

Set-Up Guide

MCERTS Radar Level Sensors
& Controllers



Certificate No: Sira MC210360/00



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Introduction

This document is designed to provide users with set-up guidance when commissioning MCERTS VEGAPULS non-contact Radar level sensors and associated VEGAMET 86x controllers. It also provides a summary of the Radar sensors and controller options with Class 1 MCERTS certification and their open channel flow functionality.

1. Overview of MCERTS Devices and Systems

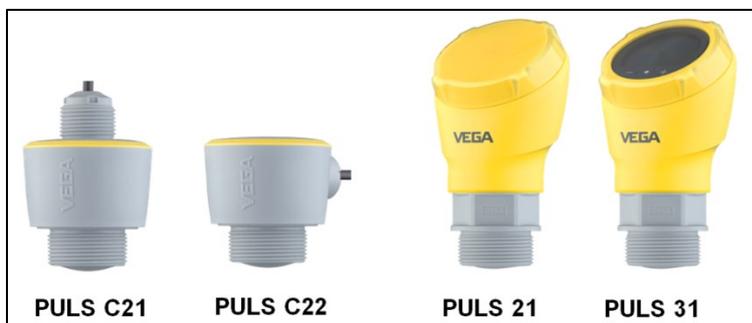
i) Radar level sensors

The **VEGAPULS C 21**, **VEGAPULS C 22**, **VEGAPULS 21** and **VEGAPULS 31** are smart, compact, 80 GHz, non-contact radar level transmitters that can be applied on MCERTS open channel flow applications providing flow rate measurement as stand-alone devices.

The **VEGAPULS C 21** and **VEGAPULS C 22** have an integral signal cable and ingress protection IP66/IP68. Cable lengths from 5 metres to 300 metres are available.

The **VEGAPULS 21** and **VEGAPULS 31** have a housing with cable gland connection IP66/IP67.

The **VEGAPULS 31** has an integral display for adjustment and local level or flow rate indication in selectable engineering units with bar graph indication.



*VEGA MCERTS certified
Radar Level Sensors*

Outputs:

*4 to 20 mA proportional to
flow rate.*

*HART digital signal of flow
rate, head etc.*

The class 1 MCERTS certification applies to all four radar options as stand-alone devices, they do not need to be connected to a VEGAMET Controller.

This certification is based on the analogue 4 to 20 mA loop powered output or reading the HART digital signal for flow rate. The set-up and functionality is identical for all four sensors.

ii) VEGA Controllers

All the above radars can be used in combination with **VEGAMET 861** single channel and **VEGAMET 862** dual channel digital input controllers to provide the totalization function and data logging including back-up to an SD card.

The **VEGAMET 861/862** controllers have fully programmable relay functions for alarms or flow volume pulse output for remote totalization or automatic dosing systems, as well as an analogue re-transmission of the flow rate signal.

The HART digital communications protocol should always be used between the selected MCERTS VEGAPULS radar level sensor and the VEGAMET 86x controller to maximise the accuracy and reliability of the flow measurement data.



VEGA MCERTS certified Radar Level Sensors with Controllers to provide additional functionality.

Totalization - Data logging - SD card back-up – Analogue 4 to 20 mA re-transmission of flow rate - Relay functions for alarms or remote totalization.

2. Configuration tools

The VEGAPULS radar level sensors and VEGAMET 86x controllers can be configured, via Bluetooth, using the VEGA Tools app on a tablet or phone. However for the initial set up of an MCERTS system, we recommend using PACTware / VEGA DTM on a laptop, as this offers easier programming, overview and functionality as well as a back-up file of all the settings. The screenshots in the following sections are taken from PACTware / VEGA DTM software, although they are all available on the VEGA Tools App. For a comparison between the VEGA DTM and VEGA Tools App screen visualisation, please see screenshots in the [Appendices](#).

3. Flow Curves in VEGA radars and controllers (ISO standards)

The non-contact radar, as a stand-alone device or in combination with a controller, is fundamentally an accurate distance measurement device. The distance measurement is configured to provide a filling height above a flume or weir, which in turn uses a **flow curve** to convert the filling height into a flow rate in a choice of engineering units. 32 point flow curves, to the following **ISO Standards**, can be configured using a simple set-up assistant in the VEGA Tools app or in PACTware.

ISO 1438:2008: Open channel flow measurement using thin-plate weirs (Rectangular & V-notch).

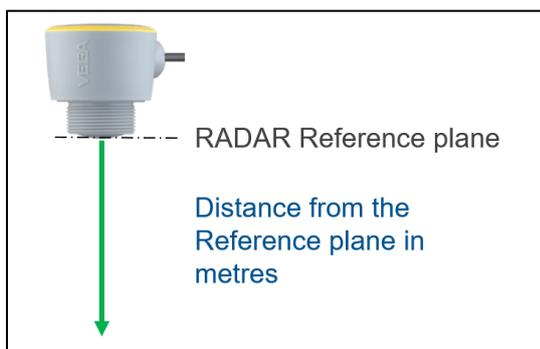
ISO 4359:2013: Flow Measurement Structures: Rectangular, Trapezoidal & U-Shaped Flumes.

ISO 3846:2008: Rectangular broad-crested weirs for the accurate measurement of flow of clear water in open channels under free flow conditions.

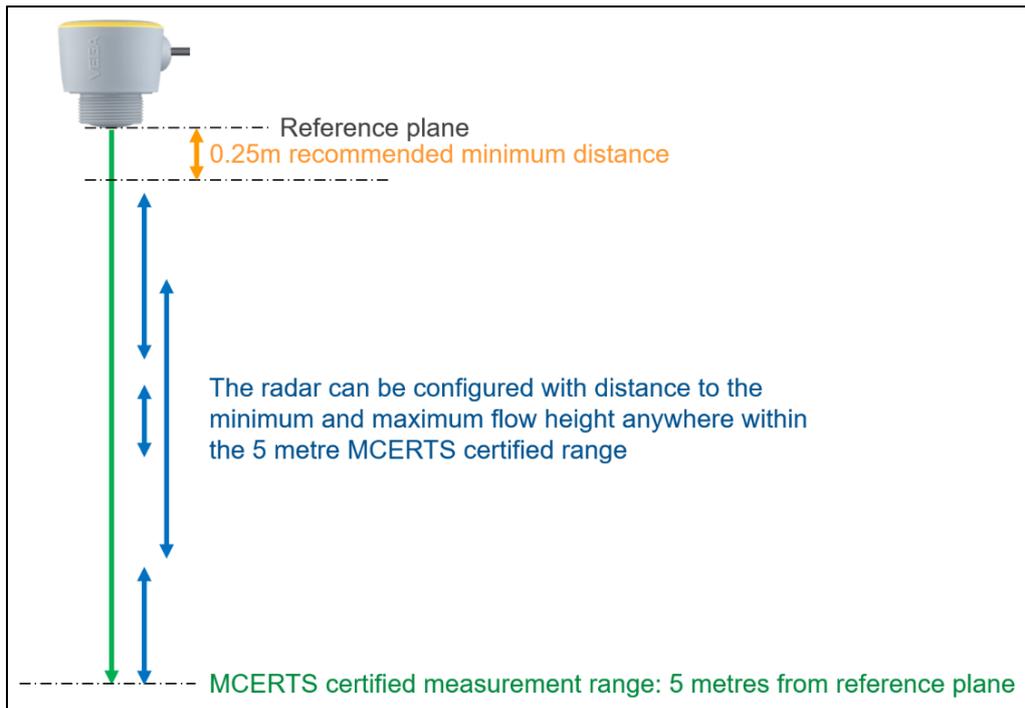
Alternatively, a third party flow curve, of up to 32 points, can be imported or generated directly in the radar and/or controller.

4. Radar Set-up for Open Channel Flow (MCERTS)

VEGAPULS MCERTS radar: All distance measurements are taken from the radar "Reference plane" (i.e. 0 metres). The reference plane is the face of the radar antenna.

