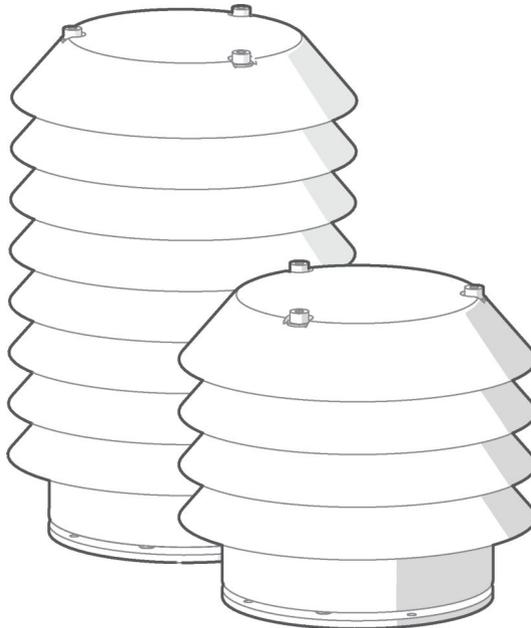


Configuration Guide

Vaisala Air Quality Transmitter

AQT400 Series



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1. About This Document

1.1 Version Information

This document provides information about the configuration of Vaisala Air Quality Transmitter AQT400.

Table 1 Document Versions

Document Code	Date	Description
M212059EN-B	June 2018	Service cable update
M212059EN-A	February 2018	First version.

1.2 Related Manuals

Table 2 Related Manuals

Document Code	Name
M211942EN	<i>Vaisala Air Quality Transmitter AQT400 Series User Guide</i>
M212056EN	<i>Vaisala Multi-Observation Gateway MOG100 Configuration Guide</i>
M211951EN	<i>Vaisala Multi-Observation Gateway MOG100 User Guide</i>

The documentation is available online at www.vaisala.com.

1.3 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.

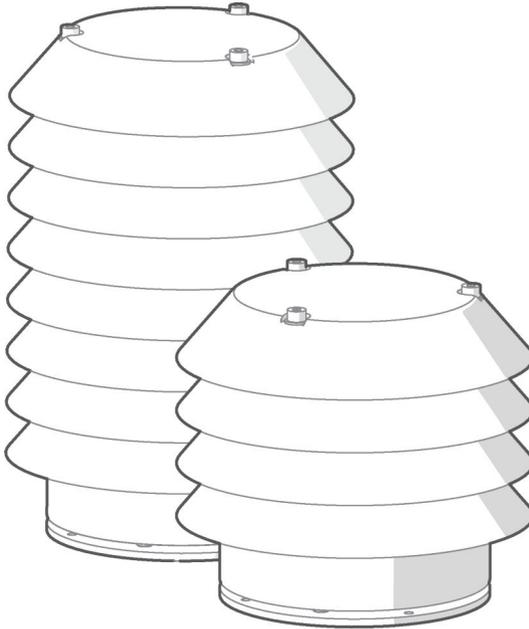
1.4 Trademarks

Vaisala® is a registered trademark of Vaisala Oyj.

Modbus® is a registered trademark of Schneider Automation Inc.

Microsoft® and Windows® are either registered trademarks or trademarks of Microsoft Corporation in the United States and other countries.

2. Vaisala Air Quality Transmitter AQT400 Series



Vaisala Air Quality Transmitter AQT400 Series measures the pollution content of ambient air. The series consists of two products, AQT420 and AQT410.

The measurement performance of AQT400 series is based on proprietary advanced algorithms that enable parts per billion (ppb) measurements at an affordable price by using electrochemical sensors. The algorithms compensate for the impact of ambient conditions and aging on the sensor elements and remove the need for costly gas sampling and maintenance equipment.

AQT400 series is specifically designed for air quality monitoring networks in urban areas, road networks, or around industrial sites and transportation hubs. Thanks to its small weight and compact size, it is ideally suited for deployment even in large air quality networks.

The measurement data is sent wirelessly to a web-based database with a gateway solution or is available locally through a serial interface. Depending on local conditions, AQT400 series device has a maintenance and calibration interval of 12 ... 24 months.

