

Urban housing with a touch of chic

- The HSB Turning Torso in Malmö

New light from laser technology

- Industrial oxygen measurements

Mastering the fermentation process

- Enzyme production at ROAL

Ensure trouble-free electricity supply with dewpoint control

- Fortum Power and Heat
relies on Vaisala





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Vaisala in Brief

– We develop, manufacture and market products and services for environmental and industrial measurements.

– The purpose of these measurements is to provide a basis for a better quality of life, cost savings, environmental protection, improved safety and better performance.

– We focus on market segments where we can be the world leader, the preferred supplier. We put a high priority on customer satisfaction and product leadership. We secure our competitive advantage through economies of scale and scope.

Cover photo:

The HSB Turning Torso in Malmö, Sweden. Photo by Ole Jais.

Editor-in-Chief:

Marikka Metso

Publisher:

Vaisala Oyj
P.O. Box 26
FI-00421 Helsinki
FINLAND

Phone (int.):

+ 358 9 894 91

Telefax:

+ 358 9 8949 2227

Internet:

www.vaisala.com

Design and Artwork:

Sampo Korkeila

Printed in Finland by:

SP-Paino

ISSN 1238-2388

Good-bye and thank you

I joined Vaisala as a CEO almost 15 years ago, in 1992. Now I've decided it's a good time to retire. I've enjoyed the past 15 years tremendously. The company has grown and our market position has strengthened. Today, Vaisala is well-positioned to face the future.

I feel great satisfaction to have been part of that development and experience. It's been fun to work in an innovative environment and entrepreneurial culture, and to see the changes in the global market environment.

Much has changed in the past 15 years. We've made some mistakes but more often succeeded. Competent people around the world have made this possible. I'm amazed by young people, their talent, education and energy - how quickly they learn the complexity of our business and start questioning things, in a constructive way.

Environmental measurements have an important role in the future. With this rate of growth in the world population and industrial activity, sustainable development is a must. We must get more out of less. We cannot afford to waste any more energy and resources. Climate change is a fact, and mankind has to adapt. This

is possible only through knowing our environment and understanding its parameters.

When more environmental data is available, new information services can be created. This produces new business. There are untapped opportunities in combining data sets from different sectors of the environment. Tighter integration of environment and applications is also feasible now. By feeding environmental data into application-specific process models, efficient decision-making support systems can be introduced.

The reasons behind my decision to retire are very personal. A busy business life has not left me much time for private projects and activities. While I'm still in good shape, I'd like to see more of that side of life as well. As the company is doing well, it's a good time to pass the duties on to my successor. I believe Kjell Forsén has all the qualifications and experience to successfully lead the company to face the challenges of the future, and to enable it to grow further to reach new dimensions.

I'd like to express my warmest thanks to our customers, partners and employees for good cooperation over the years. I wish you every success in your future efforts.



Best regards,
Pekka Ketonen

The future looks promising

It gives me great pleasure to introduce myself to all Vaisala News readers. I'm looking forward to meeting as many of you as possible in the near future at different events around the world. Please don't hesitate to grab me by the sleeve and stop for a chat.

I'm very proud to have been appointed the new Vaisala CEO. I've been following the developments at Vaisala for a long time. It has provided a prime example of best practices and operational excellence in a technology company. How is it possible that Vaisala has reached such a market position and technology leadership? How has it been able to sustain this position throughout the years? It's a rare achievement in our turbulent times.

Pekka Ketonen has done an outstanding job. Among other achievements, the turnover has quadrupled

during his tenure. It's a tough act to follow. Pekka has ensured that the company is in great shape and the future looks promising.

I've made a 20-year career in another international technology company, Ericsson, and worked in many managerial positions within telecommunications, both in Finland and abroad. I'm looking forward to learning the environmental measurement business, and how we can harness it to benefit our daily routines.

I'm a strong believer in good customer relations based on cooperation and trust. Only by being close to the customer can we ensure that we're on the right track. This is why I intend to be very active in meeting customers and other interest groups.

I'm looking forward to working with you.



Best regards,
Kjell Forsén

Ensure trouble-free electricity supply with dewpoint control

Fortum Power and Heat relies on Vaisala for accurate measurement



One of the critical jobs in power plant service and maintenance is to monitor the moisture level of circuit-breakers that are filled with SF₆ (sulfur hexafluoride). This is because the dewpoint of SF₆ reflects the circuit-breakers' ability to withstand fault situations.

During electrical power distribution, power switching or load current interruptions can lead to arc formation, which in turn may cause serious and costly cut-off of power to the distribution network. Sulfur hexafluoride gas is widely used for insulating and quenching purposes in high voltage circuit-breakers because of its high resistance to arcing. This is especially true in the case of large-scale circuit-breakers and switchgear, where no equally effective alternative to SF₆ has been found – even though other insulators have been sought to replace this environmentally problematic greenhouse gas.

Excess moisture in SF₆ downgrades its electrical insulation capabilities and can lead to the formation of unwanted by-products. To prevent critical consequences in the power distribution system, it is important to maintain low humidity in the SF₆ gas.

Experts in switchgear maintenance

Fortum Power and Heat is one of the leading providers of maintenance and operation services within the industry and energy sectors in Finland. The company provides service and maintenance for a number of power utilities. Vantaa Energy, one of Finland's biggest

Circuit-breaker maintenance includes verification of critical parameters as well as functional tests.

With the Vaisala meter, we end up with a reliable dewpoint reading with much less uncertainty than before.



The Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 with the probe DMP74C is especially designed for measuring moisture in SF6 gas.

municipal energy companies, outsources some special service and maintenance work at its nine substations. Each substation has, on average, six 110kV circuit-breakers containing SF6 gas.

Jussi Penttinen works as a foreman in the switchgear maintenance group in Fortum Power and Heat. With 35 years of experience in the company, he has a solid background in circuit-breaker maintenance.

According to Jussi Penttinen, the servicing of a circuit-breaker is a thorough process that involves verification of the critical parameters with the appropriate measurement instruments, as well as functional tests. Typically, the circuit-breaker fields are serviced at an interval of 8-10 years, as specified by the circuit-breaker manufacturer. The place of installation and volume of operations is also taken into account when deciding the maintenance interval of each piece of equipment. When it comes to measuring the moisture content of equipment containing SF6, the maintenance team relies on the Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70.

Dewpoint compared with reference values

During maintenance of a circuit-breaker, Fortum's team measures the dewpoint of the SF6, the SF6 percentage concentration and the operating pressure of the circuit-breaker. The acceptable dewpoint values in a circuit-breaker vary between -22...-45 °C (-8...-49 °F) in atmospheric pressure. The operating pressure is typically 4-5 bars, and the measurement is commonly done at system pressure. The Td/f atm calculation available in the Vaisala DRYCAP® Hand-Held Dewpoint

Meter DM70 can be used to conveniently make the conversion to atmospheric dewpoint. In addition, the humidity of the SF6 may be expressed in terms of ppm volume or weight concentration. Both of these parameters can be selected on the display as well.

If the SF6 is not dry enough to pass the inspection, it will be replaced by new gas or processed in a drying unit. In large switchgear, where hundreds of kilograms of SF6 are used, drying is the usual procedure. In circuit-breakers out in the field, the old SF6 is typically collected for appropriate waste treatment, and new gas is fed into the system.

Dry without a doubt

Fortum has been using the Vaisala DRYCAP® Hand-Held Dewpoint Meter DM70 in circuit-breaker maintenance for two years, with good results: "We like the instrument because it gives exact readings. The technology we had before was not easy to use. The result always depended on who took the measurement. With the Vaisala meter, we just follow the dewpoint until it stabilizes, watch this on the graphical display, and end up with a reliable dewpoint reading with much less uncertainty than before. We also appreciate the unit's light weight and easy handling," says Jussi Penttinen.

The company has two meters that are posted from place to place as required. Jussi Penttinen has been impressed by their robustness: "We are somewhat apprehensive every time we ship them, since cargo handling can be pretty rough. But the instrument has always survived the transit without any problems, thanks to its firm carrying case."



Jussi Penttinen from Fortum Power and Heat makes sure the dewpoint of the SF6 is up to standard at Vantaa Energy's power plant.



The lightweight instrument is appreciated by the service team.



Increasing compressed air plant efficiency

Compressed air is one of the least efficient forms of energy that is used in modern manufacturing plants. It takes seven to eight times more electricity to produce one horsepower with compressed air than with an electric motor. Compressed air is often the largest end-use of electricity in a plant.

There are many actions a plant manager can take that will quickly and easily increase efficiency of their compressed air system and decrease compressed air energy usage by 20% or more. Here, I will discuss only one of these actions, that is, installation of a Dewpoint Demand Switching system for the heatless desiccant dryer (HDD). The HDD is typically a major use point of compressed air and some of these dryers will use up to 18% of the compressor capacity just to operate the dryer.

How does a desiccant dryer operate?

In order to understand how we can improve efficiency, we must first understand the basic operation of this type of dryer. The HDD operates to maintain the

compressed air at a specified pressure dewpoint; usually -40° or -70°C .

The dryer utilizes two vertical pressure vessels (sometimes called “dual towers”) filled with a desiccant such as activated alumina, silica gel, or molecular sieve. The compressed air passes through the desiccant bed before being distributed to the plant.

As the air passes through the desiccant, water vapor is removed from the air through a process called adsorption. Adsorption is defined as the binding of molecules or particles to a surface. The binding to the surface is usually weak and reversible.

Regeneration consumes energy

As the compressed air is passing through one vessel where water vapor is being adsorbed, the desiccant in the other vessel is undergoing regeneration where the water vapor that was previously adsorbed is removed.

Regeneration is accomplished by extracting a portion of the dry air as it exits the active vessel, expanding

this air to atmospheric pressure and passing it over the desiccant that is to be regenerated.

The air that is extracted as it exits the active vessel is called purge air. As the purge air is expanded to atmospheric pressure it becomes very dry and will easily separate the water vapor molecules from the desiccant beads causing the regeneration of the desiccant bed.

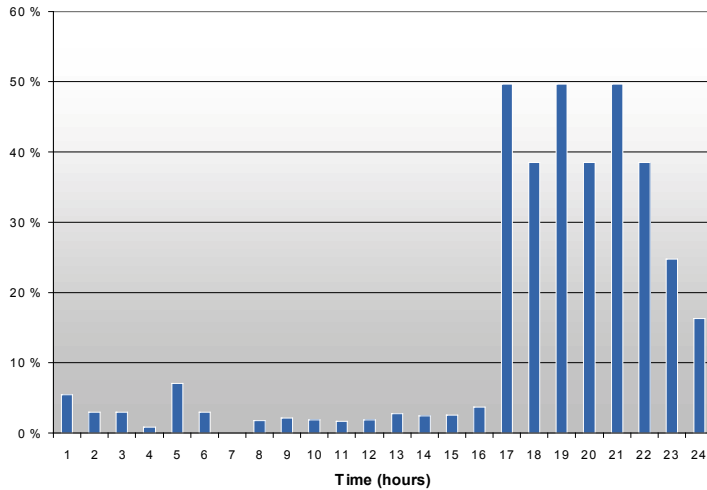
Purge air and the energy required to produce the extra compressed air to fulfill the regeneration requirement is the direct energy cost that is required to operate the heatless desiccant dryer.

