User Guide

Air Quality Transmitter

AQT400

VAISALA

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1. About This Document

1.1. Version Information

This document provides information about the installation, operation, and maintenance of Vaisala Air Quality Transmitters AQT400.

Table 1   Document Versions

Document Code	Date	Description
M211930EN	October 2016	First version of this manual.

1.2. Documentation Conventions

WARNING! Warning alerts you to a serious hazard. If you do not read and follow instructions carefully at this point, there is a risk of injury or even death.

CAUTION! Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

Note highlights important information on using the product.

Tip gives information for using the product more efficiently.

Lists tools needed to perform the task.

 Indicates that you need to take some notes during the task.

2. Product Overview

2.1. Introduction to AQT400

Vaisala Air Quality Transmitter AQT400 measures the pollution content of ambient air. The AQT400 series consists of two products, AQT410 and AQT420. Both models measure four gases (CO, NO_2, SO_2, and O_3) and weather data, such as humidity, air pressure, and temperature in the ambient air. AQT420 additionally includes a laser particle counter for $PM_{2.5}$ and PM_{10} particulate measurements.

You can send the measuring data from the air quality transmitter to local systems through a serial interface.

AQT400 is enclosed in an IP65-rated weatherproof casing and can be installed outdoors. The units are compact but robust with no moving parts and low power consumption. AQT400 can be used in conjunction with a PC, data logger, or other device.

The following features and components are available in AQT410 and AQT420:

- Gas measuring (CO, NO_2, SO_2, and O_3)
- Installation kit
- Installation cable
- Configuration cable

The following feature is available only in AQT420:

- Particle measuring ($PM_{2.5}$ and PM_{10})
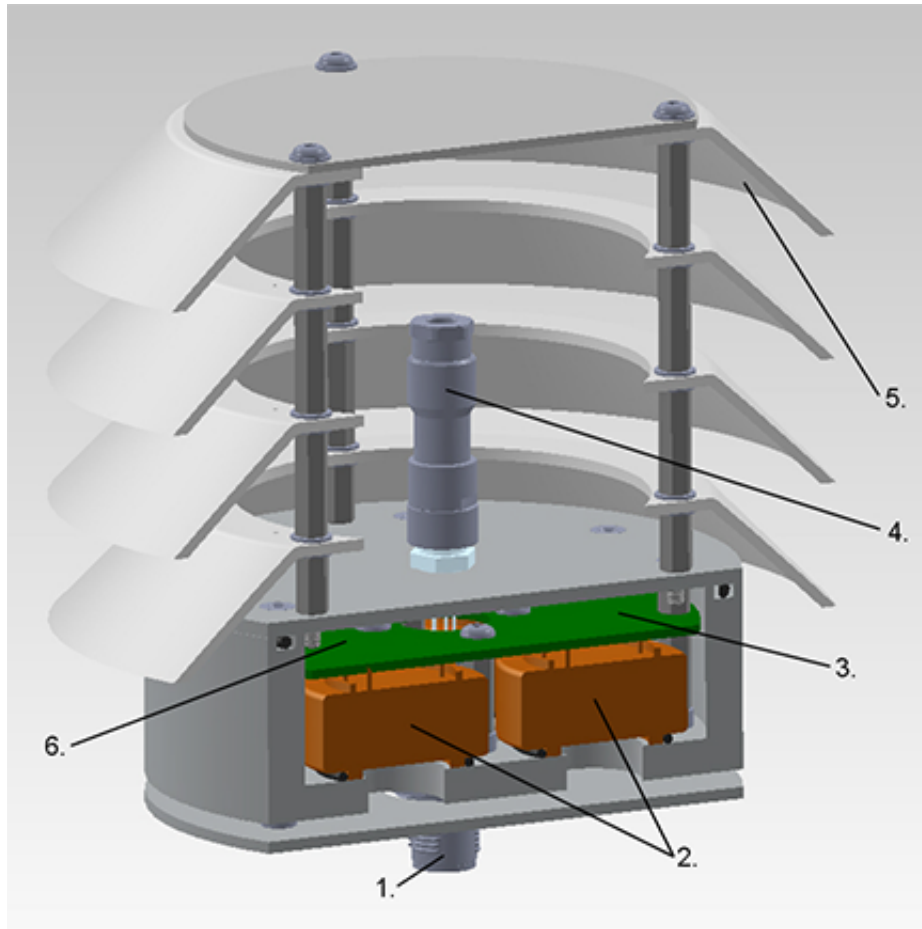
Figure 1   Structure of AQT410

1   M12 connector
2   Sensor elements (four sensors per unit)
3   Main electronics board
4   Combined temperature and humidity sensor
5   Radiation shield
6   Integrated pressure sensor

2.2. Safety

This product has been tested for safety. Note the following precautions:

> ⚠ **CAUTION!** Do not exceed the specified input voltage range.