Table 3 AQT400 Product Comparison

Measurement	AQT420	AQT410
NO ₂	✓	✓
SO ₂	✓	✓
CO	✓	✓
O ₃	✓	✓
PM _{2,5}	✓	-
PM ₁₀	✓	-
Humidity	✓	✓
Temperature	✓	✓
Air pressure	✓	✓

2.1 Safety

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



WARNING! Do not substitute parts or modify the system, or install unsuitable parts in the system.



WARNING! Do not perform installation or maintenance procedures when there is a risk of thunderstorm or lightning activity in the area.



WARNING! Follow the risk assessments you have carried out for the installation work. To ensure safety, make sure that all work is organized and planned, and carried out by competent persons.



WARNING! Follow local and state legislation and regulations on occupational safety.



WARNING! Failure to comply with these precautions or with specific warnings elsewhere in these instructions violates safety standards of design, manufacture, and intended use of the product. Vaisala assumes no liability for the customer's failure to comply with these requirements.



WARNING! If the equipment is used in a manner not specified by Vaisala, the protection provided by the equipment may be impaired.



CAUTION! Improper modification can damage the product or lead to malfunction. Any modification voids your warranty.

Vaisala Air Quality Transmitter AQT420 Series incorporates a laser particle counter.

AQT420 is classified as a Class 1 laser device in accordance with International Standard IEC/EN 60825-1. The laser is contained in an enclosure, preventing direct physical access to laser radiation. A Class 1 laser is safe under all conditions of normal use.

2.1.1 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.

2.2 Regulatory Compliances

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

- EN/IEC 61326-1
- EN 55032 Class B



2.2.1 FCC Compliance

AQT410/420 complies with FCC Chapter 47 Part 15. Operating is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.



This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

3. Connecting to AQT400

3.1 AQT400 Configuration

You can view the measurement data and change the settings of AQT400 through the RS-232 serial interface. The RS-232 interface is used mainly for the maintenance connection.

Use the service cable kit to connect your computer to AQT400.

You can connect to AQT400 with the following options:

- Vaisala recommends using a graphical user interface tool: AQ Tool.
See *Vaisala Air Quality Transmitter AQT400 Series User Guide*.
- For more versatile management and troubleshooting options, use a standard terminal program with a command line interface (CLI).

3.2 Connecting to AQT400 with RS-232 (CLI)

The RS-232 interface is used mainly for the maintenance connection.

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

- ▶ 1. Connect AQT400 to a computer with the service cable kit.
2. Switch on AQT400.
3. Open a terminal program (for example, PuTTY).
4. To establish a connection with the serial interface of AQT400, select the COM port. If your computer 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, one stop bit)
- No flow control

If you connect several devices to the same port, define the correct parity setting.

4. Configuration Commands

4.1 List of Commands

The commands are for use in a standard terminal program (command-line interface, CLI).

Table 4 List of Commands

Command	Description	Reference
date	Prints or changes current date and time.	Setting Date (date Command) (page 10)
ls	Lists available commands.	-
meas	Outputs current measurements: <ul style="list-style-type: none"> Gas measurements in ppm units Particle measurements in $\mu\text{g}/\text{m}^3$ units 	Changing Measurement Output Unit (meas Command) (page 11)
reboot	Restarts the device.	Restarting Device (reboot Command) (page 11)
set	Changes a configuration parameter.	Using Configuration Parameters (set and show Commands) (page 12)
show	Prints the value of a configuration parameter.	
write	Writes the configuration changes to non-volatile memory of the device.	Saving to Non-Volatile Memory (write Command) (page 13)

To use the commands, establish a connection to AQT400. See [Connecting to AQT400 with RS-232 \(CLI\) \(page 9\)](#).

4.2 Setting Date (**date** Command)

To display or change the device date, use the **date** command.

```
date [YYYY-MM-DDTHH:II:SS]
```

Table 5 Parameters for **date** Command

Parameter	Value	Mandatory	Description
YYYY-MM-DDTHH:II:SS	Year, month, date, hour, minute, second	No	Sets a new date. If you omit the parameter, the command shows the current date and time.

