

## User manual

# CF8-W-Disp-AL

## CO<sub>2</sub> transmitter with two relays prepared for Modbus communication protocol

### General

The IAQ-sensor product *CF8-W-Disp-AL* is used to measure indoor air carbon dioxide concentration in rooms. It is flexible controller with programmable output for relay control of e.g. mixed air dampers, humidifier and fans. The measured values are shown on the display. The sensor is designed for wall mounting.

The unit is designed for connecting to Direct Digital Control (DDC). The linear output functions are pre-programmed as CO<sub>2</sub> transmitters with jumper selected outputs. The measuring ranges can be modified from a PC (Windows) and use of the software UIP (version 4.3 or higher) together with the RS232 communication cable.



*Figure 1 CF8-W-Disp-AL for wall mounting*

## Functional description

*This part describes the function of the standard configuration of CF8-W-Disp-AL. It may be re-programmed before or after the installation by a PC and the standard UIP software (version 4.3 or higher).*

Out(1) = measuring signal of carbon dioxide concentration 0-4 % CO<sub>2</sub>

Out(2) = measuring signal of carbon dioxide concentration 0-4 % CO<sub>2</sub>

OUT3 = ON/OFF signal of demand of air quality

OUT4 = ON/OFF signal of demand of air quality

The opening of the relay is controlled by the hysteresis of the relay. See figure 4.

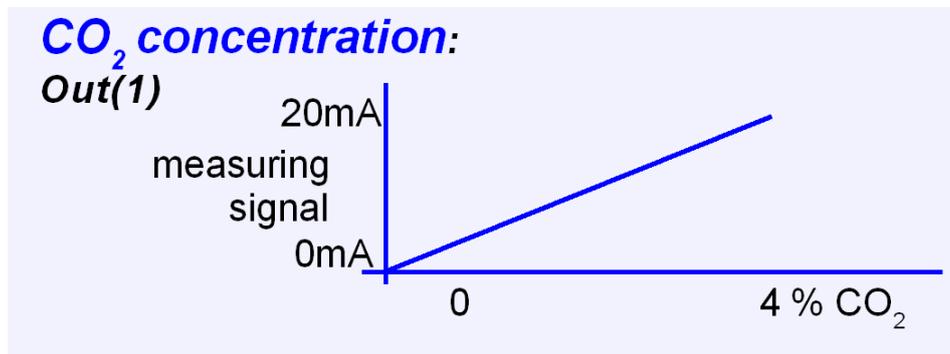


Figure 2 The measuring signal of carbon dioxide.

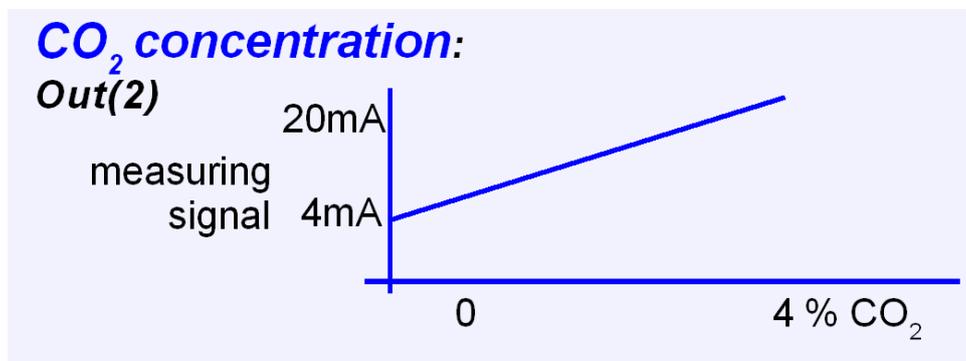


Figure 3 The measuring signal of carbon dioxide

Terminal	Default Output	Default Output Range	Outputs of this sensor	Output Range of this sensor
OUT1	0-20 mA	0-4 % CO <sub>2</sub>		
OUT2	4-20 mA	0-4 % CO <sub>2</sub>		
Relay 1	Closed Open	> 1,5 % CO <sub>2</sub> < 1,4 % CO <sub>2</sub>		
Relay 2	Closed Open	> 3,0 % CO <sub>2</sub> < 2,9 % CO <sub>2</sub>		