Switching based on worst case conditions

The cycle of the dryer refers to the time between switching from one tower to the other. A typical cycle time is some ten minutes. During this ten-minute cycle, the dryer will switch one time so that each tower is online for five minutes and regenerates for five minutes.

The cycle time is determined by the manufacturer and will depend on the dewpoint that is specified and the

Example of Energy Savings with Dewpoint Demand Switching in a Heatless Desiccant Dryer



An example on savings in a typical 24 hour day at a company where manufacturing occurs in two shifts and the third shift is a cleaning shift. It is evident that the majority of the savings will occur during the off shift. If a plant operates only one shift, the overall savings would increase.

A savvy plant manager can capitalize on energy savings by installing a Dewpoint Demand Switching system.

amount of desiccant in the vessels. The cycle time and amount of desiccant is determined based on worst case conditions; full rated air flow of the dryer, 35 °C air temperature, 100% relative humidity, and 100 psig (7.9 bar) pressure. The dryer is constantly demanding purge air based on this design. For example, if a dryer is rated to provide a -40 °C dewpoint at a maximum flow of 1000 cfm (28 m³/min) and requires 15% purge air, it means that the dryer will continuously consume 150 cfm (4 m³/min) of the output from the compressor, regardless of the actual conditions and actual compressed air flow. In this specific example, the purge air requirement is equivalent to running a 35 horsepower compressor just to provide purge air to the dryer. With such a fixed cycle, the dryer will demand 150cfm (4 m³/min) purge air every minute of the day, regardless of the actual conditions and demand of the plant and regardless of the real capacity of the desiccant bed.

Dewpoint demand switching optimizes the cycle

As we know, it is rare that a plant operates in such a way that it requires 100% of the compressor/dryer capacity 24 hours a day, seven days a week. The demand for air will vary throughout the shift and from day-to-day, depending on shift and plant

operation, etc. The inlet air conditions will also vary depending on the ambient temperature and relative humidity.

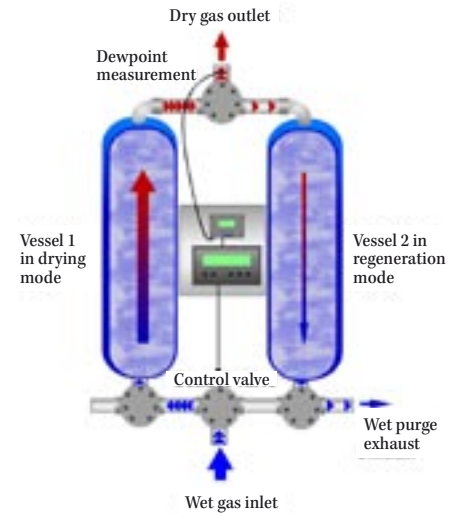
This is where a savvy plant manager can capitalize on energy savings by installing a Dewpoint Demand Switching (DDS) system. With a DDS system installed, rather than the towers switching every five minutes and demanding constant purge air, the towers switch based on the dewpoint temperature as measured at the outlet from the dryer. Savings can be made because the towers will not switch back and begin using purge air until the hygrometer senses a degrading dewpoint temperature.

The DDS system ensures the full use of the desiccant bed, increasing efficiency and thus reducing the use of purge air, which in turn reduces the use of electricity.

A DDS system consists of a hygrometer that can reliably measure the dewpoint of the compressed air as it exits the active tower, and which is also able to generate an output signal that can be detected by the dryer operating system.

Retrofit your dryer for DDS

Is it possible for an existing dryer to be retrofitted with a Dewpoint Demand Switching system? The answer is yes, as long as the dryer operating system allows



The operation principle of a heatless desiccant dryer equipped with a DDS system. The valve directing the flow to either of the two vessels is controlled with respect to the measured dewpoint at the dry gas outlet. The blue color illustrates wet gas and red represents dry gas.

for controlled tower switching. If you are not sure, consult the dryer manufacturer or read the operating manual.

Retrofitting a dryer with this type of system is relatively easy. The first step is to confirm that the dryer will accept a signal and operate the switching process based on that signal. The second step is to find the correct type of hygrometer that will operate accurately, provide a suitable output signal, is easy to install, offers low maintenance and is resistant to contamination. There are several different types on the market, each with different pros and cons, and it is important to know what questions to ask the manufacturer to ensure that you reap rewards and not headaches from installing a Dewpoint Demand Switching system.

Vaisala DRYCAP® Dewpoint Transmitter technology is the reliable choice. The DMT142 and DMT242 transmitters are compact and rugged. The DMT340 series transmitters, with a variety of options, provide the user with a complete solution, and the hand-held DM70 is a practical tool for spot measurements.

From the woods and into the air

Carbon dioxide flux measurement in Japanese forests

Understanding the carbon dioxide flux in forest ecosystems has become an important subject in the international effort to prevent global warming. Observations of the carbon dioxide flux between the atmosphere and forests are promoted worldwide.

The components of the carbon budget in a forest ecosystem - the carbon dioxide flux released from the forest floor and that released from or absorbed into foliage - are often measured with the chamber method. Accurate measurements of the carbon dioxide efflux from the forest floor are required especially because it accounts for a large part of the total carbon dioxide efflux from the forest ecosystem. However, the forest floor carbon dioxide efflux has a large spatial dispersion. Therefore, a large number of measurements at different locations are required to evaluate it. A compact and easy-to-operate CO₂ sensor and a simple chamber system is an ideal solution for scientists measuring the carbon dioxide efflux at multiple sampling points.

Demanding application

A closed-path CO₂ sensor is a general CO₂ sensor that has closed optical paths for measuring the carbon dioxide concentration. Although the closed-path CO₂ sensor has advantages with regard to stability and accuracy, a sample needs to be drawn into the sample cell in the sensor using an air pump through a sampling tube. The chamber method, which uses a closed-path CO₂ sensor with a pump and tubes, is often not very easy to use or portable. In addition, the carbon dioxide efflux risks being influ-

enced by the small pressure changes when sample air is drawn with a pump for measurement from the forest floor, for example from porous soil or snow. What is required is a sensor that can perform direct measurements without drawing the sample from the chamber.

In the beginning of our research, we attempted to use the Vaisala CARBOCAP® Carbon Dioxide Transmitter GMD20 or module GMM220 for measuring the forest floor carbon dioxide efflux. The performance of these sensors with regard to response time was insufficient for measuring the carbon dioxide efflux with an increasing rate of carbon dioxide concentration in the chamber. Therefore we developed a backward estimation method for recovering the delayed outputs (Mizoguchi and Ohtani, 2005). This method employs the initial carbon dioxide concentration and the compensation coefficient that has been obtained from the sensor response experiments, which enables the correction of the delayed output of the sensor. Thus, it solves the error of the efflux that is caused by the delayed response.

Snow surface measurements

However, even with this method, the error caused by the unstable output of the sensor cannot be totally excluded. In particular, the measurement method cannot be applied for measuring a snow surface with a small carbon dioxide efflux. Subsequently, we used a newly developed sensor - a diffusion type Vaisala CARBOCAP® Carbon Dioxide Probe GMP343 - to measure the carbon dioxide efflux from a snow surface in the forest.

We generally calculate the efflux with an increasing rate for 10–30 min when using the static chamber method. The carbon dioxide concentration increased by about 30 ppm ten minutes after the chamber was closed (Figure 1). This indicates that the performance of the GMP343 was sufficient to measure even the small effluxes from a snow surface. We plan to measure the efflux from the snow surface at many sampling points in our research forest, and evaluate the accurate carbon dioxide emission.

FFPRI Flux Net

The Forestry and Forest Products Research Institute has constructed observation towers at five research sites with varying climates and forest types (FFPRI FluxNet). The observations of carbon dioxide and other fluxes have been conducted while each component in the carbon dioxide balance - the carbon dioxide efflux due to photosynthesis, the forest floor carbon dioxide efflux, and so on, has been measured. We will analyze the relationship between the carbon dioxide balance and the individual components, and hope to clarify the carbon cycle in the forest ecosystem.

Further information:

www.ffpri.affrc.go.jp/labs/flux

References:

Y. Mizoguchi, and Y. Ohtani, "Response Characteristics of VAISALA CO₂ Sensors and its Correction for the accurate estimation of soil CO₂ efflux", *Asia-Flux Newsletter*, vol.19, pp.4-8, 2006.



Yoshikazu Ohtani at the Fujiyoshida forest research tower.

A compact and easy-to-operate CO₂ sensor is an ideal solution for scientists.

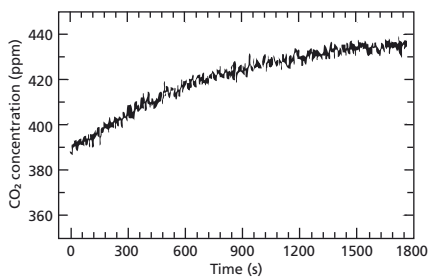


Figure 1. The carbon dioxide concentration increased by about 30 ppm ten minutes after the chamber was closed.



Carbon dioxide efflux measurement by Yasuko Mizoguchi on snow surface at the Fujiyoshida forest research site, the FFPRI FluxNet.

Mastering the fermentation process

Oxygen and carbon dioxide measurements for fermentation

A specific group of proteins, largely unknown to the general public but used in various industrial processes, are manufactured by a Finnish company. Roal Corporation produces these enzyme proteins for the needs of food, paper, baking, and textile industries. The biological process utilized to produce the enzymes is called fermentation.

Roal produces enzymes in submerged fermentation units. The company is jointly owned by ABF Ingredients, a division of Associated British Foods, and Altia Corporation, a publicly held beverage company that focuses on wines and spirits and operates in the Nordic and Baltic countries. The plant is located in Rajamäki, Finland and it produces enzyme products mainly for use in the textile industry, for example in cloth desizing, denim finishing or biofinishing. In the adjacent pilot plant, new research projects for novel enzyme processes are carried out. The person in charge of Roal's pilot plant is R&D Manager Dan Haglund.

Fermentation basics

The souring of milk to yogurt, the rising of bread dough with yeast, or the conversion of sugar to alcohol in wine making or beer brewing are common everyday examples of fermentation.

Fermentation is a chemical change brought about by the action of micro-organisms. In industrial fermentation, the term is used broadly to refer to the growth of micro-organisms on a growth

medium. The fermentation process itself typically takes place in a tank called a bioreactor or fermentor, but the whole production process can be composed of multiple process steps that refine the raw materials to the end product. These process steps include raw material treatments such as blending and sterilization as well as end product processing such as filtration, concentration, drying, and finally packaging.

