iST Innovative Sensor Technology

physical. chemical. biological.

SENSING WHAT MATTERS

CONTENTS

INNOVATIVE SENSOR TECHNOLOGY IST AG
– YOUR MANUFACTURER AND PARTNER FOR PHYSICAL, CHEMICAL AND BIOLOGICAL SENSORS

With more than 25 years of experience Innovative Sensor Technology IST AG is one of the leading manufacturers of physical, chemical and biological sensors. Our objective is to be the global leader in standard and customized sensor technology – empowering our customers to provide new levels of innovation and product design to deliver to their markets worldwide.

IST AG specializes in the development and manufacturing of sensors in five product areas; temperature, flow, humidity, conductivity and bio. In addition to development and manufacturing of standard sensors, our highly qualified technical team offers consulting and R&D tailored to specific customer requests in the field of sensor technology. This service makes us a valuable partner for your sensor project.

Since the foundation of IST AG in 1991, we have experienced continuous growth – in our product range, the number of employees and our locations. As a globally present company we deliver our products and services with highest quality standards throughout the world. Since 2005, IST AG is part of the Endress+Hauser Group.

FACTS ABOUT IST AG

Number of employees:	> 400
Headquarters:	Ebnat-Kappel, Switzerland (canton St. Gallen)
Further locations:	USA, Czech Republic (Rožnov pod Radhoštěm), Czech Republic (Prague)*, Ireland*, China*, India*
Related companies:	Jobst Technologies GmbH, Germany
Products & Services:	Platinum and nickel temperature sensors, TSic temperature sensors, flow sensors, humidity sensors, humidity modules, conductivity sensors, biosensors; customer-specific sensor adjustments, developments of new technologies

* Sales office / regional salesperson

OUR DIFFERENCE

Our advanced expertise is driven by the challenge to be at the forefront of the industry. We are continually improving existing technology, by working closely with customers to find optimal solutions for application specific requirements, and collaborating with a broad network of partners, including institutes and universities.

- We develop sensors fitted to application-specific requirements.
- We offer support by product specialists from development to after-sales.
- We manufacture small and large quantities within a short development and production time.
- We offer technology development and consultation out of our state-of-the-art facilities.
- We develop and manufacture sensors that are compatible across the entire product range.

Sensor substrate after passing through clean room processes.

Our processes are continuously optimized.

Together with our customers we find the optimal sensor solution.

Premium materials and production know-how ensure high quality.

We are there for you - whether in person, by email or on the phone.

QUALITY FROM A TO Z

We, together with our customers, set our priority on the highest quality standards. This is reflected in our processes, the materials used, production and our customer service.

Processes
IST AG is certified according to ISO 9001:2008 and ISO 14001:2004. Appropriate quality management systems and procedures are implemented across day-to-day operations. These procedures are regularly audited and optimized, according to business requirements.

R&D and consulting
In the initial consulting phase of a customer brief, we go to great lengths to understand our customers' business and requirements. Each customer brief is specifically examined and approved – ensuring every aspect of the development is considered before entering production. Our quality in the area of R&D is evident in the customized solutions we deliver – empowering our customers to achieve new levels of success.

Production
IST AG sources only the highest quality materials from our trusted network of suppliers. Our custom-built manufacturing facility in Ebnat-Kappel allows for a streamlined production process that is controlled at every step.

Customer service
At IST AG we believe in working as closely as possible with our customers. Personal contact throughout the entire process is a matter of course for us.

Working as development partners with our customers enables us to deliver to specific requirements or provide standardized sensor solutions – whatever your project needs. Our range of experience across a variety of industries brings unparalleled expertise to customer projects.

Numerous long-term relationships with customers is evidence of our success. We are well known for our outstanding quality amongst our customer.

STANDARD SENSORS OR CUSTOMIZED SOLUTIONS

The product range of Innovative Sensor Technology IST AG contains standard sensors in the areas of temperature, flow, humidity, conductivity and bio. When your requirements cannot be met by a standard solution, we realize a customer-specific adaption or development of a sensor.

A successful sensor solution is only possible with an in-depth knowledge of a customer's business, challenges and requirements, which come with the particular application. In order to identify the sensor solution that best fits the application of our customer, we discuss the requirements and specifications extensively with the customer. That's how we collaboratively find the optimal solution for your application.

In order to provide the ideal solution for individual application requirements and to use the technological possibilities to full capacity, IST AG offers a variety of technology and material variants throughout the production process. First a meeting takes place between our engineers and the customer to discuss the specific application requirements. Depending on the complexity of the project the solution can either be an existing sensor, an adapted sensor or a custom made design. For new custom designs, prototypes are developed and thoroughly tested, before production starts.

Every sensor passes a precisely defined production process. A sensor with lead wires for example passes the following process: In our cleaning rooms the sensors are sputtered, exposed with photoresist, etched and trimmed. During screen printing, the contact points are strengthened and the substrate is covered. Afterwards the substrate is diced and the wires are welded to the chip. Before the sensors leave IST AG, they enter a measuring process where they are checked and sorted according to their accuracy.

