

# ROTRONIC APPLICATION NOTE

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## Energy Efficiency and Indoor Air Quality with Temperature and Humidity control

### Facts:

*Energy Efficiency (EE) refers to either the reduction of energy inputs for a given service or the enhancement of a service for a given amount of energy inputs.*

*Relative humidity is highly temperature dependent, so if the temperature is stable, so are the relative humidity levels.*

*Air in our atmosphere is a mixture of gases with very large distances between molecules. Therefore, air can accommodate a large quantity of water vapor. The warmer the air, the more water vapor can be accommodated.*

Key factors for energy efficiency in indoor applications are the control of Relative Humidity (RH) and temperature levels. The question is, how to achieve acceptable RH levels in an energy efficient manner. Energy efficient humidity control has a very strong bearing on thermal comfort, Indoor Air Quality (IAQ) and eventually on the health and performance of occupants in air-conditioned buildings.

IAQ seeks to reduce Volatile Organic Compounds (VOCs), and other air impurities such as microbial contaminants. As such it is important for the IAQ to control the

relative humidity which may lead to mould growth and promote the presence of bacteria and viruses as well as dust mites and other organisms and microbiological concerns.

Buildings rely on a properly designed ventilation system to provide adequate ventilation of cleaner air from outdoors or recirculated, filtered air as well as isolated operations from other occupancies.

Air-conditioning system designs typically employ a high level of recirculation rates in cooling and dehumidification. Typical recirculation rates are in the order of 80-

90% and sometimes even higher. The challenge is not so much in being able to dehumidify but do so without having to overcool. Thus, ventilation is integrated into a general comfort and economical savings approach.

Building technology is designed for certain room conditions including temperature, humidity, brightness, noise and air flow. Careful engineering and implementation of building automation and control is the only way to achieve energy efficient and building operation conditions are met during occupancy at the lowest possible energy costs.



## Why the need to measure CO<sub>2</sub>, temperature and relative humidity?

### Discussed in this edition:

- Energy efficiency and IAQ with temperature and humidity Control **1**
- Why the need to measure CO<sub>2</sub>, temperature and relative humidity? **1**
- What solutions can Rotronic offer? **2**
- Rotronic Products **2**
- Customer benefits **2**
- Contact us **3**

It is with precise temperature control of the supply of air to rooms, where the temperature is defined so that a certain comfort range can be guaranteed, at the lowest possible energy consumption. The room temperature should be held constant to the applicable set point in the given condition.

The temperature transmitters installed in the supply air duct are compared to this measured value with the supply air set point. A constant room temperature can result if there is little or no heat gain in the room. Supply air temperature control can be used where the air handling unit is primarily used for air renewal and room temperature control.

It is with good RH control that we can process the air for air conditioned rooms independent of the state of outside air and the processes in the room. This way the RH remains constant or within the pre-set limits and thus energy consumption for humidification and dehumidification is minimized.

Air conditioning is supposed to maintain room temperature and RH as precisely as possible, it is possible through the use of temperature and RH controlling and monitoring system in the room (or in the extract for air) to be conditioned. With precise control of temperature and humidity measurement, Energy consumption for humidification & dehumidification

as well as thermal energy use for heating and cooling is attained.

Room air quality with changing occupancy in buildings and rooms, can improve comfort and minimize energy consumption.

Room air quality is influenced by demand-controlled transport of outside air. The CO<sub>2</sub> content of the room can be a good indicator for the room air load caused by humans.

With CO<sub>2</sub>, RH and temperature measurement it is possible to implement energy efficient building operation conditions with the lowest energy costs.

## What solutions can Rotronic offer?

Rotronic offers a wide range of CO<sub>2</sub>, temperature and humidity transmitters.

All of the CO<sub>2</sub> transmitters are based on the principle of NDIR technology.

A major advantage of the current sensor is the stability

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

Relative humidity is measured with a capacitive sensor: the HygroMer IN-1. This thick-film sensor, with the

best long term stability on the market is ideal for BMS / HVAC applications.

All transmitters offer multiple analogue outputs like current loop, voltage and relay contact to allow an easy adaptation to every application.



CF3-W-EU-Disp transmitter



HF3 wall mount transmitter

## Rotronic products:

### Humidity and temperature probes:

- **HC2-S**  
Standard humidity sensor  
-50...100 °C, 0...100 %rh,  
±0.8 %rh and ±0.1 K
- **HC2-IC402**  
-100...200 °C, 0...100 %rh,  
Ø15 mm ±0.8 %rh and ±0.1 K
- **HC2-IC402-A**  
-100...200 °C, 0...100 %rh,  
Ø15/25 mm, ±0.8 %rh and  
±0.1 K

### Transmitters:

- **HF1 series**  
0...50 °C, 5...95 %rh ±3 %rh  
and ±0.3 K  
Various analogue outputs  
Display...
- **HF5 series**  
For interchangeable probes,  
various analogue and digital  
outputs, display, all psychro-  
metric calculations available...
- **CF3 series**  
0...2000ppm or 0...5000ppm,  
±30ppm, ±3% of reading  
Optional display
- **HF3 series**  
-40...60 °C, 0...100 %rh ±2 %rh  
and ±0.3 K  
Various analogue outputs  
Display...