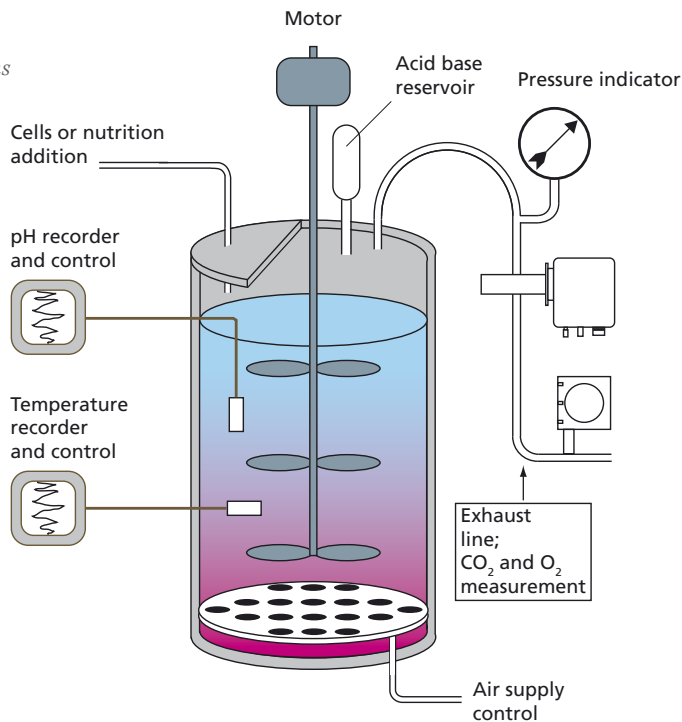
In the heart of the fermentation process - the bioreactor - the control of acidity and temperature of the growth medium is important. The constant supply of nutrients as well as gases such as CO₂ and O₂ is also monitored. Oxygen is the most important gaseous substrate in aerobic fermentation, while carbon dioxide is the most important gaseous by-product of the process.

Enzyme manufacturing

The production of yeast and alcohols is a large part of the fermentation industry. Besides this, it also produces antibiotics, enzymes, and amino acids.

A growing field of fermentation is enzyme manufacturing. Most of the enzymes produced globally are used in detergents. In the future, more enzymes will be needed for example in the baking industry, which uses enzymes in bread manufacturing. Enzymes are also produced for food and animal feed as well as the pulp and paper industry. Enzyme manufacturers have to maintain constant research activities, so that new

A schematic of a fermentor tank: CO_2 and O_2 concentrations are measured from the exhaust line of the fermentor.



applications for enzyme use are developed and the production of older enzyme generations is enhanced.

What are enzymes?

Enzymes are proteins composed of amino acids. They are produced by all living organisms - in the fermentation industry by moulds or bacteria, but they are not living organisms. The enzyme production process requires a strictly controlled environment within the bioreactor. In the fermentation process the enzymes are produced in the microbial cells and then secreted into the fermentation broth. Prior to the production fermentor, the biomass serving as the growth medium is built up in several inoculum fermentors.

What are enzymes used for?

Enzymes work in various industrial production processes breaking more complex compounds into simpler ones. In baking, enzymes are used for example to increase baking volume, act as stabilizers, and extend the shelf-life of the product. Enzymes are used in the extraction of fruit juices in the beverage industry and in wine making. In the animal feed industry, enzymes are used for improved animal feed conversion. In the textile industry, enzymes are used for biofinishing, cloth desizing, and denim finishing. The pulp and paper industry uses enzymes for bleaching, deinking, and improved paper production.

The use of enzymes in industries results in reduced chemical costs, increased

production capacity, and better quality of the end product. Using enzymes generally requires minor investments.

The pilot plant at Roal

At the pilot plant at Roal, careful monitoring of the fermentation process is essential. The pH-value, temperature, dissolved oxygen, and carbon dioxide are usually measured from the fermentor broth. The oxygen and carbon dioxide levels are measured from the exhaust gas. The gas temperature is typically 25°-30°C and the relative humidity is around 100%. The exhaust gas may also contain ammonia, since the substance is used to control the pH levels of the fermentor broth. Also the humidity of the fresh air blown into the fermentor is measured. The demanding surroundings require reliable measurement instruments.

The CO_2 concentration of the enzyme production process is monitored in order to get a picture of the state of the process. The level of CO_2 is an indication of the metabolic activity of the mould or bacteria, and the information is used to control the feed of new nutrient pulses to the process. "The correct level depends on the microbial strain and the fermentation process itself, and it is a matter of experience to know when a new nutrient pulse should be fed into the process", says Dan Haglund, the R&D Manager of the pilot plant at Roal. It is essential to ensure that fresh air supply to the bioreactor is sufficient to keep the fermentation process on-going.

Exhaust gas measurements are generally taken from a secondary line, which



R&D Manager Dan Haglund from ROAL states that Vaisala carbon dioxide transmitters require minimal maintenance, and minimize the downtime of the fermentation process.

enables removing undesired elements such as foam or excess humidity from the exhaust gas. The carbon dioxide concentration of the enzyme production process is typically from 0 to 5% of CO_2 , in exceptional cases concentrations as high as 10% of CO_2 have been measured. In a fermentation process where mould is elevated, the carbon dioxide concentration is typically around 1 or 2% of CO_2 . The oxygen concentration of the exhaust gas also depends on the metabolism. Often the metabolism consumes O_2 as much as it produces CO_2 . The relation of the volume of CO_2 released to the volume of O_2 consumed is called the respiratory quotient (RQ).

At the Roal plant, the humidity of the fresh air blown into the bioreactor is measured with Vaisala humidity instruments. Carbon dioxide and oxygen are monitored with the Vaisala CARBOCAP® Carbon Dioxide Transmitter GMT221 and the Vaisala SPECTRACAP® Oxygen Transmitter OMT355, respectively.

The Vaisala carbon dioxide transmitter has been installed in the pilot plant to measure the exhaust gas line with the aid of a field-check adapter from a secondary line. A water trap and a foam removing trap are used since the exhaust gas is very humid and occasionally foam rises into the exhaust tube. The extremely robust Vaisala oxygen transmitter is installed directly into the exhaust tube. "The Vaisala instruments have proved to be very reliable in the pilot plant. They require minimal maintenance and minimize the downtime of the fermentation process", says Dan Haglund.

The HSB Turning Torso in Malmö, Sweden. Photo by Ole Jais.



Urban housing with a touch of chic

The HSB Turning Torso is an unusual high-rise building in Malmö, Sweden. The original idea is based on a sculpture called the Twisting Torso.

The HSB Turning Torso was designed by Architect Santiago Calatrava, and inspired by the human body in a twisting motion. Mr. Calatrava was commissioned by HSB Malmö, a housing cooperative set up in 1925. The building was completed in November 2005, and now stands 190 meters tall with its ten floors of offices, 147 apartments and meeting facilities on the two top floors.

Intelligent interiors from Honeywell

Honeywell International is a \$30 billion diversified technology and manufacturing company, serving customers worldwide with aerospace products and services; control technologies for buildings, homes and industry; automotive products; turbochargers; and specialty materials.

Honeywell Building Solutions is part of Honeywell's Automation and Control Solutions group and has more than 100 years of experience in making buildings safe, comfortable secure and efficient - be they commercial buildings, community schools, single office properties, or healthcare facilities.

In spring 2004, Per Wernersson of Honeywell Building Solutions was asked to find a solution for the fan coil units in the apartments. The building consists of nine cubes, which turn 90 degrees between floors 0 to 54. The basement and floors 13, 25, 37, 49 and 54 have technical areas. On each apartment floor, there is

an industrial PC which communicates with the apartments' IO-boards (both digital and analogue). Every room has a fan coil unit.

Per's first task was to find a sensor for the fan coil unit that matched both the technical and the architect's requirements. The sensor contains a temperature element, a control point for adjustment, and a fan speed switch. Because the space in the installation shafts was limited, Honeywell built its own Transmission Control Protocol (TCP) network for the

The building consists of nine cubes, which turn 90 degrees between floors 0 to 54.

building. A lot of multicast messages are sent in the network between controllers - like fire alarms, fire dampers' positions, pressures, temperatures, etc.

Reliable weather transmitter communicates outdoor conditions

The radiator-controlled temperature in the building is compensated for by the outdoor temperature and wind speed. This is why it was important to find a reliable weather transmitter to indicate outdoor weather conditions. Again, because of the limited installation space, Honeywell decided to find a company that could deliver a multi-sensor with a communications capability, instead of electrical signals.

Before the Turning Torso project, Honeywell had used Vaisala's humidity sensors in some industrial facilities. In 2000, it installed some Vaisala sensors at Arla Foods' facility in Götene, Sweden, at Arla's central warehouse for cheese and butter.

The Vaisala Weather Transmitter WXT510 is a compact multi-sensor that measures wind speed and direction, precipitation, barometric pressure, temperature and relative humidity. It was chosen for the Turning Torso because of its small size, easy maintenance, and the RS-485 communications capability. During the first year, all radiators are compensated for according to the measurements of the weather transmitters.

During the second year, Honeywell will be using weather forecasts as a point of reference for energy consumption. The first priority is to collect some data about the construction of the building - like type of building, type of windows, window area, number of people living there, airflow, energy source, energy consumption, etc. Based on this data, Honeywell will then obtain a code for the building and an area code for the location from the Swedish Meteorological and Hydrological Institute. The outdoor temperature will then be estimated with these codes, combined with the five-day weather forecast.

Further information:

www.honeywell.com
www.turningtorso.com



Keep the noise down, please

Vaisala weather instruments in environmental noise monitoring



eBrüel & Kjaer Sound & Vibration Measurement A/S is the world-leading manufacturer and supplier of sound and vibration solutions. Today, Brüel & Kjaer has 900 employees and sales offices in 55 countries. The customers are from a wide range of industries including automotive, aerospace, consumer goods and telecommunications, as well as national government agencies.

Brüel & Kjaer chose the Vaisala Weather Transmitter WXT510 product line as the weather measurement instruments for its new generation of environmental noise monitoring terminals used in continuous noise monitoring.

Brüel & Kjaer and Vaisala are both well-established companies within the airport environment. Brüel & Kjaer has 40 years of experience in producing noise monitoring solutions for airports. The cooperation between Brüel & Kjaer and

Vaisala has been ongoing for almost a decade. Before the weather transmitter was introduced on the market, Brüel & Kjaer have been installing Vaisala weather stations at airports.

In addition to airports, the problem of increasing noise exposure has been realized in many cities. Noise levels are monitored and calculated in bigger cities in order to understand the extent of the actual noise problem. Many European cities are supplied with noise monitoring equipment; several have chosen Brüel & Kjaer's solutions.

The Vaisala Weather Transmitter WXT510 and WINDCAP® Ultrasonic Wind Sensor WMT50 have proven to be optimal weather sensors for both airport and urban noise monitoring applications.

Airport noise monitoring

People living around airports are exposed to constant noise from aircraft takeoffs

◀ *The Vaisala Weather Transmitter WXT510.*

and landings. The demand for quieter airports has led to strict legislation relating to airport noise management. In some countries, airport noise monitoring has been made compulsory.

Flight tracking is possible by interfacing airport radar information with a noise monitoring system. The aircraft and airlines that violate regulations can be identified. By monitoring airport noise, we learn how to minimize the noise impact caused by aircraft.