Table I. Default output configurations for CF8-W-Disp-AL

## Formulas for calculation of output values

Configuration	Output Range	Formula for calculation
0-10 VDC	0-4 % CO <sub>2</sub>	CO <sub>2</sub> value = Volt/10*4
2-10 VDC	0-4 % CO <sub>2</sub>	CO <sub>2</sub> value = (Volt -2)/8*4
4-20 mA	0-4 % CO <sub>2</sub>	CO <sub>2</sub> value = (mA-4)*4/16
a-b	c-d	Value = (reading-a)/(b-a)*(d-c)+c
		a = lowest value of the configuration b = highest value of the configuration c = lowest value of the range d = highest value of the range

Table II. Calculation of CO<sub>2</sub> value for CF8-W-Disp-AL

## Output Configurations

If other options are needed for the application, the output jumpers have to be configured before the unit is powered up. Each jumper selection is independent from the others, except for the "Start point selection" jumper, which affects both, Out(1) & Out(2), linear outputs. Alternative measuring ranges of the outputs can be selected with the software UIP (version 4.3 or later).

Jumper	Position	Function
Start point selection jumper	0%	Jumper top position provides 0Vdc or 0mA start point for Out(1), Out(2) (0-20mA or 0-10V).
	20%	Jumper bottom position provides 2Vdc or 4mA start point for Out(1), Out(2) (4-20mA or 2-10V).
Communication selection jumper	MB	Jumper at top position provides Modbus communication protocol
	SA	Jumper at bottom position SenseAir communication protocol
Out(1)	Current	Connection in position "Current" provides 0/4-20mA output range for Out(1).
	Voltage	Connection in position "Voltage" provides 0/2-10VDC output range for Out(1).
Out(2)	Current	Connection in position "Current" provides 0/4-20mA output range for Out(2).
	Voltage	Connection in position "Voltage" provides 0/2-10VDC output range for Out(2).

Table II. Configuration jumpers for CF8-W-Disp-AL

## FUNCTIONAL TEST of CO<sub>2</sub> Sensor **CF8-W-Disp-AL**

The unit has three LED's – one yellow and two red – to indicate the status of the controller.

*Yellow LED* - "Call for maintenance" is lit, if an error flag is set or the measurement is out of range. This information is also shown on the display by the wrench icon.

*Left red LED* - "the relay1 is actuated" is lit, when Out(3) (relay1) is actuated (closed).

*Right red LED* - "the relay2 is actuated" is lit, when Out(4) (relay2) is actuated (closed).

A simple and visual functional test can easily be performed. Take a breath and blow the air from a distance of a few centimetres on the sensor. The sensor will detect a rapid increase in the carbon dioxide concentration. The red LEDs are lit when the CO<sub>2</sub> concentration passes the pre-set values.

### Self-diagnostics

The system contains complete self-diagnostic procedures. A full system test is executed automatically every time the power is turned on. In addition, constantly

during operation, the sensor probes are checked against failure by checking the valid dynamic measurement ranges. All EEPROM updates, initiated by the sensor itself, as well as by external connections, are checked by subsequent memory read back and data comparisons. These different system checks return error bytes to the system RAM. The error codes are available by connecting a PC with a special RS232 cable connected to the UART port slide connector. The error codes are shown in the software UIP (version 4.3 or later). *Warm up* and *Out of Range* are the only bits that are reset automatically after return to normal state. All other error bits have to be reset manually after return to normal by power off/on.

The yellow LED flashes if an error has been detected. If a fatal error has been detected the yellow LED is lit.

