PST
PROCESS SENSING
TECHNOLOGIES

Fail-safe Oxygen, Dew-point and Humidity Control

For additive manufacturing quality

MICHELL Instruments · Analytical Industries Inc · rotronic MEASUREMENT SOLUTIONS · LDetek · DYNAMENT INFRARED GAS SENSORS · NTRON Gas Measurement · SST

Fail-safe Oxygen, Dew-point and Humidity Control for Additive Manufacturing Quality

Manufacturers of metal powder-bed fusion 3D printers depend on careful control of the printing process to avoid oxidation and moisture contamination which impacts the quality of the end product.

The AM Process

OxyDew

SF82

SenzTX Luminox

SIL O2 (LP)

SF82

SIL O2 + OC-26

Depowdering System

3D Printer
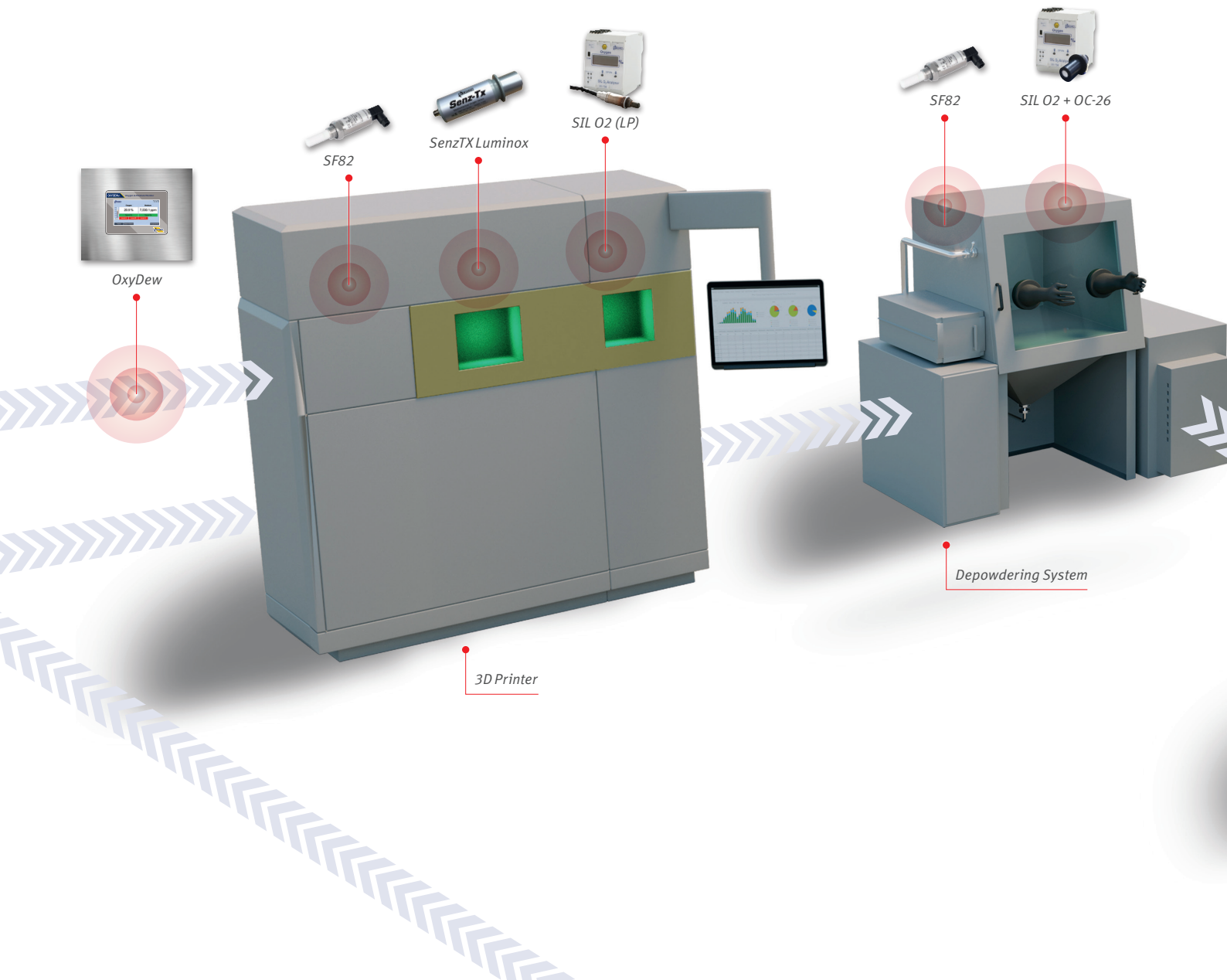
The application

Metal additive manufacturing is the process of creating a 3D object from a CAD model by building it up from metal powder, layer by layer. This technology can produce complex shapes that are not possible with traditional manufacturing methods.

