Maid Labs TECHNOLOGIES

VOLUCALC™ RT

User Manual

Real Time Volumetric Flow Meter, Derived Flow Based Flow Meter And An Open Channel Flow Meter

Contacts

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Registration

Thank you for purchasing the VOLUCALC™ RT. Please go on Maid Labs Technologies' Web site and complete the registration of your product. By registering your product, you will be able to enjoy the many upgrades we will make over the years.

The internal software for the products manufactured by Maid Labs Technologies can be updated easily. The procedure is in this manual.

Our services and guarantees are only available for registered products.

If you have several products, please register them all.

Use the MAID Device Configuration software to setup this instrument

Note: **The VOLUCALC™ RT was designed to be programmed and setup by the MAID Devices Configurator software. Please visit MAID Labs website (www.maidlabs.com) section Volucalc RT to download the latest version.** This software has many features and libraries which allows the reuse of standard pump curve data for different station. However, minor changes to the Volucalc RT setup can be accomplished through the display screen by following the prompts.

Warranty

MAID Labs Technologies Inc. (hereinafter called "MAID Labs") states the following warranty for any new Maid Labs product, sold by our authorized representatives.

MAID Labs guarantees that this product, under normal use and maintenance is free of all manufacturing defects, and is subject to the following terms and conditions:

1. To obtain warranty service:
   (a) The product was registered on Maid Labs Web site within 30 (thirty) days from the date of receipt.
   (b) The product must be shipped to Maid Labs main office or to an approved maintenance and repair service center for repair or replacement. Shipping is at the customer's expense.
2. Limitations: This warranty does not apply to:
   (a) Repair or replacement of all cabinets, batteries, connecting wires, antennas and accessories.
   (b) Any defect or repair as a result of abuse, neglect, inadequate care and/or misuse.
   (c) Any defect or repair due to failure to follow the recommendations in the user manual.
   (d) Any modification, adjustment or repair to Maid Labs products by any other company other than Maid Labs authorized maintenance and repair centers.
   (e) All Maid Labs products, whose serial number has been damaged, altered or removed.
   (f) All Maid Labs products that are not the property of the original owner.
   (g) Products purchased from a bankrupt, insolvent or non-approved representative.
   (h) Any damages caused by fire, rain, flood, lightning, power surges or other events beyond the control of Maid Labs (acts of God).
   (i) The warranty does not cover the elimination of static or electrical interference, adjustments or costs of labor associated with removal or reinstallation of the unit for repair.
   (j) The warranty does not cover damage caused by high humidity, water or leaking/damaged batteries.
3. If a Maid Labs product is defective under applied conditions, necessary repairs will be performed, at no additional cost, for parts and labor where Maid Labs recognizes that such defects are caused by materials or manufacturing.
4. This warranty constitutes the entire expressed warranty given by Maid Labs for Maid Labs products. No representative or service maintenance employee is authorized to extend this warranty on behalf of Maid Labs
5. Since each installation may incorporate malfunctions, preventing Maid Labs from ensuring the smooth operation of its devices in all circumstances, Maid Labs will not refund nor exchange the instruments that were caused by connections to any problematic installation.
6. The warranty period is three years on parts and labor from the date of shipment.
7. LIMITATION OF DAMAGES: To the extent permitted by applicable law, under no circumstances MAID Labs or its affiliates be liable to you, to a user or a third party for any indirect, special, consequential, or punitive damages of any kind whether in contract or civil, including but not limited to, personal injury, loss of revenue, loss of goodwill, loss of business opportunities, loss of data, whatever may have been the predictability of such damages. And in no case may the total responsibility of Maid Labs or its affiliates exceed the equipment purchase price received from you, from a user or from a third party, regardless of the laws by which the cause of action was brought. The foregoing does not affect your territory's statutory rights.

At Maid Labs Technologies, we have made every effort to provide a user manual that is up to date and easy to use. However, it is possible that errors may occur, or recent hardware or software upgrades might not be in your manual. We strongly suggest checking our website to see if a newer version of the manual is available www.maidlabs.com.

Table of contents

Product Description

VOLUCALC™ RT is a volumetric flow meter, a derived flow based flow meter, an open channel flow meter, a backup pump controller and an efficiency optimizer.

VOLUCALC™ RT can be used on lift stations having constant speed and variable speed pumps. With constant speed pumps, flow is calculated with a volumetric algorithm. With variable speed pumps, flow rate is derived from the calibrated pump curves. A rain gauge can also be connected, for infiltration studies.

Product Application

Constant speed pumps flow meter

To be used as a volumetric flow meter, the lift station dimensions are entered in the Volucalc RT. The instrument calculates the time it takes for the liquid to rise and fall between these levels and calculates a volumetric flow as often as it is possible to do so accurately, which means within 2%. As soon as a calculation is performed, the computed flow is displayed on the screen of the instrument, the cumulative volume is updated and the 4-20 mA analog output is adjusted. The frequency at which the flow calculations are done depends on the level signal available. If pump signals are the only means to know when start and stop levels are reached, then flow can only be calculated at the end of a filling cycle. If an analog level signal is available, then the instrument calculates the flow at a fixed interval and every times the level changes.

Variable speed pumps flow meter

For variable speed pumps, flow curves are required. This is programmed through with the Maid Devices Configuration software. The RPM of the pump comes from the analog outputs of inverters/drives. The optional calculated head pressure comes from the difference between the liquid level input and discharge-pressure or effluent pressure input of the station. VOLUCALC™ RT integrates the curves of all pumps and adjusts the analog 4-20mA output proportionally to the resulting calculated derived flow.

Up to four pumps can be connected to VOLUCALC™ RT. When only two variable speed pumps are connected, the inputs of pumps 3 and 4 can record the current drawn of pumps 1 and 2. This allows the evaluation of their energy consumption more accurately. If 3 pumps are connected to VOLUCALC™ RT, then pump 4 input can be used to record the main current consumption. Energy consumption will be divided proportionally.

The VOLUCALC™ RT displays the flow rate and total volume pumped. A monthly html report with rainfall and volume pumped per day can be generated using the stored data and copied to a USB drive. The instrument can store years of data. The data is be downloaded to a USB drive or through the Ethernet port. The optional Mermaid software allows for a more detailed analysis of the data. The optional MaidMap geographical monitoring software displays real time information of all Maid Labs devices connected to the Internet through the Ethernet port.

Open channel flow meter

The VOLUCALC™ RT can measure flow from many different open channels and generic equations. This can be used to record the real time inflow and generate reports, alarms or send the data on the online MaidMaps software.

Volucalc RT detects problems in lift stations

Simply install the VOLUCALC™ RT and look at the generated alarm on the screen or in the monthly report of the device to detect abnormal events. You can also ask MAID Labs for a review and analyses of your data.

VOLUCALC™ RT saves energy

Volucalc RT can suggest the best pump to use at the right time in order to maximize the energy efficiency of the lift station. It could suggest to run the most efficient pump when inflow is normal or high, and to run the less efficient pump when inflow is lower.

VOLUCALC™ RT – Installation

It is the user's responsibility to ensure that this product is not exposed to an environment for which it is not designed. These conditions may include a range of extreme operating temperatures, high humidity, vibration or abnormal shock, submersion or potentially explosive atmospheres.

Periodic cleaning is recommended for the sensors to prevent fouling and insure they are providing the correct data. It is important to follow the sensor manufacturer's recommendations.

Each Maid Labs product is designed to operate correctly within a specific range of electrical conditions. The product label identifies the main parameters for all connections. All input connections are designed to resist reverse polarity, as well as higher voltage to a certain extent. It is the user's responsibility to ensure that all electrical connections are made in accordance with the recommendations of MAID Labs and the local electrical code. **The user should read this manual before connecting the device.**

The VOLUCALC™ RT is not waterproof. Avoid placing it in wet locations where liquids could enter the product or where condensation is a problem. Damage caused by water or excessive humidity voids the Maid Labs warranty. The instrument must be placed in a location where there is no risk of being hit or dropped. A label is supplied to cover the Ethernet port to minimize the risk of damaging the port from insects or infiltration.

Before going to the lift station:

- The sensors should be selected using the Sensor Selection Chart of page 9
- Pumps information that is needed:
  - How many pumps in the lift station. Are they fixed speed of variable speed pumps?
  - Power or current consumption per phase. A good rule of thumb is 1A per HP.
  - Operating voltage.
  - Optional: Make and model of the pumps.
  - Pump capacity if possible.
- The lift station must have a socket to plug into or 12V to 24V DC available to power up the VOLUCALC™ RT.

With this information, select the quantity and the proper current sensors for the Volucalc RT if using fixed speed pumps. If variables pumps are used, for less than 2 pumps it's possible to record current on each pump, if 3 pumps are used, it's possible to only record the total current of the station and if 4 pumps are used, there is no way to monitor the current. Default is MLCT75 that can be configured for 15A or 75A range. If the average current is over ¾ of the range of the sensor, we recommend using a bigger sensor.

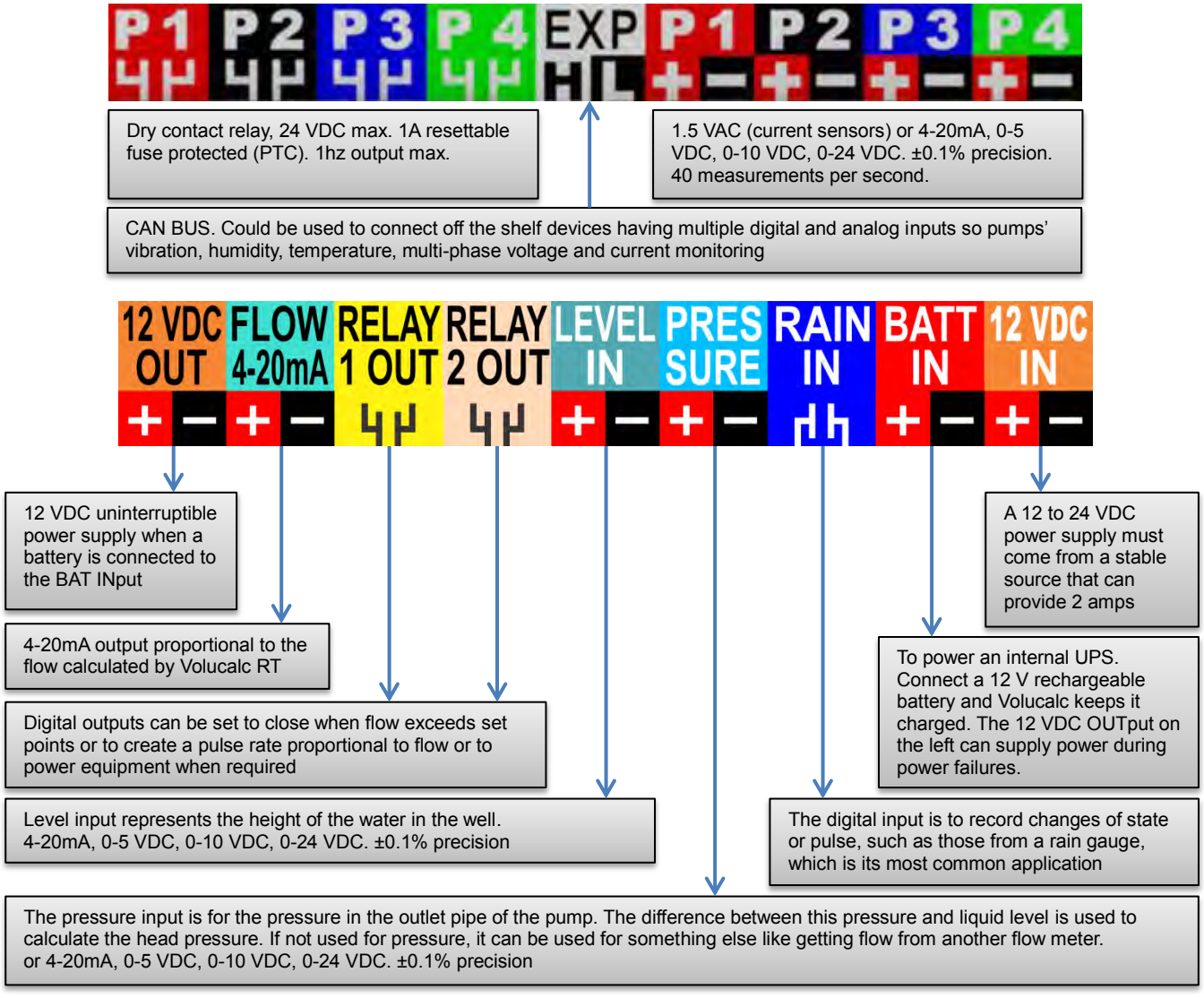
- Station information
  - How the station is working. How pumps start and stop.
  - What is the wet well dimension? The lift station construction (blueprint) plan is ideal.
  - Where is located the inflow pipe and if there is any overflow pipe.
  - Is there a level sensor at the lift station that the device can connect to? If yes, what is the make and model? If not, do you want to install one? Is there a pressure sensor at the lift station that the device can connect to?

- A USB key and a computer with the free Maid Devices Configurator software (available on www.maidlabs.com) installed and required to configure the device.
- If using Maidmaps SCADA software
    - The address of the lift station (to position the device on the map of Maidmaps)
    - Configure the device on Maidmaps before installation.

When arriving at the lift station:

1. Find an appropriate location to install the Volucalc RT. The device needs to be near the pumps power cables to install the current clamps if not, the current clamp cable will need to be extended. The Volucalc RT require 12-24 VDC 2A. The provided power supply can be used or any other stable power source. If a cellular modem is used, reserve a place for it and ideally install the antenna outside of the control panel.
2. Prepare all the necessary connexions to the inputs and outputs. Do not connect to the Volucalc RT yet.
3. If using a fixed speed pump lift station, confirm the pump start and stop level if not connected to an analog level sensor.
4. Prepare the configuration with the MaidDevice Configurator, save it on a USB drive and program the Volucalc RT.

The Volucalc RT connectors



Accessories Selection Chart

Number of pumps	Pumps Constant / Variable	Current sensors required	Specify
1	Constant	1	Pump size (HP) or current per leg
2	Constant	2	Pump size (HP) or current per leg for each pump if not same
3	Constant	3	Pump size (HP) or current per leg for each pump if not same
4	Constant	4	Pump size (HP) or current per leg for each pump if not same
1	Variable	1	Pump size (HP) or current per leg
2	Variable	2	Pump size (HP) or current per leg for each pump if not same
3	Variable	1	Pump size (HP) or current per leg for each pump if not same
4	Variable	0	No input available to record current
1 constant, 1 variable	Mix	2	Pump size (HP) or current per leg for each pump if not same
1 constant, 2 variable	Mix	2	Pump size (HP) or current per leg for each pump if not same. A current sensor will be used for both variable speed pumps at the same time.
1 constant, 3 variable	Mix	1	Pump size (HP) or current per leg for constant speed pumps. No input available to record current for variable speed pumps
2 constant, 1 variable	Mix	3	Pump size (HP) or current per leg for each pump if not same
2 constant, 2 variable	Mix	2	Pump size (HP) or current per leg for constant speed pumps. No input available to record current for variable speed pumps
3 constant, 1 variable	Mix	3	Pump size (HP) or current per leg for constant speed pumps. No input available to record current for variable speed pumps

Current sensors (select size and quantity for each pump station)			
Pump size or better, current of one leg	**Part number**	**Range**	**Description**
For pumps between .5 HP and 40 HP	MLCT75	75 Amps	Mini current sensor 75 Amps
For pumps between 40 HP and 100 HP	MLCT150	150 Amps	Current sensor 150 Amps
For pumps between 100 HP and 250 HP	MLCT300	300 Amps	Current sensor 300 Amps
For pumps between 250 HP and 1000 HP	MLCTP1500	1500 Amps	Current sensor 1500Amps

Level sensors - The existing system can be used if available			
Not required for constant speed pumps, unless Real Time Flow or Backup Controller is wanted. *Cable length need to be specified.*			
	Part number	**Range**	**Description**
Ultrasonic	MLUS-6M	6 m / 19.7 ft	Ultrasonic level sensor (deadband 0.6m / 2ft)
Pressure	MLPLR	7.6 m / 25 ft (default but can be customized)	Level pressure sensor for wastewater lift station

Communication	Part number	Service	Description
Cellular	MLCELETH	By GSM local provider	Cellular modem with Ethernet port
Cellular	MLCELETH-V	Verizon	Cellular modem with Ethernet port for Verizon network only.
Wifi	MLWIFIPICO	By local hotspot	WiFi interface module
Others	Volucalc RT can communicate through most TCP/IP compatible hardware		

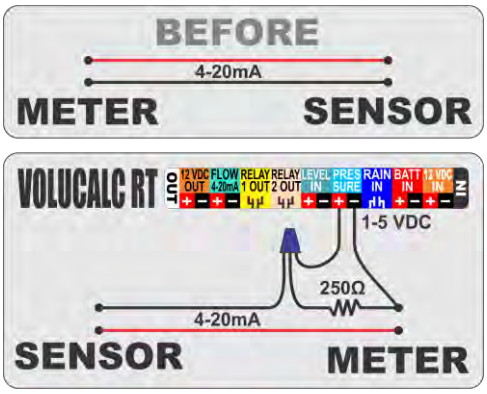
Other accessories	Part number	Description
Force main pressure gauge	MLPSVL	100 PS1 Pressure sensor (cable 5 m / 16 ft).
Rain Gauge	MLRG	National Weather Services approved. 0.01" (0.0254mm) per pulse
Water tight enclosure IP67	MLENCPEL1150RT	Watertight lockable enclosure for Volucalc, Modem & Battery

Front panel door bracket	MLSUPPANEL	Brackets to fix Volucalc on panel door
DIN Rail brackets	MLSUPDIN	Brackets to fix Volucalc on Din Rail

Connections

4-20mA current loop (for anything monitored this way)

There are 2 options: These drawing shows a connection to the Level analog input. Other sensors can be connected to this input, if no level monitoring is done.



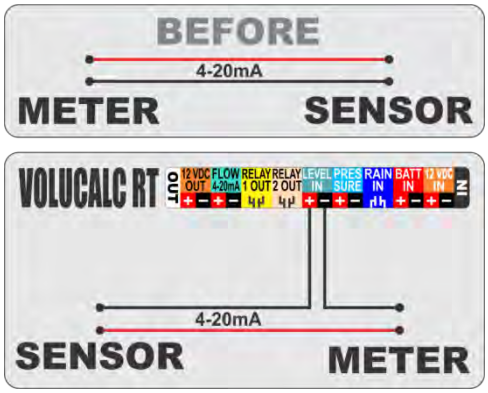
← RECOMMANDED METHOD

Add an in-line 250 ohms precision resistor in the current loop. Connect the Volucalc RT in parallel of the resistor and configure the level input in the Volucalc in 0 – 5 VDC mode.

This drawing shows a connection to the Pressure analog input. Something else than pressure can be connected to this input, if no pressure monitoring is done.

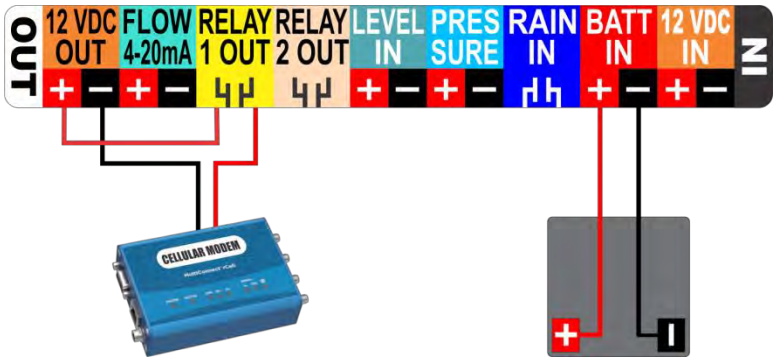
THE OTHER WAY →

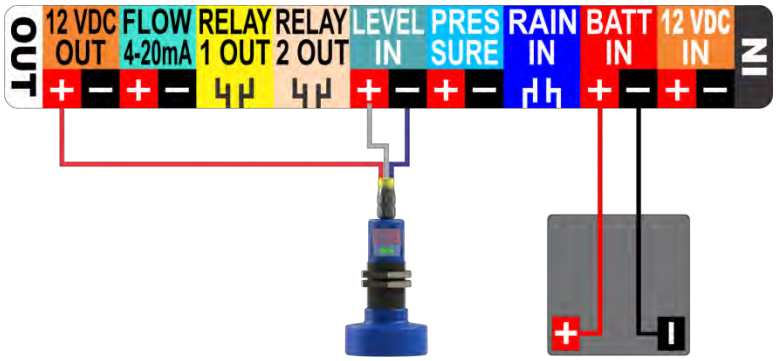
Insert the Volucalc RT level input in-line in the current loop. Advantages: High precision. Inconvenient: If the Volucalc RT reboot or is disconnected, the current loop is broken. PLC cannot share same power ground as the PLC.



Cellular modem power with battery backup

It's recommended to use the 12v output and to connect the cellular modem through the Relay 1 out (and configure this output to "Ethernet control") so this way, the Volucalc RT can manage the power to the modem independently of the level sensor during power failure or if the modem need to be reinitialized.

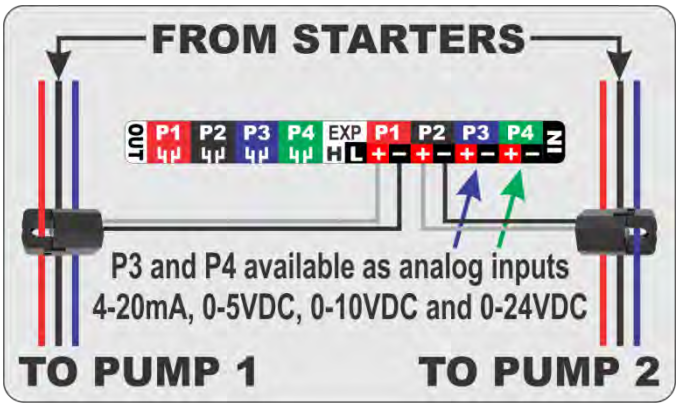




3 wire ultrasonic level sensor.

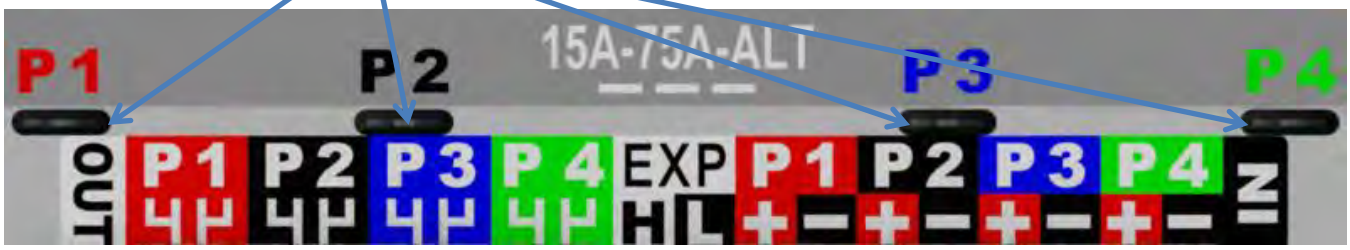
When using a 3 wire analog level sensor, most of the time, it's because the level sensor need 12VDC to operate, which are 12v, ground and a wire for the output signal (typically 0-10v or 4-20mA).

Duplex, Triplex and Quadruplex Constant Speed Pumps



The most common constant speed pump configuration is one current sensor per pump. This connection drawing shows where to connect the current sensors for a duplex lift station. One sensor per pump connected to the appropriate pump input, on the right hand side of the instrument. The unused pump input sensors can be used as standard analog input and will be recorded every second.

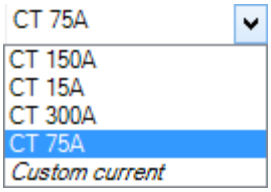
If mini current sensors (MLCT75) are used for pumps of less than 10 HP, then the DIP switches should be moved left with a very small screw driver or a paper clip to adjust the setting of the current clamp to 15 Amps.



If mini current sensors (MLCT75) are used for pumps of less than 40 HP, then the DIP switch should be centered. If the size of the pumps is above 40 HP or if the inputs are used for generic analog inputs, then the DIP switches should be place to their most right position.

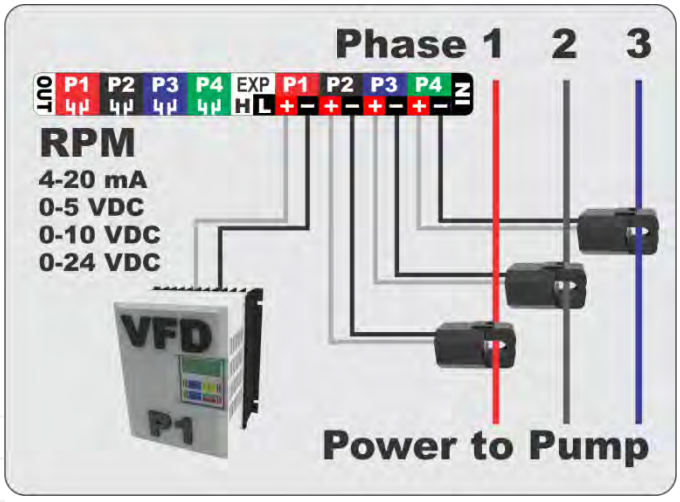
Pump 1	Pump 1 (phase 1)	CT 75A
Pump 2	Pump 2 (phase 1)	CT 75A
Pump 3	*Not used*	
Pump 4	*Not used*	

In the Inputs and Outputs dialog of the MaidDevices Configurator software, the pumps inputs setup on the left is standard for a duplex pump station. The size of the current sensor can be changed easily. Don't forget to change the position of the DIP switches if required.



Simplex pump station (Constant and Variable speed)

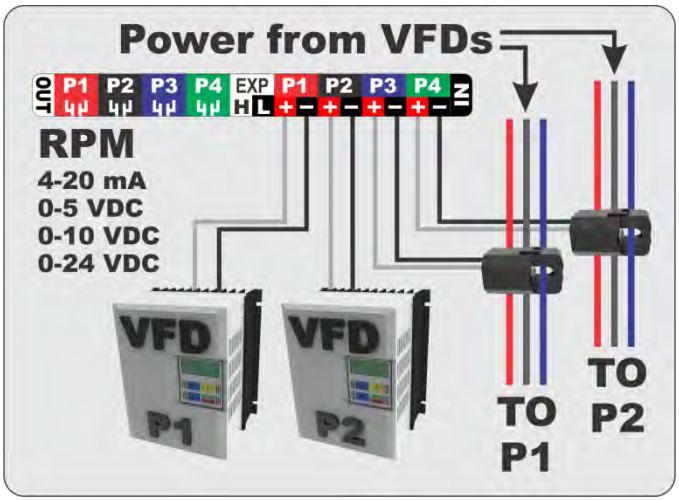
In rare occasions, only one pump might be installed. In this case only, it is possible for the Volucalc RT to monitor and record the current of each of the three 3 phases powering the pump. In the Lift Station basic options dialog of the Maid Devices Configurator, ☑ Read all phases should be checked when Volucalc RT is used to monitor one pump and if 3 current sensors are connected to all 3 phases of the monitored pump. The drawing to the right shows how to connect a variable speed pump. The following MaidDevices Configurator setup is set for constant speed pumps.



Pump 1	Pump 1 (phase 1)	CT 75A
Pump 2	Pump 1 (phase 2)	CT 75A
Pump 3	Pump 1 (phase 3)	CT 75A

Duplex Variable Speed Pumps

This is a very common configuration for variable speed pumps. On each Variable Frequency Drive (VFD), connect a RPM analog proportional output (usually 4-20mA, 0-5VDC or 0-10VDC) to Volucalc's inputs **P1** and **P2**. Connect current sensors of the appropriate size to **P3** for pump #1 and to **P4** for pump #2.

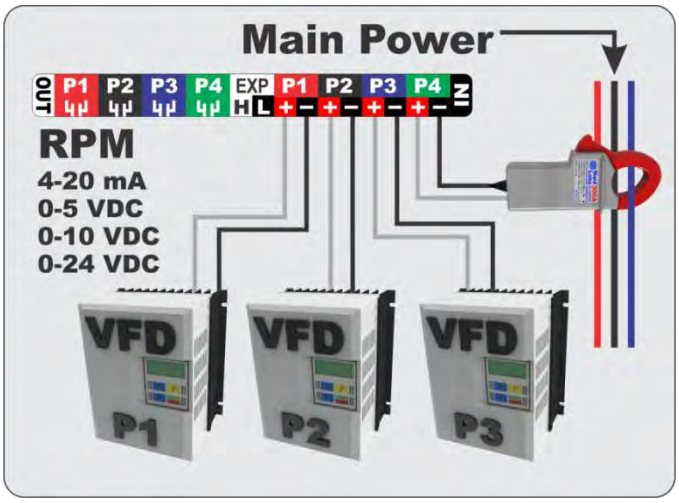


In the Inputs and Outputs dialog of the MaidDevices Configurator software, the pumps inputs setup looks like this. The RPM range can be changed.

Pump 1	Pump 1 speed	0-2000 RPM
Pump 2	Pump 2 speed	0-2000 RPM
Pump 3	Pump 1 (phase 1)	CT 75A
Pump 4	Pump 2 (phase 1)	CT 75A

Triplex Variable Speed Pumps

This is also a very common configuration for variable speed pumps. On each Variable Frequency Drive (VFD), connect a RPM analog proportional output (usually 4-20mA, 0-5VDC or 0-10VDC) to Volucalc's inputs **P1**, **P2** and **P3**. Connect the current sensor of the appropriate size to **P4**, then hook it to a wire powering the entire control panel (all pumps).

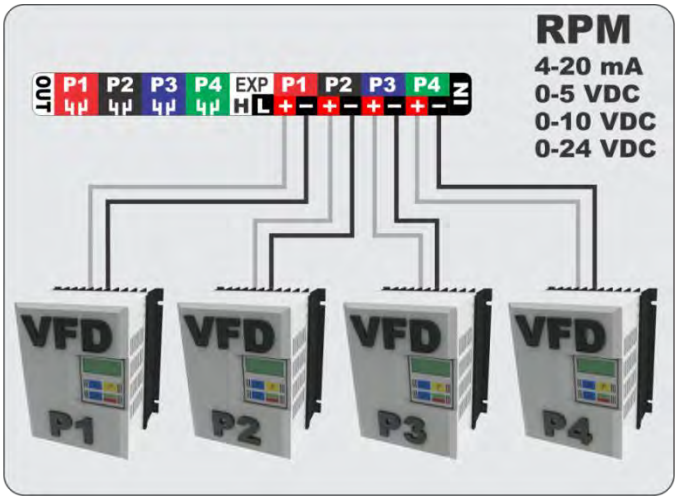


In the Inputs and Outputs dialog of the MaidDevices Configurator software, the pumps inputs setup looks like this. The RPM range can be changed.

Pump 1	Pump 1 speed	0-2000 RPM
Pump 2	Pump 2 speed	0-2000 RPM
Pump 3	Pump 3 speed	0-2000 RPM
Pump 4	Master current (phase 1	CT 75A

Quadruplex Variable Speed Pumps

On each Variable Frequency Drive (VFD), connect a RPM analog proportional output (usually 4-20mA, 0-5VDC or 0-10VDC) to Volucalc's inputs **P1**, **P2**, **P3** and **P4**. No current sensor input is available; therefore the efficiency of the pumps cannot be used to detect a derived flow that would be abnormal.



In the Inputs and Outputs dialog of the MaidDevices Configurator software, the pumps inputs setup looks like this. The RPM range can be changed.