Photolithography process in clean room
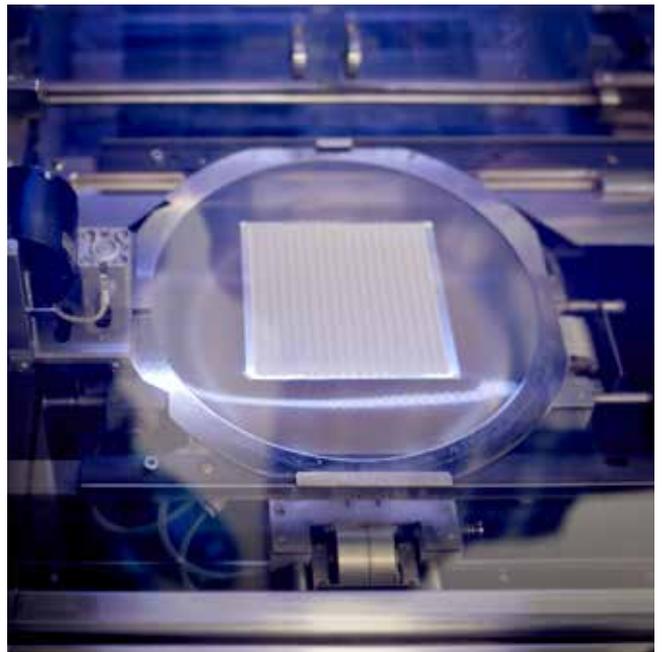
Sensor substrate in dicing machine

Welding of wires to the sensor

Measuring of the sensors

TEMPERATURE SENSORS

Wide temperature measurement with excellent long-term stability and high accuracy available as standard and customer-specific solutions

IST AG offers platinum, nickel as well as TSic sensors for a precise and reliable temperature measurement. Our temperature sensors are used in various industries, such as process control & automation, HVAC (Heating, Ventilation, Air Conditioning), handheld, medical, biotechnology, aviation and space, appliance or automotive industry. Beside standard sensors our product range contains customer-specific solutions, adapted individually to your requirements.

PLATINUM TEMPERATURE SENSORS (Pt)

The IST AG platinum RTD temperature sensors cover an operating temperature range of -200 °C to +1000 °C. The thin-film sensors are developed with the highest quality materials and can operate in the harshest conditions while experiencing minimal drift. The construction is extremely robust. Due to the small dimensions the sensors can be implemented in various applications. Our platinum temperature sensors are available with a standard TCR of 3850 ppm/K and with accuracies according to the IEC 60751 norm.

NICKEL TEMPERATURE SENSORS (Ni)

The nickel RTD temperature sensors of IST AG can be used in an operating temperature range from -60 °C to +300 °C, depending on the sensor type. The sensors are characterized by a simple linearization and a steep characteristic curve which makes them suitable for HVAC applications, for example. They offer an excellent long-term stability and easy interchangeability. Our nickel temperature sensors are available with various TCRs such as 6180 ppm/K (Nickel ND), 5000 ppm/K (Nickel NL), 6370 ppm/K (Nickel NJ), 6720 ppm/K (Nickel NA) or Balco.

TSIC TEMPERATURE SENSORS

TSic sensors are semiconductor temperature sensors that feature highly accurate measurements within a limited temperature range. They are ideal for mobile applications due to their low power consumption. The TSic is offered as a calibrated temperature sensor with an integrated signal converter for analog or digital output. Easily integrable, it offers excellent accuracy with long-term stability.

PLATINUM TEMPERATURE SENSORS (Pt)

Temperature range:	-200 °C to +1000 °C
Available tolerance classes (according to IEC 60751):	F0.3 (IST AG class B), F0.15 (IST AG class A), F0.1 (IST AG class Y)
Dimensions:	Various dimensions (details see data sheets) Length between 1.6 and 10.0 mm Width between 0.8 and 5.1 mm
Connection:	With various lead wires (several materials, wire length can be adapted individually) or as SMD
Temperature coefficient:	3850 ppm/K (other characteristic curves on request) Exception: 1000 °C Series with 3770 ppm/K

Benefits:

- Excellent long-term stability
- Low self-heating
- Fast response time
- Good vibration stability

Customer-specific adaption possible (see p. 14/15)

Sensor examples:

161.1E   102.2I   202.3FW   308.4W   161.6W

308.7W   516.8W   420.10K

SMD   FlipChip

PRODUCT OVERVIEW PLATINUM TEMPERATURE SENSORS WITH WIRES

Sensor type	Temperature range	Standard connection	Sensor characteristics (special characteristics see p. 14)
150 °C Series	-50 °C to +150 °C	• Enameled Cu-wire, tinned wire endings	• Very small dimensions possible
200 °C Series	-50 °C to +200 °C	• Cu/Ag-wire with PTFE-insulation • Cu/Ag-stranded wire with PTFE-insulation • Ag-wire	• Optimal for connector assemblies or for soldering, welding and crimping
300 °C Series	-200 °C to +300 °C	• Ni/Au-wire • Ni/Au-flat wire • Ag-wire	• Optimal for soldering, brazing, crimping and laser welding
400 °C Series	-200 °C to +400 °C	• Ag-wire • Grain-stabilized Ag-wire	• 1/5 IEC 60751 and 1/10 IEC 60751 accuracy standard available
600 °C Series	-200 °C to +600 °C	• Pt-cladded Ni-wire	• Optimal for welding, crimping and brazing • 1/5 IEC 60751 and 1/10 IEC 60751 accuracy standard available
750 °C Series	-200 °C to +750 °C	• Pt-wire	
850 °C Series	-200 °C to +850 °C	• Pt-wire	
1000 °C Series	-70 °C to +1000 °C	• Pt-wire	• Temperature coefficient: 3770 ppm/K • Specifically for automotive industry

All our platinum temperature sensors can be adapted individually. More information about the different sensor characteristics and the possible adaptions of the sensors can be found on page 14/15.