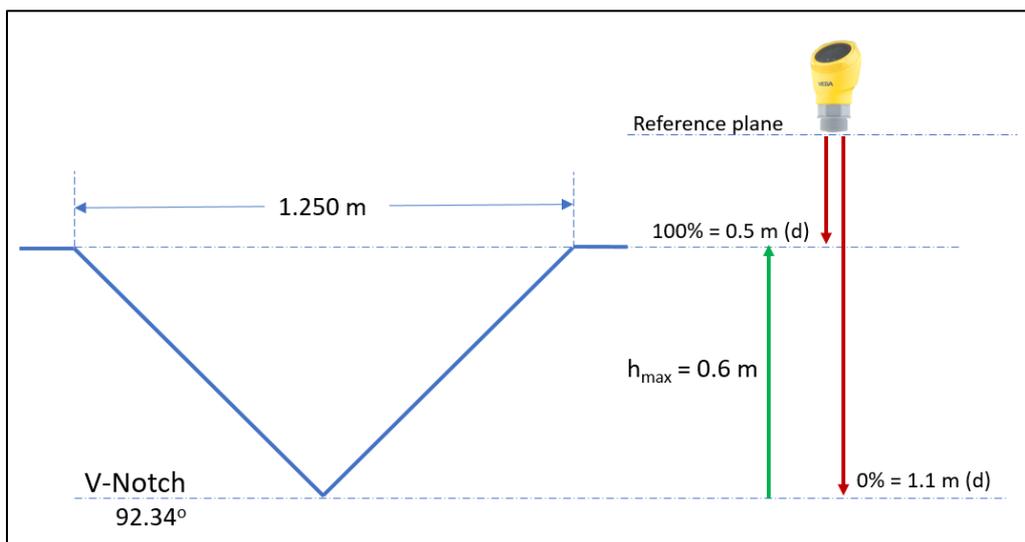


Although the VEGAPULS radar level sensors have a range of 15 metres, the MCERTS certified range is up to 5 metres from the radar reference plane. For optimum accuracy, we recommend a minimum distance of 0.25 metres from the radar reference plane to the maximum height of the liquid level, h_{max} .

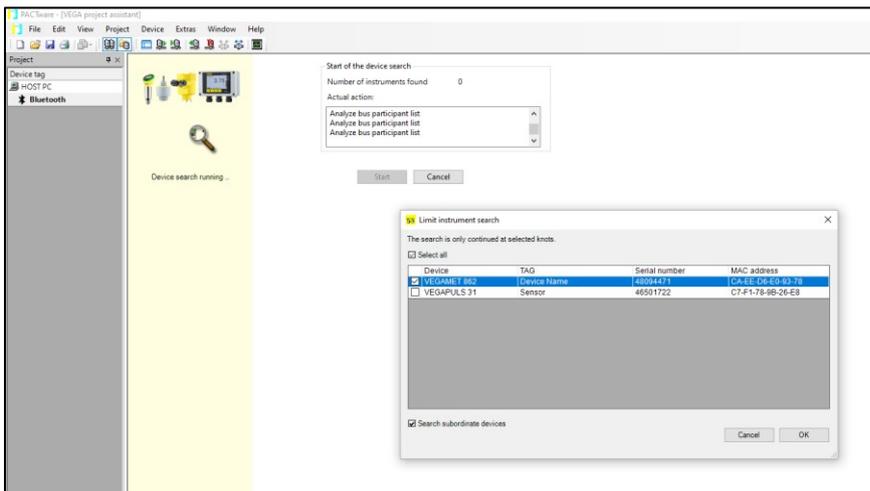
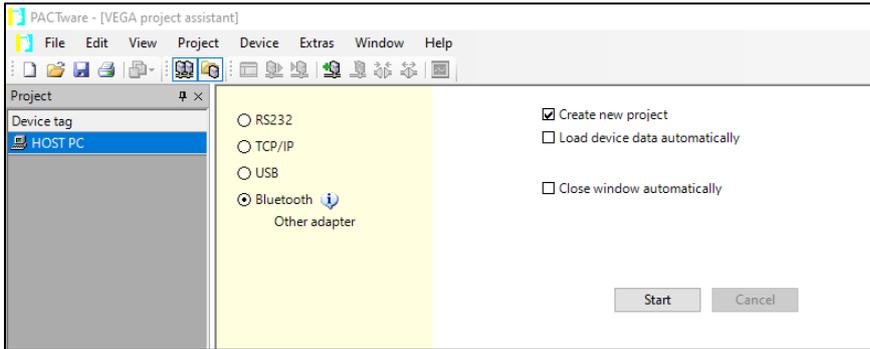


5. Radar set-up with CONTROLLER using PACTware operating software

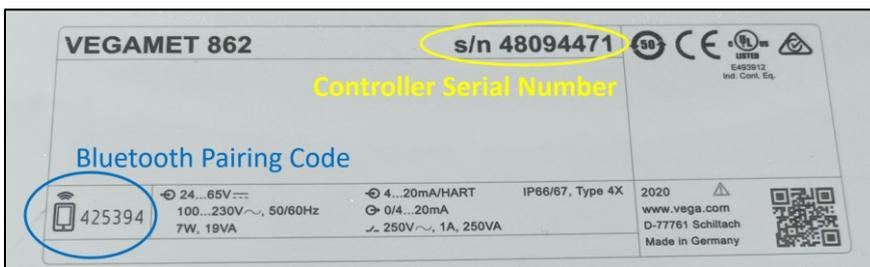
i.) Application example: V-notch thin plate weir



Open PACTware and search for the VEGAMET 86x controller using the Bluetooth tab within VEGA Project Assistant. The software will automatically search for available instruments within Bluetooth range.



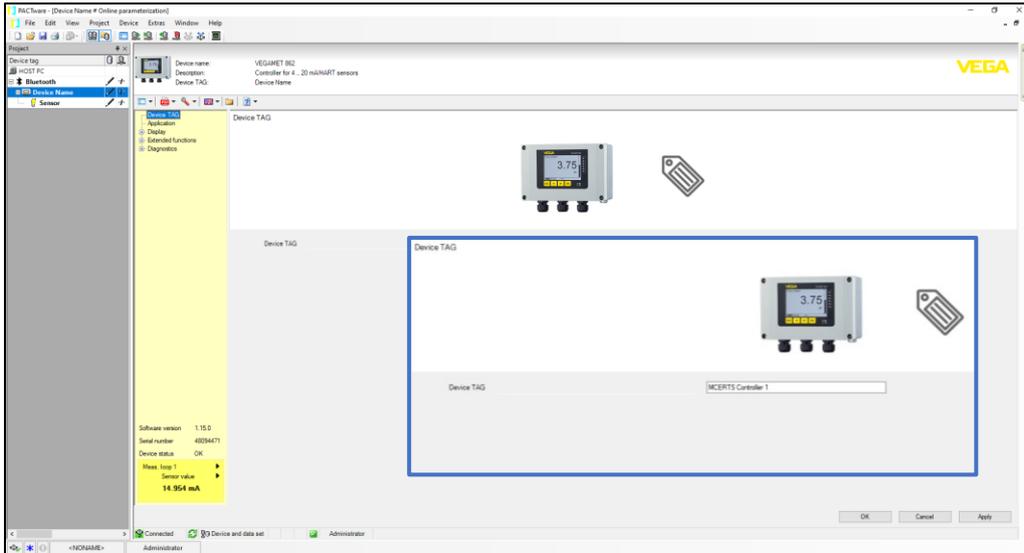
Select the VEGAMET 86x controller which is identified by its unique 8-digit serial number. Once connected, you will need to “pair” with the controller using the 6-digit Bluetooth code. Both the unique 8-digit instrument serial number and the 6-digit Bluetooth pairing code can be found on the label on top of the controller housing or within the documentation supplied with the controller.



Once you have paired with the controller, the VEGA Project Assistant will ensure that PACTware connects to the controller and the connected VEGAPULS radar(s).

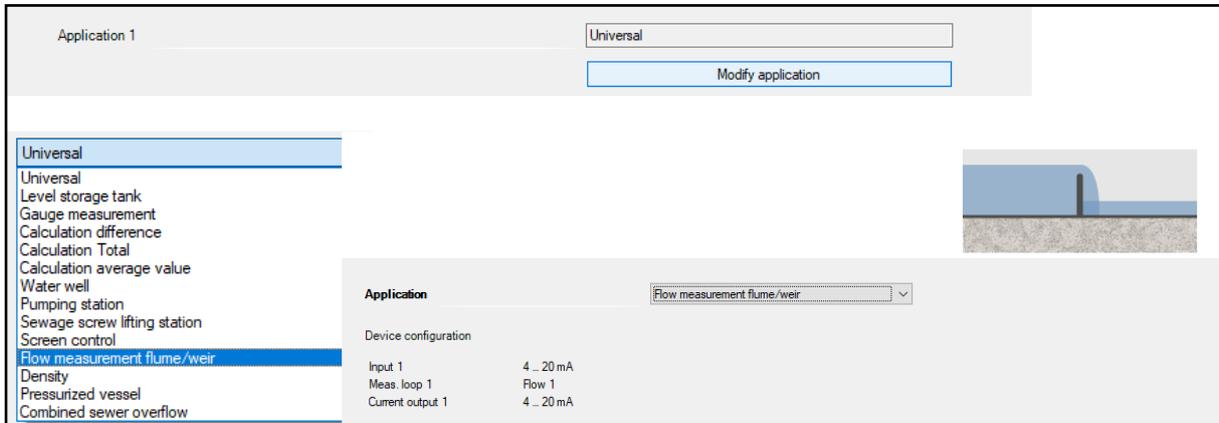
Connect to the VEGAMET 86x controller DTM from the PACTware project tree by double clicking on the device in the PACTware Project tree.

