

ROTRONIC APPLICATION NOTE

Application note: N° F034

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Greenhouse

Facts & figures:

One of the largest greenhouses in the world is in Almeria, Spain where greenhouses cover almost 50000 acres (200km²)

In the Netherlands, greenhouses occupy 0.25% of the total land area.

The Netherlands has around 9000 greenhouse enterprises that operate over 10000 hectares of greenhouses and employ some 150000 workers: 80% of the manufactured produce is exported.



Greenhouses in general

CO₂ is necessary for photosynthesis and thus essential for the growth of plants.

ent plants need different levels of CO₂ concentration to maximise development.

Efficient CO₂ monitoring can optimise the growing period and increase profits. Differ-

Why the need to measure CO₂?

It is essential to monitor the CO₂ value in greenhouses at all times because different plants have different needs. C3 plants cannot store all the CO₂ and transpires more as their stomata's are open all the time. C4 is another kind of plants and these plants can store the CO₂ in its environment so they do not need to keep their stomata's open. The third type of plant, the CAM plants, can only take up CO₂ at night because their stomata are closed during the day.

It is important to have effective control of the ventilation for the growing plants to utilise the CO₂ to maximum effect without risk of damage. Generally, the best effect is to distribute CO₂ to young plants and mother plants regularly and for all plants for a short period during spring. If the plant is sensitive it is extremely important to have pure CO₂, to prevent damage. Up to 1 000 ppm CO₂ is estimated as a good level.

If the levels of CO₂ are too high in the greenhouse, plants can be damaged. One cause is they protect themselves by closing their stomata more than normal, which can

result in damage to the plant in warm periods. The content of CO₂ varies considerably over 24 hours. The reason why levels as high as 500 to 1000 ppm is dependent on plant respiration which is usually higher during the night, regardless of the type of plant.

How does it work?

If all plants have the same conditions (including the CO₂ level) it increases the chances to harvest all at once and get similar results. The annual consumption of CO₂ in a greenhouse is about 5 - 10 kg/m², only in exceptional cases does it take more. Profit Effects of CO₂ vary considerably. With tomato and cucumber it can obtain 8-10% higher return. According to Crooks Hanks, M., Taylor, G. and Dolan, L., studies demonstrated that plants CO₂ enriched produced more biomass than other plants. The fortified plants put their new biomass into the root, to be able to develop faster and become stronger specimens and contribute to the plant's reproduction.

Discussed in this edition:

Greenhouses in general	1
Why the need to measure CO ₂ ?	1
What solution can Rotronic offer?	2
Rotronic products	2
Customer benefits	2
Contact us	3

What solution can Rotronic offer?

Rotronic offers a wide range of fix-mounted CO₂ only and CO₂ temperature transmitters. All of them are based on the principle of NDIR technology. They are pre-calibrated and have a life-

time of over 15 years under normal conditions. Multiple analogue outputs like current loop, voltage and relay contact allow for the easy adaptation to every application. A major advantage of the cur-

rent sensor is the stability of the measurement over the entire temperature range, whereas some sensors are temperature dependant, Rotronic remains stable.



CF3 duct mount transmitter

Rotronic products:

Transmitter:

- **CF3 series**
0...2000ppm or 0...5000ppm,
±30ppm, ±3% of reading
Optional display,
IP54
- **CF8 series**
0...2000ppm or 0...4000ppm,
±30ppm, ±3% of reading or
±300ppm, ±3% of reading
Optional display,
IP54,
Optional visual alarm,
Optional relay,
Optional CO measurement,
Optional temperature measurement,

Hand held device:

- **CP11**
Measurement of CO₂, temperature and relative humidity,
-20...60°C,
±0.3K,
0.1...99.9%rh,
±2.5%rh,
0...5000ppm,
±30ppm, ±5% of measured value,
Data logging function (18000 values) with time stamp.

Calibration:

- **CO2 calibrator**
Neutralises CO₂ from the air,
Cleanness: 20-25ppm CO₂ gas flow out,
Reaction time: 90 seconds to neutralise CO₂
Operating range: 0...45°C,
Delivered with 10 soda lime cartridges.



CF8-D/W-IN transmitter

Customer benefits:

Accuracy and long term stability

Choosing Rotronic gives you the best accuracy on the market.

