Fixed Gas Detection Systems

smart GasDetection Technologies

D-ReX®

State-of-the-art monitoring of gases in the semiconductor industry

MADE IN GERMANY

GfGsafety.com

D-ReX®

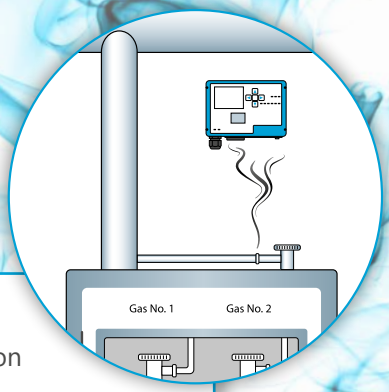
Designed for Versatility

Gases are used in many areas of application and process steps of the semiconductor industry. This results in a wide variety of associated requirements for measuring methods, sensors, measuring ranges and communication.

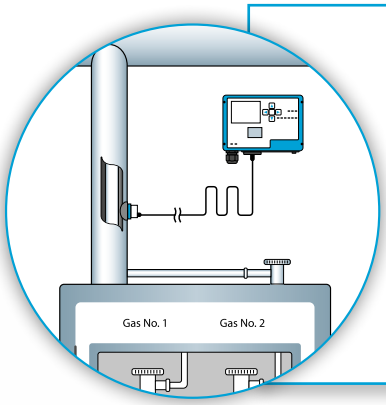
The D-ReX allows you to select the ideal combination of measurement method and sensor for every requirement. Benefit from the DIN-rail mounted gas detector's easy-to-understand user interface, its modern, future-proof technology, and simple and cost-effective maintenance.

Versatility in measurement methods

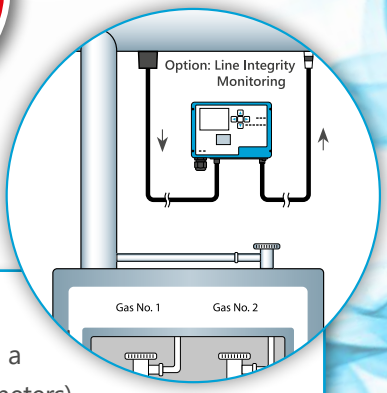
The D-ReX gas detector series lets you choose between different measuring methods to ensure you are using the ideal solution for every requirement.



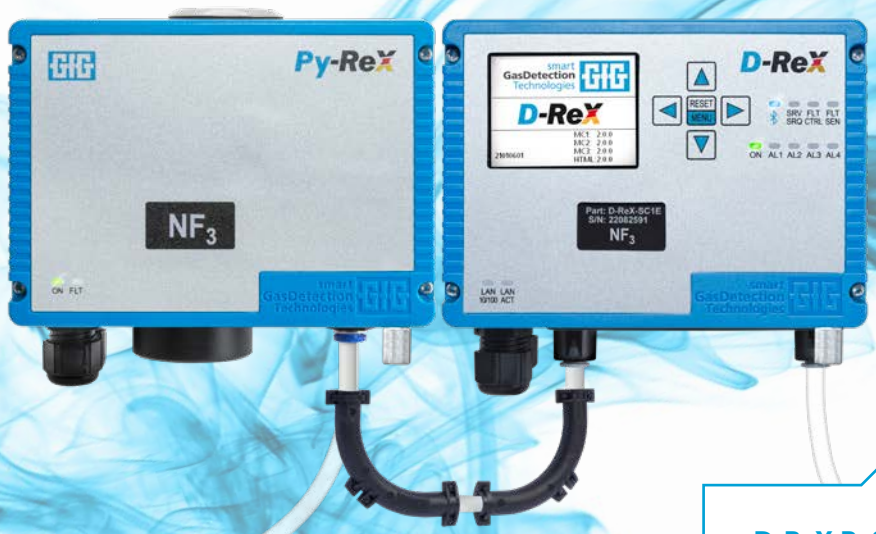
» D-ReX PoU (Point of Use)
Monitoring of gases using the diffusion method.

