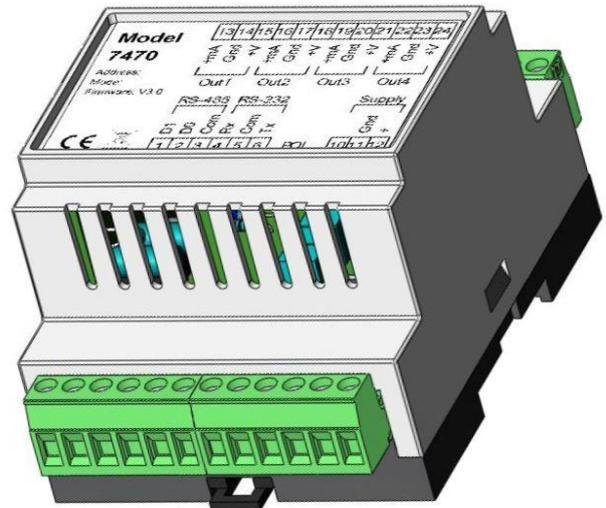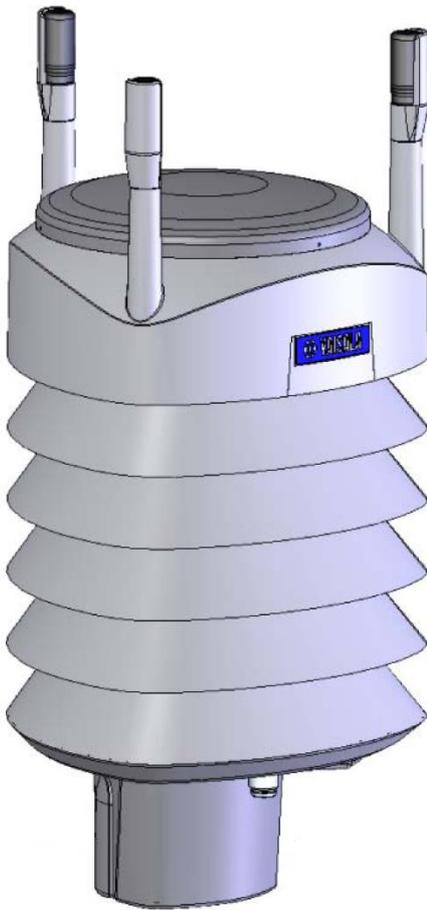**Application note**

Vaisala WXT and Nokeval 7470 V4.0-

Juha Hämäläinen / Nokeval Oy 2018-08-06

General

Nokeval 7470 analog output unit can be configured to interpret the messages of the Vaisala WMT and WXT weather sensors. This application note will give instructions for this process. The supported Vaisala transmitters are WXT530-536, WXT520, WXT510, WMT52, and WMT50.

This note applies to the 7470 firmware versions V4.0 and up (shipped since May 2015). For older 7470 versions, an older application note should be used, or the 7470 firmware updated at the manufacturer.

How to go

Wire together

Refer to page 4 for examples on how to wire the devices.

For Vaisala

If it seems that the weather station can work with its default settings, then it may not need any configuring, see page 4.

If it needs configuring, then it is recommended to have the official Vaisala configuration tool, which means a cable for connecting the station to a computer, and the Vaisala software. See page 7.

If those are not available, then the station can be temporarily connected to a computer via RS-232 or RS-485 and configured with a terminal software, page 13.

