# Product Specification

model

## $CO_2$ Engine™ K22-PWM


edition 2/2000
Date of issue: 2007-04-26

***$CO_2$ ENGINE™*** *model* ***K22-PWM*** *is a $CO_2$ sensor module designed to be built-in into stationary ventilation equipment, such as window vent or duct exhaust actuators, serving as a linear transmitter of $CO_2$. In spite of being based on reliable infrared gas sensing technology, and being very precise, the design is very cost efficient.*

## Functional Description

The unit is designed to run at 4.5 to 12 V stabilized supply voltages provided that load and line regulation of power supply is within +-5%.

During normal operation, the sensor module measures ambient gas $CO_2$ concentrations at two seconds intervals. Measured $CO_2$ concentration is filtered and is transmitted to the PWM Output. The PWM Output continues to keep the last valid value in the case of measurement fault detected.

# Technical Data *

## General Performance:

Storage Temperature Range ..... -30 to +70 °C
Operating Temperature Range ..... -5 to +60 °C
Operating Humidity Range ..... 0 to 95 %RH (non-condensing)
Operating Environment ..... Residential, commercial and light-industrial spaces
Lifetime expectancy ..... > 15 years
Conformance with standards ..... RoHS directive 2002/95/EG
*EMC Immunity*.... EN 61000-6-1:2001 *"… for residential, commercial and light-industrial environments"*
*EMC Emission*.... EN 61000-6-3:2001 *"… for residential, commercial and light-industrial environments"*
*EMC Tests*..... EN 61000-4-8 level 4, EN 61000-4-3 level 2, EN 61000-4-4 level 4, EN 61000-4-2 level 2, EN 55022 class B

## Mechanical Performance:

Dimensions ..... 6,5 x 6,0 x 3,5 cm (Length x Width x Height)
Conformance with standards ..... Mechanical shock test IEC 60068-2-27 Test Ea
..... Random vibration test IEC 60068-2-64 Test Fh
Vibration immunity Test severity .... IEC TR 60721-4-5 table 5: IEC 60721-3-5, Class 5M3 (3,6 gRMS)
*"Mechanical conditions in road vehicles in areas without well-developed road systems, light-weighted vehicles, tracked vehicles and self propelled machines, including installations in places which may be directly hit by flying stones"*
Random vibration Test severity ..... IED TR 60721-4-2 table 7: IEC 60721-3-2, Class 2M3 (3,2 gRMS)
*"Transportation in lorries, trailers and all other kinds of transportation in areas without well-developed road systems, by trains with shock reducing buffers and by ships",*
..... IEC 60721-3-2, Class A (1,0 gRMS)
*"Instrumentation and automation equipment on ships"*

## Electrical Data:

Power Input ..... 4,5 to 12,0 VDC maximum rating[3] (without reverse polarity protection) stabilized to +-5% over load and line changes. Ripple voltage less than 50mV.
Current Consumption..... 40 mA average, < 300 mA peak current (~55 ms)
Electrical Connections..... Power (+), Ground (G0), PWM Output;
..... 3-pin 2,5mm pitch JST connector *B3B-EH-A*
Serial Data Communication ..... $I^2C$ bus; 2,5mm pitch footprint holes and Factory edge connector
Warm Up time to spec precision ..... 30 sec

## $CO_2$ Measurement:

Sensing Method ..... Non-dispersive infrared (NDIR) waveguide technology with ABC long term drift compensation
Sampling Method ..... diffusion
Measurement interval ..... 2 seconds
Measurement Range[2] ..... 0 to 2 000 $ppm_{vol.}$
Extended Measurement Range .... 2000 to 10 000 $ppm_{vol.}$ (digital readout only – accuracy not specified)
Calibration Adjustment Switch ..... Close @ fresh air (~400 ppm) restores calibration if S1 short cut > 2 seconds
Repeatability ± 40 ppm ± 1 % of measured value
Accuracy ..... (+-) 75 ppm + 5% of measured value
Pressure dependence..... +1,6 % of reading per kPa deviation from normal pressure @ 100 kPa

## PWM Output:

Electrical Characteristics ..... Open collector with series 120R resistor, 10kΩ pull-up resistor to power (+)
Minimum output concentration ..... 350 ppm
Output cycle period ..... 1004ms
Output high level min duration ..... 177.0ms (@ 350 ppm)
Output high level max duration ..... 1002ms (@ 2000 ppm)
Resolution ..... 0.5ms (@ 1 ppm)