## Error code and action plan

Bit #	Error code	Error description	Suggested action
0	N/A	<b>Fatal Error</b>	Try to restart sensor by power OFF/ON. Contact local distributor
1	2	Reserved	
2	4	<b>Algorithm Error.</b> Indicate wrong EEPROM configuration.	Try to restart sensor by power OFF/ON. Check detailed settings and configuration with UIP software version 4.3 and higher. Contact local distributor.
3	8	<b>Output Error</b> Detected errors during output signals calculation and generation.	Check connections and loads of outputs. Check detailed status of outputs with UIP software version 4.3 and higher.
4	16	<b>Self-Diagnostic Error.</b> May indicate the need of zero calibration or sensor replacement.	Check detailed self-diagnostic status with UIP software version 4.3 and higher. Contact local distributor
5	32	<b>Out of Range Error</b> Accompanies most of other errors. Can also indicate overload or failures of sensors and inputs.  Resets automatically after source of error disappearance.	Try sensor in fresh air.  Check detailed status of measurements with UIP software version 4.3 and higher.  <i>See Note 1!</i>
6	64	<b>Memory Error</b> Non-fatal error during memory operations.	Check detailed settings and configuration with UIP software version 4.3 and higher.
7	128	<b>Warm Up state</b> Is always set after power up or power failure. Resets after restart sequence.	If it doesn't disappear in half a minute, check power stability.

**Note 1.** Any probe is out of range. Occurs, for instance, during over exposure of CO<sub>2</sub> sensor, in which case the error code will automatically reset when the measurement values return to normal. Could also indicate the need of zero point calibration.

**Remark:** If several errors are detected at the same time the different error code numbers will be added together into one single error code!

**PLEASE NOTE! The sensor accuracy is defined at continuous operation (at least 3 weeks after installation)**

## Maintenance

The *CF8-W-Disp-AL* is basically maintenance free. An internal self-adjusting calibration function takes care of normal long term drift associated to the CO<sub>2</sub> sensor. To secure the highest accuracy, a time interval of five years is recommended between CO<sub>2</sub> calibrations, unless some special situations have occurred. A zero calibration can be performed by use of pure nitrogen or air that has passed through a chemical absorber and a PC together with the *UIP software version 4.3* (or higher). The Zero Calibration Bag can be used to produce carbon dioxide free air. The software can be free downloaded from [www.rotronic.com](http://www.rotronic.com). The RS232-cable and the zero calibration bag can be ordered from Rotronic. The cable is to be connected to the UART port slide connector. For change of control parameters and re-calibration of CO<sub>2</sub> this PC tool has to be used. The check can be done on site without interfering with the ventilation system.

### **This is for sensors with measuring ranges between 0-3000 ppm and 0-4%:**

When a zero calibration shall be executed a plastic tube with 2.2 mm outer diameter and 0,8 mm inner diameter shall be inserted in marked holes of the sensor. Plastic tubing is connected to the tube. The gas flow should be between 0.3 and 1.0 l/min.

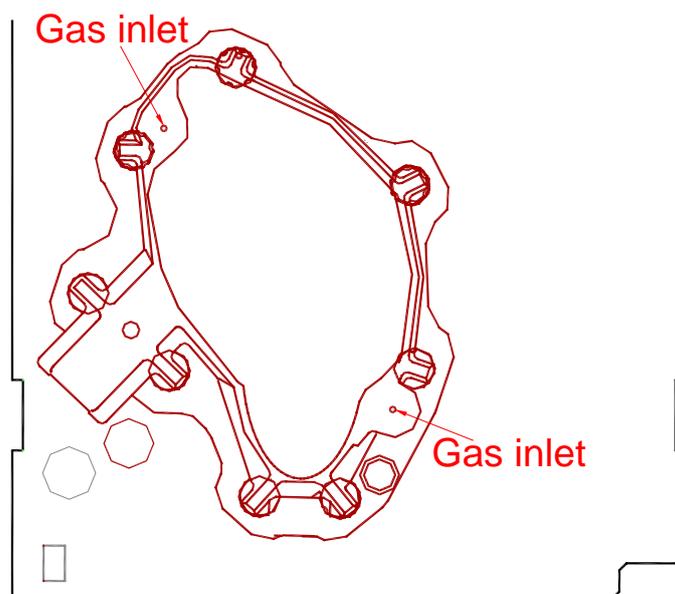


Figure 4 Part of the PCB with holes for gas inlets marked.