The Rotronic CO₂ sensors can easily be calibrated, to guarantee highest possible precision of the measured concentration.

Calibration

The ABC function automatically avoids baseline drift. A calibration and adjustment is carried within a user defined time where the lowest value is automatically calibrated at 400ppm. Optionally

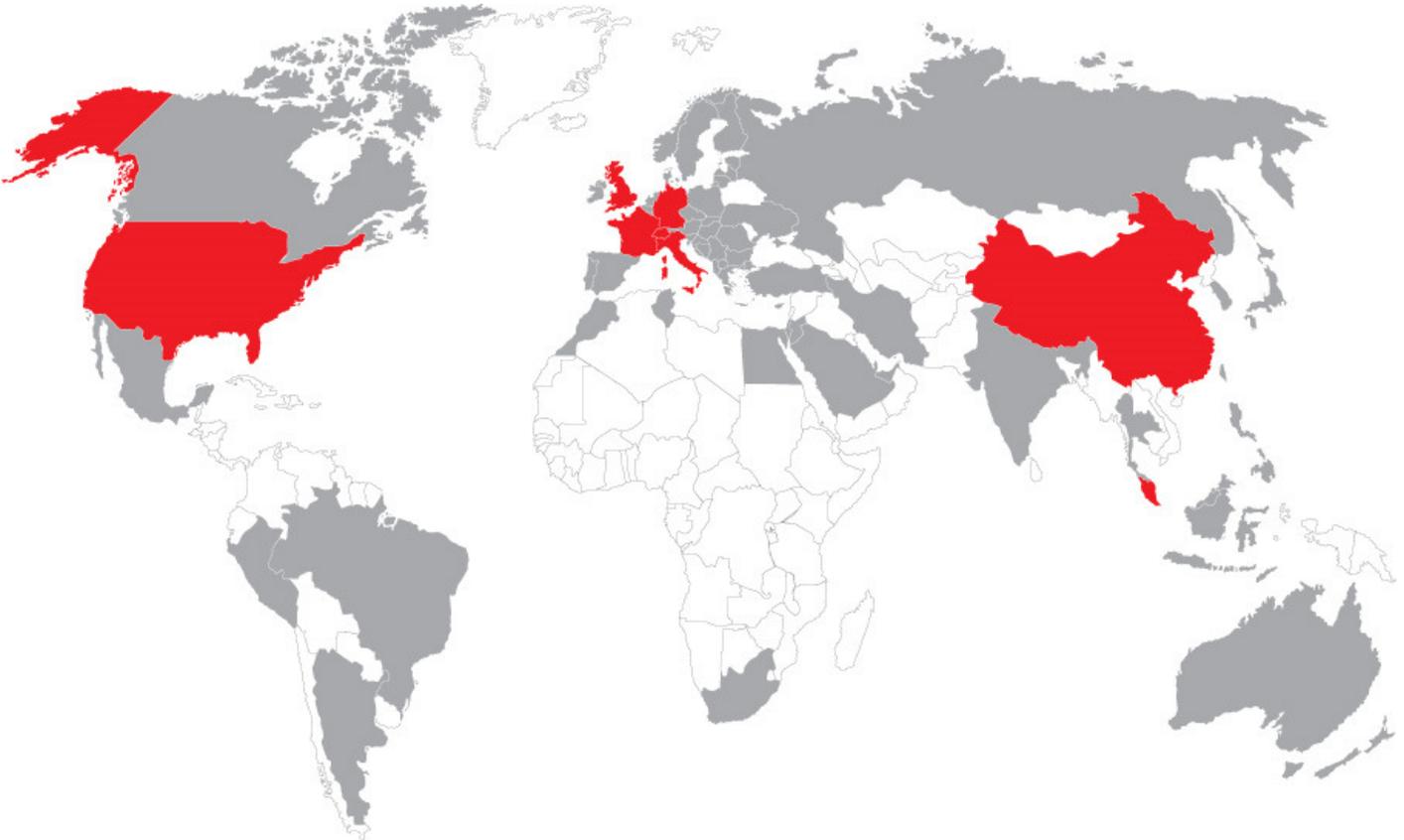
a 0ppm calibration unit is available from Rotronic.



CP11 handheld device with the 0-calibration unit

Contact us:

Rotronic is represented in more than 40 countries around the world. An up to date list of all our partners is available at www.rotronic.com



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