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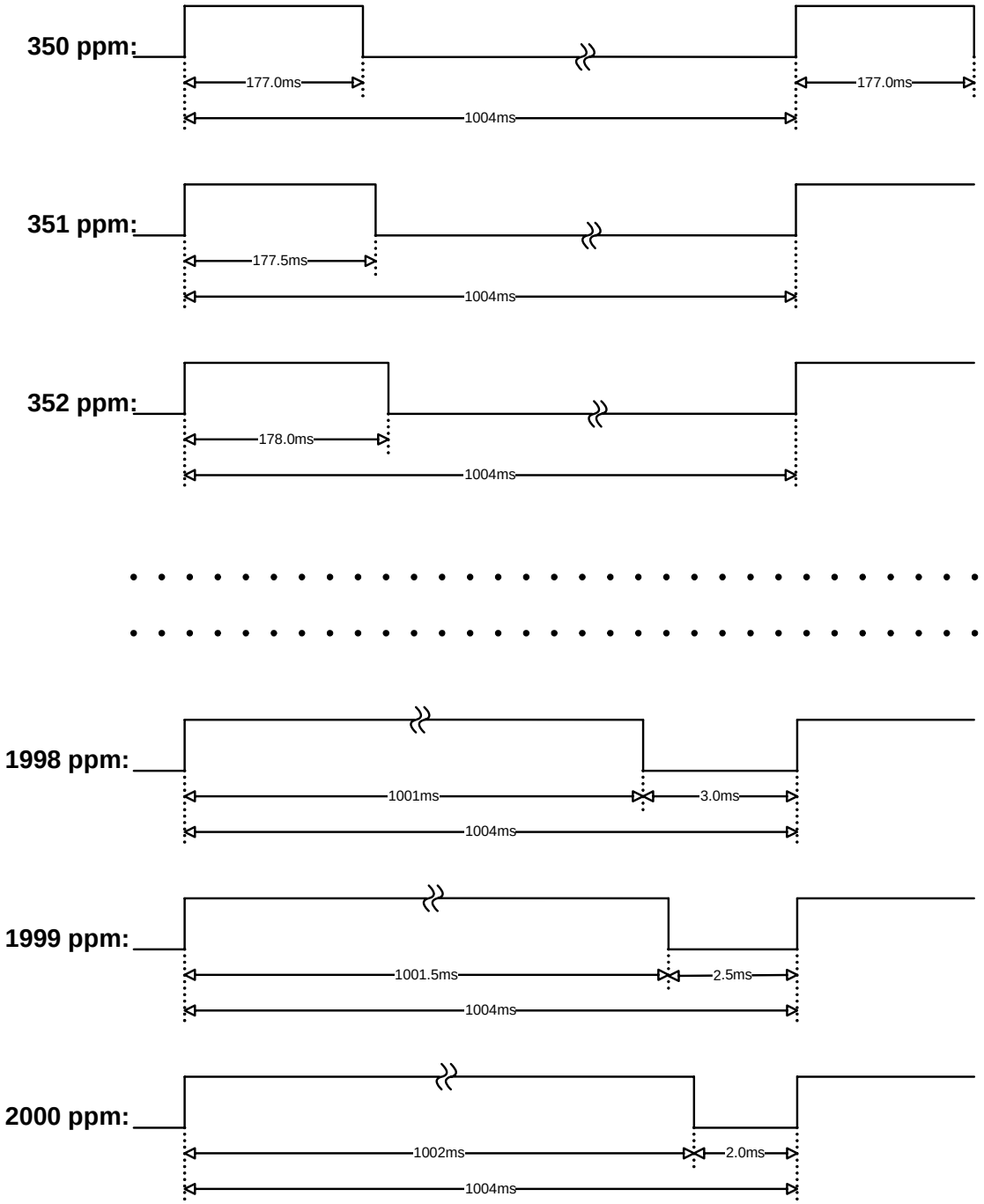
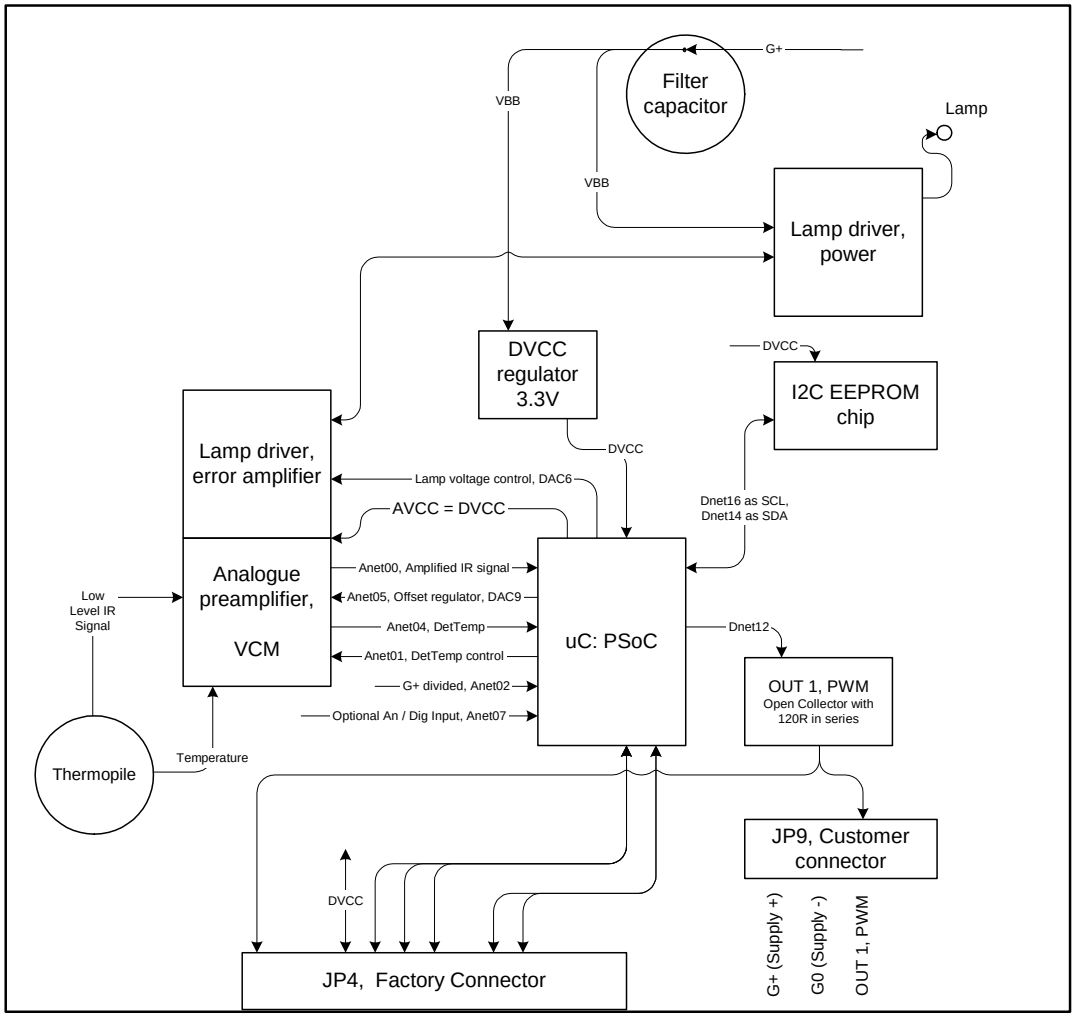
Note 1: Cannot exceed supply voltage. Output voltage is not defined at processor reset
Note 2: At sea level altitudes and normal pressures
Note 3: Notice that absolute maximum rating is 12V, so that sensor can't be used with 12V+-5% supply voltage.