This will open the VEGA DTM software for the controller. A Device TAG can be given to the controller to identify it when connecting via Bluetooth in future.



Select the Application tab within the VEGA DTM and click on “Modify application”. This will open up a set-up assistant that will enable you to configure the controller for the given ISO Standard primary flow device (Flume or Weir). Select, “Flow measurement flume/weir”.

NOTE! If you are only using one channel of a two channel device (VEGAMET 862) make sure you deactivate ‘Application 2’ if you are not intending on using the 2nd input either physically or virtually (e.g. as an extra measurement value output).



You can give the measurement loop (VEGAMET 861) or measurement loops (VEGAMET 862) a name or tag number appropriate to the application. This will be seen on the display of the controller.



A check box allows you to suppress negative values. For example, if the upstream level could drop below the bottom of the notch with a v-notch weir.

ii.) Selecting the VEGAPULS radar level sensor on HART

IMPORTANT NOTE! The next set-up step is important to ensure MCERTS Class 1 accuracy

Under “Sensor input”, you must select, “Use HART sensor”.

If two sensors are connected to a dual channel VEGAMET 862 controller, you need to identify the correct sensor from the unique 8-digit Serial number.

The screenshot shows a configuration window with two radio buttons at the top: "Use 4 _ 20 mA sensor" (unselected) and "Use HART sensor" (selected). Below the radio buttons is a table with the following columns: Device, TAG, Input, Address, and Serial number. The first row is checked and contains the following data:

Device	TAG	Input	Address	Serial number
<input checked="" type="checkbox"/> VEGAPULS 20/30 series HART	Sensor	1	0	46501722

Below the table is a button labeled "Instrument search".

At this point you are able to select the HART digital value appropriate for the application. For most MCERTS flow applications, you should select “**Distance**”, which is the fundamental radar measurement from the reference plane and the default value.

The screenshot shows two dropdown menus. The first is labeled "Sensor value" and has "Distance" selected. The second is labeled "Unit" and has "m" selected.

The other options are the four selected HART variables. One of these could be used for a different measurement value on the *second channel of a dual channel VEGAMET 862*.

For example: filling height or the measurement reliability (in decibels, dB) of the radar level sensor could be displayed and/or retransmitted on the analogue output.

iii.) Flow curve selection & configuration

Under Linearization, select “Dimensions (ISO Standard)”.

This will allow you to select the correct primary flow device and prompt you to enter the relevant mechanical dimensions of the chosen flume or weir.

Linearization type: Dimensions (ISO standard) (selected)
 Flume type: [Empty]

- Fixed curves
- Fixed curves
- Dimensions (ISO standard)
- Flow formula
- Manufacturer definition
- Q/h table

The range of available ISO standard flumes and weirs can be seen in the drop down box.

Dimensions (ISO standard) (selected)
 Rectangular flume (selected)
 Rectangular flume
 Trapezoidal flume
 U-flume
 Thin plate V-notch weir (selected)
 Thin plate rectangular weir
 Rectangular broad crested weir

The dimensions and parameters required for this V-notch weir example are as follows:

Thin plate V-notch weir according to ISO 1438 is selected.

Linearization type: Dimensions (ISO standard)
 Flume type: Thin plate V-notch weir

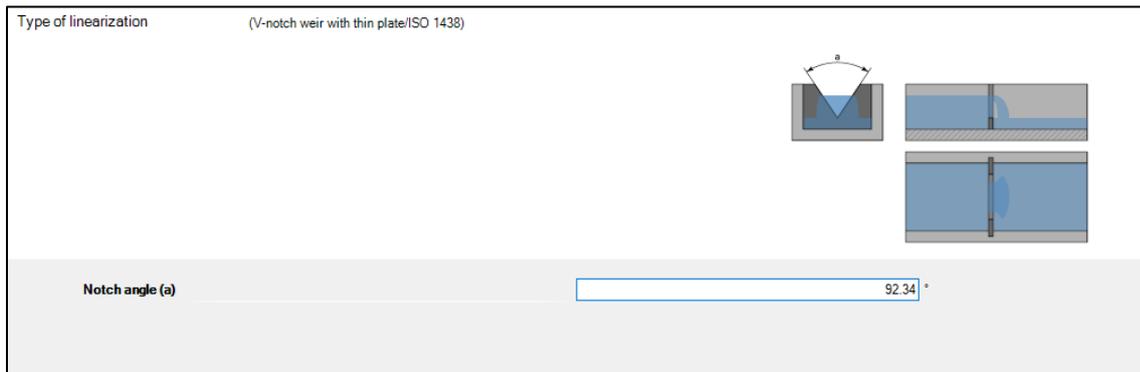
Sensor values A (100%) and B (0%) are distances taken from the VEGAPULS radar reference plane.

From these values, the filling height, h_{max} , is derived.

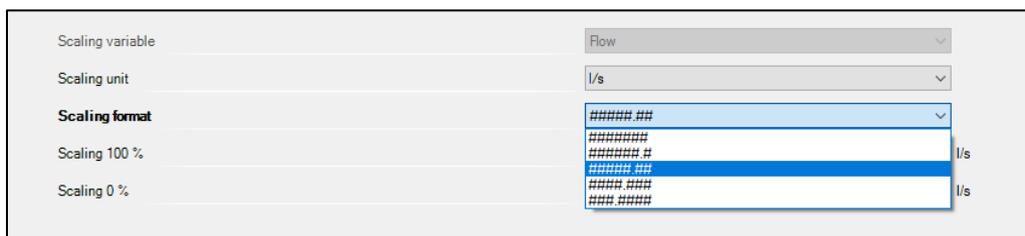
Sensor value A at 100 %: 0.500 m
 Sensor value B at 0 %: 1.100 m

Please enter the measured values of the measurement loop for 0 % and 100 %.

The V-notch angle is applied.



This is followed by the required flow rate engineering units (e.g. litres/second) and resolution on the display (decimal places). The assistant calculates and displays the maximum flow rate, Q_{max} , for the primary flow device selected and configured.



The set-up assistant will request relevant dimensions of the primary flow device selected in “Dimensions (ISO Standard)”. For example, rectangular flume, u-flume or trapezoidal flume dimensions according to ISO 4359:2013.

iv.) Totalization of flow

Two/Four internal totalizers can be selected for MCERTS flow applications with the VEGAMET 861/862 controllers respectively. These are the next options available within the set-up assistant.

Activate the totalizer with the check box, select the engineering units, such as m³. Low flow suppression of the totalizer can be configured, depending on the requirements of the primary flow device.

Totalizer 1 (Set up totalizer 1)



Activate totalizer	<input checked="" type="checkbox"/>	
Measuring unit		<input type="text" value="m³"/>
Display format		<input type="text" value="#####"/>
Low flow suppression		<input type="text" value="0.000"/> %
Resetting with digital input	<input type="checkbox"/>	
Reset at a time	<input type="checkbox"/>	

 The low flow suppression influences all totalizers.

The totalizers can be non-resettable. However, you may consider using the second available totalizer as a resettable totalizer. The totalizer can be reset by using one of the digital inputs in the controller.

Another option is to reset at a pre-selected time.

Totalizer 2 (Set up totalizer 2)



Activate totalizer	<input checked="" type="checkbox"/>	
Measuring unit		<input type="text" value="m³"/>
Display format		<input type="text" value="#####"/>
Low flow suppression		<input type="text" value="0.000"/> %
Resetting with digital input	<input checked="" type="checkbox"/>	
Digital input		<input type="text" value="Digital input 2"/>
Signal level for resetting		<input type="text" value="High"/>
Reset at a time	<input type="checkbox"/>	

 The low flow suppression is accepted by totalizer 1.