Further product information and details can be found on our website and in our data sheets.

PRODUCT OVERVIEW PLATINUM TEMPERATURE SENSORS WITHOUT WIRES

Sensor type	Temperature range	Standard connection	Sensor characteristics
Surface-mounted Device (SMD)	-50 °C to +250 °C	• Solderable pads on both sides (various materials)	• For automatic PCB assembly processes with wrap-around contacts on both ends • Reflow soldering possible • Standard dimensions: 0805, 1206 • From 100 pieces taped on reel (sensor side up or sensor side down) • Available up to IST AG class A (IEC 60751 F0.15)
FlipChip (FC)	-50 °C to +600 °C	• Solderable pads on one sides (various materials)	• Contacts on one side resulting in no short-cut risk on the backside of the chip • Reflow soldering possible • Bonding possible • Standard dimensions: 0603, 0805, 1206 • Available up to IST AG class B (IEC 60751 F0.3)

Further product information and details can be found on our website and in our data sheets.

SPECIAL SENSOR CHARACTERISTICS (Pt)

Metallized backside (M)
- Can be easily soldered onto a metallic surface - improvement of thermal coupling
- Improved accuracy and response time
- Also available as **RealProbe**^{Temp} - sensor built-in into stainless steel probe

metallized backside

Invert welded and bent wires (U)
- For applications with limited space
- Optimal for mounting the sensor to the bottom of a tube or a blind hole
- Available with metallized backside and extended or directly welded wires

RealProbe^{Temp}

Insulated wires, directly welded
- 1E Enameled Cu-wire (Ø 0.2 mm), extended wires possible, with stripped insulation and pre-tinned wire ends for easy soldering
- 2I Cu/Ag-wire or 2L Cu/Ag-stranded wire with PTFE-insulation for outstanding robustness, optimal for connector assemblies or for soldering, welding and crimping

Invert welded and bent wires

Temperature measurement up to 600 °C in class A (PW sensor)
- Precise measuring results up to IEC 60751 F0.15 (IST AG class A) from -200 °C to +600 °C
- Combines the advantages of wire wound sensors (high accuracy in a wide temperature range) with the advantages of thin film sensors (robustness, small dimensions and very low hysteresis at an optimal price level)
- Available in round ceramic housing (wire-wound sensors can easily be replaced)
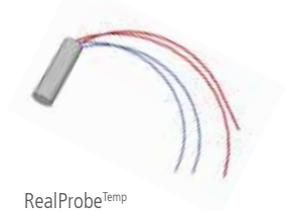

1E wire

Pairs and groups
- For applications where the relative deviation between two or more sensors is crucial

2I stranded wire

Other temperature coefficients (standard: 3850 ppm/K)
- 3911 ppm/K: GOST-norm compatible, IST AG term: PG
- 3750 ppm/K: partly used in USA as common characteristic curve, IST AG term: PU
- 3770 ppm/K: especially for automotive applications (up to +1000 °C)

PW sensor

PW in round ceramic housing

CUSTOMER-SPECIFIC SENSOR ADAPTIONS (Pt)
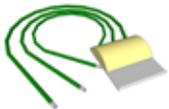
3-wire construction, extended wires

with PVDF shrink tube and glass fiber insulation

with M5 eyelet and PUR cable with 3-pin M8 plug

soldered to copper sheet, silicone glob top for protection

with customer-specific housings

with customer-specific housings

Extended 2- to 4-wire constructions
- 2- to 4-wire constructions available (depending on application), sensors with extended wires or with wires directly welded to the chip
- Various types of wire material and length are available

Shrink tube
- To avoid electrical short-circuits
- Shrink tube covers one or more of the electrical contacts
- Various solutions, e.g. shrink tubes placed over the extension point, shrink tubes covering the sensor chip or both in one solution

Connectors
- Sensor solutions with ready mounted connectors on wire ends for optimized assembly
- Various types of connectors for different applications available

Sensors on sheets/disks
- Sensors with metallized backside soldered to metal sheets, disks or in caps
- Optimal thermal coupling
- No need of in-house soldering technology

Sensors in housings
- Conventional way: after inserting the sensor, the housing is filled with an epoxy, polyure-thane or silicone
- Alternative: sensor is soldered to the bottom of the housing (better thermal contact, faster response time)
- Housings are available with various diameters, lengths and materials
- Easy integration in various applications - optimized assembly at the customer site
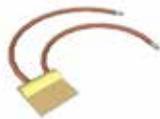
NICKEL TEMPERATURE SENSORS (Ni)

Temperature range:	-60 °C to +300 °C
Dimensions:	Various dimensions (details see data sheets) Length between 2.0 and 10.0 mm Width between 1.2 and 5.0 mm
Connection:	With various lead wires (several materials, wire length can be adapted individually) or as SMD
Temperature coefficient:	6180 ppm/K (nickel ND), 5000 ppm/K (nickel NL), 6370 ppm/K (nickel NJ), 6720 ppm/K (nickel NA), different Balco polynomials
Benefits:	• Easy linearization • Simple interchangeability • Outstanding long-term stability • Vibration and temperature shock resistant

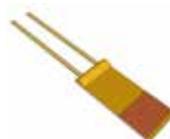Customer-specific adaption possible (see p. 46)

Sensor examples:

538.1K   538.2S   520.2FW   232.3W

SMD

PRODUCT OVERVIEW NICKEL TEMPERATURE SENSORS WITH WIRES

Sensor type	Temperature range	Standard connection	Sensor characteristics
150 °C Series	-60 °C to +150 °C	• Enameled Cu-wire	• Thin and very robust wire insulation
200 °C Series	-60 °C to +200 °C	• Ag-wire • Cu/Ag-wire • Ni/Au-wire • Ni/Au-flat wire • Cu/Ag-wire with PTFE-insulation	• Versatile applicable, many different possibilities for customer-specific adaptions
300 °C Series	-60 °C to +300 °C	• Ni-wire • Pt-/Ni-wire	• Very robust connections • Inorganic glass passivation

Further product information and details can be found on our website and in our data sheets.