Example of changing the date:

```
date 2017-05-22T12:34:11
```

4.3 Changing Measurement Output Unit (**meas** Command)

To display or change the measurement unit, use the **meas** command.

```
meas [--metric|--ppb|--raw|--csv|--csm]
```

Table 6 Parameters for **meas** Command

Parameter	Value	Mandatory	Description
--metric	Fixed	No	Displays the data in metric units.
--ppb	Fixed	No	Displays the data in parts per billion (ppb) units.
--raw	Fixed	No	Displays raw measurements for debugging purposes.
--csv	Fixed	No	Displays the data in comma separate value (CSV) format in parts per million (ppm) units.
--csm	Fixed	No	Displays the data in comma separate value format in metric units.

Example of setting measurement output to ppb units.

```
meas --ppb
```

4.4 Restarting Device (**reboot** Command)

To restart the device, use the **reboot** command.

```
reboot --really
```

Table 7 Parameters for **reboot** Command

Parameter	Value	Mandatory	Description
--really	Fixed	Yes	Confirms the restart.

4.5 Using Configuration Parameters (**set** and **show** Commands)

To view or change device configuration, use the **show** and **set** commands.

```
show [serial | hwver | swver | time | lpc | rs485_addr | rs485_baud |
rs485_mode | tempunit]
```

```
set [ lpc | rs485_addr | rs485_baud | rs485_mode | tempunit]=[variable]
```

Table 8 Parameters for **set** and **show** Commands

Parameter	Read/Write	Description
serial	R	Device serial number
hwver	R	Hardware version
swver	R	Software version
time	R	Current time
lpc	R/W	Particle measurement interval, 3 ... 255 minutes Default = 10
rs485_addr	R/W	Modbus address, 1 ... 247 Default = 1
rs485_baud	R/W	Modbus baud rate, 4800 ... 115200 bps
rs485_mode	R/W	Modbus in use 0 = ASCII CSV 1 = Modbus ASCII 4 = Modbus RTU
tempunit	R/W	Temperature unit 0 = °C 1 = °F

Example of checking the software version:

```
show swver
```

Example of changing the temperature unit:

```
set tempunit=1
write --really
```

4.6 Parameters for Advanced Adjustments

The advanced parameters are available for adjusting the measurements. To use the parameters, establish a connection to AQT400. See [Connecting to AQT400 with RS-232 \(CLI\) \(page 9\)](#).

Use the advanced parameters with the **set** and **show** commands.

Table 9 Parameters for Advanced Use of **set** Command

Parameter	Read/Write	Description
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 %)
h2s_zero	R/W	H ₂ S zero correction (-10000 ... 10000 ppb)
h2s_span	R/W	H ₂ S 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 %)
pm25_zero	R/W	PM _{2.5} zero correction
pm25_span	R/W	PM _{2.5} span correction
pm20_zero	R/W	PM ₁₀ zero correction
pm10_span	R/W	PM ₁₀ span correction



To save the configuration changes, type **write --really**.

4.7 Saving to Non-Volatile Memory (**write** Command)

To write the configuration changes to the non-volatile memory of the device, use the **write** command.

```
write --really
```



Use the **write** command together with the other commands, for example **set**.

Table 10 Parameters for **write** Command

Parameter	Value	Mandatory	Description
<code>--really</code>	Fixed	Yes	Confirms the action.

5. Configuring Connections

5.1 Using RS-485 Data Connection

To change the RS-485 settings, establish a maintenance connection with RS-232. See [Connecting to AQT400 with RS-232 \(CLI\) \(page 9\)](#).



If you are using MOG100, you do not need to adjust the settings.

The RS-485 interface is used mainly for the data connection.

The interface supports the following data transfer protocols: Modbus ASCII and Modbus RTU.



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

- ▶ 1. Using a terminal program, define the settings for the RS-485 interface.
 - To use the RS-485 port in Modbus ASCII mode, type the following:

```
set rs485_baud=9600
set rs485_mode=1
set rs485_parity=e
set rs485_databits=7
write --really
reboot --really
```

- Bit rate: 9600 bps
 - Mode: ASCII
 - Port settings: 7E1 (7 data bits, even parity, one stop bit)
- To use the RS-485 port in Modbus RTU mode, type the following:

```
set rs485_baud=9600
set rs485_mode=4
set rs485_parity=e
set rs485_databits=8
write --really
reboot --really
```

- Port settings: 8E1 (8 data bits, even parity, one stop bit)



Modbus RTU mode may give communication errors. This does not affect data transfer or the availability and accuracy of measurement data. You may safely ignore the errors.