Activate totalizer	<input checked="" type="checkbox"/>
Measuring unit	m ³
Display format	#####
Low flow suppression	0.000 %
Resetting with digital input	<input type="checkbox"/>
Reset at a time	<input checked="" type="checkbox"/>
Reset by	07:00

 The low flow suppression is accepted by totalizer 1.

v.) Display options

The VEGAMET 86x controller can be configured to display up to three different measurement variables on the controller display screen. For an MCERTS flow application, this allows flow rate, level height and one of the totalizers to be displayed at the same time. The display shows the Measurement loop name and the engineering units of the flow rate (scaled value), filling height and totalizer.

Measured value indication 1



Number of measured values	3
Measured value 1	Measuring point 1
Display value	Scaled
Display format	Automatically
Measured value 2	Measuring point 1
Display value	Filling height
Display format	Automatically
Measured value 3	Measuring point 1
Display value	Totalizer 1
Display format	Automatically



Example of three flow measurement values being displayed on a VEGAMET 86x controller.

Configurable display options. Three, two or one measurement values per screen.



The flow set-up assistant provides a summary of the configuration, for review before the changes to the VEGAMET 86x controller are applied by clicking “Finish”.

Application	Flow measurement flume/weir
Meas. loop 1	
Measurement loop name	MCERTS V-Notch 01
Adjustment	
Sensor value A at 100 %	0.5000 m
Sensor value B at 0 %	1.1000 m
Scaling	
Measured variable	Flow
Measuring unit	l/s
Display format	#####.##
Scaling 100 %	398.45 l/s
Scaling 0 %	0.00 l/s
Totalizer 1	
Activate totalizer	Yes
Measuring unit	m ³
Display format	#####
Resetting with digital input	Deactivated
Reset at a time	Deactivated
Totalizer 2	
Activate totalizer	Yes
Measuring unit	m ³
Display format	#####
Resetting with digital input	Deactivated
Reset at a time	Activated
Reset by	07:00
Display	
Measured value indication 1	
Number of measured values	3
Measured value 1	Measuring point 1
Display value	Scaled
Display format	Automatically
Measured value 2	Measuring point 1
Display value	Filling height
Display format	Automatically
Measured value 3	Measuring point 1
Display value	Totalizer 1
Display format	Automatically

Example of the Flow Application Summary within the PACTware set-up assistant.

vi.) Analogue output from VEGAMET 86X controller

If required for re-transmission of flow rate, the analogue output needs to be configured as “Lin. Percent”. Lin. percent means linearized percentage which is proportional to flow rate. Percentage does not take into account the derived flow curve. Therefore, it would be proportional to the filling height.

Go to the current output tab and ensure that the Basic value is set as “Lin. Percent”. Click, “apply”.

The screenshot displays the configuration interface for a VEGAMET 862 controller. The device name is VEGAMET 862, and the description is 'Controller for 4 ... 20 mA/HART sensors'. The device TAG is MCERTS Controller 1.

The main configuration area is titled 'Current output 1 (Current output settings for meas. loop 1)'. It includes a graph showing the output characteristic, which is a linear relationship between the measured value in [Lin %] (x-axis, 0 to 100) and the current output in [mA] (y-axis, 0 to 20). The line starts at approximately 4 mA at 0% and reaches 20 mA at 100%.

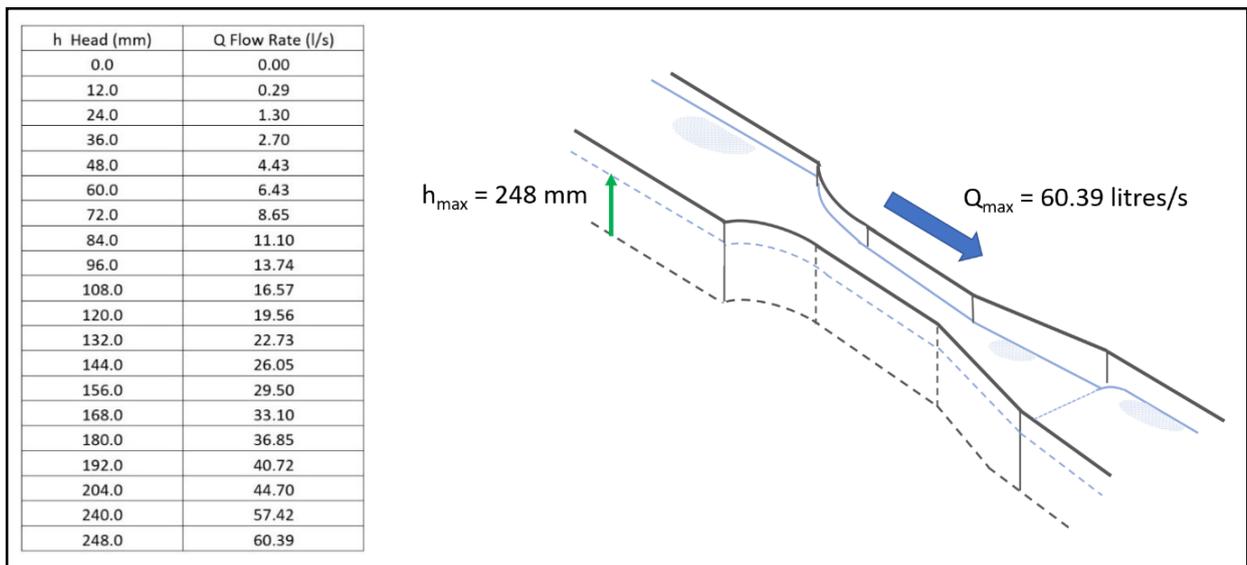
The configuration options are as follows:

- Output characteristic: 4 ... 20 mA
- Basic value: Lin. percent
- Behaviour in case of failure: Percent
- Limit current output to the selected output characteristic:

6. Third party flow curves

It is possible to use a third party flow curve instead of using the VEGA Class 1 MCERTS flow curves that are selected under Linearization: "Dimensions (ISO Standard)". This could be where the manufacturer of the primary flow device has provided an ISO Standard flow curve with the device or the device is not covered in the options. For example, a crump weir. The VEGAMET 86x or VEGAPULS radar sensors can take up to 32 points in the flow linearization curve. The following is typical third party data provided for a flume. In this case, there are 20 linearization points. $Q_{max} = 60.39$ litres/second and $h_{max} = 248$ mm .

Typical flume flow table and Flume flow and height values



The distance, "x", from the radar reference plane to the minimum level in the flume (or weir) should be measured accurately. With an empty flume, the empty distance measured by the radar can be used.

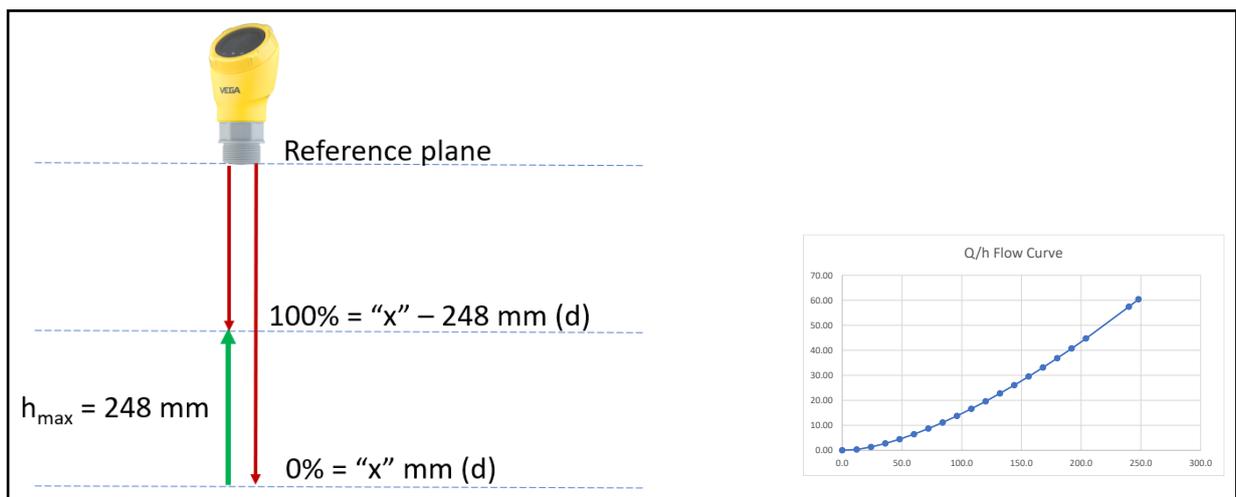


Illustration of the radar level measurements to be made.

i.) Flow curve configuration (Q/h table)

Follow the “Flow measurement Flume/weir” application set-up assistant as before.