* PATENT PENDING: *WO 2004/010116*

## Sensor PWM output timing diagram



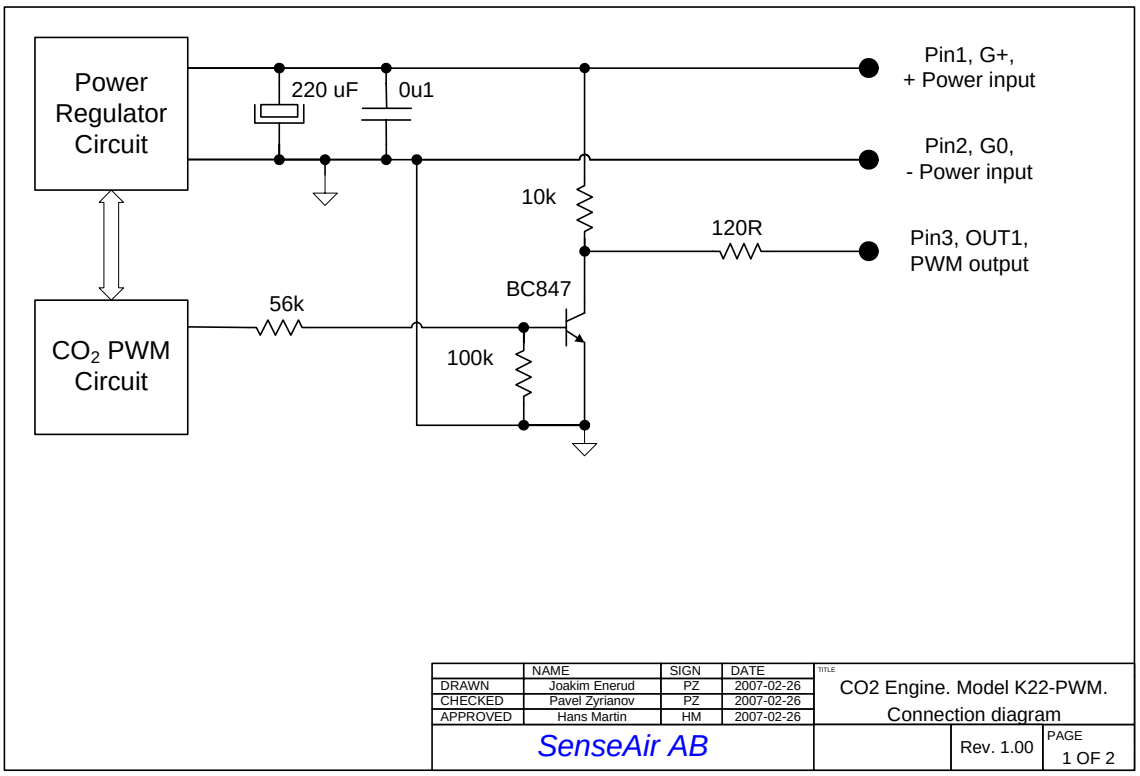
## Circuit functional diagram



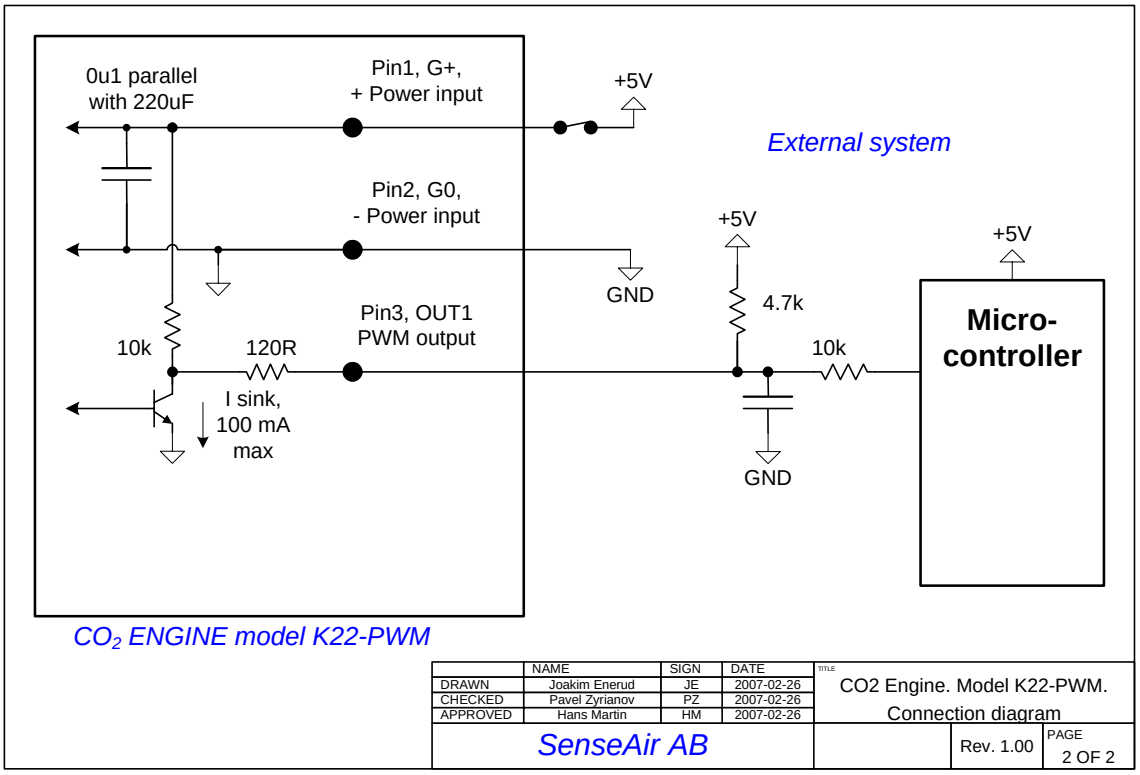

| | | |
|---|---|---|
| OUT 1, PWM | PWM Output, proportional to CO2 concentration | |
| DVCC | Processor programming interface. It is used for test of DVCC and meter hardware restart | |
| XRES | | |
| con-XTALin/SCL | | |
| con-XTALout/SDA | | |
| con-I2C_SDA | Test and calibration communication with processor | |
| con-I2C_SCL | | |
| G+ (Supply +) | Power supply lines. Supplyed by 5V in test board for PO model. | |
| G0 (Supply -) | | |

| | NAME | SIGN | DATE | TITLE |
|---|---|---|---|---|
| DRAWN | Joakim Enerud | JE | 2007-03-20 | CO2 Engine. Model K22-PWM. |
| CHECKED | Pavel Zyrianov | PZ | 2007-03-21 | |
| APPROVED | Hans Martin | HM | 2007-03-21 | |
| SenseAir AB | | | Rev. 1.00 | PAGE 1 OF 1 |