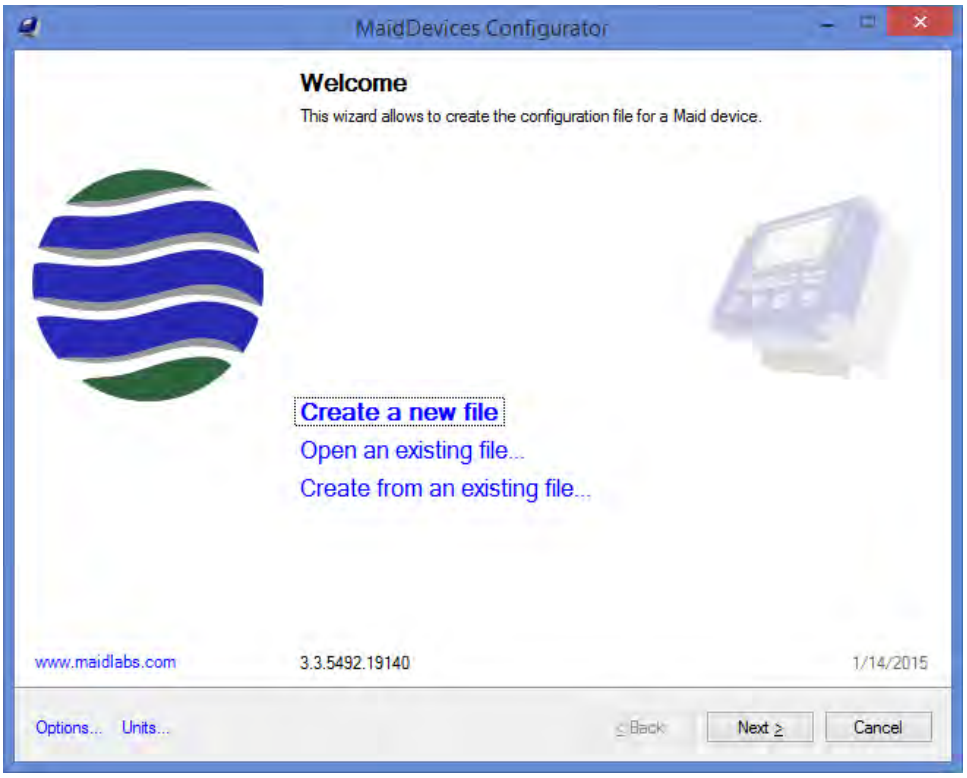
Pump 1	Pump 1 speed	0-2000 RPM
Pump 2	Pump 2 speed	0-2000 RPM
Pump 3	Pump 3 speed	0-2000 RPM
Pump 4	Pump 4 speed	0-2000 RPM

Configuration of a lift station.

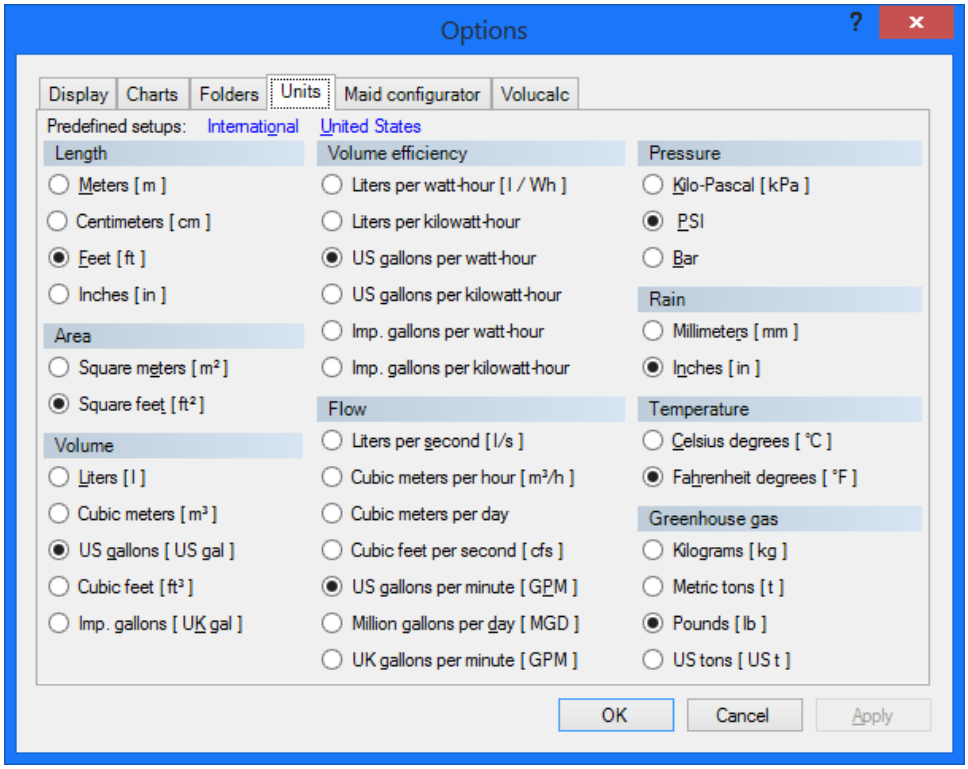
To create a new configuration for the Volucalc RT a computer with the free MaidDevices Configurator software is required. This software can be downloaded from the Web page of the Volucalc RT at www.maidlabs.com.

Start the software and click **Create a new File**.

Select the Volucalc RT icon  and enter the serial number of the device that you are doing the setup for.



The **Units** can be changed by clicking on **Units ...** in the lower left corner of the dialog. To change them all rapidly, click on **United States** or **International** at the top of the dialog.



The name given is used to identify the monthly reports copied to the USB drive or downloaded remotely with the free scada software maidMaps.

Select the Power source

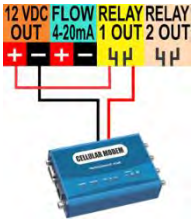
AC adapter is the most common configuration for lift stations.

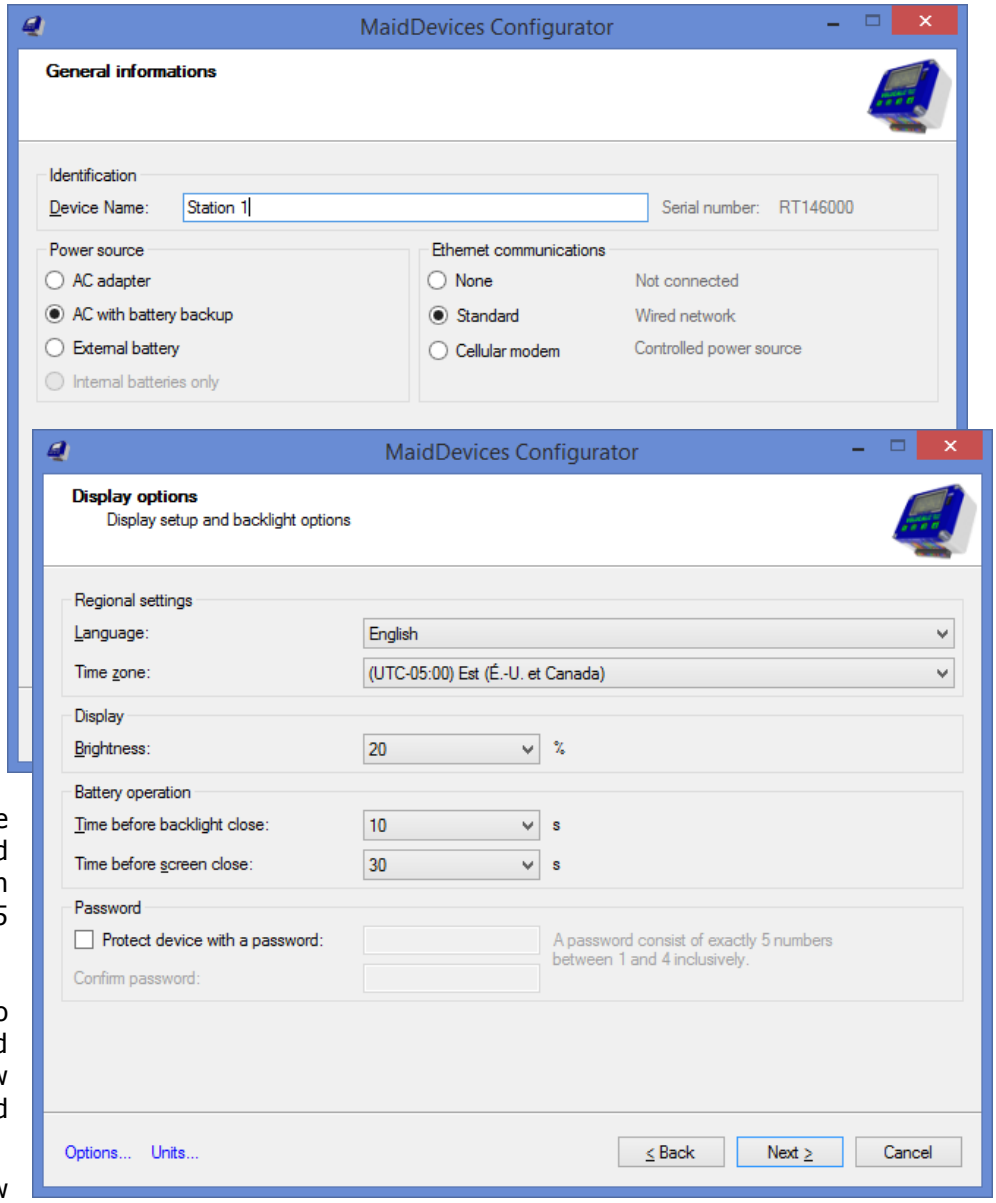
Ethernet communications:

None – Should be clear

Standard – Any communication devices including cellular modems if it is not connected like below.

Cellular Modem - If the modem is connected like this:



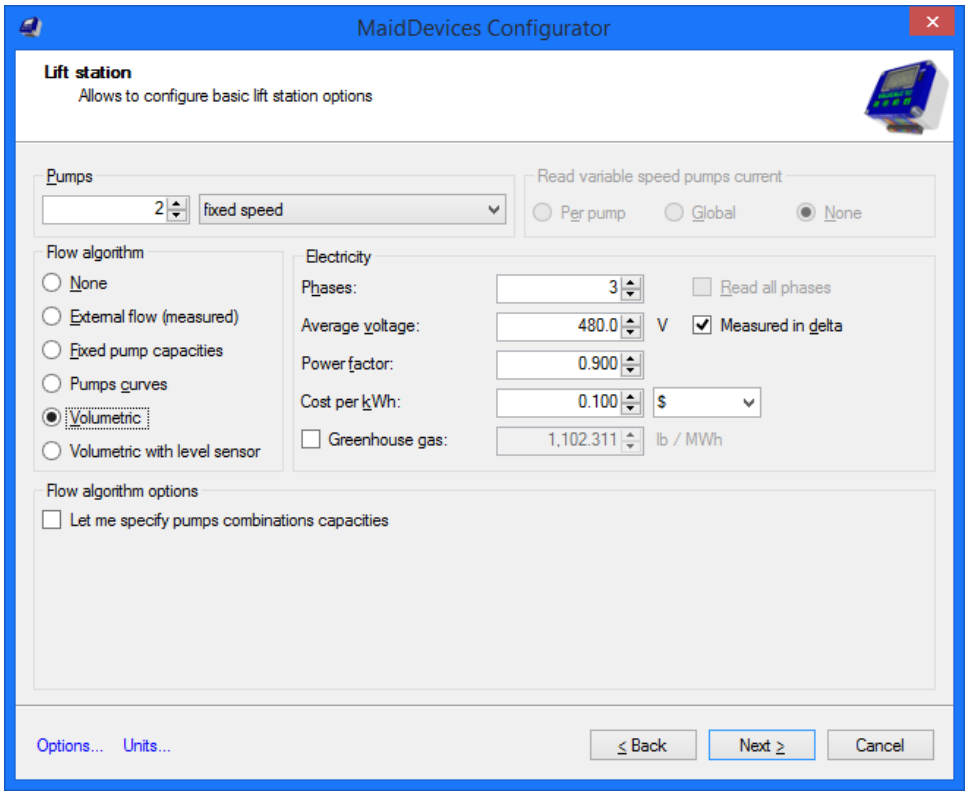


Set the language, time zone and display options. You can protect the device with a 5 digit password if needed.

This next dialog is to select the quantity and type of pumps, the flow algorithm used and electrical parameters.

A large choice of flow algorithms is available. They are related to the type of pump selected.

Flow algorithm



None - the Volucalc RT won't do any type of flow computation.

External flow – The Volucalc RT will read the flow from an external flow meter, like a mag meter. Any unused analog input can be used to get the "Measured inflow or measured outflow", as setup in the Inputs and Outputs dialog of the MaidDevices Configurator software.

Fixed pump capacities – A dialog will allow to enter pump capacities for each pump and combinations of pumps. The volume passing through the station is based on those capacities multiplied by their run times.

Pump curves – Pump curves are entered, instead of pump capacities. The calculated outflow is affected by the head (which is affected by the level and the force main pressure). If any of these two elements are missing, the real time accuracy will be lower.

Volumetric – Good for fixed speed pumps - This is based on the volume between the start and stop levels of the pumps. A dialog allows entering the shape of the well, its dimensions and levels calculated from the bottom of the well, the top of the well, or between the levels. For odd shapes, a volume can be entered. Flow when the pumps are off is based on the time it takes to fill the calculated volume. If the calculated flow rate is abnormal, then another algorithm must be used. Calculating the flow rate in and out of the station while the pumps are on requires a more complicated algorithm because sometimes, the pumps do not start or stop at their usual levels or the results seems abnormal. In these cases, other algorithms must be automatically selected.

Volumetric with level sensor – Best for fixed speed pumps - This When an analog level sensor is used and the shape of the well is constant, and then only the area of the well is required. In this configuration, Real Time Flow is calculated every time the level rises or falls by 2 inches or every 30 seconds or every time a pump start or stop.

Electricity

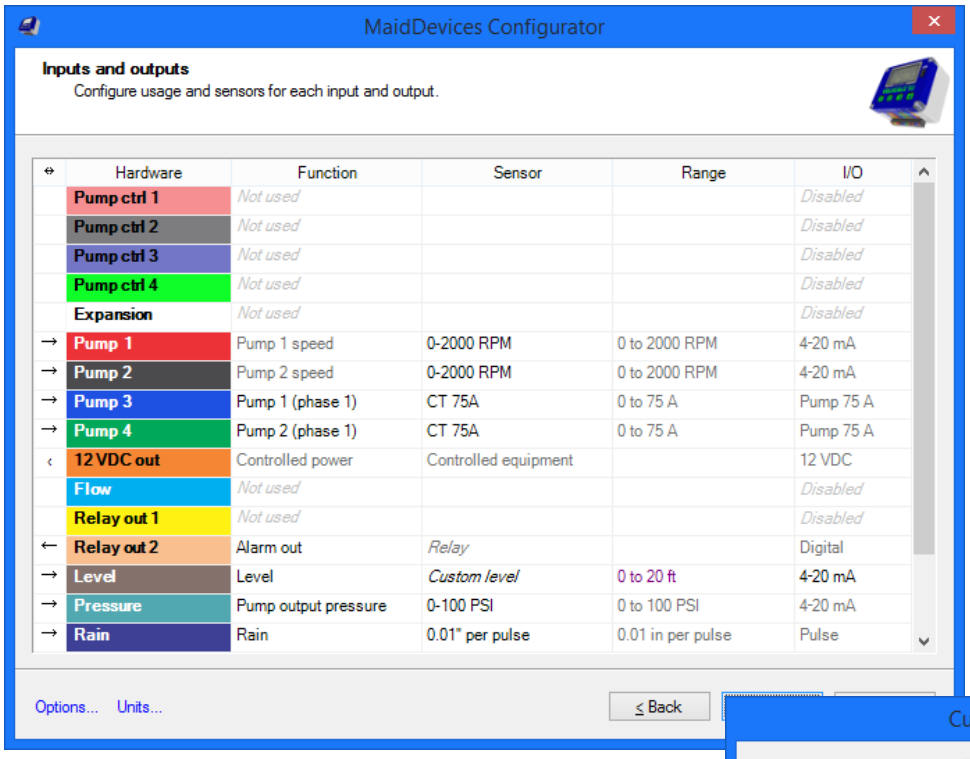
Phases - The preset is 3 since most pumps used in collection system are 3 phases pumps.

Average voltage – This is to calculate the power consumption in kWh. Measured in delta means that the voltage is calculated between the phases and not compared to the ground.

Power factor – This is also used to calculate the power consumption in kWh. This is a value usually found on the electrical bill. If you don't know it, use 0.9.

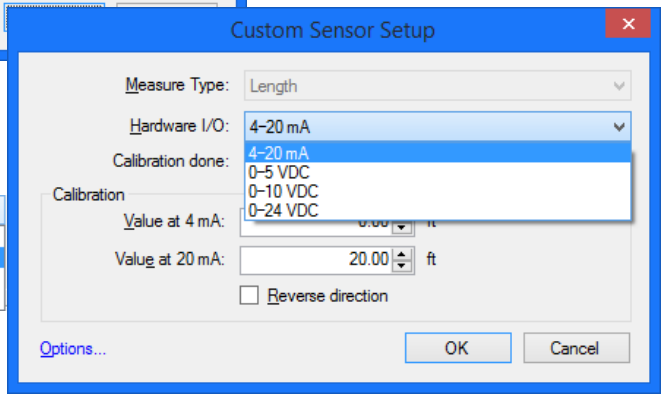
Cost per kWh – Another information found on the electrical bill. Volucalc uses it to estimate the cost of inefficient pumps.

Greenhouse gas – This is used to transform the wasted energy caused by inefficient pumps into gas.

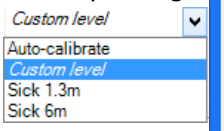


Current clamps are used to monitor the states of the pumps and their current. The input must be set to their right value by clicking on the sensor's displayed value. With fixed speed pumps, the input number represents the Pumps number. With variable speed pumps, the input number is right for the RPM monitoring, but not the current sensors as you see on the dialog on the right.

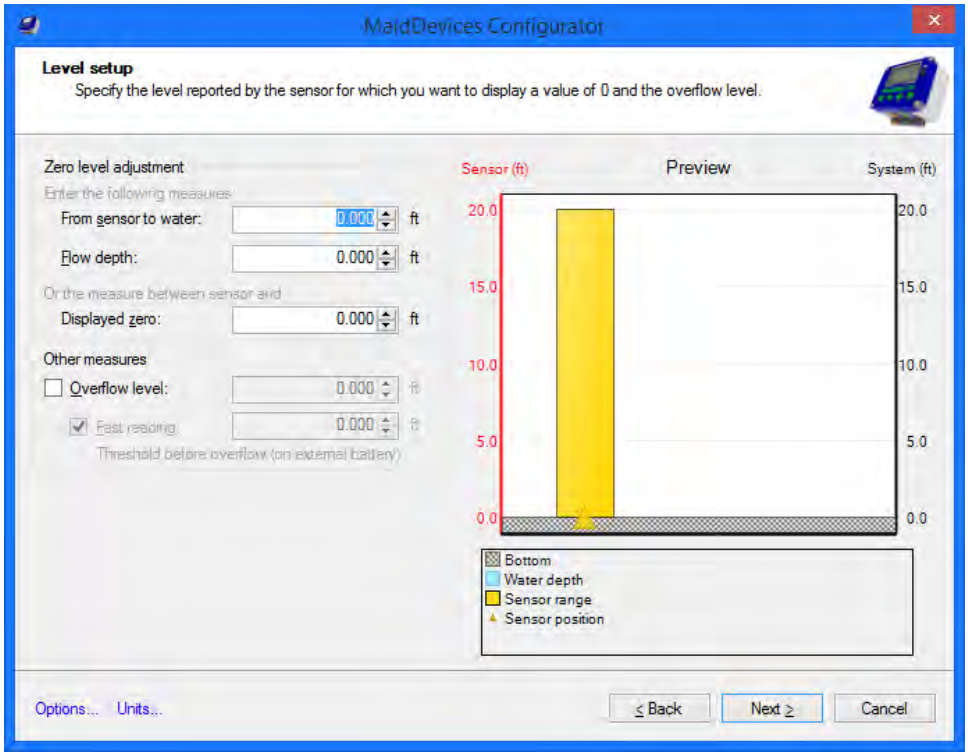
Also, DIP switches relate to the sensors size to set on the instrument. Read page 11 on that subject.



If a level sensor is used, a predefined model or custom sensor can be selected. The custom Sensor Setup dialog opens when clicking on the range of the sensor. The type of input and range can be entered.



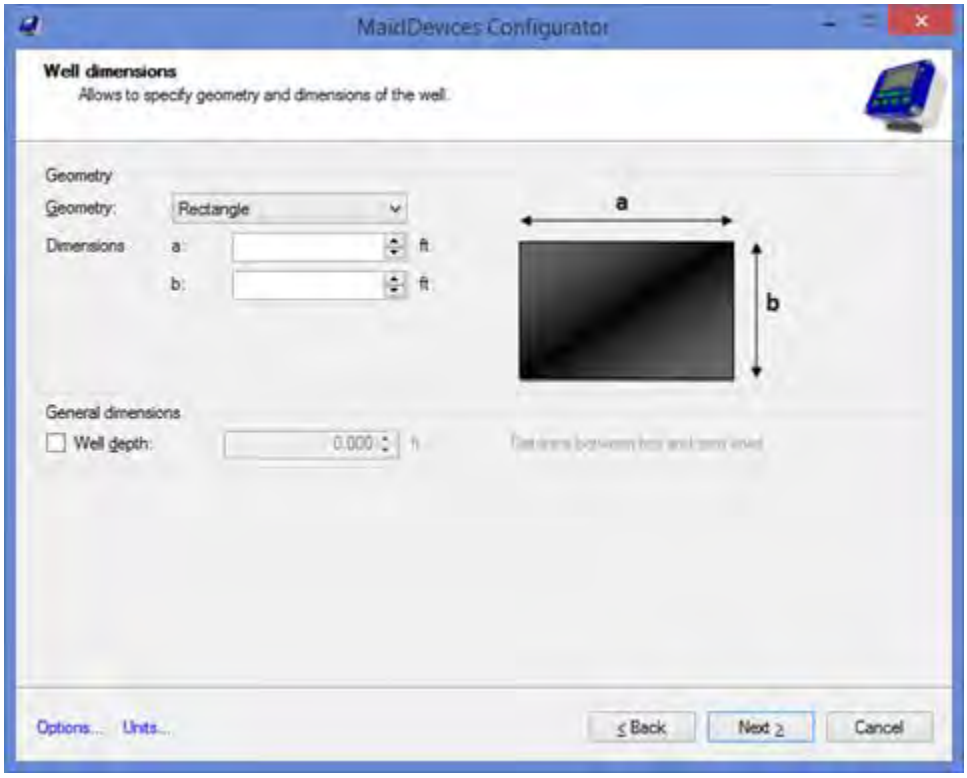
The **Auto-calibrate option** is used when the range of the level sensor is unknown. Simply connect the level sensor to the Volucalc RT and in the **Operation mode** dialog, specify the start and stop level of a pump. The first time the Volucalc RT boot, it will wait for a pump start and a pump stop at precisely at the moment, it will record the value on the level input and compute a linear equation between the 2 points to generate a level input configuration that match the actual sensor.



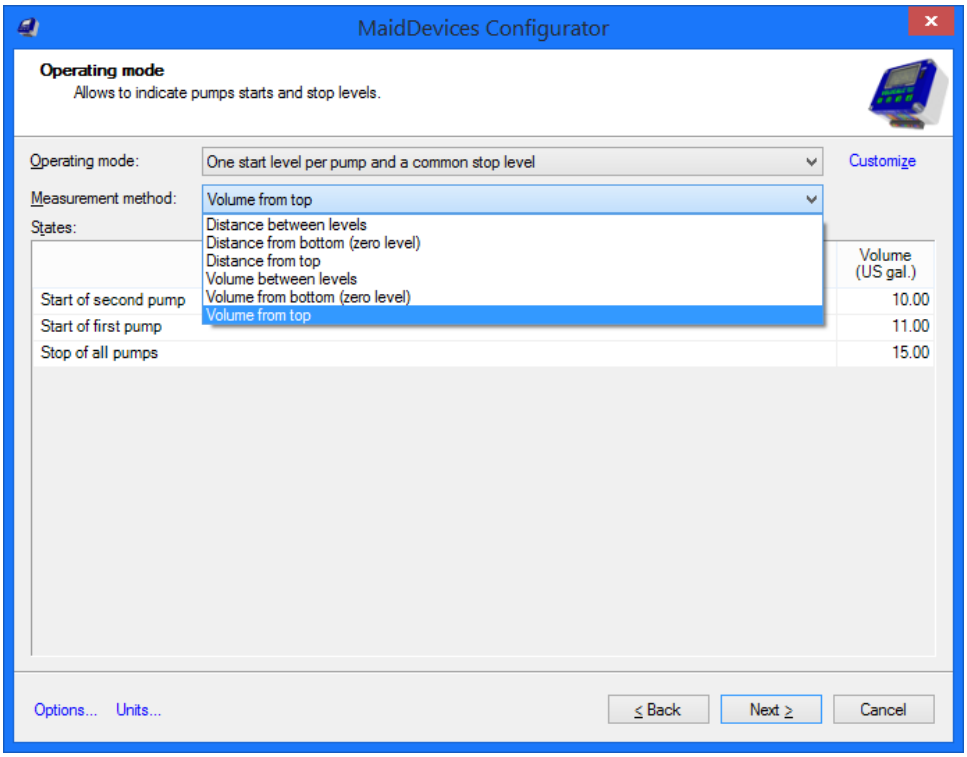
If a level sensor is configured a the **Inputs and outputs page**, the Level setup dialog will be displayed and a graph will show the range of the sensor with other options like the possibility to record sewage sewer overflow events including volume lost during the event.

The **Well dimensions** dialog appears when **Volumetric** or **Volumetric with level** is selected.

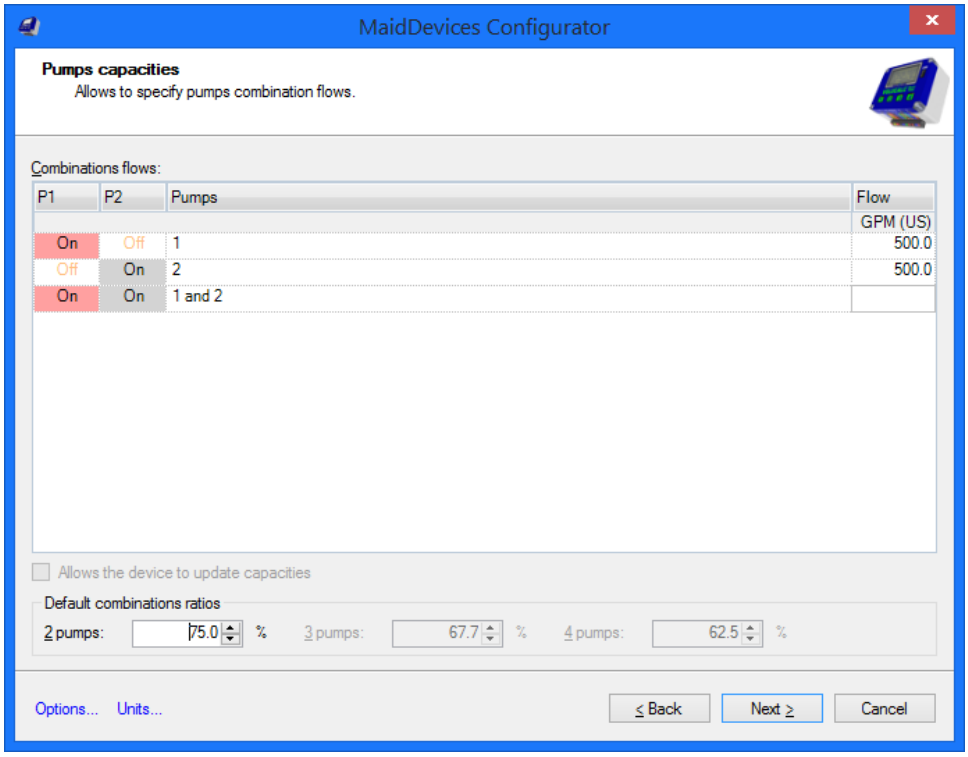
Volumetric with level sensor is the best most accurate method to calculate flow. It is based on the lift station's dimensions and the analog level sensor measurements. Volucalc RT computes the inflow in Real Time, which is every 2 inches or 30 seconds.



If **Volumetric** is selected, the **Operation mode** dialog is displayed at the next page, which allow entering the distances for the levels according to the selected distance method used. Enter all the values required. For very odd shapes, a volume can be entered.



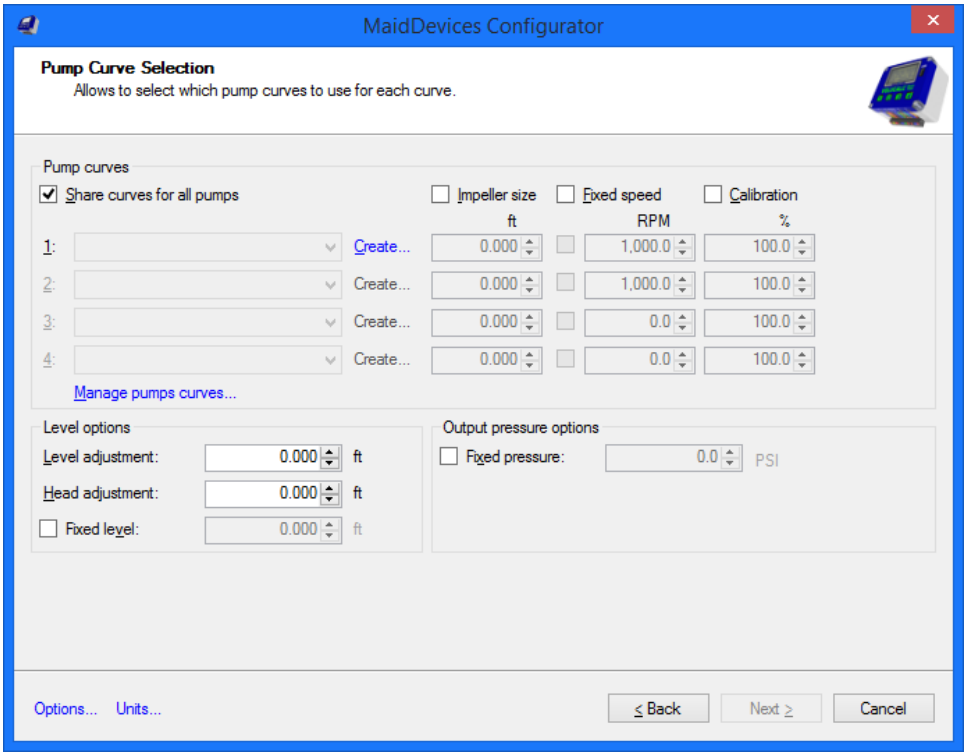
If **Fixed pump capacities** is the selected **Flow algorithm**, the dialog to the right appears and allows to enter the capacities for each pump and each combination, but this last one is optional. If the pump combinations are unknown, pump ratio can be used like 75% of total flow for 2 pumps.



Pumps curves can be used as the **Flow algorithm** for fixed and variable speed pumps. Other than being connected to an external flow meter, this is the only mean to calculate the flow out of variable speed pumps.

The Volucalc RT will compute the outflow from the entered pump curves. It is possible to use up to 4 pumps, with fixed or variable speed in this mode. If less than 3 variable speed pumps are used, it's possible to record global current, as seen on this image. If 2 pumps are used, it's possible to record the current of each pump individually.

Optionally, a level sensor and a force main pressure sensor can be connected to the Volucalc RT in order to compute the flow from the real head to increase accuracy. A constant head can also be specified.