If such a port is not available, the last option is to configure it via the 7470, which is not convenient. Page 15.
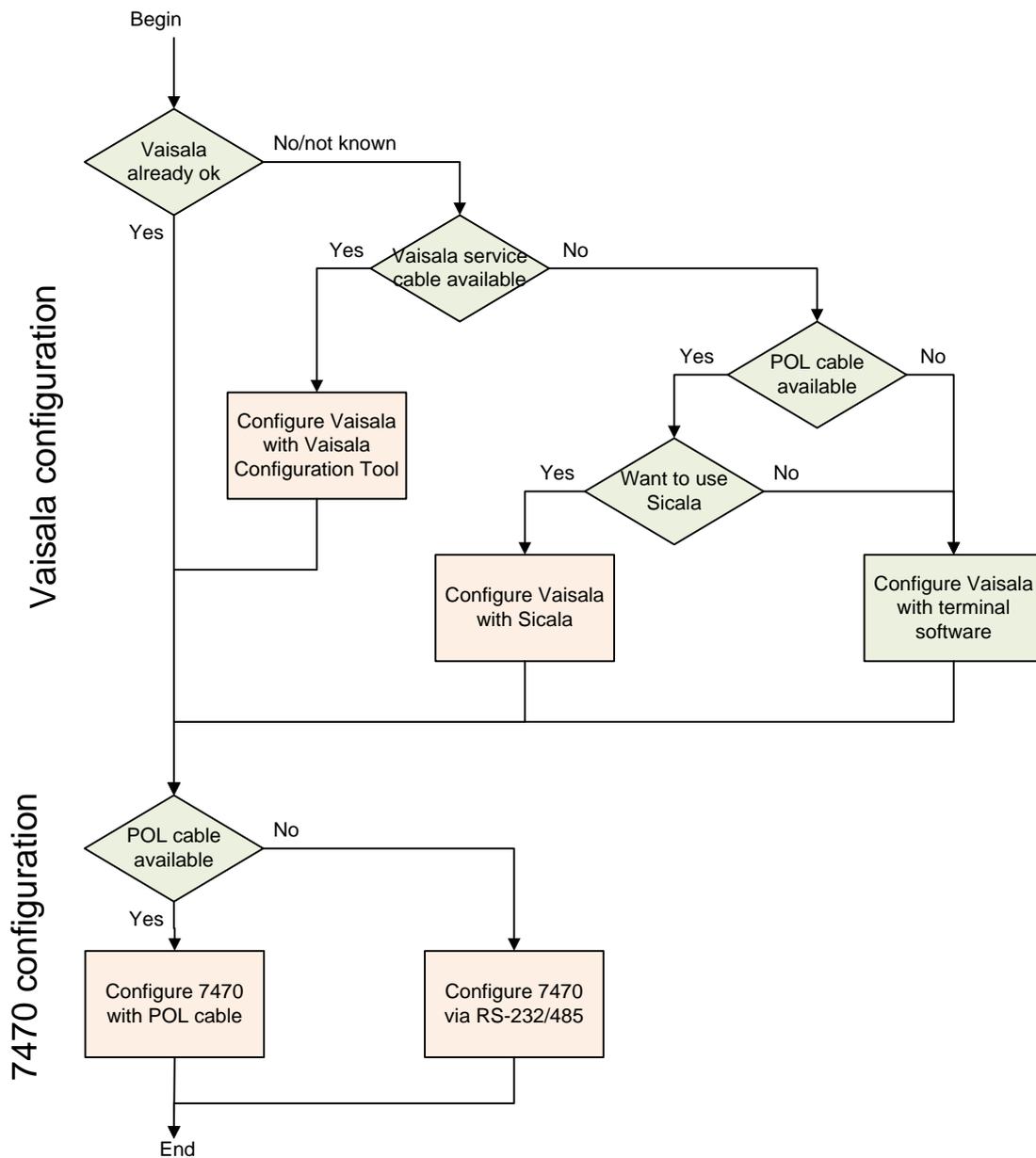
For 7470

The 7470 is preferably connected to the computer for configuration using a programming cable Nokeval DCS772, which connects to a USB port of the computer. The older POL-RS232 cable can be used as well. These cables are collectively referred to as "POL cable".

If no programming cable is available, the 7470 can be configured using an RS-232 or RS-485 connection, but it will make things much more difficult. The jumper JP1 must be closed inside 7470 during configuration, and it is not possible to monitor the communications.