PRODUCT OVERVIEW NICKEL TEMPERATURE SENSORS WITHOUT WIRES

Sensor type	Temperature range	Standard connection	Sensor characteristics
Surface-mounted Device (SMD)	-60 °C to +150 °C	• Solderable pads (100% Sn) on both sides	• Bondable contacts without wrap-around contacts available on request • Reflow soldering possible • Standard dimensions: 0805 • From 100 pieces taped on reel (sensor side up or sensor side down)

Further product information and details can be found on our website and in our data sheets.
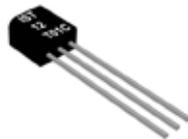
TSIC TEMPERATURE SENSORS

Output signal:	Digital, analog or ratiometric
Measurement accuracy:	±0.07 K to ±0.5 K
Signal resolution:	Medium (0.1 K) to high (0.034 K, 0.004 K)
Benefits:	• Fully calibrated • Very low power consumption • Outstanding long-term stability

Customer-specific adaption possible (see p. 46)

Sensor examples:

TSic with SOP-8 housing   TSic with TO92 housing

PRODUCT OVERVIEW TSIC TEMPERATURE SENSORS

Sensor type	Temperature range	Calibrated tolerance range	Accuracy	Output signal
TSic 206/203/201	-50 °C to +150 °C (-47 °C to +147 °C guaranteed)	80 K (e.g. +10 °C to 90 °C)	±0.5 K	• Digital (ZacWire, TSic x06) • Analog (0 V to 1 V, TSic x01) • Ratiometric (10 % to 90 % V+, TSic x03)
TSic 306/303/301	-50 °C to +150 °C (-47 °C to +147 °C guaranteed)	80 K (e.g. +10 °C to +90 °C)	±0.3 K	• Digital (ZacWire, TSic x06) • Analog (0 V to 1 V, TSic x01) • Ratiometric (10 % to 90 % V+, TSic x03)
TSic 506F/503F/501F	-10 °C to +60 °C (-7 °C to +57 °C guaranteed)	40 K (e.g. +5 °C to +45 °C)	±0.1 K	• Digital (ZacWire, TSic 506F) • Analog (0 V to 1 V, TSic 501F) • Ratiometric (10 % to 90 % V+, TSic 503F)
TSic 716	-10 °C to +60 °C (-7 °C to +57 °C guaranteed)	20 K (e.g. +25 °C to +45 °C)	±0.07 K	• 14 Bit digital (ZacWire, TSic 716F)

Further product information and details can be found on our website and in our data sheets.

FLOW SENSORS

Thermal gas and liquid flow
sensors with large dynamic range,
high sensitivity and excellent
long-term stability

IST AG develops and produces sensors for various tasks in the area of flow velocity measurement. Our flow sensors are used in many different application areas, such as process control & automation, HVAC (Heating, Ventilation, Air Conditioning), handheld, medical or appliance. For flow measurements in gases, our FS sensors are suitable as all-rounders. Also our MFS as well as SFS sensors with a very fast response time are perfectly suitable for the measurement of gas flow. With our Out of Liquid sensors velocity in liquids can be measured precisely. Additionally we offer convenient electronics for the evaluation of the sensors.

All IST AG flow sensors can be individually adapted to your specific requirements. Also, customer-specific module developments can be supported or completely realized on demand.

FLOW SENSORS FOR GASES

Our flow sensors for gases are able to measure flow rates from 0 m/s to maximum 150 m/s. Depending on the sensor type, they can be used in an overall temperature range of -20 °C to +400 °C. IST AG flow sensors for gases are based on the anemometric or calorimetric principle.

Due to their customizable lead wires, our robust FS sensors are ideally suited for the implementation in customer-specific sensor housings or applications.

The SFS sensors based on silicon technology are characterized by a very fast response time and low energy consumption.

Our MFS sensors are particularly suitable for the use in a large dynamic range without bypass.

FLOW SENSORS FOR LIQUIDS

The Out of Liquid sensors (OOL) of IST AG are used in a flow range of 0 ml/min to 3000 ml/min (4 m/s). They consist of a stainless steel flow channel, on which a heater and a temperature resistor are soldered. The liquid flows through the stainless steel channel, whereby the direct contact between the fluid and the heater/temperature resistor is prevented. This construction enables an excellent thermal contact with the liquid and is perfectly suitable for the measurement of all kind of liquids, including aggressive fluids.