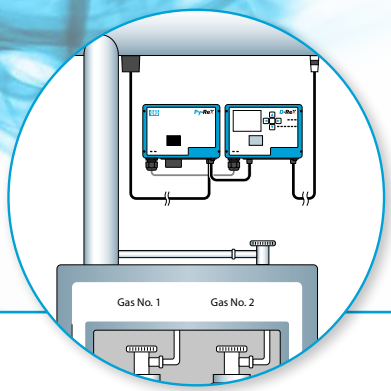


» D-ReX PoI
(Point of Installation)
Monitoring of gases by diffusion method using a remote sensor cartridge. Distance between the D-ReX and the cartridge can be up to 1200 meters / 4000 feet.



» D-ReX PoS (Point of Sampling)
Monitoring of gases via extraction using a built-in pump (suction distance up to 30 meters). The sensor is situated within the D-ReX.
Furthermore, the D-ReX PoS was the first gas detector in the world that offers optional monitoring of the hose line for leaks. The Line Integrity Monitoring (LIM) technology continuously works to prevent unnoticed absorption of secondary air.





» D-ReX PoS with Pyrolyzer

The Py-ReX is the matching pyrolyzer for the D-ReX PoS to monitor gases that are chemically inactive to be measured directly. The Py-ReX will be mounted before the D-ReX and breaks the monitored gas down to detectable components.

D-ReX®

Features:

- » 5x internal relays (form C, configurable)
- » Smart sensors for more than 60 gases
- » Hot-swappable smart sensor cartridge
- » Tool-free maintenance
- » Power-over-Ethernet (PoE) communication
- » Web server for browser access
- » Password-protected menu
- » Interface: Analog outlet: 4–20 mA output
  Digital: RS-485 (Modbus/RTU)
  10/100 Mbit Ethernet (Modbus/TCP)
- » Bright status and alarm LEDs
- » Data logger to review sensor and alarm history
- » Marked as FCC, CE, IC and UKCA

USPs:

- » High-resolution, full-color 2.4" TFT display
- » Plain text information
- » Bluetooth®
- » Configuration via DReX-App

Options:

- » 16x external relays (GMA200-RT/D)
- » LonWorks®

Diffusion Mode Gas Detection at the Point of Use (PoU)

D-ReX® PoU

The D-ReX PoU is the new standard when it comes to monitoring toxic, combustible and corrosive gases as well as the oxygen concentration at the Point of Use.

It offers a variety of modern features that set it apart from other gas detection instruments for the semiconductor industry. These include easy-to-understand information on its high-resolution color display and a variety of different communication options, including Bluetooth and a Power-over-Ethernet (PoE)-enabled network interface.

Available Accessory:

» Calibration cap for PoU
» DIN rail
» Touch protection insert for sensors

Remote Diffusion Mode Gas Detection at the Point of Installation (PoI)

D-ReX® PoI

The D-ReX PoI's external sensor can be mounted in a location up to 1200 meters / 4000 feet away from the device and monitor toxic, combustible and corrosive gases as well as the oxygen concentration from there.

The remote sensor can be mounted directly onto pipe systems, gas cabinets and other hard-to-reach locations so that the gas detector itself can be mounted at eye level for easy access. This facilitates maintenance, inspections and operation.

With the optional saddle, it can also be used for in-situ measurements in ducts.

Available Accessory:

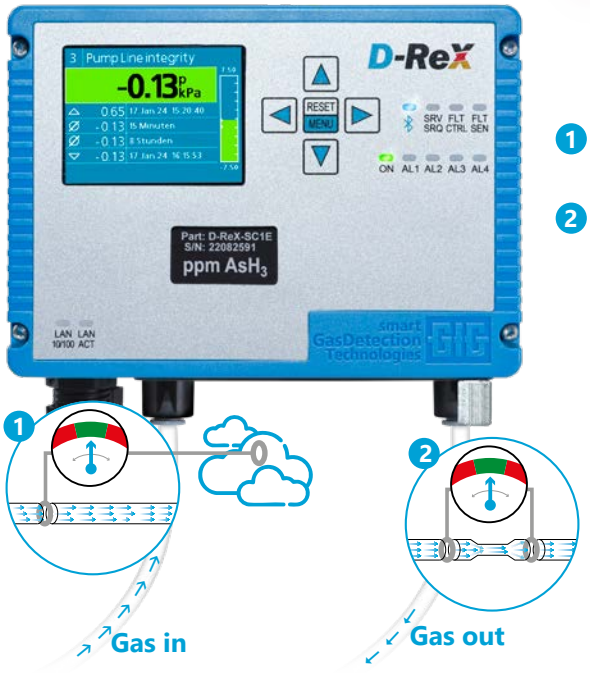
» Mounting saddle
» Viton® (FKM) sealing for all saddle types
» M12 remote sensor cable, various sizes (1 to 30 m / 3 to 100 ft)
» Calibration cap for PoI
» Mounting brackets
» DIN rail

eXtraction Mode Gas Detection at the Point of Sampling (PoS)

D-ReX® PoS

Not all gases can be monitored directly at the measuring point. This may be because the maintenance of a remote sensor would be too complicated or because the target gas has to be broken down into detectable components first. This can be done using a pyrolyzer.

