CO2METER.COM
CO2 MEASUREMENT SPECIALISTS

# IR COMPONENTS AND GAS SENSORS MH-100

Our customers are facing challenges in IR measurement applications. We are supporting their mission.

# MH-100 Gas Sensors

## Sensors and components for NDIR gas analysis

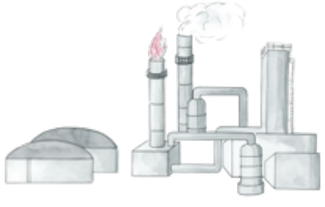
For process control, environmental measurement and laboratory analysis, over 100 different gases can be detected reliably from ppm to percent by means of NDIR analysis.

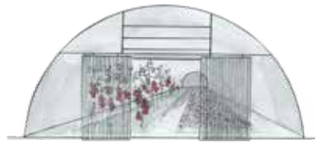
Micro-Hybrid supplies all infrared components up to the complete gas sensor for diverse measurement applications in a wide variety of industries. We develop customized systems with the latest IR technology and our own, optimally matching IR components for a wide range of measurable gases.

### CUSTOMER BENEFITS OF OUR GAS SENSOR DEVELOPMENT

- High degree of innovation and flexibility in product development
- From the MEMS chip to packaging technologies to the complete gas sensor system
- Hard- and software
  - Permanent further development of all components and parts
  - Focus on long-term stability and harsh environmental conditions (environmentally stable even at high temperatures and humidity)

Our sensors are always characterized by high-precision measurement results and are suitable for almost all industrial and laboratory measurements of gas concentration.





*For more information contact our sales team by Email to* Sales@CO2Meter.com *or call* 877-678-4259

## We develop high quality and advanced gas sensor modules

With more than 20 years of experience in the development and production of IR components, Micro-Hybrid is one of the world's leading manufacturer of high quality measurement systems.

Micro-Hybrid NDIR gas sensors are convinient in set up and usability. We also provide after sales services and maintenance like calibration service and equipment.

- **Suitable for use in harsh environmental conditions**
- **High reliability + accuracy**
- **Long lifetime**
- **Multi-gas solutions**

Depending on the type of gas sensing application and the corresponding measurement range we offer two different gas sensor modules:

### Available on Request - MicroFLOW

Gas flow sensors for analysis applications

- Reflecting cuvette
- For absorption distances up to 100 mm
- Minimum gas flow through e.g. an external pump required to completely fill the cuvette

The gas to be detected flows through the absorption path of the measuring chamber. Infrared radiation delivered by a MEMS based IR-source passes through the gas and generates a signal voltage in the themopile IR detector. The detector is assembled with narrow band pass filters. The robust housing is designed for easy implementation in gas analysers.

### Microhybrid MH-100

Sensors for diffusion based measurement applications

- Open cuvette
- For absorption distances up to 50 mm
- Sample in the atmosphere to be measured

The absorption path of the measuring chamber is filled with the gas to be detected. Infrared radiation delivered by a MEMS based IR- source passes through the gas and generates a signal voltage in the thermopile IR detector. The detector is assembled with narrow band pass filters.
(Equipment for sensor calibration available)

## MicroFLOW IR methane sensor

Inline NDIR $CH_4$ sensor for measuring combustible and explosive gases such as methane or propane*.
Designed for various gas measurement applications like environmental monitoring, process control or leak detection, even for hand held gas detection systems.

The sensor can easily be integrated into OEM systems. IR dual beam technology and MEMS based components provide long term stability due to low signal drift.

*ATEX conformity must be guaranteed by the customer through flame arresters.

### FEATURES

- High accuracy by 5 point pre calibration
- Temperature and pressure compensated, integrated temperature measurement
- RS485 interface, customized interface for controlling keys and displays
- Low signal drift by dual beam technology
- Low maintenance (maintenance service available)

### APPLICATIONS

- Industry
  - Environmental monitoring and process controll
  - Detection of leaks in petro chemical facilities
- Mining
  - Underground monitoring of methane levels
- Agriculture
  - Process monitoring in bio gas plants

### Technical specification

| General | |
|---|---|
| Measuring principle | NDIR |
| Measurement range | 0 – 5 Vol.-% switchable to 4.4 Vol.-% as well as to 1 Vol.-% and to 0.88 Vol.-% |
| Gas supply | M5 or hose screw connection 6/4 mm |
| Flow rate | Operation 0.5-2 l/min<br>Rinse max. 6 l/min |
| Dimensions | 123 mm x 30 mm x 40 mm (L x W x H) |

| Measurement | |
|---|---|
| Start-up time | 60 s |
| Warm-up time | 15 min (full scale) |
| Response time | (t90) < 10 s at 0.5 l/min |
| Accuracy | ± 0.2 Vol.-% ± 2 % MW |
| Repeatability | < 0.05 Vol.-% |
| Long-term stability in the measuring range | ± 5 % FS or ± 10 % at 60 days |

## Microhybrid MH-100 Hightemp IR carbon dioxide sensor

This IR $CO_2$ sensor has been specially optimized for the measurement of 5 Vol.-% $CO_2$ in cell incubators to manage ideal cell and tissue growth.