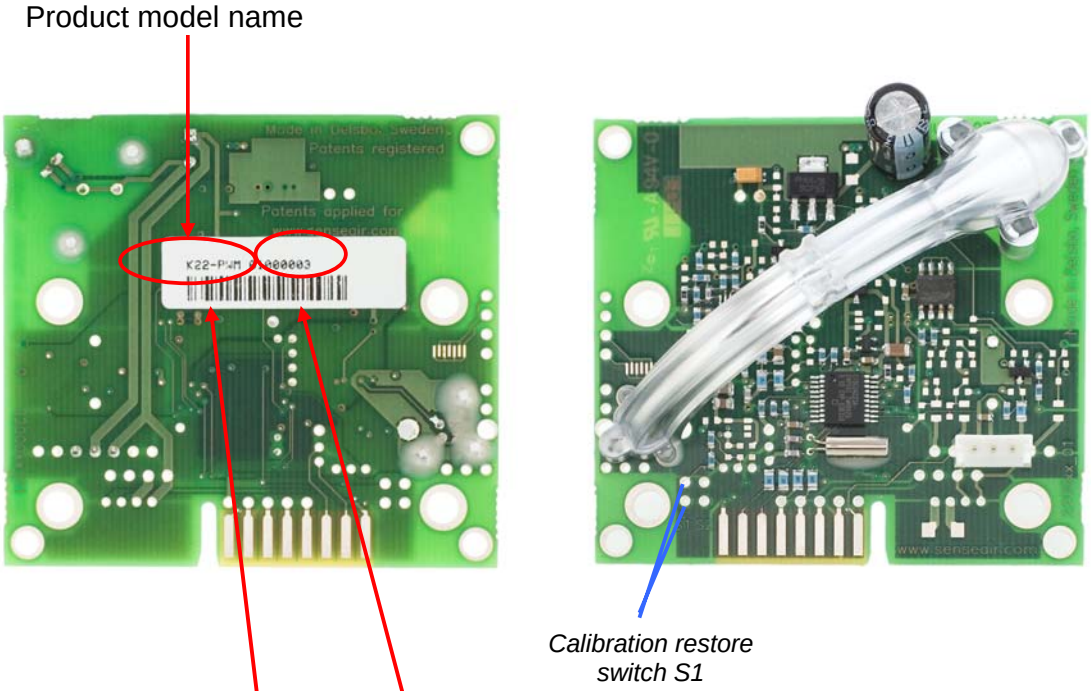
## Sensor power and output schematics

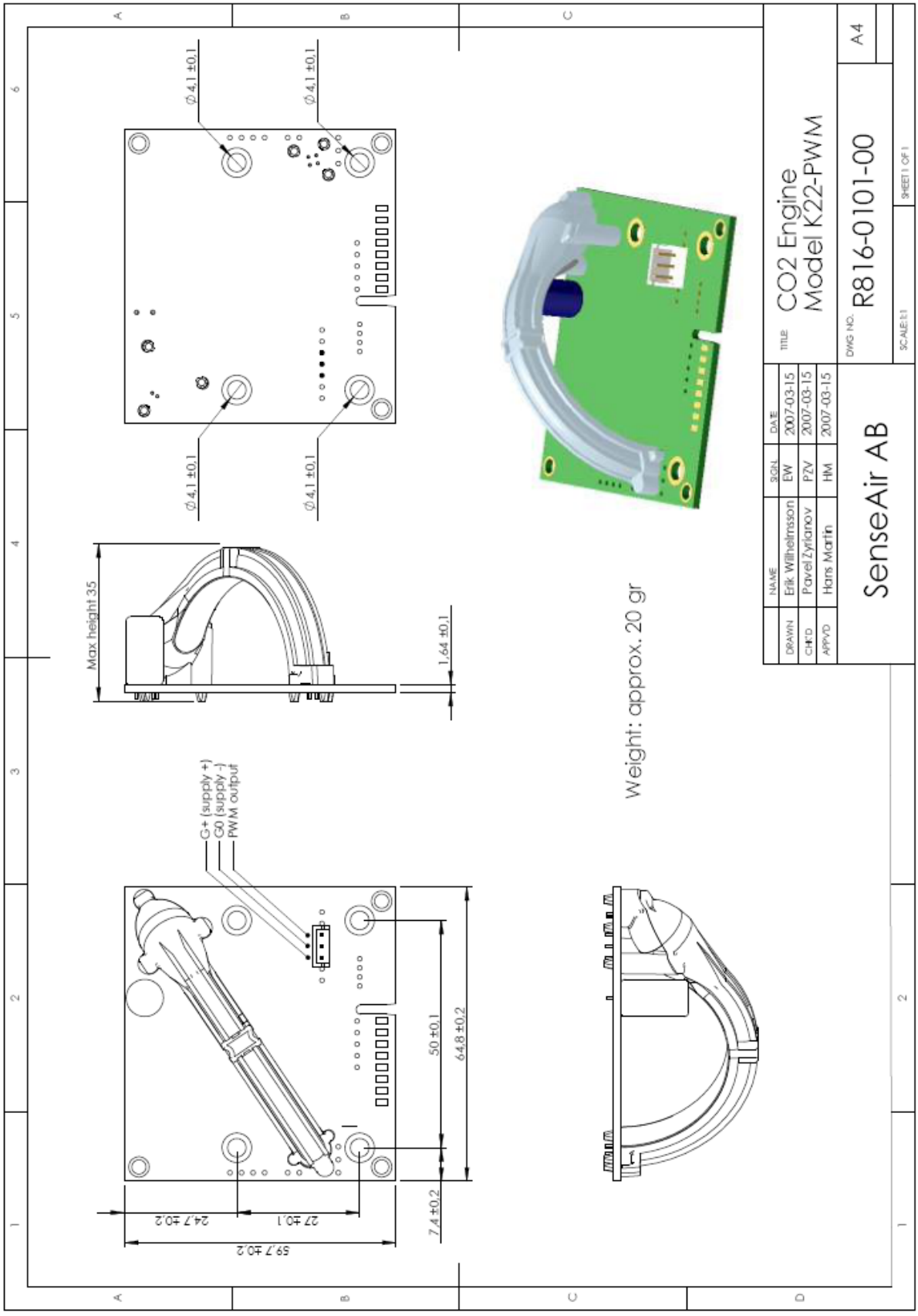



## Wiring Interface with PWM Output to external microcontroller



## Outward appearance of sensor




Ø4,1 ±0,1
Ø4,1 ±0,1
Ø4,1 ±0,1
Ø4,1 ±0,1
Max height 35
1,64 ±0,1
Weight: approx. 20 gr
G+ (supply +)
G0 (supply -)
PWM output
50 ±0,1
64,8 ±0,2
7,4 ±0,2
27 ±0,1
24,7 ±0,2
59,7 ±0,2
CO2 Engine
Model K22-PWM
R816-0101-00
A4
SenseAir AB
DRAWN Erik Willhelmsson EW 2007-03-15
CH'D Pavel Zyrianov PZV 2007-03-15
APP'D Hans Martin HM 2007-03-15

## Revision history

| Edition | Date | By | Description |
|---|---|---|---|
| 1b | 2007-03-21 | PZ | First appearance |
| 2 | 2007-04-04 | PZ | Resolution of output is changed from 0.5 msec (2ppm) to 0.25 msec (1ppm) |
| 2/2000 | 2007-04-26 | PZ | Output range is changed from 4000ppm to 2000ppm , Time resolution of PWM output is changed to 0.5 msec keeping the same resolution in ppm (1ppm) |
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