2.2.1. ESD Protection

Electrostatic Discharge (ESD) can damage electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects in the equipment housing.

To avoid delivering high static voltages to the product:

- Handle ESD-sensitive components on a properly grounded and protected ESD workbench or by grounding yourself to the equipment chassis with a wrist strap and a resistive connection cord.
- If you are unable to take either precaution, touch a conductive part of the equipment chassis with your other hand before touching ESD-sensitive components.
- Hold component boards by the edges and avoid touching component contacts.

2.3. Regulatory Compliances

This product complies with the following performance and environmental test standards:

- IEC/EN 61326-1:2013
- IEC/EN 61000-4-2/3/4/5/6
- CISPR 22

3. System Functional Description

The gas measuring technology in AQT400 is based on proprietary advanced algorithms and electrochemical technology.

The sampled gas causes a reduction or oxidation reaction in an electrochemical cell. Both reactions create a weak electric current. The electric current is directly dependent on the volume of measured gas. By measuring the electric current and using advanced calculation and compensation algorithms, AQT400 calculates the gas content. Most electrochemical cells are highly susceptible to ambient conditions (temperature and humidity), but AQT400 reverses the impact with a proprietary adjustment and compensation system, which guarantees accurate ppb measurements.

The particle sensor technology of laser particle counter in AQT420 is based on the scattering of laser light caused by passing particles. With the help of optics and photosensitive sensors, the laser particle counter measures the angular scattering intensity data and analyzes it with digital signal prosessing (DSP). The method allows simultaneous measuring of two particle sizes, <2.5 and <10 µm.

The CPU of the air quality transmitter regularly controls the sampling pump to transfer outside air into the gas analysis module for measuring. All measuring results are saved in the CPU, from where they can be sent through a mobile network to a database or through a serial interface to a local system (such as a PC).

4. Installation

4.1. Selecting Location

Compact and weatherproof AQT400 can be installed in a variety of outdoor locations. Install the air quality transmitter in a location where adjacent walls, buildings, or other obstacles do not influence the measuring results. Make sure other locally operated equipment, such as radio transmitters, power lines, and generators, cannot affect the performance. Do not mount the device in close proximity of high-powered radio transmitters. If you suspect external electrical noise, order a site survey.

> **i** Protect AQT400 from direct sunlight in high temperatures. Fast temperature changes can temporarily decrease the performance and direct sunlight can raise the operating temperature over the allowed limit.

4.2. Unpacking

Remove the air quality transmitter from its cardboard package and check that no visible damage has occurred during transport. If you detect any damage, immediately contact your carrier and Vaisala technical support.

4.3. Installing to Mast or Wall

Install the air quality transmitter to a height of 1.5 ... 4 m from the ground. Applicable local standards and guidelines may influence the installation height.

To reduce the build-up of deposits, handle the unit with lint-free gloves and remove all grease from the surface after the installation

Vaisala recommends to use the installation kit to install both models onto a mast or a wall.

1. Fix AQT400 to a mounting plate with three M3 screws.

2. Use U bolts included in the installation kit to mount the air quality transmitter, for example, onto a mast. Optimally, the tube or mast is at least 3 mm thick and 35 ... 45 mm in outside diameter.

3. Pass the M12 connection cable along the tube and use appropriate strain relief to the cable.

4.4. Connecting Cables

Connect the 8-pin M12 connection cable to the male connector in AQT400, and manually tighten the outer sleeve. Connect the other end of the connection cable to an external power source or to any other necessary systems. Do not switch on the power source yet.

> **ℹ**   Only use the recommended cable types and lengths.

AQT400 uses 8 … 30 V direct-current voltage. Use a power source that complies with this voltage. The power source must be able to supply at least 5 W, although AQT400 normally uses less power than that.

Isolate any unused cable wires at the terminating equipment/user end. To preserve the EMC performance, maintain the cable screen integrity in places where the cables are cut and re-connected, such as junction boxes, plugs and sockets.

> **⚠ CAUTION!** Do not exceed the specified input voltage range.

In case of power failure, Vaisala recommends using a rechargeable battery or an uninterrupted power source (UPS). If the unit loses power for a few seconds, it may disrupt the measuring for several hours if the power supply is not redundant.

