

## Mushroom farming

### Facts & figures:

China supplies over 45% of the total world output of mushrooms, followed second by the USA with 10%.

Over twenty species of mushroom are commercially cultivated.

### Mushroom Farming in general

*The growing cycle in a mushroom farm takes about 13 weeks and consists of seven steps.*

*First you make compost which is then heated up. In the third step the compost is mixed with mushroom spawns and put on trays. The trays are then cased with a layer of peat.*

*In step five the first mushrooms appear and when the growing step is complete they are handpicked and weighed. After harvesting the compost is re-used in garden mulch as an example.*



### Why the need to measure CO<sub>2</sub>?

The value of carbon dioxide in the air is very important for growth in mushroom farms. Thanks to measurement of the CO<sub>2</sub> concentration we can adjust for the optimal rate of growth. Different CO<sub>2</sub> values also make the mushrooms incubate in different ways. One specific concentration makes the mushrooms grow wider, while another makes them higher.

Both temperature and humidity must also be controlled during mushroom growth, depending on the different growth stages. The values for the CO<sub>2</sub>, temperature and RH are individual for different mushroom types.

#### How does it work?

CO<sub>2</sub> is a normal product of fungi metabolism and it's one of the most important factors determining high quality and yield of edible fungi (e.g. button mushrooms). During the growth phase of the mushroom spawn a high concentration (10 000 to 20 000 ppm) of carbon dioxide is required.

When the mushroom growth becomes visible CO<sub>2</sub> concentrations of 800 to 1500 ppm is an optimum level for growth and development, however there are some differences among the fungi types and the different stages of growth.

The details should be indicated by the producer of the mycelium. Generally, at CO<sub>2</sub> concentrations of less than 800 ppm, fungus are too small and numerous. Above 2000 ppm, the quality of the mushrooms is poor (the stem is too long and the cap is too small). At CO<sub>2</sub> concentrations of 4000-5000 ppm mushroom development is inhibited. New mycelium begins to grow if the CO<sub>2</sub> concentration is higher than 5000 ppm.

#### Reduced costs

Mushrooms that do not meet the quality requirements get discarded. When not controlling the CO<sub>2</sub> concentration in the air the quality yield becomes poorer and for that reason it is more cost-effective to have control about the mushrooms' growth. Better control of the growing process of the mushrooms requires fewer resources to maintain.

#### Discussed in this edition:

- Mushroom farming in general **1**
- Why the need to measure CO<sub>2</sub>? **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 CO<sub>2</sub> only and CO<sub>2</sub> 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



CF8-W-Disp-GH 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 CO<sub>2</sub>, 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:

- **CO<sub>2</sub> calibrator**  
Neutralises CO<sub>2</sub> from the air,  
Cleanness: 20-25ppm CO<sub>2</sub> gas flow out,  
Reaction time: 90 seconds to neutralise CO<sub>2</sub>  
Operating range: 0...45°C,  
Delivered with 10 soda lime cartridges.

## Customer benefits:

### Accuracy and long term stability

Choosing Rotronic gives you the best accuracy on the market.

The Rotronic CO<sub>2</sub> 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.