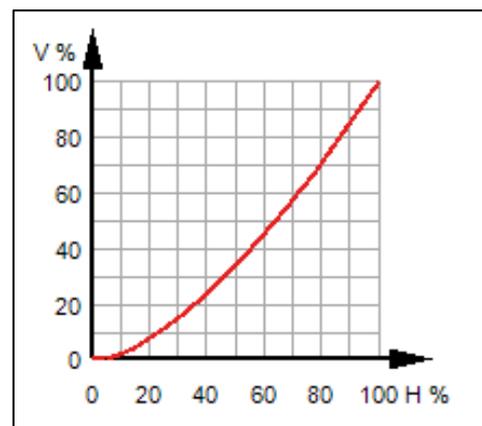
The units for the sensor value “Distance” can be changed to suit the units provided in the third party flow table. In this case, they can be changed from metres to millimetres.

Instead of selecting “Dimensions (ISO Standard)”, select “Q/h table” under linearization type and the flow engineering units and display format (decimal places) required.

The Q/h table can be filled in as follows. The software “draws” the linearization table so it is clear that the table has been completed correctly.

Transfer the data from the Q/h table into the entry fields of the table shown below.

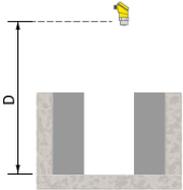
	Height [mm]	Flow [l/s]
▶ 1	248	60.39
2	240	57.42
3	204	44.70
4	192	40.72
5	180	36.85
6	168	33.10
7	156	29.50
8	144	26.05
9	132	22.73
10	120	19.56
11	108	16.57
12	96	13.74
13	84	11.10
14	72	8.65
15	60	6.43
16	48	4.43
17	36	2.70
18	24	1.30
19	12	0.29
20	0	0.00
*		



Q/h table and corresponding flow curve

Next input the "Empty distance", "x", from the radar reference plane. In this example it is 800 mm.

Empty distance



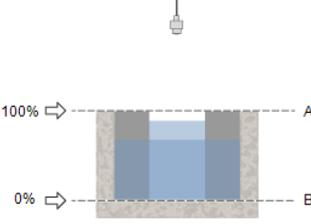
Enter in the field "Empty distance" the distance to the channel bottom.

Empty distance mm

Actually measured distance value mm

Therefore, the software will automatically calculate the radar distance for the 100%, h_{max} .

Adjustment Meas. loop 1 (Adjustment values of the measurement loop)



Sensor value A at 100 % mm

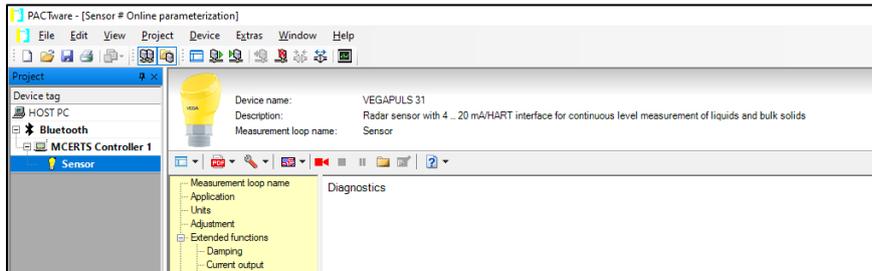
Sensor value B at 0 % mm

 Please enter the measured values of the measurement loop for 0 % and 100 %.

7. VEGAPULS radar set-up

The VEGAPULS radar is sending the raw distance value information to the VEGAMET 86x controller via HART digital communications. The following are the minimum suggested adjustments to optimize the radar for the open channel flow application.

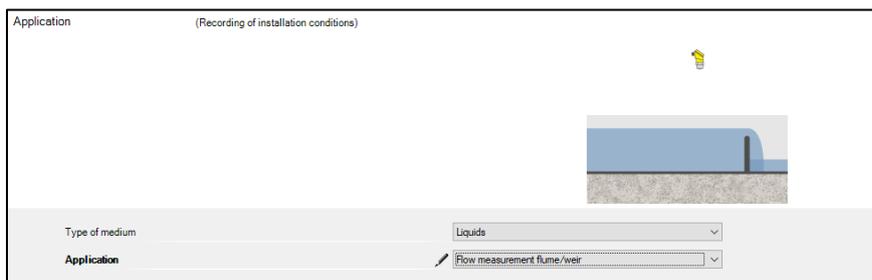
Double click on the sensor in the PACTware Project connection tree.



Give the radar a measurement loop name



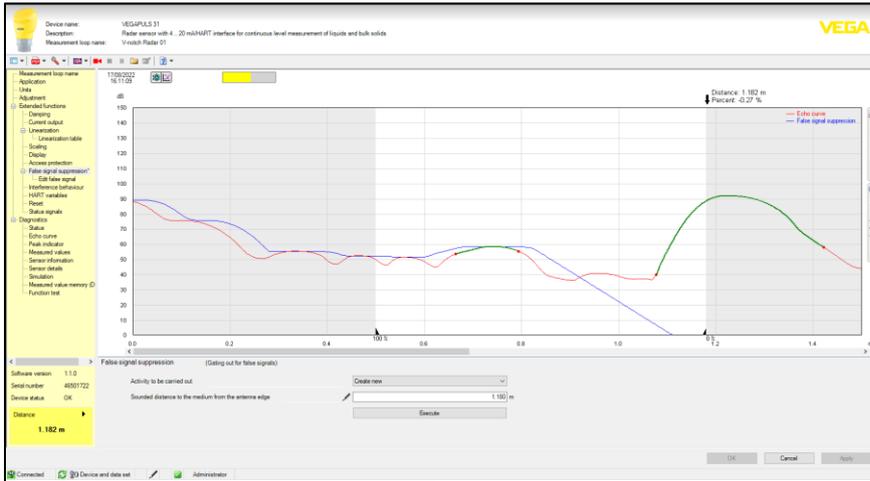
Select, Application / Liquids / Flow measurement flume/weir



Change the radar adjustment to the same range as in the VEGAMET 86x taking the Distance A (100%) and Distance B (0%) from the radar reference plane.



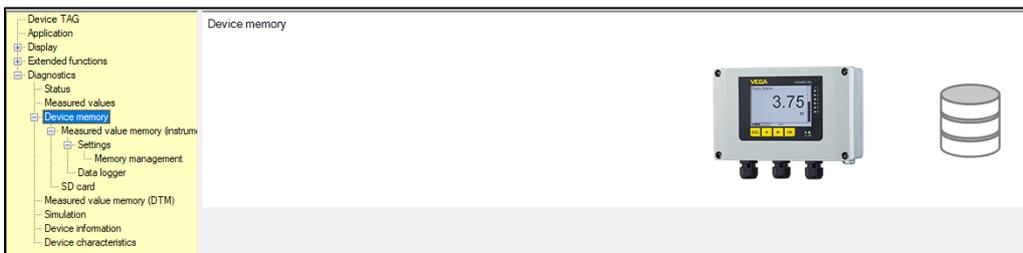
With the flume or weir empty, a false signal suppression to the zero distance may be required. See relevant radar operating instructions.



Example of radar false signal suppression.

8. VEGAMET 86x Controller Internal Memory and Data Logging with SD-card Back-up

The VEGAMET 86x controllers have an internal memory to record measured values and a micro-SD card to enable back up of this measured value data. The internal memory can record up to 260,000 measured values. The factory supplied back-up is an 8 GB micro-SDHC card. A maximum of 32 GB can be installed in the card slot. Once the internal memory has been copied to the SD card, this frees up the internal memory again and significantly increases data logging capabilities.



