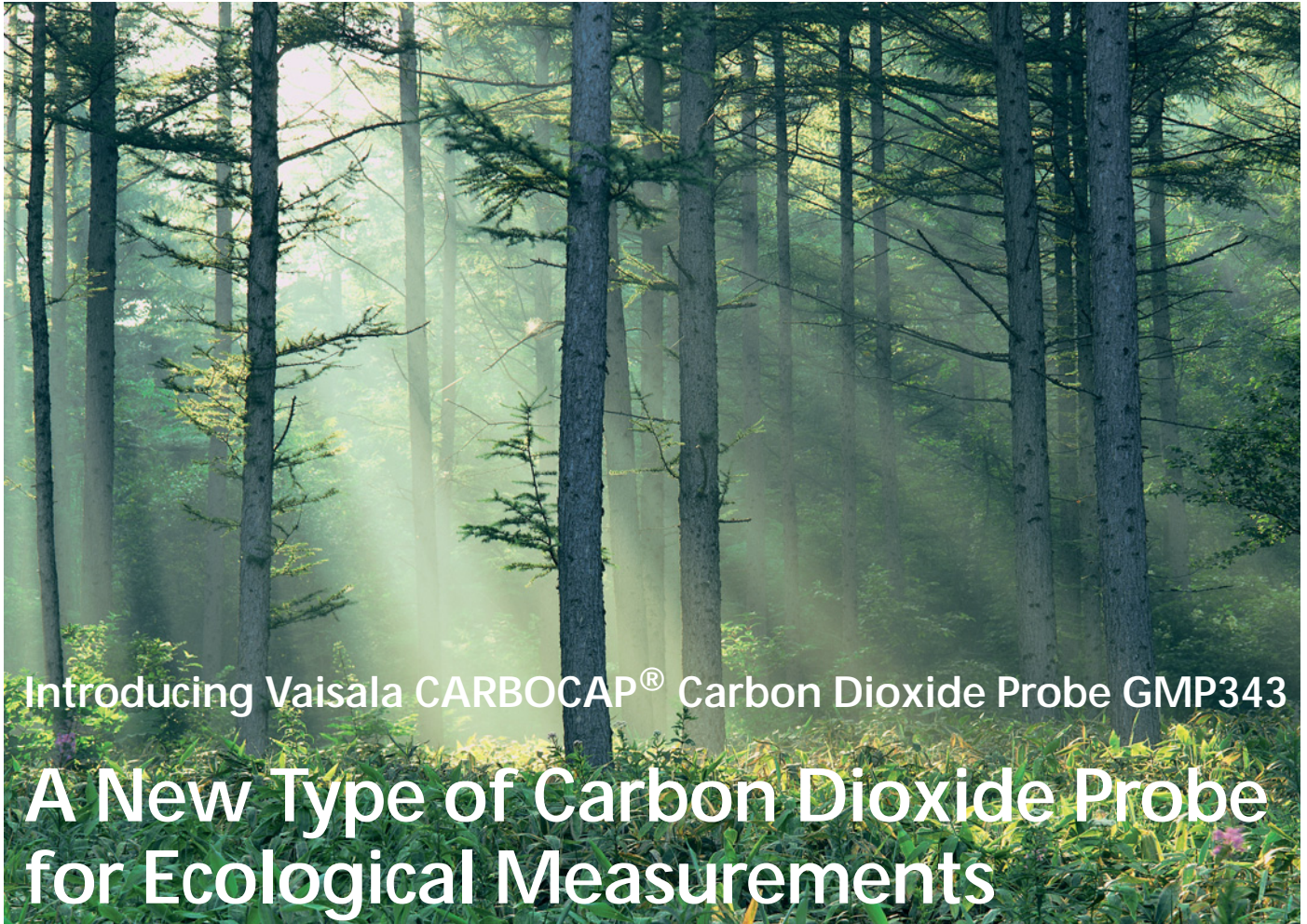


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Introducing Vaisala CARBOCAP® Carbon Dioxide Probe GMP343

A New Type of Carbon Dioxide Probe for Ecological Measurements

The need for outdoor carbon dioxide measurements is increasing. This is driven by a growing environmental awareness and a political willingness to fund more ecological and environmental research. So far, CO₂ measurements in the field have, to a large extent, been made with high-performance, expensive, and often also bulky, analyzer-type instruments. With a few exceptions, these analyzers have not been especially suitable for use in harsh outdoor environments. In order to be able to use these instruments in the field, sampling systems, shelters, power systems etc., need to be included in the measurement set up. This further increases the cost of the measurement.

