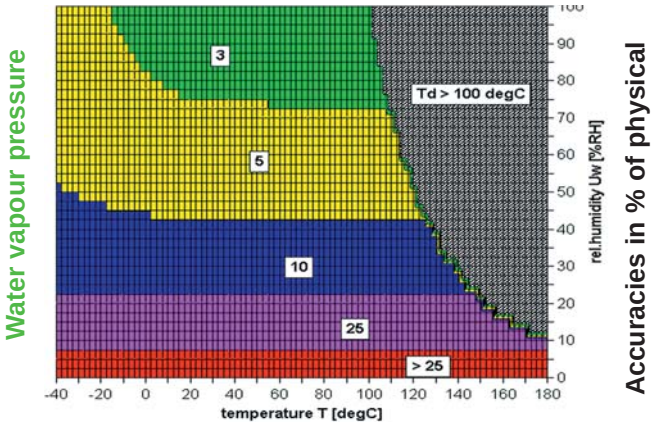
Accuracies in °C

Absolute humidity



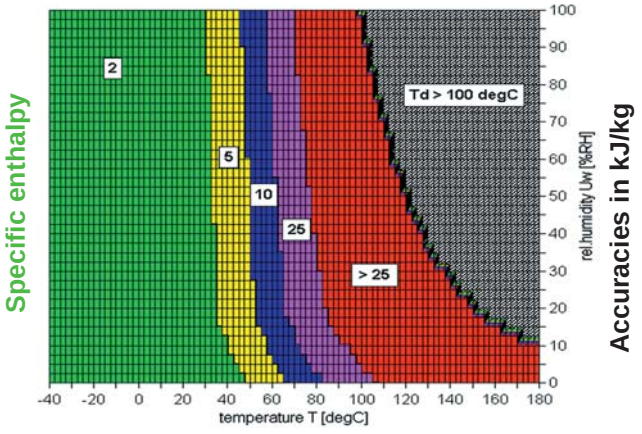
Accuracies in % of physical quantity [g/m³]

Water vapour pressure



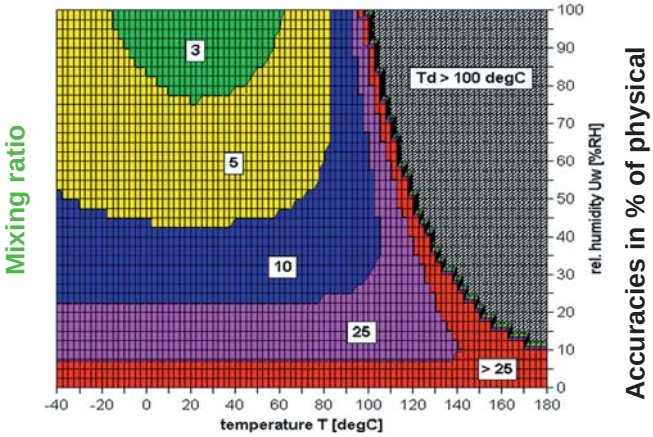
Accuracies in % of physical quantity [mbar]

Specific enthalpy



Accuracies in kJ/kg

Mixing ratio



Accuracies in % of physical quantity [g/kg]