The configuration software used is Mekuwin, available free from the Nokeval web site.
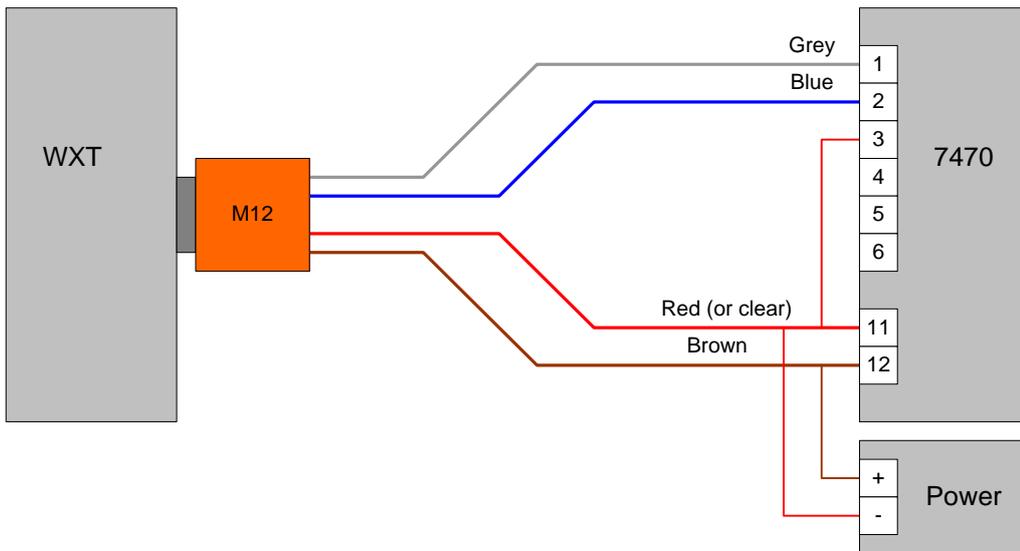
Table of contents

Begin

Vaisala configuration

Vaisala already ok — No/not known → Vaisala service cable available

Yes

Vaisala service cable available — Yes → Configure Vaisala with Vaisala Configuration Tool

Vaisala service cable available — No → POL cable available

POL cable available — Yes → Want to use Sicala

POL cable available — No → Configure Vaisala with terminal software

Want to use Sicala — Yes → Configure Vaisala with Sicala

Want to use Sicala — No → Configure Vaisala with terminal software

7470 configuration

POL cable available — No → Configure 7470 via RS-232/485

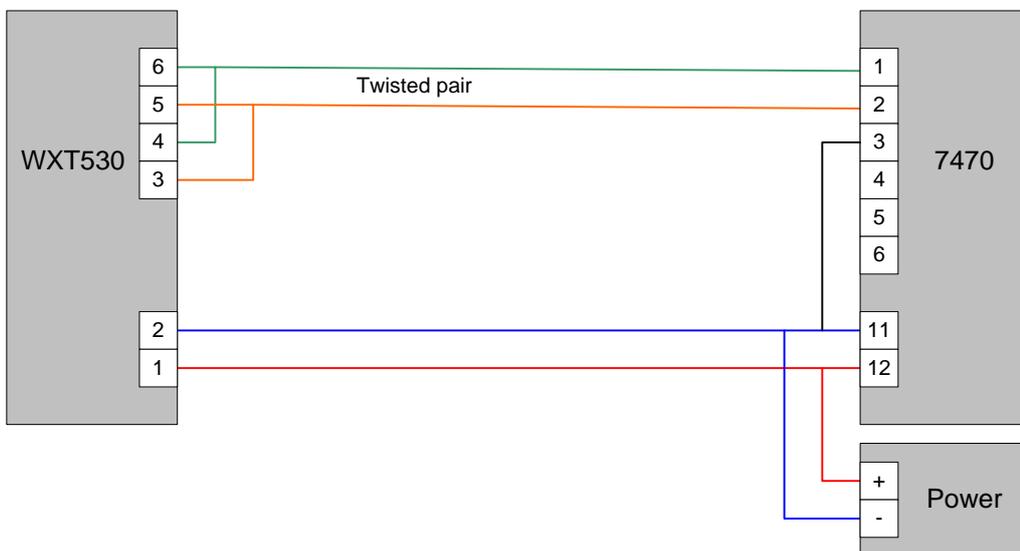POL cable available — Yes → Configure 7470 with POL cable

End

WIRING

## WXT530 and WXT520 RS-485 with the Vaisala M12 cable

WXT530 RS-485 from the screw terminals

Since Vaisala does not have an isolation between its serial and power ports, one wire can serve as a serial common and power supply minus wire.