The sensor can be placed directly in the incubation chamber to measure the exact cell experienced environment. It determines the $CO_2$ concentration based on its IR absorption.

### FEATURES

- IR dual beam technology
- Temperature and pressure compensated
- Heat-sterilizable up to 190° C
- Long lifetime
- Humidity correction

### APPLICATIONS

- Monitoring and measuring $CO_2$ concentration in medical, pharmaceutical and biotechnical incubators for cell and tissue growth
- To guarantee regulatory compliance
- Reliable test and process results

### Technical specification

| General | |
|---|---|
| Measuring gas | $CO_2$ |
| Measurement range | 0 – 20 Vol.-% |
| Gas supply | Diffusion |
| Warm up time | < 1 minute (start-up)<br>< 15 minutes (full spec) |

| Measurement | |
|---|---|
| Accuracy[1] | ± 0.2 Vol.-% ± 2 % of reading |
| Response time ($t_{90}$) | ≤ 30 s |
| Digital resolution | 0.001 Vol.-% |
| Temperature dependence[2] | ≤ ± 0.1 Vol.-% |
| Pressure dependence[3] | ≤ ± 0.05 Vol.-% |
| Long term stability[4] | ≤ ± 0.2 Vol.-% at 5 Vol.-% / year |
| Humidity correction | 0 ... 200 hPa $H_2O$ |

[1] at 37° C, 1013 hPa, dry test gas, excludes calibration gas tolerance of ± 1 %

[2] with compensation at 1 Vol.-% ... 20 Vol.-% $CO_2$ and 20° C ... 60° C, 1013 hPa

[3] with compensation at 600 – 1200 hPa, 37° C and 5 Vol.-% $CO_2$

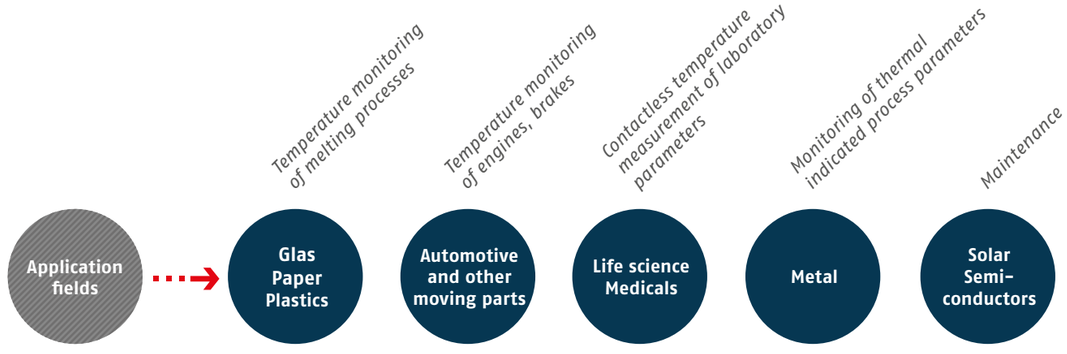
[4] stability at 37° C, without heat sterilization

# ↗ APPLICATION GUIDE

Serving measurement solutions for nearly
all industries, applications and the future

# Temperature measurement

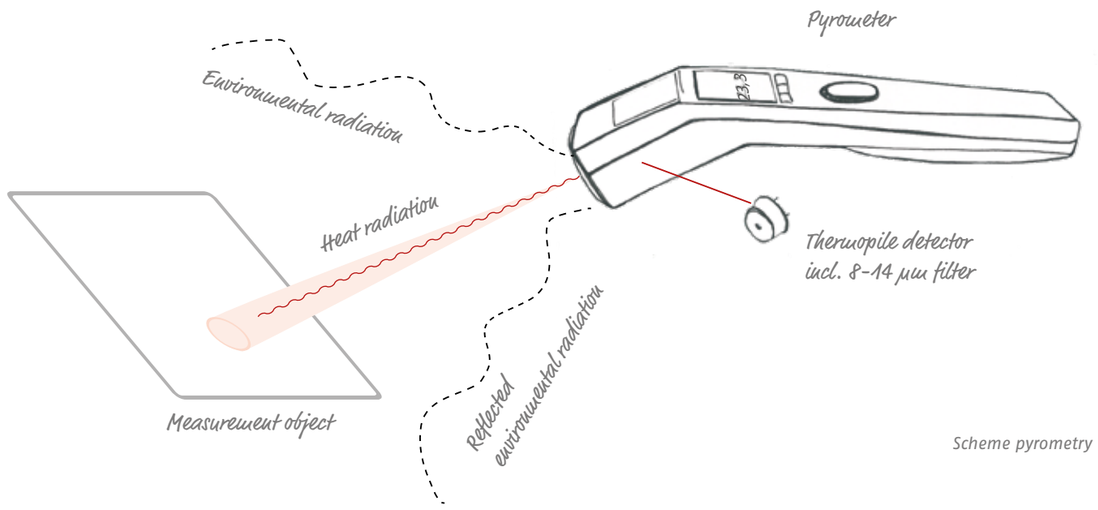





The process and product temperature is an important physical indicator for manufacturing processes. Monitoring the temperature ensures a high quality level of the production line. Remote temperature measurement is ideal for large distances, moving parts or due to high temperatures applicable in various industrial fields.