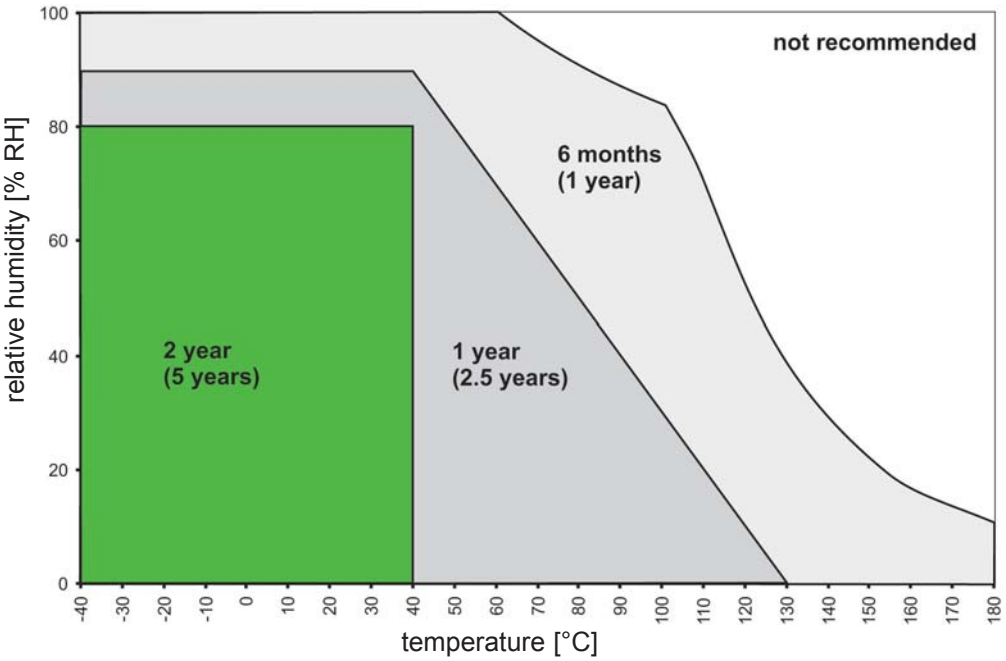
Accuracies of the calculated variables are subject to the accuracy of the humidity and temperature measurement.

The above accuracy values are valid for **±2% RH and ±0.2°C (0.36°F).**

High accuracy values can be reached by a special humidity/temperature calibration.

Maintenance of RH Transmitters

Due to their excellent reliability and long time stability, under normal operation conditions the E+E relative humidity and temperature transmitters do not require any maintenance.
For use in high polluted environment the filter cap shall be periodically exchanged with a new original one.
For high accuracy requirements under extreme humidity and temperature working conditions, the transmitters can be periodically recalibrated.
The recalibration interval can be extended by a special E+E low - or high-humidity calibration.
The following graph shall be used as guide for the recalibration interval:

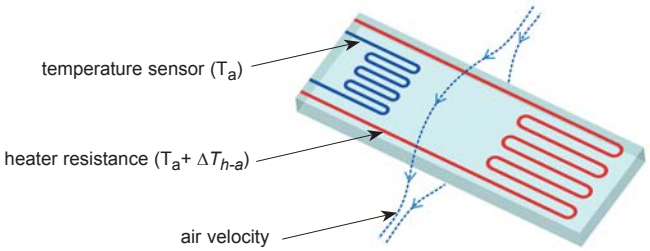


First value for measurement accuracy in the range ±2% RH
Second value for measurement accuracy in the range ±5% RH

Measuring Air Velocity - Basics

Operating Principle

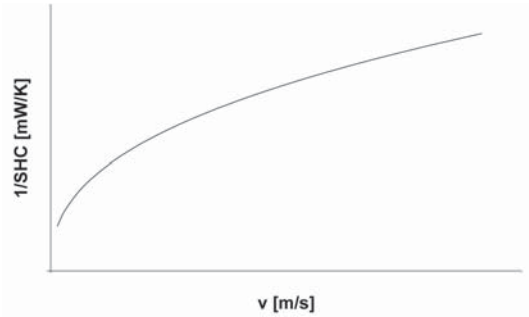
The E+E air velocity sensor utilizes the principle of hot-film anemometry.



The sensor consists of two resistive mesh deposited on a thin glass substrate using cutting-edge thin-film technology. One of the two resistors operates as a temperature sensor and measures the temperature of the flowing medium.
Using electrical current, the other resistive mesh is heated and kept at a constant temperature offset ΔT_{h-a} relative to the temperature of the medium. The medium (air or gas) flowing over the sensor with velocity v is cooling the heated resistor. The power P necessary to keep the temperature offset between heater and temperature resistor constant is a measure for the air velocity.