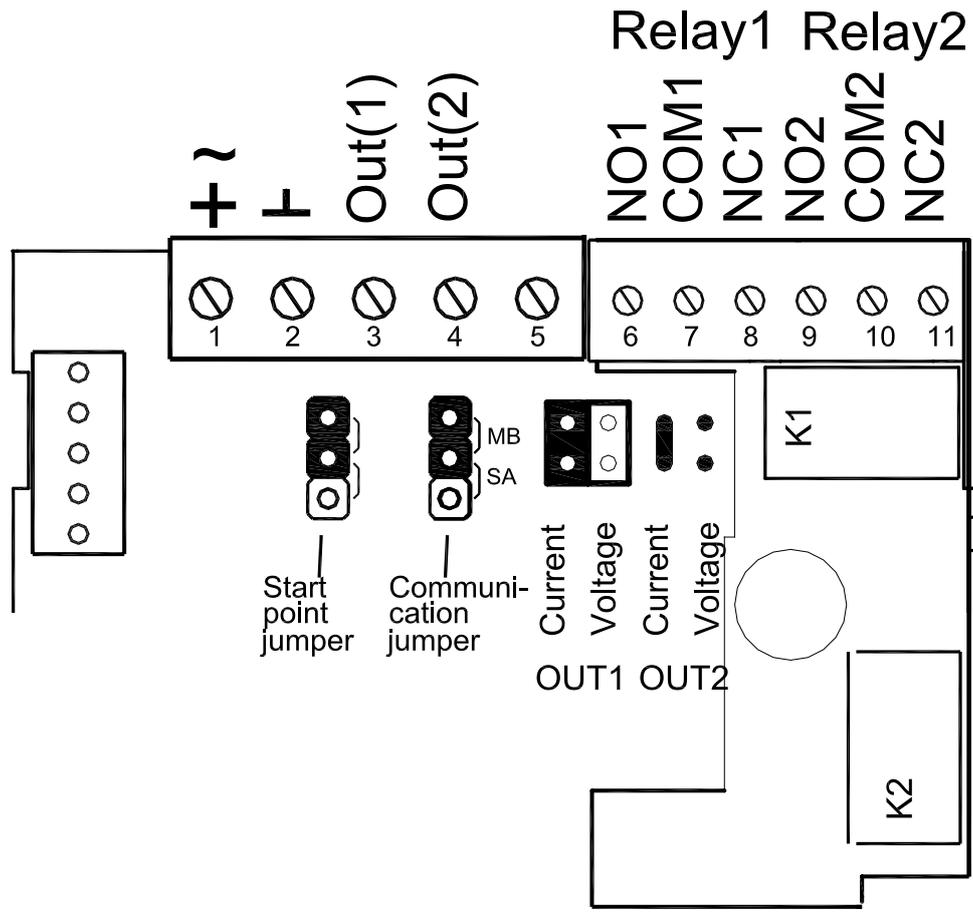


Figure 5 The CF8-W-Disp-AL printed circuit board with the terminal area enlarged at right. The darker positions are default settings. Communication protocol is set with communication jumper Upper position Modbus communication protocol

This product is in accordance with the EMC 2004/108/EC, 92/31/EEG including amendments by the CE-marking Directive 93/68/EEC

The product fulfils the following demands:

EN 61000-4-2 level 2, EN 61000-4-3 level 2,

EN 61000-4-4 level 4, EN 61000-4-6, EN 61000-4-8 level 4, EN 55022 class B

