International Energy Agency

Demand Controlled Ventilating Systems

Sensor Market Survey

Energy Conservation in Buildings and Community Systems Programme

Demand Controlled Ventilating Systems

Sensor Market Survey

Energy Conservation in Buildings and
Community Systems Programme, Annex 18
December 1991

Willigert Raatschen

IEA Energy Conservation

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Contents

Preface

International Energy Agency

The International Energy Agency (IEA) was established in 1974 within the framework of the Organization for Economic Co-operation and Development (OECD) to implement an International Energy Programme.

As one element of the International Energy Programme, the participants undertake co-operative activities in energy research, development and demonstration. A number of new and improved energy technologies which have the potential of making significant contributions to our energy needs have been identified for collaborative efforts. The IEA Committee on Energy Research and Development (CRD), assisted by a small secretariat staff, co-ordinates the energy research, development and demonstration programme.

Energy Conservation in Buildings and Community Systems

The IEA sponsors research and development in a number of areas related to energy. In the area of energy conservation in buildings, the IEA is sponsoring various exercises to more accurately predict the energy use of buildings, including:

- comparison of existing computer programs
- building monitoring
- comparison of calculation methods, ventilation and air quality
- studies of occupancy

Sixteen countries and the Centre of European Countries (CEC) have elected to participate in this area and have designated contracting parties to the Implementing Agreement that covers collaborative research in this area. Participation was not restricted solely to governments, but a number of private organizations, universities and laboratories were selected as contracting parties. This brought a much broader range of expertise to projects in various areas of technology. The IEA recognizes the importance of associating industry with government-sponsored energy research and development, and every effort is made to encourage this trend.

The Executive Committee

Overall control of the R&D programme Energy Conservation in Buildings and Community Systems is maintained by an Executive Committee, which not only monitors existing projects but identifies new areas where collaborative effort may be beneficial. The Executive Committee ensures that all projects fit into a predetermined strategy without unnecessary overlap or duplication, but with effective liaison and communication. The Executive Committee has initiated the following projects to date:

1 Load Energy Determination of Buildings •
2 Ekistics & Advanced Community Energy Systems •
3 Energy Conservation in Residential Buildings •
4 Glasgow Commercial Building Monitoring *
5 Air Infiltration and Ventilation Centre
6 Energy Systems & Design of Communities *
7 Local Government Energy Planning *
8 Inhabitant Behaviour with regard to Ventilation *
9 Minimum Ventilation Rates *
10 Building HVAC Systems Simulation •
11 Energy Auditing *
12 Windows and Fenestration •

13 Energy Management in Hospitals
14 Condensation and Energy *
15 Energy Efficiency in Schools
16 BEMS 1 - User Interfaces & System Integration
17 BEMS 2 - Evaluation & Emulation Techniques
18 Demand Controlled Ventilating Systems
19 Low Slope Roof Systems
20 Air Flow Patterns
21 Thermal Modelling of Buildings
22 Design of Energy Efficient Communities & Urban Planning
23 Multizone Air Flow Modelling
24 Heat-, Air-, Moisture Transfer in New Retro-fitted Insulated Envelope Parts
25 Real Time Simulation of HVAC-systems for Building Optimisation, Fault Detection and Diagnosis

(* denotes completed projects)

Annex 18 - Demand Controlled Ventilating Systems

The subject of indoor and outdoor air quality has generated a great deal of attention in many countries. Areas of concern include outgassing of building materials as well as occupant-generated pollutants such as carbon dioxide, moisture and odours.

Progress has also been made towards addressing issues relating to the air tightness of the building envelope. Indoor air quality studies indicate that better control of supply flow rates as well as the air distribution pattern within buildings are necessary. One method of maintaining good indoor air quality without extensive energy consumption is to control the ventilation rate according to the needs and demands of the occupants, or to preserve the building envelope. This is accomplished through the use of demand controlled ventilating (DCV) systems.

The specific objective of Annex 18 is to develop guidelines for demand controlled ventilating systems based on state of the art analyses, case studies on ventilation effectiveness, and proposed ventilation rates for different users in domestic, office, and school buildings.

To fulfil this objective, the work was divided into the following subtasks:

Subtask	A	Review of existing technology
Subtask	B1	Long term testing of the performance of sensors in laboratory and field
	B2	Trials in unoccupied test buildings or test rooms
	B3	Field trials in occupied buildings
Subtask	C	Preparation of a source book on design and operation of demand controlled ventilating systems

The activities of Annex 18 are a follow-up to the work undertaken by Annex 9 to establish minimum ventilation rates for buildings.

Annex 18 - Participants

The participants will undertake a co-ordinated effort, involving the sharing of activities within the Subtasks. Each participant will deliver a product of its own to provide support to all Subtasks. The participating countries are:

Belgium	
Canada	leader of Subtask B3
Denmark	
Federal Republic of Germany	leader of Subtask A
Finland	
Italy	leader of Subtask B2
The Netherlands	
Norway	
Sweden	operating agent leader of Subtasks B1 and C
Switzerland	

IEA Annex 5, Air Infiltration and Ventilation Centre (AIVC), will act as a vehicle for disseminating the results of Annex 18.

1. Introduction

The work undertaken in Subtask A provides an assessment of existing technologies and current knowledge about Demand Controlled Ventilating (DCV) Systems.

With regard to the specific goals of Annex 18 and the ongoing research work, a demand controlled ventilating system is defined in the following way:

> **A DCV system is a ventilation system in which the airflow rate is governed by airborne contaminants.**
>
> - **An automatic DCV system is one in which the airflow rate is governed by an automatic control device.**
>
> - **A manual DCV system is one in which the airflow rate can be governed by the user (a human being acts as an indicator).**

A DCV system can therefore consist of a time clock control, and/or a presence control, and/or a sensor control, where the latter is activated by suitable gases such as carbon dioxide, humidity or hydrocarbons to keep air quality at a desired level.

2. Background on Sensors for DCV Systems

A fundamental pre-requisite for demand controlled ventilating systems is the possibility to find a measurable "indicator" of the air quality. Another pre-requisite is the existence of commercially available sensors for the measurand which have acceptable sensitivity, accuracy, long term characteristica and price level.

Different types of "indicators" can provide different types of information concerning the ventilation requirements of a specific building. Furthermore, different types of sensors for the same "indicator" can give different results. Such sensors must be sensitive enough to detect changes in the air quality, requiring increased or decreased supplies of outdoor air and simultaneously be stable enough to function satisfactorily over long periods in varying environments.

Hence it is of great value to increase our knowledge of

1) which "indicators" are suitable
2) which sensors are possible for the planned "indicators"
3) how the different "indicators" read relative to each other
4) how different sensors for one particular "indicator" read both in the short term and in the long term.

A 1st market survey on humidity and indoor air quality (iaq) sensors was undertaken in 1988. The results were published in the Subtask A report of IEA-Annex 18[2]. The more information and experience concerning iaq-sensors had been gathered at that time, the more it was obvious, that the worldwide knowledge of sensor-performance (especially for mixed gas sensors) was very poor and of course insufficient for the use of such sensors in DCV systems.

[2] the report is available through the *AIVC at University of Warwick Science Park, Coventry CV47EZ, UK*

3. Sensor Test Programme

Therefore, the IEA-Annex 18 working group decided to develop a detailed test procedure for iaq-sensors and to conduct a broad sensor test in the laboratory and in the field. This work is currently under way at the *National Testing Institute in BORAS/Sweden.* The tests started in summer 1990. The report of the lab test results should be available in Oct. 91, the report of the 1 year field-test result in spring 1992.

4. 2nd Market Survey on Humidity and iaq-Sensors

Parallel to the currently running sensor test in Sweden it was decided to update the 1st market survey of 1988, because new interesting developments came on the market, prices and quality had changed and more detailed technical information should be provided to the interesting reader. Therefore, this 2nd sensor survey devotes one page to each sensor.

How the 2nd market survey was conducted.

The questionnaire with an attached 2-sided information sheet and additional information about the scope of IEA-Annex 18 and the sensor survey were distributed on June 7, 1991 to 69 companies around the world. It can be said, that the survey covers the European sensor market pretty good, whereas the United States may be underrepresented. Table 1 gives an overview about sensor product distribution in the different countries.

Countries	addressed	humidity sensors	CO_2-sensors	mixed gas sensors	combined and miscellaneous
Austria	1	1			2
Finland	1	5			
Germany	9	12	2	4	2
Israel	1		1		
Japan	1			2	2
The Netherlands	1				1
Norway	1		1		
Sweden	1	1			
Switzerland	3	3	1	1	
United States	2	4	2		5

Table 1: Number of sensors produced in addessed countries

All companies, which didn't respond were addressed again by FAX at July 8, 1991. The 2nd survey was completed on July 22, 1991.

This report contains in Appendix 1 the questionnaire with the 2-sided information sheet, the completed questionnaires filled-out by the companies in alphabetical order of the company name and splitted into the 4 groups of sensors according to Table 1. Appendix 2 lists the addresses of the contacted companies.

The prices in the questionnaires were converted to US$ for comparability according to Table 2.