The Modbus modes are:

- 0 = ASCII CSV
- 1 = Modbus ASCII
- 4 = Modbus RTU

5.2 Configuring Modbus ASCII Mode

- ▶ 1. Establish a connection to AQT400. See [Connecting to AQT400 with RS-232 \(CLI\)](#) (page 9).

2. Port settings are 7E1 (7 data bits, even parity, one stop bit). To use the RS-485 port in Modbus ASCII mode, type the following:

```
set rs485_baud=9600
set rs485_mode=1
set rs485_parity=e
set rs485_databits=7
write --really
reboot --really
```

If you connect several devices to the same port, define the correct parity setting.

3. To reboot the device and check that the settings are correct, type the following:

```
reboot --really
show rs485_mode
```

4. When done, close the connection.

5.3 Configuring Modbus RTU Mode



Modbus RTU mode may give communication errors. This does not affect data transfer or the availability and accuracy of measurement data. You may safely ignore the errors.

- ▶ 1. Establish a connection to AQT400. See [Connecting to AQT400 with RS-232 \(CLI\) \(page 9\)](#).
- 2. Port settings are 8E1 (8 data bits, even parity, one stop bit). To use the RS-485 port in Modbus RTU mode, type the following:

```
set rs485_baud=9600
set rs485_mode=4
set rs485_parity=e
set rs485_databits=8
write --really
reboot --really
```

If you connect several devices to the same port, define the correct parity setting.

3. To reboot the device and check that the settings are correct, type the following:

```
reboot --really
show rs485_mode
```

4. When done, close the connection.

5.4 Configuring Parity

Depending on if you connect one or multiple devices to the same port, define the correct parity setting.

- ▶ 1. Establish a connection to AQT400. See [Connecting to AQT400 with RS-232 \(CLI\) \(page 9\)](#).
2. Select the parity according to your setup. If you connect multiple devices to the same port, all the devices must have the same parity setting.
For example, if the system uses odd parity, set the device parity to odd:

```
set rs485_parity=o
```

The parity setting options are:

- Even parity: **set rs485_parity=e**
- Odd parity: **set rs485_parity=o**
- No parity: **set rs485_parity=n**

3. To reboot the device and check that the settings are correct, type the following:

```
reboot --really
show rs485_parity
```

4. When done, close the connection.

5.5 Configuring Modbus Address

- ▶ 1. Establish a connection to AQT400. See [Connecting to AQT400 with RS-232 \(CLI\) \(page 9\)](#).
2. To change the Modbus address and save the configuration change to the non-volatile memory, type the following:

```
set rs485_addr=<address>
write --really
```

Modbus address range: 1 ... 247, default = 1.

3. To reboot the device and check that the settings is correct, type the following:

```
reboot --really
show rs485_addr
```

4. When done, close the connection.

6. Configuring Measurements

6.1 Changing Temperature Unit

- ▶ 1. Establish a connection to AQT400. See [Connecting to AQT400 with RS-232 \(CLI\)](#) (page 9).
- 2. To change temperature unit to Celsius, type the following:

```
set tempunit=0
write --really
```

To change to Fahrenheit, type:

```
set tempunit=1
write --really
```

- 3. To reboot the device and check that the settings is correct, type the following:

```
reboot --really
show tempunit
```

- 4. When done, close the connection.

6.2 Configuring Measurement Interval

The measurements of the particle counter are based on the number of particles sampled over a period of 60 seconds, and the default measurement interval is 10 minutes.

- ▶ 1. Establish a maintenance connection to AQT400. See [Connecting to AQT400 with RS-232 \(CLI\)](#) (page 9).
- 2. Set the measurement interval in minutes.
Measurement interval defines how often AQT400 takes measurements.
To define the measurement interval to be 3 minutes, type the following:

```
set lpc_int=3
write --really
```

Measurement interval 3 ... 255 minutes, default 10 minutes.