Urban noise monitoring

Noise is a nuisance especially in dense urban areas. The major urban sources of noise are road and railway traffic, construction-sites, leisure activities and industry. Our living comfort is reduced when we are exposed to high noise levels.

Traffic regulation, low noise pavements and noise barriers are examples of noise level reduction measures. As these investments are very expensive, it is important to pinpoint the worst noise areas precisely, before investing in noise protection. The best tools for this identification are noise calculations and measurements.

EU Environmental Noise Directive

In order to harmonize the noise protection programs that vary country by country, the EU has approved the EU Environmental Noise Directive 2002/49/EC. The directive covers transportation and industrial noise. It calls for noise maps and action plans to be made for bigger cities (populations > 100,000), major roads (> 3 million vehicles a year), major railways (> 30,000 trains a year) and major civil airports (> 50,000 operations a year). Noise maps show the noise parameters of each source of noise at a height of four meters over the ground. The first maps for major areas are required by mid 2007 and action-plans a year after.

Weather measurement in noise monitoring

The most important factors affecting noise propagation are the type of noise source, distance from source, atmospheric absorption, wind, temperature and temperature gradient, obstacles such as barriers and buildings, ground absorption, reflections, humidity, and precipitation.

Wind speed is the most important weather parameter in noise monitoring.

The compact and solid design ensures that the maintenance requirement of the Vaisala sensors is minimal.



*The Vaisala WINDCAP®
Ultrasonic Wind
Sensor WMT50.*

Over 5m/s winds create noise, and thus affect the noise level detected by a microphone. If the wind is higher than 5m/s, the noise monitoring terminals must report a possible error source in the noise measurement results.

Air pressure is another important parameter in airport noise monitoring. Because aircraft communicate their altitude in air pressure units, the real aircraft altitude can be calculated using the Vaisala Weather Transmitter WXT510 ground level air pressure.

Noise monitoring terminals

Brüel & Kjaer's environmental noise management solutions uniquely link calculated and measured noise data together. The concept includes noise monitoring terminals (NMT) with an outdoor microphone, a server and a portfolio of calculation software. The noise management software has an advanced functionality for the handling of measured noise data, plus weather parameters from integrated weather sensors. The software is prepared for the support of web clients for easy access from any PC. It is possible to connect a number of Brüel & Kjaer NMTs, including weather sensors, into a network.

The Vaisala sensors are attached to noise monitoring terminals via an RS232 interface, and the measured parameters are transmitted to the central noise monitoring server for later data browsing and reporting.

The multi-sensor weather transmitter, measuring six different weather parameters, is installed mainly into NMTs that are used in permanent noise monitoring at airports.

The Vaisala Weather Transmitter WXT510 product line grew when the Vaisala WINDCAP® Ultrasonic Wind Sensor WMT50 was released in January 2006. The WMT50 is a "wind only" derivative of the WXT510. The new sensor is Brüel & Kjaer's choice for permanent urban noise monitoring terminals, where only wind speed measurements are required.

Cost-savings and long-term partnership

The compact and solid design with no moving parts ensures that the maintenance requirement of the two Vaisala sensors is minimal. In addition, the installation and handling costs are small as several weather parameters are integrated into one sensor.

Brüel & Kjaer's Sales and Marketing Manager, Lars G. Winberg, appreciates the benefits of working with Vaisala: "As we are reselling Vaisala products to our clients we find the limited support requirement and consequently, the low handling cost a true cost-saving. The Vaisala products have proven to be reliable, accurate and very cost-efficient. We consider Vaisala a company that provides security for the long-term supply and service of products".

Watch out for water contamination

Mosaic uses Vaisala equipment in its turbine lubrication systems

Mosaic is the combination of two global leaders in the fertilizer industry, IMC Global and Cargill Crop Nutrition. It is one of the world's largest potash and phosphate mining and processing operations, providing an ever-expanding selection of products and services to enhance crop yield and livestock nutrition.

One of Mosaic's potash mining sites, the Belle Plaine plant in Regina, Saskatchewan, relies on two General Electric 20 MWe turbine generator sets for co-generated power and process steam, and three Westinghouse EL125 prime movers for

Water contamination is an inevitable phenomenon that should be carefully managed.

process applications. A major consideration for any turbine operation is the development of a comprehensive preventive maintenance program for ensuring long service life.

One of the most destructive contaminants for a turbine's bearings and hydraulic system is water. Despite all the measures

in place designed to prevent water ingress into a turbine's lubrication system, water contamination is an inevitable phenomenon that should be carefully managed. Sources of water ingress include the high pressure steam driving the turbine, condensation of water vapor in the head space of a lubrication reservoir, and failed bearing seals.

Take moisture problems by the throat

Troubled with continuous moisture problems, the Mosaic Technical Services



The Vaisala HUMICAP[®] Moisture and Temperature Transmitter for Oil HMP228 is inserted directly into the line with ball valve assembly. The unit is installed in a bearing return oil drain adjacent to the high pressure end turbine packing.

Group initiated a research project in 2005 to identify the sources of water contamination by actively measuring moisture levels in their turbine's oil and hydraulic systems.

Mosaic chose the Vaisala HUMICAP® Moisture and Temperature Transmitter for Oil HMP228 to provide in-line, continuous measurement. The instrument displays the reading locally and provides an analog output signal and fully adjustable alarm relays. It also directly measures a parameter called water activity (aw) which indicates a fluid's margin to saturation on a scale of 0 to 1, with 0 signifying a completely dry situation with no water present and 1 signifying full saturation.

Test your equipment

Before installing the device, Mosaic first needed to characterize the performance of the instrument as a function of temperature and water concentration (in ppm mass) as a variable of aw output. A test apparatus was created consisting of a steel drum placed on a heating plate with an agitator to circulate the oil.

The study comprised three different response tests:

Test #1:

Determine if the Vaisala transmitter would respond to the oils used in Mosaic's turbines at the Belle Plaine location. The two oils used for the test were Petro Can Superflow Turboflow Turbine Oil (virgin oil) and Shell VSI Circulating Oil 32 (water saturated oil). Each oil was placed into the test apparatus and heated to 115°F. The Vaisala transmitter was inserted into each oil and allowed to stabilize. The virgin oil measured water activity (aw) of 0.091 with the visual observation noted as "clear, transparent." The water saturated oil read an aw of 0.968 with a noted appearance of "foggy, cloudy, unable to see bottom of drum."

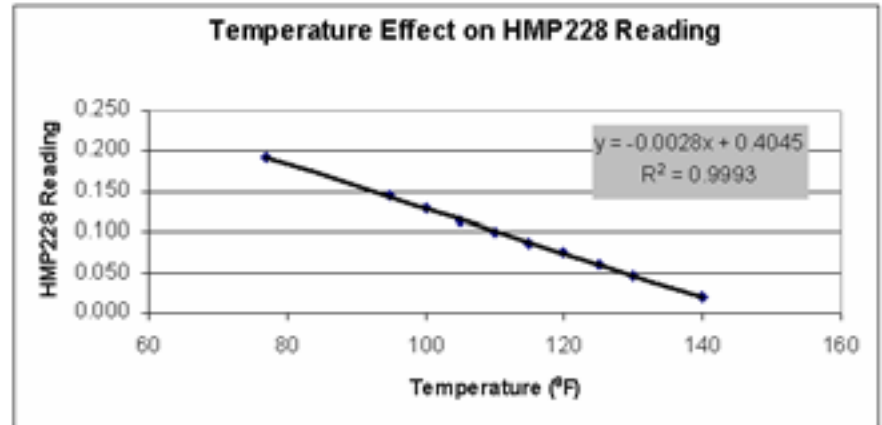
Test #2:

Determine how temperature affects the water saturation level of the virgin turbine engine oil. Using the test apparatus, the turbine oil was heated from room temperature to 140°F while water activity readings were recorded with the Vaisala transmitter. The data was plotted and a linear trendline was formatted. As expected, the water activity readings decreased as the oil temperature increased.

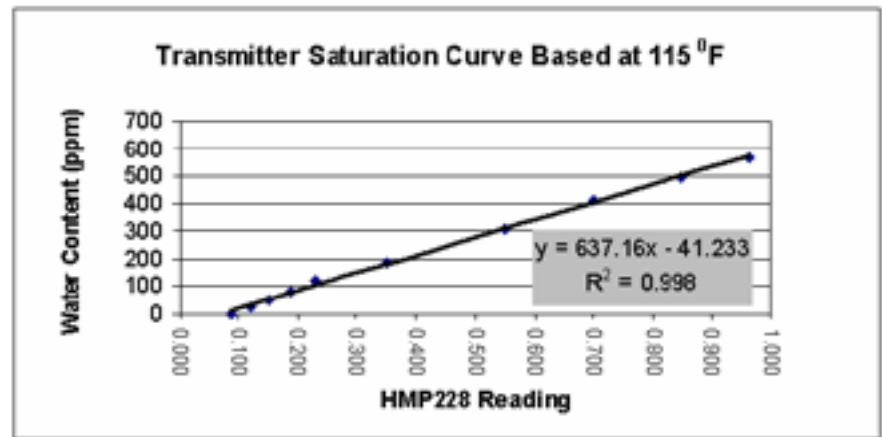
Results, test 1

Oil Type	Transmitter Reading (aw)	Temperature (°F)	Observations
Petro Can	0.968	115.3	
Shell	0.091	115.8	Oil looked clear. Transparent

Results, test 2



Results, test 3



Test #3:

Determine how the Vaisala transmitter responds to water content changes in turbine engine oil. Maintaining the turbine oil temperature at 115°F, known ppm volumes of water were added to the oil and water activity readings were recorded at each point. The data was plotted and a linear trendline was formatted. As anticipated, the water activity readings increased linearly as the water content of the oil increased.

A regression analysis was completed for both oils and a contour plot was developed to characterize water activity as a function of both temperature and water content. With the positive results of this analysis yielding correlation coefficients greater than 0.99, Mosaic installed the Vaisala equipment on both 20 MWe turbine generators.

Prevent hazards with reliable measurements

"Based on this good result, our intent is to alarm at 0.60 water activity. Both temperature and water activity will be used to calculate ppm water in oil within plant DCS systems. The ppm water calculation can be compared to oil analysis results. Corrective actions will be taken beyond 0.65 aw and can include external scrubbing, corrections to gland condenser systems, packing inspections, etc.," states the Mosaic Technical Services Group.

After installing the Vaisala transmitter with the alarm relay function activated, Mosaic was alerted to a potentially destructive water ingress problem caused by water entering their oil system via a faulty bearing packing that was spilling steam into an adjacent bearing labyrinth seal.



Choose Vaisala for critical elevation measurements

Spatial Technologies relies on Vaisala BAROCAP®

Yani Zaki
Application Sales Engineer
Vaisala
Boston, MA, USA

Spatial Technologies Inc. sells, rents, services and supports leading edge Geomatics technologies in Western Canada. With offices in Calgary and Edmonton Alberta and a staff of nine employees, Spatial Technologies has become one of the most trusted and experienced suppliers of top quality measurement solutions.