The most common industries to commission production of specific components are aerospace, defence and transport. Reducing the chances of oxidization of the metal during the build process is essential as this can lead to a build failure, stress test failure or also a density test failure due to low quality standards. Interstitial absorption of any oxide embrittles the weld and may render the component useless.

Room Monitoring Solution

Rotronic
Relative Humidity
& Temperature Analyzer

Gasenz
Ambient O_2 Analyzer

Minox i

SF82   *Minox i*

Sieve Station

Air Filtration

Safety
- Ntron fail-safe solution (Analyzer & Sensor) meets the requirements of IEC61508 (SIL2 Capable)
- SIL O2 is SIL2 Capable, with a probability of failure on demand (PFD) of less than 0.01

Reliability
- Zirconia sensor with long life and no drift
- Optical PPM Oxygen Transmitter with fast response from ambient air. Unaffected by hydrogen.
- Fast-responding polymer moisture sensors resistant to contamination
- Robust performance proven in harsh environment of AM build chamber
- Suited to inert gas blanketing applications

Accuracy
- O_2
  - Capable of detecting 1ppm O_2
  - Operating ranges from 0-10ppm to 0-25%
  - Response time T90 <5 seconds
- Dew-point
  - Accuracy ±2 °C dew-point
  - Rapid response down to -60 °C dew-point
  - Measurement range -110 °C to +60 °C dew-point

In addition to the risk of oxidisation, moisture contamination is now becoming recognised as a potential quality issue that affects the integrity of the end product. Traditional metallurgical process – such as sintering – require dry, inert atmospheres to ensure strength and reliability, and metal additive manufacturing is no different.

The future adoption of this technology in many industries depends on the measurement and control of oxygen concentration within the manufacturing process. The PST Group has been working alongside some of the industry leaders in AM machine manufacturing to supply high performance oxygen analyzers measuring from 1 ppm up to 25% oxygen within the process.

A Complete Solution for Additive Manufacturing

Ntron's unique range of OEM oxygen analyzers have been specifically designed to be integrated into the AM machine manufacturer's control and safety systems. Ntron employs zirconia sensor and solid-state technology which has been specially developed for harsh process applications and are able to supply a SIL2 capable oxygen analyzer designed to comply with the requirements of IEC 61508 (SIL Capable) for the fail-safe oxygen measurement on inert gas blanketing applications.

When combined with the humidity transmitters and environmental control systems from other companies in the PST group we are able to provide a complete solution for quality, safety and efficiency in additive manufacturing.

Oxygen Analyzers for Additive Manufacturing

SIL O2 LT Fail-safe Oxygen Analyzer

This SIL2 capable oxygen analyser has been developed specifically for the measurement and control of oxygen for safety critical applications within the additive manufacturing industry.
- Safety Integrity Level in accordance with IEC61508 / IEC61511 (SIL Capable)
- Zirconia sensor developed to withstand harsh environments
- 3 configurable alarm outputs
- 4-20 mA, RS232 and RS485 communication

Meets the requirements of IEC61508 (SIL 2 Capable)

OC-26 sensor

SenzTx Oxygen Transmitter

A robust, minimal maintenance and small footprint oxygen transmitter to give a reliable and fast response time, long life and no drift from oxygen measurement.
- Measurement range from 0 to 1,000 ppm O_2
- 4-20 mA and RS485 Modbus communication
- Cost-effective and easy to install
- Fast response from ambient air, unaffected by hydrogen

Compact Oxygen Transmitter

SIL1O2 Oxygen Analyzer

Proven in thousands of 3D printers, reliable low-cost ppm or % oxygen zirconia-based analyzers for OEMs, with fast response time and no drift.
- Flexible panel, wall or din rail configurations
- 4-20 mA and RS232 Modbus communication
- LCD display and 3 alarm contacts
- Meets the requirements of SIL1 Capable Unit

Cost-effective OEM solution

AM Trace Portable Oxygen and Humidity Monitor

Specifically designed to measure the atmosphere in the additive manufacturing chamber.
- Oxygen measurement range 1 ppm to 25% O2
- Dew-point measurement range -100 to +20 °C
- Full colour display for easy use