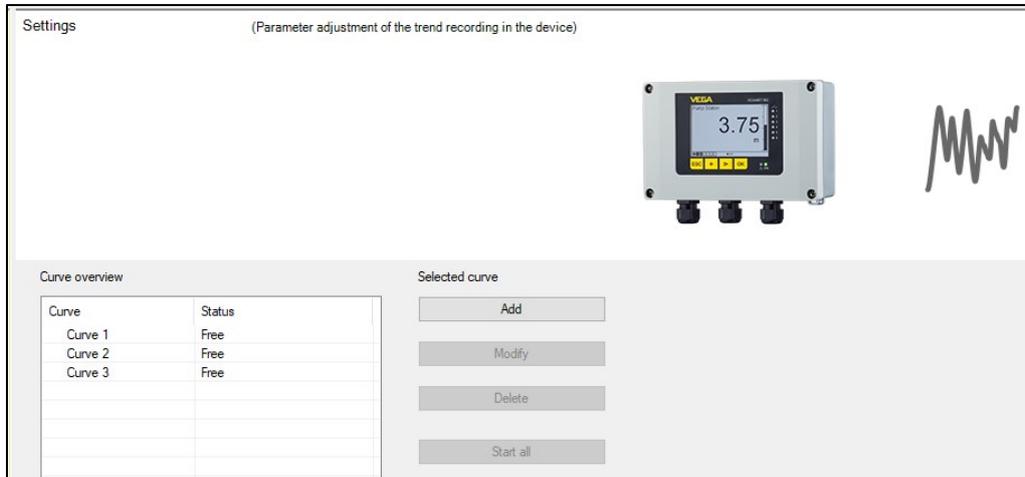
When delivered, the internal memory is divided into three equal “curves” of 33% each.

The memory management tab, allows you to re-distribute the percentage of internal memory for each curve.



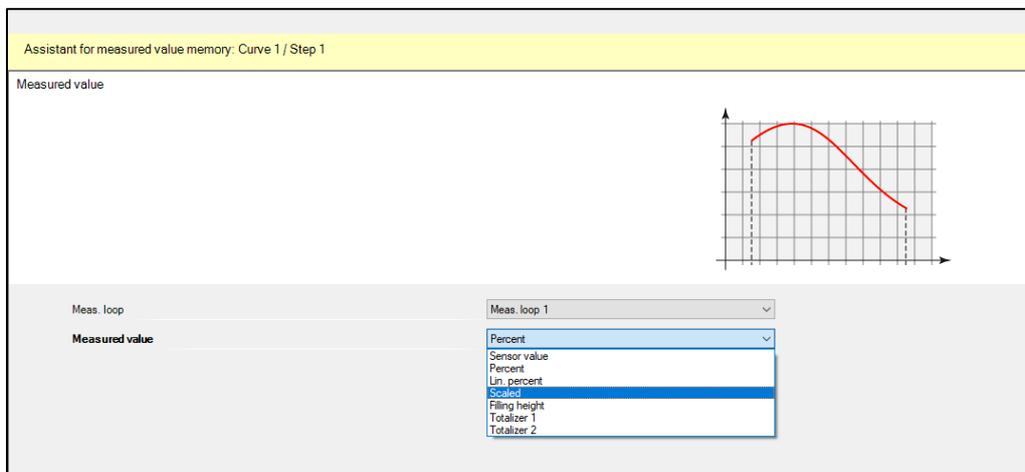
The curves can be assigned measurement values and the internal data logging is started under:

Diagnostics / Device memory / Measured value memory (instrument) / Settings

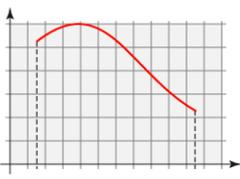


The set-up assistant can be started by selecting the 'curve' that you want to setup and clicking on the 'Add' button, this allows you to select the required measurement value for each of the curves.

For example: Scaled: flow rate in litres/second (Q), filling height (h) or Totalizer (m³). The time interval can be selected and the maximum recording time is displayed. Data recording based on a difference in flow rate can also be selected. Start and stop conditions can be activated. The recording can overwrite or stop when the memory is full.



Recording mode



Time pattern activated

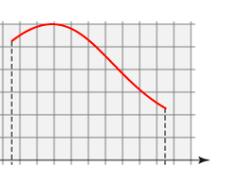
In the time pattern 1 min

Measurement value difference active

With measured value difference

Max. number of measured values

Recording mode



Time pattern activated

In the time pattern 1 min

Measurement value difference active

Max. recording time

Start condition active

Condition >

Threshold /s

Stop condition active

Condition <

Threshold /s

Stop recording when memory full

Time pattern activated

In the time pattern 1 min

Measurement value difference active

With measured value difference /s

Max. number of measured values

After each of the available recording curves has been configured, the “Start all” button is used to start the recording.

Device TAG

- Application
- Display
- Extended functions
- Diagnostics
 - Status
 - Measured values
 - Device memory
 - Measured value memory (instrument)
 - Settings
 - Curve 1
 - Curve 2
 - Curve 3
 - Memory management
 - Data logger
 - SD card
 - Measured value memory (DTM)
 - Simulation
 - Device information
 - Device characteristics

Settings (Parameter adjustment of the trend recording in the device)



Curve overview

Curve	Status
Curve 1	configured
Curve 2	configured
Curve 3	configured

Selected curve

Add

Modify

Delete

Start all

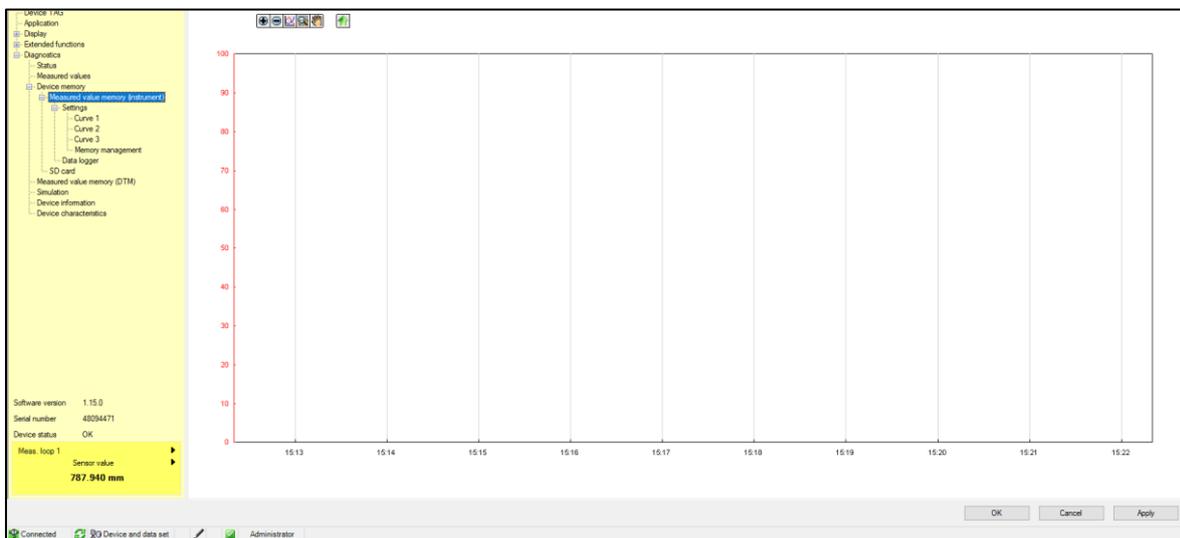
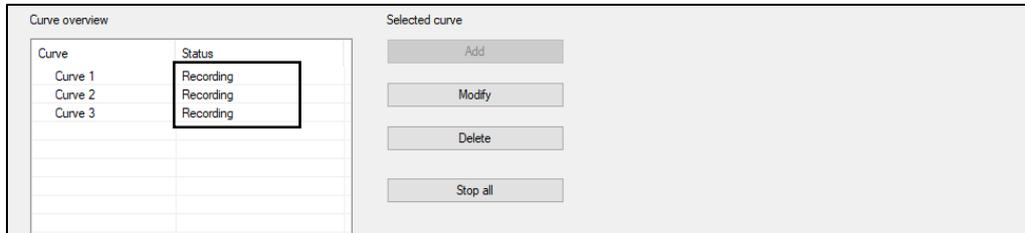
Ensure that the Status “Recording” is showing in the Curve overview before moving to a different configuration tab in the software.

9. Retrieving Internal Memory Data

Click, "Stop all".

Diagnostic / Device memory / Measured value memory (instrument).

Click on green up arrow above empty trend graph.