Austria	100 Schilling	7.86 US$
Finland	100 Finmark	23.31 US$
Germany	1 DM	0.55 US$
Israel	1 Shekel	0.49 US$
Japan	100 Yen	0.72 US$
The Netherlands	100 hfl	49.18 US$
Norway	100 norw. Krone	14.54 US$
Sweden	100 swed. Krone	15.63 US$
Switzerland	1 sFR.	0.64 US$

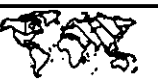
Table 2: Currency conversion as of July 19, 1991

Attention: **Information in the questionnaires have been supplied by the sensor manufacturers themselves. The author is not liable for mistakes or improper content in this survey report. No responsibility can be accepted for the use of data presented in this publication. It is recommended that the reader order the latest information on a specific product directly from the appropriate company.**

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification



General

Address of manufacturer:	Ahlborn Mess- und Regelungstechnik, Eichenfeldstr. 1-3, D-W-8150 Holzkirchen Tel: +49-8024-3007-0
Contact person and fax.:	Dieter Ahlborn, +49-8024-3007-10
Sensor designation:	C 846 / Therm 2286-2
Sensor element type used:	NTC
Measurement principle of sensor element:	Psychrometric system
Measuring range:	1.0..100 %RH, 0..500 g/kg abs. hum., -25..100°C dewpoint

Influencing factors [1]

Temperature:	[no]	if	yes <	
Humidity:	[no]	if	yes <	
Cross sensitivity:	gas:		in	%
	gas:		in	%
Atmospheric pressure:	[no]	if	yes <	

Measuring properties

		of full scale / measured value
Accuracy:	± 0.15°C	/ resolution 0.1 %RH
Sensitivity: [1]		
Rise time:	T_{63} min, T_{90} min,	other $T_{...}$ min
Repeatability: [1]	%	
Long-term stability: [1]	< %	of full scale

Additional information

Linearized output signal:	continuous / switched 10 mV / %RH
Power requirements:	10 mA
Size :	l= 240 mm, 330 g
Warrenty:	12 months/year
Price:	326 US$
Comments:	Measures also dewpoint, absolute humidity and temperature

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	E+E Elektronik GmbH, Langwiesen 7,
	A-4210 Engerwitzdorf Tel: +43-7235-2343-0
Contact person and fax.:	Mr. Johann Palzenberger, +43-7235-2343-43
Sensor designation:	Hyfreq Type Fit
Sensor element type used:	HC 500
Measurement principle of sensor element:	capacitive
Measuring range:	from 0 to 100 % RH

Influencing factors [1]

Temperature:	[no]	if	yes <	±0.1 % RH / °C
Humidity:	[no]	if	yes <	
Cross sensitivity:	gas:		in	%
	ges:		in	%
Atmospheric pressure:	[no]	if	yes <	

Measuring properties

		of full scale / measured value
Accuracy:	±	2.5 % RH (0..95 % RH) /
Sensitivity: [1]	6.3 µsec full range, 200 Hz / %RH	
Rise time:	T_{63} min, T_{90} 0.25 min, Other $T_{...}$ min	
Repeatability: [1]	± 1 % RH	
Long-term stability: [1] 50% RH, 80 °C	< ± 0.5 % RH	of full scale

Additional information

Linearized output signal:	continuous / switched Frequency output
Power requirements:	10-30 VDC
Size :	38*53 mm, probe 20..200 mm
Warrenty:	12 months/year
Price:	1 piece 143 US$
Comments:	new approach with pulse-frequency output

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Feutron GmbH Greiz, Reichenbacher Str. 173
	D-O 6600 Greiz Tel:
Contact person and fax.:	Mr. Fiedler, +37-793-71281
Sensor designation:	Feuchtesensor Typ 1087/01
Sensor element type used:	Feutron sensor element
Measurement principle of sensor element:	capacitiv humidity sensor element
Measuring range:	from 0 to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± / ± 2 % RH
Sensitivity: [1]	10 mV / % RH
Rise time:	T_{63} min, T_{90} 0.16 min, Other $T_{..}$ min
Repeatability: [1]	± 2 % RH
Long-term stability: [1]	< over years % of full scale

Additional information

Linearized output signal:	continuous / switched 0-1 V
Power requirements:	9-24 VDC, 0.1 VA
Size :	110 mm * 22 mm diometer
Warrenty:	6 months/year
Price:	128 US$
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Galltec Mess- und Regeltechnik GmbH, Boschstr.4, D-W-7048 Bondorf Tel: +49-7457-3056
Contact person and fax.:	Mr. A. Gall, +49-7457-3758
Sensor designation:	FG80H / TFG80 H, duct type
Sensor element type used:	"Polyga" from Galltec
Measurement principle of sensor element:	hygroscopic stripe
Measuring range:	from 25 % RH to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes < -0.1% RH
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < base 1013 mbar

Measuring properties

	of full scale / measured value
Accuracy:	± >40 % RH: ± 2.5 % RH , <40 % RH ± 3.5 % RH
Sensitivity: [1]	
Rise time:	T_{63} 1.4 min, T_{90} min, Other $T_{..}$ min
Repeatability: [1]	1 %
Long-term stability: [1]	< 1 % of full scale

Additional information

Linearized output signal:	continuous / switched OHM
Power requirements:	no
Size :	108*70*273 mm
Warrenty:	6 months/year
Price:	225.- US$, (1-9 pcs.) , 146.- US$ (> 200 pcs.)
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Galltec Mess- und Regeltechnik GmbH, Boschstr.4, D-W-7048 Bondorf Tel: +49-7457-3056
Contact person and fax.:	Mr. A. Gall, +49-7457-3758
Sensor designation:	FG80J / TFG80J, duct type
Sensor element type used:	"Polyga" from Galltec
Measurement principle of sensor element:	hygroscopic stripe
Measuring range:	from 25 % RH to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes < -0.1% RH
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < base 1013 mbar

Measuring properties

	of full scale / measured value
Accuracy:	± >40 % RH: ± 2.5 % RH , <40 % RH ± 3.5 % RH
Sensitivity: [1]	
Rise time:	T_{63} 1.4 min, T_{90} min, Other $T_{...}$ min
Repeatability: [1]	1 %
Long-term stability: [1]	< 1 % of full scale

Additional information

Linearized output signal:	continuous / switched	4..20 mA or 0..20 mA, 0..10 VDC
Power requirements:	15..30 VDC, (1.5) 1 VA	
Size :	108*70*273	
Warrenty:	6	months/year
Price:	234.- US$ (1-9 pcs.) ,	152.- US$ (> 200 pcs.)
Comments:		

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Galltec Mess- und Regeltechnik GmbH, Boschstr.4, D-W-7048 Bondorf Tel: +49-7457-3056
Contact person and fax.:	Mr. A. Gall, +49-7457-3758
Sensor designation:	FG80UAC / TFG80UAC, duct type
Sensor element type used:	"Polyga" from Galltec
Measurement principle of sensor element:	hygroscopic stripe
Measuring range:	from 25 % RH to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes < -0.1% RH
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < base 1013 mbar

Measuring properties

	of full scale / measured value
Accuracy:	± >40 % RH: ± 2.5 % RH , <40 % RH: ± 3.5 % RH
Sensitivity: [1]	
Rise time:	T_{63} 1.4 min, T_{90} min, other $T_{..}$ min
Repeatability: [1]	1 %
Long-term stability: [1]	< 1 % of full scale

Additional information

Linearized output signal:	continuous / switched 0..10 VDC
Power requirements:	20..28 VAC, 1.5 VA
Size :	108*70*273 mm
Warrenty:	6 months/year
Price:	234.- US$ (1-9 pcs.), 152.- US$ (> 200 pcs)
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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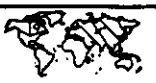
Sensor specification



General

Address of manufacturer:	Galltec Mess- und Regeltechnik GmbH, Boschstr.4, D-W-7048 Bondorf Tel: +49-7457-3056
Contact person and fax.:	Mr. A. Gall, +49-7457-3758
Sensor designation:	FG120 / TFG120, room type
Sensor element type used:	"Polyga" from Galltec
Measurement principle of sensor element:	hygroscopic stripe
Measuring range:	from 25 % RH to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes < -0.1% RH
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < base 1013 mbar

Measuring properties

	of full scale / measured value
Accuracy:	± >40 % RH: ± 2.5 % RH , <40 % RH ± 3.5 % RH
Sensitivity: [1]	
Rise time:	T_{63} 1.8 min, T_{90} min, Other $T_{..}$ min
Repeatability: [1]	1 %
Long-term stability: [1]	< 1 % of full scale

Additional information

Linearized output signal:	continuous / switched OHM
Power requirements:	no
Size :	115*70*42 mm
Warrenty:	6 months/year
Price:	225.- US$ (1-9 pcs.) , 146.- US$ (> 200 pcs.)
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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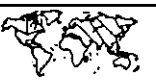

General

Address of manufacturer:	Golltec Mess- und Regeltechnik GmbH, Boschstr.4, D-W-7048 Bondorf Tel: +49-7457-3056
Contact person and fax.:	Mr. A. Goll, +49-7457-3758
Sensor designation:	FG120U / TFG120U, room type
Sensor element type used:	"Polyga" from Golltec
Measurement principle of sensor element:	hygroscopic stripe
Measuring range:	from 25 % RH to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes < -0.1% RH
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < base 1013 mbar

Measuring properties

	of full scale / measured value
Accuracy:	± >40 % RH: ± 2.5 % RH , <40 % RH: ± 3.5 % RH
Sensitivity: [1]	
Rise time:	T_{63} 1.4 min, T_{90} min, other $T_{...}$ min
Repeatability: [1]	1 %
Long-term stability: [1]	< 1 % of full scale

Additional information

Linearized output signal:	continuous / switched 0..10 VDC
Power requirements:	15 VDC or 24 VDC, 1 VA
Size :	115*70*42 mm
Warrenty:	6 months/year
Price:	234.- US$ (1-9 pcs.), 152.- US$ (>200 pcs.)
Comments:	

[1] Specify, when data is based on *scale and value* (full scale) or another *value*

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Sensor specification

General

Address of manufacturer:	HY-CAL Engineering, 9650 Telstar Ave., El Monte, CA 91731, USA Tel: +1-818-444-4000
Contact person and fax.:	Ed Nowak, +1-818-444-1314
Sensor designation:	CT-829-A-MH
Sensor element type used:	HY-CAL CMOS IC
Measurement principle of sensor element:	capacitive IC
Measuring range:	from 0% to 100% RH

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes < not applicable
Cross sensitivity:	gas: no in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 2% RH /
Sensitivity: [1]	0.16 mA / %RH
Rise time:	T_{63} 0.83 min, T_{90} min, other $T_{..}$ min
Repeatability: [1]	±0.5% RH
Long-term stability: [1]	< 1.0 % of full scale

Additional information

Linearized output signal:	continuous / switched 4-20 mA
Power requirements:	20-45 VDC
Size :	113*71.4*35 mm
Warrenty:	12 months/year
Price:	205.- US$
Comments:	Decorative wall mount composite housing. Temperature compensated output. Integral calibration jack.

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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General

Address of manufacturer:	HY-CAL Engineering, 9650 Telstar Ave., El Monte, CA 91731, USA Tel: +1-818-444-4000
Contact person and fax.:	Ed Nowak, +1-818-444-1314
Sensor designation:	CT-829-A-X 20 / X 21
Sensor element type used:	HY-CAL CMOS IC
Measurement principle of sensor element:	capacitive IC
Measuring range:	from 0% to 100% RH

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes < not applicable
Cross sensitivity:	gas: no in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 2% RH /
Sensitivity: [1]	0.16 mA / %RH
Rise time:	T_{63} 0.83 min, T_{90} min, Other $T_{..}$ min
Repeatability: [1]	±0.5% RH
Long-term stability: [1]	< 1.0 % of full scale

Additional information

Linearized output signal:	continuous / switched 4-20 mA
Power requirements:	20-45 VDC
Size :	housing: 114*70*51 mm, probe: 9.5 mm dia * 203 mm
Warrenty:	12 months/year
Price:	205.- US$
Comments:	Duct, surfoce and remote mount configurations. Rated for outdoor use. Temperature compensated output. Integral calibration jack.