**ADVANTAGES**

- Short response time
- Reactionless measuring; no influence on measuring object
- No destructions
- Continious real-time monitoring of temperature critical time




*Scheme pyrometry*

**PRODUCT RECOMMENDATION**

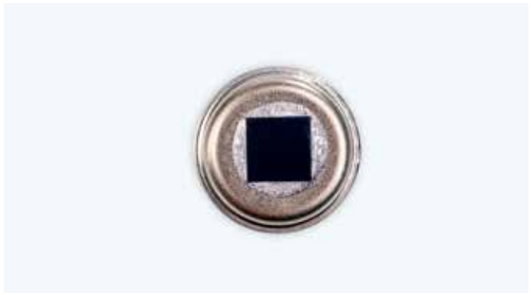
We offer sensor types for different measurement demands within a housing temperature range of -20° C up to 190° C. Our detectors are suitable for most application fields of pyrometry.

**Application**

Punctual temperature measurement

*For more information contact our sales team by Email to infrared@micro-hybrid.de or call T +49 36601 592-0*

*Thermopile detector with glued window*



*Thermopile detector with soldered window*

# Flame detection

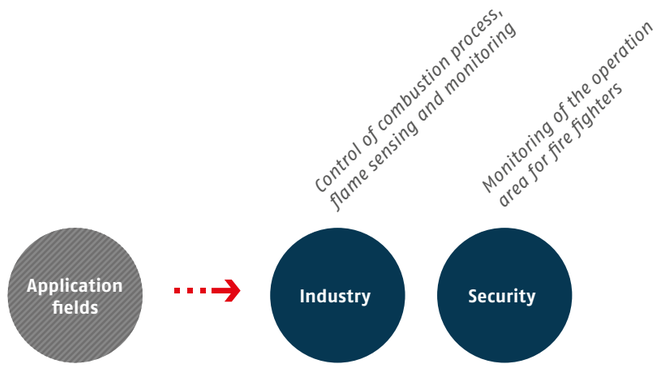
Safety for health and life as well as for all other values is the first demand in all industrial process meanings. Fire detection in all industrial buildings, storages etc. by IR flame detectors is an indispensable safety requirement. For secure building fire protection IR flame detectors guarantee immediate reaction in hazardous situations to prevent fire caused damages.

**ADVANTAGES**

- In house fire detection
- Fast and reliable measurement even in smoky rooms and over large distances
- Detecting different flame features like heat, gases ($CO_2$, CO) or flicker frequency

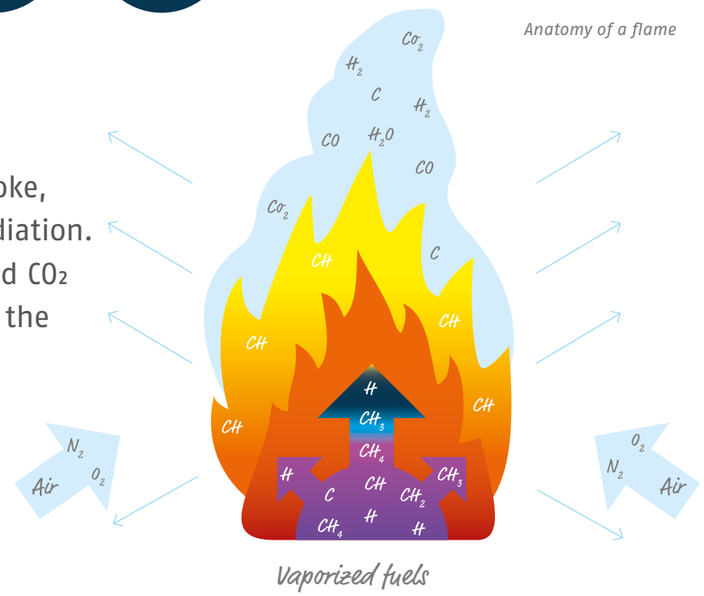

*Scheme flame detection*






Flame caused fumes, smoke, steam, heat and light radiation. The resulting gases CO and $CO_2$ are detectable as well as the flames flicker frequency.

*Anatomy of a flame*




**PRODUCT RECOMMENDATION**

We offer sensor types for different measurement demands within a housing temperature range of -20° C up to 190° C. Our detectors are suitable for most application fields of pyrometry.