The sensor characteristic is non-linear and can be described using the self-heating coefficient SHC.

$$1/SHC = \frac{P}{\Delta T_{h-a}}$$



Measuring with E+E velocity meters

Generally speaking, the accuracy of the measurement depends not only on the accuracy of the velocity meter, but also to a significant extent on the installation conditions.

The accuracy of the velocity meter depends on the quality of the linearization of the characteristic and the reproducibility of the measuring signal.

The innovative design and electrical circuitry of E+E velocity sensors result in excellent reproducibility and long-term stability.

For the linearization of the characteristic, every E+E velocity meter is calibrated in a low-turbulence wind tunnel at the factory. A high-precision Laser Doppler Anemometer (LDA) is used as a reference, allowing only minimal uncertainties in the calibration of the sensor characteristic. The high quality calibration standards of E+E are traceable to the standards at leading international calibration laboratories.

The velocity meter's total uncertainty of measurement U_{total} is calculated from the meter's accuracy $u_{accuracy}$ (linearisation and reproducibility) and the uncertainty of the factory calibration U_{cal}.

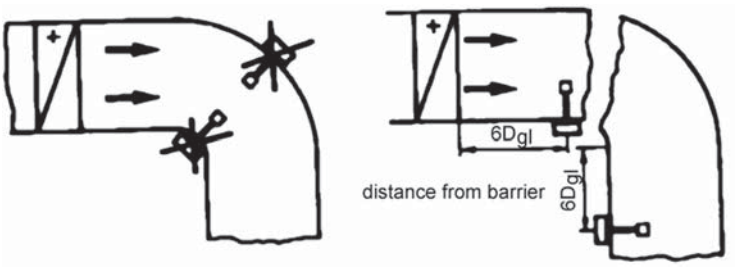
$$U_{total} = k \cdot \sqrt{\left(\frac{U_{cal}}{2}\right)^2 + \left(\frac{u_{accuracy}}{\sqrt{3}}\right)^2}$$

The total uncertainty of measurement is calculated in accordance with EA-4/02, and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).
The enhancement factor k defines the confidence interval. In measurement technique commonly k = 2 is used, corresponding to a confidence level of 95%.

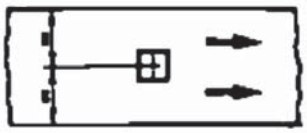
Positioning The Air Velocity Probe

The correct position of the sensing probe is significant for reliable and accurate measurement of the air velocity.
Turbulence appears after fans as well as after bends, junctions or section changes in the duct. Reliable measurements are only possible if the probe is placed far enough from such places. The minimum distance is a function of the duct's diameter. The equivalent diameter of a rectangular duct a x b is

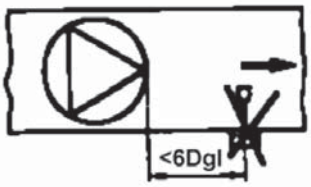
$$D_{gl} = \frac{2 \cdot a \cdot b}{a + b}$$

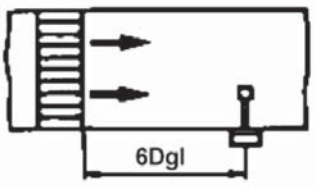


The following pictures are guidelines for correct installation of air velocity transmitters. Reliable measurements can be made by positioning the transmitter after filters (clean rooms), air heaters or air coolers, where the turbulence is very low.

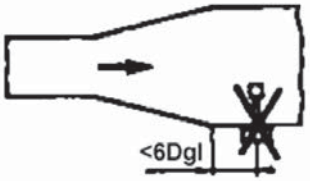


The probe shall be installed in the middle of the duct.





Preferred location after filters, rectifiers, coolers (no turbulences)



The probe shall be placed in front of diffusers or confusers.

Filters and coolers calm down the air flow.