## Customer benefits:

### Accuracy:

Choosing Rotronic products gives you the best accuracy on the market.

Precise temperature and humidity measurement enables the ventilation units to work at their maximum performance

### Communication:

Networking with Rotronic is an easy affair! With the wide range of communication interfaces available, from conventional analogue out-

put signals to USB, RS-485, Wireless and Ethernet RJ-45, Rotronic can provide the required interface to your DDC control system, or any third party monitoring system.

### Long term stability:

With long term sensor stability of under 1 %rh per year (depending on the environment), Rotronic offers the possibility to "plug & play": install the device and leave it. We would recommend regular spot checks between

multi-point calibrations.

### Calibration:

Rotronic offers a factory calibration certificate, and SCS certificate if required. The portable HygroGen2 temperature & humidity calibrator as well as traceable unsaturated humidity salts are available for on-site calibration. All HygroClip2 probes can be set with two fixed %rh / °C values to validate the loop to the controller.



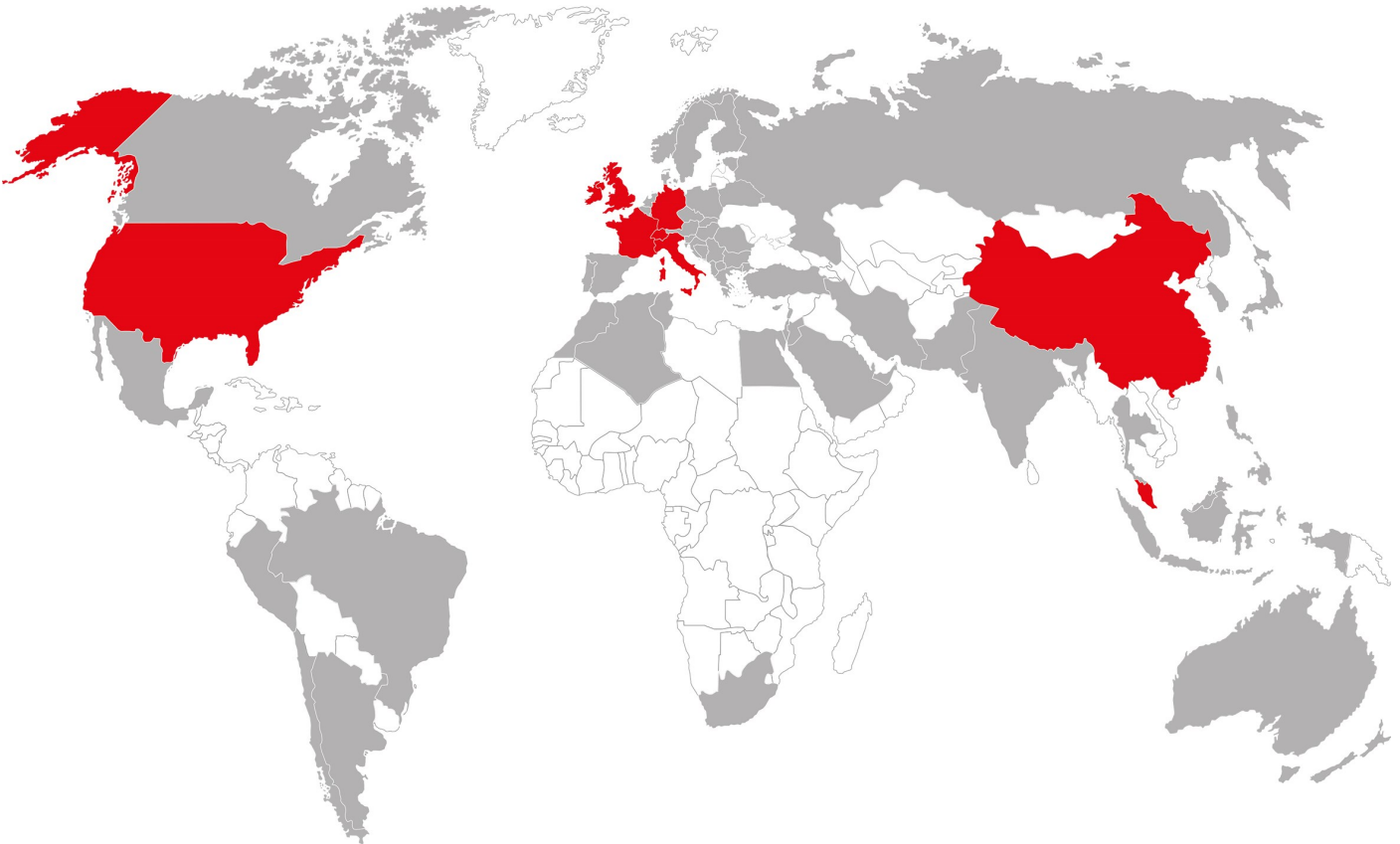
HF1 space mount transmitter



HF5 wall mount transmitter

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



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