**FEATURES**

- High sensitivity
- Large field of view for wide angles

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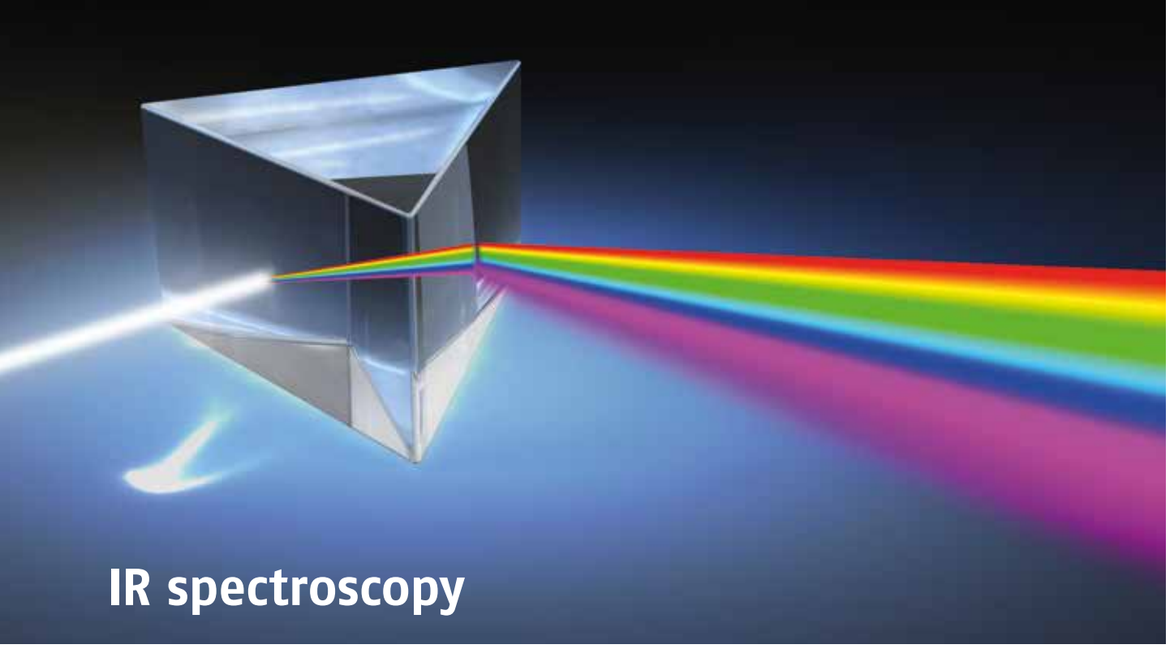


# IR spectroscopy

IR spectrometers are among the most important instruments for the observation of vibratonal spectra due to the absorption bands of molecules in a wide wavelength range. The most common spectral range is the mid-infrared, which ranges from about 2.5 to 15 µm.

This technique is used in many areas, e.g. biomedical applications, pharmaceutical industry, environmental analysis and chemistry. IR spectra provide a unique fingerprint of substances and it is possible to identify functional groups and find even small impurities in a substance. In order to evaluate and process the IR spectra, there are many databases and different methods that make this method very powerful. In addition, the IR spectra of a substance can be used for quantitative analysis.

One application of IR spectral measurement is the investigation of tissues in the vicinity of the cell plane. It is possible to determine the bio-distribution of molecules and obtain information about proteins, peptides, lipids and carbohydrates.

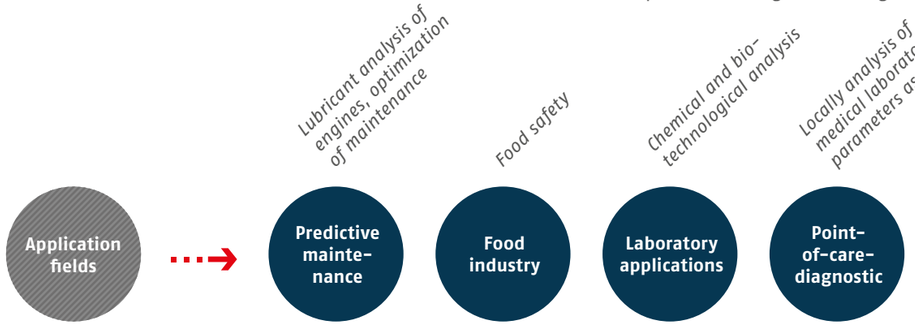
It is increasingly important to quickly obtain reliable results for point-of-care analysis outside a laboratory. For example, IR spectroscopy can be used to monitor metabolites at the bedside.

Studies show that IR devices can be used to monitor blood integration. Especially for It can be used to improve the treatment of seriously ill patients, but also for diabetics.

Another environmental application is the condition monitoring of liquids. Clean and standardized lubricants are the prerequisite for a flawless production process. Corrosion and wear cause a surface deterioration of the lubricated surfaces in machines and most mechanical plant downtimes.

Infrared spectroscopy is one of the most efficient methods for the analysis of oils and lubricants. Machine condition monitoring provides early indications of equipment, wear mechanisms and identifies the causes of corrosion. By checking oil for impurities, changes in chemistry and the presence of abnormal situations. Wear particles and deposits; give operators the information they need to properly maintain their equipment.

Condition monitoring of engineering fluids and gases is a fundamental challenge to the success of ongoing efforts to conserve valuable fossil resources such as oil and gas. It is a prerequisite for optimized use of raw materials and, in this context, indispensable for cost-effective production of goods throughout the industry.