The heater wiring is not shown here. It may be better to use a dedicated pair of wires for the heater in order to avoid significant voltage drop on the operating supply wires which serve also as the serial bus common.

WXT520 RS-485 from the screw terminals
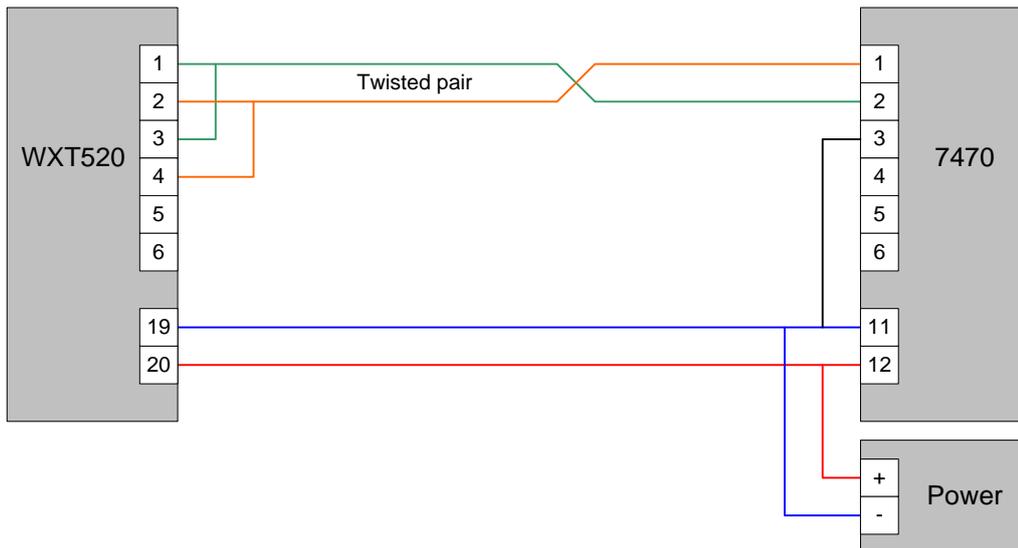
Several 7470's

If there are several 7470's for more than four parameters, just connect them in parallel.

RS-485 polarization

Every RS-485 bus should have one or two devices capable to feed a weak current on the bus. The purpose of the current is to have a small (0.2 to 5 V) voltage between the data wires when nobody is transmitting on the bus. This is called fail-safe, polarization, or biasing. If there is no polarization, the devices may receive phantom data from the bus when it is idling.

The Vaisala stations are not able to provide the polarization. The task is then assigned for the 7470. Set the jumper JP4 to position "Polarized" or "Terminated and polarized" per the 7470 manual.

Overvoltage protection

If the weather station is installed prone to the lightning, it is advisable to protect the 7470 with a surge protector. Such are available from Vaisala and other suppliers. Please also pay attention to the weather station grounding.

5

IS IT NECESSARY TO CONFIGURE VAISALA AT ALL?

If the following conditions are met, it is likely not necessary to configure the Vaisala at all:

1. If the Vaisala is ordered with "ASCII Auto" option. The Vaisala station must be configured to transmit its messages automatically, because the 7470 is not able to send any commands.

2. If the Vaisala defaults are acceptable. There are settings like averaging time, measurement units, baud rate, automatic counter resets, etc. In a new unit, they are in their default values.

# CONFIGURING VAISALA WITH THE VAISALA CONFIGURATION TOOL

General

This guide is based on some version of the Vaisala tools. This guide is not regularly updated when new versions are released. The basic ideas should however remain the same. Refer to the Vaisala instructions on how to use their tools.

Connecting

Launch the *Vaisala configuration tool* software.