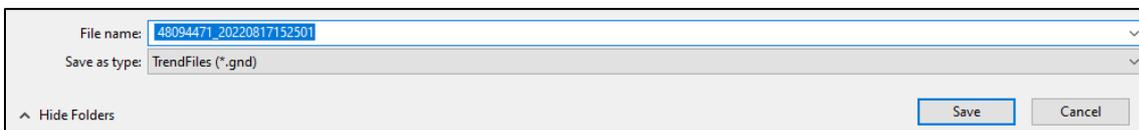
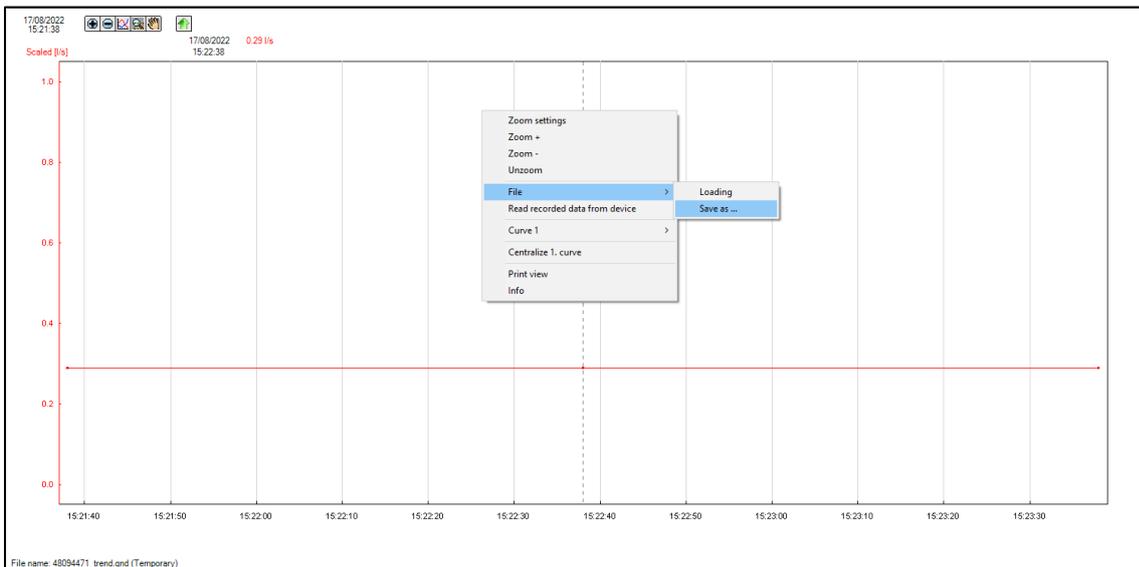
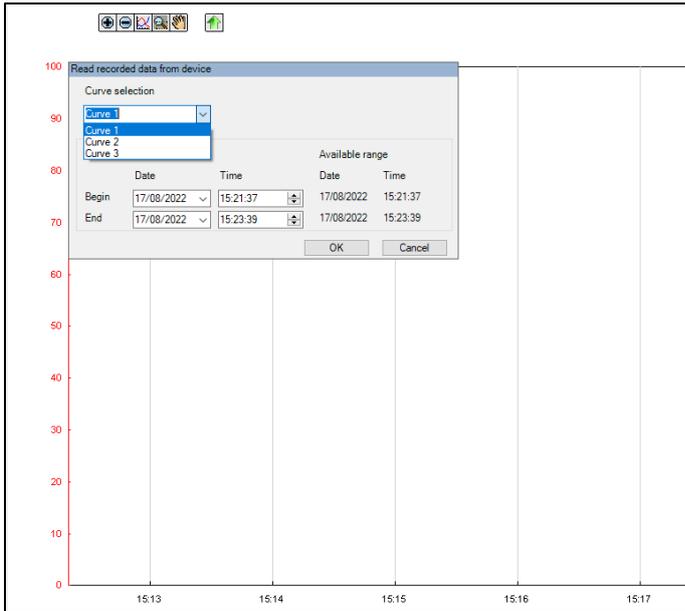


Choose the required curve and the date / time period.

The data is downloaded to the trend graph.

Right click on the graph and select Files / Save as ...

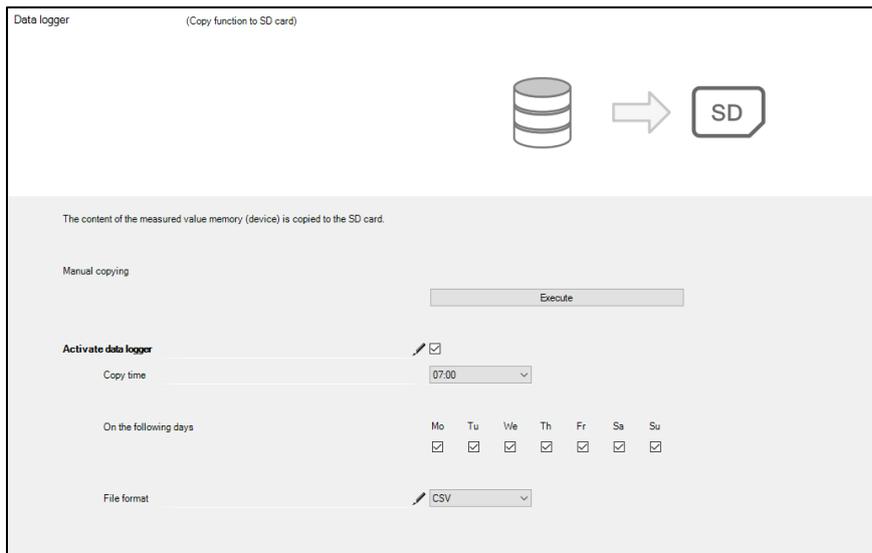
It will save the data as a .gnd file which can be viewed and saved as a CSV file within VEGA Data Viewer software. Alternatively the data can be retrieved using the micro SD card as explained in the next section.



10. Data Logger – SD card

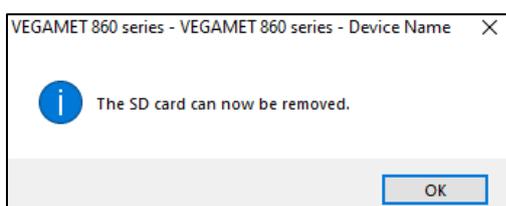
The data logger function copies the recorded device data on to the SD card.

Activate the data logger and it will allow you to select the daily time to copy the data and days that this data is required. The file format, such as Comma Separated Values (CSV), can be selected. Click, “Apply”. The user can also copy the data to the micro SD card as a CSV file manually, as an alternative to downloading through PACTware as a gnd file.



11. Removing the SD card safely

When in PACTware, the tab “Remove safely” must be clicked before the micro-SD card is removed from inside the lid of the VEGAMET 86x.



Alternatively, the push buttons on the front of the VEGAMET 86x controller can be used for the same safe SD card removal function.

OK / > Diagnostics / >Device memory / >Remove SD card safely / OK

“Remove SD card Safely?” / OK / Remove SD card!

12. Checklist

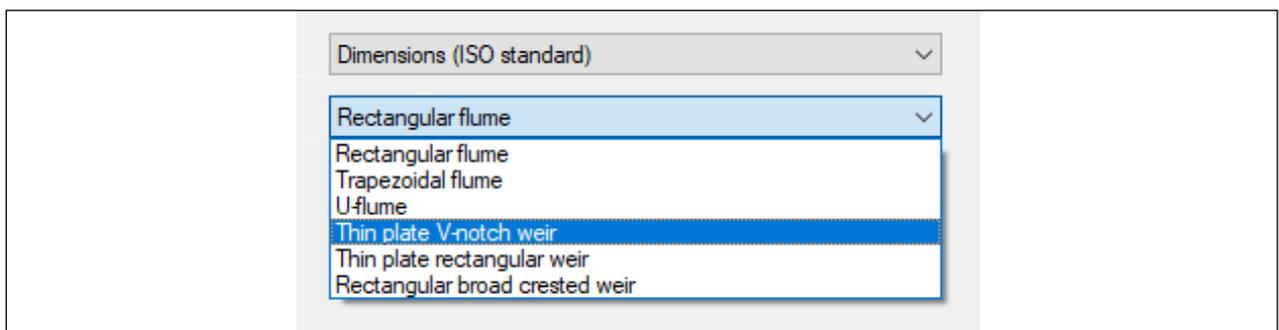
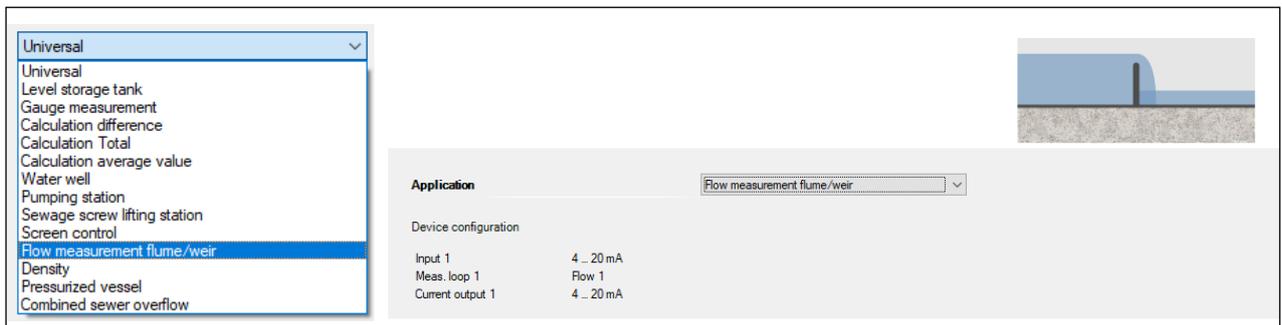
This site checklist can be used to verify that all the basic MCERTS parameters have been set.