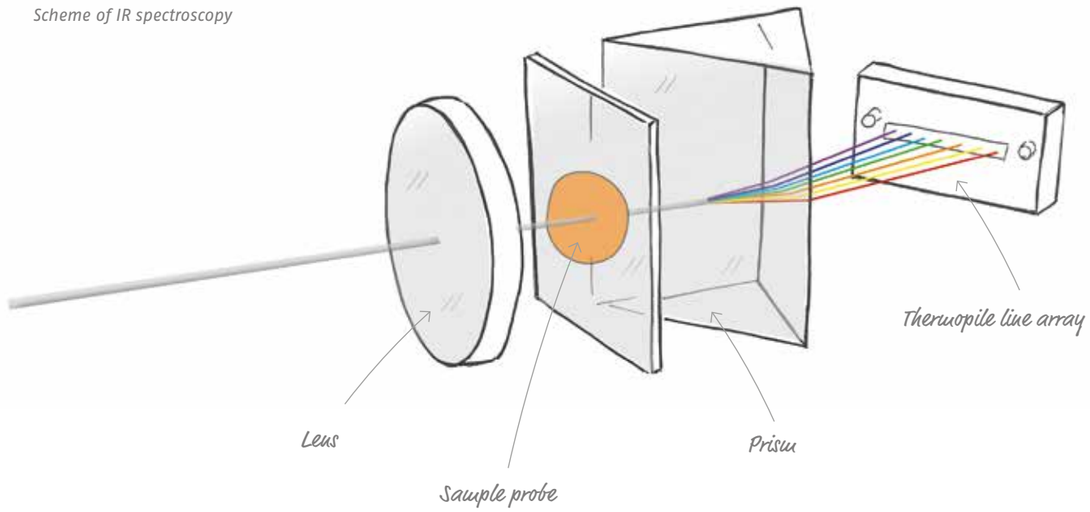





State-of-the-art IR spectrometers calculate the IR spectra with an intermediate ferometer and a Fourier transform. This technique is called FTIR spectroscopy. Stationary instruments are available for laboratory applications. Handheld instruments are practical for the acquisition and analysis of data in the field.

As a result, there is a significant need for robust, cost-effective and portable instruments for point-of-care analysis and condition monitoring in our environment. By using the advantages of the 64-pixel line array TPL 640 it is possible to build dispersive infrared spectrometers with the desired properties.

*Scheme of IR spectroscopy*

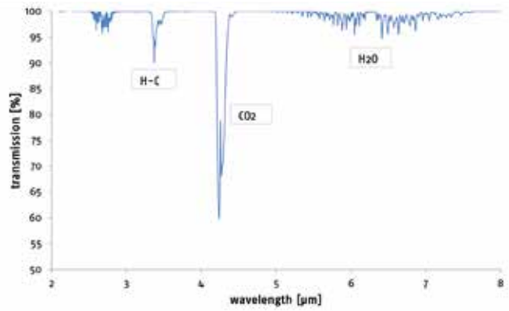



**PRODUCT RECOMMENDATION**

For condition analysis in harsh environments, point of care analysis and biomedical and biochemical applications the dispersive infrared spectroscopy with line arrays is the method of choice. Micro-Hybrid´s **Thermopile Line Array TPL 640** is an outstanding device for spectroscopy applications.

*For more information contact our sales team by Email to infrared@micro-hybrid.de or call +49 36601 592-0*

*Thermopile Line Array TPL 640*



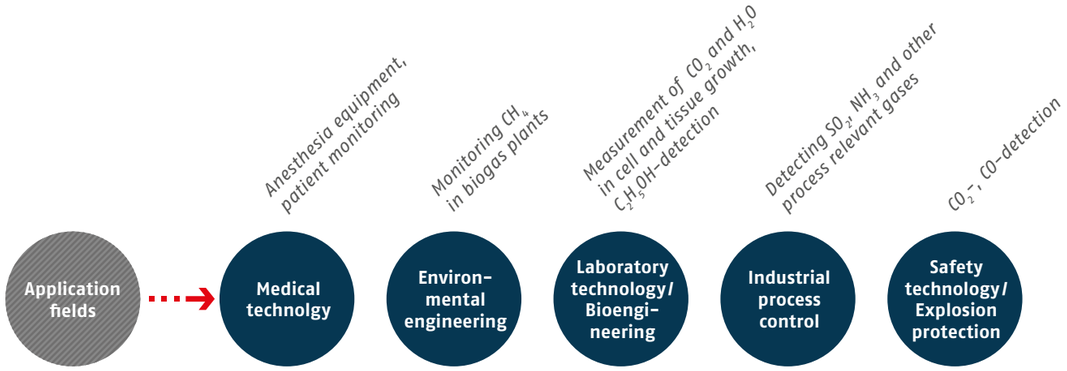

***Example chart:*** *transmission spectrum*

# Gas measurement

## Applications of NDIR gas sensors and IR components

For process control, environmental measurement and laboratory analysis, over 100 different gases can be detected reliably from ppm to percent by means of NDIR analysis. We develop and produce sensors and components for analyzing the concentration of a wide range of gases and fluids in various technical applications:

| Environmental & technical gases | Refrigerants | Anesthetic gases | Fluids |
|---|---|---|---|
| CO (carbon monoxide) | R134a | $N_2O$ (nitrous oxide) | Oil |
| $CO_2$ (carbon dioxide) | R404a | $C_4H_3F_7O$ (sevoflurane) | Beer |
| $CH_4$ (methane) | R1234ze | $C_3H_2ClF_5O$ (isoflurane) | Others on request |
| $C_3H_8$ (propane) | R449a | $C_2HBrClF_3$ (halothane) | |
| $C_4H_{10}$ (n-butane) | R407c | $C_3H_2F_6O$ (desflurane) | |
| $SF_6$ (sulfur hexafluoride) | ... | $C_3H_4Cl_2F_2O$ (methoxyflurane) | |
| $C_2H_4$ (ethylene) | | $CHCl_3$ (chloroform) | |
| $C_2H_2$ (acetylene) | | | |
| $SO_2$ (sulfur dioxide) ... | | | |