Maintenance of E+E Air Velocity Transmitters

Due to the absence of moving parts, the E+E air velocity transmitters are very reliable. Their innovative hot film anemometer principle makes them highly insensitive to dust and dirt. Under normal environmental conditions no maintenance is required.
For operation in polluted environment we recommend to clean the sensor periodically by washing it in isopropylalcohol and let it dry. Do not touch or rub.

Theory CO_2 - Measurement

Basics CO_2

Carbon dioxide (CO_2) is a gaseous component of the earth's atmosphere. The concentration of CO_2 in natural ambient air is about 0.04% or 400ppm. With each breath, humans convert oxygen (O_2) into carbon dioxide.
Although carbon dioxide is invisible and odorless, an increased CO_2-content makes is apparent because humans will notice increased fatigue and reduced concentration. In rooms with high occupancy such as conference rooms and theatres, negative effects become all the more evident.
Modern climate control can assure optimal air quality by adjusting the supply of fresh air based on the measurement of CO_2 concentration in the indoor air. The CO_2-concentration is regarded as an important measure of indoor air quality.

Guide values for CO_2-concentration:

• ~ 40,000ppm	Proportion in exhaled human breath (20l CO_2/h)
• 5,000ppm	Limit of CO_2-concentration at the workplace
• > 1,000ppm	Fatigue and reduced concentration
• 1,000ppm	Recommended CO_2 level of indoor air
• 400ppm	Fresh, natural ambient air

Measuring methods

CO_2 measurements in HVAC applications are based exclusively on the Infrared (IR) absorption principle.

There are two methods to measure CO_2 concentration with the IR absorption method:
- Non-Dispersive InfraRed (NDIR) absorption sensor
- Photo-acoustic sensor

E+E Elektronik has decided for the NDIR absorption sensor principle. Compared with the photo-acoustic sensors, NDIR sensors offer the following advantages:
- less sensitive to pressure variations
- less sensitive to vibrations and acoustic interference
- compact design

The E+E NDIR system uses a two-source two-beam procedure to detect a certain wavelength of the infrared light.

A patented auto-calibration procedure uses two IR-sources with distinct operation cycles:
One IR-source operates to measure the CO_2 concentration and generates an IR signal every 30 seconds.
The second IR-source, the reference source, is used for the auto-calibration only. This source is activated twice every 24h, which leads to virtually no aging and therefore to negligible drift. The quasi drift-free signal of the reference source is used to offset eventual drifts of the measuring source.

The advantages if the E+E NDIR CO_2 sensing are:
- easy drift compensation with stable IR-reference source
- use of simple IR-filter. Other methods use two IR-filters or complicated switchable IR-filters
- only one IR-detector required
- simple and reliable design

Measuring Temperature - Basics

Definition

Temperature is the main physical quantity which describes the state of a thermodynamic system.
The measurement of temperature is based on the fact that all objects - and consequently also temperature sensors - are **exchanging energy** with their surroundings.
There are three ways to exchange energy:

- Conduction
- Connection
- Radiation

For an ideal temperature measurement, the temperature sensor and its surroundings are in **thermal equilibrium**, thus there is no energy transfer to or from the sensor. The temperature of the sensor is equal to the surrounding temperature.
To state the absolute temperature, a **reference value** is necessary.
A scale for temperature can be defined knowing the reference value and the temperature behaviour of the sensor. The Kelvin scale is based on the **absolute minimal temperature** 0 K and the triple state of water 273.16 K. The unit is 1 Kelvin = 1 K.
T is used for absolute temperature measured on Kelvin scale. The **triple state of water** is the temperature where water can exist in all its three states.
Apart from the Kelvin scale, the **Celsius scale** is accepted in Europe. The unit of the Celsius scale is 1°C = 1K. The Celsius scale is shifted by 273.15, with respect to the Kelvin scale. At normal atmospheric pressure of 1013.25 mbar the melting of water is at 273.15 K (resp. 0°C).
The symbol for this temperature information is **t**.
All temperature scales (IPTS-68 or TTS) were replaced 1990 by the **International Temperature Scale ITS-90**. On this new Celsius scale the boiling temperature of water (was 100°C) is no point of reference any more. The new boiling temperature of water acc. ITS-90 is already at t = 99.974°C at normal atmospheric pressure.