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General

Address of manufacturer:	HY-CAL Engineering, 9650 Telstar Ave., El Monte, CA 91731, USA Tel: +1-818-444-4000
Contact person and fax.:	Ed Nowak, +1-818-444-1314
Sensor designation:	CT-880-C
Sensor element type used:	HY-CAL thin film polymer and thin film Pt RTD
Measurement principle of sensor element:	capacitive RH with RTD temp compensation
Measuring range:	from 0% to 100% RH

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes < not applicable
Cross sensitivity:	gas: no in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 2.5 % RH /
Sensitivity: [1]	0.16 mA / %RH
Rise time:	T_{63} 0.21 min, T_{90} min, Other $T_{...}$ min
Repeatability: [1]	±0.5% RH
Long-term stability: [1]	< 1.0 % of full scale

Additional information

Linearized output signal:	continuous / switched 4-20 mA
Power requirements:	24-45 VDC
Size :	housing: 117 dia * 127 mm, probe: 9.5 dia * 305 mm
Warrenty:	12 months/year
Price:	895.-US$
Comments:	Explosion proof nema 4x housing. Washable sensor operates to 185°C. Optional digital display. Probe lenghts 51-812 mm.

1) Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General	
Address of manufacturer:	HY-CAL Engineering, 9650 Telstar Ave., El Monte, CA 91731, USA Tel: +1-818-444-4000
Contact person and fax.:	Ed Nowak, +1-818-444-1314
Sensor designation:	IH-3602-L (Sensor only)
Sensor element type used:	HY-CAL CMOS IC
Measurement principle of sensor element:	capacitive IC
Measuring range:	from 0% to 100% RH

Influencing factors [1]	
Temperature:	[no] if yes < -0.22 % of reading RH / °C
Humidity:	[no] if yes < not applicable
Cross sensitivity:	gas: no in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties	of full scale / measured value
Accuracy:	± 5% RH /
Sensitivity: [1]	30 mV / %RH nominal
Rise time:	T_{63} 0.5 min, T_{90} min, Other $T_{...}$ min
Repeatability: [1]	±0.5% RH
Long-term stability: [1]	< 1.0 % of full scale

Additional information	
Linearized output signal:	continuous / switched linear 0.8-3.8 VDC nominal
Power requirements:	4.5-6.5 VDC regulated; 5 VDC nominal
Size :	6-pin TO-5 can, 9 mm diameter * 4.6 mm h
Warrenty:	contact factory months/year
Price:	< 25 US$ each (100 pcs.)
Comments:	IC mounted in slotted TO-5 can

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Wilh. Lambrecht GmbH, P.O. Box 2654, Friedländer Weg 65-67
	D-W-3400 Göttingen Tel: +49-551-4958-0
Contact person and fax.:	Ralf Bäcker, +49-551-4958-12
Sensor designation:	809 L 0-100, humidity
Sensor element type used:	own hair stripes
Measurement principle of sensor element:	hair stripes
Measuring range:	from 5% to 100%

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 2.5 %RH /
Sensitivity: [1]	0.5 % RH
Rise time:	T_{63} 1.8 min, T_{90} min, other $T_{...}$ min
Repeatability: [1]	± 1 %
Long-term stability: [1]	< must be regenerated weekly of full scale

Additional information

Linearized output signal:	continuous / switched 0-100 OHM
Power requirements:	no
Size :	395*79 mm, diameter measuring head 104 mm
Warrenty:	6 months/year
Price:	640 US$
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Landis & Gyr Building Control, Friesstr. 20-24, D-W-6000 Frankfurt 60 **Tel:** +49-69-4002-0
Contact person and fax.:	Mr. Günther, +49-69-4002-590
Sensor designation:	QFA 62.5
Sensor element type used:	Humicap H1
Measurement principle of sensor element:	capacitive
Measuring range:	from 0 to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes < 1%
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± / ± 2% (10..90 % RH)
Sensitivity: [1]	
Rise time:	T_{63} min, T_{90} min, Other $T_{...}$ min
Repeatability: [1]	0.5 %
Long-term stability: [1]	< 0.5 % RH/year (40..90 % RH)

Additional information

Linearized output signal:	continuous / switched 0..10 V
Power requirements:	24 VAC
Size :	85*110*32 mm
Warrenty:	12 months/year
Price:	456.- US$
Comments:	Sensor must not be exposed to aggressive media. No industrial application.

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Pax Electro Products AB, P.O. Box 72, S-64030 Hälle-forsnäs, Sweden **Tel:** +46-157-41200
Contact person and fax.:	Boo Wiksöter, +46-157-40065
Sensor designation:	Pax Humidity & Time Controller
Sensor element type used:	Orko optic GmbH, Villingen-Schwenningen, Germany
Measurement principle of sensor element:	humidity; hygroscopic stripe
Measuring range:	from 30 % RH to 80 % RH

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes < at set point
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 5 % , 50% RH factory calibrated, the set point
Sensitivity: [1]	can be changed by the user
Rise time:	T_{63} min, T_{90} min, other $T_{...}$ 5 min
Repeatability: [1]	% (to stort the fan)
Long-term stability: [1]	< % of full scale

Additional information

Linearized output signal:	continuous / switched
Power requirements:	
Size :	100*100*70 mm
Warrenty:	months/year
Price:	78.15 US$ (fan not included)

Comments: The main application is in residential buildings. Humidity and time control device works on light and humidity. The device can be located in a shower cabin or close to a bath tub.

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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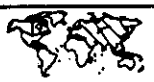
Questionnaire

Sensor specification



General

Address of manufacturer:	Rotronic AG, P.O Box, Grindelstr. 6,
	CH-8303 Bassersdorf Tel: +41-1-838-1111
Contact person and fax.:	Mr. Robert Spichiger, +41-1-837-0073
Sensor designation:	F-Series, Hygromer R
Sensor element type used:	CK-90, Rotronic R
Measurement principle of sensor element:	capacitive
Measuring range:	from 0 to 100 % RH

Influencing factors 1)

Temperature:	[no] if yes < compensated
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 2% RH 30..95 % RH / ±3% 20..100 % RH /
Sensitivity: 1)	0..10 Volt for 0..100 % RH
Rise time:	T_{63} 0.1 min, T_{90} min, Other $T_{...}$ min
Repeatability: 1)	0.1 % RH
Long-term stability: 1) per year	< 1 % RH of full scale

Additional information

Linearized output signal:	continuous / switched
Power requirements:	24 VAC / 24 VDC / 10..35 VDC , 25 mA
Size :	154*73*48 mm
Warrenty:	3 months/year
Price:	230.- US$
Comments:	

1) Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Staefa Control System AG, Laubesrüti, CH-8712 Stäfa Tel: +41-1-928-6111
Contact person and fax.:	Mr. Inauen, +41-1-928-6711
Sensor designation:	FR-H90
Sensor element type used:	H90, Staefa Control
Measurement principle of sensor element:	polyamid strip
Measuring range:	from 30 % to 80 % RH

Influencing factors [1]

Temperature:		[no]	if yes <
Humidity:		[no]	if yes <
Cross sensitivity:	no data	gas:	in - %
		gas:	in - %
Atmospheric pressure:		[no]	if yes <

Measuring properties

			of full scale / measured value
Accuracy:		±	/
Sensitivity: [1]			
Rise time:	no data	T_{63} min,	T_{90} min, Other $T_{..}$ min
Repeatability: [1]			
Long-term stability: [1]		<	% of full scale

Additional information

Linearized output signal:	continuous / switched 3.73..2.21 V
Power requirements:	6 VDC
Size :	80*80*22 mm
Warrenty:	1 months/year
Price:	list price 194.- US$
Comments:	This declaration applies to the room device. A duct version is available in combination with the temp.sensor T30.

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General	
Address of manufacturer:	Staefa Control System AG, Loubesrüti,
	CH-8712 Stäfa Tel: +41-1-928-6111
Contact person and fax.:	Mr. Inauen, +41-1-928-6711
Sensor designation:	FRA-H2
Sensor element type used:	H2, Philips
Measurement principle of sensor element:	capacitive
Measuring range:	from 10 % to 90 % RH

Influencing factors [1]	
Temperature:	[no] if yes < 0,1 % RH /K
Humidity:	[no] if yes <
Cross sensitivity:	gas: not fit at conta- in - %
	gas: minated air in - %
Atmospheric pressure:	[no] if yes <

Measuring properties	of full scale / measured value
Accuracy:	± / 5 % (10..90 % RH)
Sensitivity: [1]	0.4 ± 0.05 pF / %RH
Rise time:	T_{63} min, T_{90} min, other $T_{..}$ 10..43%: 3min, 43..90%: 5 min
Repeatability: [1]	(for RH ex 10-90-10) 3% approx.
Long-term stability: [1]	< % of full scale

Additional information	
Linearized output signal:	continuous / switched 0..10 V
Power requirements:	15 VDC ±5%, 75 mW
Size :	80*80*28 mm
Warrenty:	1 months/year
Price:	list price 208.- US$
Comments:	This declaration applies to the room device. A duct version is available in combination with the temp.sensor T1.