Pump Curves

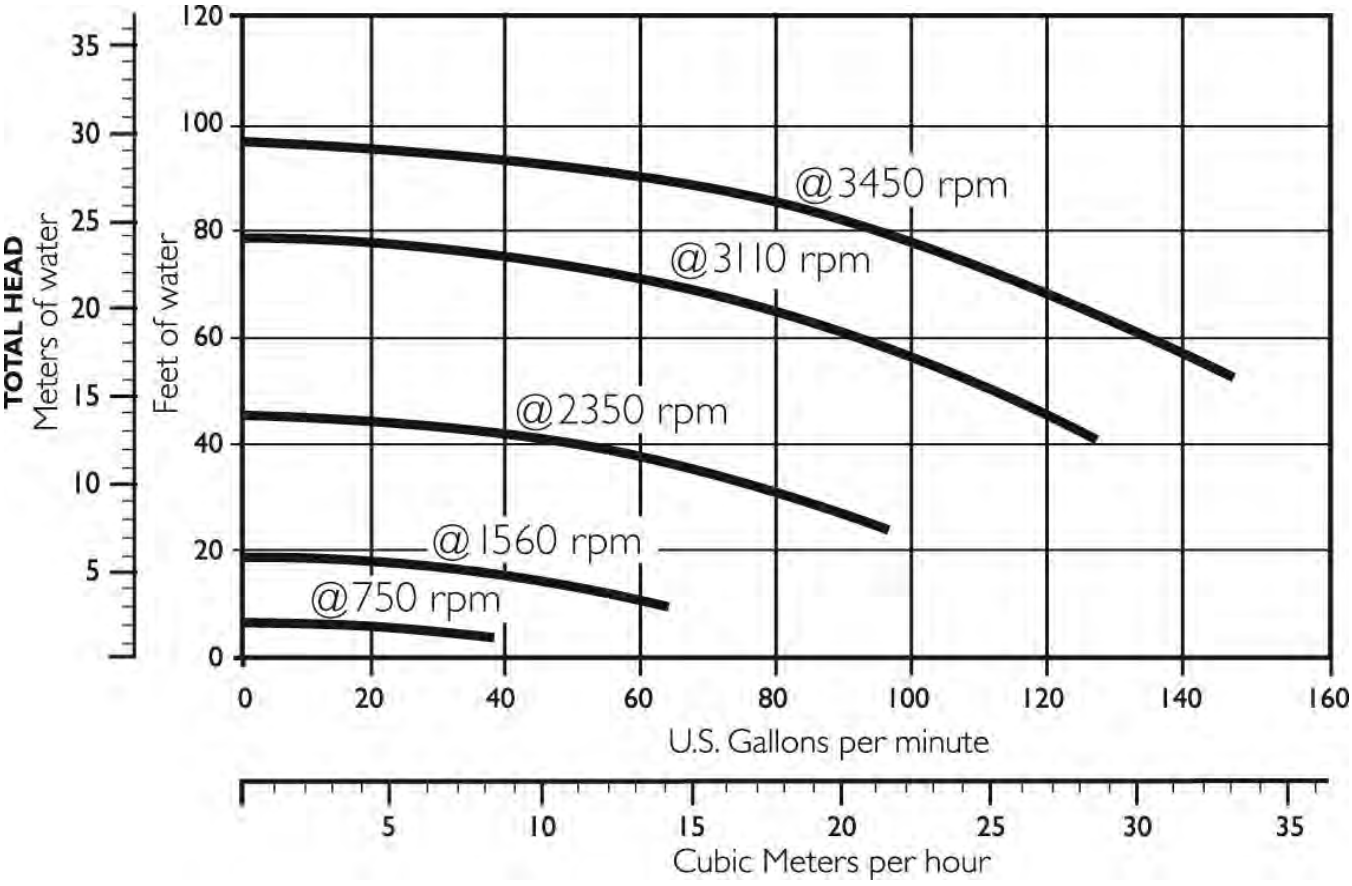
Programming pump curves is the same for fixed and variable speed pumps.

Check ☑ Share curves for all pumps when all pumps are identical and only the first pump field needs to be configured.

Once a pump curve is created with the Configurator, all other Volucalc RT configuration will have access to it. Therefore it is important to give the curve a meaningful name. To select an existing curve, simply click on the drop down selector.

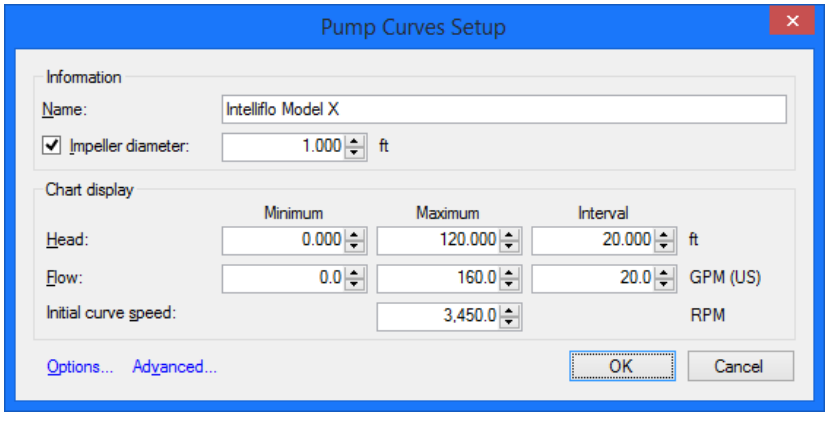
The pump curves represent flow rate relative to head, which is a length. Contrary to constant speed pumps, variable speed pumps have several curves in the graph for multiple rotation speed (RPM). Note: Before creating curves in the Configurator, it is important to have these curves in the computer in a graphic format. The pump curves images should be displayed in a large format like in the following example that can be used to practice.

EXAMPLE OF PUMP CURVE : MODEL INTELLIFLO



Once the pump curves is displayed on the screen of the computer (picture above), in the **Pump curves** area, click **Create ...** for the corresponding pump and the **Pump Curves Setup** dialog window will appear.

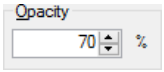
Use the same units as the graph, even if it is only temporarily. The Configurator does the conversion. Click on the **Options…** link, in the lower left corner of the dialog to change the units.



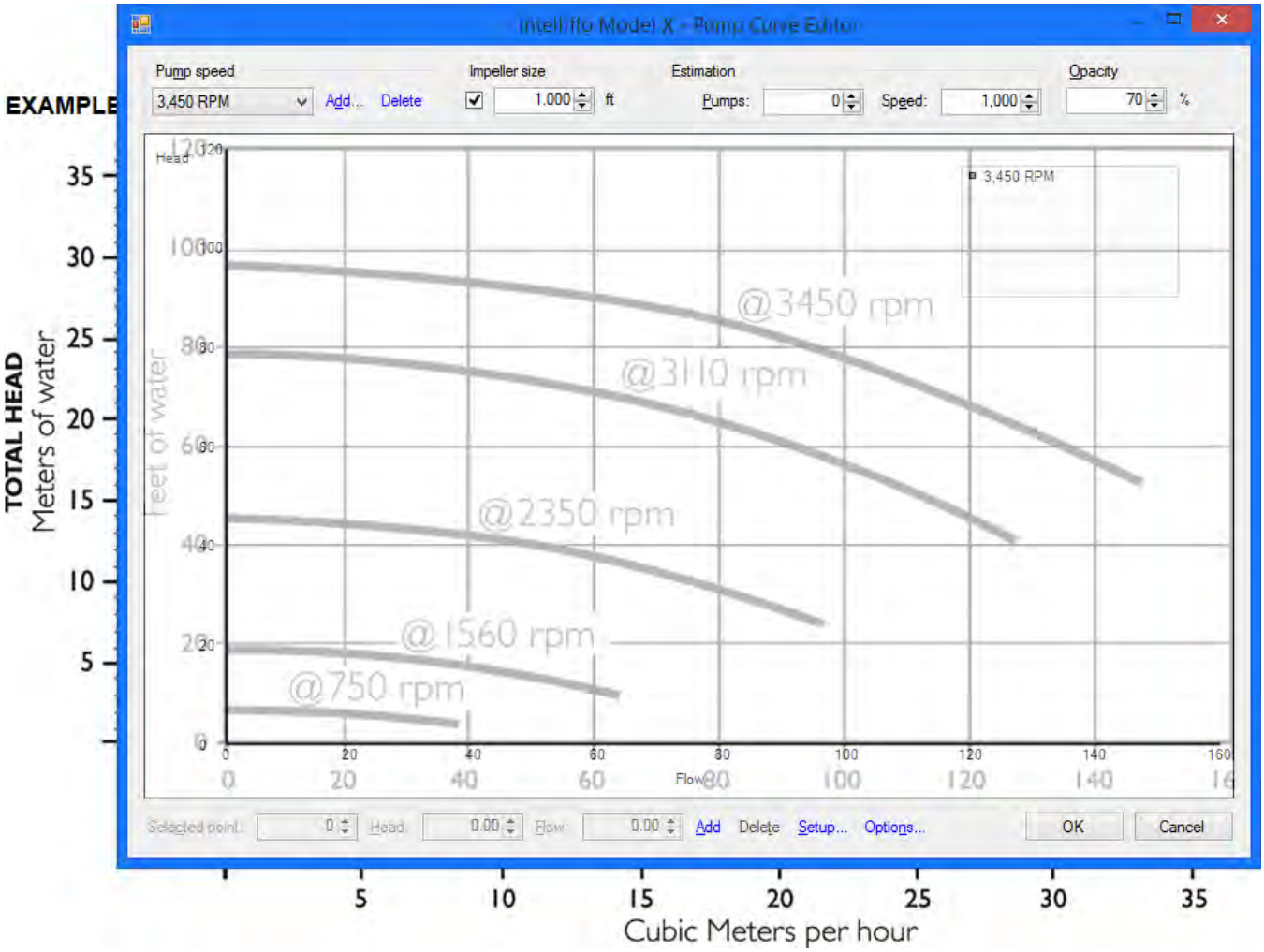
When the diameter of the impeller is known, it can be entered as part of the curve. If a different impeller diameter is used and entered in the **Pump Curve Selection** dialog (previous page), then the calculated flow will be automatically adjusted according to updated data on the impeller's diameter.

To create pump curves, enter the minimum and maximum values for the X-axis (flow) and Y (head) from the pump curve graph (like on the previous page) and the value of the intervals in the appropriate fields. Set a speed at which the first curve will be created in the **Initial curve speed** field. Start by the highest RPM curve.

The **Pump Curve Editor** provides a semi-transparent window to overlay and copy curves. Stretch the editor's transparent window over the manufactures pump curves graph until both scales match. The original pump curve document might need to be zooming in if too small.

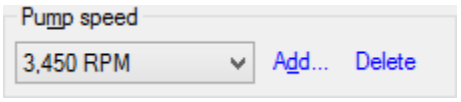


You may want to adjust the opacity of the window of the overlay screen. The smaller percentage of opacity makes the window more transparent.

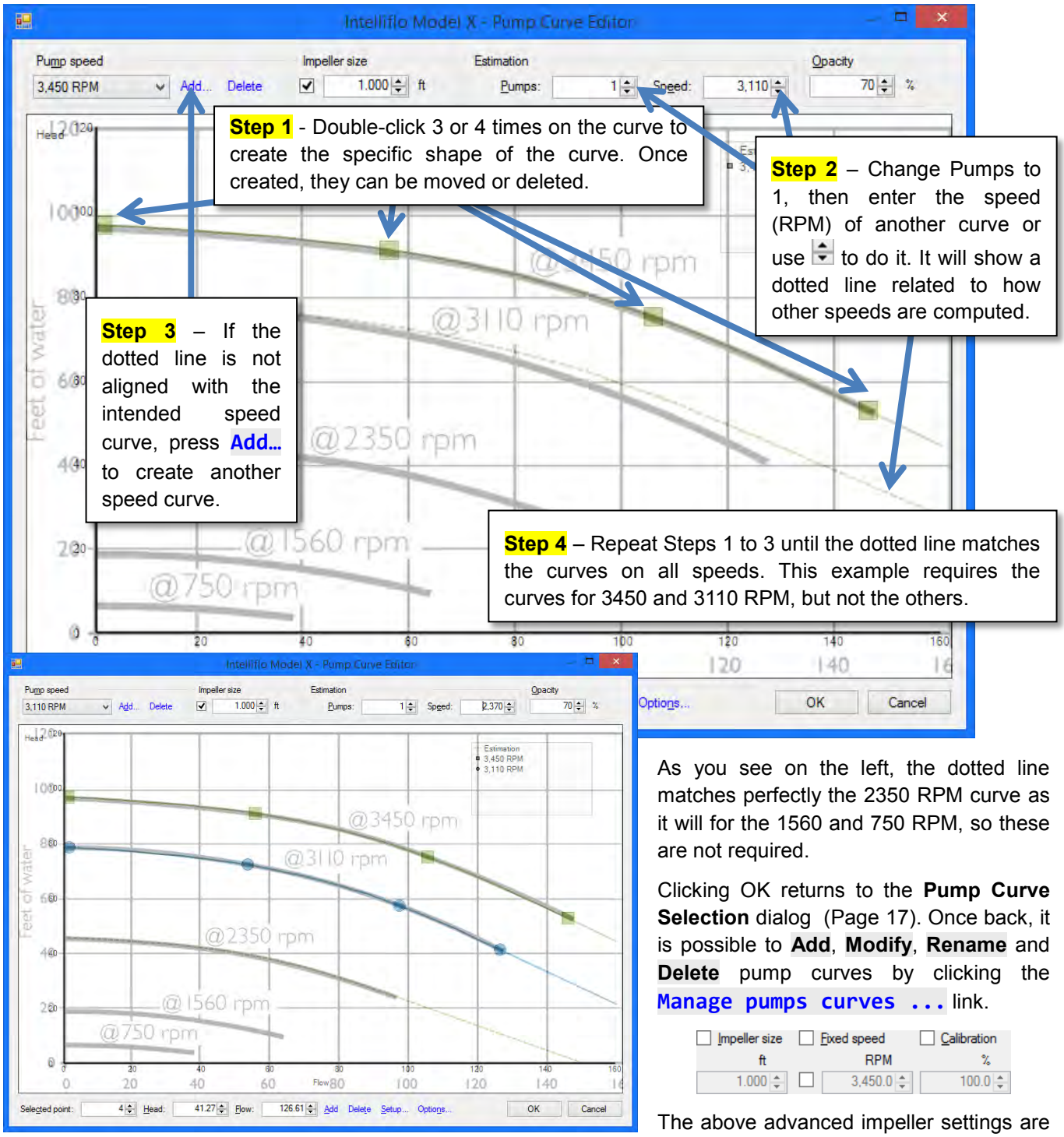


When overlapping the windows, be sure to use identical scales and adjust the window size for a perfect overlay of the graph of the pump curve document. Place the origin of the axes over each other to start and stretch the top right sides of the **Pump Curve Editor**.

After the axes and intervals are properly aligned, align the pointer of the mouse to the absolute left of the curve related to the Pump speed. Double-click the mouse left button to create a first point at zero flow (the x-axis is zero) for the RPM entered in the previous screen (shown in the upper left corner of the curve editor).



Create a second point in the middle of the curve and a third and final point at the end of the curve. A curve connecting the three points will be at the screen. If necessary, add additional points on the curve to an almost perfect superposition. It is possible to enter and clear head / flow points at the bottom of the curve editor. Up to four curves for different speeds can be created, but they are rarely required as you will see.



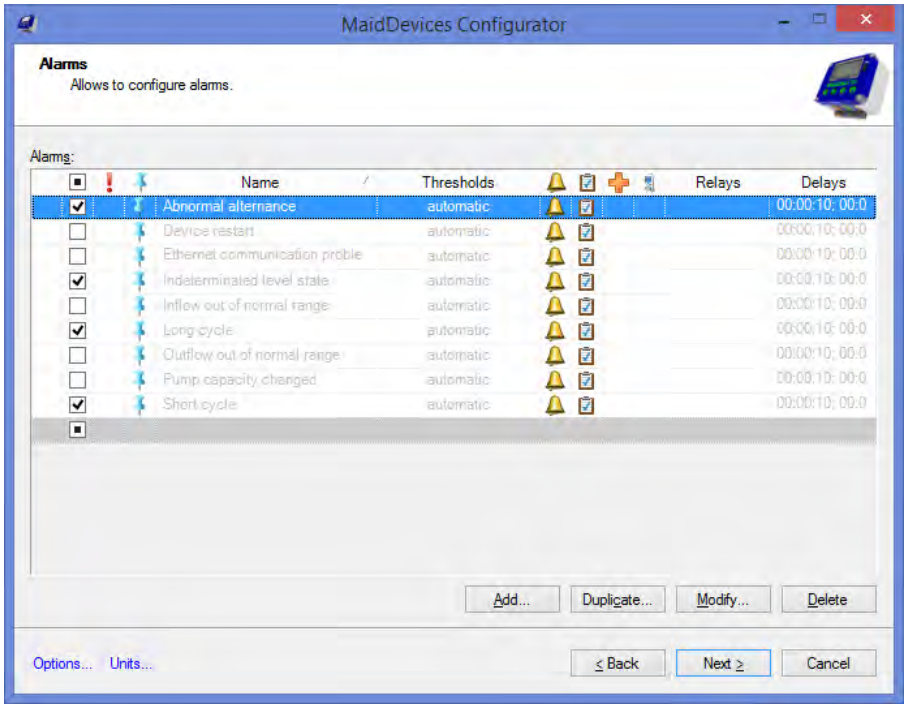
As you see on the left, the dotted line matches perfectly the 2350 RPM curve as it will for the 1560 and 750 RPM, so these are not required.

Clicking OK returns to the **Pump Curve Selection** dialog (Page 17). Once back, it is possible to **Add**, **Modify**, **Rename** and **Delete** pump curves by clicking the `Manage pumps curves ...` link.

The above advanced impeller settings are used when the impeller is worn or not the original impeller or an adjustment to the flow results is required. The setting compensates for the impeller size, speed or calibration. These adjustments will only affect the system curve and not the pump curve loaded into the instrument.

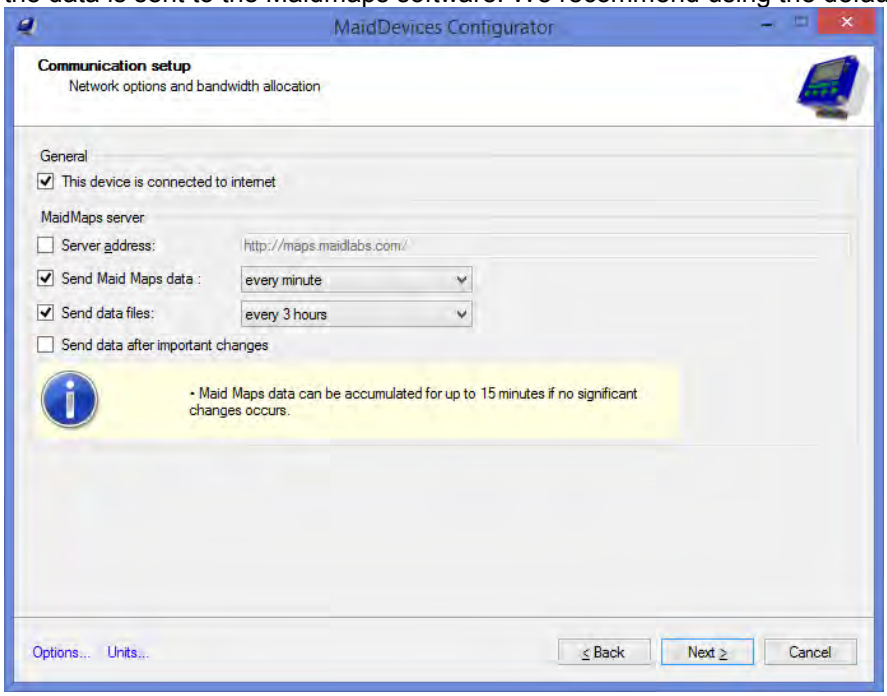
For variable speed pumps, if a level and pressure sensors are connected to the Volucalc RT, a manual adjustment of the Head allows adjustment of the flow calculated from the curves so it would match the real flow out of the pumps. A proper pump calibration might be needed to figure out the proper head adjustment.

Next step is to configure the alarms if they are needed on the Volucalc RT. By default, based on the operation mode, the Volucalc RT already have predefined alarms to detect standard problems. The view the predefined alarms or disable it, in the **Options…** menu, in the **Maid Configurator Tab**, check the **Predefined alarms** check box.



It's possible to create multiple type of alarms of different values. All the explanations are described in the Maid Device Configurator section in this manual.

The communication dialog is used to configure if the Volucalc RT will be connected to the internet and how often the data is sent to the Maidmaps software. We recommend using the default values.

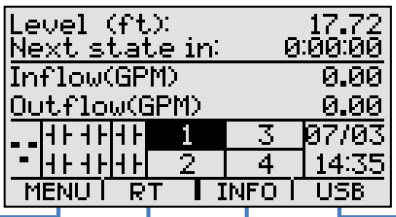


When configuration is ready

Power up the Volucalc RT and insert the USB drive to program the Volucalc RT. If the Volucalc was already installed, we suggest to do a factory reset (Menu, Configuration, Technician, Factory Reset) before reinstalling the device to a new station. It's also recommended to back up the Mermaid files (USB, Mermaid) before.

1. You can connect all the connectors now.
2. Verify that the device is working properly
    a. Check in the Real time windows (button 2) the current or rpm of each pump when ON and nothing when off.
    b. If the level sensor is used, check that the value make sense
    c. If pressure sensor is used, check that the value make sense
    d. If MaidMaps SCADA Web Interface is used, do a Communication test in the menu (button 1).
    e. After a moment or after a complete pump cycle check if the computed inflow make sense
3. Confirm that the installation of the Volucalc RT doesn't affect the operation of the lift station.
4. Note all the information used to configure the device and if possible, take pictures of the general installation, of the connections and of the information at the lift station.
5. Before leaving, copy the Mermaid data from the USB menu (button 4), on the USB key in case of problem.

VOLUCALC RT
MENU FLOWCHART



- Configuration
- Device Info
- IP Information
- Communication Test
- Relay Test
- Analog Output Test
- Screen Lock
- Shutdown device

- Real Time
- Pumps Statistics
- Power Consumption
- Internal Info
- Rain Statistics
- Analog Overflow
- Digital Overflow

- Events Report – Related to the digital input
- Alarms Report – Alarms recorded
- Channel Flow Report – Flow and Overflow
- Volucalc Report – Flow, Run times, Starts, Power Consumption

- Reports
- Copy User Manual – On the USB Drive
- MerMaid Data – Compatible with MerMaid version 2015 and later
- Raw Data – For Troubleshooting
- Download Settings
- Firmware Upgrade
- Copy config to USB

Total, Current Month and Dav

Information about the inputs and outputs of the device.

Total Cost, $/kWh, Reset

Starts, Run Time, Average and Current Outflow, Total Volume, Efficiency

Level, Head, Pressure, Flow, Pumps inputs (Amps or RPM)

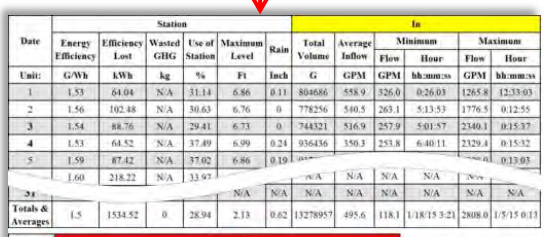
- Monthly Events
- Monthly Flow and Overflow
- Monthly Volucalc

- Date & Time
- Units
- Display
- Inputs / Outputs
- Level setup
- Channel flow setup
- Bandwidth setup
- Alarms setup
- Download Settings
- Firmware Upgrade
- Language
- Lock Screen Password
- Pressure Override
- Level Override
- Pump Capacities
- Pump Ratio
- Report Options
- Technician

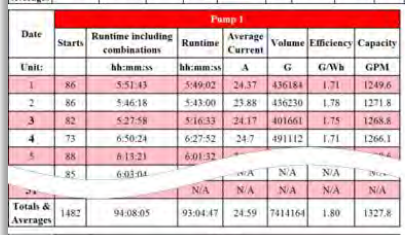
- Factory Reset
- Erase Files
- SD Card Info
- Copy App from USB
- Inputs Calibration
- Raw Values

- Contracted Rectangular Weir
- Suppressed Rectangular Weir
- Trapezoidal Weir (Cipoletti)
- V Notch Weir
- Manning Equation (Open channel)
- Manning Equation (Partially full pipe)
- Parshall Weir
- Palmer-Bowlus Weir
- Leopold-Lagco Weir
- Polynomial Flow Formula
- Standard Flow Formula
- Lookup table
- California Pipe

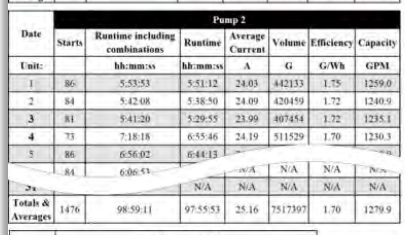
- Analog Out
- Level Input
- Pressure Input
- Relay Out 1
- Relay Out 2
- Digital Input



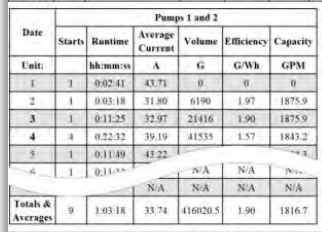
Date	Station						In					
	Energy Efficiency	Efficiency Lost	Wasted GHG	Use of Station	Maximum Level	Rain	Total Volume	Average Inflow	Minimum		Maximum	
									Flow	Hour	Flow	Hour
Unit:	G/Wh	kWh	kg	%	Ft	Inch	G	GPM	GPM	hh:mm:ss	GPM	hh:mm:ss
1	1.53	64.04	N/A	31.14	6.86	0.11	804686	558.9	326.0	0:26:03	1265.8	12:33:03
2	1.56	102.48	N/A	30.63	6.76	0	778256	540.5	263.1	5:13:53	1776.5	0:12:55
3	1.54	88.76	N/A	29.41	6.73	0	744321	516.9	257.9	5:01:57	2340.1	0:15:37
4	1.53	64.52	N/A	37.49	6.99	0.24	936436	350.3	253.8	6:40:11	2329.4	0:15:32
5	1.59	87.42	N/A	37.02	6.86	0.19						0:13:03
	1.60	218.22	N/A	33.97					N/A	N/A	N/A	N/A
					N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Totals & Averages	1.5	1534.52	0	28.94	2.13	0.62	13278957	495.6	118.1	1/18/15 3:21	2808.0	1/5/15 0:13



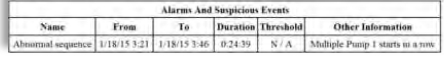
Date	Pump 1						
	Starts	Runtime including combinations	Runtime	Average Current	Volume	Efficiency	Capacity
Unit:		hh:mm:ss	hh:mm:ss	A	G	G/Wh	GPM
1	86	5:51:43	5:49:02	24.37	436184	1.71	1249.6
2	86	5:46:18	5:43:00	23.88	436230	1.78	1271.8
3	82	5:27:58	5:16:33	24.17	401661	1.75	1268.8
4	73	6:50:24	6:27:52	24.7	491112	1.71	1266.1
5	88	6:15:21	6:01:32				
	85	6:03:04		N/A	N/A	N/A	N/A
			N/A	N/A	N/A	N/A	N/A
Totals & Averages	1482	94:08:05	93:04:47	24.59	7414164	1.80	1327.8



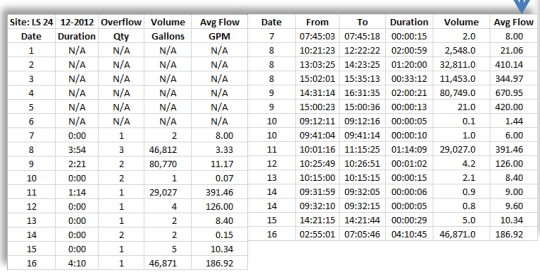
Date	Pump 2						
	Starts	Runtime including combinations	Runtime	Average Current	Volume	Efficiency	Capacity
Unit:		hh:mm:ss	hh:mm:ss	A	G	G/Wh	GPM
1	86	5:53:53	5:51:12	24.03	442133	1.75	1259.0
2	84	5:42:08	5:38:50	24.09	420459	1.72	1240.9
3	81	5:41:20	5:29:55	23.99	407454	1.72	1235.1
4	73	7:18:18	6:55:46	24.19	511529	1.70	1230.3
5	86	6:56:02	6:44:13				
	84	6:06:53		N/A	N/A	N/A	N/A
			N/A	N/A	N/A	N/A	N/A
Totals & Averages	1476	98:59:11	97:55:53	25.16	7517397	1.70	1279.9



Date	Pumps 1 and 2					
	Starts	Runtime	Average Current	Volume	Efficiency	Capacity
Unit:		hh:mm:ss	A	G	G/Wh	GPM
1	1	0:02:41	43.71	0	0	0
2	1	0:03:18	31.80	6190	1.97	1875.9
3	1	0:11:25	32.97	21416	1.90	1875.9
4	4	0:22:32	39.19	41535	1.57	1843.2
5	1	0:11:49	43.22			
	1	0:11:33		N/A	N/A	N/A
			N/A	N/A	N/A	N/A
Totals & Averages	9	1:03:18	33.74	416020.5	1.90	1816.7



Alarms And Suspicious Events					
Name	From	To	Duration	Threshold	Other Information
Abnormal sequence	1/18/15 3:21	1/18/15 3:46	0:24:39	N / A	Multiple Pump 1 starts in a row



Site: LS 24	12-2012	Overflow	Volume	Avg Flow	Date	From	To	Duration	Volume	Avg Flow
Date	Duration	Qty	Gallons	GPM	7	07:45:03	07:45:18	00:00:15	2.0	8.00
1	N/A	N/A	N/A	N/A	8	10:21:23	12:22:22	02:00:59	2,548.0	21.06
2	N/A	N/A	N/A	N/A	8	13:03:25	14:23:25	01:20:00	32,811.0	410.14
3	N/A	N/A	N/A	N/A	8	15:02:01	15:35:13	00:33:12	11,453.0	344.97
4	N/A	N/A	N/A	N/A	9	14:31:14	16:31:35	02:00:21	80,749.0	670.95
5	N/A	N/A	N/A	N/A	9	15:00:23	15:00:36	00:00:13	21.0	420.00
6	N/A	N/A	N/A	N/A	10	09:12:11	09:12:16	00:00:05	0.1	1.44
7	0:00	1	2	8.00	10	09:41:04	09:41:14	00:00:10	1.0	6.00
8	3:54	3	46,812	3.33	11	10:01:16	11:15:25	01:14:09	29,027.0	391.46
9	2:21	2	80,770	11.17	12	10:25:49	10:26:51	00:01:02	4.2	126.00
10	0:00	2	1	0.07	13	10:15:00	10:15:15	00:00:15	2.1	8.40
11	1:14	1	29,027	391.46	14	09:31:59	09:32:05	00:00:06	0.9	9.00
12	0:00	1	4	126.00	14	09:32:10	09:32:15	00:00:05	0.8	9.60
13	0:00	1	2	8.40	15	14:21:15	14:21:44	00:00:29	5.0	10.34
14	0:00	2	2	0.15	16	02:55:01	07:05:46	04:10:45	46,871.0	186.92
15	0:00	1	5	10.34						
16	4:10	1	46,871	186.92						