**$CO_2$ Measurement:** ■ Exhaust gas ■ Process gas ■ Biogas ■ Wood carbonisation ■ Fruit storage ■ Capnography ■ Incubator ■ TOC

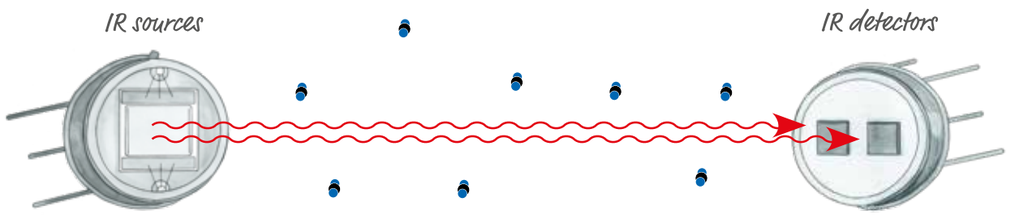
**$CH_4$ Measurement:** ■ Ex. Warning ■ Leakage detection ■ Wobbe index

The concentration of gases is reliably detected by infrared sensors and further processed as a measurement signal by stationary or portable devices. For gas measurement and gas warning systems we offer gas sensors with different functional principles:

**MicroFLOW**
Inline flow sensors

**Microhybrid MH-100**
In-situ diffusion sensors

Micro-Hybrid also provides the complete range of high-quality IR components for various purposes of optical gas detection systems like NDIR gas analysis or photoacoustic spectrometry.




**JSIR sources:** Micro-Hybrid IR sources are MEMS based hot plate emitters for all applications of non dispersive measurement technology. We developed a worldwide unique process to hermetically seal our emitters. The HermeSEAL® emitters are gastight and suitable for use in harsh environments.

**IR detectors by Micro-Hybrid:** reliably measure the spectral emission of hot materials. In industrial applications the high accuracy of the measurement results is the decisive advantage.

*Medical applications demand highest precision and reliability.*

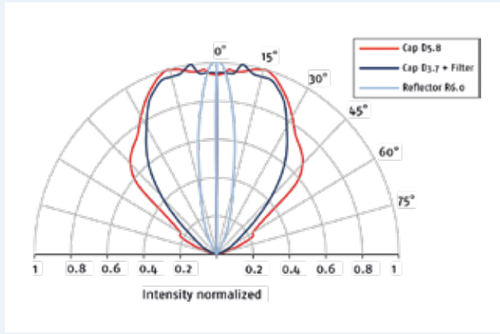
*Quality is the result of monitoring bio- and agricultural process from the seed to the consumer.*

# Modifications of IR sources

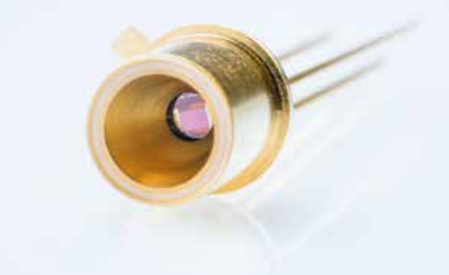
## Many process relevant gases are detectable by NDIR gas measuring systems.

The performance of all participant IR components is essential for the precision of all measurement results. Therefore a powerful, broadband emitting radiation source is of central importance. Due to high membrane temperature and Planck similar radiation Micro-Hybrid´s IR sources are perfectly suitable for the use in NDIR gas analysis.

We can adapt chip size and the reflectors' geometry individually corresponding to application demands. The range of possible adaptions extends even more by the big variety of filters and protective gases.




*Angular distribution of the JSIR 350 with large aperture cap (red) small aperture cap and window (blue) and with a reflector (light blue)*



*IR source with reflector and filter*

### Cap / Reflector

Micro-Hybrid´s IR sources are available either with cap or reflector. Compared to the cap, the reflector is characterized by a very small beam angle and collimates radiation. An up to ten times higher radiation intensity can be achieved.

For perfect integration into the application we also offer to draw up customized reflectors.