4.5. Using Serial Interfaces

The 8-pin M12 connector provides RS-232 and RS-485 serial interfaces which can be used to change the settings or output measurements.
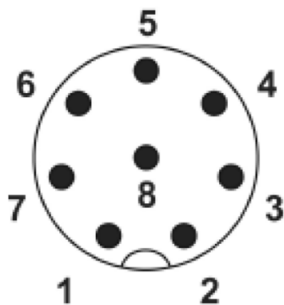
Figure 2   Pin-out of M12 Connector

1	RS-232/RS-485 GND	White
2	RS-232 RX (input)	Brown
3	RS-232 TX (output)	Green
4	No connection (floating)	Yellow
5	RS-485 B (-)	Grey
6	RS-485 A (+)	Pink
7	Power GND	Blue
8	Power 8–30 VDC	Red

RS-232 Serial Interface

The RS-232 interface is used to control AQT400 either with a command line interface or with AQT Configuration Tool. Use the following settings:

- 115200 bps
- 8N1 (8 data bits, no parity, one stop bit)
- no flow control (disable with the command line interface)

RS-485 Serial Interface

The RS-485 interface is used to control AQT400 either with a command line interface or with AQT Configuration Tool. RS-485 interface uses the following default settings:

- 4800 ... 115200 bps (default value is 9600 bps)
- 7E1 (7 data bits, even parity, one stop bit)
- 120 Ω termination

Change the serial interface and protocol settings through a control connection. The interface supports the following data transfer protocols: Modbus ASCII and ASCII formatted text with comma separated values.

> When using the RS-485 interface, use a protected and twisted pair cable with both ends terminated with a 120 ohm termination resistor. AQT400 has been terminated by default. To remove the termination, contact Vaisala technical support.

4.6. Switching on Power Supply

Verify that AQT400 is properly connected to a power source and any other systems. Switch on the power supply.

5. Measurements

5.1. Stabilization Period

> ℹ️ When AQT400 is switched on, let the unit stabilize for at least 24 hours before using the measurement results. To ensure optimal measuring accuracy, Vaisala recommends a stabilization period of 48 hours. The units take measurements during the stabilization period, but they are marked as invalid.

5.2. Measured Variables

The measured variables have been configured to AQT400 at the factory. When the air quality transmitter is on, it continuously takes measurements, regardless of how often the measurements are sent to the database or printed out from the serial port. The measurements of the particle counter are based on the number of particles sampled over a period of sixty seconds. You can set the measuring interval to 1 ... 1440 minutes for both gas and particle measuring.

5.3. Measuring Units

AQT400 reports the gas measurements as parts per million and the particles in μg/m^3. The temperature readings are in degrees, Celsius (°C) or Fahrenheit (°F). The air pressure is represented in mbar. To change the reported units, use AQT Configuration Tool.

5.4. Impact of Ambient Conditions

The ambient conditions (temperature and relative humidity) can influence and distort the measuring results. AQT400 includes a sophisticated compensation feature for eliminating the distortion in a non-condensing environment. If the conditions change very fast (for example, the relative humidity suddenly drops), there may be some measuring inaccuracy that temporarily exceeds the specifications.

6. Configuration and Operation

You can view the measuring data and change the settings of AQT400 through the RS-232 serial interface. Vaisala recommends to use a graphical user interface AQT Configuration Tool and a USB/RS-232 adapter.

For more versatile management and troubleshooting options, you can use a command line interface to create a terminal connection to the management console of the air quality transmitter.

6.1. Installing AQT Configuration Tool

System Requirements: Microsoft Windows XP, Windows Vista, Windows 7, Windows 8, or Windows 10.

▶ 1. Download the AQT Configuration Tool installer from www.vaisala.com. Save the file on your computer.

2. Start the installer. Windows may ask whether you trust the program. Click **Run**.

3. The installer window opens. The installer recommends you to close all other applications before the installation. To start the installation, click **Next**.

4. Accept the default installation location or click **Browse** to select a different location. To continue the installation, click **Next**.

5. The installer shows the destination location and the Start Menu folder of the program. To continue the installation, click **Install**.

6. The installer installs the program. To exit the installer, click **Finish**.

6.2. Using AQT Configuration Tool

▶ 1. To start the program, select **Start > AQT Configuration Tool**.

2. Before you connect the AQT Configuration Tool to AQT400, make sure the transmitter is connected to your computer with a PC connection cable. To connect and retrieve the configurations from the transmitter, click **Connect**.

3. To retrieve the measurements, select the display options:

- To retrieve a single measurement, select **Single**.
- To retrieve continuous measurements, select **Continuous** and define the interval in seconds.
- Select the measurement units, pump mode, measurement mode (single or continuous) and measurement interval in seconds.

When you have selected the options, click **Start**.

The AQT Configuration Tool displays the retrieved measurements in the **Measurements** field.

- The measurements that have not stabilized are displayed in red. During the stabilization period (24 hours), the window displays a red text **Device is warming up**.
- Once the stabilization period is over and the measurements are reliable, the windows displays a green text **Device is ready for measurements**.

4. To retrieve the device settings, click **Synchronize**. The window displays the changes made to the settings.

5. To change the settings, modify the values in **Configuration** and press **ENTER**.

6. If you use an additional memory card, you can view the measurement log. To view the measurement history, click **Read**. The configuration tool retrieves the log file.