Formula:	**t [°C]**	**= T - 273.15**			
		e.g. 250 K	=	(250-273.15)°C	= -23.15°C
	T [K]	**= t + 273.15**			
		e.g. 50°C	=	(50+273.15) K	= 323.15 K

Measuring Methods

The temperature can be measured mechanically or electronically.

Mechanical methods are based e.g. on bimetal, liquid thermometers or gas thermometers. In the **industrial measurement** technology the electronic methods are preferred. These are mainly based on the variation of an electrical resistor as function of temperature. The PTC elements (positive temperature coefficient) are used for thermal protection switches, NTC-elements (negative temperature coefficient) for low accuracy requirements.

For **high accuracy applications** metal resistors are used. The metal employed can be platinum, molybdenum or nickel in form of wire or thin film on a substrate.
E+E temperature transmitters are using **platinum-temperature sensors** with characteristics according **IEC751 and EN60751**.

Humidity Calibration-Basics

It is known and accepted that relative humidity is one of the physical quantities most difficult to calibrate.
The main problem is to generate humidity with high accuracy and stability especially for calibration outside a special humidity lab. There are different methods to generate humidity, whereby all classical methods require either temperature stability and uniformity or accurate measurement of the temperature.

Saturated Salt Solutions

A closed box partly filled with saturated salt solutions generates relative humidity in the free room above the salt with good accuracy. The value of the relative humidity depends on the type of salt used.
It is mainly independent of temperature, but strongly dependent on temperature uniformity. For an accuracy of ±2% RH a temperature uniformity better than 0.5°C (0.9°F) is necessary.

Non Saturated Salt Solutions

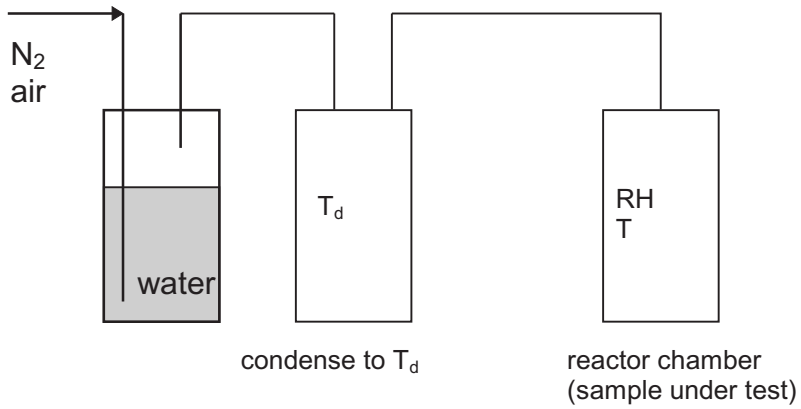
Instead of saturated salts non concentrated LiCl-solutions can be used. The obtained values of the relative humidity depend on the salt concentration.

Mixing Reactor

A stream of dry air (0% RH) is splitted into two separated streams. One gas stream is saturated with vapour in a saturation chamber (100% RH), the other one remains dry.
The RH in the measuring chamber is set by adjusting the mixing ratio of the two air streams with a mass flow controller.