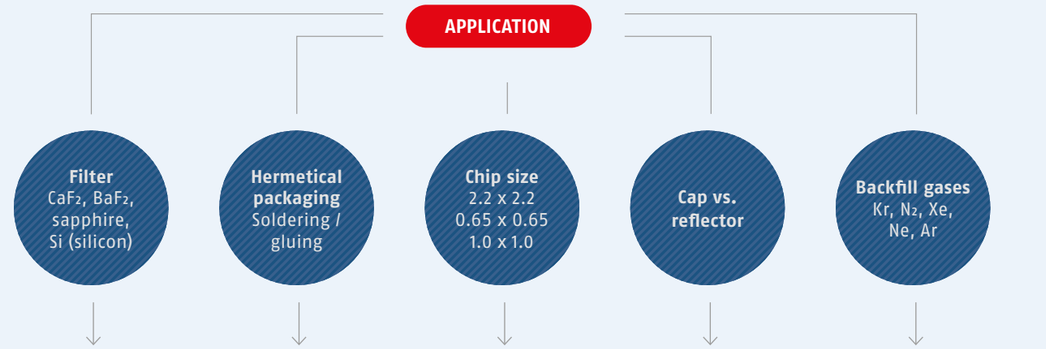
*IR source with reflector*

### Hermetic sealing

Wavelength selective bandpass filters usually get attached to cap or reflector by gluing which may not exclude eventual permeability of diverse gases or vapor. That is why we created a unique process of filter-cap-connection: HermeSEAL® technology.

The edge area of the filter is first metallized and then soldered hermetically to the cap or the reflector. The result is an IR source made for harsh environments.
The use of refill gases allows further parameters to be adjusted and the power of the radiator to be optimised.

*IR source with reflector and hermetically soldered filter*



# Modifications of thermopile detectors

IR thermopile detectors are among the core components in infrared measurement technology. Micro-Hybrid produces multichannel detectors based on thermal sensors for simultaneous measuring of up to 7 different gases.

This highest degree of adaptation is achieved through our deep value chain. In order to guarantee the optimal function of the measuring system, subcomponents such as cap, socket, sensor chip and infrared filter can be individually adapted to the application.

## Sensor chip

A sensor chip based on the thermocouple operation principle forms the base of each thermopile detector. Besides sensor chips for one- and multi-channel in gas analyzing applications we offer special chips for remote temperature measurement in different measurement environments. Optional your detector can be equipped with an additional thermistor to display the housing temperature.

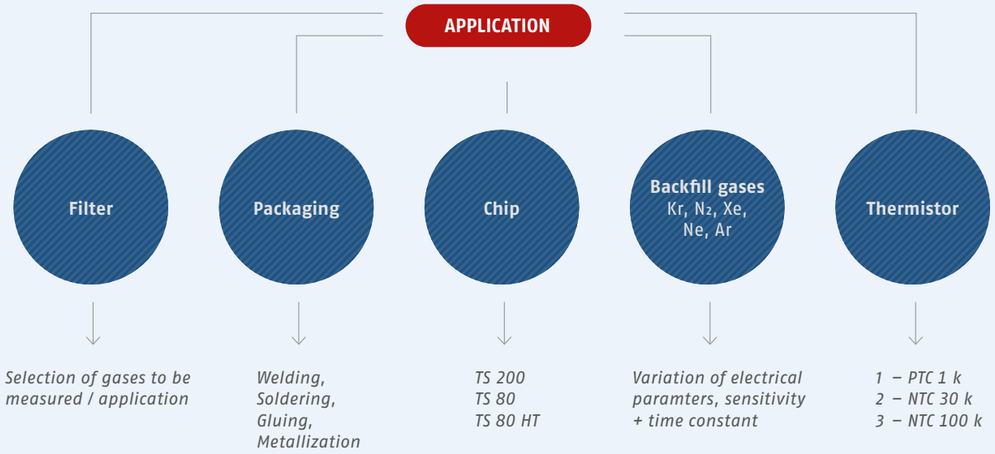
*Four TS 200 chips on a TO 8 socket*

## Infrared filter

Big variety and complexity mark the application fields of infrared measurement technology. To ensure a reliable function of your measurement system it is essential to choose the right infrared filter.

We provide individual support and a very extensive portfolio for this sometimes tricky choice. This includes diverse infrared windows such as: $CaF_2$ or $BaF_2$, Cut on / off as well as bandpass filter.

*Micro-Hybrid filter selection*




# Modifications of pyroelectric detectors

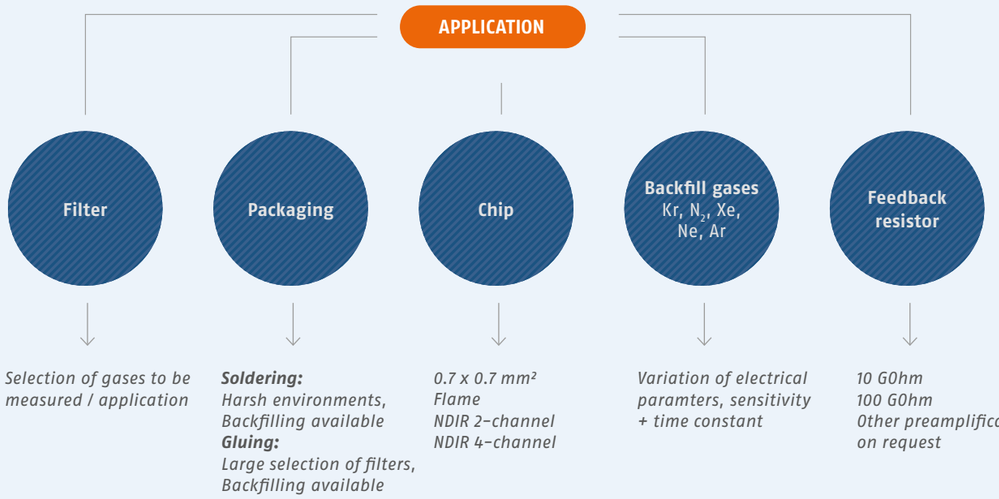
MPS pyroelectric detectors operate with an external voltage supply and are suitable for diverse measurement tasks referring to their internal pre-amplification.