Since 2002 Spatial has integrated Vaisala digital barometers in its GPS receivers, starting first with the Vaisala BAROCAP® Digital Barometer PTB210 and then upgrading to the PTB220 for its ease-of-use and accuracy.

Calculating accurate elevations

The Vaisala barometer is incorporated in two Spatial GPS receivers; the Leica System 500 and System 1200. Customers using these systems are primarily seismic surveying companies who use the barometers to stake out lines for their geophones. The pressure measurement is critical in determining an elevation when the surveyor is working in areas where the tree cover limits GPS.

Equipped with a single transducer, the barometer is packaged in a compact

backpack along with the GPS receiving equipment and power supply. It is not necessary to remove the transmitter from the pack when taking pressure measurements. The GPS hand-held unit displays and stores the readings that are later downloaded to a computer for processing in GPS seismic software. Using the pressure data combined with a quality GPS position taken every 20 minutes ensures the calculation of accurate elevations.

It works like magic

The life expectancy of the GPS receiver is approximately five years. Until GPS receivers function under the tree canopy, which is not anticipated in the foreseeable future, Spatial Technologies will continue to incorporate the rugged and reliable Vaisala BAROCAP® Digital Barometer PTB220 in its GPS receivers.

"We selected Vaisala's digital barometers primarily for their accuracy, ruggedness, size and weight and they have worked well for us for years," says Rick Kurash, President of Spatial Technologies Inc.

Further information:

www.vaisala.com

www.spatialtechnologies.ca



Equipped with a single transducer, the Vaisala BAROCAP® Digital Barometer PTB220 is packaged in a compact backpack along with the GPS receiving equipment and power supply.



Mr. Minoru Kakita (left) and Mr. Youichi Ochiai (right) from ORIX Rentec.

Renters can be choosers

Yoshitaka Arai
Technical Consultant
Vaisala
Tokyo, Japan

ORIX Rentec's customers expect the best from their rental product provider

Established in 1976, ORIX Rentec Corporation was the first company to enter the test and measurement equipment rental industry in Japan. Today, the company has two Technical Centers and 40 offices in Japan, where it employs 900 personnel.

ORIX Rentec specializes in office automation equipment, such as personal computers and measuring instruments. The company's main customers are in development and manufacturing businesses. Its rental system is user-friendly, as equipment can be rented for any period necessary - a week, a month, or a year.

The company's customers expect reliable delivery schedules, and a comprehensive and high quality product offering. To satisfy these customer requirements, ORIX Rentec owns about 500,000 products, and is able to keep its one-day

delivery promise. The company pays special attention to product quality control, following ISO standards at its Technical Centers where returned products and those about to be shipped are controlled. The product make can be chosen by the customer, or recommended by ORIX Rentec, who is an expert in the good and reliable choices that are available.

ORIX Rentec and Vaisala started working together in 1983, the same year Vaisala KK was established in Tokyo. Now ORIX deals with six types of Vaisala products, such as humidity measurement, barometric pressure measurement and dewpoint measurement equipment. Frequent information exchange and a strong partnership are the cornerstones of this cooperation.

Ground-breaking innovation in humidity measurement

The making of the revolutionary
Vaisala HUMICAP®

IE40

*The tiny HUMICAP® sensor is fabricated
using thin film technology.*



Yrjö Toivola was Vaisala's Managing Director from 1969 to 1991.

Upon the death of Vilho Väisälä, Vaisala's founder, in 1969, Yrjö Toivola became Vaisala's Managing Director. He held this position until he retired in 1991.

Just like his predecessor, Yrjö Toivola had an insatiable appetite for new technology. It was not enough that new instruments were a bit better than the old ones. He also wanted to investigate fundamental issues in the field. Hence, in 1971, he commissioned a study which tried to answer the question: "Which meteorological quantity cannot be accurately measured, and which technology could provide a solution for the problem?"

The challenge was taken up by Dr. Tapio Wiik, who was working at the semiconductor laboratory at the Technical Research Center of Finland (VTT). The laboratory had been established in the mid-1960s by Professor Tor Stubb, one of the pioneers of electronic and semiconductor research in Finland.

Tapio Wiik and his colleague Tuomo Suntola decided to investigate the technologies that were used to measure relative humidity in the atmosphere. The problem was without doubt one that both meteorologists and other scientists wanted to solve. It was also a question that had bothered Vaisala since the 1930s. Although Vilho Väisälä had struggled to construct reliable hygrometers, he was never fully satisfied with the results. The Vaisala radiosondes were equipped with the so-called Frankenberg hair hygrometer, a standard type of hygrometer in which a piece of hair, approximately 28mm long and rolled several times, reacted to the changes in humidity. Therefore, Tuomo Suntola's

Humicap was a radical innovation that changed humidity measurements for good.

task was to develop a new method for radiosonde humidity measurement that would replace the hair hygrometer.

Tapio Wiik and his research team abandoned the Frankenberg hair and searched for a completely new solution. Trusting their skills and intuition they focused on semiconductors and thin film technology. This was not an entirely new idea and several research teams around the world were simultaneously trying to construct a new type of humidity sensor. However, for one reason or another they failed. Suntola's team had to pass several obstacles before the right solution was found.

Beating all odds

After two years of hard work, Tuomo Suntola, who had by now become the project manager, accomplished the task. The project resulted in the construction of five hygrometers, all of which used the revolutionary new technology. Tuomo Suntola explains: "The sensor is fabricated using thin film technology similar to that generally used in microelectronics. The lower electrical contacts are first etched on a metalized glass plate. Then a thin amorphous polymer layer is added over the electrical contacts. This results in a uniform amorphous polymer layer. The upper electrode, which must be transparent to water vapor, is then vacuum evaporated onto the polymer surface through a mechanical mask to form the active capacitor area."¹

Tuomo Suntola's innovation became known as the Humicap (later HUMICAP®). It was revolutionary in many ways. First, it had no moving parts and because of the semiconductor and thin film technologies, the hygrometer was amazingly small in size. It was, of course, doubtful, how well such a new technology would operate in extreme temperatures (+40°C to -60°C) and humidity (from 0 to 100%RH), but the Humicap beat all odds. It was small, accurate and fast. According to Eero Salasmaa, Manager of the R&D Department, and Pekka Kostamo, Manager of Development Planning: "The new Humicap sensor has many attractive features – fast response, good linearity,

low hysteresis and small temperature coefficient."²

The skeptics became believers

Vaisala presented the new sensor at the CIMO VI congress in Helsinki in the spring of 1973, only a few months after Tuomo Suntola's team had completed the innovation. The next opportunity came in September of the same year, when Helsinki hosted an International Technological Fair. Vaisala put the Humicap on display without much expectation. After all, Humicap represented radically new technology that was unknown for most customers. This assumption was completely false. The reaction among visitors was overwhelming. Orders began to come in during the fair and the first 50 sensors were practically torn from the Vaisala exhibition booth.³

Humicap was, indeed, a radical innovation that changed humidity measurements for good. In fact, the construction was so radical that customers had a hard time believing it would actually work in various environments. Nevertheless, Pekka Kostamo and other Vaisala managers persuaded customers around the world to test the new instrument and report the results. Yutaka Watari, a local marketing director of Vaisala humidity instrumentation in Japan recalls: "At first it was quite difficult to introduce the Vaisala Humicap because no one instantly believed in its characteristics or capabilities. Many earlier experiments had been made with other sensors and much energy had been expended, but no one had succeeded in measuring relative humidity well. So when the Vaisala Humicap was introduced in Japan, people were skeptical."⁴ However, the skeptics soon became believers, as they saw how well the sensor worked in demanding conditions.

An edited extract of the Vaisala history book, published in 2006.

² Eero Salasmaa and Pekka Kostamo. 1975, pp. 10.

³ Pekka J. Kostamo, *TECOMAP in Helsinki. Vaisala News* 59/1973, pp. 11-12.

⁴ *Humicap in Japan. Vaisala News* 81/1979, pp. 10-11.

¹ Tuomas Suntola and Jorma Antson, *A Thin Film Humidity Sensor. Vaisala News* 59/1973, pp. 12.



New light from laser technology

Introducing the Vaisala SPECTRACAP® Oxygen Transmitter OMT355

Vaisala Instruments has recently made a significant entry into a new market segment by launching its first product for industrial oxygen measurements - the Vaisala SPECTRACAP® Oxygen Transmitter OMT355.

The new product introduces a novel concept for oxygen measurement by featuring an insertion probe with a built-in optical spectrometer. Using advanced laser technology, the instrument combines state-of-the-art measurement performance with robustness that enables in-situ measurements in conditions where this has been unimaginable until now.

Oxygen for all

Oxygen is one of the most common elements found in nature. In the Earth's crust, it is most predominantly present in the form of silicate and oxide minerals, in the oceans as a major constituent of water. In its gaseous form of a diatomic oxygen molecule O_2 , oxygen makes up 20.9% of the Earth's atmosphere.

Industrial uses of oxygen are numerous and diverse. The chemical industry uses it to improve the yield of many chemical and petrochemical manufacturing processes. Many industries use it for wastewater treatment, water purification or enhancement of other types of aqueous reactions. In fermentation processes it is used to improve fermentation yield, and in a number of combustion processes it is used to boost the process for a better and cleaner burn.

In-line measurement for best results

Any process parameters are best measured in-situ, with a sensor that is

located inside the process at a representative location. For many process control parameters this is not possible, but measurements are made from gas or liquid samples drawn from the process continuously, or even from samples taken manually and measured in a laboratory afterwards with a significant delay.

Continuous sampling is often employed for process gas oxygen measurements. Depending on the composition and conditions of the process gas, varying schemes are used to render the gas sample suitable for the sensitive gas analyzer. This may include gas drying, cooling, particulate removal, flow rate stabilization and filtering for removing liquid water or harmful chemicals from the sample. Apart from adding cost and complexity to the measurement system, the sample treatment may even affect the composition of the gas sample, causing an error or a bias in the measurement result.

In the OMT355 product concept, the oxygen measurement probe can be installed directly - even in a demanding wet or aggressive process environment - with a flange mount.

Durable probe for difficult conditions

The Vaisala SPECTRACAP® Oxygen Transmitter OMT355 is designed to endure difficult chemical environments. The main construction material of the probe is AISI316 stainless steel. Other wetted materials are SiN and MgF2

optical coatings and, depending on selected sealing and filter options, PTFE, EPDM or Kalrez®. The optical surfaces are protected from dust and dirt with a stainless steel mesh filter and an optional hydrophobic porous PTFE filter. Should any particles or dirt surpass the filter barriers, the measurement algorithm of the SPECTRACAP® sensor is designed to tolerate a significant level of light obscuration. It even issues a warning signal of the situation for the user well before the measurement performance is affected.

