



# WHITE PAPER

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CO<sub>2</sub> MONITORING FOR  
GREENHOUSE APPLICATIONS

## Introduction

The levels of carbon dioxide in combination with temperature, humidity, and light intensity are the most important factors for the quality and productivity of plant growth in greenhouses. Constant monitoring of these environmental parameters provides data to the grower to better understand how these factors affect growth and how to increase crop productiveness.

CO<sub>2</sub> is one of the key ingredients of photosynthesis, it is essential for plant growth. Monitoring CO<sub>2</sub> in a greenhouse allows optimisation of environmental conditions, resulting in more efficient plant growth and higher crop yield. Different plants need different levels of CO<sub>2</sub> in the air to maximise development.

## CO<sub>2</sub> and photosynthesis

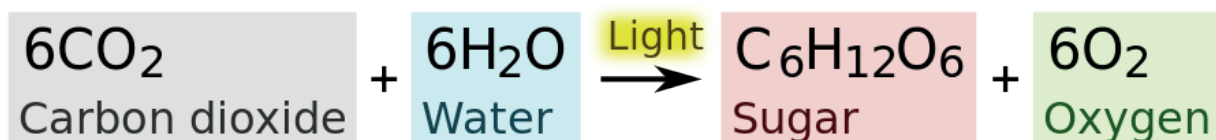
Carbon dioxide (CO<sub>2</sub>) is a natural gas, in high concentrations, it is dangerous for humans, but essential for plant development.

Photosynthesis is the process which involves a chemical reaction between water and carbon dioxide (CO<sub>2</sub>) in the presence of light to make sugars for plants, and as a by-product releases oxygen in the atmosphere. Carbon dioxide is a colourless and odourless gas in the atmosphere but has an important role in sustaining life.

The plant growth rate is greatly influenced by the CO<sub>2</sub> concentration in the greenhouse, therefore CO<sub>2</sub> levels need to be monitored and controlled for optimal development. The CO<sub>2</sub> concentration needed depends on the plant type, with the optimal growth level being 1 000 ppm (parts per million) for most crops.

Active photosynthesis can bring down the greenhouse CO<sub>2</sub> concentration to a level of 200 ppm, which is low enough to negatively impact the plant growth. Too low CO<sub>2</sub> level limits growth but a too high level of CO<sub>2</sub> is not beneficial either. Plants are more sensitive towards high CO<sub>2</sub> concentrations than humans and show damages like burnt leaves at elevated CO<sub>2</sub> levels.

Monitoring in greenhouses can be a difficult task to accomplish effectively and without wasting resources and time for installation and maintenance of the devices. Therefore IoT and wireless monitoring solutions offer a great alternative to the wired systems. Wireless sensors can provide 24/7 remote monitoring for a variety of parameters including CO<sub>2</sub>.



### Things to remember:

- Increase in photosynthesis results in increased growth rates and biomass production.
- If CO<sub>2</sub> levels are monitored and adjusted plants have an earlier maturity and more crops can be harvested annually. The decrease in time to maturity can help in saving heat and fertilization costs.
- Never allow CO<sub>2</sub> to exceed plant requirements. Have an alert system when CO<sub>2</sub> level reaches 2 000 ppm and below 200 ppm;
- Always monitor the CO<sub>2</sub> levels through sensors and adjust to the required level.
- In addition monitor growing condition like lighting, temperature and humidity to make CO<sub>2</sub> monitoring more effective.

### Wireless CO<sub>2</sub> monitoring

Wireless monitoring solutions consist of base stations with a connectivity to the cloud or built-in local web servers for data storage and analysis and wireless sensors that measure different environmental parameters such as CO<sub>2</sub>.

Applying sensors in greenhouses provides constant monitoring of the chosen parameters. Wireless monitoring solutions offer centralized critical real-time data gathering and the ability to use software for data viewing, analysis and comparison any time from any device.

Operating costs associated with monitoring are going down thanks to wireless sensors technologies that help make installation process easy, quick and cost-effective – no

extensive planning or preparation needed. In addition, wireless sensors can send alerts when certain parameter thresholds have been crossed. Thus informing to take preventive action and avoid damage related to unforeseen circumstance.

The Internet of Things technologies offer wireless sensors that can function up to 2 years without battery replacement and can provide multiple kilometre receiving range that allows sensors to be deployed within large areas.

Compared to the cabled systems, the installation wireless monitoring systems are fast, affordable and easy. Moreover, it is easy to relocate the measurement points when needed by just moving sensors from one location to another within a communication range of the base station.

It has never been easier and more cost-effective to implement industrial IoT solutions!

### Features and benefits for wireless monitoring systems:

- Easy and quick installation;
- Affordable full solution systems;
- 2-year sensor battery life;
- At least 3km/1.9mi line-of-sight receiving range;
- 100 sensors per base station;
- 24/7 monitoring;
- Text message or e-mail alert functionality;
- Real-time data readings;
- Advanced data analysis software;



Get started today! IoT wireless monitoring systems are an affordable, easy and time-saving way to monitor greenhouse environment.

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