7. To clear the measurement log, click **Clear**. The AQT Configuration Tool asks you to confirm that you want to clear the memory.

8. To view the measurements in graphical form, click **Graph**. To view one measurement at a time or all measurements simultaneously, or to compare the measurements with one another, select the appropriate variables on the left-hand side of the window. To clear the latest measurements, click **Clear**.

6.3. Connecting to Management Console

To change all of the transmitter settings, read measurements, and review diagnostics data, establish a terminal connection to the management console.

▶ 1. Connect the air quality transmitter to a PC with a USB/RS-232 adapter. You can also use the RS-232 interface on your PC, if available.

2. Open a terminal window (for example, PuTTY).

3. Establish a connection with the serial interface of the air quality transmitter. If your PC has several serial interfaces (such as COM1 and COM2), you may have to switch interfaces to find the right one.
Use the following settings:

   - 115200 bps
   - 8N1 (8 data bits, no parity and one stop bit)
   - no flow control

4. Switch on the air quality transmitter.

5. You have established a connection to the management console. For more information on the available commands, type `help` and press **ENTER**.
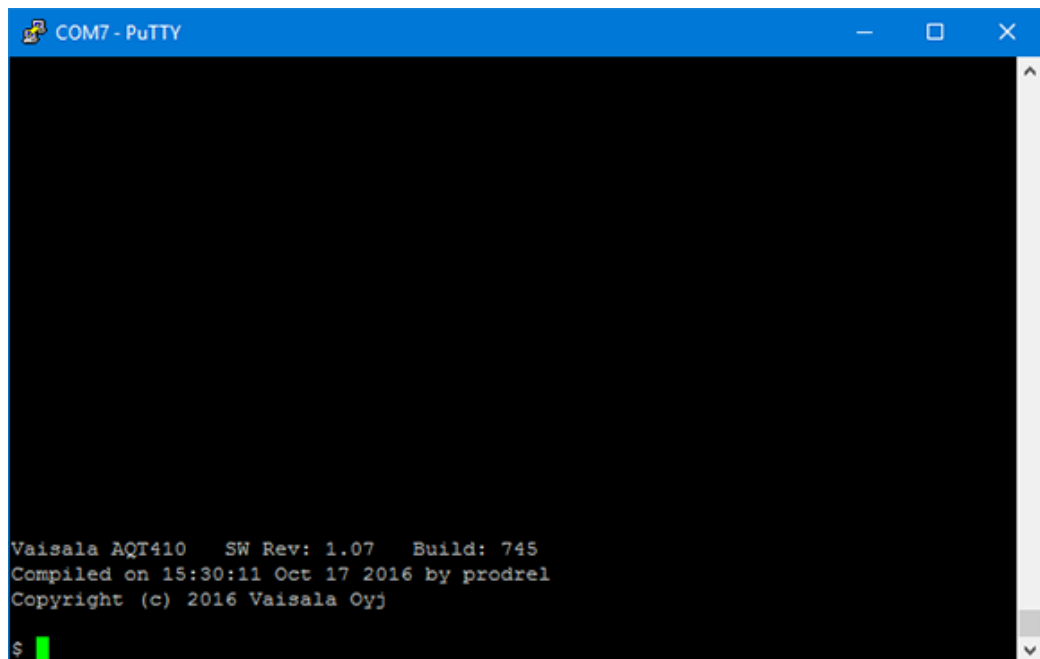
6.4. Using General Commands

Command	Description	Parameters
`date`	Prints current date and time.	`[date]` sets a new date and time in ISO8601 format (for example, 2015-01-01T12:15:00)
`initconf`	Initializes the transmitter to default settings. The command does not write the configuration to non-volatile memory. Use with care!	`--really` is a mandatory parameter
`ls`	Lists available commands.	None
`meas`	Outputs current measurements in ppm units.	`--metric` displays in metric units `--ppb` displays in ppb units `--raw` displays raw measurements for debug purposes `--csv` displays comma separated values (in ppm units) `--csm` displays comma separated values (in metric units)
`protect`	Disables password protection if it is enabled.	`[password]`
`reboot`	Reboots the device.	`--really` is a mandatory parameter
`set`	Changes a configuration parameter. For more information, see 6.5. Using Configuration Parameters (page 22).	`[parameter]=[value]`
`show`	Prints the value of a configuration parameter. For more information, see 6.5. Using Configuration Parameters (page 22).	`[parameter]`
`write`	Writes the current configuration to non-volatile memory.	`--really` is a mandatory parameter

6.5. Using Configuration Parameters

Table 2   List of parameters

Parameter	R/W	Description
`serial`	R	Device serial number
`hwver`	R	Hardware version