TCP/IP MODBUS TABLE

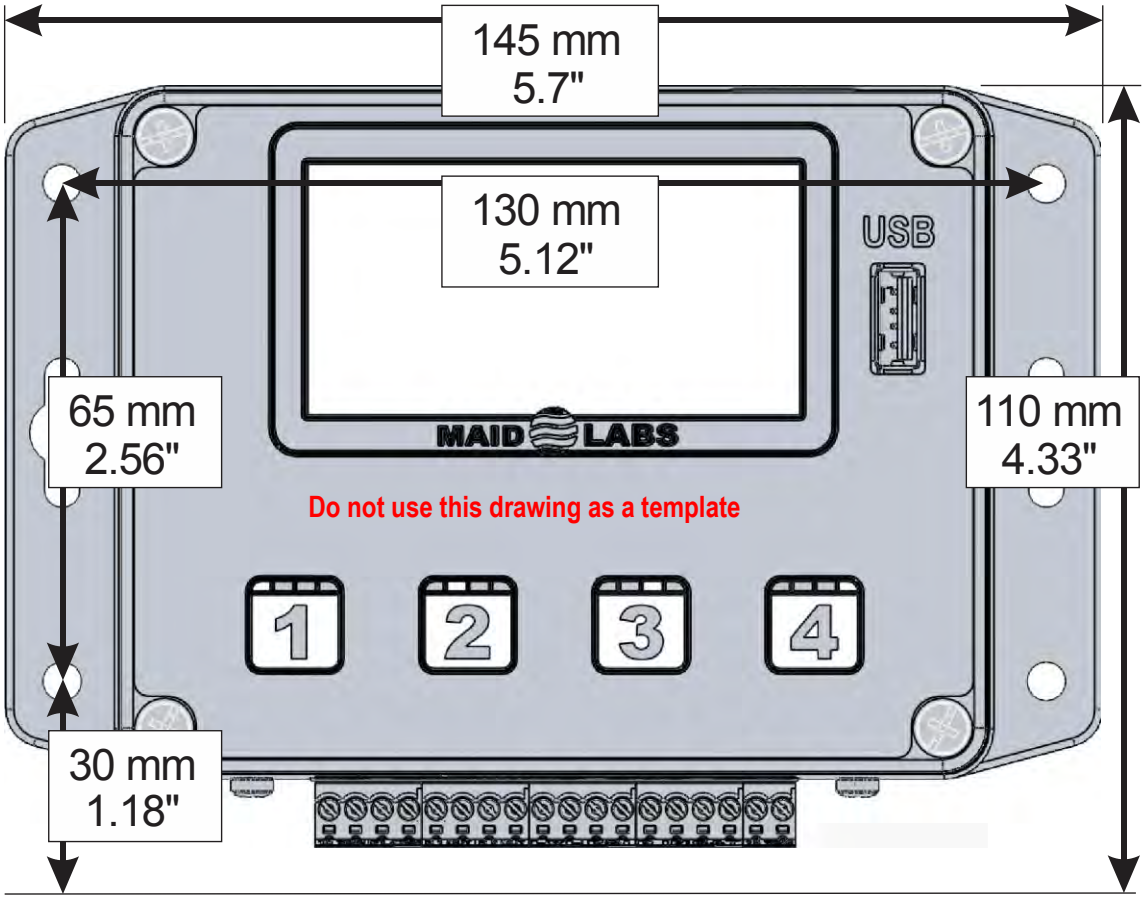
* See IEEE 754

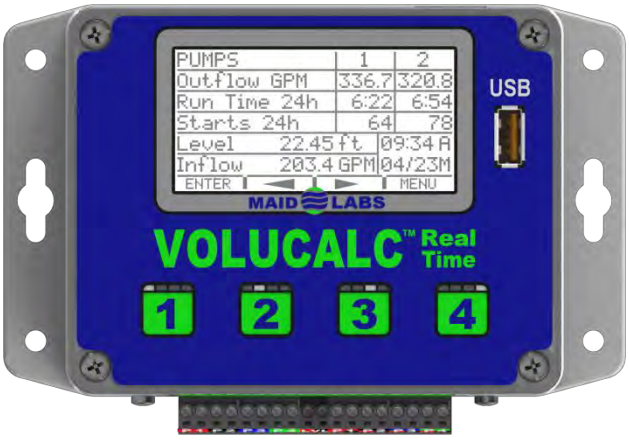
Address	Description	Type	Format	Scaling	Unit	Data min	Data max	Read/Write	Comments
40001	Current P1P1	Real Time	Unsigned Integer 16	10	Ampere	0	6535.5	Read	
40002	Current P2P1	Real Time	Unsigned Integer 16	10	Ampere	0	6535.5	Read	
40003	Current P3P1	Real Time	Unsigned Integer 16	10	Ampere	0	6535.5	Read	
40004	Current P4P1	Real Time	Unsigned Integer 16	10	Ampere	0	6535.5	Read	
40005	RPM P1	Real Time	Unsigned Integer 16	0	RPM	0	65535	Read	
40006	RPM P2	Real Time	Unsigned Integer 16	0	RPM	0	65535	Read	
40007	RPM P3	Real Time	Unsigned Integer 16	0	RPM	0	65535	Read	
40008	RPM P4	Real Time	Unsigned Integer 16	0	RPM	0	65535	Read	
40009	Starts P1	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40010	Starts P2	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40011	Starts P1-P2	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40012	Starts P3	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40013	Starts P1-P3	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40014	Starts P2-P3	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40015	Starts P1-P2-P3	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40016	Starts P4	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40017	Starts P1-P4	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40018	Starts P2-P4	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40019	Starts P3-P4	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40020	Starts P1-P2-P4	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40021	Starts P1-P3-P4	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40022	Starts P2-P3-P4	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40023	Starts P1-P2-P3-P4	Cumulative	Unsigned Integer 16	0		0	65535	Read	Rollover value
40024	Voltage external battery	Real Time	Unsigned Integer 16	10	Volt	0	6553.5	Read	
40025	Voltage	Fixed	Unsigned Integer 16	10	Volt	0	6553.5	Read	
40026	Power Factor	Fixed	Unsigned Integer 16	0	%	0	100	Read	
40027	Real Time Rain	Real Time	Unsigned Integer 16	100	mm/hour	0	6553.5	Read	
40028	Tap Water Pressure	Real Time	Unsigned Integer 16	0	kPa	0	65535	Read	
40029	Force Main Pressure	Real Time	Unsigned Integer 16	0	kPa	0	65535	Read	
40030	Level	Real Time	Signed Integer 16	100	Meters	-327.68	327.67	Read	
40031	Internal Temperature	Real Time	Signed Integer 16	10	Celcius	-3276.8	3276.7	Read	
40032	Head	Real Time	Signed Integer 16	100	m	-327.68	327.67	Read	
40034	Run Time P1	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40036	Run Time P2	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40038	Run Time P1-P2	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40040	Run Time P3	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40042	Run Time P1-P3	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40044	Run Time P2-P3	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40046	Run Time P1-P2-P3	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40048	Run Time P4	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40050	Run Time P1-P4	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40052	Run Time P2-P4	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40054	Run Time P3-P4	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40056	Run Time P1-P2-P4	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40058	Run Time P1-P3-P4	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40060	Run Time P2-P3-P4	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40062	Run Time P1-P2-P3-P4	Cumulative	Unsigned Integer 32	0	Seconds	0	4294967295	Read	Rollover value
40064	Serial Number	Fixed	Unsigned Integer 32	0		0	4294967295	Read	
40066	Delay before next event	Real Time	Unsigned Integer 32	0	Seconds	0	4294967295	Read	
40070	Capacity P1	Last used	Float 32	0	l/s	*	*	Read	
40072	Capacity P2	Last used	Float 32	0	l/s	*	*	Read	
40074	Capacity P1-P2	Last used	Float 32	0	l/s	*	*	Read	
40076	Capacity P3	Last used	Float 32	0	l/s	*	*	Read	
40078	Capacity P1-P3	Last used	Float 32	0	l/s	*	*	Read	
40080	Capacity P2-P3	Last used	Float 32	0	l/s	*	*	Read	
40082	Capacity P1-P2-P3	Last used	Float 32	0	l/s	*	*	Read	
40084	Capacity P4	Last used	Float 32	0	l/s	*	*	Read	
40086	Capacity P1-P4	Last used	Float 32	0	l/s	*	*	Read	

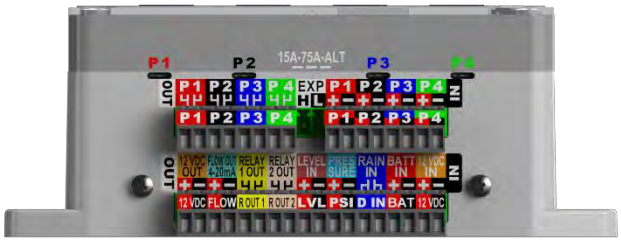
Address	Description	Type	Format	Scaling	Unit	Data min	Data max	Read/Write	Comments
40088	Capacity P2-P4	Last used	Float 32	0	l/s	*	*	Read	
40090	Capacity P3-P4	Last used	Float 32	0	l/s	*	*	Read	
40092	Capacity P1-P2-P4	Last used	Float 32	0	l/s	*	*	Read	
40094	Capacity P1-P3-P4	Last used	Float 32	0	l/s	*	*	Read	
40096	Capacity P2-P3-P4	Last used	Float 32	0	l/s	*	*	Read	
40098	Capacity P1-P2-P3-P4	Last used	Float 32	0	l/s	*	*	Read	
40100	Inflow	Real Time	Float 32	0	l/s	*	*	Read	
40102	Outflow	Real Time	Float 32	0	l/s	*	*	Read	
40104	Open Channel Flow	Real Time	Float 32	0	l/s	*	*	Read	
106/0	Relay P1	Real Time	Coil	-	-	0-1		Read	
106/1	Relay P2	Real Time	Coil	-	-	0-1		Read	
106/10	Pump status 3	Real Time	Coil	-	-	0-1		Read	
106/11	Pump status 4	Real Time	Coil	-	-	0-1		Read	
106/2	Relay P3	Real Time	Coil	-	-	0-1		Read	
106/3	Relay P4	Real Time	Coil	-	-	0-1		Read	
106/4	Relay Out 1	Real Time	Coil	-	-	0-1		Read	
106/5	Relay out 2	Real Time	Coil	-	-	0-1		Read	
106/6	Digital Input	Real Time	Coil	-	-	0-1		Read	
106/7	12v output	Real Time	Coil	-	-	0-1		Read	
106/8	Pump status 1	Real Time	Coil	-	-	0-1		Read	
106/9	Pump status 2	Real Time	Coil	-	-	0-1		Read	
	Total Rain	Cumulative	Unsigned Integer 16	0	mm	0	65535	Read	Available soon
	% of use of the station	Real Time	Unsigned Integer 16		%	0	100	Read	Available soon
	Efficiency P1	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P2	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P1-P2	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P3	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P1-P3	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P2-P3	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P1-P2-P3	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P4	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P1-P4	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P2-P4	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P3-P4	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P1-P2-P4	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P1-P3-P4	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P2-P3-P4	Last used	Float 32	l/kWh		*	*	Read	Available soon
	Efficiency P1-P2-P3-P4	Last used	Float 32	l/s		*	*	Read	Available soon
	Total Volume In	Cumulative						Read	Available soon
	Total Volume Out	Cumulative						Read	Available soon
	Alarm 1							Read	Available soon
	Alarm 2							Read	Available soon
	Alarm 3							Read	Available soon
	Alarm 4							Read	Available soon
	Alarm 5							Read	Available soon
	Alarm 6							Read	Available soon
	Alarm 7							Read	Available soon
	Alarm 8							Read	Available soon
	Alarm 9							Read	Available soon
	Alarm 10							Read	Available soon
	Alarm 11							Read	Available soon
	Alarm 12							Read	Available soon
	Alarm 13							Read	Available soon
	Alarm 14							Read	Available soon
	Alarm 15							Read	Available soon
	Alarm 16							Read	Available soon
	Alarm 17							Read	Available soon
	Alarm 18							Read	Available soon
	Alarm 19							Read	Available soon
	Alarm 20							Read	Available soon

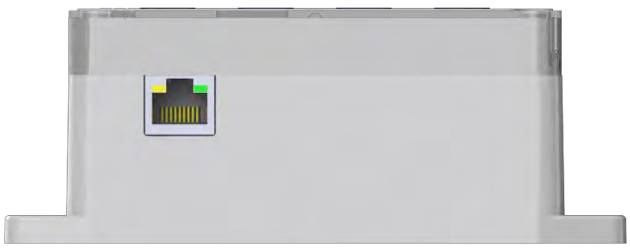
Physical Specifications	
Physical Size in inches (cm)	5.7 x 3.9 x 2.14 (14.5) x (9.9) x (5.5)
Weight	0.5 lb/0.22 kg
Working temperature	-4° to 140° F (-20° to 60° C)
Storage temperature	-22° to 158° F (-30° to 70° C)
Display	Backlit graphic monochrome 3” 128 x 64 pixels LCD.
Power Specification	
12 VDC Input	10 to 26 VDC, 2A max.
Battery input	16v max. Integrated 12 VDC lead acid battery charger. Do not connect a non-rechargeable battery.
P1 to P4 pumps inputs	1.5 VAC or 4-20mA, 0-5 VDC, 0-10 VDC, 0-24 VDC ±0.1% precision. 40 measurements per second.
P1 to P4 Relay outputs, Relay 1 out and Relay 2 out	Dry contact relay, 24 VDC max. 1A resettable fuse protected (PTC). 1hz output max.
Level Input and Pressure Input	4-20mA, 0-5 VDC, 0-10 VDC, 0-24 VDC ±0.1% precision. 40 reads averaged each second.
Flow 4-20mA output	Self-powered 4-20mA output, 600ohms load max. Updated every second.
12VDC output	(12VDC Input voltage or battery input voltage) minus 1.5 VDC. 1A max. Controlled by the device. Resettable fuse protected (PTC).
Digital Input	Self-powered dry contact input. 3.3 VDC. 100uA min. Can accept 5v signal max. 10hz max.
Other connectors	
Ethernet connector	RJ45 connector with 10BaseT network capabilities
USB	Standard USB-A port to read/write FAT or FAT32 formatted USB drive. Max 100mA.
Other	
Internal memory	2 gigabytes. Enough memory for the entire life of the product without erasing it. Automatically cleaned when device need more memory. Can be formatted on demand.
Accuracy	
Volumetric flow accuracy (normal operation)	± 1.5 % for most lift station with inlet above pump operating levels. RT allows calculating flow with a partially submerged inlet.
Open channel flow accuracy	Based on level sensor specifications and flow equation used. Available formulas: Manning, California pipe, Rectangular weir with end contractions, Rectangular weir without end contractions, V-notch (or triangular) weir and Trapezoidal (or Cipolletti) weir or use a standard or polynomial flow formula or a lookup table.
Real time clock accuracy	Max 10 seconds per month. Auto correction if the device has internet access.
Internal temperature sensor accuracy	±3°C
Warranty	
Volucalc RT warranty	3 years, part and labor.

Dimensions









Height 5.5 cm (2.2 in), Length 14.5 cm (5.7 in) , Width (including connectors and wires) 11 cm (4.33 in)

When installing, provide enough space above the instrument for the Ethernet port (2 cm 0.8 in) if used, and below the instrument for the connector and wires (1.5 cm 0.6 in).

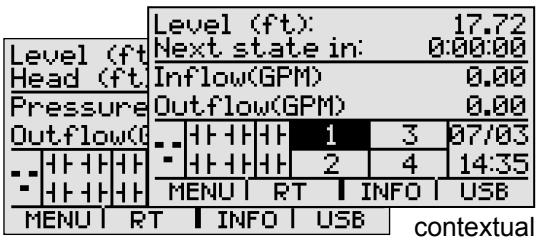
Communication

Devices communicate with a web server via a continuous internet connection. There is no configuration required when connecting to Maid Labs. The devices use port 80 (standard port for all web pages) to communicate with the MaidMaps server. If a computer in the network is capable of browsing the internet, then the communication will work.

Devices are DHCP clients and require no special configuration with the exception of having a DHCP server in the network (present in all standard networks). It is not possible at the moment to enter a fixed IP address to a device. It is possible to connect the unit to a Wi-Fi connection using an external module sold by Maid Labs. Configuration of the module is required using a computer. To know the IP address of the device or its MAC address, from the main screen, press the MENU 1 key, then ▼ 3 twice and ENTER 4 to display IP Informations. The screen provides the communications and network information including IP, MAC address, network Mask and Gateway data.

Screens

Main Screen



The main screen of the VOLUCALC™ RT is different for constant speed (front) and variable speed (back) pumps. It displays some computed data, sensor readings and the contextual use of the 4 keys of the keyboard. The 4 menu screens on the right are related to the 4 keys as displayed on the bottom row of the main screen.

Level (ft) 0.00 The level is displayed according to the configuration chosen by the user.

Next state in: 0:00:00 Displays approximatively time to wait until a pump starts or stops.

Inflow (GPM) 0.00 Displays flow coming in the station as calculated by the selected algorithm.

Outflow (GPM) 0.00 Displays flow pumped out of the station as calculated by the selected algorithm.

Head (ft) 0.00 Displays head calculated or entered.

Pressure (PSI) 0.00 Displays pressure read by the sensor or entered.

▪▪ This symbol indicates that there is no "Ethernet" connection.

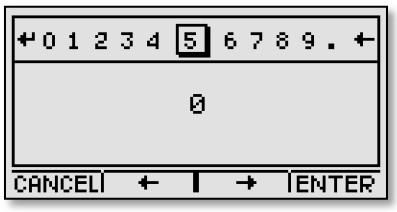
▚ This symbol indicates there is an « Ethernet » connection. The Ethernet cable is connected and the IP address is valid (communication is not necessarily functional).

┤├ This symbol indicates that the internal relay contact is open or ┼┼ close. The group of 4 represents the 4 pump outputs and the group of 2 represents the 2 relays of the bottom connector of the Volucalc RT.

1 When dark, it indicates the pump is in operation.

02/07
11:35 The current date and time is displayed.

Numbers selection screen



The setting for the Volucalc RT is easier using the *Maid Devices Configurator* software (on page 13 and 41). However, it is possible to set many functions from the display screen.

A scrolling scale 0 to 9 allows to select a value which is boxed 5. Scroll using the ← 2 and → 3 bottons. To select a number, press ENTER 4 ..

← is to correct or erase a number.
↵ is to accept the number and exit the menu.

When the curser comes on at +, press 4 and change to a negative number.

A negative value may be necessary for some parameters in the overflow equations. It is important to note that in some cases, the entered number will be validated. In such a case, an error message might appear below the window. The user will also be limited as to the number of digits after the decimal.

MENU 1

Pressing the MENU 1 button displays 8 options. Browse the menu with the ↑ 2 ↓ 3 keys, and press ENTER to execute.

1. Configure the device
2. Displays data relative to the hardware and software
3. Display IP addresses and network information.
4. Test the communication with Maidmaps.
5. Test the relay
6. Test the analog output
7. Lock the screen
8. Stop or reboot the device.

Configuration Menu

From the main screen, press the MENU 1 key to access the menu, and then ENTER 4 to open the Configuration menu. This enables to configure the following settings. Scroll through the menu with the ↑ 2 and ↓ 3 keys, and then press ENTER 4 to execute.

1. Date & Time
2. Units
3. Display
4. Inputs / Outputs
5. Level setup
6. Channel flow setup
7. Bandwidth setup
8. Alarms setup
9. Download Settings (Configuration)
10. Firmware Upgrade
11. Language
12. Lock Screen Password
13. Pressure Override (if no pressure sensor)
14. Level Override (if no level sensor)
15. Pump Capacities
16. Pump Ratio
17. Report Options
18. Technician

After a function is completed, press RETURN 1 to return to the previous menu. The list of submenus is longer than what is displayed on the initial screen.

Date & Time setup

In the Configuration (above) menu, press ▼ 3 to Date & Time, then press ENTER 4 to execute this function.

This menu displays time, date, and the difference to the Universal Time Coordinated (UTC), also known as Greenwich Mean Time (GMT). With a working Internet connection, the instrument updates automatically its internal clock using internet time. It is possible to force the update via internet with the button SET 3.

When the Bandwidth (page 30) is disabled, time modification is possible with these keys −, + and NEXT. A cursor appears under the first number that can be changed. Keys ▲ 2 and ▼ 3 are to change the value and NEXT 4 is to go to the next variable.

The data is stored in Greenwich Mean Time – GMT and then adjusted to local time for display and when generating files and reports. This prevents the loss of data caused by changes to daylight savings time to standard time and vice versa. Changes to the time or date can cause loss of data when entering an older time or date. If this happens, the data following the entered time and date are lost. In this case, a warning message will appear. Changing the GMT relation does not cause a loss of data.

Units

In the Configuration (page 28) menu, press ▼ to Units, then press ENTER 4 to select. The units can be chosen based on settings. Press the EDIT 4 key to move from one unit to another and the ▲ 2 keys and ▼ 3 to move from one parameter to another.

Display

In the Configuration (page 28) menu, press ▼ 3 to Display, and then press ENTER 4 to select.

Press ENTER 4 to select the Brightness setting, then ▲ 2 or ▼ 3 to adjust it between 0% (off) and 100%, in increments of 20%, then ENTER 4 again to accept it.

The backlight (brightness) and display can be disabled by adjusting the on-time in these features. Press ENTER 4 to accept the selection, then ▲ 2 and ▼ 3 to change, then ENTER 4 again to accept the selected time.

Inputs/Outputs

In the Configuration (page 28) menu, press ▼ 3 to Inputs/Outputs, then press ENTER 4 to select. VOLUCALC™ RT has several entries of various types that can be configured:

1. Analog Out
2. Level Input
3. Pressure Input
4. Relay Out 1
5. Relay Out 2
6. Digital Input

The configuration through the screens is intuitive, but it is wiser to use the MAID Device Configurator to do it.

Level setup

In the Configuration (page 28) menu, press ▼ 3 to Level Setup, then press ENTER 4 to select. The level configuration is used to adjust the values read by the device with the actual measured values. The only

parameter to be set is the thickness of water currently read by the sensor. Simply press the MODIF 4 key. If there is no water to measure, enter 0. The device will automatically adjust its settings. It is possible to reset all the settings by using the RESET key.

Channel Flow (Overflow) Setup

In the Configuration (page 28) menu, press 3 to Channel Flow Setup, then press ENTER 4 to select. Two options: Flowmeter or Overflow.

To record digital overflow with a dry contact, a device like a float switch needs to be connected to the RAIN IN input. It must be configured as a digital input and is only used to record the number of times a set level is reached and duration of these events.

In Overflow mode, a level sensor is connected to the LEVEL IN input of the device. It can be configured as an open channel flow meter, while still able to monitor the levels, record the duration and event while in an overflow condition. In Overflow mode, the Level (ft) is measured in real time, and the Compute flow over is the level at which the overflow began and open channel flow starts recording. This is the only value that the user can define. To do this, press the EDIT key using the *Numbers selection screen* (page 27), then accept the value with the APPLY key.

In Flowmeter mode, the device simply always record and compute the flow over 0. The device don't store the events as separate events in Overflow mode but all the events are totalized for each day. Press APPLY 4 key to continue. An open channel flow equations window appears.

Open Channel Flow Equations (Overflow)

Depending on the type of weir or primary device used, you can select among the 13 equations listed on page 46. The set engineering units are displayed in the parameter input screen. When multiple parameters are required, press OK 4 to move on. To select an item in a list, press LIST and to change a value, press EDIT and follow the instructions on page 32. The keys may have different functions depending on the selected equation.

Bandwidth setup

In the Configuration (page 28) menu, press 3 to Bandwith setup, then press ENTER 4 to select. The bandwidth setup screen allows changing four parameters for communication with the MaidMaps web server.

The first parameter determines whether or not to activate the communication with the MaidMaps server. The second indicates the delay between events uploaded to MaidMaps. These data allows displaying sensor values on the map and generating graphs from the web interface. The third parameter defines the delay between dayt files uploaded to MaidMaps. This applies to both .csv reports generated by the instrument and technicians files allowing a detailed monitoring of the operation of the device. The last parameter allows, when an overflow or an alarm configured accordingly, immediate transmission of data when it is running on battery.

Alarms setup

In the Configuration (page 28) menu, press 3 to Alarms setup, then press ENTER 4 to select.

WARNING! Sending alarms to MaidMaps is not fully integrated. Until it is completed, alarms must be created in the device and in MaidMaps . If no alarm is configured on the device, when operating on

battery, the device will not wake up to transfer its information to MaidMaps, so no real-time alarm will be issued.

Alarms setup in the device allows to be notified on the screen, using a relay contact or an internet connection is present, the web application MaidMaps when a predetermined condition occurs. You can configure alarms on several types of readings and conditions. The choices are to add an alarm, edit existing alarms, delete an existing alarm, cancel current changes to alarm or restore the default alarms present in the initial configuration. When `Add` or `Modify` is selected, a window with the options of this alarm is displayed:

The `Add` option allows enabling or disabling an alarm without having to delete it. `Data` is used to determine for what type of data this alarm is present. `Type` lets you choose whether the alarm is active if the reading exceeds `High` or `Low` when under the threshold. `Interval` is a third choice, which allows generating an alarm when the value is in the specific interval. The `threshold` is the value at which an alarm is generated.

The `Threshold2` can be setup only when the `Type` field is on `Interval`. The next parameter is `Delay before beginning` which specifies for how long the state should be valid before an alarm is considered active. `Delays after end` also allows you to filter alarms and wait for a predetermined time when the state is no longer valid before considering the alarm as complete. Thereafter, the `Display` option advises you on screen when an alarm becomes active. `Must recognize` requires an acknowledgment from the user so the alarm shuts down.

`Send to MaidMaps` allows, where internet communication is available, to transmit the list of alarms transferred to the MaidMaps web application. The options `Initial` delay and `Final` delay allows to be informed *via* the MaidMaps web application by SMS, email or otherwise when the alarm starts or ends. When the `Relay Active` settings are at `YES`, for a relay output `Relay Out 1` for example, in the list of inputs and outputs, is set in alarm mode, then the relay contact will close when the alarm will be considered active.

Download settings

In the `Configuration` (page 28) menu, press ▼ 3 to `Download settings`, then press `ENTER` 4 to select. This is to read the configuration file and to copy the firmware.

Reset total events

In the `Configuration` (page 28) menu, press ▼ 3 to `Reset total events`, then press `ENTER` 4 to select. This function resets the total events contained in the main screen. After selecting this function, press `YES` 3 to confirm the deletion of the data from the main screen or `CANCEL` 1 to return to the previous screen.

To reset the Volucalc RT “as new”, go to the `Factory Reset` function (page 32). A configuration file on a USB drive must be available to restart the Volucalc RT since it has no configuration following a factory reset.

Firmware Upgrade

In the `Configuration` (page 28) menu, press ▼ 3 to `Firmware upgrade`, then press `ENTER` 4 to select. Be sure of the reliability of the energy source before beginning the programming of the instrument. There must not be any power loss during the update. After selecting `Firmware update`, insert a USB drive that contains the **`volucalcrt.hex`** file in the root directory. Once this file is detected, the update programming will automatically start and a percentage of the update progress will be displayed in steps. The instrument restarts when the update is completed. This does not affect the configuration of the Volucalc RT.

Language

In the Configuration (page 28) menu, press ▼ 3 to Language, then press ENTER 4 to select. The instrument can work in French or English. Press ▼ 2 or ▲ 3 to select the language, then APPLY 4 to accept the displayed language.

Lock screen password

In the Configuration (page 28) menu, press ▼ 3 to Lock Screen Password, then press ENTER 4 to select. By default and if no lock has been configured, simply press 1234 to have full access to the menus of the device. To create a custom locking key, press EDIT 3 and enter a 5-digit code between 1 and 4, using the keys 1, 2, 3 and 4..

Pressure Override and Level Override

In the Configuration (page 28) menu, press ▼ 3 to Pressure Override or Level Override, then press ENTER 4 to select.

The override selection for pressure and level allows the user to input a value for damaged for missing sensors. Please note, these values will not change and will affect the accuracy of the data.

Press the ON 3 key to indicate that a pressure or level will be entered, then EDIT 2, follow the instructions at page 32, then press APPLY 4 to accept the value. To deactivate the fixed pressure or level, press OFF 3.

Pump Capacities

In the Configuration (page 28) menu, press ▼ 3 to Pump Capacities, then press ENTER 4 to select. If pump capacities are used to calculate a derived flow, the values entered in the MAID Device Configurator are displayed.

Pump Ratio

In the Configuration (page 28) menu, press ▼ 3 to Pump Ratio, then press ENTER 4 to select. If pump capacities are used to calculate a derived flow and a ratio is used to calculate capacities for combinations of pumps, then the ratio used will be displayed.

Report Options

In the Configuration (page 28) menu, press ▼ 3 to Report Options, then press ENTER 4 to select. This option is to filter events that are too short to be significant in the digital reports (mainly for overflow measurement with a float). If events are shorter than the set time, no event will be recorded. If multiple events occurs during the set time, only one event will be recorded.

Technician

In the Configuration (page 28) menu, press ▼ 3 to Technician, then press ENTER 4 to select. The technician menu allows access to functions that are normally reserved for factory or experienced technicians. In this menu, please note there are functions that could totally erase the memory of the instrument. These are the functions of Technician :

1. Factory Reset
2. Erase Files
3. SD Card Info
4. Copy Manual from USB
5. Copy App from USB
6. ScreenShot
7. Inputs Calibration
8. Raw Values

Factory Reset

This resets the device to the same condition that it was when new and never installed. To start press (in the order) 3 and 2. Nothing will be in the internal memory after this execution. It is equivalent to formatting the disk of a computer. A configuration file on a USB drive must be available to restart the Volucalc RT since it has no configuration following a factory reset.

Delete File

This function allows the user a selection of files to be deleted from the memory. Only do that if a Maidlabs technician ask you to.

To delete a selected file, press ENTER 4, then OK 2 to confirm.

SD Card Info

This function allows you to check the amount of memory for internal memory and free space. With 2 GB or more of memory, there is enough memory for the lifetime of the instrument, or more than 10 years.

Device info

From the main screen, press the MENU 1 key, then ▼ 3 one time and ENTER 4 to display Device Info. Displays the serial number of the instrument. The serial number is required to create a configuration file .

IP Information

From the main screen, press the MENU 1 key, then ▼ 3 twice and ENTER 4 to display IP Informations. This screen provides the communications and network information including IP, MAC address, network Mask and Gateway data.

Communication test

From the main screen, press MENU 1 to enter the menu, then the arrow 3 and ENTER 4 to initiate the communication test. The TEST 4 key allows to manually repeat the test to observe the commands that are sent. The button Init. 3 is used to reinitialise the connexion with Maidmaps and resend all new data immediately. *Communication Test* screen indicates if a network cable is connected to the device, if its IP address is valid or not and its IP address. On the screen, under the IP address, the text Successful Communication and Communication Failed will appear after the communication test. The test may take a few seconds to execute.

Successful Comm.
26/09 10 :10. 4. 0

Information appearing under the “Successful Communication” status is the date and time of the last communication, the command sent (represented by a digit) and the replies received. This information is not important to the user but allowed the technician to better diagnose a problem.

Relay test

From the main screen, press the MENU 1 key, then ▼ 3 4 times and ENTER 4 to do a Relay test. The user can change the status of the internal relay contacts of the instrument.

⊣⊢ This symbol indicates that the internal relay contacts are open.

⊣⊢ This symbol indicates that the internal relay contacts are closed.

Press 3 to open the relay and 4 to close it. You should be able to hear it change positions.

Analog output test

From the main screen, press the MENU 1 key, then ▼ 3 5 times and ENTER 4 to Analog Out Test. The user can change the value of the 4 to 20 mA analog output in 1 mA increments by pressing the buttons – 2 to decrease the value and + 3 to increase it.