In these cases, the D-ReX PoS with its integrated pump is an ideal solution. The point of sampling (PoS) can be up to 30 meters away from the D-ReX. This also applies to the length of the recirculation hose.



1. Line Integrity Monitoring
2. Flow measurement

Available Accessory:

- DIN rail
- PTFE hose
- Various particle filters
- Push-Pull plug-in adapter
- Angle braces

The D-ReX offers optional **Line Integrity Monitoring** alongside flow measurement. This technology continuously monitors the negative pressure in gas-carrying lines. An additional pressure sensor measures the ambient pressure as a reference. If the pressure ratio between the line's negative pressure and the ambient pressure changes, it indicates a leak or blockage in the line. In such cases, the D-ReX reports a fault.

Py-ReX®

Gas detection in extraction mode combined with pyrolysis

The Py-ReX® pyrolyzer improves the performance of our D-ReX gas detectors. When used in combination with a D-ReX PoS and its integrated pump, the Py-ReX will allow you to detect highly toxic or chemically inactive gases. Since the D-ReX detects their decomposition products, it is able to measure these gases even in small concentrations.

How does pyrolysis work?

Pyrolyzers, sometimes also called "decomposers", are used in many analysis devices. No matter the application however, the goal is always to transform the original gas (target gas) into another gas (measured gas), which can be detected more easily.

The Py-ReX is a filament pyrolyzer. Inside a quartz glass tube, it contains a filament which is heated to a certain temperature – depending on the gas you need to detect. The target gas decomposes into the measured gas (and potentially other components) upon coming into contact with the filament. It is then measured using an electrochemical smart sensor.

The concentration of measured gas can then be used to calculate the original concentration of target gas.

Why choose a filament pyrolyzer?

All pyrolyzers use heat to disassemble samples. In devices which analyze unknown samples for their components, pyrolysis often takes place without oxygen and in precisely defined thermic conditions.

Adhering to such specific parameters is not necessary for reliable gas detection, since both the monitored target gas as well as the expected decomposition product are known in advance. This is why filament pyrolyzers have been appreciated as the most reliable and durable solution for pyrolyzing gases for years now.

Some manufacturers also sell pyrolyzers which use an α-radiation absorption method. In this process, a radioactive α-radiation source generates a continuous ion current in the measuring chamber and a reference chamber.

The decomposition products generated as a result of pyrolyzing the target gas absorb parts of this ion current in the measuring chamber and the difference between the values in the two chambers are then used to calculate the concentration of target gas.