Parameter	R/W	Description
swver	R	Software version
time	R	Current time
commint	R/W	Communication interval (10 ... 1440 minutes, 0 = disabled)
measint	R/W	Measurement interval (1 ... 1440 minutes)
logint	R/W	Data logging interval (1 ... 1440 minutes, 0 = disabled)
tempunit	R/W	Temperature unit (0 = ºC, 1 = ºF)
rs485_addr	R/W	Modbus address
rs485_baud	R/W	Modbus baud rate (4800 ... 115200 bps)
rs485_mode	R/W	Modbus in use (0 = ASCII CSV, 1 = Modbus ASCII, 2 = AQT interconnect, 3 = Vaisala WXT)
co_zero	R/W	CO zero correction (-10000 ... 10000 ppb)
co_span	R/W	CO span correction (1 ... 255 %)
no2_zero	R/W	NO_2 zero correction (-10000 ... 10000 ppb)
no2_span	R/W	NO_2 span correction (1 ... 255 %)
o3_zero	R/W	O_3 zero correction (-10000 ... 10000 ppb)
o3_span	R/W	O_3 span correction (1 ... 255 %)
so2_zero	R/W	SO_2 zero correction (-10000 ... 10000 ppb)
so2_span	R/W	SO_2 span correction (1 ... 255 %)

7. Data Formats

7.1. Data Format in ASCII Mode

To use the RS-485 port in ASCII mode, set parameter `rs485_mode` to `0`.

In ASCII mode, the device prints CSV formatted measurements based on `measint` parameter. The measurement interval can be 1 … 1440 minutes.

Table 3   CSV Output Format

Field	Description	Example
DATE	Date and time in ISO8601 format	2015-07-01T12:34:56
TEMP	Air temperature in ºC or ºF (`tempunit` parameter)	23.5
HUM	Air humidity in %RH	43.2
PRES	Air pressure in mbar	1013.4
MEAS	Gas measuremets in ppm Particle measurements in µg/m^3	0.023,0.067,26.2,105.7
CONF	Specifies the printing order of the measurements in the MEAS field Always includes T:H:P (temperature, humidity, and pressure).	T:H:P:NO2:SO2:PM2.5:PM10
UPTIME	Device uptime in seconds Measurements are considered valid when uptime is more than 86400 seconds (one day).	131422

7.2. Data Format in Modbus Mode

To use the RS-485 port in Modbus mode, set parameter `rs485_mode` to `1`. The device complies with Modbus ASCII standard, but does not support Modbus RTU mode. For full specifications, see http://www.modbus.org/.

AQT400 supports the following Modbus function codes:

Table 4   Modbus Function Codes

Command	Function Code	Description
regread	0x03	Reads holding registers

Command	Function Code	Description
regwrite	0x06	Writes single register

The following register addresses are available in AQT400. Note that all registers may not be available on your device.

Table 5   Modbus Register Addresses

Register address	Data Range	Description
0x00	Read only, in ppb	A0 / NO2
0x01	Read only, in ppb	A1 / SO2
0x02	Read only, in ppb	A2 / CO
0x03	Read only, units depend on sensor type	A3 / EXTRA
0x04	Read only, in ppb	A4 / H2S
0x05	Read only, in ppb	A5 / O3
0x06	Read only, in ppb	A6 / NO
0x07	Read only, in ppb	A7 / VOC
0x08	Read only, in $\mu g/m^3$ * 10	P0 / PM2.5 raw
0x09	Read only, in $\mu g/m^3$ * 10	P1 / PM10 raw
0x0A	Read only, in ºC * 10 or ºF * 10	Air temperature
0x0B	Read only, in %RH * 10	Air humidity
0x0C	Read only, in mbar * 10	Air pressure
0x0D	Read only, in m/s * 10	Wind speed
0x0E	Read only, in deg	Wind direction
0x0F	Read only, in mm/h * 10	Precipitation
0x13	Read only, year	Calibration year
0x14	Read only, month	Calibration month
0x15	Read only, day	Calibration day
0x19	Read only, version * 100	Software version
0x1A	Read only, seconds	Seconds from the latest measurement

Register address	Data Range	Description
0x1B	Read only, 0 or 1	Measurement validity 0 = not valid 1 = valid
0x1C	Read only, 0 or 1	Temperature units 0 = ºC 1 = ºF
0x1D	Read only, 0xFFFF	Sensor configuration word 1
0x1E	Read only, 0xFFFF	Sensor configuration word 2
0x1F	Read only, 0-100	Device health, percent
0x20	Read only, year	Time stamp, year
0x21	Read only, month	Time stamp, month
0x22	Read only, day	Time stamp, day
0x23	Read only, hours	Time stamp, hours
0x24	Read only, minutes	Time stamp, minutes
0x25	Read only, seconds	Time stamp, seconds

8. Maintenance

8.1. Overview to Maintenance

AQT400 has no moving or user-serviceable parts that require routine maintenance. Apart from removing visible obstructions from the device.and adding new and calibrated gas sensors every 12 ... 24 months, the air quality transmitters require no regular maintenance.