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Adolf Thies GmbH & Co. KG, Hauptstr.76,
	D-W-3400 Göttingen Tel: +49-551-79001-0
Contact person and fax.:	Mr. Peter Künnemann, +49-551-79001-65
Sensor designation:	Hygro Transmitter 1.1010.22.040
Sensor element type used:	Thies
Measurement principle of sensor element:	polyester
Measuring range:	from to

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 3 % /
Sensitivity: [1]	
Rise time:	T_{63} min, T_{90} min, other $T_{..}$ min
Repeatability: [1]	%
Long-term stability: [1]	< % of full scale

Additional information

Linearized output signal:	continuous / switched 0(4)-20 mA / 0-1(10) V
Power requirements:	24 VDC
Size :	130*75*55 mm
Warrenty:	6 months/year
Price:	475.- US$
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Adolf Thies GmbH & Co. KG, Hauptstr.76,
	D-W-3400 Göttingen Tel: +49-551-79001-0
Contact person and fax.:	Mr. Peter Künnemann, +49-551-79001-65
Sensor designation:	Hygro Transmitter 1.1010.40.040
Sensor element type used:	Vaisola
Measurement principle of sensor element:	capacitive
Measuring range:	from 10 to 85 %

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 5 % /
Sensitivity: [1]	
Rise time:	T_{63} min, T_{90} min, Other $T_{..}$ min
Repeatability: [1]	%
Long-term stability: [1]	< % of full scale

Additional information

Linearized output signal:	continuous / switched 0(4)-20 mA / 0-1(10) V
Power requirements:	24 VDC
Size :	130*75*55 mm
Warrenty:	6 months/year
Price:	295 US$
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
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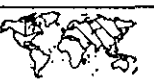
Sensor specification



General	
Address of manufacturer:	Figaro Eng. / Unitronic GmbH, P.O. Box 330429, Münsterstr. 338, D-W-4000 Düsseldorf 30 Tel: +49-211-626364
Contact person and fax.:	Mr. R. Breiden, +49-211-626360
Sensor designation:	HVAC systems
Sensor element type used:	High polymer in porous ceromic
Measurement principle of sensor element:	AC resistonce
Measuring range:	from 30 to 90 % RH

Influencing factors [1]	
Temperature:	[no] if yes < 0.3 % RH / °C (30-90% RH)
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties	of full scale / measured value
Accuracy:	± / 10^6 - 10^3 OHM
Sensitivity: [1]	30-90 % RH
Rise time:	T_{63} min, T_{90} 2 min, other $T_{...}$ min
Repeatability: [1]	%
Long-term stability: [1]	< % of full scale

Additional information	
Linearized output signal:	continuous / switched
Power requirements:	5 VAC
Size :	16*11.2 mm
Warrenty:	2 months/year
Price:	9.04 US$ /ea. (1-25 pcs.)
Comments:	Humidily sensor with integroted thermistor

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General	
Address of manufacturer:	Vaisala Oy, PL 26, SF-00421 Helsinki, Finland Tel: +358-0-89491
Contact person and fax.:	Mr. Heikki Mesiä, Product Manager, +358-0-8949485
Sensor designation:	Humitter™
Sensor element type used:	Intercap ™ by Vaisala
Measurement principle of sensor element:	capacitive polymer sensor
Measuring range:	from 10 % RH to 90 % RH

Influencing factors [1]	
Temperature:	[no] if yes < ±2% RH (-10 to +60°C)
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties		of full scale / measured value
Accuracy:	(at 20 °C)	± ±5% RH over 2 years (incl. sensor interchangeability)
Sensitivity: [1]		10 mV/%RH
Rise time:		T_{63} min, T_{90} 0.08 min, Other $T_{...}$ min
Repeatability: [1]		%
Long-term stability: [1]		< ±1% RH per year

Additional information	
Linearized output signal:	continuous / switched 0 to 1 VDC (optionally 4-20 mA 2-wire)
Power requirements:	7 to 28 VDC / 4 mA
Size :	length 68 mm + cable length, diameter 12 mm
Warranty:	12 months/year
Price:	intended for HVAC and OEM applications
Comments:	no humidity calibration because of the INTERCAP™ interchangeable humidity sensor

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
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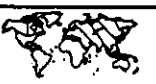
Sensor specification



General

Address of manufacturer:	Vaisala Oy, PL 26, SF-00421 Helsinki, Finland Tel: +358-0-89491
Contact person and fax.:	Mr. Heikki Mesiä, Product Manager, +358-0-8949485
Sensor designation:	HMD 20 / HMW 20
Sensor element type used:	HUMICAP ™ by Vaisala
Measurement principle of sensor element:	capacitive polymer sensor
Measuring range:	from 0 % RH to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes < ± 0.04 % RH /°C
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

		of full scale / measured value
Accuracy:	(at 20 °C)	± 2 % RH (0 to 90 % RH), ±3 % RH (90 to 100 % RH)
Sensitivity: [1]		0.16 mA /%RH
Rise time:		T_{63} min, T_{90} 0.08 min, Other $T_{...}$ min
Repeatability: [1]		%
Long-term stability: [1]		< ±1% RH per year

Additional information

Linearized output signal:	continuous / switched 4-20 mA 2-wire
Power requirements:	10 to 35 VDC
Size :	HMD 20: 100*100*310 mm / HMW 20: 110*85*32 mm
Warrenty:	12 months/year
Price:	intended for HVAC / EMCS applications

Comments: 1) temperoture measurement available as an option
2) the product features single-point on-site RH calibration

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Vaisala Oy, PL 26, SF-00421 Helsinki, Finland Tel: +358-0-89491
Contact person and fax.:	Mr. Heikki Mesiä, Product Manager, +358-0-8949485
Sensor designation:	HMD 30 / HMW 30
Sensor element type used:	HUMICAP ™ by Vaisala
Measurement principle of sensor element:	capacitive polymer sensor
Measuring range:	from 0 % RH to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes < ± 0.04 % RH /°C
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

		of full scale / measured value
Accuracy:	(at 20 °C)	± 2 % RH (0 to 90 % RH), ±3 % RH (90 to 100 % RH)
Sensitivity: [1]		e.g. 10 mV /% RH at 0-1 VDC output range
Rise time:		T_{63} min, T_{90} 0.08 min, other $T_{...}$ min
Repeetebility: [1]		%
Long-term stability: [1]		< ±1% RH per year

Additional information

Linearized output signel:	continuous / switched 0-1/0-5/0-10 VDC or 0-20 mA
Power requirements:	10 to 35 VDC / 9 to 24 VAC
Size :	HMD 30: 100*100*310 mm / HMW 30: 110*85*32 mm
Warrenty:	12 months/year
Price:	intended for HVAC / EMCS applications

Comments: 1) temperature measurement available as an option
2) the product features single-point on-site RH calibration

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Vaisala Oy, PL 26, SF-00421 Helsinki, Finland Tel: +358-0-89491
Contact person and fax.:	Mr. Heikki Mesiä, Product Monager, +358-0-8949485
Sensor designation:	HMD 40 / HMW 40
Sensor element type used:	Intercap ™ by Vaisala
Measurement principle of sensor element:	capacitive polymer sensor
Measuring range:	from 10 % RH to 90 % RH

Influencing factors [1]

Temperature:	[no] if yes < ±2% RH (-10 to +60°C)
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

		of full scale / measured value
Accuracy:	(at 20 °C)	± ±5% RH over 2 years (incl. sensor interchangeability)
Sensitivity: [1]		0.16 mA /%RH
Rise time:		T_{63} min, T_{90} 0.08 min, Other $T_{...}$ min
Repeatability: [1]		%
Long-term stability: [1]		< ±1% RH per year

Additional information

Linearized output signal:	continuous / switched 4-20 mA 2-wire
Power requirements:	10 to 28 VDC
Size :	HMD 40: 80*80*302 mm / HMW 40: 80*80*26 mm
Warrenty:	12 months/year
Price:	intended for HVAC / EMCS applications

Comments: 1) no humidity calibrotion becouse of the INTERCAP™ interchangeable humidity sensor
2) HMD 40 for duct mounting, HMW 40 for wall mounting

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Vaisala Oy, PL 26, SF-00421 Helsinki, Finland **Tel:** +358-0-89491
Contact person and fax.:	Mr. Heikki Mesiä, Product Manager, +358-0-8949485
Sensor designation:	HMD 50 / HMW 50
Sensor element type used:	Intercap ™ by Vaisala
Measurement principle of sensor element:	capacitive polymer sensor
Measuring range:	from 10 % RH to 90 % RH

Influencing factors [1]

Temperature:	[no] if yes < ±2% RH (-10 to +60°C)
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

		of full scale / measured value
Accuracy:	(at 20 °C)	± ±5% RH over 2 years (incl. sensor interchangeability)
Sensitivity: [1]		10 mV /% RH (optionally 100 mV /% RH)
Rise time:		T_{63} min, T_{90} 0.08 min, Other $T_{...}$ min
Repeatability: [1]		%
Long-term stability: [1]		< ±1% RH per year

Additional information

Linearized output signal:	continuous / switched 0 to 1 VDC (optionally 0 to 10 VDC)
Power requirements:	12 to 35 VDC / 12 to 24 VAC
Size :	HMD 50: 50*80*302 mm / HMW 50: 80*80*26 mm
Warrenty:	12 months/year
Price:	intended for HVAC / EMCS applications

Comments: 1) no humidity calibration because of the INTERCAP™ interchangeable humidity sensor
2) HMD 50 for duct mounting, HMW 50 for wall mounting

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Aritron Instruments LTD, Lohwisstr.30, Ch-8123 Ebmatingen, Switzerland Tel: +41-1-980-3381
Contact person and fax.:	+41-1-980-3366
Sensor designation:	Arox 425 - passive diffusion / Fumox 425 - with pump
Sensor element type used:	Photoacoustic CO2-Sensor (infrared)
Measurement principle of sensor element:	Photoacoustic
Measuring range:	from 0 to 200/1000/2000/3000/5000/10,000/ 50,000/100,000/500,000

Influencing factors [1]

Temperature:	[no]	if yes	<	0.4% FS / °C
Humidity:	[no]	if yes	<	0.3% FS / RH
Cross sensitivity:	gas: CO: <2%FS	in	1	%
	gas: CH4:<2%FS	in	1	%
Atmospheric pressure:	[no]	if yes <		

Measuring properties

	of full scale / measured value
Accuracy:	± 0.5% /
Sensitivity: [1]	output fluctuation 0.7 % FS
Rise time:	T_{63} min, T_{90} 4(Arox)/0.1(Fumox) min, other $T_{...}$ min
Repeatability: [1]	0.5 % FS
Long-term stability: [1]	< ±5 % of full scale

Additional information

Linearized output signal:	continuous / switched
Power requirements:	220V/110V/24V, 50 or 60 Hz
Size :	Arox:180*120*90, Fumox:193*184*135
Warrenty:	18 months/year
Price:	958 US$ (ea.); 32 US$ (50,000 pcs.)
Comments:	ONLY FOR OEM-CUSTOMERS