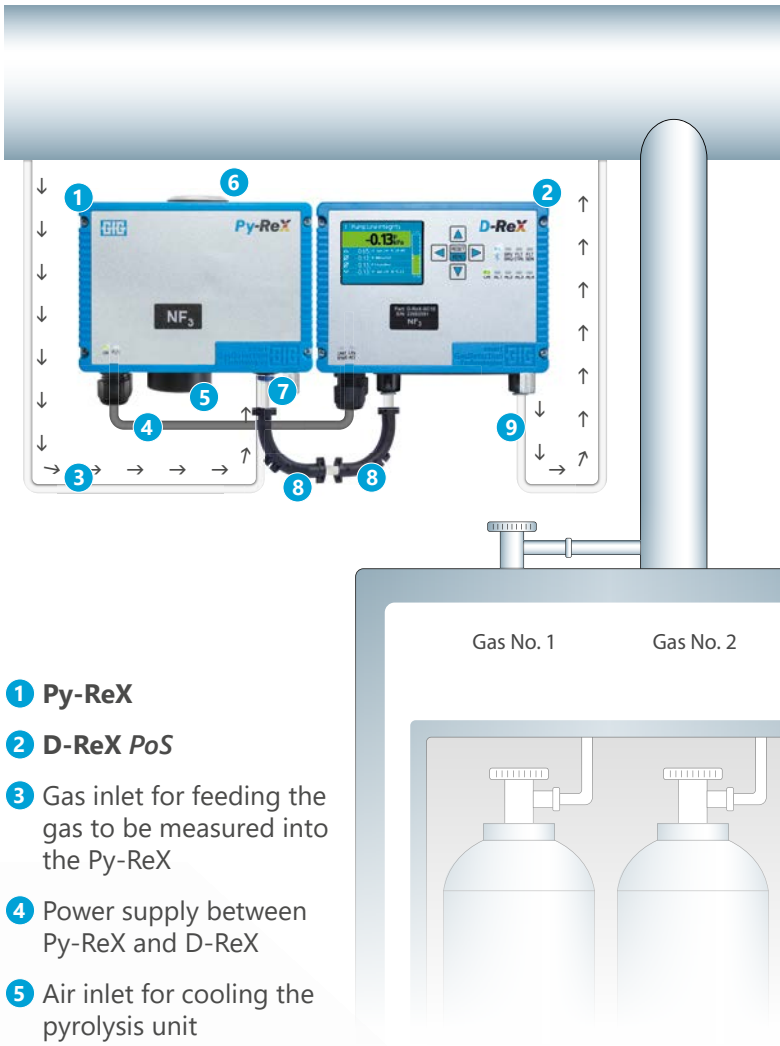
We deliberately decided against using this approach when developing the Py-ReX, since it would bring only disadvantages to users:

- It does not improve measuring accuracy or speed.
- Users would continuously have to take precautions regarding the use, storage and transport of radioactive material.
- Pyrolyzers cannot just be disposed or recycled, but instead have to be sent back to the manufacturer in special safety packaging.
- They must be labeled as radioactive "Type L" packages by a qualified forwarding agent for every transport. Special restrictions also apply for air transport.

Which gases do you need a pyrolyzer for?

Most inert gases used in the semiconductor industry and industrial processes are fluorine-based. But there are also fluorine-free inert gases, such as 1,2 dichloroethene, which need to be monitored.

The temperature needed for the pyrolysis process depends on the specific gas. That's why the Py-ReX is calibrated meticulously, ensuring the decomposition products needed for the subsequent detection are created.



1. **Py-ReX**
2. **D-ReX *PoS***
3. Gas inlet for feeding the gas to be measured into the Py-ReX
4. Power supply between Py-ReX and D-ReX
5. Air inlet for cooling the pyrolysis unit
6. Outlet for the heated air
7. PTFE connecting hose between Py-ReX (gas outlet) and D-ReX (gas inlet)
8. Bent clips 90° for PTFE hose
9. Gas outlet for recirculating the gas

Easy to use and maintain

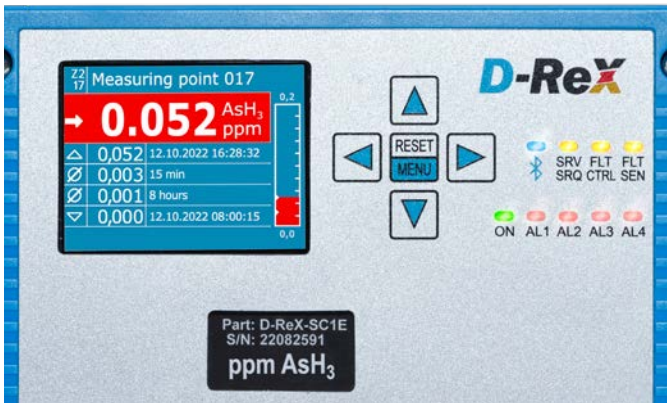
The D-ReX is a very user-friendly, easy-to-maintain gas detector.

High-resolution, full-color display

The 2.4", 320 x 240 pixel full-color TFT display sets new standards for gas detectors. It provides clear and precise information about the current measured values, the short-term and long-term exposure, as well as any malfunctions that may have occurred. Information can be displayed in a variety of languages and scripts, including English and German.

Clear information

No longer will you have to decipher cryptic error codes. Information on any issue is instead displayed in plain text. Status LEDs provide an additional instant overview of vital components of the system.



User interface with display, control keys and status LEDs

Intuitive device management

Settings on the D-ReX can easily be managed using the configuration program or the DReX-app (Android). They can be connected to the device either via an Ethernet interface or Bluetooth. This will give you access to all settings and configuration options. After entering the password, changes can also be made using the control keys in the D-ReX's service menu.