Select *File/Connection Setup*. Select your serial port. If you use the service cable, the baud rate is always 19200. Otherwise the baud rate is whatever is configured in the weather station; factory default is 19200. 8 bits, none parity, 1 stop. After closing the Connection setup window, the main window should say *Connected* in the status bar. If not, check the connections and that the weather station is powered up.
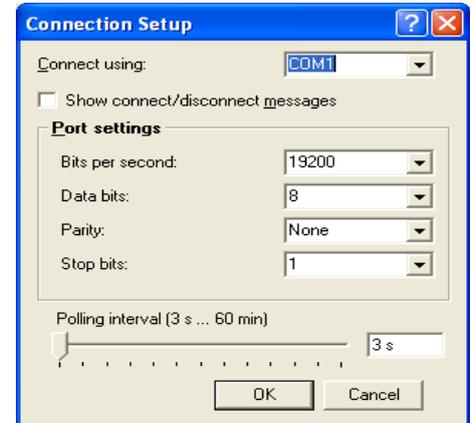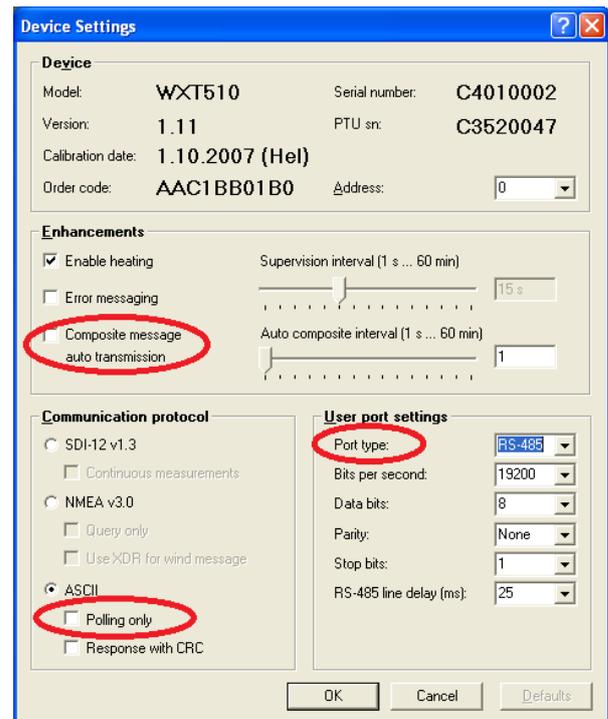
Device settings

Make sure the *Composite message auto transmission* is disabled.

Select the *ASCII* protocol. Enable the automatic transmissions by disabling the *Polling only* check box.

Select *Port type* according to the cabling. The *baud rate* here must match what will be configured in the 7470; 19200 is a good choice. *Data bits* must be 8, *Parity* None, and *Stop* 1.

Sensors setup

Most of the settings here are obvious. Refer to the Vaisala documentation for more info.

If using the rain and hail counters (i.e. the cumulative values), set up an automatic reset for them. Otherwise the values will increase and increase, which is not possible with an analog signal. The automatic reset value should correspond to the high end scaling of the analog signal (the scaling is configured in the 7470).

Message settings

Ignore the Composite message section.

Select the Wind, PTU, Precipitation etc parameters required. It does not harm if there are extra parameters enabled. Just make sure, that the parameters you need, are enabled.

CONFIGURING 7470 WITH A POL CABLE

Connecting

Open a MekuWin connection to 7470, using the serial number or the serial port of the POL cable, SCL protocol, 9600 baud, address 0 (if using RS-232/485 for configuration see page 16). Connect using the *Direct* button.

Serial setup

Go to the Ser submenu. Set up:

- *Mode* = Ascii
- *Baud* = same as Vaisala (19200)
- *Parser* = Custom
- *Stime* = 10

Now comes the interesting part. There is a *String* setting under the Ser submenu. It is used to define how the Vaisala message is interpreted. It is a multi-line string, meaning you can press the Enter key to move to the next line.

The first line must be %FS=,

which tells to the 7470 that the Vaisala message consists of several fields, which are separated by commas (please note the comma at the end of the line). Consequently the 7470 will split each message at each comma and treat the pieces individually.

Now define which weather parameter you want from the 7470's first output channel, e.g. Wind direction average. Vaisala marks this field with Dm. In the String setting, press Enter to have a new line. Write Dm=%1. This means that when any field contains Dm=, the 7470 will pick the value for its first channel.