FS FLOW SENSORS

Flow range:	0 m/s to 100 m/s
Temperature range:	-20 °C to 150 °C resp. +400 °C for applications in high temperature areas
Voltage range (nominal):	2 V to 5 V (dependent on flow velocity)
Electronics:	For FS7 and FS7.4W: FS Flow Module (for the evaluation of the sensors)
Accuracy:	< 3 % of the measured value (dependent on the electronics and calibration)
Temperature sensitivity:	< 0.1%/K (dependent on the electronics)
Benefits:	• Easy calibration • Excellent long-term stability • Easy signal evaluation • Very good reproducibility • Easy installation in flow channels with different diameters

Customer-specific adaption possible (see p. 46)

Sensor examples:

FS7   FS7 with housing   FS2

PRODUCT OVERVIEW FS FLOW SENSORS

Sensor type	Temperature range	Response time t_{63}	Standard connections	Sensor characteristics
FS7* (standard)	-20 °C to +150 °C	~200 ms (jump from 0 to 10'000 sccm)	Cu/Ag-stranded wire (AWG 30) with PTFE-insulation, 3-leads	• Anemometric principle • Available with housing • Optimal for applications requiring a high sensitivity up to +150 °C • Electronics available
FS7.4W	-20 °C to +400 °C	~200 ms (jump from 0 to 10'000 sccm)	Pt/Ni-wire (Ø 0.2 mm), 3-leads	• Anemometric principle • Specifically for applications requiring a high sensitivity up to +400 °C • Electronics available
FS2	-20 °C to +150 °C	< 0.5 s	Enameled Cu-wire (Ø 0.2 mm), 6-leads	• Calorimetric principle • Detection of flow direction with outstanding sensitivity

Further product information and details can be found on our website and in our data sheets.

SFS FLOW SENSORS

Flow range:	0 m/s to 3.5 m/s
Temperature range:	0 °C to +80 °C
Voltage range (nominal):	0 V to 4 V
Electronics:	SFS EvaKit (easy evaluation)
Accuracy:	< 2 % of the measured value (dependent on the electronics and calibration)
Temperature sensitivity:	< 0.2 %/K (dependent on the electronics)
Benefits:	• Extremely fast response time • Very low power consumption • Easy system integration incl. temperature compensation • Detection of flow direction

Sensor examples:

SFS01

PRODUCT OVERVIEW SFS FLOW SENSORS

Sensor type	Tempera-ture range	Response time t_{63}	Standard connections	Sensor characteristics
SFS01	0 °C to +80 °C	<5 ms	Bonding pads	• Suitable for wedge-wedge bonding • Calorimetric principle • Simple interpretation and evaluation of the measurement signal • Very suitable for space-saving applications

Further product information and details can be found on our website and in our data sheets.

MFS FLOW SENSORS

Flow range:	Full bridge mode: 0 m/s to 1.5 m/s resp. 0 ml/min to 100 ml/min CTA-mode: 0 m/s to 150 m/s resp. 0 l/min to 10 l/min
Temperature range:	-40 °C to +80 °C
Voltage range (nominal):	2 V to 6 V (full bridge mode)
Electronics:	• MicroFlowSens Amplifier Module (demonstration and evaluation) • MicroFlowSens EvaKit (easy evaluation) • Mass flow meter MFM.EVAL.01.DI2C (for very low differential pressure applications)
Accuracy:	< 2 % of the measured value (dependent on the electronics and calibration)
Temperature sensitivity:	< 0.1 %/K (dependent on the electronics)
Benefits:	• Wide dynamic range • Fast response time • Excellent for very low flow rates • Detection of flow direction

Customer-specific adaption possible (see p. 46)

Sensor example:

MFS   MIDAS

PRODUCT OVERVIEW MFS FLOW SENSORS

Sensor type	Temperature range	Response time t_{63}	Standard connections	Sensor characteristics
MFS02/ MFS05/ MFS06*	-40 °C to +80 °C	< 10 ms	Bonding pads, strengthened with Au	• Suitable for ball-wedge bonding • Sensor element on PCB available • Customer-specific PCB on request
MFS03*	-40 °C to +80 °C	< 10 ms	Solderable pads	• Optimized for full bridge mode with small chip size

* A comparison of the characteristics of the different MFS types, can be found on our website.

MIDAS	-40 °C to +80 °C	< 10 ms	• Solderable pads (sensor) • 4-pin plug (sensor on PC board)	• MFS sensor supplied in MID housing with integrated flow channel • Three different flow channel geometries available • Low temperature dependence

Further product information and details can be found on our website and in our data sheets.

FLOW SENSORS FOR LIQUIDS

Flow range:	0 ml/min to 3000 ml/min (4 m/s)
Temperature range:	-50 °C to +180 °C
Voltage range (nominal):	4 V to 10 V
Electronics:	Out of Liquid Demo Module (demonstration of flow applications in aggressive liquids)
Accuracy:	< 3 % of the measured value (dependent on the electronics and calibration)
Temperature sensitivity:	< 0.2 %/K (dependent on the electronics)
Benefits:	• Suitable for aggressive liquids
	• High chemical resistance (construction with stainless steel probe)
	• No direct contact between heater/temperature resistor and liquid
	• Simple flow switches or exact mass flow meters possible

Customer-specific adaption possible (see p. 46)

Sensor examples:

OOL

PRODUCT OVERVIEW FLOW SENSORS FOR LIQUIDS

Sensor type	Temperature range	Response time t$_{63}$	Standard connections	Sensor characteristics
OOL (Out of Liquid)	-50 °C to +180 °C	< 300 ms (jump from 0 to 1000 ml/min)	Cu/Ag-stranded wire (AWG 30) with PTFE-insulation	• Stainless steel flow channel with heater and temperature resistor (soldered on tube by means of metallic backside) • Tube diameter standard 4mm, other diameters on request

Further product information and details can be found on our website and in our data sheets.