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

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Questionnaire

Sensor specification

General

Address of manufacturer:	Horiba Europe GmbH, Industriestr. 8, D-W-6374 Steinbach/Ts. Tel: +49-6171-704-0
Contact person and fax.:	Mr. Birk, +49-6171-8044
Sensor designation:	
Sensor element type used:	Pyro electic sensor, Horiba
Measurement principle of sensor element:	NDIR
Measuring range:	from 0 to 3,000 ppm

Influencing factors [1]

Temperature:	[no] if yes < ± 4 % FS / 10°C
Humidity:	[no] if yes <
Cross sensitivity:	gas: H_2O 2.3%(20°C sat) ±1% FS in %
	gas: no data in %
Atmospheric pressure:	[no] if yes < Sensitivity changes in proportion to atmospheric pressure

Measuring properties

	of full scale / measured value
Accuracy:	± 2% FS /
Sensitivity: [1]	approx. 1% FS
Rise time:	T_{63} min, T_{90} 0.25 min, Other $T_{...}$ min
Repeatability: [1]	± 1.5 % /FS
Long-term stability: [1]	< ± 10 % of full scale /3 months

Additional information

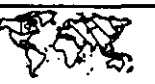
Linearized output signal:	continuous / switched 4-20mA
Power requirements:	220VAC, 50 Hz, approx. 20 VA
Size :	220*85*262 mm
Warrenty:	months/year
Price:	
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification



General

Address of manufacturer:	Sauter-Cumulus GmbH, P.O Box 350, Hans-Bunte-Str.15, D-W-7800 Freiburg Tel: +49-761-5105-0
Contact person and fax.:	W. Schäuble, +49-761-5105-234
Sensor designation:	CO_2-sensor+transformer EGQ 10 F 001 / F 003
Sensor element type used:	
Measurement principle of sensor element:	NDIR
Measuring range:	from 0 to 2000/6000 ppm

Influencing factors [1]

Temperature:	[no] if yes < 0.5% /K
Humidity:	[no] if yes < 0.1% / % RH
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < 0.1% / mbar

Measuring properties

	of full scale / measured value
Accuracy:	± 10 % /
Sensitivity: [1]	<0.5 %
Rise time:	T_{63} ~2 min, T_{90} ~3 min, Other $T_{..}$ min
Repeatability: [1]	< 1 %
Long-term stability: [1]	< 5 % of full scale

Additional information

Linearized output signal:	continuous / switched 0-10 VDC / 0-20 mA
Power requirements:	24 VAC +10%-15% / 50-60 Hz / 5VA
Size :	122*120*55 mm
Warrenty:	1 months/year
Price:	F 001: 1557.- US$, F 003: 1503 US$

Comments: with LED-indicator in steps of 200 ppm / 600 ppm; F 003 for use with pump / pump set 170 US$; adjustable to four zones of altitude

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Simrad Optronics A/S, P.O. Box 6114 Etterstod, N-0602 Oslo 6, Norway Tel: +47-2-670490
Contact person and fax.:	Trygve Wangsmo, +47-2-192991
Sensor designation:	GD 200 CO_2
Sensor element type used:	N.A.
Measurement principle of sensor element:	IR Spectroscopy
Measuring range:	from 3,000 ppm to 20,000 ppm

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 5% /
Sensitivity: [1]	
Rise time:	T_{63} min, T_{90} 0.08 min, other $T_{...}$ min
Repeatability: [1]	%
Long-term stability: [1]	< 5% % of full scale

Additional information

Linearized output signal:	continuous / switched 4..20 mA
Power requirements:	18..32 VDC / 6 W
Size :	140*132*318 mm
Warrenty:	18 months/year
Price:	
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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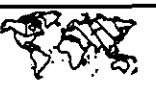
Sensor specification



General

Address of manufacturer:	Spegos Industries LTD, Har Hotzvim Industrial Park, P.O. Box 23650, Jerusalem 91235 **Tel:** +972-2-828867
Contact person and fax.:	Ruth Iscovich, +972-2-826873
Sensor designation:	Agrico 2
Sensor element type used:	CO_2
Measurement principle of sensor element:	non dispersive infra red
Measuring range:	from 0 to 3000 ppm

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes <
Cross sensitivity:	gas: H_2O 0 in 100 %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± / 1.5 %
Sensitivity: [1]	
Rise time:	T_{63} min, T_{90} min, other $T_{..}$ min
Repeatability: [1]	%
Long-term stability: [1]	< 5% over 6 months

Additional information

Linearized output signal:	continuous / switched 0-1 VDC and 4-20 mA
Power requirements:	220 VAC, 50/60 Hz, 12 W
Size :	315*245*135 mm
Warrenty:	12 months/year
Price:	
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

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Questionnaire

Sensor specification

General

Address of manufacturer:	Valtronics, 1011 Detroit Avenue, Concord, CA 94518 USA Tel: +01-415-689-1076
Contact person and fax.:	Ms. Melissa Graves, +01-415-689-3739
Sensor designation:	Model 2089 Wall-Stat; Model 2088 Duct-Stat
Sensor element type used:	
Measurement principle of sensor element:	NDIR
Measuring range:	from 0 to 2000 ppm

Influencing factors [1]

Temperature:	[no] if yes < 10 ppm / °C
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 3% /
Sensitivity: [1]	1% FS
Rise time:	T_{63} min, T_{90} 0.13 min, Other $T_{...}$ min
Repeatability: [1]	1 %
Long-term stability: [1]	< % of full scale

Additional information

Linearized output signal:	continuous / switched 0-1 VDC, 4-20 mA
Power requirements:	24 VAC
Size :	100*127*51 mm
Warrenty:	12 months/year
Price:	675.- US$
Comments:	SPDT dry relay contacts output with adjustable setpoints

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Valtronics, 1011 Detroit Avenue, Concord,
	CA 94518 USA **Tel:** +1-415-689-1076
Contact person and fax.:	Ms. Melissa Graves, +01-415-689-3739
Sensor designation:	Model 2080 CO_2 Stot
Sensor element type used:	
Measurement principle of sensor element:	NDIR
Measuring range:	from 0 to 2000 ppm

Influencing factors [1]

Temperature:	[no] if yes < 10 ppm / °C
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 3% /
Sensitivity: [1]	1 % FS
Rise time:	T_{63} min, T_{90} 0.13 min, Other $T_{...}$ min
Repeatability: [1]	1 %
Long-term stability: [1]	< % of full scale

Additional information

Linearized output signal:	continuous / switched 0-2 V
Power requirements:	24 VAC
Size :	100*127*51 mm
Warrenty:	12 months/year
Price:	860.- US$
Comments:	LCD Digital Display

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Figaro engineering inc,, 1-5-3 Senbanishi, Minoo 562 Osaka Japan Tel: +81-727-28-2560 or +49-211-358128
Contact person and fax.:	Mr. Murakami, +49-211-359538 or +81-727-28-0467
Sensor designation:	AM 800 IAQ Unit
Sensor element type used:	Semiconductor Gas Sensor
Measurement principle of sensor element:	Metal Oxide Semiconductor
Measuring range:	from 1 to 10 ppm Hydrogen

Influencing factors [1]

Temperature:	[no] if yes < Automatic adjustment
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < negligible

Measuring properties

	of full scale / measured value
Accuracy:	± NA /
Sensitivity: [1]	< 1 ppm Hydrogen
Rise time:	T_{63} min, T_{90} <1 min, Other $T_{..}$ min
Repeatability: [1]	NA %
Long-term stability: [1]	< % of full scale

Additional information

Linearized output signal:	continuous / switched
Power requirements:	12 VDC
Size :	70*50*15 mm
Warrenty:	months/year
Price:	
Comments:	Microprocessor controlled IAQ unit using TGS 800
	Four output signal terminals with C-MOS output

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Figaro engineering inc,, 1-5-3 Senbanishi, Minoo 562 Osaka Japan Tel: +81-727-28-2560 or +49-211-358128
Contact person and fax.:	Mr. Murakami, +49-211-359538 or +81-727-28-0467
Sensor designation:	AMS 800
Sensor element type used:	Semiconductor Gas Sensor
Measurement principle of sensor element:	Metal Oxide Semiconductor
Measuring range:	from 1 to 10 ppm Hydrogen

Influencing factors [1]

Temperature:	[no] if yes < can be reduced by control IC
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < negligible

Measuring properties

	of full scale / measured value
Accuracy:	± NA /
Sensitivity: [1]	< 1 ppm Hydrogen
Rise time:	T_{63} min, T_{90} <1 min, Other $T_{..}$ min
Repeatability: [1]	NA %
Long-term stability: [1]	< % of full scale

Additional information

Linearized output signal:	continuous / switched
Power requirements:	5 VDC
Size :	22*31 mm
Warrenty:	months/year
Price:	
Comments:	Pre-calibrated IAQ-sensor unit to be used with a control IC chip

Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Landis & Gyr Building Control, Friesstr. 20-24,
	D-W-6000 Frankfurt 60 Tel: +49-69-4002-0
Contact person and fax.:	Mr. Günther, +49-69-4002-590
Sensor designation:	SER 61.1 and QAP 61.1
Sensor element type used:	
Measurement principle of sensor element:	resistor
Measuring range:	from 100 to 0% IAQ

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± /
Sensitivity: [1]	
Rise time:	T_{63} min, T_{90} min, Other $T_{..}$ min
Repeatability: [1]	%
Long-term stability: [1]	<

Additional information

Linearized output signal:	continuous / switched 0..10 V DC
Power requirements:	24 VAC
Size :	QAP 61.1: 100*81*32.4 mm
Warrenty:	12 months/year
Price:	OEM-device, contact factory for price
Comments:	Sensor QAP 61.1 can be used only in connection with controller SER 61.1. No industrial application.