Now do the same for the second, third, and fourth parameter if applicable. Finally the String setting should be something like:

```
%FS=,
Dm=%1
Sm=%2
Sx=%3
Ta=%4
```

The most common Vaisala parameters:

Dm	Wind direction average
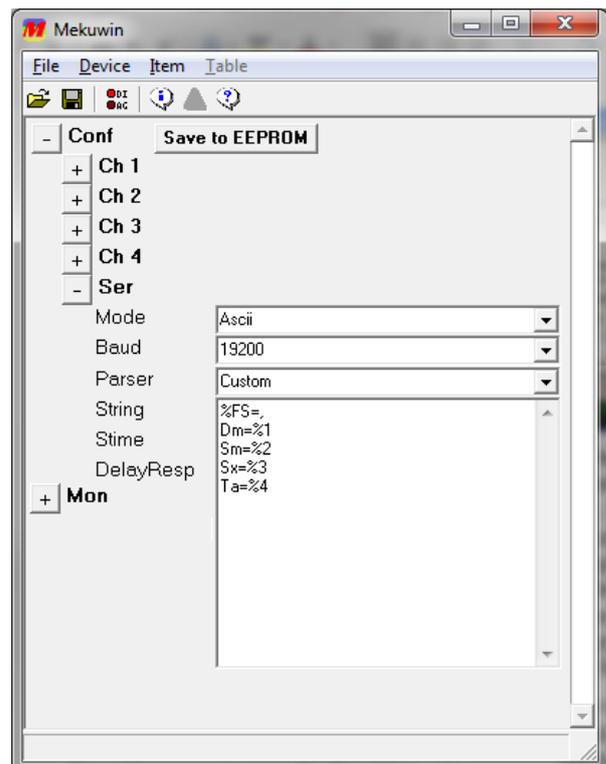
Sm	Wind speed average
Sx	Wind speed maximum (gust)
Ta	Air temperature
Ua	Air humidity
Pa	Air pressure
Ri	Rain intensity (intantaneous)
Ra	Rain amount (cumulative counter)
Hi	Hail intensity (intantaneous)
Ha	Hail amount (cumulative counter)

Output channel setup

Each of the four analog outputs are configured individually in the corresponding submenus *Ch 1* to *Ch 4*.

Scaling the analog signals

The Range setting defines the analog output signal type, e-g. 4-20 mA.

The *Lo* and *Hi* settings define the weather parameter values that will give the low end and high end signals. For example, to get 4 mA when the wind speed is 0, and 20 mA when it is 50, set *Range*=4-20mA, *Lo*=0, and *Hi*=50. The 7470 does not know nor care about the measurement unit – it is defined in the Vaisala configuration.

Please note that when using the cumulative counter parameters (rain and hail), it is necessary to set up an automatic reset in Vaisala, otherwise the value increases forever which is not suitable for an analog signal.

The From setting should be 1 on the first channel, 2 on the second, etc.

Finally click the *Save to EEPROM* button.

Testing

Remove the service cable from the weather station, if still attached, to enable the auto-transmission. Wire the Vaisala and 7470 together, if not already.

If using a DCS772 programming cable, open the Monitor on MekuWin. Readings should appear in *Ch1-4*. The analog outputs should activate.

Several 7470's

Several 7470's can be parallel-connected in an RS-485 bus and configured to pick different parts of the Vaisala composite message using a different parser string.

Defaults

If ordered unconfigured, the 7470 is not configured for Vaisala use. However if ordered configured for Vaisala but no other details are given, it will likely have the following default parameter associations and scalings with 4-20 mA output:

Channel	Parameter	Scaling
1	Wind direction	0…360 °
2	Wind speed average	0…30 m/s
3	Wind speed maximum (gust)	0…30 m/s
4	Air pressure	600…1100 mbar

Another device in the same order:

Channel	Parameter	Scaling
1	Air temperature	-40…+60 °C
2	Air humidity	0…100 %RH
3	Rain intensity	0…100 mm/h
4	Hail intensity	0…100 mm/h

TROUBLESHOOTING

7470 outputs are 0 mA or 0 V	Remove the programming cable, if still attached.
	7470 is not receiving proper messages. Make sure that the weather station is auto-transmitting, and that the baud rates match. Also check the serial bus wiring.
Vaisala not auto-transmitting	Remove the service cable, if attached.
	Check the configuration once more.

Also look at the troubleshooting instructions in the 7470 manual.