7. Servicing and Configuring Device

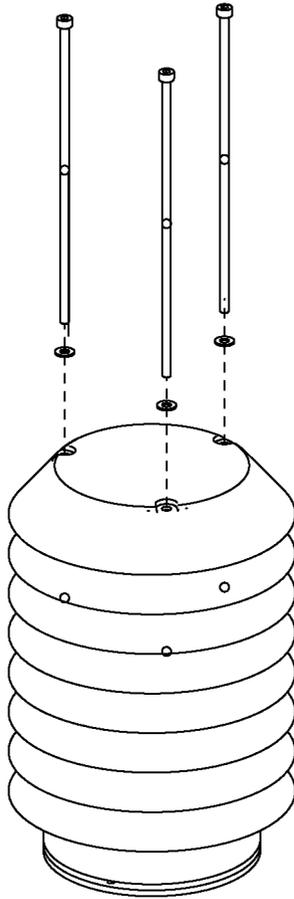
7.1 Removing Radiation Shield



- 3-mm Allen key

To replace modules in AQT400, remove the radiation shield.

- ▶ 1. Loosen the 3 screws that hold the radiation shield in place and pull them out. Remove the radiation shield.



- 2. Carry out the needed maintenance.
- 3. To attach the radiation shield, use the 3 washers and screws. Tighten the screws.

7.2 Replacing AQT400 Base Module



- 3-mm Allen key
- Crosshead screwdriver
- Laptop with standard terminal program
- Service cable kit

Order the AQT400 base module from Vaisala.

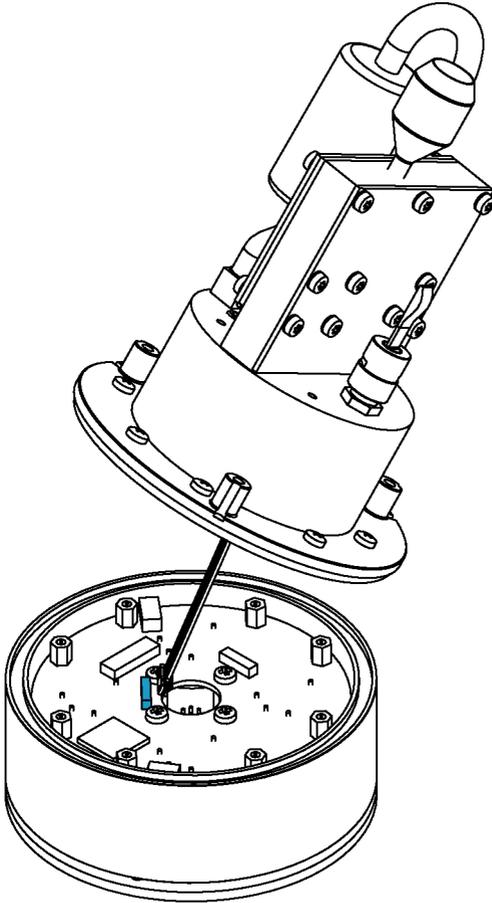
Replace the AQT400 base module when the device health (service indicator) of your AQT400 is lower than 30 %.



CAUTION! To avoid damaging the device, carry out the replacement indoors.

- ▶ 1. If you have created special configurations on the base module, connect to AQT400 with RS-232 and copy the configuration and settings to your computer.
2. Remove AQT400 from the mounting bracket at the installation site.
3. Remove the radiation shield.
4. Remove the 8 screws that hold the lid in place.

5. Lift the lid so that you can see the lid connector. Unplug the connector from the circuit board of the base module.



6. Take the new calibrated base module from the box.
7. Plug the connector to the circuit board of the new base module, check that the O-ring is in place, and close the lid.
8. Attach the screws tightly.
9. Attach the radiation shield with the 3 screws and tighten the screws.

10. Verify the AQT420 base module installation.

With the default settings, the spare part is fully compatible with AQT420. If you have created special configurations, copy the configuration and settings from your computer to the new base module. Verify that the real-time clock is correct and adjust if required:

- In AQ Tool, select **Set to UTC**.
- In a terminal program, use the **date** command:

```
date [YYYY-MM-DDTHH:II:SS]
```

For example:

```
date 2017-05-22T12:34:11
```

11. Verify the AQT410 base module installation.

Establish a maintenance connection with a terminal program and type the following:

```
initconf --aqt410  
write --really
```

To check that the settings are correct, type the following:

```
show unit
```

To confirm that everything works as expected, use the **meas** commands or AQ Tool.

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.

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 more information, see www.vaisala.com/support.

Recycling



Recycle all applicable material.



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

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