Measures O_2 and H_2O

*Electrochemical
sensor technology*

*Manual or automatic
actuation*

*Versatile
transportable
analyzer*

Minox i

The Minox i is a highly reliable and cost-effective two-wire, loop-powered hazardous area certified oxygen transmitter with a linearized 4 to 20 mA output.
- Measurement range: ppm or %
- M12 Electrical connection
- Process connection KF40 as standard with Flowcell optional
- ATEX, IECEx, UKEX, cQPSus, CML (Japan) Hazardous Certification

OxyExtract

IECEx and ATEX approved oxygen sensor to measure oxygen concentration directly in the gas stream to ensure process safety.
- No additional sampling system required
- Fast and simple maintenance with out exposing the process to ambient air
- Variety of tri-clamp and flange process connections for easy installation
- Automatic in-line calibration

GasTrak Oxygen and Moisture Analyzer

A compact, transportable analyzer for convenient spot-checks of processes.
- Tough, high-impact case for use in industrial location
- Measurement range from 0-1000 ppm_V moisture and 0-1000 / 25% O_2

Related Products

Hot Isostatic Pressing: measurement of trace impurities in Argon

HIP combines very high temperatures (up to 2,000 °C), very high pressures (up to 30,000 psi), and inert UHP gas to eliminate porosity in 3D printed materials to optimise their density. It alters the microstructure of metals to improve strength, durability and corrosion resistance, enabling manufacturers' components to work more efficiently with significantly extended operational lifetimes. Dissimilar materials can be bonded together to manufacture unique, cost effective components.

An inert gas is required to prevent chemical reactions during the HIP process at elevated temperatures, making argon the ideal candidate. Monitoring of the HIP argon gas and its impurities is required to control the quality and repeatability of the HIP process. The MultiDetek 2 from LDetek, combined with the PlasmaDetek 2 detector provides an ideal solution to measure the different impurities in UHP argon.

MultiDetek 2 Compact Gas Chromatograph Based Analyzer

A standalone trace impurities gas analyzer based on gas chromatography technology. It provides a flexible and customisable platform.
- Wide measurement range covers sub-ppb to percent measurements
- A single instrument allows multiple trace impurity measurements

*Compact and robust industrial
rackmount 6U chassis*

Dew-Point Measurements for Additive Manufacturing

Michell Instruments has over 40 years of experience in producing dew-point transmitters and analyzers for industrial processes where dryness is essential for product quality. The range of dew-point transmitters offer a choice of 5/8" UNF, 3/4" UNF, G 1/2" process connections and 4-20 mA output for easy integration into modern 3D printers. For processes where dryness is essential, the Easidew dew-point transmitter measures down to -110 °C dew-point and has an intrinsically safe version with global certification for use in hazardous areas. The fast-responding SF82 provides a quick response in the key -60 to +60 °C dew-point range.

Easy to install and maintain

Sensor exchange programme for easy maintenance

Designed for harsh industrial conditions

Easidew Transmitter and Easidew I.S.

Simple to install and maintain the the dew-point transmitter measures dew-point and moisture content across a broad humidity range.
- Measurement range from -100 to +20 °C dew-point 0-3000 ppm_v
- Intrinsically safe version for hazardous area use
- Wide range of process connections for easy installation

SF82 Fast Responding Dew-Point Transmitter

The SF82 is a fast-response moisture transmitter for dew-point and moisture content and is available with a range of process connections and electrical connectors.
- Dew-point or ppmV moisture content output
- Accuracy ±2 °C dew-point
- Ultra-fast response to moisture change

SF52 Industrial Dew-Point Transmitter

The SF52 dew-point transmitter is a simple, cost effective solution designed for use in harsh industrial dryer applications where reliability and toughness are required.
- Ideal for OEM use
- Dew-point measurement range -40 to +60°C (-40 to +140°F)
- Rugged IP65 construction

Related Gas Analyzers

LD8000

- Unique micro-valve for very low dead volume and fast purging time
- Low sample consumption

GPR-1200 Portable O$_2$ Analyzer

- Measurement range from 0-10 ppm up to 0-1% O_2
- Integral data logging of measurement

PI2-MS

- Electrochemical sensors with 12 months life
- Stable measurements of oxygen at low parts per ppm / ppb

Online trace nitrogen and/or oxygen

ATEX certified

Analyzer for ultra-high purity gases

Rotronic Continuous Monitoring System – RMS

Monitor all parameters to ensure maximum quality

Additive manufacturing requires substantial monitoring of oxygen, nitrogen, dew point, particles, temperature and relative humidity. The Rotronic Monitoring System (RMS) allows for all of this data from digital and analog sensors and process controllers to be consolidated and monitored in one system, recording all critical data from multiple products in one secure, robust and easily accessible platform. RMS offers a comprehensive overview of live data, real time alarming for users as well as complete data integrity. From the data gathered in RMS you can provide clear reports to customers or for internal audit, in addition you can integrate RMS data into more detailed analysis software to better understand your process and how to optimise and improve final product quality.