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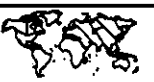
Sensor specification



General

Address of manufacturer:	Sauter-Cumulus GmbH, P.O Box 350, Hans-Bunte-Str.15, D-W-7800 Freiburg Tel: +49-761-5105-0
Contact person and fax.:	W. Schäuble, +49-761-5105-234
Sensor designation:	IAQ-sensor EGQ 1 F 001
Sensor element type used:	TGS 822 Figaro
Measurement principle of sensor element:	Metaloxide sensor
Measuring range:	from 0 rel. units to 10 relative units

Influencing factors [1]

Temperature:	[no] if yes < 1%/K
Humidity:	[no] if yes < 0.3% / % RH
Cross sensitivity:	gas: sensitive to a in %
	gas: lot of gases in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 20 % /
Sensitivity: [1]	< 0.5%
Rise time:	T_{63} ~1 min, T_{90} min, other $T_{...}$ min
Repeatability: [1]	< 1 %
Long-term stability: [1]	< 10 % of full scale

Additional information

Linearized output signal:	continuous / switched 0-10 VDC
Power requirements:	24 VAC ±20%, 50-60 Hz, 3.5 VA
Size :	72*72*32 mm
Warrenty:	1 months/year
Price:	189.- US$

Comments: 5 relative units are equivalent to a well defined concentration of acetone or alternatively to a well defined concentration of tobacco smoke ; with LED-indicator

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Sensor specification

General

Address of manufacturer:	Sauter-Cumulus GmbH, P.O Box 350, Hans-Bunte-Str.15, D-W-7800 Freiburg Tel: +49-761-5105-0
Contact person and fax.:	W. Schäuble, +49-761-5105-234
Sensor designation:	IAQ-sensor ERQ 1 F 001 / F 002
Sensor element type used:	TGS 822 Figaro
Measurement principle of sensor element:	Metaloxide sensor
Measuring range:	from 0 rel. units to 10 relative units

Influencing factors [1]

Temperature:	[no] if yes < 1%/K
Humidity:	[no] if yes < 0.3% / % RH
Cross sensitivity:	gas: sensitive to a in %
	gas: lot of gases in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 20 % /
Sensitivity: [1]	<0.5
Rise time:	T_{63} ~1 min, T_{90} min, Other $T_{...}$ min
Repeatability: [1]	< 1 %
Long-term stability: [1]	< 10 % of full scale

Additional information

	100 V/ 0.5 (cosφ=1), 24 VDC, 42 VAC/1A
Linearized output signal:	continuous / switched 0-10 VDC / 0-620 mVDC
Power requirements:	24 VDC +20%, 50-60 Hz
Size :	72*72*32 mm
Warrenty:	1 months/year
Price:	F001: 232.- US$, / F002: 221.- US$

Comments: 5 relative units are equivalent to a well defined concentration of acetone or alternatively to a well defined concentration of tobacco smoke / F002 with external setpoint (necessary! 66.- US$) / with 2 LED indicators

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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Questionnaire

Sensor specification

General

Address of manufacturer:	Sauter-Cumulus GmbH, P.O Box 350, Hans-Bunte-Str.15, D-W-7800 Freiburg **Tel:** +49-761-5105-0
Contact person and fax.:	W. Schäuble, +49-761-5105-234
Sensor designation:	iaq-sensor, on-off control, ERQ 2/8.349.002.001
Sensor element type used:	TGS 822 Figaro
Measurement principle of sensor element:	Metaloxide sensor
Measuring range:	**from** 0 rel. units **to** 10 relative units

Influencing factors [1]

Temperature:	[no] if yes < 1%/K
Humidity:	[no] if yes < 0.3% / % RH
Cross sensitivity:	gas: sensitive to a in %
	gas: lot of gases in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 20 % /
Sensitivity: [1]	<0.5 %
Rise time:	T_{63} ~1 min, T_{90} min, Other $T_{...}$ min
Repeatability: [1]	< 1 %
Long-term stability: [1]	< 10 % of full scale

Additional information

Linearized output signal:	continuous / switched 5(1) A, 250 VAC
Power requirements:	220-240 V +10-15%, 50-60 Hz, 11VA, 2W
Size :	107*72*40 mm
Warrenty:	1 months/year
Price:	256 US$

Comments: Time delay for relay 1..25 min; 5 relative units are equivalent to a well defined concentration of acetone or alternatively to a well defined concentration of tobacco smoke.

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Questionnaire

Sensor specification

General

Address of manufacturer:	Staefa Control System AG, Laubesrüti, CH-8712 Stäfa Tel: +41-1-928-6111
Contact person and fax.:	Mr. Inauen, +41-1-928-6711
Sensor designation:	FRA-Q1
Sensor element type used:	Q1 / Figaro TGS 812
Measurement principle of sensor element:	catalytic
Measuring range:	from 0 % to 100 % IAQ

Influencing factors [1]

Temperature:	[no] if yes < 5 % IAQ (0..40 °C)
Humidity:	[no] if yes < 5 % IAQ (40..80 % RH)
Cross sensitivity:	gas: CH_4 etc. in - %
	gas: FCKW etc. in - %
Atmospheric pressure:	[no] if yes < no data

Measuring properties

			of full scale / measured value
Accuracy:		±	/
Sensitivity: [1]			
Rise time:	no data	T_{63} min, T_{90} min, Other $T_{..}$ min	
Repeatability: [1]		%	
Long-term stability: [1]		< % of full scale	

Additional information

Linearized output signal:	continuous / switched 0..10 V
Power requirements:	24 VAC +15/-10%, 1.75 VA
Size :	80*80*28 mm
Warrenty:	1 months/year
Price:	list price 186.- US$
Comments:	This declaration applies to the room device. A duct version is available in combination with the temp.sensor T1.

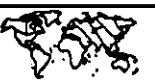
[1] Specify, when data is based on *scale end value* (full scale) or another *value*

8. Product Information on 'Miscellaneous Sensors and' 'Sensor Elements'

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification



General

Address of manufacturer:	E+E Elektronik GmbH, Langwiesen 7,
	A-4210 Engerwitzdorf Tel: +43-7235-2343-0
Contact person and fax.:	Mr. Johann Palzenberger, +43-7235-2343-43
Sensor designation:	HC 200
Sensor element type used:	HC 200, E+E Elektronik
Measurement principle of sensor element:	capacitive
Measuring range:	from 10 to 95 % RH

Influencing factors [1]

Temperature:	[no] if yes < -0.02 % RH / °C
Humidity:	[no] if yes <
Cross sensitivity:	gas: 100 ppm NH_3 at 85 % RH in 6 % RH
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

		of full scale / measured value
Accuracy:		± 1.5 /
Sensitivity: [1]		0.6 pF / %RH
Rise time:		T_{63} min, T_{90} 0.25 min, Other $T_{..}$ min
Repeatability: [1]		± 1 % RH
Long-term stability: [1]	50% RH, 80 °C	< ± 0.5 % RH of full scale

Additional information

Linearized output signal:	continuous / switched
Power requirements:	
Size :	4*5 mm
Warrenty:	12 months/year
Price:	23 US$ (each) , 11 US$ (1000 pcs.)
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	E+E Elektronik GmbH, Langwiesen 7,
	A-4210 Engerwitzdorf Tel: +43-7235-2343-0
Contact person and fax.:	Mr. Johann Palzenberger, +43-7235-2343-43
Sensor designation:	HC 500
Sensor element type used:	HC 500, E+E Elektronik
Measurement principle of sensor element:	capacitive
Measuring range:	from 0 to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes < -0.02 % RH / °C
Humidity:	[no] if yes <
Cross sensitivity:	gas: 100 ppm NH_3 at 85 % RH, in 6 % RH
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

		of full scale / measured value
Accuracy:		± 1.5 /
Sensitivity: [1]		1.7 pF / % RH
Rise time:		T_{63} min, T_{90} 0.25 min, Other $T_{...}$ min
Repeatability: [1]		± 1 % RH
Long-term stability: [1]	50% RH, 80 °C	< ± 0.5 % RH of full scale

Additional information

Linearized output signal:	continuous / switched
Power requirements:	
Size :	4*10 mm
Warrenty:	12 months/year
Price:	47 US$ (each) , 26 US$ (1000 pcs.)
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Feutron GmbH Greiz, Reichenbocher Str. 173
	D-O 6600 Greiz Tel:
Contact person and fax.:	Mr. Fiedler, +37-793-71281
Sensor designation:	Feuchtesensorelement
Sensor element type used:	Feutron- type
Measurement principle of sensor element:	copacitiv humidity sensor element
Measuring range:	from 0 to 100 % RH

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± /
Sensitivity: [1]	~ 1 pF / % RH
Rise time:	T_{63} min, T_{90} 0.16 min, other $T_{...}$ min
Repeatability: [1]	±1.5 % RH
Long-term stability: [1]	< over years % of full scale

Additional information

Linearized output signal:	continuous / switched osc. circuit necessary
Power requirements:	
Size :	10*7.5*1 mm
Warrenty:	6 months/year
Price:	33 US$
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Figaro engineering inc,, 1-5-3 Senbanishi, Minoo 562 Osaka Japan Tel: +81-727-28-2560 or +49-211-358128
Contact person and fax.:	Mr. Murakami, +49-211-359538 or +81-727-28-0467
Sensor designation:	TGS 501
Sensor element type used:	Semiconductor Gas Sensor
Measurement principle of sensor element:	Thin film metal oxide
Measuring range:	from 0.1 to 10 ppm Methylmercaptan

Influencing factors [1]

Temperature:	[no] if yes < NA
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < negligible

Measuring properties

	of full scale / measured value
Accuracy:	± NA /
Sensitivity: [1]	< 0.1 ppm
Rise time:	T_{63} min, T_{90} < 0.1 min, Other $T_{...}$ min
Repeatability: [1]	NA %
Long-term stability: [1]	< % of full scale

Additional information

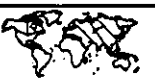
Linearized output signal:	continuous / switched
Power requirements:	0.55 VDC
Size :	6mm *7.6 mm diameter
Warrenty:	months/year
Price:	
Comments:	Offensive odor sensor element sensitive to volatile sulfide

Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification



General

Address of manufacturer:	Figaro engineering inc,, 1-5-3 Senbonishi, Minoo 562 Osaka Japon Tel: +81-727-28-2560 or +49-211-358128
Contact person and fax.:	Mr. Murakami, +49-211-359538 or +81-727-28-0467
Sensor designation:	TGS 800
Sensor element type used:	Semiconductor Gas Sensor
Measurement principle of sensor element:	Metal oxide Semiconductor
Measuring range:	from 1 to 20 ppm Hydrogen

Influencing factors [1]

Temperature:	[no] if yes < 3% /°C of measured value
Humidity:	[no] if yes < 1% /%RH of measured value
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes < negligible

Measuring properties

	of full scale / measured value
Accuracy:	± NA /
Sensitivity: [1]	< 1 ppm Hydrogen
Rise time:	T_{63} min, T_{90} < 1 min, Other $T_{...}$ min
Repeatability: [1]	NA %
Long-term stability: [1]	< % of full scale

Additional information

Linearized output signal:	continuous / switched NA
Power requirements:	5V AC/DC
Size :	10mm * 17mm diameter
Warrenty:	months/year
Price:	
Comments:	Mixed gas sensor element sensitive to tobacco smoke

Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	HY-CAL Engineering, 9650 Telstar Ave., El Monte, CA 91731, USA Tel: +1-818-444-4000
Contact person and fax.:	Ed Nowak, +1-818-444-1314
Sensor designation:	IH-3602-C (Sensor only)
Sensor element type used:	HY-CAL CMOS IC and thin film Pt RTD
Measurement principle of sensor element:	capacitive IC and Pt RTD
Measuring range:	RH: from 0% to 100% RH, Temp.: from -50°C to 85 °C

Influencing factors [1]

Temperature:	[no] if yes < 1% full scale w/temp comp
Humidity:	[no] if yes < not applicable
Cross sensitivity:	gas: no in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 2% RH /
Sensitivity: [1]	30 mV / %RH nominal
Rise time:	T_{63} 0.83min, T_{90} min, other $T_{...}$ min
Repeatability: [1]	±0.5% RH
Long-term stability: [1]	< 1.0 % of full scale

Additional information

Linearized output signal:	continuous / switched linear 0.8-3.8 VDC nominal
Power requirements:	4.5-6.5 VDC regulated; 5 VDC nominal
Size :	6-pin TO-5 can, 9 mm diameter * 7 mm h
Warrenty:	contact factory months/year
Price:	65.- US$
Comments:	RH and temp. elements in TO-5 can sealed with a sintered SST hydrophobic filter. Calibration data provided.

