

Certificate Number: AHEL192120001



Case Number: 123456
Customer: Vaisala Oyj
Address: Vanha Nurmijarventie 21
01670 Vantaa
Finland

Manufacturer: Vaisala Oyj
Instrument: Carbon Dioxide Probe GMP252
Serial Number: N2910008
Calibration Date: 2019-05-20
Recalibration Date: 2020-05-20

Approved by:

Aki Jurvanen
Senior Test Engineer

Note(s):
Service report as an attachment.

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2$, which for a normal distribution corresponds to a coverage probability of approximately 95 %. The measurement results are traceable to the international system of units (SI) through national metrology institutes (NIST USA or equivalent) or via ISO/IEC 17025 accredited calibration laboratories.

The measurements carried out and the Certificates of Calibration issued by an Accredited Calibration Laboratory comply with the measurement ranges and uncertainties approved by FINAS Finnish Accreditation Service. The measurement results issued by the Laboratory are traceable to national or international measurement standards. Measurement Standards Laboratory of Vaisala Oyj is a calibration laboratory K008 accredited by FINAS Finnish Accreditation Service, accreditation requirement ISO/IEC 17025. The accreditation is included in the Multilateral Agreement (EA MLA) of the European co-operation for Accreditation (EA).

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As Found Results

Carbon dioxide concentration (parts per million volume) calibration results

| Reference [ppm] | Calibration pressure [hPa] | Reading [ppm] | Error [ppm] | Uncertainty [ppm] | Specification [ppm] | Notes |
|-------------------|------------------------------|-----------------|---------------|---------------------|-----------------------|-------|
| 194 | 1012.0 | 194 | 0 | 13 | 40 | - |
| 1999 | 1011.7 | 2027 | 28 | 31 | 40 | - |
| 9911 | 1011.6 | 10156 | 245 | 113 | 199 | * |

Temperature calibration results

| Reference [°C] | Reading [°C] | Error [°C] | Uncertainty [°C] | Specification [°C] | Notes |
|------------------|----------------|--------------|--------------------|----------------------|-------|
| 22.9 | 22.7 | -0.2 | 0.6 | - | - |

Analog channel 1 calibration results

Output settings: 0 to 10 V from 0 to 10000 ppm

| Reference [ppm] | Calibration pressure [hPa] | Reading [V] | Reading [ppm] | Error [ppm] | Uncertainty [ppm] |
|-------------------|------------------------------|---------------|-----------------|---------------|---------------------|
| 194 | 1011.8 | 0.196 | 195 | 1 | 13 |
| 1999 | 1011.7 | 2.021 | 2021 | 22 | 32 |
| 9910 | 1011.7 | 10.156 | 10156 | 246 | 116 |

Analog channel 2 calibration results

Output settings: 4 to 20 mA from 0 to 10000 ppm

| Reference [ppm] | Calibration pressure [hPa] | Reading [mA] | Reading [ppm] | Error [ppm] | Uncertainty [ppm] |
|-------------------|------------------------------|----------------|-----------------|---------------|---------------------|
| 194 | 1011.8 | 4.310 | 193 | -1 | 13 |
| 1999 | 1011.7 | 7.231 | 2020 | 21 | 32 |
| 9910 | 1011.7 | 20.253 | 10158 | 248 | 116 |

References used in the calibration

| Model | Instrument number | Certificate number | Calibration date | Recalibration date |
|-------------|-------------------|--------------------|------------------|--------------------|
| PXIe-4080 | 18141 | B03517 | 2018-12-04 | 2019-12-31 |
| PTU307 | 18002 | K008-B03240 | 2018-11-07 | 2019-11-30 |
| SEC-Z512MGX | 18292 | C01223 | 2019-04-11 | 2020-04-30 |
| SEC-Z512MGX | 18308 | C01224 | 2019-04-11 | 2020-04-30 |
| SEC-Z512MGX | 18309 | C01225 | 2019-04-10 | 2020-04-30 |

Ambient conditions:

Humidity
40.7 %rh ±2.1 %rh

Temperature
22.8 °C ±1.2 °C

Pressure
1011.9 hPa ±1.3 hPa

Any error greater than the specification is noted with *

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As Left Results

Carbon dioxide concentration (parts per million volume) calibration results

| Reference [ppm] | Calibration pressure [hPa] | Reading [ppm] | Error [ppm] | Uncertainty [ppm] | Acceptance Limit [ppm] | Pass/Fail |
|-------------------|------------------------------|-----------------|---------------|---------------------|--------------------------|-----------|
| 194 | 1012.0 | 194 | 0 | 13 | 40 | PASS |
| 1999 | 1011.7 | 1999 | 0 | 31 | 40 | PASS |
| 9911 | 1011.6 | 9911 | 0 | 113 | 199 | PASS |