HUMIDITY SENSORS

Capacitive humidity measurement with excellent accuracy and high chemical resistance available as sensors and modules

The most critical task in humidity measurement is a stable detection of a correct humidity level within an acceptable response time. Coverage of the full measurement range from 0 % RH to 100 % RH is mandatory. Stability should remain unchanged, even if operated under elevated conditions and over an extended period.

Humidity modules and sensors of IST AG address these challenges perfectly. Through specially developed polymers and use of high quality materials, our products perform extremely well, even under harsh conditions caused by temperature cycling and exposure to aggressive chemicals.

HUMIDITY MODULES

Our digital HYT modules possess a chemical and condensed waterproof sensing area. Precisely calibrated, the HYT modules deliver an outstanding accuracy and excellent long-term stability even at high humidity - ideal for sophisticated mass applications, industrial handheld devices and precise humidity transmitters.

The Lin- & DigiPicco series provides Plug & Play modules for humidity and temperature measurements. The modules are fully calibrated, have an analog or digital output signal and are temperature compensated. They are suitable for applications where a fast, simple and easy to integrate humidity and temperature measurement is needed.

HUMIDITY SENSORS

Our capacitive humidity sensors consist of a ceramic substrate on which a thin film of polymer is deposited between two conductive electrodes. The sensing surface is coated with a microporous metal electrode, allowing the polymer to absorb moisture while protecting it from contamination and exposure to condensation. As the polymer absorbs water, the dielectric constant changes incrementally and is nearly directly proportional to the relative humidity of the surrounding environment. Thus, by monitoring the change in capacitance, relative humidity can be derived.
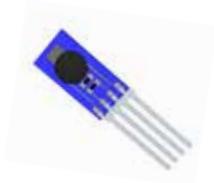
HYT HUMIDITY MODULES –
DIGITAL HUMIDITY AND TEMPERATURE MODULES

Humidity range:	0 % RH to 100 % RH
Temperature range:	-40 °C to +125 °C
Digital interface:	I^{2}C protocol (address 0x28 or alternative address): relative humidity and temperature
Accuracy:	Humidity: ±1.8 % RH at +23 °C (0 % RH to 90 % RH) Temperature: ±0.2 °C (0 °C to +60 °C)

Additional electronics:

- HYT LabKit with USB-interface (as Plug & Play tool for fast evaluation)
- HYT LCD Module (for evaluation and demonstration)

Benefits:

- Calibrated and temperature compensated
- Individual calibration of humidity and temperature possible
- High chemical resistance
- Very low drift
- Very stable at high humidity
- Interchangeable without adjustment
- P14 as standard polymer, other options available

Customer-specific adaption possible

Module examples:

HYT271   HYT221   HYT939

PRODUCT OVERVIEW HYT HUMIDITY MODULES

Module type	Design (without connection)	Response time t_{63}	Sensor characteristics
HYT 271	L: 10.2 mm (±0.2) W: 5.1 mm (±0.2) H: 1.8 mm (±0.3) Exposed humidity sensor	Humidity: < 4 s (50 % RH to 0 % RH) at +23 °C Temperature: < 5 s	• Very wide application spectrum • Outstanding price-performance ratio • Optimal for handheld instruments, transmitters, measuring technology and HVAC applications
HYT 221	L: 15.3 mm (±0.2) W: 10.2 mm (±0.2) H: 5.3 mm (±0.3) Sensor protected with round stainless steel casing and membrane filter	Humidity: < 10 s with membrane filter (50 % RH to 0 % RH) at +23 °C Temperature: < 10 s with membrane filter	• Suitable for fittings into house openings, can be sealed against the wall with the use of an O-ring • Waterproof membrane filter • Optimal for meteorology, industrial drying systems, agriculture and medical devices
HYT 939	Ø (min.): 8.1 mm (±0.1) Ø (max.): 9.8 mm H: 5.2 mm (±0.2) Module in TO-housing with stainless steel cap	Humidity: < 10 s with metal mesh filter (50 % RH to 0 % RH) at +23 °C Temperature: < 10 s with metal mesh filter	• Especially robust construction • Ideally suitable for high pressure applications • Pressure-resistant version up to 16 bar upon request • Optimal for medical and drying systems, autoclaves, pressure dew point measurement and laboratory applications

Further product information and details can be found on our website and in our data sheets.

HUMIDITY MODULES LIN- & DIGIPICCO – CAPACITIVE PLUG & PLAY MODULES

Humidity range:	0 % RH to 100 % RH
Temperature range:	-25 °C to +85 °C (extended temperature range possible with external sensor element)
Accuracy:	Humidity: < ±3 % RH (15 % RH to 85 % RH at +23 °C) < ±5 % RH (0 % RH to 15 % RH and > 85 % RH at +23 °C) Temperature (only DigiPicco™): ±0.5 K (-25 °C to +85 °C)
Dimensions (L x W x H):	47.0 x 10.0 x 2.8 mm
Benefits:	• Fully calibrated and temperature compensated • Moisture-protected PCB • Very low drift due to wide, separated sensor area • Optimal for fast, simple and easily integrated humidity and temperature measurements • Module with external sensor available