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	HY-CAL Engineering, 9650 Telstar Ave., El Monte, CA 91731, USA Tel: +1-818-444-4000
Contact person and fax.:	Ed Nowak, +1-818-444-1314
Sensor designation:	CT-839-A-MH
Sensor element type used:	HY-CAL CMOS IC and thin film Pt RTD
Measurement principle of sensor element:	capacitive IC and Pt RTD
Measuring range:	RH: from 0% to 100% RH, Temp: from -23°C to 65 °C

Influencing factors [1]

Temperature:	[no] if yes <
Humidity:	[no] if yes < not applicable
Cross sensitivity:	gas: no in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 2% RH; ± 0.8% of temp span /
Sensitivity: [1]	0.16 mA / %RH ; variable for temp
Rise time:	T_{63} 0.83 min, T_{90} min, other $T_{...}$ min
Repeatability: [1]	±0.5% RH, ± 0.01°C
Long-term stability: [1]	< 1.0 % of full scale

Additional information

Linearized output signal:	continuous / switched 4-20 mA, dual temp + RH
Power requirements:	20-45 VDC
Size :	113*71.4*35 mm
Warrenty:	12 months/year
Price:	398.-US$
Comments:	Decorative wall mount composite housing. Temperature compensated RH output. Integral calibration jacks.

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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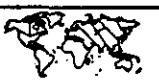
IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification



General	
Address of manufacturer:	HY-CAL Engineering, 9650 Telstar Ave., El Monte, CA 91731, USA Tel: +1-818-444-4000
Contact person and fax.:	Ed Nowak, +1-818-444-1314
Sensor designation:	CT-839-A-X 20 / X 21
Sensor element type used:	HY-CAL CMOS IC and thin film Pt RTD
Measurement principle of sensor element:	capacitive IC and Pt RTD
Measuring range:	RH: from 0% to 100% RH, Temp: from -23°C to 65 °C

Influencing factors [1]	
Temperature:	[no] if yes <
Humidity:	[no] if yes < not applicable
Cross sensitivity:	gas: no in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties	of full scale / measured value
Accuracy:	± 2% RH ; ± 0.8% of temp span /
Sensitivity: [1]	0.16 mA / %RH ; variable for temp
Rise time:	T_{63} 0.83 min, T_{90} min, other $T_{...}$ min
Repeatability: [1]	±0.5% RH, ± 0.01°C
Long-term stability: [1]	< 1.0 % of full scale

Additional information	
Linearized output signal:	continuous / switched 4-20 mA, dual temp + RH
Power requirements:	20-45 VDC
Size :	housing: 114*70*51 mm, probe: 9.5 mm dia * 203 mm
Warrenty:	12 months/year
Price:	398.-US$
Comments:	Duct, surface and remote configurations. Rated for outdoor use. Temperature compensated RH output. Integral calibration jacks.

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	HY-CAL Engineering, 9650 Telstar Ave., El Monte, CA 91731, USA Tel: +1-818-444-4000
Contact person and fax.:	Ed Nowak, +1-818-444-1314
Sensor designation:	CT-890
Sensor element type used:	HY-CAL thin film polymer and thin film Pt RTD
Measurement principle of sensor element:	capacitive dewpoint and RTD temp
Measuring range:	dewpoint:from -104.7°C to 100°C, temp.: from 0°C to 204.7°C

Influencing factors [1]

Temperature:	[no]	if	yes <	
Humidity:	[no]	if	yes <	
sensitivity:	gas: no		in	%
	gas:		in	%
Atmospheric pressure:	[no]	if	yes <	

Measuring properties

	of full scale / measured value
Accuracy:	temp.:±0.05°C,dewpoint:±0.6°C to ±6°C at 100°C + depression
Sensitivity: [1]	0.018 mA / °C
Rise time:	T_{63} 0.27 min, T_{90} min, Other $T_{...}$ min
Repeatability: [1]	included in published accuracy spec.
Long-term stability: [1]	included in published accuracy spec.

Additional information

Linearized output signal:	continuous / switched 4-20 mA dual output
Power requirements:	24-45 VDC or 115 VAC ± 10%
Size :	housing: 117 dia * 185 mm, probe: 9.5 dia * 305 mm
Warrenty:	12 months/year
Price:	3880.-US$
Comments:	Explosion proof nema 4x housing. Washable sensor operates to 185°C. Dual digital display. Probe lenghts 51-1524 mm. 350 PSI pressure rating.

[1] Specify,when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Wilh. Lambrecht GmbH, P.O. Box 2654, Friedländer Weg 65-67
	D-W-3400 Göttingen **Tel:** +49-551-4958-0
Contact person and fax.:	Rolf Bäcker, +49-551-4958-12
Sensor designation:	humidity sensor 8163 (humidity and temperature)
Sensor element type used:	Rotronic C-80
Measurement principle of sensor element:	capacitive
Measuring range:	from 0% to 100%

Influencing factors [1]

Temperature:	[no] if yes < +0.5 %RH /Δ 70 K
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 1% RH /
Sensitivity: [1]	0.1 % RH
Rise time:	T_{63} min, T_{90} 0.17 min, Other $T_{..}$ min
Repeatability: [1]	0.5 % RH
Long-term stability: [1]	< stable % of full scale

Additional information

Linearized output signal:	continuous / switched 0..1 V hum, -0.2..+0.5V temp.
Power requirements:	8..30 V
Size :	195*25 mm
Warrenty:	6 months/year
Price:	490 US$
Comments:	

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

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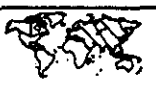
IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification



General

Address of manufacturer:	tke-vento bv, Reehorsterweg 25 E, NL-6717 LD EDE,
	Postbus 500, NL-6710 BM EDE Tel: +31+8380-32432
Contact person and fax.:	A.J. van Silfhout, +31-8380-34670
Sensor designation:	De Snuffelaar
Sensor element type used:	Figaro TGS 812 and MC-2 Minicap/Panametrics
Measurement principle of sensor element:	Mixed gas sensor, Methane, Isobutane, Hydrogen, CO, Ethanol
Measuring range:	from 500 to 6000 ppm

Influencing factors [1]

Temperature:	[no] if yes < 2.7 % at 65 % RH
Humidity:	[no] if yes < 5 % at 20 °C
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 10 % /
Sensitivity: [1]	RS 3000 ppm / RS 1000 ppm = 0.63 + 0.85 Isobutane
Rise time:	T_{63} min, T_{90} min, Other $T_{..}$ min
Repeatability: [1]	%
Long-term stability: [1]	After 6 days < no deviation % of full scale

Additional information

Linearized output signal:	continuous / switched Load= 4 K Vc = 10V
Power requirements:	Vc max 24 V PS = 15 mW max
Size :	16,5 mm* 17 mm diameter
Warrenty:	-- months/year
Price:	283.- US$ (1 pc.), 255.- US$ each (100 pcs.)
Comments:	Intended for towngas monitoring and domestic gasleak detector

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

The information given on this page comes from the manufacturer and is not verified by IEA - Annex 18

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer:	Valtronics, 1011 Detroit Avenue, Concord, CA 94518 USA Tel: +01-415-689-1076
Contact person and fax.:	Ms. Melissa Graves, +01-415-689-3739
Sensor designation:	Model 6289 IAQ- Stat
Sensor element type used:	
Measurement principle of sensor element:	(CO_2) NDIR, (RH) capacitive, (Temp) solid state
Measuring range:	CO_2 0-2,000 ppm, RH 15 to 95 %, Temp 8 to 40 °C

Influencing factors [1]

Temperature:	[no] if yes < 10 ppm / °C
Humidity:	[no] if yes <
Cross sensitivity:	gas: in %
	gas: in %
Atmospheric pressure:	[no] if yes <

Measuring properties

	of full scale / measured value
Accuracy:	± 3% /
Sensitivity: [1]	1 % FS
Rise time:	T_{63} min, T_{90} 0.13 min, other $T_{...}$ min
Repeatability: [1]	1 %
Long-term stability: [1]	< % of full scale

Additional information

Linearized output signal:	continuous / switched 4-20 mA
Power requirements:	
Size :	76*152*50 mm
Warrenty:	12 months/year
Price:	750.- US$
Comments:	SPDT dry relay contacts output with adjustable setpoints

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

IEA - Annex 18, Demand Controlled Ventilating Systems, 2nd Sensor Survey, May 1991
Questionnaire

Sensor specification

General

Address of manufacturer: .....

.....Tel.:.....

Contact person and fax.: .....

Sensor designation: .....

Sensor element type used: .....

Measurement principle of sensor element: .....

Measuring range: from.....to.....

Influencing factors [1]

Temperature: [no] if yes <.....

Humidity: [no] if yes <.....

Cross sensitivity: gas:..... in .....%

gas:..... in .....%

Atmospheric pressure: [no] if yes <.....