Advanced connectivity

The D-ReX comes with a wide variety of communication interfaces: Choose between analog, industry standard 4–20 mA, digital RS-485 interface (Modbus/RTU), Ethernet (Modbus/TCP) and LonWorks (optional) for signal transmission. The Bluetooth option enables wireless connectivity. In addition to the five internal, configurable changeover contact relays, 16 additional relays can be addressed by connecting the D-ReX to a GMA200-RT/D relay module.

Periodic sensor self-tests

The plug-and-play smart sensor cartridges are pre-configured and pre-calibrated for easy installation or replacement. Automatic sensor self-tests increase safety while reducing maintenance costs even further.

The new standard for versatility: D-ReX

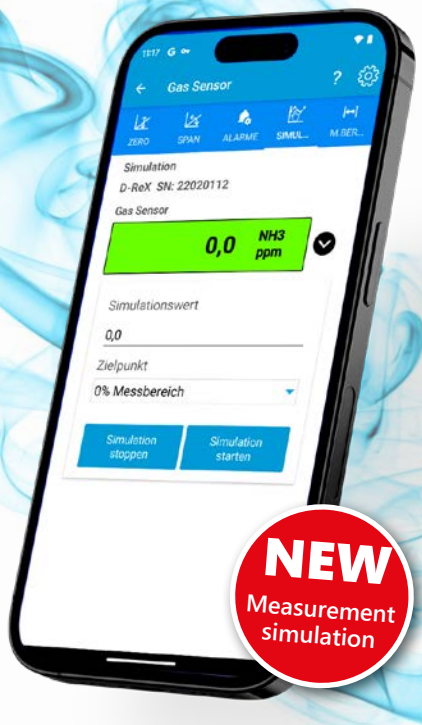
All the advantages mentioned perfectly qualify the D-ReX for numerous applications in virtually all industries. Some of its unique features make it particularly suitable for use in the semiconductor industry, photovoltaic industry and industrial manufacturing as well as in laboratories. If you are looking for the gas detector that best suits your needs, the D-ReX will be your first choice for many applications.

Possible areas of application:

- Distribution boxes
- Process tools
- Vacuum pumps
- Scrubbers
- Gas cabinets
- Ambient breathing zones
- Storage areas
- Cleanroom environments
- Sub fab systems

and many more.

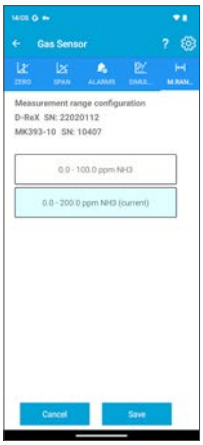
Visualization and configuration via app



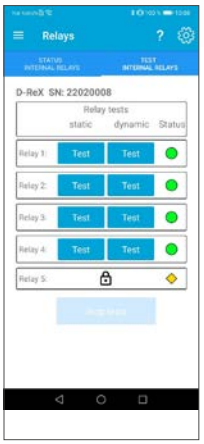
The DReX app provides a convenient way to visualize and configure the D-ReX using a smartphone or tablet (Android 5 or higher). It offers full access to all relevant measurement data, system settings, and diagnostic functions.

The app allows real-time monitoring of key values such as gas concentration, pump flow rate, Line Integrity Monitoring, and pump current. It also simplifies maintenance tasks, including sensor calibration. The integrated measured value simulation enables testing of the gas detection system's behavior under various conditions—such as faults or alarms – without requiring test gas.

Live-Data-View



Measuring ranges



Relay test

Relay status

Adjustments

Alarms

Gas concentrations can be simulated within a range of -7.5% to 112.5% of the measurement range, or one of four predefined alarm levels can be selected. This function was specifically developed to provide a user-friendly and effective way to verify gas detection systems and connected system controls.

Additionally, the measured value simulation goes even further: in addition to gas concentrations, it allows the simulation of faults, maintenance states, deviations in pump flow or line pressure (for D-ReX models with a pump), as well as variations in heating current. This also enables the simulation of temperature-related faults when using a pyrolyzer. As a result, gas detection systems and safety measures can be thoroughly and reliably tested

Versatility means having options

No two facilities are the same and even within a facility, the requirements for a gas detector can vary from department to department or from one gas being monitored to another. It is therefore an immense help to have a gas detector that can be configured and adapted accordingly.