Customer-specific adaption possible

Module examples:
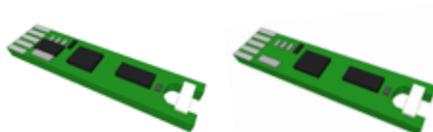
LinPicco™   DigiPicco™

PRODUCT OVERVIEW LIN- & DIGIPICCO HUMIDITY MODULES

Module type	Output signal	Response time t_{63}	Sensor characteristics
LinPicco™	Analog: relative humidity; three different output signals available - each from 0 to 100 % RH: • A01: 0 V to 1V • A05: 0 V to 5 V • A420: 4 mA to 20mA	< 5 s (50 % RH to 0 % RH) at +23 °C	• Integrated P14 SMD humidity sensor and Pt1000 or Pt100 temperature sensor • Looped-through temperature sensor to connection side • Immediately applicable, no extra software is required
DigiPicco™	Digital (I^2C, address 0x28): relative humidity and temperature	< 5 s (50 % RH to 0 % RH) at +23 °C	• Integrated P14 SMD humidity sensor and Pt1000 temperature sensor • Additional software is required

Further product information and details can be found on our website and in our data sheets.

HUMIDITY SENSORS

Humidity range:	0 % RH to 100 % RH
Temperature range:	-80 °C to +190 °C
Dimensions:	Various dimensions (details see data sheets) Length between 4 and 10.8 mm Width between 2 and 3.8 mm
Connection:	With various lead wires (several materials, wire length can be adapted individually) or as SMD
Benefits:	• Excellent linearity • Low hysteresis • Fast response time • High chemical resistance • Resistance to condensation • Very low drift

Customer-specific adaption possible (see p. 46)

Sensor examples:

P14-W   P14 Rapid   P14 FemtoCap   P14 2FW Thermo   MK33-W

K5-W

PRODUCT OVERVIEW HUMIDITY SENSORS

Sensor type	Temperature range	Standard connection	Capacity (at 30 % RH and +23 °C)	Sensor characteristics
P14-W	-50 °C to +150 °C	• Sn-covered CuP/SIL-wire • Au/Cu-wire • SMD	• Wire: 150 pF ±50 pF • SMD: 180 pF ±50 pF	• Optimal for universal measuring tasks in a wide variety of different applications • Very stable at high humidity
P14 Rapid	-80 °C to +150 °C	• Sn-covered CuP/SIL-wire • Au/Cu-wire • SMD	• Wire: 140 pF ±40 pF • SMD: 180 pF ±50 pF	• Fast response time • Optimal for application involving meteorology • Very stable at high humidity
P14 Femto-Cap	-50 °C to +150 °C	• SMD	180 pF ±50 pF	• Weldable and bondable (fully automated assembly) • Optimal for automotive and white good applications
P14 2FW Thermo	-50 °C to +150 °C	• Ni/Au-flat wire	150 pF ±50 pF	• Heated humidity sensor (Pt100 integrated) • Temperate measurement on-chip • Optimal for dew point applications
MK33-W	-40 °C to +190 °C	• Sn-covered CuP/SIL-wire • Au/Cu-wire	300 pF ±40 pF	• Suitable for extreme environments • Optimal for oil measurement applications • Very stable at high humidity
K5-W	-40 °C to +150 °C	• Sn-covered CuP/SIL-wire	200 pF ±50 pF	• Optimal for low humidity measurement

Further product information and details can be found on our website and in our data sheets.

CONDUCTIVITY SENSORS

Conductivity measurement with
high chemical resistance and optional
integrated temperature sensor for
optimal accuracy

CONDUCTIVITY

Conductivity measurements are widely used in industrial and environmental applications as a simple and inexpensive way to control the ionic content in a solution. In water purification systems, the conductivity is monitored at different stages of the process. Since the mobility of the dissolved ions is affected by temperature, these monitoring systems are required to either control the process temperature or to compensate readings according to the sample temperature.

Innovative Sensor Technology IST AG has combined thin- and thick-film technologies to develop ceramic-based conductivity sensors that include a resistive temperature sensor (Pt1000 IEC 60751 F0.3), thus allowing for accurate compensation at the point of measurement. The conductivity sensors typically consist of two current electrodes and two measuring electrodes. This basic design can be adjusted to specific applications and requirements.

CONDUCTIVITY SENSORS

Conductivity range:	100 µS/cm to 200 mS/cm (other ranges on request)
Temperature range:	-30 °C to +100 °C (temperatures up to +130 °C possible)
Connection:	Typically with Pt/Ni-wire or Cu/Ag-wire with PTFE-insulation (AWG 30)
Benefits:	• Fast response time
	• Excellent long-term stability*
	• Resistant to various chemicals*
	• Sterilizable (gamma/beta radiation, autoclaving)
	• Integrated Pt1000 for temperature compensation (Pt100 on request)
	• 4-electrode measurement (two electrodes on request)

Customer-specific adaption possible (see p. 46)

* Highly dependent on the composition of the medium
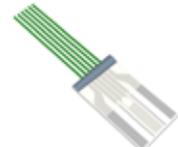
Sensor examples:

LFS1305.6W	LFS1505.6W	LFS1505.2I	LFS1710.6W	LFS1710.2I

PRODUCT OVERVIEW CONDUCTIVITY SENSORS

Sensor type	Dimensions (L x W x H) in mm	Conductivity range	Cell constant	Measurement frequency range
LFS1305	13.0 x 5.5 x 1.3	100 µS/cm to 200 mS/cm	Typically 0.86 cm^{-1}	100 Hz to 10 kHz
LFS1505	15.0 x 5.5 x 1.3	100 µS/cm to 200 mS/cm (extended range from 10 µS/cm to 200 mS/cm possible with cell-constant correction)	Typically 0.68 cm^{-1}	100 Hz to 10 kHz
LFS1710	17.0 x 10.0 x 1.3	0.2 mS/cm to 200 mS/cm	Typically 0.44 cm^{-1}	50 Hz to 3 kHz