Time constant and sensitivity of the current mode detector are adaptable to special demands by diverse feedback resistors.

## Field of view (FOV)

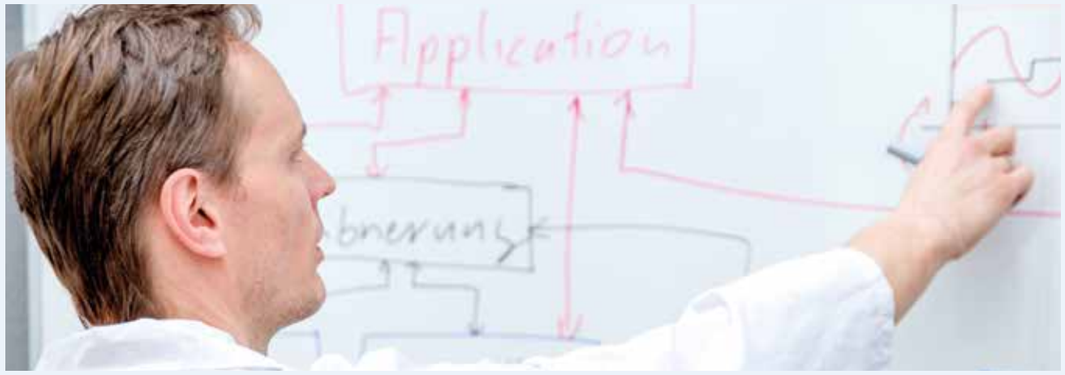
Different applications may ask for very different demands to the detector such as field of view. Detectors with a large FOV are mainly used for flame detection. For gas analysis a narrow FOV is needed. To achieve optimal performance we can adapt the FOV by the combination of sensor chip and TO cap with different apertures.

*Different cap sizes with different apertures*



# Customized development of high-level infrared sensors and sensor systems

## Focused on gas measurement applications

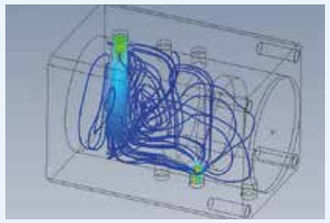


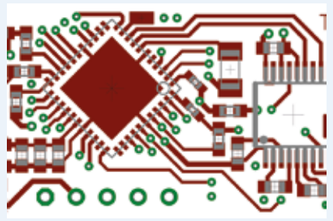

As part of our application consulting, we work closely with you to find the perfect combination of technological possibilities to realize the ideal sensor. In this way, projects are also created that cannot be realized on the basis of conventional production standards. Even harsh environments do not stop us.

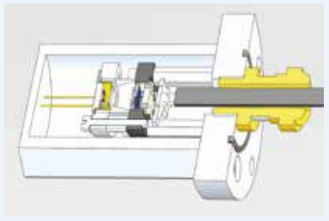
Whether in the idea, concept or product development phase – you can access the project in every phase of the development process. We combine our technological competencies in the fields of electronics and mechanics, software development, optics, microelectronic packaging as well as simulation and testing in a synergetic way in order to realize the optimal customer-specific solution.

We can also adapt and enhance existing technologies and processes as part of our process development.

Joint and cooperative projects with renowned universities and institutes regularly give us new impulses to expand our portfolio. A strong team of physicists, technologists, designers, hardware and software developers are waiting for your challenge!







# Inhouse R&D competences

### Product development

- Mechanical 3D design and construction
- Flow and thermal simulation
- Analog and digital electronic hardware design and simulation
- Microcontroller and PC based software design and simulation
- Measurement systems for optical characterization and calibration
- Durability and reliability verification
- Statistical evaluation of all measurement results
- Customized housing and packaging

### Test and measurement equipment

- Pyrometers and infrared cameras
- FTIR spectrometer with external input for IR sources
- Calibration black body up to 1200° C
- Calibration systems for gas measurement
- Measurement equipment for electrical characterization and calibration
- Mechanical measurement / test
- AOI tests, optical measurements
- He leakage test for hermetically sealed components
- Burn-in-test for IR-sources

### Laboratory

- Metallographic analysis
- Environment tests
- Fast temperature change
- High and low temperature storage (+300° C; -70° C)
- High humidity storage
- Mechanical vibration and acceleration
- Rapid prototyping of electronic and mechanical development samples
- Development of customized optical and electrical test equipment

**Contact us: We're here to help!**

If the troubleshooting guide above doesn't help you solving your problem or for more information, please contact us using the information below.

Support@CO2Meter.com
(386) 256-4910 (M-F 9:00am–5:00pm EST)
www.CO2Meter.com
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www.CO2Meter.com/pages/terms-conditions

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