Measure the voltage between the RS-485 lines. It should be 0.2 to 5 volts, D1 or + being more positive. Measure at the other end of the bus too.

Watch the voltage. You should be able to see a regular (small) deflection when Vaisala transmits. If not, it suggests that Vaisala is not transmitting.
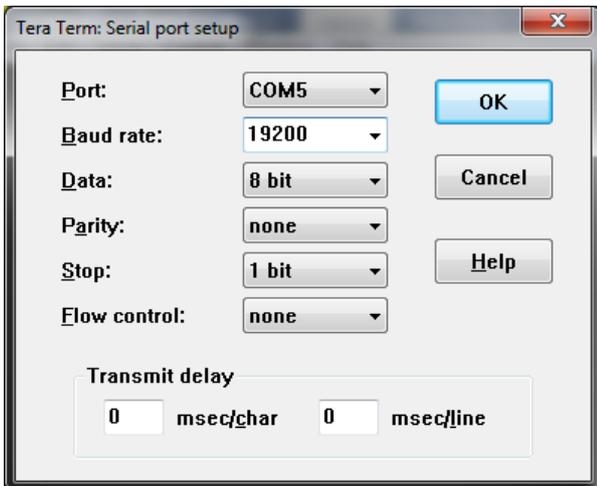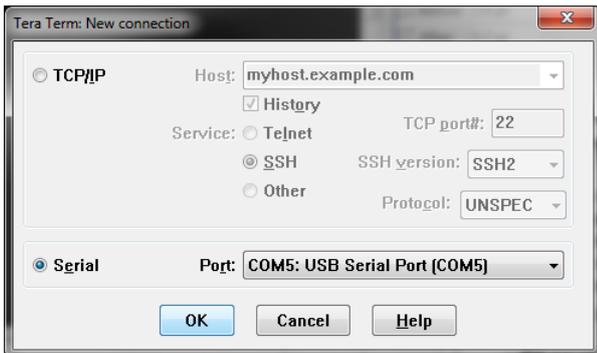
CONFIGURING VAISALA WITH A TERMINAL SOFTWARE

Connecting

Connect the Vaisala to your computer either via RS-232 or RS-485.

Setting up the terminal software

OpenTeraTerm (or any other terminal software) and create a session to the desired serial port. Use the baud rate that the weather transmitter uses (default 19200-8N1, service port always 19200).

Check that the terminal software sends and accepts CR+LF as the newline.

Enable the local echo so that you can see what you type.
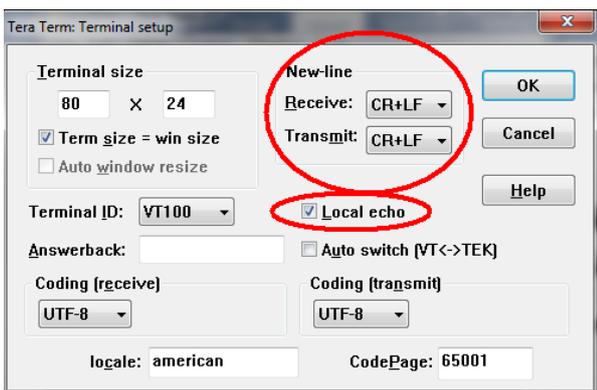
Testing the communications

If the Vaisala is configured for automatic transmission, it sends messages like 0R1,Dn=000D...

If you get mess, try other baud rates.

If you don't get anything, write command 0R1, press Enter, and see if Vaisala responds. If not, check the cabling and the supply voltage.

Sending commands with Copy – Paste

The commands described here may be copied to the clipboard and sent to the weather transmitter instead of manually typing them. Activate the text selection tool in your pdf reader. Go to the beginning of the command, keep the left mouse button pressed and move the cursor one row lower. Release the button. Select Copy. (This way we can copy the newline character too).

Now go to the terminal software and select Edit/Paste to Host. The command is sent to the weather station.

Stopping the automatic transmission

If the Vaisala is sending automatic messages, it makes it difficult to configure. So those auto transmissions are recommended to be switched off while configuring. To do that, send the command below. It is recommended to be sent using the clipboard method as described above.

```
0XU,M=P,I=0
```

Changing Vaisala baud rate

If you want to change the baud rate, write for example

```
0XU,B=19200
```

Switch the weather station off for 30 s. Change your terminal software for the new baud rate.