Temperature calibration results

| Reference [°C] | Reading [°C] | Error [°C] | Uncertainty [°C] | Specification [°C] | Notes |
|------------------|----------------|--------------|--------------------|----------------------|-------|
| 22.9 | 22.9 | 0.0 | 0.6 | - | - |

Analog channel 1 calibration results

Output settings: 0 to 10 V from 0 to 10000 ppm

| Reference [ppm] | Calibration pressure [hPa] | Reading [V] | Reading [ppm] | Error [ppm] | Uncertainty [ppm] |
|-------------------|------------------------------|---------------|-----------------|---------------|---------------------|
| 194 | 1011.8 | 0.197 | 197 | 3 | 13 |
| 1999 | 1011.7 | 1.994 | 1994 | -5 | 32 |
| 9910 | 1011.7 | 9.913 | 9913 | 3 | 116 |

Analog channel 2 calibration results

Output settings: 4 to 20 mA from 0 to 10000 ppm

| Reference [ppm] | Calibration pressure [hPa] | Reading [mA] | Reading [ppm] | Error [ppm] | Uncertainty [ppm] |
|-------------------|------------------------------|----------------|-----------------|---------------|---------------------|
| 194 | 1011.8 | 4.313 | 195 | 1 | 13 |
| 1999 | 1011.7 | 7.189 | 1993 | -6 | 32 |
| 9910 | 1011.7 | 19.860 | 9912 | 2 | 116 |

References used in the calibration

| Model | Instrument number | Certificate number | Calibration date | Recalibration date |
|-------------|-------------------|--------------------|------------------|--------------------|
| PXIe-4080 | 18141 | B03517 | 2018-12-04 | 2019-12-31 |
| PTU307 | 18002 | K008-B03240 | 2018-11-07 | 2019-11-30 |
| SEC-Z512MGX | 18292 | C01223 | 2019-04-11 | 2020-04-30 |
| SEC-Z512MGX | 18308 | C01224 | 2019-04-11 | 2020-04-30 |
| SEC-Z512MGX | 18309 | C01225 | 2019-04-10 | 2020-04-30 |

Ambient conditions:

Humidity

40.7 %rh ±2.1 %rh

Temperature

22.8 °C ±1.2 °C

Pressure

1011.9 hPa ±1.3 hPa

Pass/Fail: Pass - Error less than Acceptance Limit, Fail - Error equal to or more than Acceptance Limit

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Calibration note(s):

The carbon dioxide probe was calibrated by comparing the probe's carbon dioxide concentration reading to a generated reference carbon dioxide concentration reading in a calibration adapter. The carbon dioxide concentration readings were read with resolution of 0.1 ppmv. The reference carbon dioxide concentration reading was generated by mixing pure carbon dioxide gas and purified nitrogen gas. The mixed gas flow through the calibration adapter was approximately 0.7 liters \pm 0.2 liters per minute. The pressure compensation of the probe was on during the calibration, P comp mode = On. The calibration pressure was measured before each calibration point and inputted into the memory of the probe. The temperature compensation of the probe was on and the probe was configured to use its internal temperature value as a compensation temperature value, T comp mode = Measured. O2 and RH comp modes were off. Before measurements the probe was allowed to stabilize to the conditions of the laboratory for at least 1 hour with 24 Vdc \pm 0.3 Vdc power supply on.

The temperature of the probe was calibrated by comparing the probe's temperature reading to a reference thermometer. The temperature is always adjusted when any as left results are given to achieve best carbon dioxide concentration accuracy.

The calibration results relate only to the calibrated instrument and the calibration points. The calibration results were obtained from the measured values or the results were calculated from the measured values by using adjustment coefficients. The analog channels are always adjusted when possible if any digital or analog as left results are given. Only the analog values inside the analog range of the probe are shown in the analog results.

The uncertainty of the 0 ppm point includes the difference between 0 ppm and the negative reading of the probe when the 0 ppm point was measured if the reading of the probe froze to display 0 ppm before reaching the 0 ppm point.