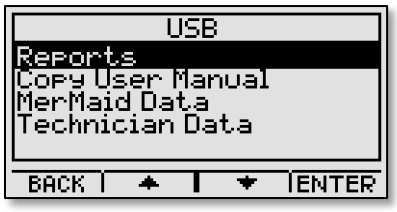
Lock screen

From the main screen, press the MENU 1 key, then ▼ 3 6 times and ENTER 4 to execute Lock Screen. Lock screen allows restricting access to the device in the main menu. By default, if no lock key has been configured, simply press 1.2,3,4 to have full access to the menus of the unit. If the lock key has been configured (*lock screen password*, page 31), just grab it with the buttons. The device automatically locks the screen after 30 seconds.

Shutdown or reboot device

From the main screen, press the MENU 1 key, then ▼ 3 7 times and ENTER 4 to open the screen. Press button 3 to Shutdown device or button 2 to reboot. This procedure is recommended when there is maintenance to do on the device, for example, a battery change. This avoids the possibility of losing recent data that has not been stored. This function stops all operations of the device. To restart normal operations, simply remove the power including the batteries and reconnect after a few seconds.

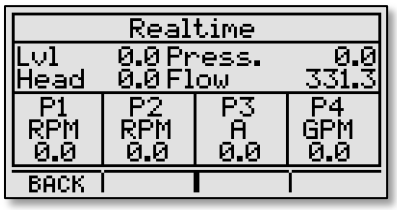
RT 2 (Real Time)



From the main screen, press the RT 2 key to display the Real Time screen.

The RT menu displays information in real time.

Real time



From the main screen, press the RT 2 key, then ENTER 4 to display the Realtime screen.

Lvl 0.0 level represents the current data from the probe.

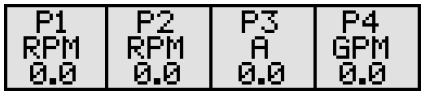
Head 0.0 is the current head pressure, a difference between the inlet or level pressure and the pumped outlet pressure.

Press. 0.0 represents the pressure at the pump outlet.

Flow 0.0 represents the flow rate calculated using the derived flow algorithm.

P1 to P4 represents the pump inputs.

RPM indicates a rotation speed in Revolution Per Minute.



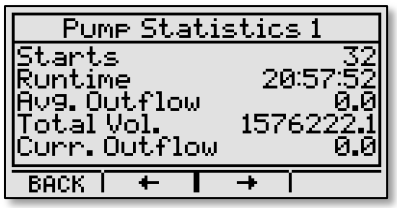
A indicates a current in Amp.

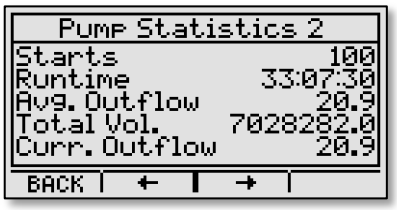
GPM, l/s or other flow unit will be displayed if an external flow meter is connected to the VOLUCALC™ RT and the RT is recording the displayed flow.

If nothing is connected, then N/A (non available) will be displayed.

Pump Statistics

From the main screen, press the RT 2 key, then ▼ 3 and ENTER 4 to display Pump Statistics of the first pump. This screen provides statistics for each pump (not pump inlet) accumulated since the last time the cumulative statistics were cleared (see page **Erreur ! Signet non défini.**) or a "Factory Reset" (page 36) was executed. Information includes:



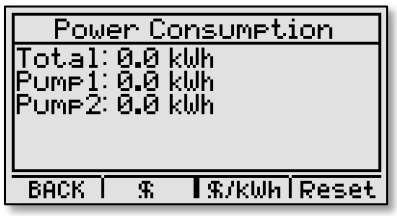


1. Starts - Number of starts
2. Run time
3. Avg. Outflow - Average flow out of the pumps
4. Total vol. - Total pumped volume
5. Curr. Outflow - Current Outflow

The keys ← 2 and → 3 are used to scroll from one pump to another.

Power Consumption

From the main screen, press the RT 2 key, then ▼ 3 twice and ENTER 4 to display Power Consumption. This screen displays the overall power consumption and kilowatt hour per pump. To achieve this, VOLUCALC ™ RT multiplied the current from the sensor by the number of phase by the voltage and the factor power. (Page 14 and 44)



BACK 1 is to get to the previous menu

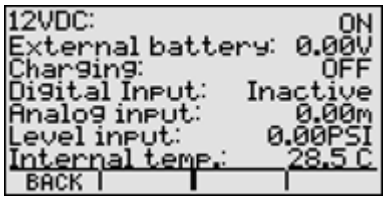
$ 2 will switch between kWh and $. $ is the cost of operating the station and the pumps.

$/kWh 3 will change the cost per kWh

Reset 4 will reset the kWh values to zero (0).

Internal Info

From the main screen, press the RT 2 key, then ▼ 3 3 times and ENTER 4 to display Internal Info.

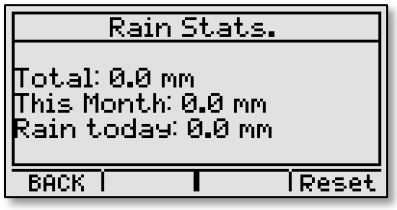


If batteries are installed in the instrument (depending on the model version), this screen allows you to see the voltage capacity.

The temperature displayed is accurate to ± 3 °.

Rain Statistics

From the main screen, press the RT 2 key, then ▼ 3 4 times and ENTER 4 to display the Rain Stats.



INFO 3

From the main screen, press the INFO 3 key.

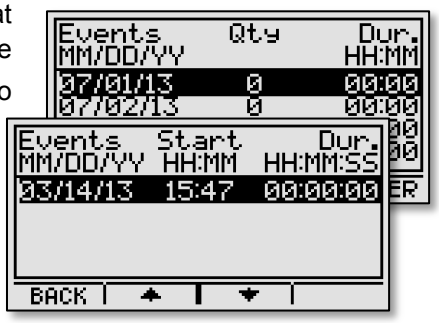
Four reports are available:

- Events Reports displays events relative to the digital input,
- Alarms Report displays alarms recorded by the device
- Channel Flow Report displays daily flow, or overflow and S.S.O. depending on the configuration of the device.
- Volucalc Report displays generic information about the station like daily flow, runtime, starts, power consumpsions.

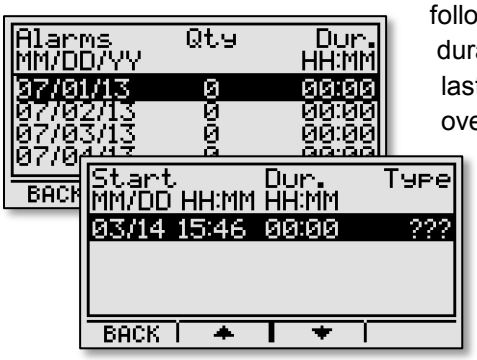
Press ENTER 4 to execute.

The current month is automatically preselected. Press MONTH 2 or YEAR 3 to select the month or year to change, and then 2 and 3 to scroll among the months and years for which data was recorded, and press ENTER 4.

Once the month has been selected, recorded daily information for that month can be viewed. To view daily details select the day to view the recorded events using ▲ 2 and ▼ 3, and then press ENTER 4 to display it.



The daily detailed report displays the date in the format MM/DD and time in the format HH:MM. On each line, there is the start time of the event, followed by its duration. Note that a duration of 00:00 means that it lasted less than 60 seconds. In the overflow report, the Flow will also be displayed. When pressing the NEXT 4 button, the last column displays the Volume.



If a day is not selected, the first event of the month will be displayed, then the next etc… In any case, press ▲ 2 and ▼ 3 to scroll through all events within the selected month.

USB 4

From the main screen, press the USB 4 key. This menu is to:

1. Copy reports on the USB key
2. Copy this instrument manual to USB key
3. Copy MerMaid format data the USB key
4. Copy to the USB key data that would allow the technician to help out, if necessary.

Press ▲ 2 and ▼ 3 to select the function to execute, then ENTER 4..

Use a USB drive formatted with FAT16 or FAT32. The amount of files on the key influence the time to copy files. It is best to reserve the use of a USB key downloads from MAID Labs' instruments.

Insert a USB drive when a message asks for it. When the transfer is completed, a message indicates that you can remove the key.

Reports

While viewing main screen, press the USB 4 key, then ENTRER 4 to access the Reports menu. The 3 choices are:

1. Monthly Events, (per the next page) without the volumes and average flow.
2. Monthly Overflow, which has flow and volume data
3. Monthly Volucalc, which summarize the monthly operation of the station.

The monthly reports are in CSV format. If Excel™ is installed on the computer, monthly reports will load automatically. The file name is composed of an identifier (name or serial number) plus the year and the month for which it is created. Note: If the device language is different from your computer, the data might not be presented properly in Excel. To remedy this, simply select the appropriate separator when importing into the spreadsheet (Excel).

A file is created for each month of operation of the instrument, unless all the data has been deleted intentionally using the Technician menu on page 27

Examples of reports are on the two next pages, the text format was altered to make them easier to read.

The reports are copied on the USB key in the subdirectory Monthly Reports, which is under the directory with the name given to the instrument or having its serial number in the root directory. See Device Name on page 37.

The Monthly Events report summarize the monthly information regarding events recorded through the instrument's digital input, or which occurred because a set point was reached. This report looks like this one, without the two right columns.

The Monthly Overflow report summarize the monthly information regarding events recorded through the instrument's digital input, or related to a reached set point. When the set point is reached, Volucalc RT uses the selected open channel equation to evaluate the quantity of water lost during the events and the average flow of these events.

If the set point is placed very low, then this report can be used as a monthly report showing the total quantity of water going through the station.

Site: LS 24	12-2012	Overflow	Volume	Avg Flow
Date	Duration	Qty	Gallons	GPM
1	N/A	N/A	N/A	N/A
2	N/A	N/A	N/A	N/A
3	N/A	N/A	N/A	N/A
4	N/A	N/A	N/A	N/A
5	N/A	N/A	N/A	N/A
6	N/A	N/A	N/A	N/A
7	0:00	1	2	8.00
8	3:54	3	46,812	3.33
9	2:21	2	80,770	11.17
10	0:00	2	1	0.07
11	1:14	1	29,027	391.46
12	0:00	1	4	126.00
13	0:00	1	2	8.40
14	0:00	2	2	0.15
15	0:00	1	5	10.34
16	4:10	1	46,871	186.92

Date	From	To	Duration	Volume	Avg Flow
7	07:45:03	07:45:18	00:00:15	2.0	8.00
8	10:21:23	12:22:22	02:00:59	2,548.0	21.06
8	13:03:25	14:23:25	01:20:00	32,811.0	410.14
8	15:02:01	15:35:13	00:33:12	11,453.0	344.97
9	14:31:14	16:31:35	02:00:21	80,749.0	670.95
9	15:00:23	15:00:36	00:00:13	21.0	420.00
10	09:12:11	09:12:16	00:00:05	0.1	1.44
10	09:41:04	09:41:14	00:00:10	1.0	6.00
11	10:01:16	11:15:25	01:14:09	29,027.0	391.46
12	10:25:49	10:26:51	00:01:02	4.2	126.00
13	10:15:00	10:15:15	00:00:15	2.1	8.40
14	09:31:59	09:32:05	00:00:06	0.9	9.00
14	09:32:10	09:32:15	00:00:05	0.8	9.60
15	14:21:15	14:21:44	00:00:29	5.0	10.34
16	02:55:01	07:05:46	04:10:45	46,871.0	186.92

If the VOLUCALC ™ RT was not installed on the first day of the month N/A (Not Available) appears on the lines on these dates without data.

Following the daily data begins the details of each event.

The Monthly Volucalc report summarize the station's data. This report is an html report. It can be displayed in any browser. Simply double click on the file and the default broswer on your computer will open the file. It provides the date of the report, the station and the month of the recorded data. The Average Outflow is the average flow rate based on the pump curves, the pump capacities, or the external flow

meter connected to an analog input. Same with the volumes. For the open channel equation, use the Monthly Overflow report of the previous page. For variable speed pumps, the runtime is usually high and the number of starts low. Constant speed pumps are opposite.

Date	Station						In					
	Energy Efficiency	Efficiency Lost	Wasted GHG	Use of Station	Maximum Level	Rain	Total Volume	Average Inflow	Minimum		Maximum	
									Flow	Hour	Flow	Hour
Unit:	G/Wh	kWh	kg	%	Ft	Inch	G	GPM	GPM	hh:mm:ss	GPM	hh:mm:ss
1	1.53	64.04	N/A	31.14	6.86	0.11	804686	558.9	326.0	0:26:03	1265.8	12:33:03
2	1.56	102.48	N/A	30.63	6.76	0	778256	540.5	263.1	5:13:53	1776.5	0:12:55
3	1.54	88.76	N/A	29.41	6.73	0	744321	516.9	257.9	5:01:57	2340.1	0:15:37
4	1.53	64.52	N/A	37.49	6.99	0.24	936436	350.3	253.8	6:40:11	2329.4	0:15:32
5	1.59	87.42	N/A	37.02	6.86	0.19						0:13:03
	1.60	218.22	N/A	33.97			N/A	N/A	N/A	N/A	N/A	
31					N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Totals & Averages	1.5	1534.52	0	28.94	2.13	0.62	13278957	495.6	118.1	1/18/15 3:21	2808.0	1/5/15 0:13

Copy User Manual

From the main screen, press the USB 4 key, then ▼ 3 and then ENTER 4 to access Copy User Manual. This function copies the PDF version of this user manual from the internal memory of the instrument to a USB key.

Date	Pump 1						
	Starts	Runtime including combinations	Runtime	Average Current	Volume	Efficiency	Capacity
Unit:		hh:mm:ss	hh:mm:ss	A	G	G/Wh	GPM
1	86	5:51:43	5:49:02	24.37	436184	1.71	1249.6
2	86	5:46:18	5:43:00	23.88	436230	1.78	1271.8
3	82	5:27:58	5:16:33	24.17	401661	1.75	1268.8
4	73	6:50:24	6:27:52	24.7	491112	1.71	1266.1
5	88	6:13:21	6:01:32				
	85	6:03:04		N/A	N/A	N/A	
31			N/A	N/A	N/A	N/A	N/A
Totals & Averages	1482	94:08:05	93:04:47	24.59	7414164	1.80	1327.8

MerMaid / Tech Data

From the main screen, press the USB 4 key, then ▼ 3 twice and then ENTRER 4 for MerMaid Data. The data is copied into a file that is formatted for the MerMaid software. To learn more about how to use the data of the MerMaid format, visit www.maidlabs.com/software-mermaid/.

Date	Pump 2						
	Starts	Runtime including combinations	Runtime	Average Current	Volume	Efficiency	Capacity
Unit:		hh:mm:ss	hh:mm:ss	A	G	G/Wh	GPM
1	86	5:53:53	5:51:12	24.03	442133	1.75	1259.0
2	84	5:42:08	5:38:50	24.09	420459	1.72	1240.9
3	81	5:41:20	5:29:55	23.99	407454	1.72	1235.1
4	73	7:18:18	6:55:46	24.19	511529	1.70	1230.3
5	86	6:56:02	6:44:13				
	84	6:06:53		N/A	N/A	N/A	
31			N/A	N/A	N/A	N/A	N/A
Totals & Averages	1476	98:59:11	97:55:53	25.16	7517397	1.70	1279.9

Copy config to USB

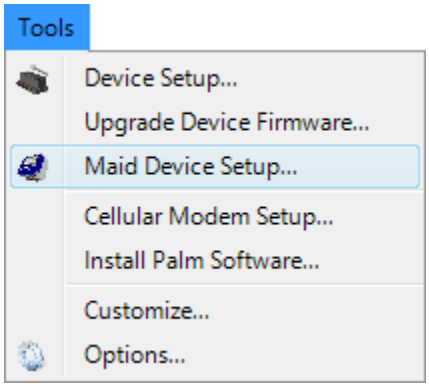
This function is used to export the configuration of the Volucalc RT to the USB key so the file can be opened with the Maid Device Configurator. It's also possible to export the configuration of the device with Mermaid software through the Mermaid Data file (.mldata).

Date	Pumps 1 and 2					
	Starts	Runtime	Average Current	Volume	Efficiency	Capacity
Unit:		hh:mm:ss	A	G	G/Wh	GPM
1	1	0:02:41	43.71	0	0	0
2	1	0:03:18	31.80	6190	1.97	1875.9
3	1	0:11:25	32.97	21416	1.90	1875.9
4	4	0:22:32	39.19	41535	1.57	1843.2
5	1	0:11:49	43.22			
6	1	0:11:23		N/A	N/A	
31			N/A	N/A	N/A	N/A
Totals & Averages	9	1:03:18	33.74	416020.5	1.90	1816.7

Alarms And Suspicious Events					
Name	From	To	Duration	Threshold	Other Information
Abnormal sequence	1/18/15 3:21	1/18/15 3:46	0:24:39	N / A	Multiple Pump 1 starts in a row

Maid Devices Configurator

The Maid Device Configurator software comes with the product and is installed within the MerMaid analysis software. Within the MerMaid software the MaidDevices Configurator is located in the Tools tab section. It will also be called **Configurator** in the text.



Maid Devices Configurator is used to setup the following instruments:

- **EE-400** Event encoder
- **FlowMaid** level monitor and open chanel flowmeter
- **PressureMaid** tap water pressure monitor
- **VOLUCALC™ RT** Fixed and Variable Speed pump flowmeter and open channel flowmeter

Welcome Window

The Configurator welcome window has three selections:

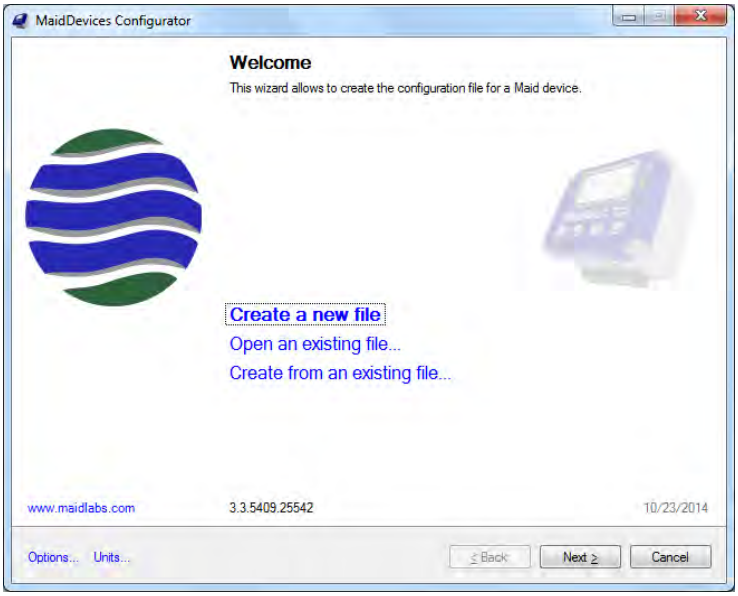
`Create a new file`

`Open an existing file -` for editing, modifing or viewing setup data

`Create from an existing file -` allows the user to copy parameters from a device already created. This is practical if many alarms have been created.

By default, the configuration process starts by creating a new file when Next ≥ is pressed.

The **`Options`** link on the bottom left corner of the window is for setting up your preferred engineering units (ft, meters etc…).



Options

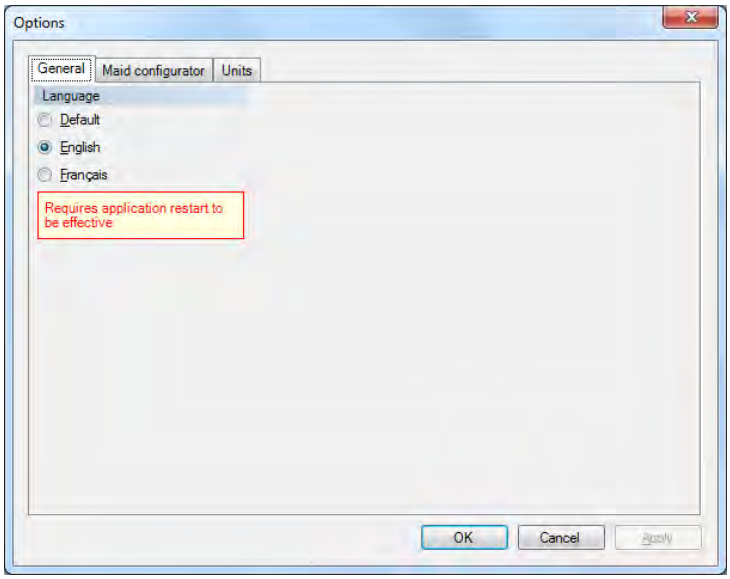
Two menu tabs are available: General and Units.

The General tab selects the desired language. By **Default**, the Configurator will appear in the language of your computer. It is possible to change it at anytime. The application must be restarted when its language is changed.

Press the Apply tab to save these changes.

By default, the **Options** dialog will open on the Units tab.

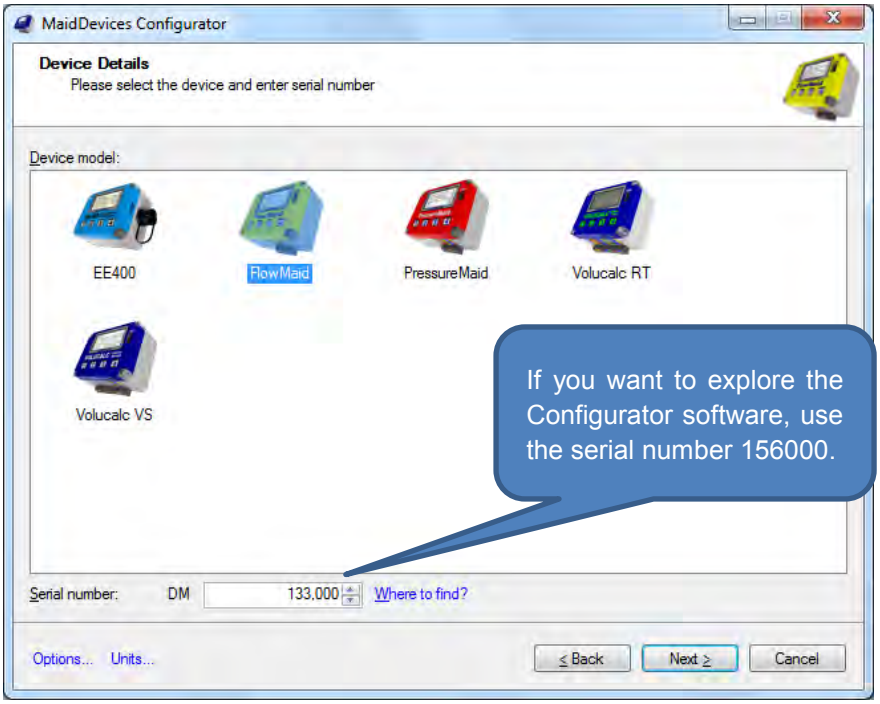
If you select **United States**, the standard engineering for this region will be selected. It is possible to change them to fit your needs. **International** units will be metric. Press the Apply tab to save the changes.



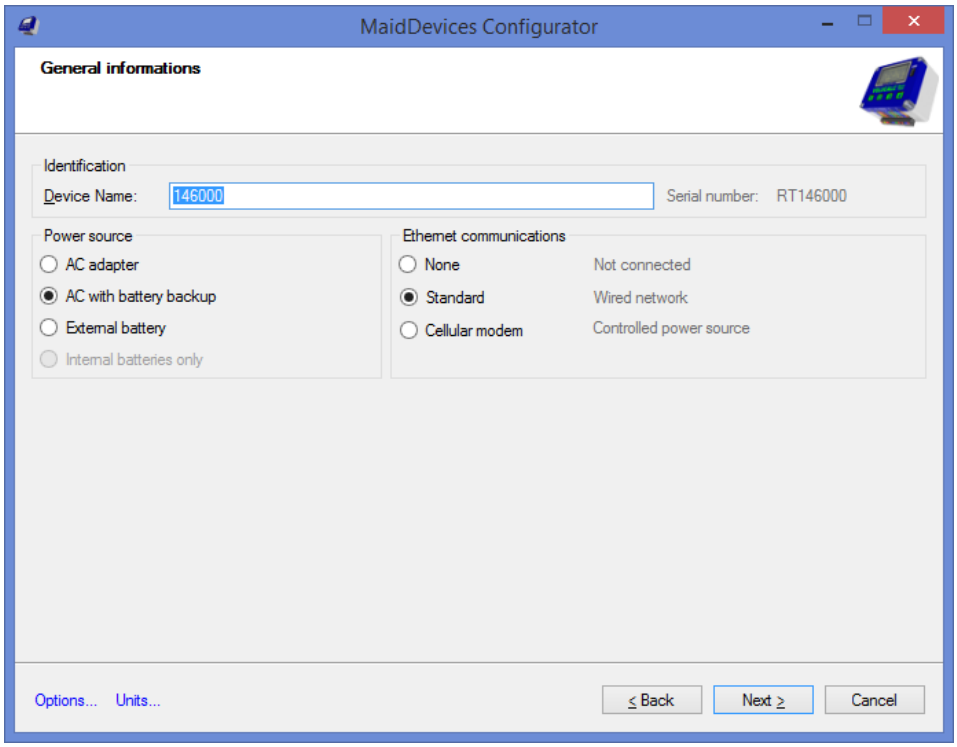
Device Details

Select Volucalc RT, then enter the serial number of the device. This number is on the label underneath the device and also appears on the *Device Info* screen (p. 37). If the serial number is incorrect, the instrument will not be able to read the configuration associated to it.

MaidDevices Configurator file is located in the root directory of the USB drive called RTxxxx (RT with serial No.).



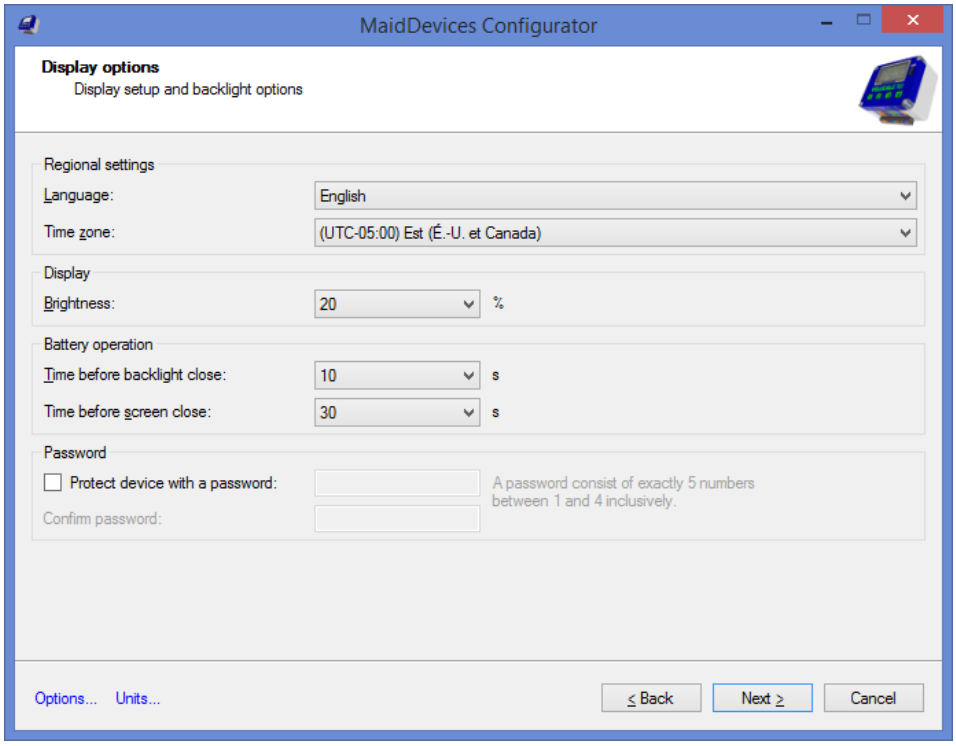
General informations



The instrument's files are identified by names. The **Device Name** is used to identify the data files copied from the instrument to the USB key. The name will be useful when a USB key is used for multiple devices. If no name is given, then the serial number of the instrument becomes its name. A maximum of only 20 characters in the name can be displayed on the screen of the instrument and no special caracters are permitted.

The **Power source** section defaults to AC with battery backup. The Ethernet communication option allows reconfiguring the settings for the communications with Maidmaps. Click Next > to continue.

Display options



In the **Regional Settings** French and English are the **Language** selections for the display and reports. The **Time Zone** is automatically adjusted to the computer's time and may be changed if required. The instrument works internally in Universal Time Coordinated (UTC), also known as Greenwich Mean Time (GMT) and will compensate for daylight savings automatically. When connected to the Internet the instrument will update the internal clock.

The **Display Brightness** can be adjusted between 0% and 100% in increments of 20%. The default value is 20%.

Battery Operation is related to other MAID Labs' products which also use the Configurator software.

An optional **Password** is use for locking the display screen. Make a 5 numbers code with digits between 1 and 4 representing the 1, 2, 3 and 4 buttons of the instrument. Click Next ≥ to continue.

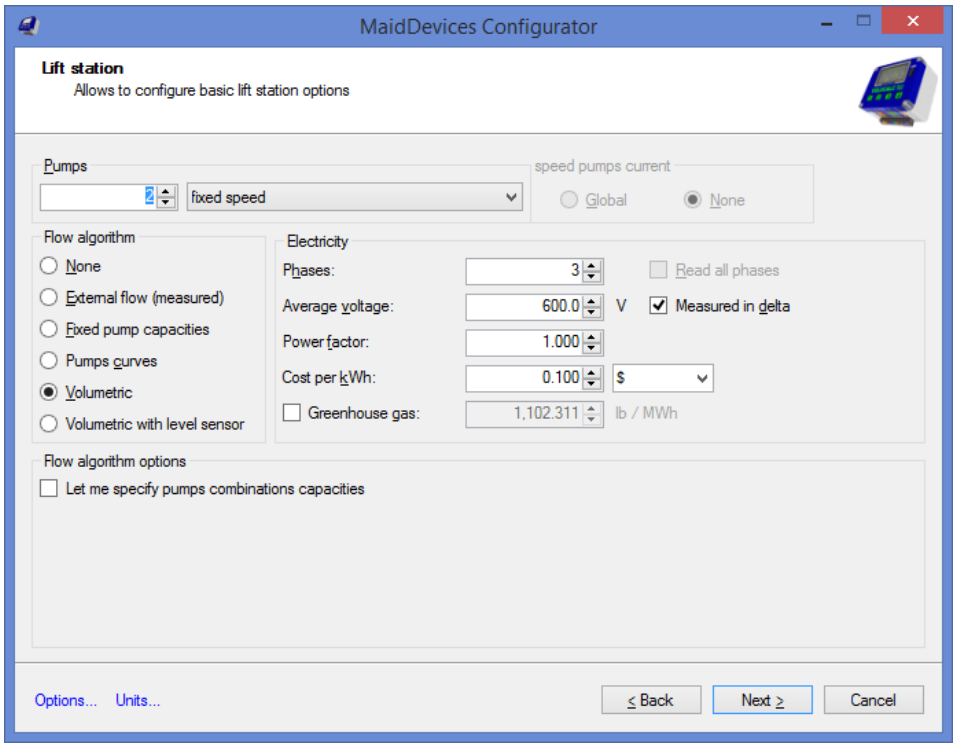
Lift station

This window will effect many of the following dialog windows. First select the number of pumps by clicking.

The drop down selection variable speed provides choices depending on the type of pumps. The selections are variable speed, fixed speed or any mixture of the two … if more than one pump.

If more than one pump and that there is at least one variable speed, then you must enter the pump curves for all pumps, even the fixed speed pumps.

If all pumps are fixed speed, provide the capacity of each pump and pump combinations.