Two-Temperature Reactor

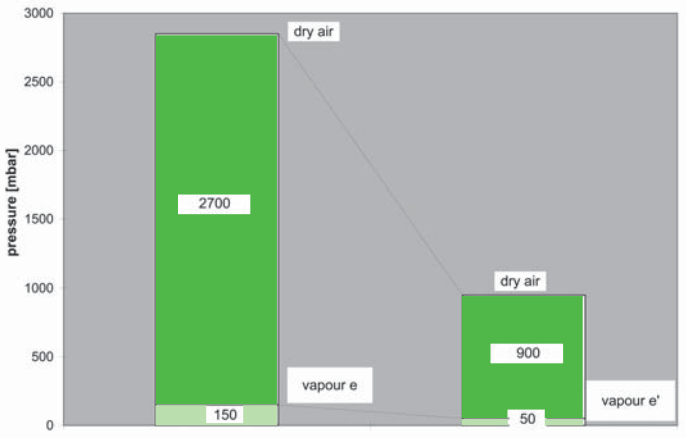
Air or nitrogen is saturated with vapour in a saturation chamber and cooled down to the dew point temperature Td corresponding to the requested relative humidity RH at temperature T. Excess vapour condenses and the vapour partial pressure equals to the saturation partial pressure.
The saturated air warms up to temperature T, the vapour partial pressure corresponds to the required RH. (Principle of reverse dew point mirror)



In an idealy designed two-temperature-reactor the accuracy depends only on the measurement of two temperatures (T, Td).
Main disadvantage is a long stabilisation time when changing the humidity.

Two-Pressure Reactor

Air with a pressure $\mathbf{p_1}$ consisting of dry air and a certain vapour pressure **e** is expanded to a pressure $\mathbf{p_2}$. During the expansion all components of the air will be expanded with the same ratio $\mathbf{p_2/p_1}$, i.e. also the vapour pressure **e** is expanded.



Initial state :
total pressure $\mathbf{p_1 = pda + e}$

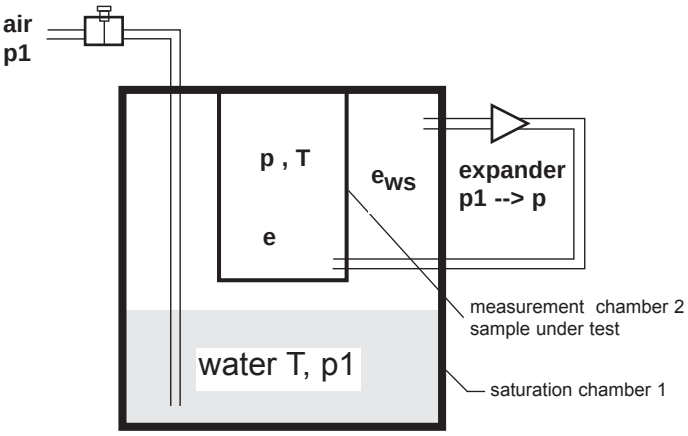
expanded state :
total pressure $\mathbf{p_2 = p_1 * p_2/p_1 = p_2/p_1 * (pda + e)}$

After expansion the vapour pressure of the moist air is reduced to

$$\mathbf{e' = p_2/p_1 * e}$$

Two-Pressure Humidity Calibrator HUMOR 20

The two pressure humidity calibrator HUMOR 20 consists of two chambers, one built within the other.



Schematic construction of the two pressure reactor HUMOR 20

Air or nitrogen with a pressure $\mathbf{p_1}$ is saturated in the saturation chamber 1. The vapor partial pressure $\mathbf{e_{ws}}$ is maximum, the RH is 100%.
Then the saturated air is expanded to the ambient pressure **p** in the measuring chamber 2.
The saturation and measuring chambers of HUMOR 20 are built one inside the other and are made from materials with high thermal conductivity. These assures uniform temperature in both chambers.
Under these conditions the partial pressure of vapors is reduced in the same ratio as the total pressure of air and becomes:

$$\mathbf{e = e_{ws} * p/p_1}$$

Consequently $\mathbf{RH = e/e_{ws} = p/p_1}$

The generated RH depends only on the ratio of two pressures, which allows a very short stabilisation time. The RH in the measurement chamber is set to the desired value by adjusting the inlet pressure $\mathbf{p_1}$.
The saturated partial pressure $\mathbf{e_{ws}}$ depends slightly on pressure. The correction is made by a micro-processor.
Practically the generated humidity is calculated from the pressures measured by two pressure sensors with excellent long term stability and reproducibility.

YOUR PARTNER IN SENSOR TECHNOLOGY

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