> ⚠ **CAUTION!** Opening the unit or breaking the security seal voids the warranty and the calibration.

8.2. Factory Calibration

To measure the four gases, AQT400 includes four integrated sensor elements. The sensors have been calibrated at the factory and must be recalibrated every 12 ... 24 months, depending on the gas type. To have the sensors replaced and calibrated, contact Vaisala technical support.

8.3. Performance Check During Operation

In addition to factory calibration, Vaisala recommends a regular performance check during operation to ensure reliable measurements. The performance check verifies the measurements and readjusts the measurement zero points with zero air. If possible, complete the zero point calibration every 3 ... 6 months.

For more information on the performance check, see A. Performance Check (page 39).

9. Troubleshooting

Before you return a faulty product to Vaisala, do the following:

- Check all cables and connectors for continuity, bad contacts, or corrosion.
- If failure persists, contact Vaisala technical support.

If you have to return the unit, contact Vaisala technical support.

Table 6   Troubleshooting AQT400

Problem	Probable Cause	Remedy
Measurement failure or irrelevant data values	Incorrect settings	Check the settings...
	Hardware failure	Contact Vaisala technical support.
No response to any commands.	Wiring is wrong.	Check the wiring.
	Operational power is not connected.	Check the operation voltage.
	Baud rate or other serial property of the device is different from the host.	Connect the serial cable and check the serial port settings of the device with AQT Configuration Tool or terminal program.

9.1. Writing Problem Report

When troubleshooting the product, write a problem report including:

- What failed (what worked / did not work)?
- Where did it fail (location and environment)?
- When did it fail (date, immediately / after a while / periodically/ randomly)?
- How many failed (only one defect / other same or similar defects/ several failures in one unit)?
- What was done when the failure was noticed?
- What was connected to the product and to which connectors?
- Input power source type, voltage, and list of other items (such as lighting, heaters, and motors) that were connected to the same power output.
- Are all parts connected and grounded properly? Take a photo to help troubleshooting.

10. Technical Data

10.1. AQT410 Specifications

Table 7   Measuring Specifications

Property	Description/Value
Temperature range	-40 ℃ … +85 ℃ (-40 ℉ … 185 ℉)
Temperature resolution	0.1 ℃ (℉)
Temperature accuracy	±0.3 ℃, repeatability ±0.1 ℃
Humidity range	0 … 100 %RH (non-condensing)
Humidity resolution	0.1 %RH
Humidity accuracy	±2 %RH, repeatability ±0.2 %RH
Pressure range	800 … 1100 mbar
Pressure resolution	1 mbar
Pressure accuracy	<±1 % FS
Sampling interval	1 … 1440 minutes
Response time	<60 seconds
Factory calibration	12 … 24 months, depending on the local measurement conditions

The gas measuring specifications are valid in normal ambient conditions, -10 ℃ … +35 ℃ (-14 ℉ … 95 ℉).

Table 8   Gas Measuring Specifications

Gas	Range	Minimum detection	Resolution	Precision	Linearity	Unit
SO_2	0 … 2	0.005	±0.001	<±1 % FS	<±1 % FS	ppm
NO_2	0 … 2	0.005	±0.001	<±1 % FS	<±1 % FS	ppm
CO	0 … 10	0.1	±0.01	<±2 % FS	<±2 % FS	ppm
O_3	0 … 2	0.005	±0.01	<±3 % FS	<±2 % FS	ppm

Table 9   Electrical Specifications

Property	Description/Value
Operating voltage	8 … 30 VDC
Power consumption	Typically 0.5 W, maximum 2 W

Table 10   Environmental Specifications

Property	Description/Value
Operating environment	-30 ℃ … +50 ℃ (-22 ℉ … 122 ℉) 15 … 95 %RH
EMC	EN/IEC 61326-1, IEC/EN61000-4-2/3/4/5/6, CISPR 22I
Ingress protection rating	IP65

Table 11   Data Connection Specifications

Property	Description/Value
Data protocols	Modbus, ASCII
Serial data interface	RS-485
Console interface	RS-232

Table 12   Mechanical Specifications

Property	Description/Value
Dimensions (H × W × D)	125 × 128 × 128 mm (4.9 × 5.0 × 5.0 in)
Weight	690 g (1.5 lb)
Enclosure material	Anodized aluminium, stainless steel
Power and data connector	Standard 8-pin M12 male

10.2. AQT420 Specifications

Table 13   Measuring Specifications

Property	Description/Value
Temperature range	-40 ℃ ... +85 ℃ (-40 ℉ ... 185 ℉)
Temperature resolution	0.1 ℃ (℉)
Temperature accuracy	±0.3 ℃, repeatability ±0.1 ℃
Humidity range	0 ... 100 %RH (non-condensing)
Humidity resolution	0.1 %RH
Humidity accuracy	±2 %RH, repeatability ±0.2 %RH
Pressure range	800 ... 1100 mbar
Pressure resolution	1 mbar
Pressure accuracy	<±1 % FS
Sampling interval	1 ... 1440 minutes
Response time	<60 seconds
Factory calibration	12 ... 24 months, depending on the local measurement conditions

The gas measuring specifications are valid in normal ambient conditions, -10 ℃ ... +35 ℃ (-14 ℉ ... 95 ℉).