RMS-ADC-L-R – Add any Analog Value

The module will allow for the integration of any analog signal into the RMS software:

- 0...1/5/10 V or 0/4...20 mA
- 2, 3 or 4 wire connection
- Power the transmitter directly via the RMS-ADC-L-R
- 44,000 data logging capacity

DIN rail mounted for easy installation

Rotronic Monitoring System Login

Check out an example of how your Additive Manufacturing Monitoring could look like:

- https://rms.rotronic.com/RMS/Login.aspx
- Company Name: Rotronic Monitoring System
- User Name: AM
- Password: 12345678

Reach out to rms@rotronic.ch for a live demo of the RMS software to understand exactly how this solution can help you!

Access data and create reports from anywhere in the world

Also Related

MDM50 Portable Fast-Response Hygrometer

Simple to use and rugged, the MDM50 high-speed portable hygrometer is the ideal tool for a wide range of on-site maintenance spot checks.

- Response to -60°C dew point in 3 minutes
- 16 hours operation between recharging
- Accuracy ±2°C dew point

Fully self-contained

MDM300 Advanced Portable Hygrometer

A high-speed portable dew-point hygrometer for rapid spot-check measurements of dew point or moisture content in many applications. A hard-wearing, ergonomic case and an easy-to-use interface make it both practical and comfortable to use.

- Repeatedly fast measurements at low pressure from less than 15 min. for T95 to -60°C
- Long battery life: up to 48 hours of typical use between charges
- Hazardous area certified version available

Lightweight and ergonomic

Process Sensing Technologies

We provide an unmatched suite of instruments, analyzers and sensors for precision measurements and monitoring in highly demanding end markets. These range from pharmaceutical/ life sciences, speciality gases, semiconductors, O&G, petrochemicals and power to gas detection, food and beverage and building automation.

Using our products, customers save millions of dollars each year through increased energy efficiency in their processes and reduced process disruptions.

The quality of food, medicines, semi-conductors and thousands of manufactured goods depends on reliable measurements of critical parameters such as humidity, oxygen, CO, N_2, H_2, hydrocarbons, pressure or CO_2 during production, storage and transport. Our products directly improve the profitability of our customers and help them to stay compliant with stringent industry regulations. We own and manufacture the sensing technologies used in the majority of our products. This allows us to remain in a strong leadership position and pass on the benefits of our innovation to our customers.

PST Leading Brands

- **Analytical Industries Inc.** – Electrochemical oxygen sensors and gas-analysis
- **Dynament** – Infrared gas sensors
- **LDetek** – Ultra low range online analyzers
- **Michell Instruments** – Moisture and oxygen sensing and instrumentation
- **Ntron Gas Measurement** – Oxygen sensors and analyzers
- **Rotronic** – Humidity and temperature instruments, monitoring systems
- **SST Sensing** – Oxygen sensors and liquid level switches

Group Facts

- OEM for leading AM technology manufacturers
- 22 Service and sales subsidiaries
- 8 global engineering and manufacturing locations
- 100+ authorized distributors
- 14 proprietary technologies

| Humidity | Temperature | Dew Point | Water Activity | Differential Pressure | Oxygen | CO_2 | Impurities | Flammable Gases | Level |

North America
Thetford Mines, QC, Canada
Hamilton, ON, Canada
Hauppauge, NY, USA
Pomona, CA, USA

Asia
Tokyo, Japan
Osaka, Japan
Beijing, China
Shanghai, China
Singapore

EMEA
Coatbridge, Scotland, UK
Mansfield, UK
Ely, UK
Crawley, UK
Navan, Ireland
Oosterhout, Netherlands
Frankfurt, Germany
Ettlingen, Germany
Lyon, France
Zürich, Switzerland
Milan, Italy
Dubai, UAE

South America
Rio de Janeiro, Brazil

Global direct sales and service support

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