A major problem in outdoor carbon dioxide measurements is the lack of CO₂ sensors with low power consumption and capabilities to withstand the harsh outdoor environment, and importantly at an affordable cost. The Vaisala CARBOCAP® Carbon Dioxide Probe GMP343 is a new type of CO₂ sensor that enables a simplified measurement set up for ecological applications.

The measurement technology

The new GMP343 probe uses the Vaisala CARBOCAP® measurement technology. The absorption of Infra-Red (IR) light is measured in this technology by using a small silicon based, electrically tunable Fabry-Perot Interferometer (FPI), acting as a tunable bandpass filter. The FPI is continuously measuring not

only the CO₂ absorption band, but also a reference band. Because of this a true reference measurement, and, therefore, a stable CO₂ measurement can be obtained. Only a single IR detector is used for measuring both the absorption and the reference bandwidths, which eliminates the errors commonly present in NDIR sensors with two IR detectors. The true reference measurement enables good stability

of the sensor both in terms of time, and temperature. It is worth emphasizing that the temperature stability results also in a good stability with flow, which is an important feature, especially in diffusion based sensors.

Although the basis of the measurement technology of the GMP343 is the familiar Vaisala CARBOCAP® sensor, the NDIR bench in GMP343 is more advanced resulting in im-

proved performance and durability.

The structure of the new carbon dioxide probe

The structure of the Vaisala CARBOCAP® Carbon Dioxide Probe GMP343 is presented in Figure 1. It differs from Vaisala's other CARBOCAP® carbon dioxide sensors in the following ways:

- The sample cell is open in order for the gas to move freely through the sensor by means of diffusion;
- The light source and the FPI/detector are both located at the same end of the sample cell, in the same space with the electronics behind a heated sapphire window, inside an IP67/ Nema 6 housing;
- On the opposite side of the sample cell there is a gold plated, specially coated focusing mirror. The mirror can also be heated;
- A sensor measuring the gas temperature is located in the sample cell.

Properties of the probe

Compared with conventional analyzer type of carbon dioxide instruments. The Vaisala CARBOCAP® Carbon Dioxide Probe GMP343 has the following advantages:

- cost efficient;
- diffusion based sampling;
- low power consumption;
- can be used in harsh environments;
- good long term stability;
- small size and weight;
- excellent possibilities for performance optimization, as well as
- no additional power supply is needed when used with an optional portable indicator/datalogger.

The diffusion based sampling is a welcomed alternative in many ecological applications, especially in cases where the pump sampling can create prob-

lems or even errors in the measurement. For instance, in soil chambers the pump sampling can sometimes generate underpressures that accidentally increase the CO₂ flux from the soil. The main advantage of a diffusion-based sensor is however that it is less complex, less power consuming and requires less maintenance. The possibility to use the product without any protective and temperature controlled shelter is also an advantage.

Good long-term stability seems to be crucial in most ecological CO₂ measurement applications, especially in long-term ambient measurements. Also, the more remote the location of the measurement site is, the more important is the long-term stability of the measurement instrumentation. In remote locations, where mains power many times is not available, also the low power consumption is appreciated.

The low power structure of the product has also its downsides. The peak-to-peak noise of GMP343 is rather large, mainly because of the low power light source and the thermopile detector used in the system. However, if the response time is not critical, output noise can be reduced with the built-in filtering algorithms.

Although the GMP343 probe



has advanced built-in pressure and humidity compensation algorithms, the probe does not contain a pressure or humidity sensor. However, not all measurement applications need active pressure and humidity compensations since the pressure and humidity remain reasonably constant throughout the measurement. And in cases where active compensation is required, pressure or humidity data is many times already available, and if so, this data can easily be linked to the compensation algorithms available in the GMP343.

Measurement applications

The aim of the Vaisala CARBO-

CAP® Carbon Dioxide Probe GMP343 has been to provide a new type of instrument for ecological CO₂ measurement applications. It will serve as a new research tool in systems where environmental ruggedness, long-term stability, low power consumption and cost efficiency are required.

Suitable applications for the GMP343 are CO₂ soil respiration measurement, ambient CO₂ monitoring and plant growth chambers. The product can also be used for different custom applications. More of GMP343 probe's measurement applications are described in a separate article in this issue of Vaisala News. ●

Figure 1. The structure of the GMP343