We offer a wide range of practical accessories for the D-ReX so that you can customise your gas detector to the conditions and environment on site.

1. **D-ReX**
   (without sensor cassette, pump and housing cover)
2. **Py-ReX**
3. **Ethernet-cable with PoE**
4. **IP Code sticker**
5. **Sensor cartridge with detachable pipe flange adapter** (up to 1200 meters / 4000 feet)
6. **Connector cartridge for remote sensors** (M12)
7. **Sensor cartridge with detachable diffusion mode adapter**
8. **Integrated pump**
   (aspiration tube of up to 30 m / 100 feet)
9. **Particle filter** (3 different versions)
10. **Mounting bracket**
11. **Touch protection insert for sensors**
12. **Pipe flange saddle incl. seal**
13. **Lower housing covers**
14. **Bent clips 90° for PTFE hose**
15. **Calibration adapter for PoI and PoU**

LonWorks®

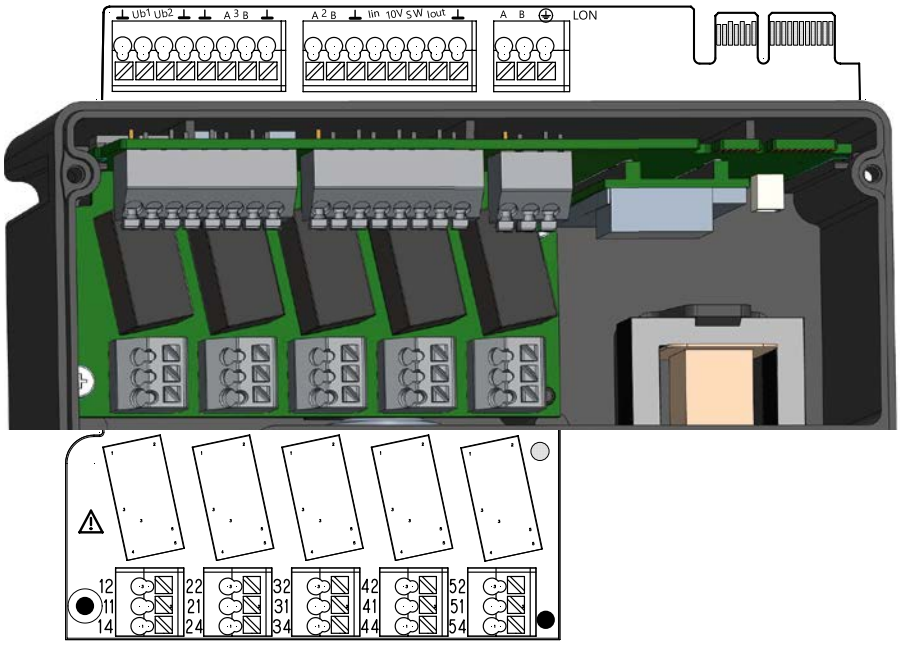
LonWorks is an open and interoperable system for building automation and is characterized by its flexible topology and cross trade functions.

If your previous gas detection system was integrated into your infrastructure via LonWorks or you want your new system to be integrated using the LonTalk® protocol, the D-ReX can be incorporated seamlessly, as all D-ReX versions are available with an optional LonWorks module. Keep the advantages of LonWorks, while benefitting from a state-of-the-art gas detection solution at the same time.

Internal Relays

All versions of the D-ReX are equipped with five internal, freely configurable changeover contact relays. This allows you to precisely control safety functions such as visual alarms, audible warning signals, ventilation systems, or shut-off valves via your gas detection device. The contact assignments are shown in the illustration on the right:

Alternatively, you can also connect an external GMA200-RT/D relay module to add a further 16 relays to the D-ReX.



D-ReX versions and options

D-ReX Version	Internal Sensor (Diffusion)	External Sensor (Diffusion)	Pump module (eXtraction Module)	Py-ReX	LonWorks®
Point of Use (PoU)	✓				(option)
Point of Installation (PoI)		✓			(option)
Point of Sampling (PoS)	✓		✓	✓*	(option)

* Required for certain gases

Smart Cartridge Technology for low total cost of ownership

Smart devices are everywhere by now, but GfG goes a step further to offer you Smart Design. One of the most efficient ways to optimize both the cost of ownership and your environmental footprint is to minimize waste.