Further product information and details can be found on our website and in our data sheets.
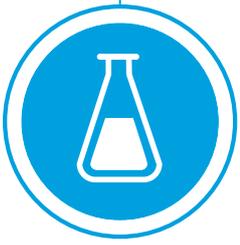
BIO SENSORS

Multiparametric measurement
(glucose, lactate, glutamine, glutamate)
with excellent long-term stability for
continuous monitoring or analyzer
operation mode

Biosensors allow the analysis of complex biological media. The detection of a large number of compounds is of great relevance, not only for scientific research but also for process control in the chemical and food industry. It is also indispensable in the healthcare field for the diagnosis and treatment of diseases and monitoring of illnesses. The pharmaceutical and biotechnology industries greatly desire frequent to continuous analysis of biological media.

In collaboration with the Jobst Technologies GmbH, IST AG develops and produces biosensors designed to measure the concentration of glucose, lactate, glutamine and glutamate. The biosensors use the enzymatic-amperometric measurement principle. They rely on immobilized enzymes to detect the target analytes with high specificity and reliability. The used immobilization system allows for adjusting parameters such as sensitivity and measurement range, thus meeting the requirements of different applications and customers. Furthermore, the technology is compatible with gamma and beta irradiation.

BIOSENSORS

Measurable analytes:	Glucose, Lactate, Glutamine, Glutamate
Operating measurement range at +25 °C*:	Glucose: 0.05 mM to 25 mM / 0.01 to 4.5 g/l Lactate: 0.02 mM to 15 mM / 0.002 to 1.5 g/l
	Adaption of measuring range possible due to our flexible membrane technology
Response time $(t_{90}\%)$ at 37 °C*:	< 25 s
Shelf life:	> 6 months (recommended storage conditions: +4 °C to +35 °C, with desiccant)
Operational life time*:	> 4 weeks
Additional electronics:	„Six" Biosensor Transmitter (evaluation kit for IST AG biosensors)
Benefits:	• Excellent long-term stability • Fast response time • Compatible with gamma and beta sterilization • Reference, counter- and blank electrodes on chip

Customer-specific adaption possible

* Deviations possible, depending on the ionic composition of the medium as well as the radiation dose

Sensor examples:

LV5   IV4

PRODUCT OVERVIEW BIOSENSORS

Sensor type	Measurable analytes	Sensor characteristics
LV5	• Glucose • Lactate • Glutamine** • Glutamate** Multiparametric measure-ments possible (up to four analytes simultaneously)	• Integrated flow cell (various volumes available; standard: 1 µl) • Suitable for flow-through applications • Stable in continuous monitoring and analyzer mode • Operational life time: > 2 weeks in continuous operation; > 4 weeks in analyzer mode • Available in housing with Luer-connection • Compatible with „Six" Biosensor Transmitter
IV4	• Glucose • Lactate** • Glutamine** • Glutamate** Measurement of one (single) specific analyte	• Suitable for dip-in applications • Very small dimensions • Suitable for continuous operation • Operational life time: > 4 weeks in continuous operation • Compatible with „Six" Biosensor Transmitter

** On request

Further product information and details can be found on our website and in our data sheets.

CUSTOMER-SPECIFIC SENSOR ADJUSTMENTS

As a partner with long lasting experience, IST AG also supports its customers in the development of customer-specific solutions. The support during the implementation of the sensor is part of this service. Thus we guarantee the best realization of specific applications.

We offer various possibilities to customize your sensor:

- Mounting of different wire materials and connectors
- Different wire lengths
- Customer-specific sensor design
- Adaption of the dimensions
- Use of specific materials (substrate, passivation etc.)
- Adaption of the resistance value
- Customer-specific calibration

Are you interested in the most compatible sensor for your application? We will be happy toadvise you and find a suitable solution. Do not hesitate to contact us to discuss your requirements.

DEVELOPMENT & TECHNOLOGY PARTNER

We are a global team of experts in the field of sensor technology offering our skills and experience as development partners for customers. We offer extensive service when it comes to advanced application needs or the development of new technologies.

IST AG has more than 25 years of micro-system experience in developing new technologies and solutions for customers. Close collaboration with a broad network of partners, universities and technical institutes means we push the boundaries of existing technology, creating innovations that fulfill increasing customer demands, across a wide spectrum of industries. This is our core competence, and gives our customers a competitive edge.

Sensors made by IST AG are proven to be reliable and efficient, evident by our repeat customers. Our versatile technological portfolio covers different substrate material choices, the use of thin- and thick-film technologies and patterning technologies as well as diverse test and assembly options.

As a development and technology partner focused on customer-specific solutions, we know that these projects are designed on a long-term basis. We look forward to discussing your requirements with you.

OUR LOCATIONS

Switzerland (Headquarters)

USA
(subsidiary; Sales, Service, R&D)

Czech Republic
(assembly site)

Germany, Jobst Technologies GmbH
(related company)

● Sales office / regional salesperson

For your personal contact in your region please visit our website at www.ist-ag.com/en/contact/our-team

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