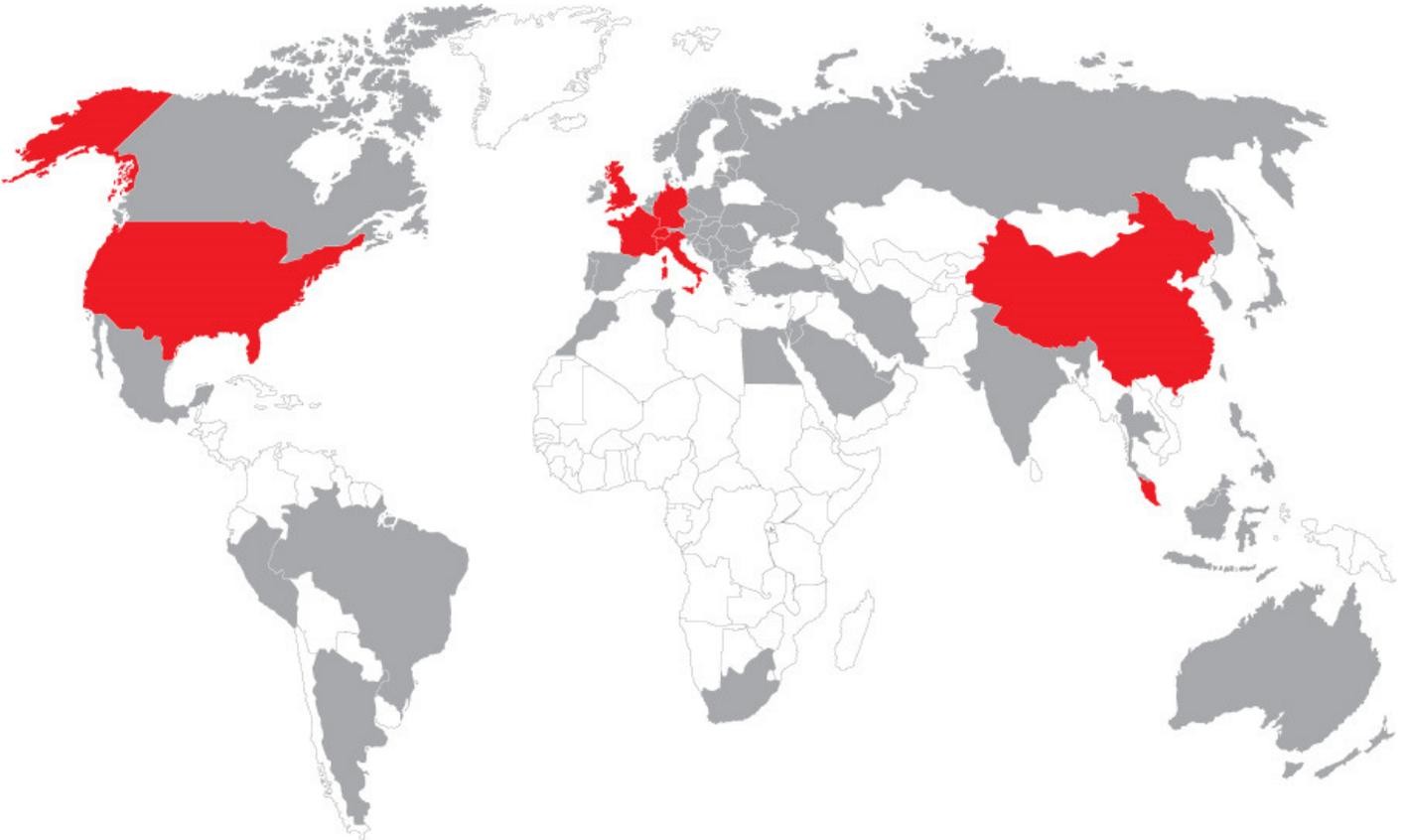


CP11 handheld device with the 0-calibration unit



## 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](http://www.rotronic.com)



### SWITZERLAND

#### ROTRONIC AG

Grindelstrasse 6,  
CH-8303 Bassersdorf  
Phone: +41 44 838 11 44  
Fax: +41 44 837 00 73  
[www.rotronic-humidity.com](http://www.rotronic-humidity.com)

### FRANCE

#### ROTRONIC Sarl

56, Bld. De Courcerin,  
F-77183 Croissy-Beaubourg.  
Phone: +33 1 60 95 07 10  
Fax: +33 1 60 17 12 56  
[www.rotronic.fr](http://www.rotronic.fr)

### SINGAPORE

#### ROTRONIC South East Asia Pte Ltd

16 Kallang Place #07-04  
Singapore 339156  
Phone: +65 6294 6065  
Fax: +65 6294 6096  
[www.rotronic.com.sg](http://www.rotronic.com.sg)

### GERMANY

#### ROTRONIC Messgeräte GmbH

Einsteinstrasse 17-23  
DE-76275 Ettlingen  
Phone: +49 7243 383 250  
Fax: +49 7243 383 260  
[www.rotronic.de](http://www.rotronic.de)

### UK

#### ROTRONIC Instruments UK Ltd.

Crompton Fields, Crompton Way  
Crawley, West Sussex, RH10 9EE  
Phone: +44 1293 57 10 00  
Fax: +44 1293 57 10 08  
[www.rotronic.co.uk](http://www.rotronic.co.uk)

### ITALY

#### ROTRONIC Italia srl

Via Repubblica di San Marino, 1  
I-20157 Milano (MI)  
Phone: +39 02 39 00 71 90  
Fax: +39 02 33 27 62 99  
[www.rotronic.it](http://www.rotronic.it)

### USA

#### ROTRONIC Instrument Corp.

Suite 150, 135 Engineers Road,  
Hauppauge, NY 11788  
Phone: +1 631 427 38 98  
Fax: +1 631 427 39 02  
[www.rotronic-usa.com](http://www.rotronic-usa.com)

### CHINA

#### ROTRONIC Shanghai Rep. Office

2B, Zao Fong Universe Building, No. 1800  
Zhing  
Shan West Road, Shanghai 200233  
China  
Phone: +86 21 644 03 55  
Fax: +86 21 644 03 77  
[www.rotronic-humidity.cn](http://www.rotronic-humidity.cn)