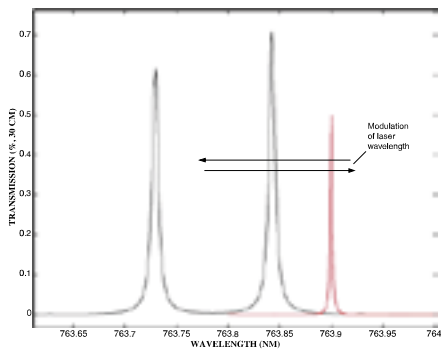
Sampling cell option

In cases where the OMT355 probe cannot be inserted directly in the process, for example due to too high process pressure or temperature, a stainless steel sampling cell can be used. Thanks to the robustness of the probe and the small pressure and flow dependencies of the SPECTRACAP® sensor, in most cases a very simple sampling system can be used.

Smooth connectivity and configuration

All the Vaisala SPECTRACAP® Oxygen Transmitter OMT355 versions feature a clear LCD display and a four-key keypad to access the instrument





In the TDL method the wavelength of the diode laser light source is continuously swept over a gas absorption peak.

control functions locally with menu structured commands. For security reasons the keypad is located under the instrument cover with some of the commands password protected to prevent tampering with the transmitter. Using the RS232 or RS485 serial communications of the device, a full set of control commands is available by using a laptop or a terminal device. Other configurable features of the OMT355 are an analog mA output with user-defined error states, and an alarm/fault relay with user-defined setpoints.

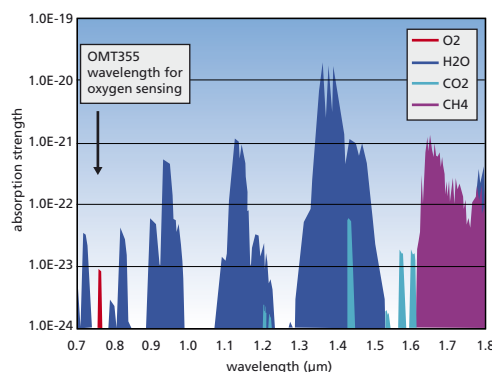
Many applications

The OMT355 measures oxygen concentration in % levels, upwards from approximately 0.2 % O₂, and can be used in practically any application where oxygen levels need to be monitored in the % range. The advantages of the SPECTRACAP® sensor and the OMT355 product concept are, however, most striking in demanding applications where the user can benefit from the 12-month calibration interval and the robustness of the in-line probe.

In fermentation processes, the oxygen and carbon dioxide levels in the fermentor off-gas give crucial information on the state of the microbial process. The OMT355 is ideally suited for real-time oxygen measurement in the high humidity gas emerging from an industrial fermentor, even at high gas flow rates and velocities often encountered in large-scale facilities. Even more demanding conditions can be found, for example, in large composting facilities, where the oxygen concentration in the exhaust gas is an important measure of how aerobic the process is.

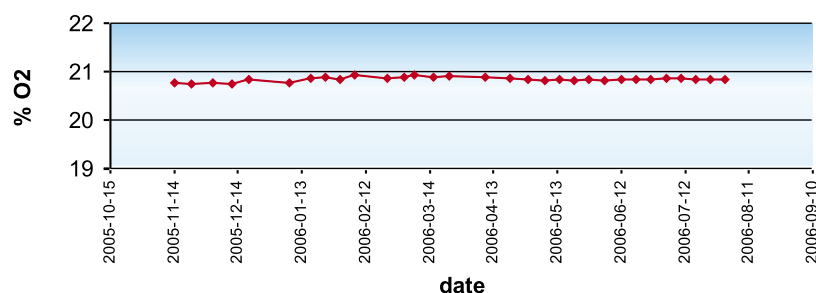
The Vaisala SPECTRACAP® sensor

The Tunable Diode Laser (TDL) technology used in the SPECTRACAP® sensor is one of the most powerful gas measurement technologies on the market today. The technology is based on measuring the attenuation of a beam of laser light in the sample gas. For oxygen sensing, the laser - a small semiconductor chip - is tuned to a wavelength which is characteristic and unique for the oxygen molecule. Since no other gas absorbs light precisely at the same wavelength as oxygen, the measured attenuation is an extremely selective measure for the amount of oxygen on the path of the laser beam.



◀ *Absorption wavelengths of some commonly known gases. The oxygen absorption does not overlap with other gases.*

▼ *Illustration of the long-term stability of the Vaisala SPECTRACAP® Oxygen Transmitter OMT355. The graph shows the weekly average readings of a transmitter installed outdoors for 9 months, with open exposure to ambient weather.*



In the SPECTRACAP® sensor, this advanced technology is for the first time implemented in a compact and robust probe suitable for industrial measurements. The optical design of the sensor is a result of an elaborate optimization based on both theoretical modeling and thorough experimental work.

The SPECTRACAP® sensor contains no moving parts or sensitive components exposed to the measured gas, which for the user means a measurement performance that is unaffected by vibrations, orientation or even aggressive chemicals.

The fundamental optical absorption principle combined with the highly optimized sensing algorithm used in the sensor yield a very stable measurement. The semiconductor lasers used in the sensor have undergone extensive aging tests that show a lifetime in excess of ten years of continuous operation.

Inert blanketing gases are used in a number of applications for minimizing or removing explosion hazards or for protecting perishable goods from the effects of oxidation or microbial activity. The OMT355 is an excellent solution for monitoring inert gas quality both in the gas supply such as an inert gas generator, and in the blanketed area such as a product storage tank or container.



No pressure with accuracy

Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU300

Since 1999, Vaisala has offered a transmitter for the measurement of barometric pressure, relative humidity and temperature. The Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU200 is now receiving a successor, the PTU300, a fully digital three parameter transmitter with several new and improved features.

Pressure, humidity and temperature are among the most important and widely measured environmental parameters, especially in meteorology. The new transmitter enables high quality measurement of all of these with a single instrument.

These three parameters are also measured when using the GPS (Global Positioning System) signal in weather-related measurements. The GPS signal is affected by the amount of water vapor on the signal path, causing a so-called tropospheric wet delay. With accurate measurements of barometric pressure, humidity and temperature at the GPS receiver antenna, all other errors in the GPS signal can be subtracted. After this, the amount of precipitable water vapor in the atmosphere can be estimated.

When calibration and test laboratories report the environmental parameters

present in the laboratory during a test or calibration, the prevailing air pressure, humidity and temperature are normally essential. These parameters are also required in accurate laser interferometric measurements, in order to compensate for their influence on the measuring laser wavelength and thereby to improve accuracy. Other applications, such as exhaust gas analyzing in engine test benches, may also require the measurement of these parameters directly or for compensation purposes.

Trust the measurement - not your luck

The pressure measurement of the Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU300 is based on the Vaisala BAROCAP® sensor, providing high measurement accuracy and excellent long-term stability. When ordering the new transmitter, the customer can choose between two different accuracy classes. The transmitter can also incorporate either one or two BAROCAP® sensors. The latter alternative provides additional reliability to the pressure measurement through the redundant measuring principle. With two sensors, the transmitter inter-

nally makes two independent pressure measurements and, in addition to the pressure signal, also gives user information on the signal reliability.

In addition to measuring barometric pressure, the new transmitter also provides the WMO (World Meteorological Organization) pressure trend and tendency code. The pressure trend indicates the amount of pressure change, while the tendency code indicates the nature of the pressure tendency for the three hours preceding the time of observation.

Choose your probe

Due to its easy configurability, the new transmitter offers several sensor head alternatives for humidity and temperature measurement. The Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU301 has a fixed humidity and temperature probe, and is especially suitable for calibration and test laboratory monitoring. The PTU303 provides a cable probe that can be easily installed for example in a radiation shield in a weather station. The PTU307 features Vaisala's patented warmed sensor head method for demanding outdoor and meteorological measurements. This



method keeps the humidity sensor safely away from condensation in all conditions, ensuring that the true ambient humidity level is observed at all times. The PTU30T incorporates a cabled temperature probe, in case only pressure and temperature measurements are required.

The humidity measurement of the new transmitter is based on the Vaisala HUMICAP® sensor, providing high accuracy and excellent long-term stability. In addition to measuring the relative humidity, the new transmitter can also provide the humidity information in the form of calculated humidity quantities such as dewpoint/frostpoint, absolute humidity, wet bulb temperature and many others.

The calibration of all the three measured quantities – barometric pressure, relative humidity and temperature – is traceable to the NIST (National Institute of Standards and Technology, USA).

It speaks your language

As an option, the new transmitter can also incorporate a graphic display, together with an intuitive menu-based interface, through which the displayed quantities and units can easily be selected. The display language can be chosen from English, German, French, Spanish, Swedish, Finnish and Japanese.

Display graphics allow the user to see the trends of the selected parameters in six different time windows, the longest being a one-year history of active opera-

tion of the unit. Cursors on the display make it possible to refer to values at individual time spots and to read the minimum and maximum values.

Connect the way you like

The new transmitter provides several different communication signals. While the standard output is RS232, the data can also be communicated using an RS485 serial line. Linear voltage and current outputs for all three parameters are also available. The voltage and current ranges can be easily modified using simple dip switches.

The voltage supply ranges from 10...35 VDC, allowing the transmitter to be also used in battery-powered applications. An optional AC supply module enables the transmitter to be connected to all universal mains AC supplies. This feature, combined with the display, makes it a handy movable environmental monitoring device. The transmitter can also be equipped with an alarm output module, providing two programmable relay outputs.

The PTU300 can be linked to a PC either via a terminal program or by using specific Windows® software to transfer the measured data, which can then be processed further and copied to other Windows® programs. The transmitter also responds to certain GPS-specific application commands and can transmit the measured data in so-called NMEA



The Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU300 is based on the Vaisala BAROCAP® sensor, providing high measurement accuracy and excellent long-term stability.

message format, making it compatible with major GPS receivers.

And how would you like to install it?

The Vaisala Combined Pressure, Humidity and Temperature Transmitter PTU300 can be installed in many different ways. The unit can be mounted as such, or by using a separate wall mounting plate that enables easy detachment of the transmitter, as well as installation on top of a connection box. With the mounting plate and a DIN rail kit, the unit can be easily connected to a standard DIN rail.

The housing of the transmitter is IP65, enabling direct outdoor installation. An outdoor installation kit HMP330MIK is available, providing the required pole mounting plate, support bars, radiation shield and static pressure head to obtain reliable measurements for meteorological and other purposes.



Dry as a bone - hot as a house on fire

Jan Grönblad
Product Line Manager
Vaisala
Helsinki, Finland

Confirm the dryness in high temperature processes

In many drying applications the temperature can be very high. Typically, the humidity level is also very low, especially at the end of the drying cycle. In such conditions, traditional humidity instruments may come up against their accuracy limits. On the other hand, the humidity level can be relatively high at the beginning of the drying process, making it difficult to take samples from the measured process air. In these situations, the new Vaisala DRYCAP® Dewpoint Transmitters provide unbeaten accuracy in direct installations in high temperature applications.

Direct humidity measurement in high temperature applications can be a challenging task. When the process temperature rises above 100 °C (212 °F), the relative accuracy of a traditional humidity instrument is acceptable if the amount of moisture in the air is high. But as the humidity level drops, the measurement accuracy suffers. In high tempera-

ture applications the humidity is typically low due to the fact that, as the temperature increases, the relative humidity level decreases rapidly. Figure 1 illustrates the maximum relative humidity in the temperature range 90...200 °C (194...392 °F). The humidity value is always below the blue saturation curve, which starts to drop fast when the process temperature exceeds the boiling point of water.