Set up Checklist	Information	Done <input checked="" type="checkbox"/>
Site / Location Name		
Loop Name		
Bluetooth Access Code		
Selected sensor input to HART		
Sensor Min. Value 0% (m distance)		
Sensor Max. Value 100% (m distance)		
h_{\max} Value from above (metres)		
Q_{\max} Value calculated (flow units)		
Ensure "Lin. percent" is selected for current output(s) of flow rate		
Checked data recording		
Photo of the Installation		
Any extra information on the set up:		
Name:	Site:	Date:

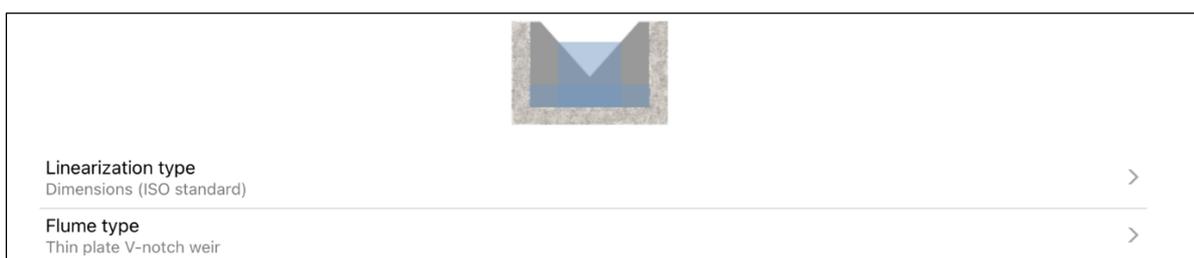
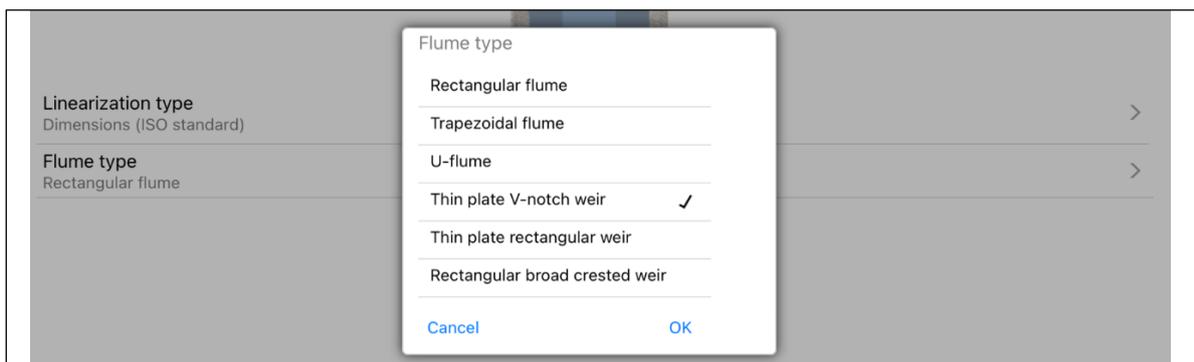
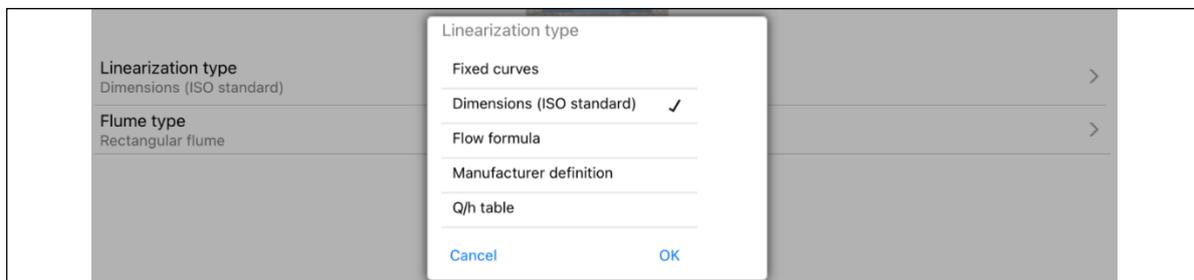
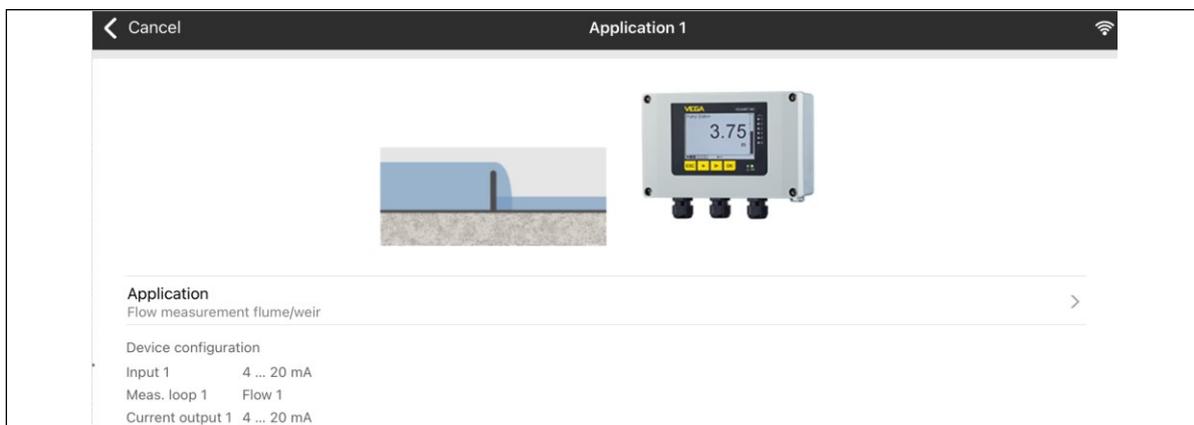
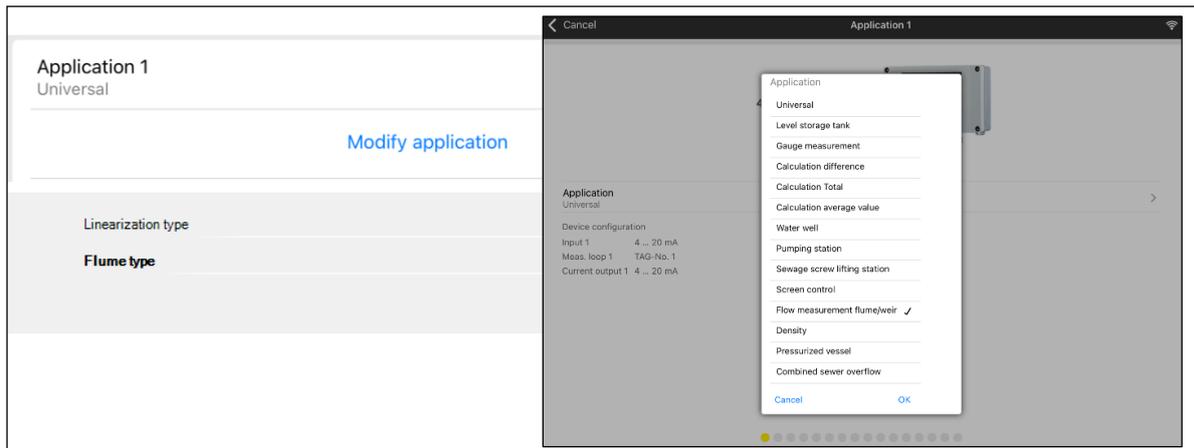
Appendices

The following images show the similarities between the PACTware / VEGA DTM software graphics and the equivalent VEGA Tools App graphics.

a. PACTware / VEGA DTM set-up images



b. VEGA Tools App set-up images



c. Certificate Details



Full certificate copy can be found [here](#).

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