Table 14   Gas Measuring Specifications

Gas	Range	Minimum detection	Resolution	Precision	Linearity	Unit
SO_2	0 ... 2	0.005	±0.001	<±1 % FS	<±1 % FS	ppm
NO_2	0 ... 2	0.005	±0.001	<±1 % FS	<±1 % FS	ppm
CO	0 ... 10	0.1	±0.01	<±2 % FS	<±2 % FS	ppm
O_3	0 ... 2	0.005	±0.01	<±3 % FS	<±2 % FS	ppm

Table 15   Particle Measuring Specifications

Property	Description/Value
Particle range	0.3 ... 20 µm (spherical equivalent)
Measurement range	PM2.5: 0 ... 2000 µg/m^3 PM10: 0 ... 5000 µg/m^3
Resolution	0.1 µg/m^3
Response time	<60 s
Sampling interval	1 ... 1440 minutes
Sample flow rate	1 SLM (integrated vacuum pump)
Units	µg/m^3

Table 16   Electrical Specifications

Property	Description/Value
Operating voltage	8 ... 30 VDC
Power consumption	Typically 0.5 W, maximum 2 W

Table 17   Environmental Specifications

Property	Description/Value
Operating environment	-30 ℃ ... +50 ℃ (-22 ℉ ... 122 ℉) 15 ... 95 %RH
EMC	EN/IEC 61326-1, IEC/EN61000-4-2/3/4/5/6, CISPR 22I
Ingress protection rating	IP65

Table 18   Data Connection Specifications

Property	Description/Value
Data protocols	Modbus, ASCII
Serial data interface	RS-485
Console interface	RS-232

Table 19   Mechanical Specifications

Property	Description/Value
Dimensions (H × W × D)	185 × 128 × 128 mm (7.3 × 5.0 × 5.0 in)
Weight	1.3 kg (2.8 lb)
Enclosure material	Anodized aluminium, stainless steel
Power and data connector	Standard 8-pin M12 male

Appendix A. Performance Check

AQT400 is designed for diffusion-based measurements. When doing a performance check, use applicable accessories and let the instrument stabilize first. Vaisala recommends using a special calibration adapter, which allows direct connection to the reference gas supply.

▶ 1. Let the instrument stabilize at least 36 hours in a stable environment.

- Use purified lab air or preferably zero air with continuous flow (0.05 ... 1.0 l/min).
- Keep the humidity of the zero air stable between 30 ... 60 %RH. You can use, for example, Nafion membrane tube or a special calibrator with humidity control to keep the humidity stable.
- Make sure the temperature variation remains within ±2 ºC.

2. Use the AQT Configuration Tool or a command line interface to read gas measurements. Make sure the measurements are within specifications and close to zero. Due to offset variation, the results can be slightly below zero if the real measurements are zero.

3. Start the flow of gas to AQT400. Use half of maximum values (5 ppm for CO and 1 ppm for other gases) and keep relative humidity the same as with zero air (±5 %RH).