Advantages of direct measurement

A sampling system is one way to get around the accuracy problem resulting from high temperature. Sampling the process air into cooler conditions outside the process is one way to keep the humidity reading at a level where the accuracy is good with traditional technologies. This works in very dry applications, where the process humidity does not condense in the sampling system. Examples of such applications are heat

treatment applications where a dry shield gas is used. But typical drying applications (e.g. foodstuffs or pharmaceuticals) use heated air with a rather high humidity, and not shield gas.

The drying process tries to remove the moisture of the dried product as effectively as possible. The dewpoint temperature (humidity) of the process is typically – for at least part of the drying cycle, if not during the whole drying cycle – higher than the outside temperature. This results in saturation in the sampling system. Direct measurement should therefore always be preferred when possible to avoid the risk of the sampling system being filled with water.

Dry end accuracy is important

Measuring the humidity of exhaust air in a drying process is typically a very good indication of the material moisture of the dried product and, when suitable, a

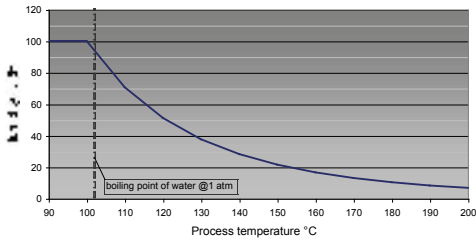


Figure 1. The maximum humidity (%RH) in a high temperature process at 1 atm.

very reliable online measurement. The key issue in drying applications is to measure whether the dried product is dry enough. However, the product should not be over-dried either, in order to optimize product composition or minimize energy consumption. The more accurate the measurement is, the narrower a window for the end product's moisture can be achieved. If accuracy higher than traditional humidity measurement accuracy with ± 1 or 2 %RH is required, and if a rugged and long-term stable measurement is preferred, Vaisala's latest DRYCAP® Dewpoint Transmitters are the right solution.

New unbeaten measurement performance

The new Vaisala DRYCAP® Dewpoint Transmitters DMT345 and DMT346 offer unbeaten measurement performance in direct installations in hot and dry processes, thanks to the updated auto-calibration function that now also operates in high temperature processes. The process temperature range for direct installation can be as high as +350 °C (660 °F).

Both models incorporate the auto-calibration method that has been used in low humidity applications in low temperatures for years with great customer satisfaction. The patented technology

offers very good accuracy and simultaneously maintains excellent long-term stability. For the user, this means not only reliable measurement values, but also reliable process control with low maintenance costs.

Passive cooling for extreme temperatures

The difference between the two new dewpoint transmitter models is the so-called passive cooling method, which enables the DMT346 to be installed directly in temperatures of up to +350 °C (660 °F). Regardless of the extreme temperatures, passive cooling keeps the sensor temperature within a range that will not burn the sensor.

Passive cooling has the advantage of not requiring any external power to generate the cooling, and the sensor is protected even in power loss situations. The mechanics conduct heat out from the sensor to the outside of the hot process. Not only is the sensor protected against extreme temperatures, but also the measurement accuracy can be improved when the temperature around the sensor is lower than in the actual process. The reason for this is that when the temperature drops, the humidity the sensor detects increases to a more sensitive range. Together with the auto-calibration,

this allows measurement in a very wide range with excellent accuracy.

To avoid getting wet in situations where the process humidity is high, the sensor also has an integrated heater that automatically switches on when the risk of saturation is present. This can happen, for example, during process changes or the start-up of the drying phase. When conditions in the process normalize, the heater is automatically switched off. The visibility of this operation is minimized, making the instrument fully automatic and very easy to operate.

Many instruments to choose from

Many instruments have specifications for humidity measurement in high temperatures. Figure 3. provides guidance on selecting the most suitable instrument. It shows that in applications where humidity is low and temperature is high the new DRYCAP® transmitters DMT345 and DMT346 provide the best accuracy. If the temperature is lower and the humidity likewise low, the basic Vaisala DRYCAP® Dewpoint and Temperature Transmitter DMT340 series is recommended. And if there is no need to measure accurately at low humidity, the Vaisala HUMICAP® Humidity and Temperature Transmitter HMT330 is the most suitable choice.

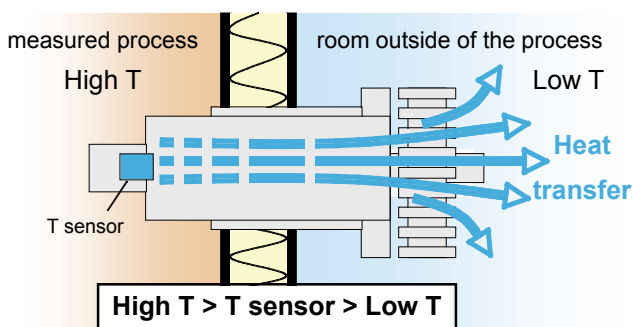


Figure 2. The passive cooling of DMT346 keeps the sensor cooled by means of the lower temperature outside the process.

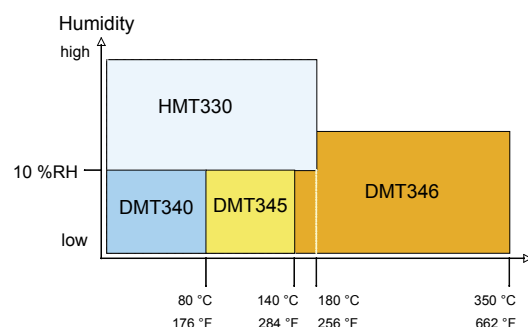


Figure 3. The new Vaisala DRYCAP® Dewpoint Transmitters DMT345 and DMT346 are made for low humidity measurements in high temperatures.

Spot and stop water contamination

New intelligence for continuous on-line measurement of moisture in oil



Senja Paasimaa
Application Manager
Vaisala
Helsinki, Finland

The new Vaisala HUMICAP® Moisture and Temperature Transmitter Series for Oil MMT330 enables fast and reliable detection of moisture in oil.

Several power generation and transmission networks have various oil filled systems, for example, transformers and turbines, where oil acts as an insulating material, lubricant and/or cooling agent. As water contamination reduces the performance of oil, moisture is an important factor determining the condition of different types of oils. With on-line information on the quality of the oil, preventive actions can be taken and the maintenance costs cut substantially.

Lubrication systems

Water contamination reduces the performance of lubrication oil. Excess moisture, particularly free water, increases the risk of corrosion, overheating, machine malfunction and other problems. Therefore measuring and controlling the moisture in lubrication systems is essential to avoid costly failures and to ensure reliable performance of the equipment at all times. Monitoring the moisture in oil within lubrication systems helps to plan servicing and prevent unscheduled downtime.

Transformers

The detection of moisture in oil is also an essential part of a comprehensive transformer maintenance program. Oil immersed transformers rely on oil for cooling, protection from corrosion and as an important component of their insulation. Excessive moisture in oil causes accelerated ageing of the insulation materials and reduces their dielectric strength. In extreme cases this can result in arcing and short circuits within the windings. If accurate moisture measurements are available, leaks in the oil system can be detected in time as water is absorbed from the surrounding air.

New Vaisala solutions

The new Vaisala HUMICAP® Moisture and Temperature Transmitter Series for Oil MMT330 enables fast and reliable

detection of moisture in oil. The MMT330 can be used in on-line moisture monitoring and as a control device, allowing separators and oil driers to be started only when needed. Proper monitoring saves both oil and the environment. With the MMT330, it is easy and economical to monitor moisture in oil.

Reliable Vaisala HUMICAP® technology

The MMT330 incorporates the latest generation of the Vaisala HUMICAP® sensor, resulting from ten years of field experience. The sensor was developed for demanding moisture measurement in liquid hydrocarbons. Its excellent chemical tolerance provides accurate and reliable measurement over a wide measurement range. The operation is based on the measurement of changes in capacitance as the film absorbs water molecules from oil.

Indicates the margin to water saturation

The MMT330 measures moisture in oil in terms of water activity (aw) and temperature (T). The measurement indicates the margin to water saturation in oil and is therefore independent of oil type, age and temperature.

Water content as ppm conversion

In addition to water activity, the MMT330 can output ppm, the average mass concentration of water in oil. Vaisala has this conversion readily available for mineral transformer oil. For other oils, the oil specific conversion coefficients can be programmed to the transmitter by the user, if the water solubility of the oil is known.

Graphical measurement trend and historical display

The MMT330 can be ordered with a large numerical and graphical display with a



multilingual menu. It allows the user to monitor measurement trends over a one-year period.

Versatile outputs

The MMT330 provides up to three analog outputs. Galvanic isolation of supply power and analog outputs are also available. The RS232 and RS485 can be used for serial interface. In addition, an alarm relay option is available.

Easy installation

The Vaisala HUMICAP® Moisture and Temperature Transmitter Series for Oil MMT330 has three different probe options available, enabling various application installations with wide pressure and temperature ranges of up to 250 bar and 180 °C. In addition, the MMT330 has several options for transmitter mounting. Transmitters are delivered pre-configured with all settings installation ready.

Go for cost-effective and straightforward CO₂ measurement

Flow-through measurement module for high CO₂ concentrations

The Vaisala CARBOCAP® Carbon Dioxide Module GMM111 is for light industrial applications requiring cost-effective and straightforward CO₂ measurement.



As an alternative to diffusion aspirated CO₂ probes, Vaisala's range of carbon dioxide instruments for high CO₂ concentrations is expanding with the Vaisala CARBOCAP® Carbon Dioxide Module GMM111.

The GMM111 is a compact CO₂ module with flow-through aspiration. The module is available with measurement ranges of 0...5% CO₂, 0...10% CO₂, or 0...20% CO₂. It is particularly well-suited for measurements in pharmaceutical incubators, bioreactors and chicken egg hatchers.

Light industrial applications

The GMM111 expands Vaisala's range of CO₂ products for light industrial applications. The success of the diffusion aspirated GMP221 probes for high concentrations has spurred us to develop a flow-through aspirated module. The module is intended for light industrial applications requiring cost-effective and straightforward CO₂ measurement for percentage level CO₂ concentrations.

Flow-through sampling

The flow-through sampling concept of the GMM111 is realized with the well-established Vaisala CARBOCAP®, a

silicon-based non-dispersive infrared (NDIR) sensor. The measurement is made with an advanced single-beam, dual wavelength technology with no moving parts. The excellent long-term stability is a result of both the CARBOCAP® technology and the corrosion resistance and tolerance of high humidity of the sensor structure. The measurement is made with renowned Vaisala accuracy - including repeatability, non-linearity, and calibration uncertainty, the accuracy is +/- 0.3% CO₂ and 3% of reading - which caters for the needs of demanding applications.

Benefiting original equipment manufacturers

The target applications for this module are mainly original equipment manufacturers (OEM) requiring a compact and cost-effective CO₂ measurement module. Bioreactor users, pharmaceutical incubator manufacturers, chicken egg hatcher producers, and other OEM manufacturers will benefit from this flow-through design.