Flow algorithm selects how the flow is calculated. If the RT is not used for flow calculation, select **None**.

External flow (measured) is from an external source, such as a magnetic flow meter. The flow rate will be displayed and used for energy efficiency calculations.

Fixed pump capacities will allow a user to enter pump capacities if all pumps are constant speed pumps. A dialog window to enter these values will be displayed at the appropriate time.

Pump curves are available for all types of pumps. The advantage of the pump curve over the fixed capacity is that if the level is very high for long periods, it will use the pump curve instead of a fixed value, which will be much more accurate than a set pump capacity under these conditions.

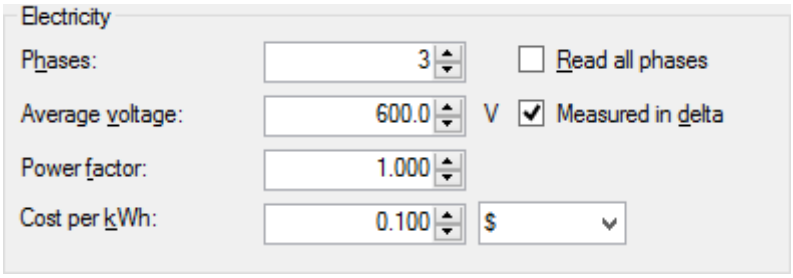
Volumetric will compute inflow in the lift station based on the pump cycles. This mode is only available with fixed speed pumps.

Volumetric with level sensor will compute inflow with fixed speed pumps in real time at a fixed time interval or level variation. This is the most accurate way to get flow in real time.

The **variable speed pumps current** section allows for per pump, global or none selections.

Per pump means that there is a current sensor per pump. This is only if there are 2 pumps or less.

Global means that there is one current sensor for all pumps, normally placed on the electrical input of the control panel. In this case, the power consumption is distributed according to the pump flow. This is only if there are 3 pumps or less. Select **None** if there are no sensors installed.



The **Electricity** section allows you to enter parameters used to calculate the power consumption of the pumps. The values are specific to the electrical configuration of each station. They are also dependent on the number and type of pumps used. The estimation of kilowatts consumed by a pump is the result of Current x Voltage x Power Factor.

If there is only one pump, then it is possible to place a current sensor per phase. In this case, ☐ Read all phases must be checked.

The majority of pumps used in sewer collection and water distribution systems have three phases. If this is the case, let the number of **Phases** be 3. If a current sensor is installed on only one of the 3 wires powering the pump, 3 indicates the current multiplier for estimating the total power usage of the pump. If the pump has two phases (240 volts), then choose 2 and 1 phase for most 120 volts pumps.

The **Average voltage** of the pumps is normally measured from phase to phase, which is called delta. If the voltage was measured between a phase and ground, then uncheck ☐ Measured in delta. Enter the average voltage of the phases on that line.

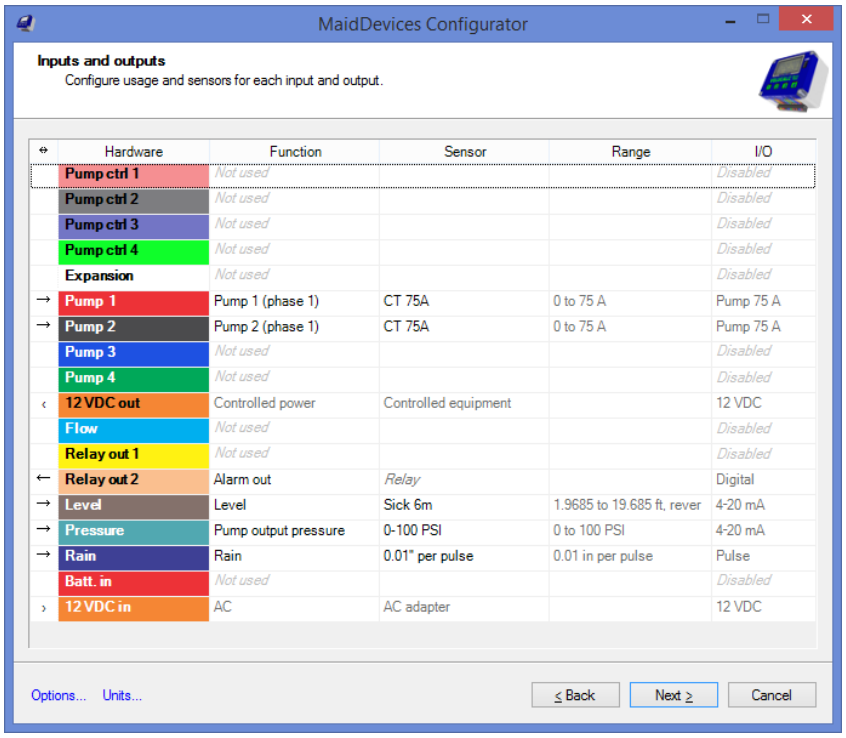
The **Power factor** is normally found on electricity bills as well as the **Cost per kWh**. These are only used to estimate the power consumption and operation cost. The last box is the currency symbol to use: $, €, £, or ¥.

The Greenhouse gas is used to estimate the quantity of greenhouse gas generated by the lost of energy of the station based on the number of gas per watt of electricity.

Click Next ≥ to continue.

Inputs and Outputs

The **Inputs and outputs** dialog is directly related to the choices of the previous dialog relating to pumps, algorithm and current reading. Choices are normally available by clicking in the appropriate cells. This table is the best way to check all the possible combinations.

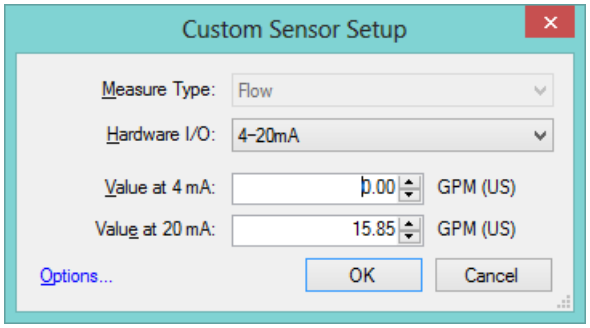


The left arrow ← means the signal is an output and to the right → means it is an input.

Flow

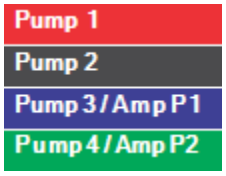
The analog 4-20mA **Flow** output is proportional to the outflow calculated from the pumped curves or pump capacities. It can also include the lost water caused by an overflow event if

calculated using one of the open channel equations. This output must first be configured by the user. The configuration window will appear by clicking the **Range** field.



In this window, **Value at 4 mA** and **Value at 20 mA** can be selected or changed with the arrows or by entering corresponding values. The user must ensure that the measurement unit shown is correct. This can be changed by clicking on the **Options** link ... All similar windows work the same way.

The 4-20 mA loop is powered by internal 12VDC. No external power is required.



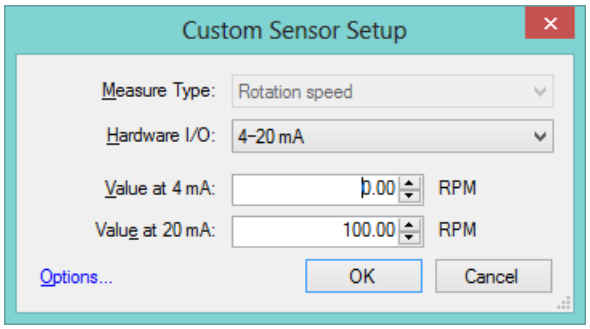
The input configuration for pumps 1, 2, 3 and 4 depends on the selected number of pumps in the Lift station dialog (page 37) window and if using fixed or variable speed pumps. The table below shows the various combinations of inputs based on the number of pumps in the station with variable speed pumps.

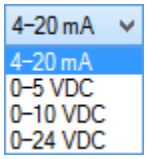
RPM and **AMP** indicates the pump input is used to measure pump speed or current. Bold letters indicates this field is not optional. Italic is optional.

RPM is the number of pump revolutions per minute which is an output from the variable frequency drives controlling pumps. **AMP** indicates a current sensor is used to measure the pump current.

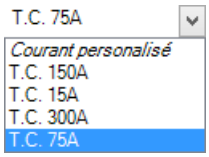
Nb of pumps	1		2		3		4	
Types of pumps	**Variable**	**Fixed**	**Variable**	**Fixed**	**Variable**	**Fixed**	**Variable**	**Fixed**
Pump 1	**RPM**	**AMP**	**RPM**	**AMP**	**RPM**	**AMP**	**RPM**	**AMP**
Pump 2			**RPM**	**AMP**	**RPM**	**AMP**	**RPM**	**AMP**
Pump 3/Amp P1	*AMP*		*AMP*		**RPM**	**AMP**	**RPM**	**AMP**
Pump 4/Amp P2			*AMP*		*AMP*		**RPM**	**AMP**

To configure the speed input of a pump, three choices are available, or **0-1000 RPM**, **0-2000 RPM** and **Custom speed**. When **Custom speed** is selected by clicking in the **Range** column, the **Custom Sensor Setup** window appears.



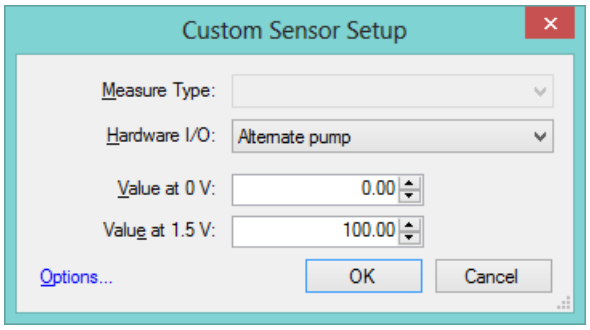


The **Hardware I/O** allows you to choose between the following analog inputs: 4-20mA, 0-5VDC, 0-10VDC or 0-24VDC. Depending on the configuration, the user must enter the RPM relative to the measurement limits of this input.



When recording the current is desired, selecting the Current Transformer (**CT**) is done using the drop-down menu in the **Sensor** column. The available standard sensors are in **15A**, **75A**, **150A**, **300A**, or a **Custom current**.

When a custom sensor is required, the user must enter the number of amperes corresponding to the limits of Volucalc RT input, which is 1.5 volts.



The selected sensor is displayed in the **I/O** (input/output) column, which is **15A**, **75A** or **Alternate** for all other types of sensors. Place the pump input switches (next page) at the proper positions on the device (15A, 75A, ALT) by means of a small screwdriver or a paperclip.

Level The analog input **Level** is configurable in the **I/O** column. The choices are **4-20mA**, **0-5V**, **0-10V** and **0-24V**. The choice of sensors include: **Sick 1.3 m**, **Sick 6m , Custom level or Auto-calibrate**. If Custom level is selected, the Configuration window of a custom sensor appears by clicking in the **Range** field.

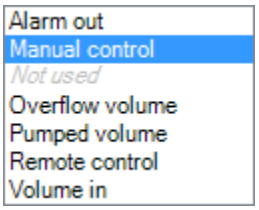
By using the Function column, several functions can be assigned to this input and recorded. The most common and default feature is the **Level**.

Auto-calibrate is used when there is an existing sensor at the lift station and the specifications of the sensor are unknown. We specify the start and stop level of the pumps and the first time the device will be powered, it will wait for a complete pump cycle and determine automatically the configuration needed to display the same start and stop level of the already installed level sensor.

Pressure The analog input **Pressure** is configurable in the **I/O** column. The choices are **4-20mA**, **0-5V**, **0-10V** and **0-24V**. This is used to read the outlet pressure for the pumps, not a single pump. The sensor ranges include: **0-100 PSI**, **0-300 PSI** and **Custom sensor**. In this case, the configuration window will appear by clicking in the **Range** field. In the Function column, several other functions can be assigned to this entry as explained in the preceding paragraph.

Relay out 1
Relay out 2

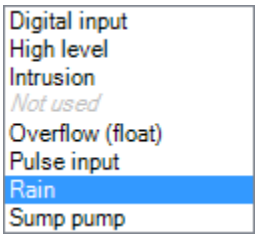
The **Relay output** can be used in different ways. As an **Alarm output**, it allows you to configure an alarm on minimum and/or maximum values. The alarm relay contacts will close when generating an alarm. The configuration of alarms is at page 23.



The **Remote control** function allows control of an alarm through the MaidMaps software.
A connection is required to the Internet via the Ethernet port of the instrument. The bandwidth options may affect the rate at which the command is received and executed by the VS.

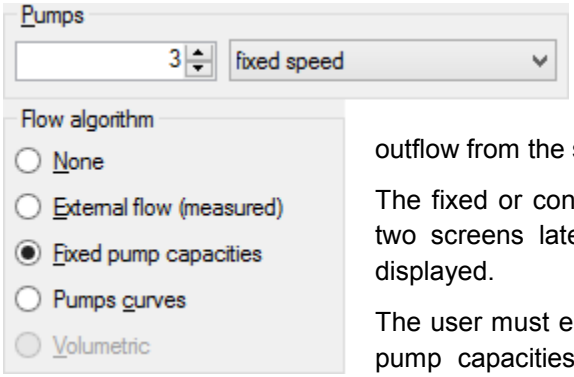
Manual control disables alarms and opens and closes the relay manually from a command entered by the user on the device.

The functions of **Overflow volume**, **Pumped volume** and **Volume in** will energize the relay contacts close for one second (create a pulse) each time the selected type of volume in the **Range** field is calculated (1 pulse = volume selected).



Rain The **Rain** input normally is used to record rainfall which is most common. However, it is a Digital input and can be used for other types of input selections. Some of these are **Intrusion** (alarm) **and Overflow** (float). The digital input can also record event from a pulse output meter.

Fixed speed pump capacity

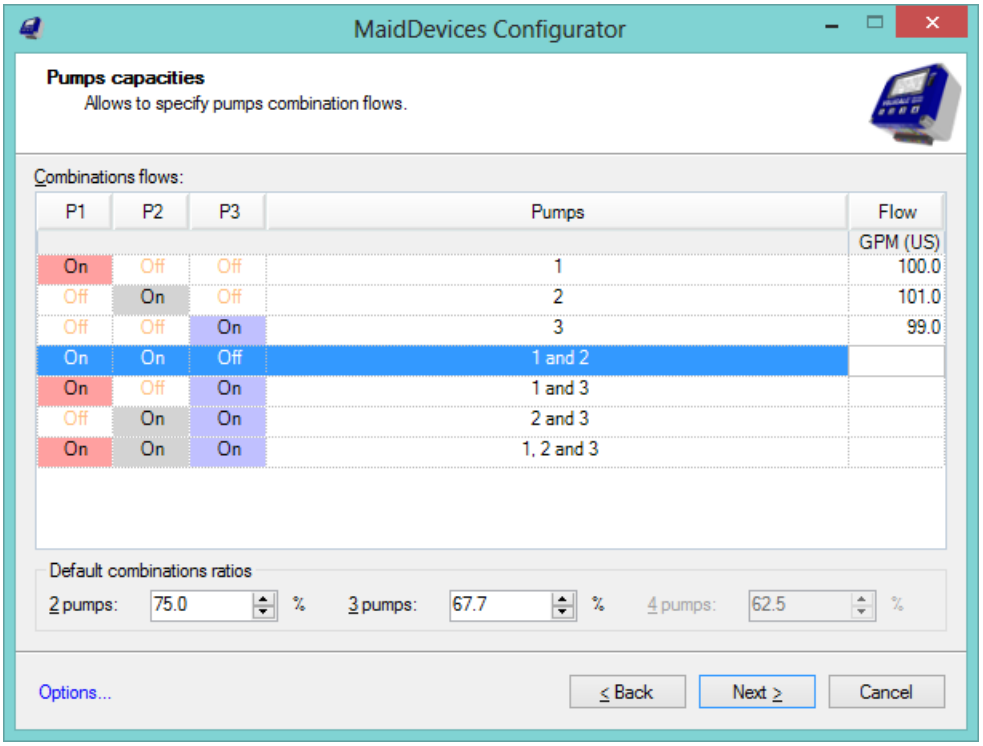


In the **Lift station** dialog window, when all pumps are constant speed, the flow algorithm will use the preset pump capacities. Based on run times for each pump, the total volumes per pump and total volumes pumped (all pumps) will be calculated as outflow from the station.

The fixed or constant speed **Pump Capacities** dialog window (next) will appear two screens later, and the **Pump Curve Selection** dialog (next page) is not displayed.

The user must enter each pump capacity in the **Flow** column. Please insure the pump capacities values were taken during normal operational levels. If the capacities of pump combinations are known, then it should be entered as well.

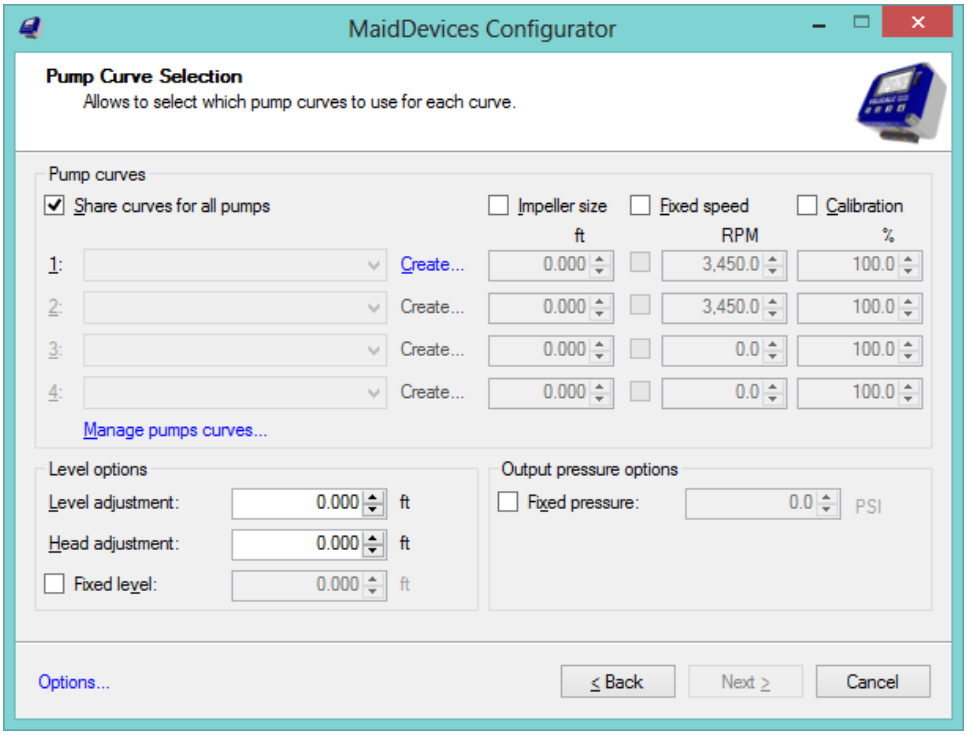
During a drawdown procedure to calculate a pump's capacity or combination of pumps, insure the levels (Lead/Lag, Start/Stop) are the same levels used for daily operations of the station. This will provide the most accurate capacity information for the Volucalc VS.



The **Default combinations ratios** selections area provides a general rule of thumb for standard pump capacities when an actual drawdown test has not provided this information.

Note: The standard default is 1 ½ times the average pump capacity for two pumps which equals 75%. A triplex station would be 67.7% the average pump capacity. Of course these values, which can be changed, are a general rule and do not replace an actual drawdown calculation.

Pump Curve Selection

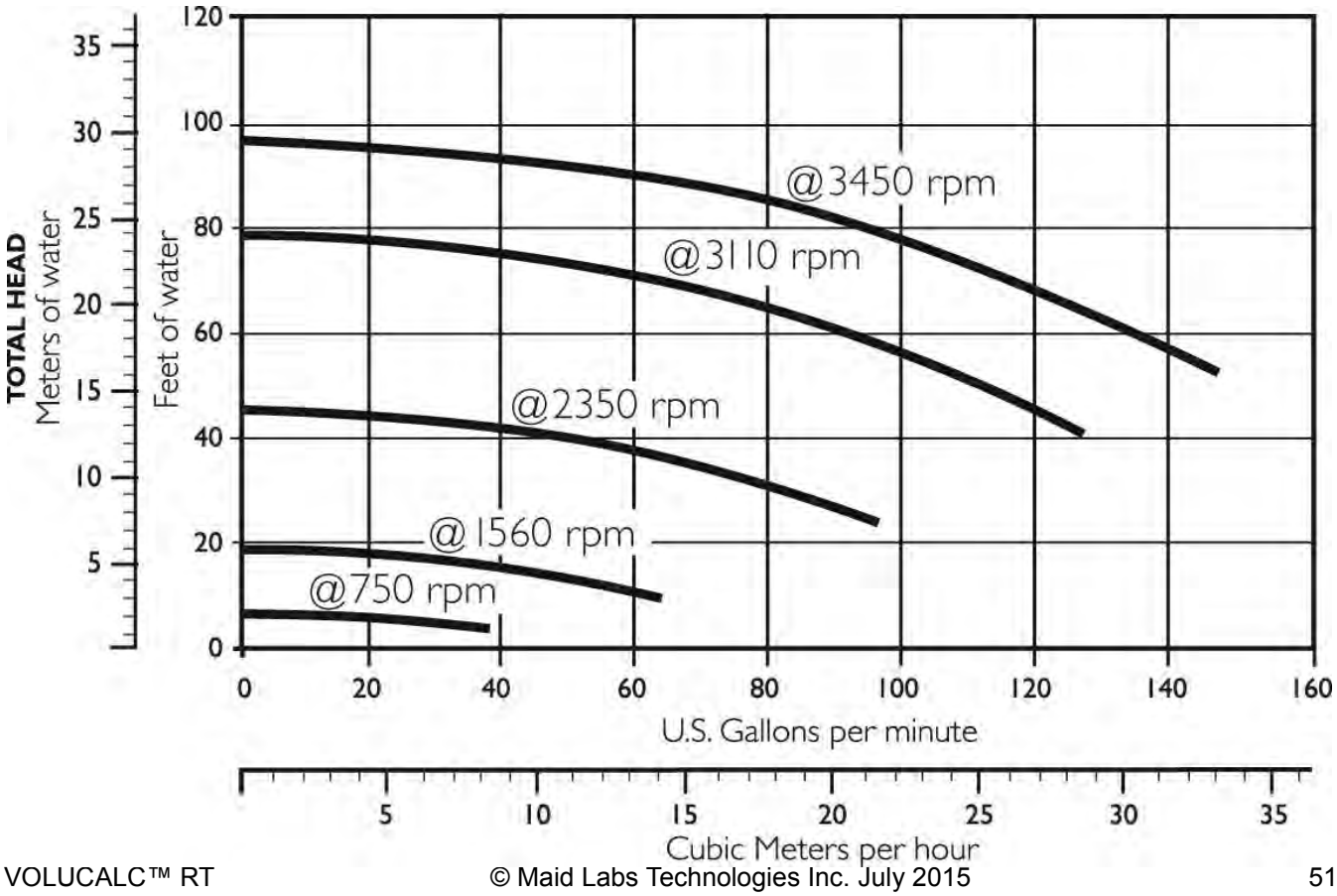


This dialog window (next page) is used to create and select the curves for variable speed pumps.

If all pumps are identical, you can use the same pump curve as pump no. 1, check ☑ Share curves for all pumps. In this case, only the first pump field 1: needs to be configured.

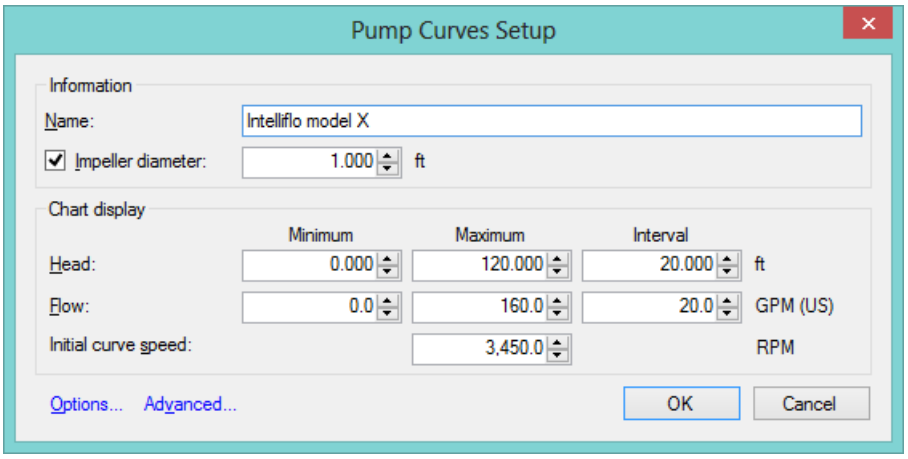
If the pumps have different curves and have not been interred into the Configurator software, you can create new curves for each pump. The pump curve data is stored in the software and can be reused with different site files using the same pump types.

The pump curves are usually provided free from the manufacturers. They represent flow rate relative to the head condition. Variable speed pumps have several curves in the graph for multiple RPM. Note: Before creating curves in the Configurator, it is important to have these curves in the computer and in a graphic format. The pump curves images should be displayed in a large format. Here is an example of pump curve : Model INTELLIFLO



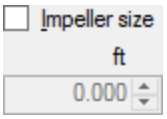
Once the pump curves is found (picture above), in the Pump curves area, click Create ... for the corresponding pump and the Pump Curves Setup dialog window will appear.

Configure the units according the graph pump curve information provided, even if it is only temporarily. The Configurator will do the conversion back, when needed. To change the units, click on the Options… link.



Each pump curve created in the Configurator for a specific pump model can be reused for other pumping stations. It is important to give them a meaningful name.

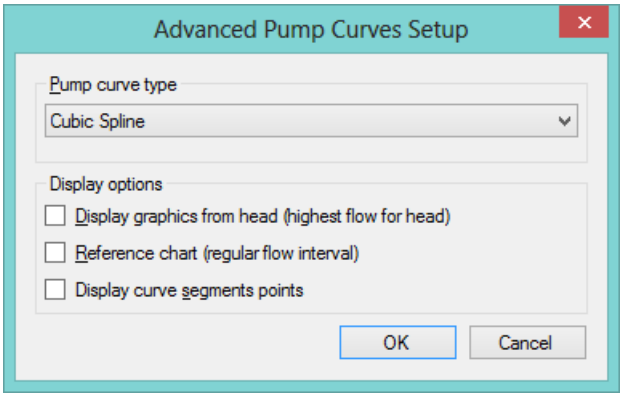
When the diameter of the impeller is known, it can be entered as part of the curve. If a different impeller diameter is used and entered in the Pump Curve Selection dialog (previous page), then the calculate flow will be automatically adjusted according to updated data on the impeller's diameter.



To create pump curves in the Configurator, enter the minimum and maximum values for the X-axis (flow) and Y (head) from the pump curve graph (like on the previous page) and the value for the intervals in the appropriate fields. Set a speed at which the first curve will be created in the Initial curve speed field.

The **Advanced …** link will change the way curves are displayed. The best configuration is the default, which is **Cubic Spline** without any **Display options** selected.

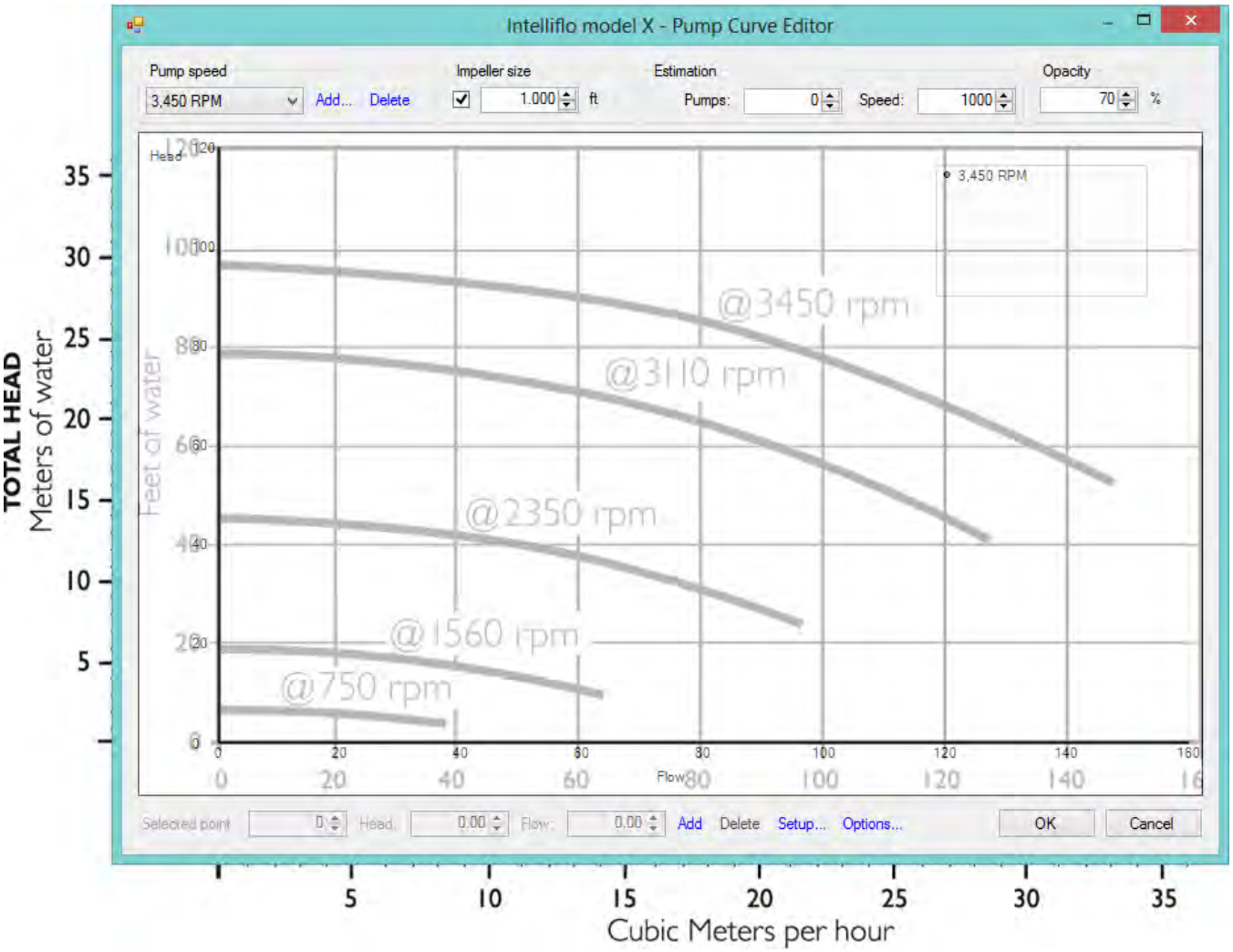
Click OK to go to the next step and the **Pump Curve Editor** window (next page) will appear.



Pump Curve Editor

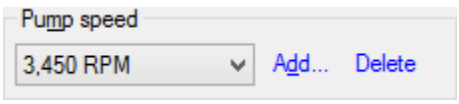
The **Pump Curve Editor** provides a semi-transparent window to overlay and copy curves. Stretch the editor window over the manufactures pump curves graph and behind the pump curve editor window.