That's why the D-ReX was designed to ensure that only components that are actually subject to wear need to be replaced. Only the sensor is replaced when it is used up – you can continue to use the smart sensor cartridge.

USPs:

» Only the sensor is replaced – less waste, lower costs
» Identical sensor cartridges for all applications (Smart Cartridge)
» Hot-swappable within seconds (no tools needed)
» Modbus communication between sensor and D-ReX

Smart Sensors

Measuring Principle:

» EC = electrochemical
» CC = catalytic combustion (LEL)
» IR = infrared
» PID = photoionization

GfG gas sensors are designed to be highly specific to the gas they are intended to detect. While their cross sensitivities are in line with the typical values of other sensors for measuring gases in industrial applications, GfG sensors offer the highest level of stability, performance and relative response documentation of any available sensors.

For detailed information on this, please refer to the sensors' individual data sheets.

Easily replaceable pump mechanism

Sustainability was also a key focus in the design of the integrated pump in the D-ReX PoS. In the event of wear, only the mechanical components need to be replaced. The pump electronics remain inside the device and continue to be used. The pump mechanism can be easily replaced by removing the housing cover and loosening a single screw.

Versatility in gases and measuring ranges

A wide range of durable smart sensors, covering all important gases of the semiconductor industry as well as the relevant measuring ranges, is available for the D-ReX. The following list is merely a selection of these. Please note that a pyrolyzer is needed for the detection of some gases. **Other gases on request.**

Gas	Formula	Nominal Range	Sensor
Acetylene	C_2H_2	0–100% LEL	CC
Ammonia	NH_3	0–100 ppm**	EC
Ammonia	NH_3	0–1000 ppm**	EC
Ammonia	NH_3	0–5000 ppm	EC
Arsine	AsH_3	0–1 ppm**	EC
Arsine (zero H_2) (no cross-sensitivity to H_2)	AsH_3	0–1 ppm**	EC
Arsine LT[1] LDL[2]	AsH_3	0–1 ppm**	EC
Bromine	Br_2	0–5 ppm	EC
Hydrogen bromide	HBr	0–30 ppm**	EC
Butane	C_4H_{10}	0–100% LEL	CC
Chlorine	Cl_2	0–10 ppm**	EC
Chlorine dioxide	ClO_2	0–2 ppm**	EC
Chlorine trifluoride	ClF_3	0–2 ppm**	EC
Hydrogen chloride	HCl	0–30 ppm**	EC
Hydrogen cyanide	HCN	0–30 ppm**	EC
Diborane LT[1]	B_2H_6	0–1 ppm**	EC
Dichlorosilane (DCS)	SiH_2Cl_2	0–30 ppm**	EC
Ethane	C_2H_6	0–100% LEL	CC
Ethylene	C_2H_4	0–100% LEL	CC
Ethylene oxide	ETO	0–20 ppm**	EC
Fluorine	F_2	0–5 ppm	EC
Hydrogen fluoride	HF	0,5-10 ppm	EC
Germanium hydrogen LT[1]	GeH_4	0–2 ppm	EC
Heptane	C_7H_{16}	0–3000 ppm	PID
Hexamethyldisilazane	HMDS	0–500 ppm**	EC
		0–5000 ppm**	
Hexane	C_6H_{14}	0–100% LEL	CC
Hydrazine	N_2H_4	0–1 ppm**	EC
Isobutylene	C_4H_8	0–2000 ppm	PID
		0–200 ppm	
Carbon monoxide	CO	0–500 ppm**	EC
Carbon dioxide	CO_2	0–10 Vol.-%	IR
Carbon dioxide	CO_2	0–10000 ppm	IR
		0–1.000 Vol.-%**	