The module can be easily integrated into any design and features both 4...20 mA and 0...10V analog outputs. Serial communication using a 2-wire RS485 connection enables several instruments

to be installed using a single connection bus. For gas sampling, an inlet and an outlet is provided with convenient gas sampling tube fittings.

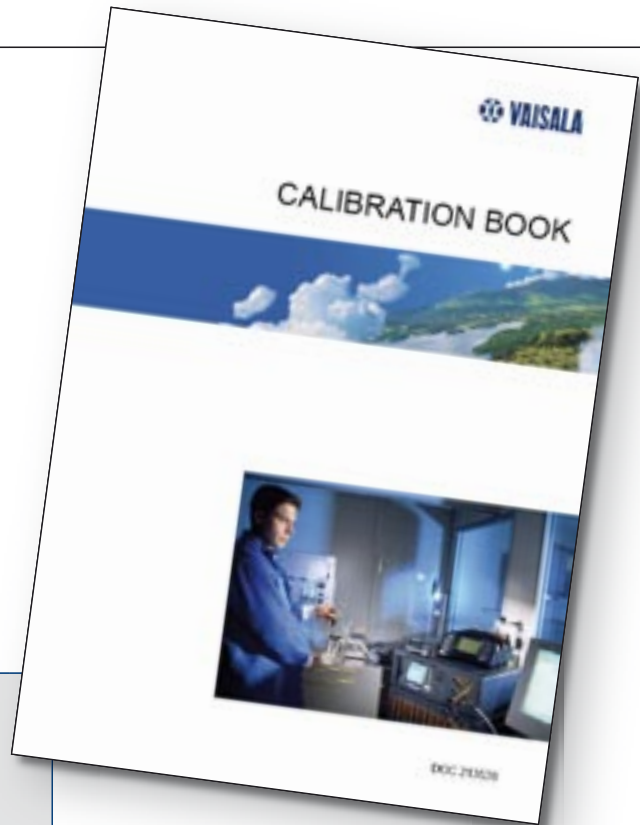
The GMM111 sensor is designed to minimize the number of particles reaching the optical cell of the sensor. Although all flow-through sampling instruments require some amount of sample conditioning, the design which prevents particles from reaching the sampling cell also prevents pressure building inside the cell. The effect of gas flow on the CO₂ reading is negligible at rates below 1 liter per minute, but allows for free flow rates up to even 10 liters per minute.

However, precaution must be taken when drawing air from humid environments, since the sensor inside the flow-through cell must still be protected from condensation. Pharmaceutical incubators and other environmental chambers in particular tend to be demanding measurement applications, since a gas sample is usually drawn from an environment with high temperature and humidity. The GMM111 offers a flow-through sampling option for these applications requiring an accurate CO₂ measurement in harsh and humid environments.

Vaisala Calibration Book

What is calibration? Why is calibration necessary? What about traceability? What kind of calibration methods are there? We have been receiving questions about calibration issues from many customers. The Vaisala Calibration Book was published on June 1 to answer these and many other questions. The book is packed with Vaisala experience and knowledge on issues such as calibration requirements, metrology and calibration service, calibration activities, terminology and uncertainty calculation.

Please visit the Vaisala website www.vaisala.com/calibrationbook for more information, to download a free PDF copy, or to order the print version.



i Did you know that Vaisala offers a comprehensive range of after sales services?

As a Vaisala customer, you have access to a wide selection of Vaisala technical support and spare parts, calibration and maintenance services, reminder programs and a comprehensive selection of guides and other useful material.

Please visit the Vaisala website to find out more www.vaisala.com/businessareas/instruments/servicesupport

Vaisala Humidity Calculator

We are proud to present the Vaisala Humidity Calculator version 1.0. It is a web-based software tool that allows you to calculate several humidity parameters from one known humidity value, make unit conversions on the fly, and see the effects of changing ambient conditions, like temperature and pressure.

You can calculate relative humidity, dewpoint / frostpoint, absolute humidity, water content, mixing ratio, vapor pressure, and parts per million. We have included the most commonly used units for each parameter which can be changed during the calculation. By changing the ambient conditions (temperature and pressure), you can see their effect on each calculated parameter.

The calculator is also localized for several languages. Initially, we have included English, Chinese, Dutch, German, Finnish, and Japanese.

Please visit the Vaisala website www.vaisala.com/humiditycalculator to access the calculator. The calculator is also available as stand-alone software, and can be downloaded at the same address.

Vaisala.com in your language

During 2005, Vaisala has actively developed several localized versions of the *www.vaisala.com* website. These localized sites are mainly concentrated on industrial process measurement instruments and our service and support offering, but also provide some general information about Vaisala.

New sites were launched in Dutch, German, French and Swedish, while the Finnish, Chinese and Japanese sites received an increase in content.

Plans for the future include Spanish and Portuguese sites, as well as a continuous increase and improvement of the localized content in every language.

Restriction of the use of certain Hazardous Substances in electrical and electronic equipment

The European Union has adopted legislation that bans certain hazardous substances from new electrical and electronic equipment. This legislation is titled RoHS - "Restriction of the use of certain Hazardous Substances in electrical and electronic equipment", and it became effective in July 2006.

Although the RoHS requirements do not apply to Vaisala's products in the first phase as they belong to category 9 (monitoring and control instruments), Vaisala has taken decisive action to adjust operations to meet the directive require-

ments. All new product designs, and from the existing products the Vaisala Instruments division's high volume products as well as the Vaisala Radiosonde RS92, are modified to meet the RoHS requirements.

Vaisala plays an active role in discussions and action-plans for electrical and electronic waste collection and recycling.

Contact the Vaisala News team

Marikka Metso
Editor-in-Chief

For subscriptions, cancellations, feedback and changes of address, please contact the Vaisala News team by sending an email to vaisala.news@vaisala.com

Thank you for your interest.



Europe

Vaisala Oyj

P.O. Box 26, FI-00421 Helsinki
FINLAND
Telephone: +358 9 894 91
Telefax: +358 9 8949 2227

Vaisala Oyj

Malmö Office
Drottninggatan 1 D
S - 212 11 Malmö
SWEDEN
Telephone: +46 40 298 991,
in Sweden: 0200 848 848
Telefax: +46 40 298 992,
in Sweden: 0200 849 849

Vaisala GmbH

Hamburg Office
Schnackenburgallee 41
D-22525 Hamburg
GERMANY
Telephone: +49 40 839 030
Telefax: +49 40 839 03 110

Vaisala GmbH

Bonn Office
Adenauerallee 15
D-53111 Bonn
GERMANY
Telephone: +49 228 24 9710
Telefax: +49 228 249 7111

Vaisala GmbH

Stuttgart Office
Pestalozzi Str. 8
D-70563 Stuttgart
GERMANY
Telephone: +49 711 734 057
Telefax: +49 711 735 6340

Vaisala Ltd

Birmingham Operations
Vaisala House
349 Bristol Road
Birmingham B5 7SW
UNITED KINGDOM
Telephone: +44 121 683 1200
Telefax: +44 121 683 1299

Vaisala Ltd

Newmarket Office
Unit 9, Swan Lane
Exning
Newmarket
Suffolk CB8 7FN
UNITED KINGDOM
Telephone: +44 1638 576 200
Telefax: +44 1638 576 240

Vaisala SAS

Paris Office
2, rue Stéphenon
F-78181 Saint-Quentin-en-Yvelines
FRANCE
Telephone: +33 1 3057 2728
Telefax: +33 1 3096 0858

Vaisala SAS

Marseille Office
2, rue de Beausset
13001 Marseille
FRANCE
Telephone: +33 4 8866 1751
Telefax: +33 1 3096 0858

North America

Vaisala Inc.

Boston Office
10-D Gill Street
Woburn, MA 01801
USA
Telephone: +1 781 933 4500
Telefax: +1 781 933 8029

Vaisala Inc.

Columbus Office
1372 Oxley Road
Columbus, Ohio 43212
USA

Vaisala Inc.

Boulder Operations
194 South Taylor Avenue
Louisville, CO 80027
USA
Telephone: +1 303 499 1701
Telefax: +1 303 499 1767

Vaisala Inc.

San Jose Office
6980 Santa Teresa Blvd
Suite 203
San Jose, CA 95119-1393
USA
Telephone: +1 408 578 3670
Telefax: +1 408 578 3672

Vaisala Inc.

Tucson Operations
2705 East Medina Road
Tucson, Arizona 85706,
USA
Telephone: +1 520 806 7300
Telefax: +1 520 741 2848
U.S. Toll Free 1 800 283 4557

Vaisala Inc.

Houston Office
1120 Nasa Road 1 Suite 220-E
Houston, TX 77058
USA
Telephone: +1 281 335 9955
Telefax: +1 281-335-9956

Vaisala Inc.

Minneapolis Operations
6300 34th Avenue South
Minneapolis, MN 55450
USA
Telephone: +1 612 727 1084
Telefax: +1 612 727 3895

Vaisala Inc.

Westford operations
2 Park Drive
Unit 1
Westford MA 01886
USA
Telephone: +1 978 692 9234
Telefax: +1 978 692 9575

Vaisala Inc. Regional Office Canada

37 De Tarascon
Blainville
QC J7B 6B7
CANADA
Telephone: +1 450 430 0880
Telefax: +1 450 430 6410

Asia and Pacific

Vaisala KK

Tokyo Office
42 Kagurazaka 6-Chome
Shinjuku-Ku
Tokyo 162-0825
JAPAN
Telephone: +81 3 3266 9611
Telefax: +81 3 3266 9610

Vaisala Pty Ltd

Melbourne Office
3 Guest Street
Hawthorn, VIC 3122
AUSTRALIA
Telephone: +61 3 9815 6700
Telefax: +61 3 9815 6799

Vaisala China Ltd.

Beijing Office
Floor 2, EAS Building
No. 21, Xiao Yun Road
Dongsanhuan Beilu
Chaoyang District
Beijing 100027
People's Republic of China
Telephone: +86 10 8526 1199
Telefax: +86 10 8526 1155

Vaisala China Ltd.

Shenzhen Office
Regus Business Centre
Anlian Centre
26th Floor
2222 Jintian Road
Futian
Shenzhen 518026
People's Republic of China
Telephone: + 86 755 3395 5998
Telefax: + 86 755 3395 5516

Vaisala Shanghai

contact address
6F 780 Cailun Lu
Pudong New Area
201203 Shanghai
People's Republic of China
Telephone: + 86 21 5132 0656
Telefax: + 86 21 5132 0657

Vaisala Guangzhou

contact address
Room 1116, Main Tower,
GITIC Plaza
339 Huanshi Dong Road
Guangzhou 510098
People's Republic of China
Telephone: 0086-20-83311106
Telefax: 0086-20-83315229

Vaisala Regional Office Malaysia

Level 9, West Block
Wisma Selangor Dredging
142-C Jalan Ampang
50450 Kuala Lumpur
MALAYSIA
Telephone: +60 3 2163 3363
Telefax: +60 3 2164 3363