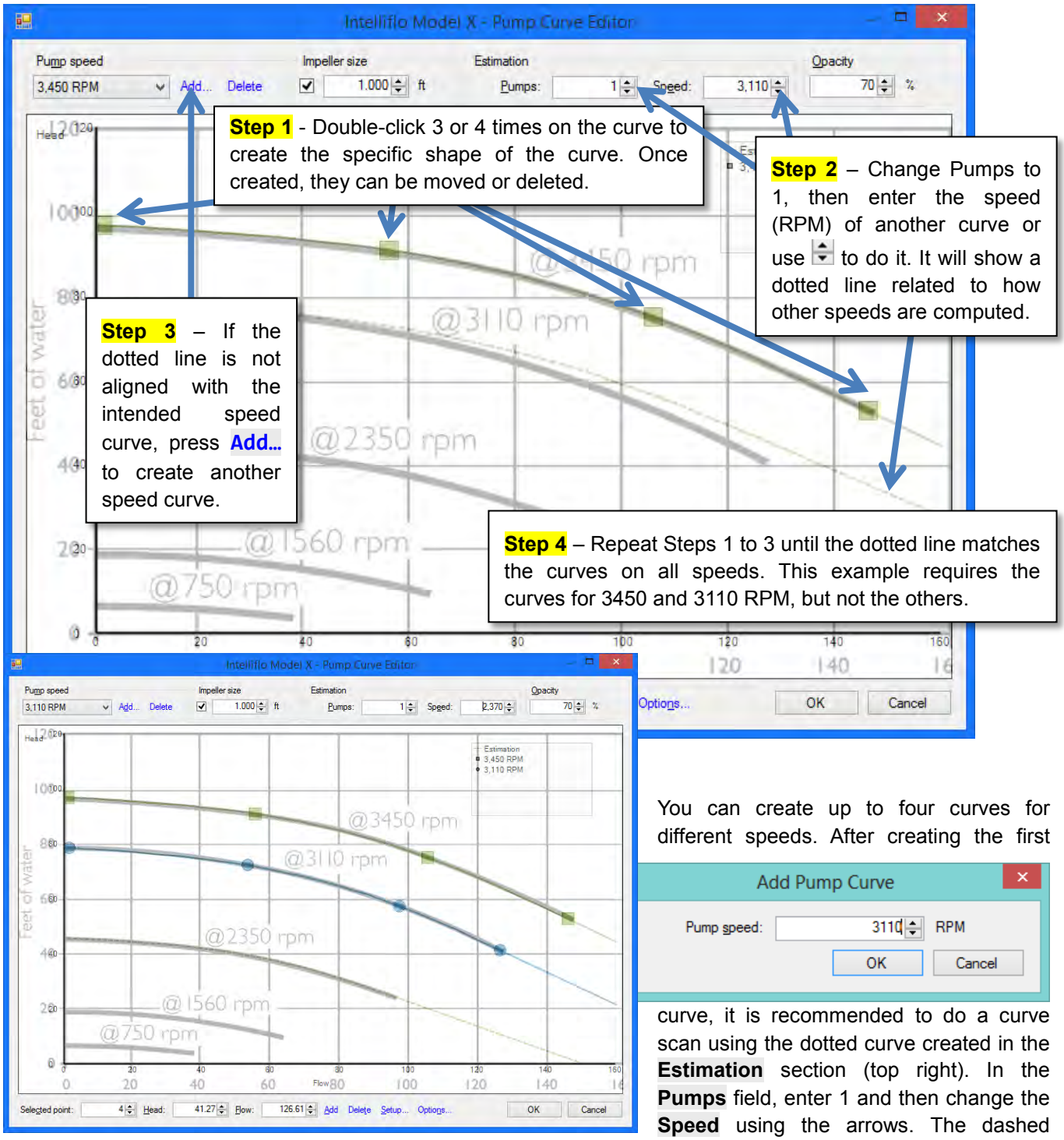
You may want to adjust the opacity of the window of the overlay screen while directly over the pump curve graph to see the data more clearly. The smaller percentage of opacity makes the window more transparent.



When overlapping the windows, be sure to use identical scales and adjust the window size for a perfect overlay of the graph of the pump curve document. Place the origin of the axes over each other to start and stretch the top and right sides of the **Pump Curve Editor**.

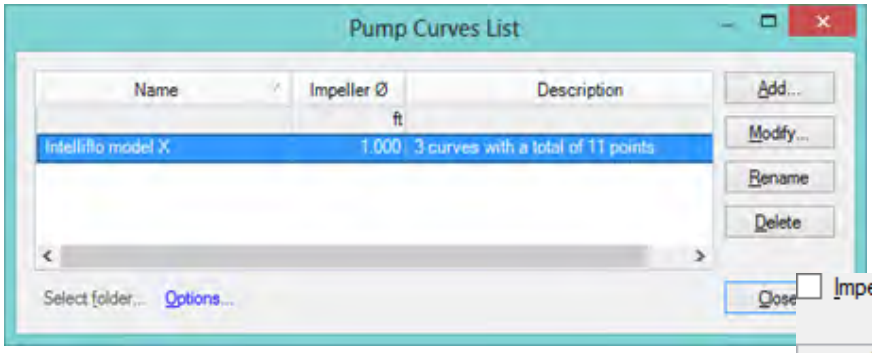
After the axes and intervals are properly aligned, align the pointer of the mouse to the absolute left of the curve related to the Pump speed. Double-click the mouse left button to create a first point at zero flow (the x-axis is zero) for the RPM entered in the previous screen (shown in the upper left corner of the curve editor). Create a second point in the middle of the curve and a third and final point at the end of the curve. A curve connecting the three points will be at the screen. If necessary, add additional points on the curve to an almost perfect superposition. It is possible to enter and clear head / flow points at the bottom of the curve editor.



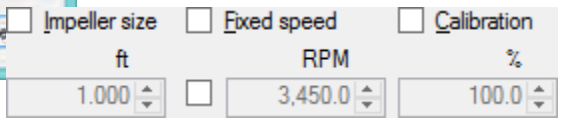


You can create up to four curves for different speeds. After creating the first

curve, it is recommended to do a curve scan using the dotted curve created in the **Estimation** section (top right). In the **Pumps** field, enter 1 and then change the **Speed** using the arrows. The dashed curve will shift depending on the speed variation obtained with the arrows. The superposition of the dotted curve with the different curves in the graph will determine whether the addition of a second curve is required. If this is the case, the **Pump speed** section, click the **Add ...** and enter the RPM for which the second curve must be created and use the same steps as before to create the new curve.



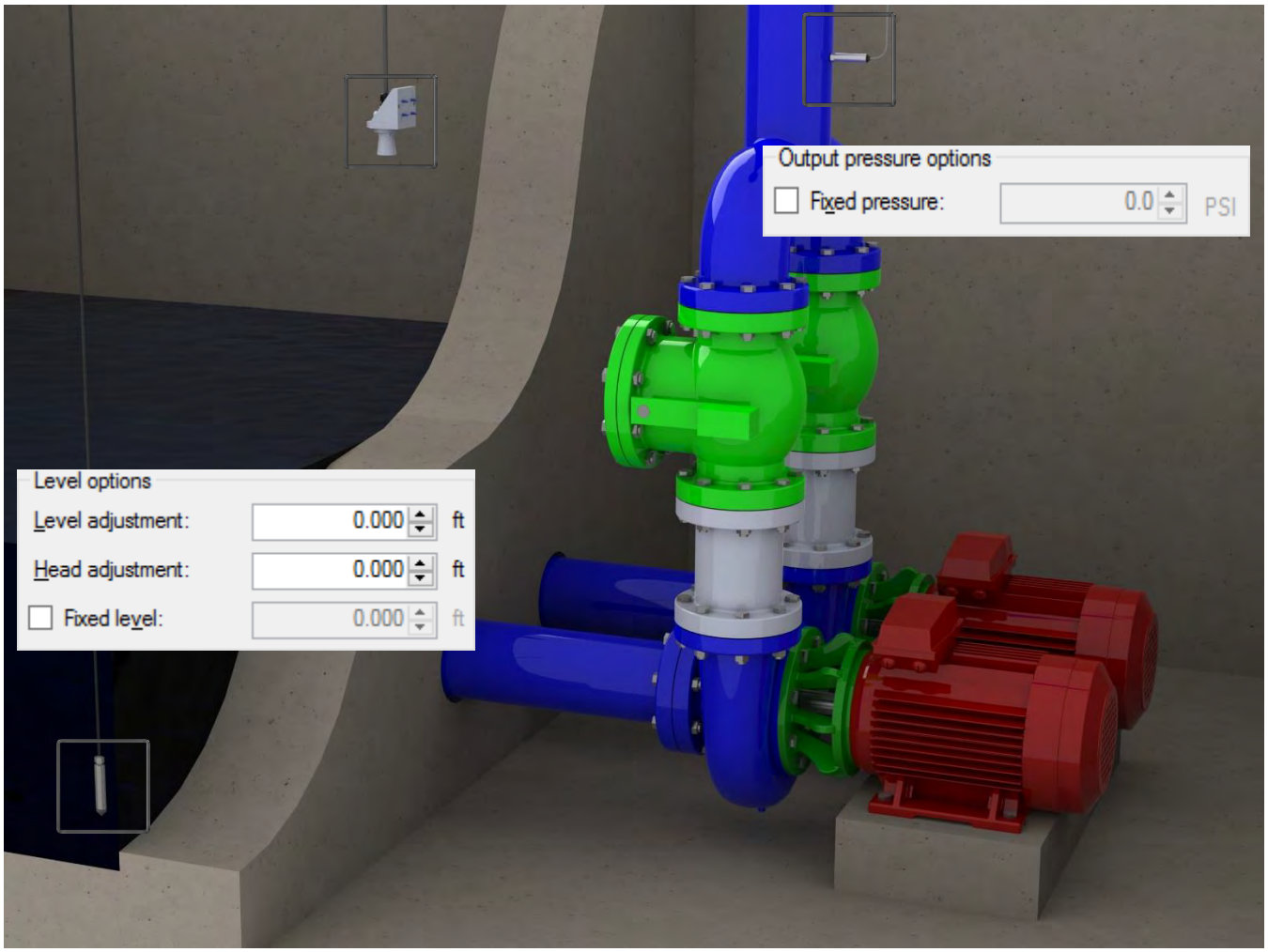
The user will automatically return to the **Pump Curve Selection** dialog window (Page 50). It is possible to **Add**, **Modify**, **Rename** and **Delete** pump curves by clicking the **Manage pumps curves ...** link.



After accepting the pump curves, return to the initial screen of the **Pump Curves Selection**. These are advanced impeller settings and only used when the impeller may be worn or not the original impeller do to maintenance requirements. The setting will compensate for the impeller size, speed or calibration. These adjustments will only affect the system curve and not the pump curve you may have loaded into the software. On the right, you can enter the true diameter of the impeller.

If only constant speed pumps are used, then this does not apply.

To complete the **Pump Curves Selection** dialog, this picture is used to explain the **Level options** and **Output pressure options**.



The **Level options** allows you to enter values to compensate abnormal readings.

Level adjustment is the difference in height between the level 0 set (page 48) and the level of the pumps. This value should be a positive number if the pump is below the level 0.

Head adjustment is similar, but for the head this time. A positive number indicates that the sensor is higher than the pump.

☐ Fixed level: or ☐ Fixed pressure: is when to force a value (no sensor or faulty sensor) is needed. If no sensor is configured, it is necessary to specify the level or fixed pressure as appropriate.

VOLUCALC™ RT Calibration worksheet

If you do not have the curves for the variable speed pumps, then they must be created. If you have them, then you can check the system curve. The flow accuracy of the VOLUCALC ™ RT is directly proportional to the quality of the calibration performed. MAID Labs provides an Excel worksheet on the USB key or downloaded from Maid Labs' website through this link www.maidlabs.com/Files/VS_Calibration_worksheet_GPM.zip. It is explained on next page.

This is how the Calibration of the Volucalc RT works:

- It takes one curve per speed, preferably low, medium and high speed, 3 speeds are required.
- Run the pumps at the each speed within a known volume.
- The start and stop levels used should be in the middle of the normal operating level for the variable speed pumps. For example: If the normal is set at 10.0' then the stop should be 9.5' and the start 10.5'.
- Manually start and stop the pumps at each level for each pump and for each speed. Then enter the run

	A	B	C	D	E	F	G	H
1	**Volucalc VS Calibration**					Enter data in grey area only		
2	**Name of Lift Station:**							
3	**Install a Volucalc VS with level and pressure sensors.**							
4	**Calibrate all the sensors (with Maid Devices configurator).**							
5	**Enter well dimensions** (surface in feet)				**Dim. 1:**		**Dim. 2:**	
6	Select start and stop levels that will be used during the tests. If possible, try to have the same distance above and below the average level at which the pumps usually operate. If the distance between the levels is too high, it will take forever to do the calibration. If the distance is too small, the accuracy will be reduced. 5 to 15 minutes fill-up time is good. Do a first fill-up cycle to calculate the average flow before the pump operation.							
7	**Measure the distance between these levels.**						**Distance:**	
8	**Volume of well (ft^3)**		0				**Gallons:**	-
9	Compute all the data and create pump curves and setup this in the MaidDevices							
11	**Pump #**	**SPEED**	**RPM**	**Pump Start HH:MM:SS**	**Pressure**	**Pump Stop HH:MM:SS**	**Time Period HH:MM:SS**	**Flow Rate GPM**
12	1	LOW					0:00:00	
13	1	LOW					0:00:00	
14	1	LOW					0:00:00	
15	1	Intermediate					0:00:00	
16	1	Intermediate					0:00:00	
17	1	Intermediate					0:00:00	
18	1	High					0:00:00	
19	1	High					0:00:00	
20	1	High					0:00:00	
21	2	LOW					0:00:00	
22	2	LOW					0:00:00	
23	2	LOW					0:00:00	
24	2	Intermediate					0:00:00	
25	2	Intermediate					0:00:00	
26	2	Intermediate					0:00:00	
27	2	High					0:00:00	
28	2	High					0:00:00	
29	2	High					0:00:00	
30	1 + 2	LOW					0:00:00	
31	1 + 2	LOW					0:00:00	
32	1 + 2	LOW					0:00:00	
33	1 + 2	Intermediate					0:00:00	
34	1 + 2	Intermediate					0:00:00	
35	1 + 2	Intermediate					0:00:00	
36	1 + 2	High					0:00:00	
37	1 + 2	High					0:00:00	
38	1 + 2	High					0:00:00	
39								

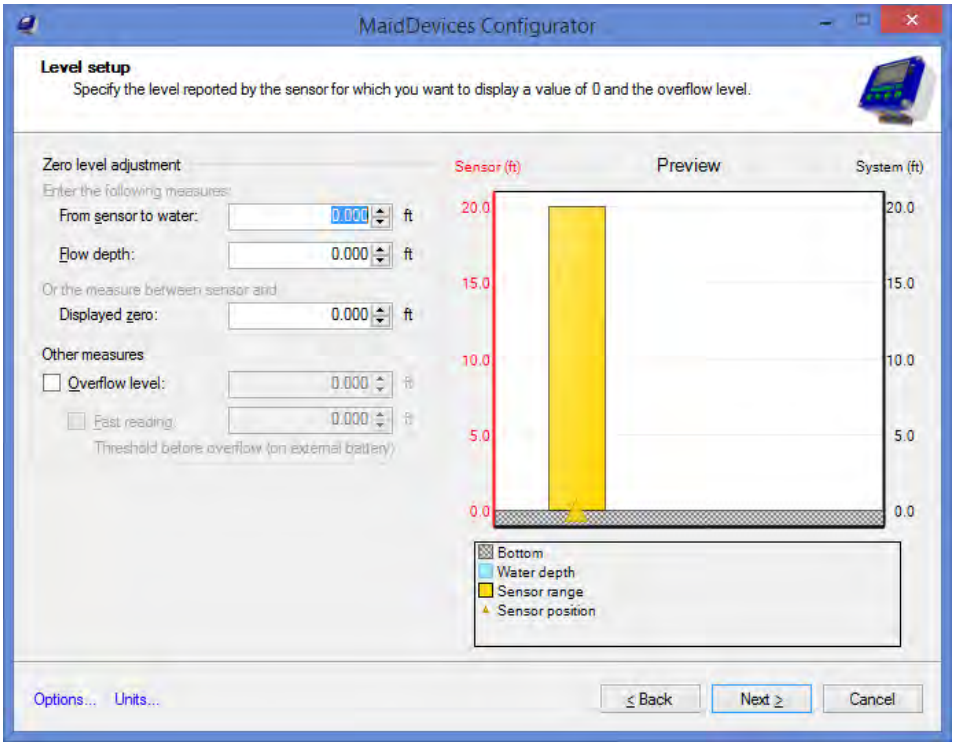
2 pumps GPM | 3 pumps GPM

time in the spreadsheet to calculate the flow rate of the pump.

- Repeat the process as many times as time allows it to generate good average results.
- Create the flow curves in the Configurator.

This is important to have the same distance above and below the average level at which the pumps usually operate. If the distance between the levels is too high, it will take forever to do the calibration. If the distance is too small, the accuracy will be reduced. 5 to 15 minutes fill-up time is good. Perform a fill-up cycle to calculate the average flow before the pump operation.

Level setup



This window allows you to select and configure the level sensor and set the overflow level if required.

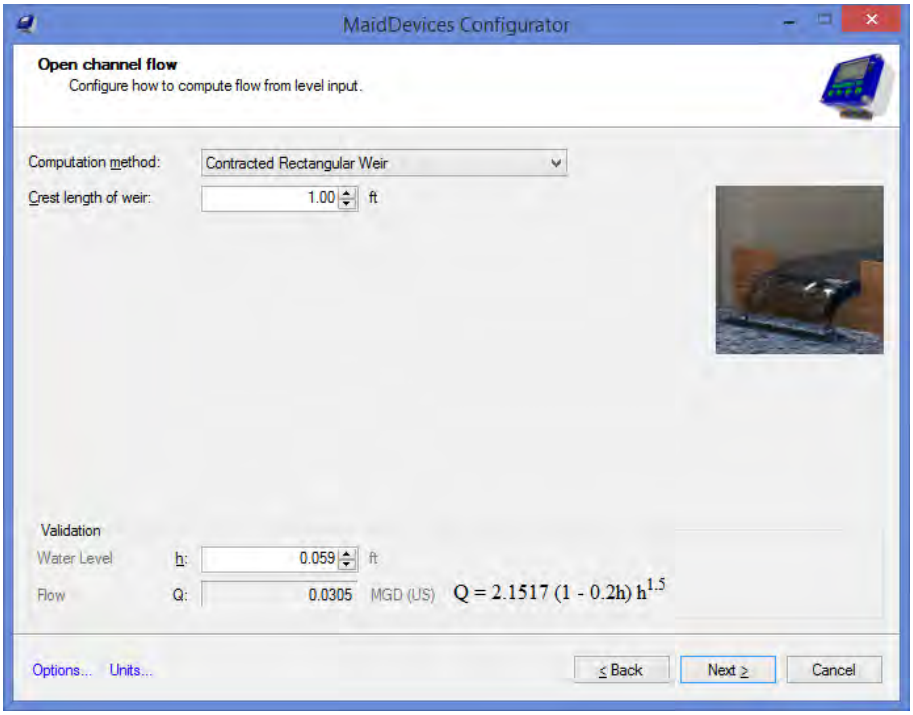
This is useful to configure the device to display the same value as an existing level sensor in the station. There is 2 methods of doing this: with the level setup windows or with the automatic calibration in the “Inputs and outputs” menu.

The level setup windows is optimized to configure a level sensor in a open channel flow meter and with a stable level.

Measure the distance between the sensor and the water level and specify the real water depth, or select a displayed zero value. Both values will update automatically when numbers are entered and on the right, there is a dynamic graphic that visually represent the configuration.

The overflow level need to be checked to record overflow events. It’s also possible to configure a faster analog read interval when the device is working on battery and when the level is near the overflow level. If the “Overflow level” is set to 10ft and fast reading is set to 1ft, this means that the device, if working on battery, will start to read the analog input faster (see the read interval at the “External battery” page) when the level is over 9 ft.

Flow computation formulas

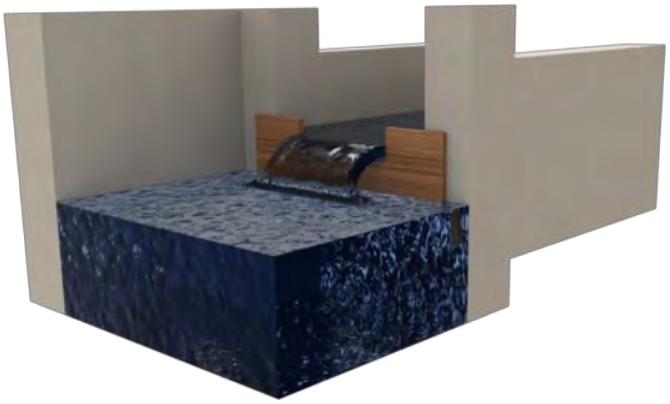


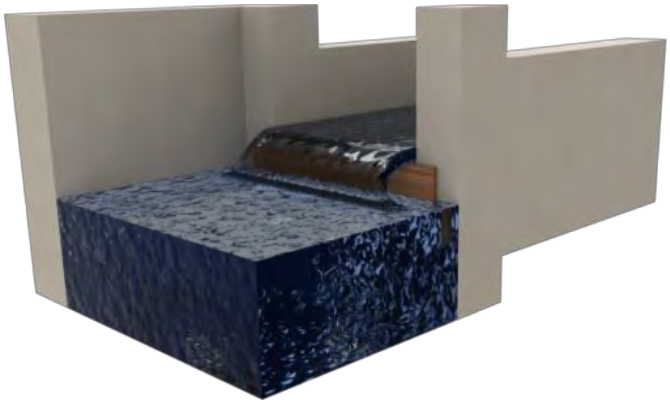
All flow formulas have their advantages and disadvantages. Choosing the one that gives the best results given the installation's limitations is the responsibility of the user. Marcel Roche wrote in SURFACE HYDROLOGY: "Being convinced that poor measurement is better than a good calculation, you should never hesitate to measure".

Conditions for implementation of Weirs:

- The plate must be perfectly vertical and perpendicular to the sides of the incoming channel, waterproof and crushproof.
- The incoming channel must be straight, uniform, and rectangular with a constant slope over a length greater than 10 times the width of overflowing water in the channel at maximum load.
- The water level in the downstream channel must be sufficiently below the highest point of overflowing water to ensure a free flow and be fully ventilated.

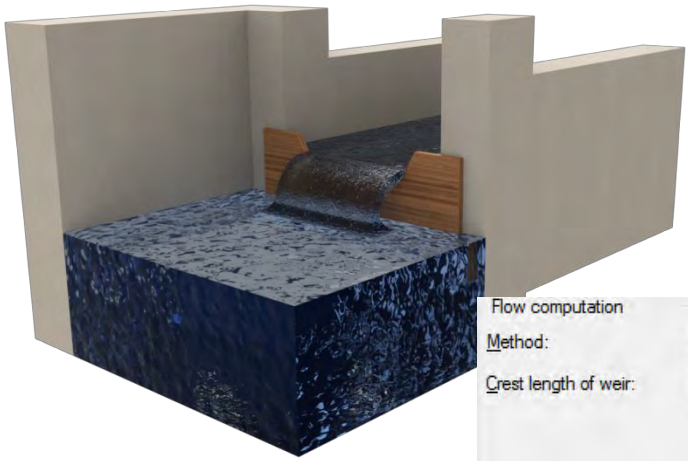
Contracted Rectangular Weir and Suppressed Rectangular Weir





The accuracy of rectangular weirs, with or without contractions, is usually between 1 to 4% of the flow coefficient when all conditions are met.

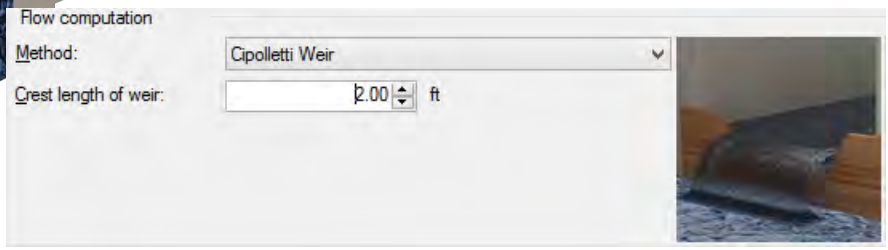
The **Crest length of weir** parameter is required.

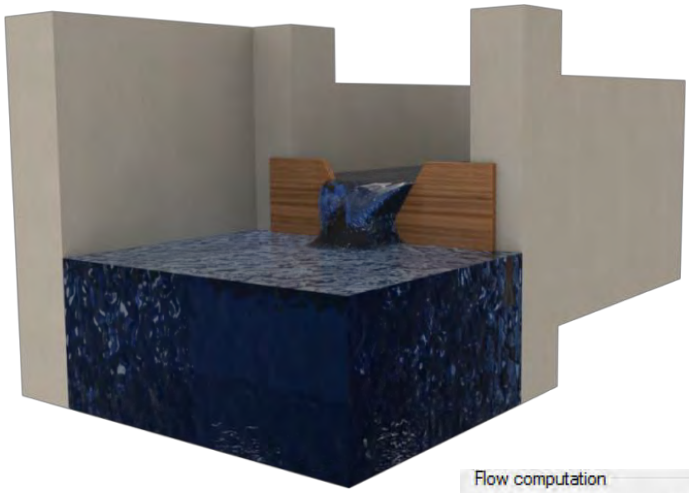


Trapezoidal Weir (Cipoletti)

The accuracy of the trapezoidal weir or Cipoletti is the order of 1 to 4% of the flow coefficient when all conditions are met.

The **Crest length of weir** parameter is required.

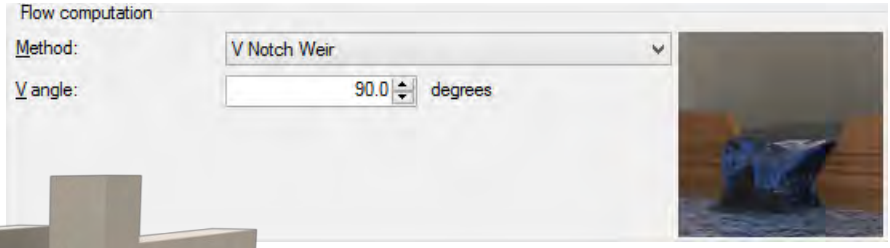


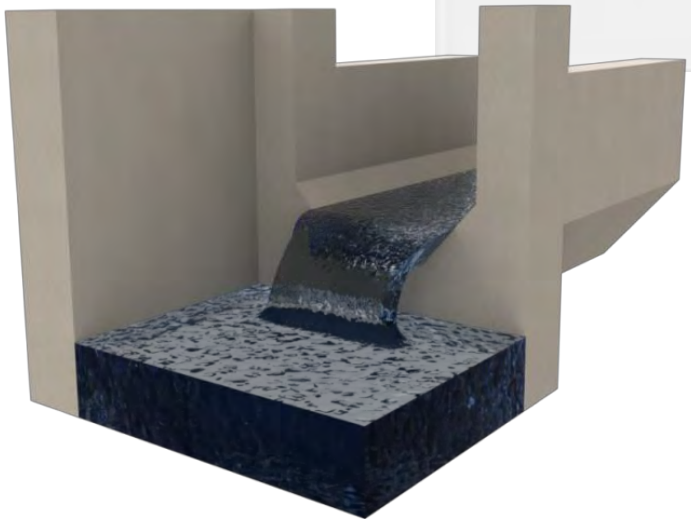


V Notch Weir

The accuracy of the triangular weir is on the order of 1 to 2% of the flow coefficient when all conditions are met.

To maximize the chances of achieving this degree of accuracy, the distance between the base of the channel and the tip of the V should be twice the distance between the tip of the V and the surface of the water and the distance between the sides of the channel and the top of the V should be twice the distance between the tip of the V and the surface of the water. The **V angle** parameter is required.

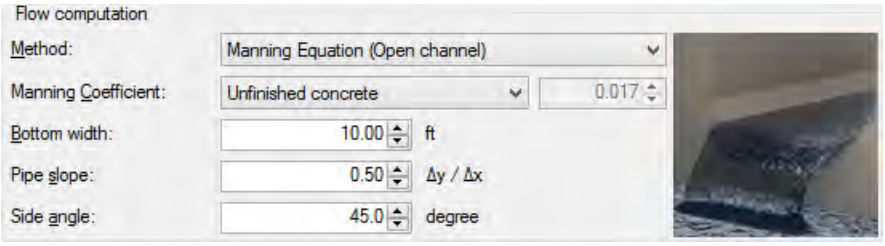


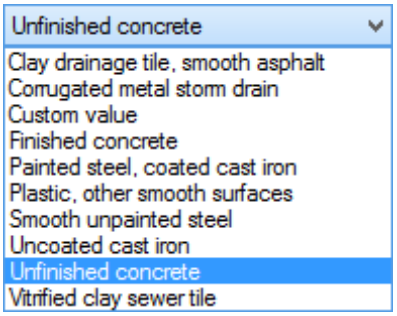


Manning Equation (Open channel)

This type of channel is often encountered in literature as a good to calculate flow in overflow conditions.

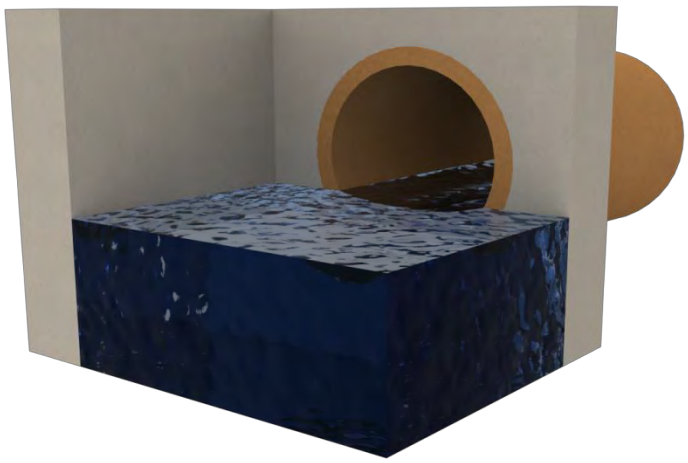
The **Manning Coefficient**, **Bottom width**, **Pipe slope** and **Side angle** parameters are required:





Manning Equation (Partially full pipe)

This equation is the easiest to use to assess the volume and flow lost in an overflow. The Manning equation is usually like this:



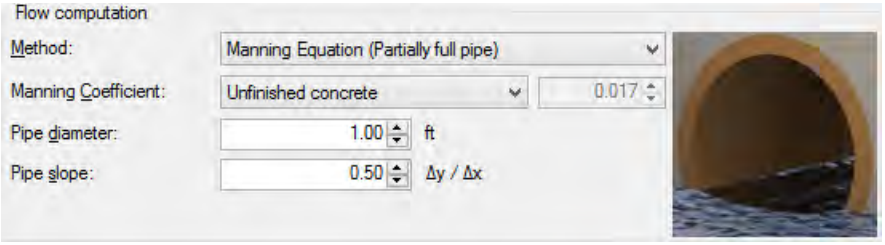
$$Q = \frac{KAR^{\frac{2}{3}}S^{\frac{2}{3}}}{n}$$

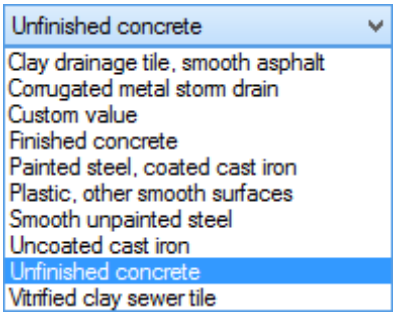
Q = Flow Rate
K = Coefficient relative to the units used in the equation
A = Area of the submerged part of the pipe
R = A divided by the perimeter of the submerged section
S = Slope of pipe
n = Coefficient representing the degree of roughness of the pipe wall.

The Manning equation is used to estimate the flow in open channel situations where it is not practical to construct a weir or channel to measure the flow with greater accuracy.