Gas	Formula	Nominal Range	Sensor
Carbon dioxide	CO_2	0–5 Vol.-%	IR
Carbon dioxide	CO_2	0–25 Vol.-%**	IR
Methane	CH_4	0–100% LEL	CC
Methane	CH_4	0–5 Vol.-%	IR
Ozone	O_3	0–1 ppm	EC
Ozone	O_3	0–5 ppm	EC
Pentane	C_5H_{12}	0–100% LEL	CC
Propane	C_3H_8	0–100% LEL	CC
Propane	C_3H_8	0–2 Vol.-%	IR
Phosgene	$COCl_2$	0–2 ppm	EC
Phosphine	PH_3	0–1 ppm	EC
Propane	C_3H_8	0–100% LEL	CC
Propane	C_3H_8	0–2 Vol.-%	IR
Oxygen (5-year sensor, lead-free)	O_2	0–25 Vol.-%	EC
Sulfur dioxide	SO_2	0–10 ppm**	EC
Hydrogen sulfide	H_2S	0–100 ppm**	EC
Hydrogen selenide LT[1]	H_2Se	0–3 ppm**	EC
Silane	SiH_4	0–50 ppm**	EC
Nitrogen monoxide	NO	0–100 ppm**	EC
Nitrogen dioxide	NO_2	0–20 ppm	EC
Tetraethyl orthosilicate (TEOS)	$C_8H_{20}O_4Si$	0–100 ppm	EC
Trimethyl borate (TMB)	$C_3H_9BO_3$	0–100 ppm**	EC
Hydrogen	H_2	0–100% LEL	CC
Hydrogen	H_2	0–2000 ppm**	EC
Hydrogen	H_2	0–1 Vol.-%**	EC
Hydrogen	H_2	0–4 Vol.-%**	EC
Requires a pyrolyzer			
Hexafluorobutadiene	C_4F_6	tbd	EC
Methyl fluoride	CH_3F	tbd	EC
Octafluorocyclopentene	C_5F_8	tbd	EC
Sulfur hexafluoride	SF_6	tbd	EC
Nitrogen trifluoride	NF_3	0–50 ppm	EC
trans-1,2 Dichlorethylen (DCE)	$C_2H_2Cl_2$	tbd	EC

[1] **Long-time:** Sensor with ionic liquid electrolyte for long service life, even in difficult conditions (e.g. high temperatures)
[2] **Lower Detectable Limit:** Refer to sensor data sheet for details.

** **Preset measuring range**, alternative measuring ranges possible, see sensor data sheet

Technical Specification: D-ReX series & Py-ReX

D-Rex series

Gases::	See gas list
Measuring Principle:	Sensor dependent; available options: EC = electrochemical | CC = catalytic combustion | IR = infrared | PID = photoionization
Sampling Method:	PoU = Diffusion | PoI = Remote sensor | Pos = Extraction with pump (if applicable, in combination with Py-ReX)
Display and Interface:	Display: 2.4" full color TFT (320 x 240 pixels) Interface: 5 push buttons
Selectable Languages:	German, English (more languages coming soon)
Communication:	» Analog outlet: 4–20 mA output » Analog inlet 4–20 mA for Py-ReX (D-ReX PoS only) » Digital: RS-485 (Modbus/RTU) » 10/100 Mbit Ethernet (Modbus/TCP) » Bluetooth » LonWorks (option) Relais: 5x internal (configurable) form C relays, 16x external relays (option) Max. 3 A / 30 V DC Min. 10 mA / 5 V
Response Time:	Varies by sensor (see sensor data sheet)
Expected Average Life of the Sensor:	Varies by sensor (see sensor data sheet)
Operating Temperature:	-10 to +40 °C 14 to 104 °F
Operating Humidity:	5 to 90 % RH
Operating Pressure:	70 to 130 kPa
Power Supply	12 to 30 V DC SELV/PELV PoE = 48 V DC
Housing:	Plastic PoS-Version: base unit IP30 (optionally IP64) / gas sensor IP64 PoU-Version: base unit IP30 (optionally IP64) / gas sensor IP43 PoI-Version: base unit IP30 (optionally IP64) / gas sensor IP40–IP64, depending on installation situation
Mounting:	(DIN) rail IEC/EN
Weight:	650 g up to 850 g
Dimensions:	5.7 x 4.1 x 3.0 in (L x H x D)
Labelling:	CE, FCC, IC, UKCA

Py-ReX

Gases	See gas list
Pyrolysis principle:	Filament pyrolysis
Sampling:	Extraction using the D-ReX PoS's integrated pump
Control elements:	2 Status LEDs
Communication:	Analog outlet: 4–20 mA
Warm-up time:	< 60 s
Expected average lifetime of the pyrolyzer:	> 2 years
Temperature:	-10 to +40 °C
Humidity:	5 to 90 % RH
Air pressure:	70 to 130 kPa
Power supply::	15 to 30 V DC SELV/PELV
Housing:	Plastic
Mounting:	DIN rail IEC/EN
Weight:	485 g
Dimensions	145 x 105 x 78 mm (L x H x W):
Labels:	CE

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