Changing the other settings

Refer to the weather station manual.

Finally enable the automatic transmission

Send command

```
0XU,M=A
```

Now the weather station should send only one type of message beginning with 0R0. Vaisala is done. Close or disconnect the HyperTerminal.

CONFIGURING VAISALA WITH SICALA

The 7470 allows sending commands to the RS-232/485 bus from the POL (programming) port. This is not convenient but may still be useful in some situations.

Sicala is a testing software for devices using the Nokeval SCL protocol. The 7470 uses this protocol on its POL port.

Set-up

Download Sicala from the Nokeval website and install it.

Connect the DCS772 cable between your PC and the 7470.

Close MekuWin totally before launching Sicala, to free the serial port.

Wire the 7470 and the Vaisala weather station together, if they are not already. Look at chapter Wiring, page 4.

In Sicala, select the COM port of the programming cable. Select 9600 baud, 8N1 bits, SCL with BCC protocol, address 0.

Write command TYPE ? And press enter. If all is OK, you should see a green response "7470 V4.1" or so.

Sending commands for Vaisala

The command C is used to request the 7470 to send a command to Vaisala. In the Command box, write C, one space, and a Vaisala command, and press enter (or click the Send button). An example:

```
C 0R1
```

This sends command 0R1 (request wind data) out of the RS-232/485 port.

Getting responses

To hear what Vaisala has to say, use command G (get). In Sicala command box, write G only, and press enter. You should see a Vaisala message in the Response box. Since the messages are buffered in the 7470, press enter several times to read out all messages, until an empty response is returned (green <> in the Response box).

The message buffer in the 7470 is limited in size, about 400 bytes, so the oldest messages will be discarded if too much data is input before reading it out.

Configuring

Proceed as in chapter Configuring Vaisala with a terminal software, page 13, but send the commands with the C command and read the responses with the G command.
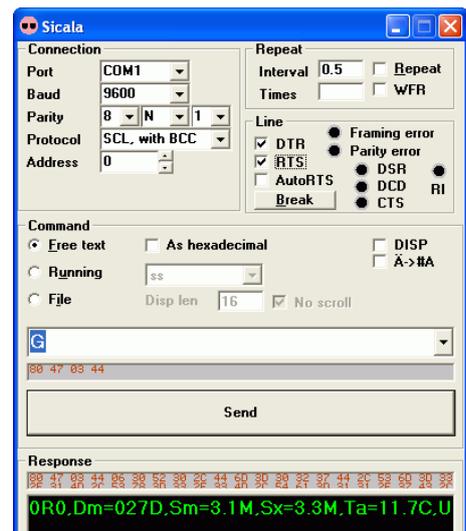
CONFIGURING 7470 VIA RS-232/485

Using RS-232 or RS-485 for configuring the 7470 is necessary only if a programming cable (DCS772 or POL-RS232) is not available. It is highly recommended to obtain the cable as it makes things much easier.

Wiring

RS-232

Disconnect the Vaisala unit from the 7470. Wire the Tx of 7470 to Rx of your PC, and vice versa. Also connect the common.

For a D9 RS-232 connector, the wiring goes:

7470	Name	PC
4	Rx	3
5	Common	5
6	Tx	2

RS-485

Connect the terminal 1 (D1) of the 7470 to the D1 or + terminal of your RS-485 port. Connect the terminal 2 (D0) to the D0 or – terminal of your RS-485 port. Also connect the commons together, if possible.

Jumper

The RS-232/485 port of the 7470 can be configured for various protocols, but only the SCL and Modbus RTU protocols allow configuration with MekuWin software. To ensure that the 7470 is using the SCL protocol, 9600 baud, and address 0, close the jumper JP1 inside the enclosure. The 7470 manual will give details on this.

Configuring

Launch MekuWin. Select the appropriate COM port, SCL protocol, 9600 baud, and address 0 or 126. Try to connect. Then proceed as in the previous chapter.

Finally

When the configuration is done, remove the jumper and cycle the power.

Now you can connect the weather station and see if the system works. It is not possible to configure the 7470 while the weather station is connected.