    • Direct method uses gas bottles with a known concentration (for example, 1 ppm or 5 ppm). Connect the calibration adapter to the reference gas supply and open the regulator to start the flow of gas.
    • Dilution method uses a calibrator that creates a correct mixture from a higher concentration gas source and a zero air source. Connect the calibrator output to the calibration adapter and use the regulator to adjust the flow rate.
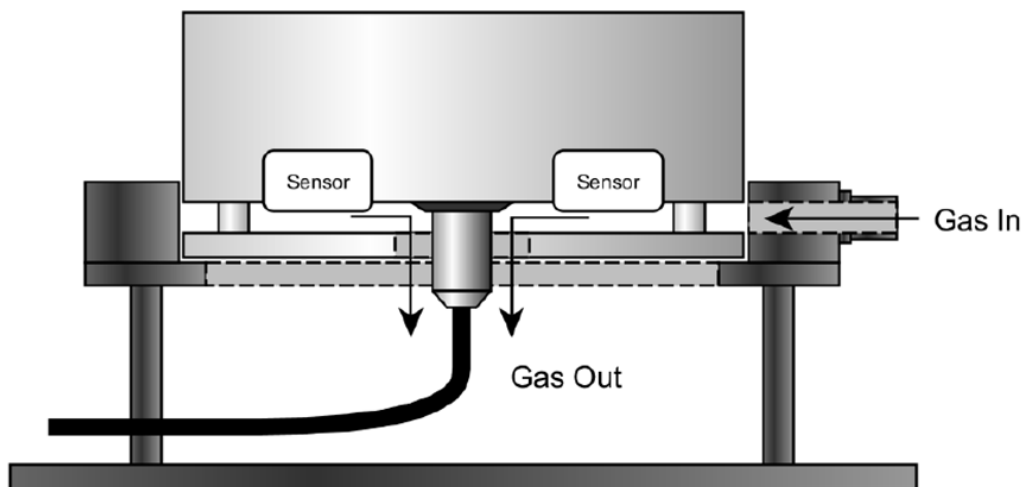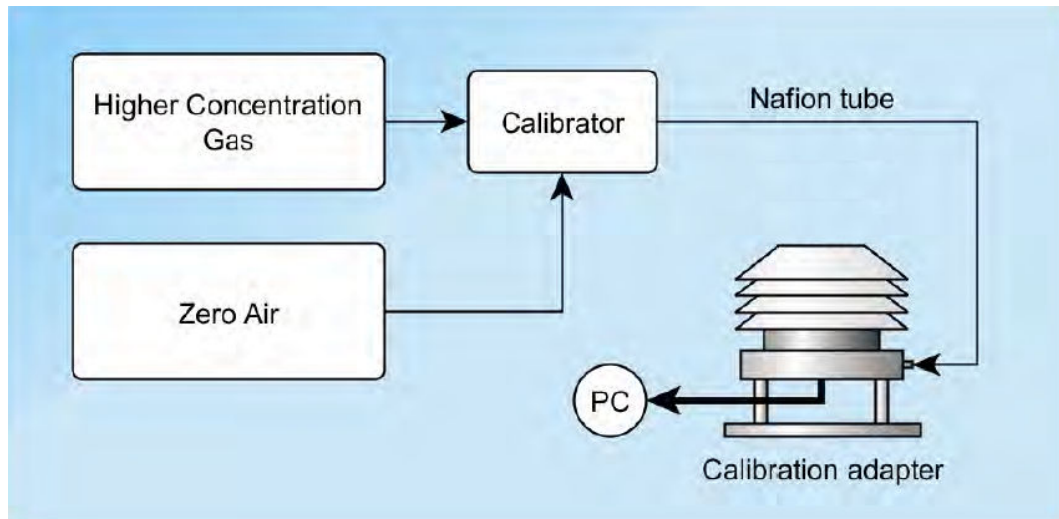
4. Maintain the flow of gas to AQT400 until gas measurements are stable. This can take several minutes. Vaisala recommends to use air (N2 + O2) as a balance gas mixture, with the flow rate 0.3 ... 1.0 l/min.

5. Compare the results with the specifications. If the results are not within the specifications, change the calibration values or contact Vaisala technical support.

6. To change the calibration values, use the command line interface.
   Use the following parameters to adjust internal gas measurements:

   - `co_span`
   - `no2_span`
   - `o3_span`
   - `so2_span`
   - `co_zero`
   - `no2_zero`
   - `o3_zero`
   - `so2_zero`

   The span adjustment is proportional and is represented as a percentage value, which can vary between `1` ... `255` (default = `100`). The zero adjustment is an absolute value in ppb and it is added after span adjustment. The zero values can vary between `-10000` ... `10000`. Use the **show** command to read the concurrent values before using the **set** command to replace them. If AQT400 has an offset adjustment (zero value other than `0`), take the old value in count before setting a new one. This also applies to span values.

7. Use the **write** `--really` command to save the new adjustments.

8. Use the **show** `health` command to check the health status of AQT400. The output is a percentage value (0 ... 100 %). If the health value is below `20`, contact Vaisala technical support.

Appendix B. Accessories

For a list of accessories, contact Vaisala Technical Support at helpdesk@vaisala.com.

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Technical Support

Contact Vaisala technical support at helpdesk@vaisala.com. Provide at least the following supporting information:

- Product name, model, and serial number
- Name and location of the installation site
- Name and contact information of a technical person who can provide further information on the problem

For Vaisala Service Center contact information, see www.vaisala.com/servicecenters.

Warranty

For standard warranty terms and conditions, see www.vaisala.com/warranty.

Please observe that any such warranty may not be valid in case of damage due to normal wear and tear, exceptional operating conditions, negligent handling or installation, or unauthorized modifications. Please see the applicable supply contract or Conditions of Sale for details of the warranty for each product.

Recycling

Recycle all applicable material.

Follow the statutory regulations for disposing of the product and packaging.

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