Measuring properties

	of full scale / measured value
Accuracy:	± ...../.....
Sensitivity: [1]	.....
Rise time:	T_{63} .....min T_{90} .....min other $T_{....}$.....min
Repeatability: [1]	.....%
Long-term stability: [1]	<.....% of full scale

Additional information

Linearized output signal: continuous / switched .....

Power requirements: .....

Size : ....

Warrenty: .....months/year

Price: .....

Comments: .....

.....

[1] Specify, when data is based on *scale end value* (full scale) or another *value*

Guide to answer the questionnaire

Refering to terms in the questionnaire a **sensor element** is defined as a device which directly measures a gas concentration (e.g. in the indoor air quality sensor of Unitronic the sensor element is the Figaro TGS 800). The **sensor** contains the sensor element and additional electronic circuits to give a standardized output signal.

1) Specify, when data is based on the *scale end value* or another *value.*

General

Address of manufacturer:	name, P.O. box, street, city, country, phone number.
Contact person and fax.:	name, department, fax. number.
Sensor designation:	article no., or order no., or type, or equipment, or name.
Sensor element type used:	which type of sensor element, from which company is used.
Measurement principle of sensor element:	***carbon dioxide sensors***: IR - spectroscopy, NDIR - spectroscopy, IR - photo-acoustic, or other ? ***mixed gas sensors***: homogenous metal oxide, mos-fet, catalytic, or other ? ***humidity sensors***: hair and polyethylene - strip, capacitive, conductance-film, lithium chloride, or other?
Measuring range:	for mixed gas sensors it is also important to specify the test gas (gas used for calibration).

Influencing factors

If output signal is independent against changes in *temperature / humidity / atmospheric pressure,* mark [no]. If there is an influence, quantify it (e.g. temperature influence for a CO_2 - sensor < 2% / K from scale end value).

If malfunction of sensor occurs with surface condensation, please indicate at the bottom of the questionnaire under comments.

Cross sensitivity:	the influence against presence of other gases (e.g. for a CO_2 - sensor , gas: CO < 1% /ppm $_{CO}$).

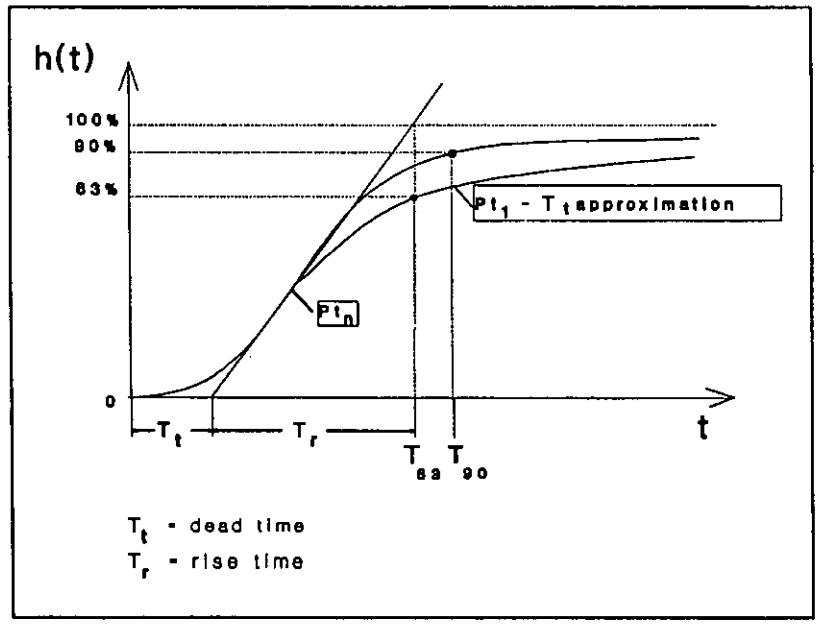
Measuring properties

Accuracy: expressed in % of the measured value or the full scale value or expressed in a concentration unit.

sensitivity: the change in output signal due to a given change in the primary measurand

Rise time: the time elapsed between a step change of the input concentration (signal) until the output has changed to a certain percentage of the steady state value. (e.g. other $T_{....}$ can be T_{60})

Step response



Repeatability: the standard deviation in % of the output signals, when conducting many tests of the same type.

Long-term stability: the change of output signal under defined concentrations after a one year period.

Additional information

Linearized output signal: the output signal may be linearized, it can be an analogous output signal or a control switch which is activated (e.g. 1-5 V, 4-20 mA). If the output signal is digital write *digital*.

Power requirements: for example: 10 or 20 V AC ,10 or 20 V DC input , 1 VA

Size: in mm

Warrenty: in months

Price: in national currency without sales tax in June 1991.

Comments: if sensor has additional features to be mentioned.

Contacted Companies:

1. **Ados GmbH**, D-5100 Aachen, Trierer Str. 23-25, Tel. +49-241-59041, FAX +49-241-59040

2. **AB Gemlaplast**, P.O. Box 7, S-36002 Gemla, Sweden, Tel. +46-470-67510

3. **ADC**, Pindar Road, Hoddesdon, Herts EN11 QAQ, England, FAX +44-992 444 567

4. **Ahlborn Mess- und Regeltechnik**, P.O. Box 1260, Eichenfeldstr. 1-3, D-8150 Holzkirchen, Tel. +49-8024-3007-0, FAX +49-8024-3007-10

5. **Alabaster**, B&H Labo. CO. Ltd, 295 Kyo-machi Kurume city, Fukuoka Pref. 830, Japan, Tel. +33-942-36-1201, FAX +33-942-37-2018

6. **Aritron AG**, Lohwiss-Str. 30, CH-8123 Ebmatingen, Tel. +41-1-980-3381, FAX +41-1-980-3366

7. **Auergesellschaft GmbH**, D-1000 Berlin 44, Thiemannstr. 1, Tel. +49-30-6891-0, FAX +49-30-6891-420

8. **Balluf**, Gebhard GmbH & Co KG, D-7303 Neuhausen, Gartenstr. 21-25, Tel. +49-7158-173-0, FAX +49-7158-69154

9. **Bayer Diagnostic GmbH**, D-8000 München 90, Weißenseestr.101, Tel. +49-89-69927-0, FAX +49-89-69927-295

10. **Beru-Ruprecht GmbH & Co KG**, Werner Str. 35, D-7140 Ludwigsburg, Tel. +49-7141-922770, FAX +49-714-132350

11. **Bieler & Lang GmbH**, Oberkirchstr. 21, D-7590 Achern, Tel. +49-7841-3886, FAX +49-7841-27899

12. **Centra-Bürkle GmbH**, P.O. Box 1164, D-7036 Schönaich, Tel. +49-7031-557-01, FAX +49-7031-557493

13. **COM air b.v.**, P.O. Box 7, Industrieweg 5, NL-5527 AJ Hapert, Tel. +31-4977-82990, FAX +31-4977-84044

14. **Control Products International**, 2724 Summer Street N.E., Minneapolis, MN 55413, USA, Tel. +1-612-331-4051, FAX +1-612-331-3180

15. **Corecl GmbH**, Hochburger Str. 23, P.O. Box 1570, D-7830 Emmendingen, Tel. +49-7641-8365

16. **DELTA Regeltechnik GmbH**, Türkenstr. 11, D-8000 München 2, FAX +49-89-283509

17. **Dräger AG**, Moislinger Allee 53/55, D-2400 Lübeck 1, Tel. +49-451-882-0, FAX +49-451-882-2080

18. **Driesen + Kern GmbH**, P.O. Box 1126, D-2000 Hamburg-Tangstedt, Tel. +49-4109-6633, FAX +49-4109-1359

19. **E+E Elektronik GmbH**, Langwiesen 7, A-4210 Engerwitzdorf, Tel. +43-7235-2343-0, FAX +43-7235-2343-43

20. **EGE-GmbH**, Ravensberg 34, D-2303 Gettorf, Tel. +49-4346-5071, FAX +49-4346-5658

21. **Elektronik GmbH**, Holbeinstr. 21, D-8500 Nürnberg 70, Tel. +49-911-66870, FAX +49-911

22. **Endrich Bauelemente Vertriebs GmbH**, Hauptstr. 56, D-7270 Nagold, Tel. +49-7452-4082, FAX +49-7452-1470

23. **Feutron GmbH Greitz**, Reichenbacher Str. 173, D-O-6600 Greiz, FAX +37-793-71281

24. **Figaro Engineering Inc.**, 1-5-3, Senbanishi, Minoo, Osaka 562, Japan, Tel. +33-727-28-2560, FAX +33-727-28-0467

25. **Figaro USA**, INC, P.O. Box 357, Wilmette, IL 60091, USA, Tel. +1-708-256-3546, FAX +1-708-256-3884

26. **Fresh Gesellschaft für Lüftungseinrichtungen mbH**, P.O. Box 3, D-3360 Osterode 22, Tel. +49-5522-81197, FAX +49-5522-81281

27. **Galltec GmbH**, Boschstrasse 4, P.O. Box 43, D-7048 Bondorf, Tel. +49-7457-3056, FAX +49-7457-3758

28. **Heidolph-Elektro GmbH & Co KG**, Starenstr. 23, D-8420 Kelkheim, Tel. +49-9441-7070, FAX +49-9441-707259

29. **Honeywell-Regelsysteme**, D-Offenbach/Main, Tel. +49-69-8064-0, FAX 49-2389-534754

30. **Horiba Europe GmbH**, Industriestr. 8, D-6374 Steinbach/Ts., Tel. +49-6171-704-0, FAX +49-6171-8044
Horiba Ltd., Miyanohigashi, Kisshoin, Minami-ku, Kyoto, Japan, Tel. +33-75-3138123, FAX +49-6171-8044

31. **HY-Cal Engineering**, 9650 Telstar Ave., P.O. Box 5488, El Monte, California, 91734, U.S.A., Tel. +1-818-444-4000, FAX +1-818-444-1314

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In this book is presented a Sensor Market Survey. The work is a result of efforts made within the frame of International Energy Agency (IEA) and its programme Energy Conservation in Buildings and Community Systems.

The survey was finished in July 1991 and contains data on commercially available sensors. Ventilation systems can be governed by these sensors when activated by a pollutant or an indicator.

In the report is given information on 26 types of humidity sensors, 7 types of CO_2 sensors, 7 types of mixed gas sensors (also called IAQ sensors), and 12 combined sensors and presence sensors.

Information is given on individual sensors from 10 countries on measuring principal, range and properties.

The price level is also indicated as well as necessary information on addresses and contact persons.

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