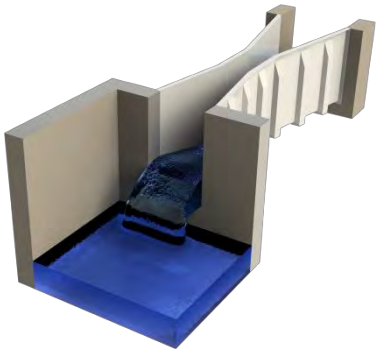
This equation was developed to calculate the flow in locations where the water flows at a speed relative to the angle of the pipe roughness and the depth of water. When water escaped from a tank, as for an overflow pipe located in pumping station, an error could be induced because the equation is not optimized for this type of installation, but it is the only one available.

The **Manning Coefficient**, **Pipe diameter** and **Pipe slope** parametres are required.





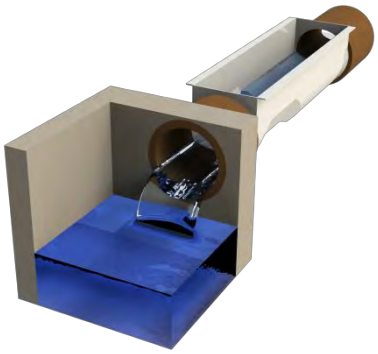
Parshall Weir



The Parshall weir is available in several sizes. Dimensions directly supported by the device are those in the following table. In the case where the size of the weir is not available in the table, just use the standard formula and set the parameters for the equivalent.

Parshall in inches
1”
2”
3”
6”
9”
12” (1’)
18” (1,5’)
24” (2’)
36” (3’)
48” (4’)
60” (5’)
72” (6’)
84” (7’)
96” (8’)
120” (10’)
144” (12’)
228” (19’)
240” (20’)
300” (25’)
360” (30’)
480” (40’)
600” (50’)

Palmer-Bowlus Weir



The Palmer- Bowlus Weir is available in several sizes. Dimensions directly supported by the device are those in the following table. In the case where the size of the weir is not available in the table, just use the standard formula and set the parameters for the equivalent.

Palmer-Bowlus in inches
4”
6”
8”
10”
12” (1’)
15”
18”
21”
24” (2’)
27”
30”
36” (3’)
42”
60” (5’)
72” (6’)

Leopold-Lagco Weir

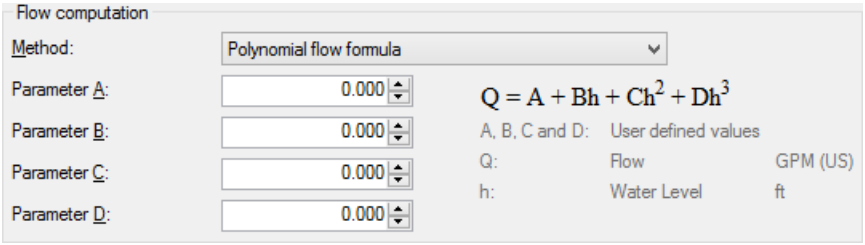
The Leopold-Lagco Weir is available in several sizes. Dimensions directly supported by the device are those in the following table. In the case where the size of the weir is not available in the table, just use the standard formula and set the parameters for the equivalent.

Leopold-Lagco in inches
4”
6”
8”
10”
12” (1’)
15”
18”
21”
24” (2’)
30”

The majority of flow formulas can be summarized in two equations, such as the standard flow and the polynomial flow equations. In both cases, the parameters must be entered according to measurements in feet and flow in cubic feet per second. The tables below are good examples :

Polynomial Flow Formula

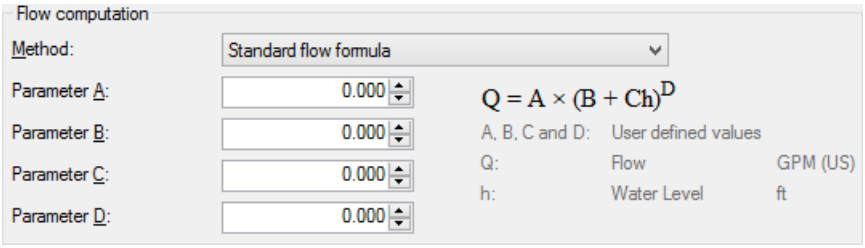
The majority of the formulas of flow can be summarized in two equations, standard flow and polynomial flow. Note that the settings of the following units are in feet (ft) for the height and cubic foot (ft^3) for flow.



Standard Flow Formula

All the following tables are based on this formula, with the exception of the Polynomial formula.

We assume that the user has the knowledge to choose the most suitable Equation for the system on which the product will be installed.



Channels

H Channel	A	B	C	D
0.50	1.60	0	1	2.2
0.75	1.77	0	1	2.23
1.00	1.95	0	1	2.30
1.5	2.12	0	1	2.30
2	2.37	0	1	2.23

Parshall	A	B	C	D
1”	0.338	0	1	1.55
2”	0.676	0	1	1.55
3”	0.992	0	1	1.55
6”	2.060	0	1	1.58
9”	3.070	0	1	1.53
12”	3.950	0	1	1.55
24”	8	0	1	1.55
36”	12	0	1	1.57
48”	16	0	1	1.58
60”	20	0	1	1.59
72”	24	0	1	1.59

Palmer-Bowlus	A	B	C	D
4”	1.73	0.00588	1	1.957
6”	2.071	0.005421	1	1.903
8”	2.837	0.01456	1	1.972
10”	2.843	0.01616	1	1.953
12”	3.142	0.017	1	1.936
15”	3.574	0.0168	1	1.906
18”	3.988	0.01875	1	1.898
24”	4.574	0.0408	1	1.950
30”	5.022	0.0625	1	1.966
36”	5.462	0.08	1	1.991

Trapezoidal	A	B	C	D
60º	1.55	0	1	2.58

Polynomial	A	B	C	D
0.4HS	-3.48e-5	2.1e-3	3.52e-1	4.40e-1
0.6HS	-7.52e-5	8.3e-3	4.02e-1	3.79e-1

Weirs

Triangular	A	B	C	D
22.5º	0.505	0	1	2.500
30º	0.676	0	1	2.500
45 º	1.028	0	1	2.500
60 º	1.420	0	1	2.440
90 º	2.490	0	1	2.475
120 º	4.333	0	1	2.500

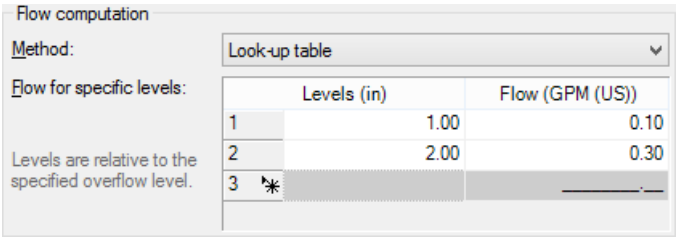
Trapezoidal	A	B	C	D
0.5’	1.684	0	1	1.5
1.0’	3.367	0	1	1.5
1.5’	5.051	0	1	1.5
2’	6.374	0	1	1.5
3’	10.101	0	1	1.5
4’	13.468	0	1	1.5

Rectangular	A	B	C	D
1’	3.333	0	1	1.5
2’	6.667	0	1	1.5
3’	10.00	0	1	1.5

Lookup table

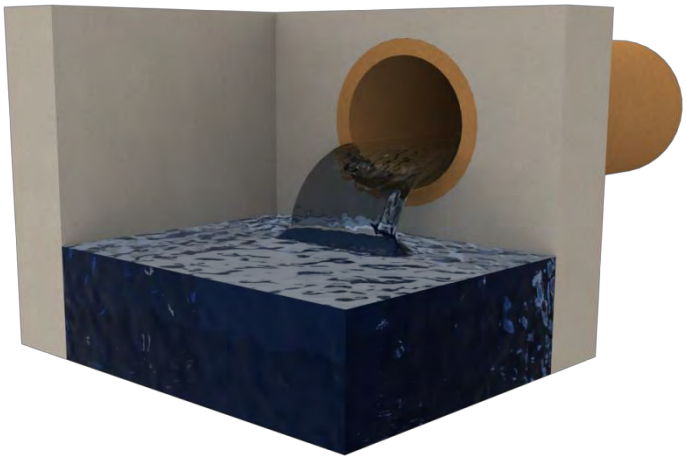
When no type of weir, channel or formulas to calculate flow with reasonable accuracy, but that a flow rate proportional to the height of the liquid is known, at least at specific heights, then the Lookup table is the function to use.

Up to 100 levels with corresponding flow rates can be entered in the table. Press the ✳ to add a **Level** and corresponding **Flow** rate. Entered values cannot be deleted or sorted, so enter them correctly.

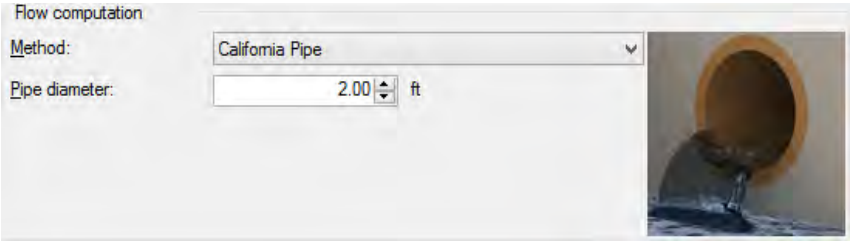


California Pipe

This method measures the output of the open end partially filled horizontal pipe which will discharge freely into the air. This method is sometimes considered to be a method of trajectory. However, the measure is really based on the depth at the end of the pipe.

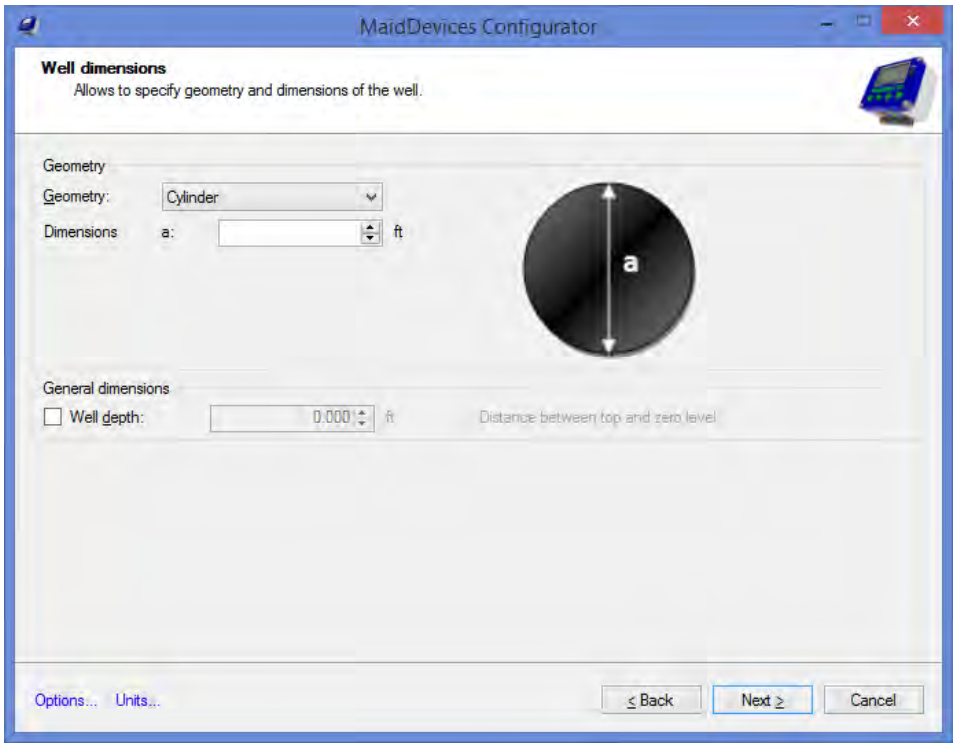


The **Pipe diameter** is required:



AJOUTER LES NOUVELLES FORMULES

Well dimensions

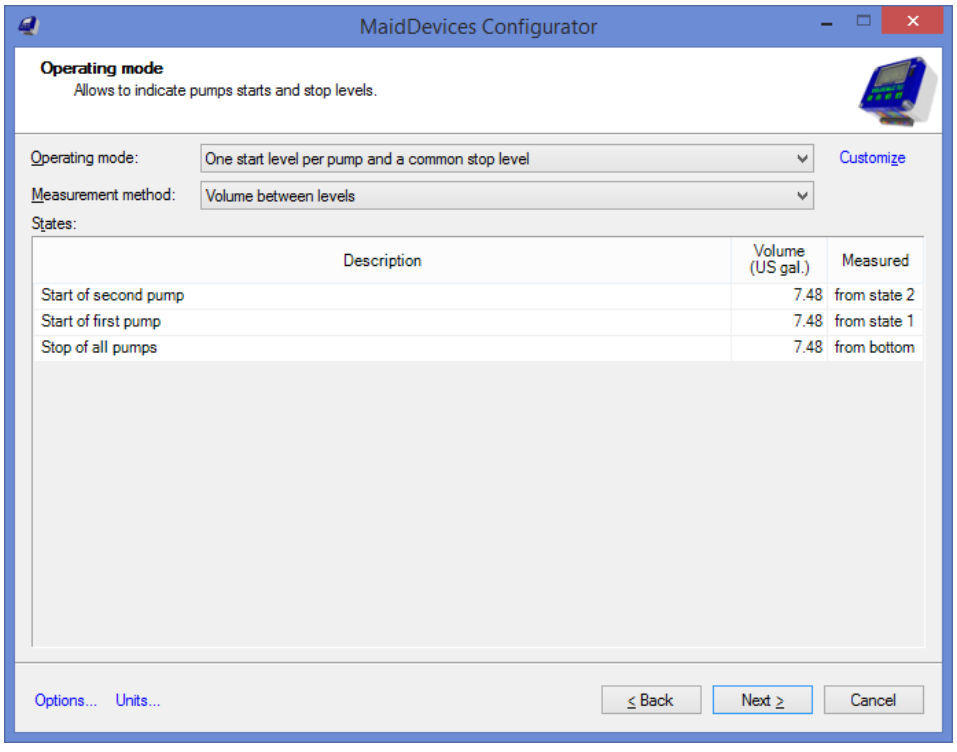


The well dimensions windows is optionnal depending on the selected flow algorithm at the lift station page.

Select the geometry of the well of the station and enter the dimensions. It's possible to enter a area directly or to select, volume between levels. This way, no dimensions are required but the volume of the water between the start and the stop of each pump is needed.

The option of the well depth is optionnal.

The operating mode windows is also an optionnal window depending of the selected flow algorithm at the lift station. Keep in mind that all parameters on this windows are required only if using the Volumetric flow option (without level sensor).



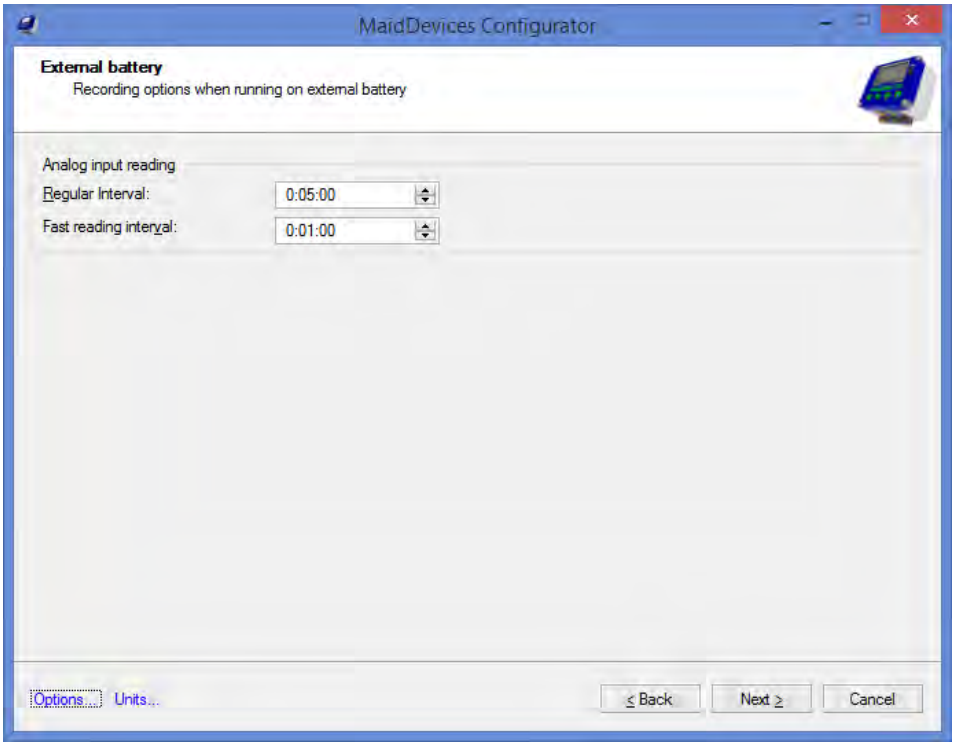
There is 3 basic operating mode. One start level per pump and a common stop level, one start level per pump and pump stop one level below and distinct start and stop levels per pump.

And there is many ways to enter the values depending on the measurement method.

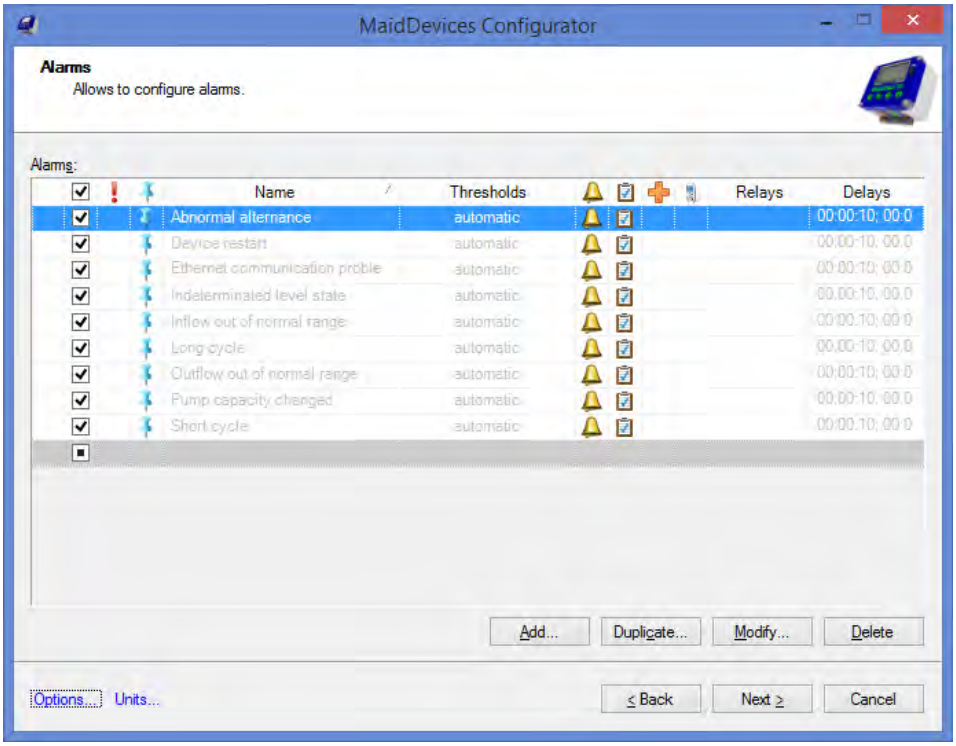
When distance between levels is selected, the Stop of all pumps value is the distance between the stop level and the bottom of the well. If this value is unknown, simply enter 0. Same thing for the volume between levels.

External battery

The external battery analing input reading option is used when the device is working on battery backup. The device will wakeup and read the level sensor at this interval. If there is an overflow level configured at the “Level setup” page, or an alarm with the “Read analog inputs faster”, the device will wake up to read the level sensor and this specified interval.



Alarms



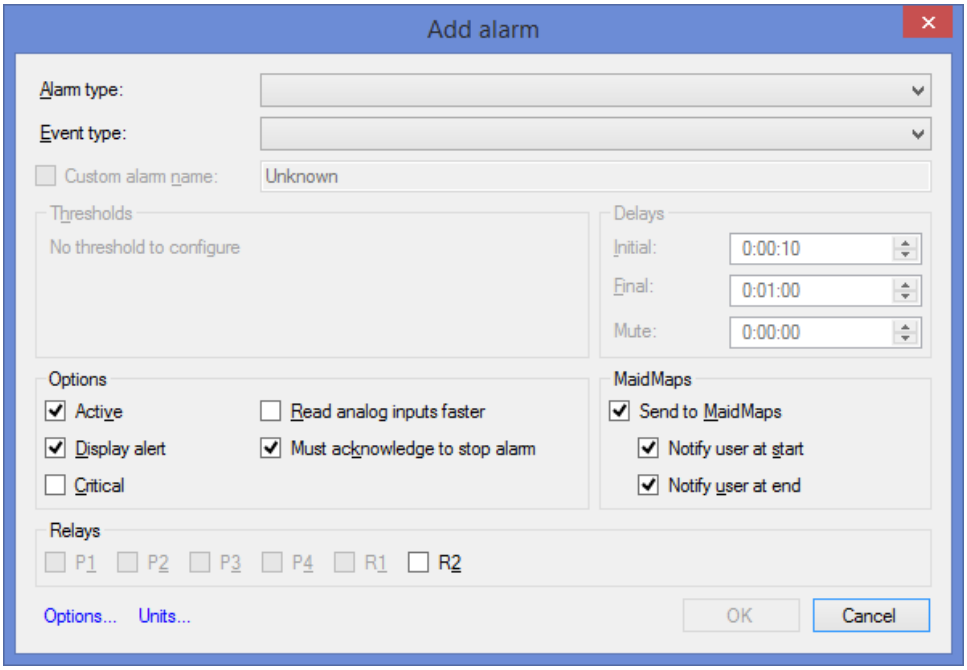
To view the preconfigured alarms of the device, click on **Options…** at the bottom of the page and in the Maid configurator tab, check the Predefined alarms checkbox.

It's possible to disable an alarm by unchecking the checkbox on the left.

To create an new alarm, select "Add". A new windows will open.

First thing is to select an alarm type. There is 3 choices: value too high, value too low and value in undesired range.

The next step is to select on which value the alarm will be configured. Then, fill the Threshold.



Delays section

Initial delay in the delays section is the time before the alarm will be generated after the value met the threshold condition.

Final is the delay before the alarm is considered ended after the value is not in the threshold condition.

Mute is the delay before it's possible to regenerate this alarm. So if only 1 alarm of this type per day is needed, it's possible to set the mute value to 24 hours.

Options section

Active is used to enable or disable the alarm without having to delete it.
Display alert is used to show the alarm on the device screen.
Critical is used to flag this alarm as critical instead of a simple warning.
Real analog inputs faster is used when working on battery, we can force the device to wakep following the fast reading delay configured at the previous page.

Must acknowledge to stop alarm is used to display the alarme on the device and require a used to acknowledge it or it will always stays on top.

Maidmaps options:

Send to Maidmaps is used to enable the communication of this alarme to Maidmaps web server or not.

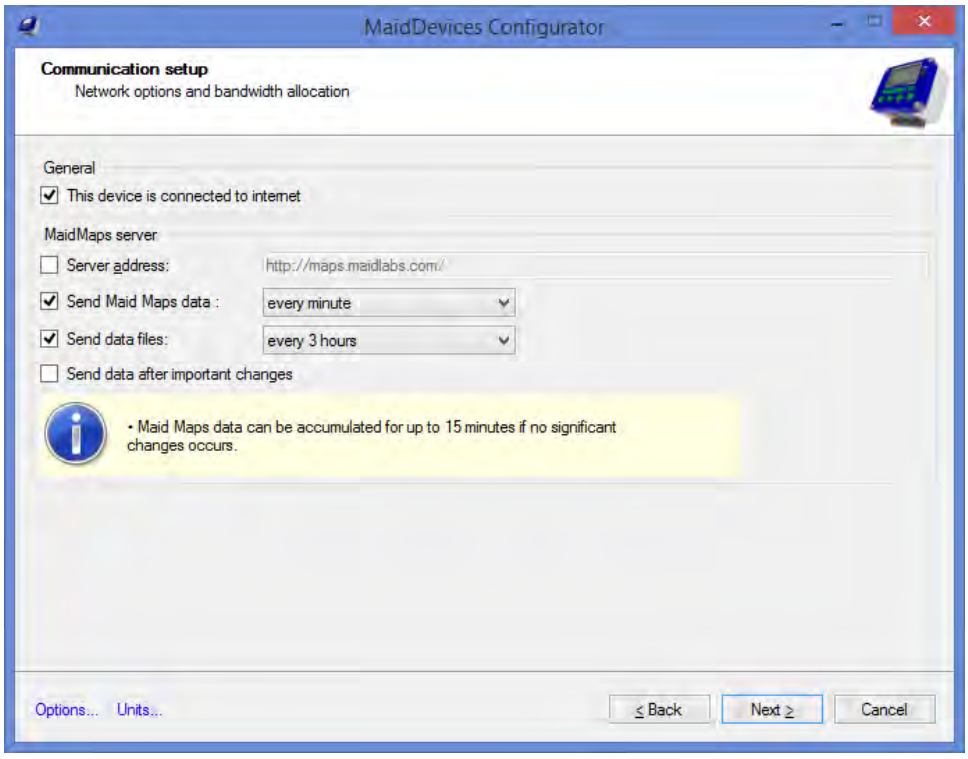
Notify user at start will for a communication of the device with Maidmaps immediately when the alarme is generated to notify Maidmaps and then Maidmaps can notify the users.

Notify user at end is the same thing as notify user at start but at the end of the alarm.

Relays section.

When the alarm is active, it's possible to configure a relay output to close the contact and make an external action. But first, the relay output needs to be configured as an alarm output on the previous Inputs and outputs configuratino page.

Communication setup



The VOLUCALC™ RT can transmit data to a Web server and be viewed in real time. The data will be displayed in the MAID Labs Technologies software known as MAID Maps.

Depending on the bandwidth quality, communication with the server will be fast or slow. In the **General** section, when **The device is connected to the Internet** is not checked, the communication will not work. This mode also disables the Ethernet module, which allows options in an "offline" mode like manually adjusting the time (page **Erreur ! Signet non défini.**). By checking this box, different configuration options are anabled.

The default Web server is http://maps.maidlabs.com. However, it is possible to use another server by checking **Use alternate server** box and supplying a valid server address running Maid Labs software MAIDMAPS.

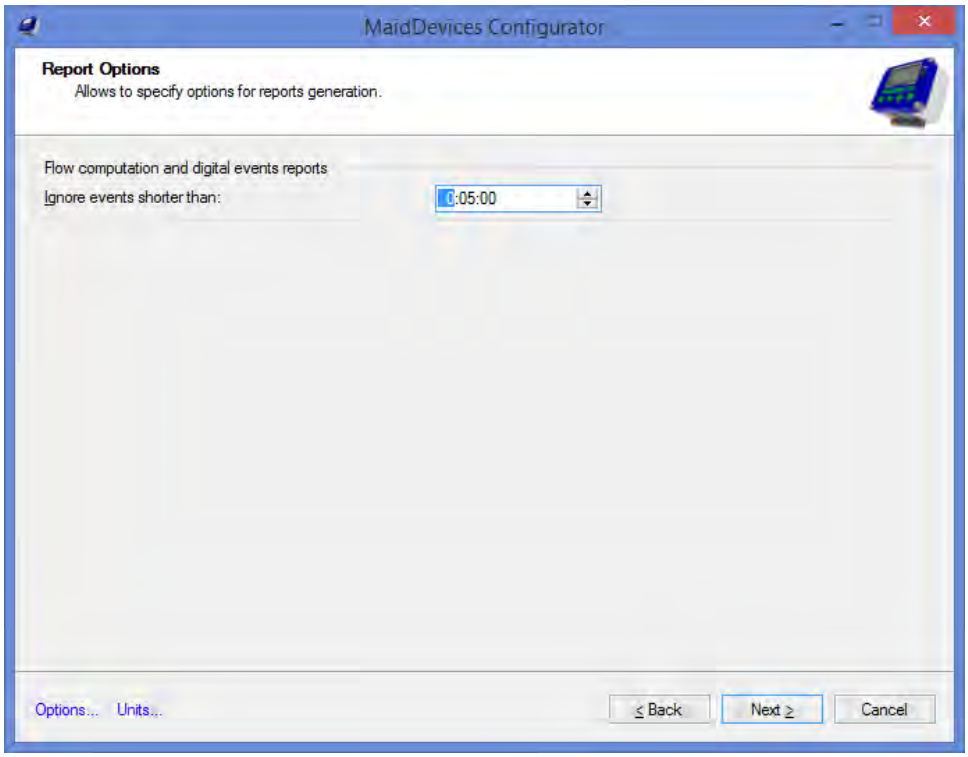
Send Maid Maps data is used to send what is been read or calculated by the instrument based of the user's time frame requirements. Choices are real time to one month.

Send data files is used to send mostly reports based of the user's time frame requirements Choices are 15 minutes to one month.

Send data after important changes means when an alarm occurs, an immediate communication will be generated to the MaidMaps server. Based on its own settings, MaidMaps might send an email to a person who can take care of the situation.

Report Options

This option is used to filter overflow report and digital reports to ignore events shorter than the specified value and to group all event that happen during this delay.



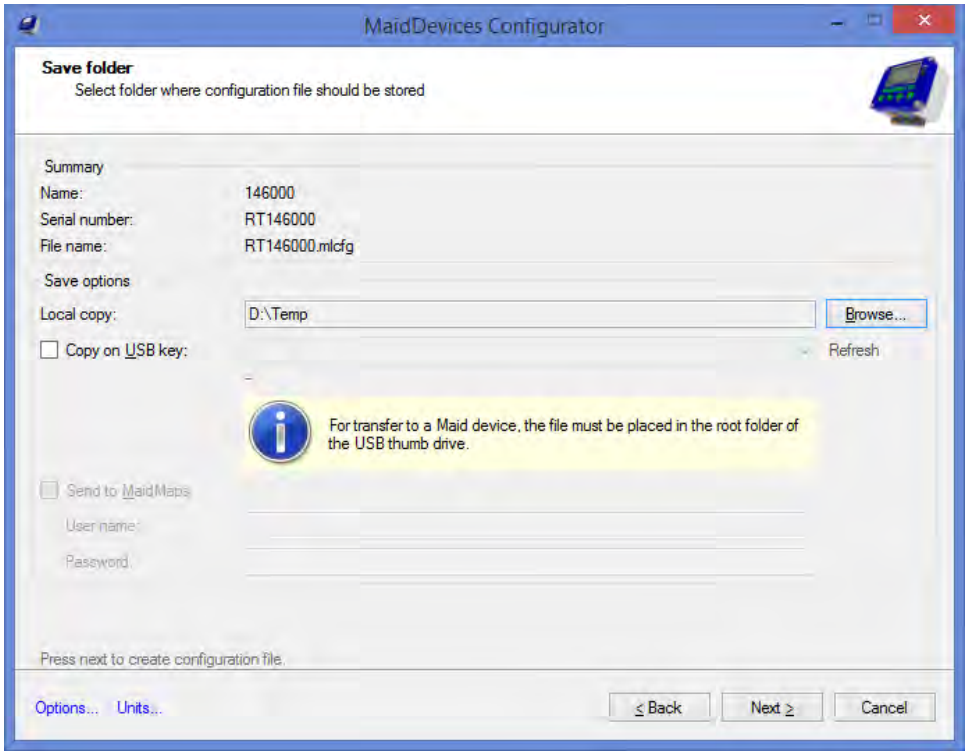
Save folder

The **Destination folder** shows where configuration files are usually saved, unless someone changed this. Click Browse... to select a different one.

To configure the Volucalc RT using the configuration file created with the MaidDevices Configurator, copy the configuration file on the root directory of a USB key.

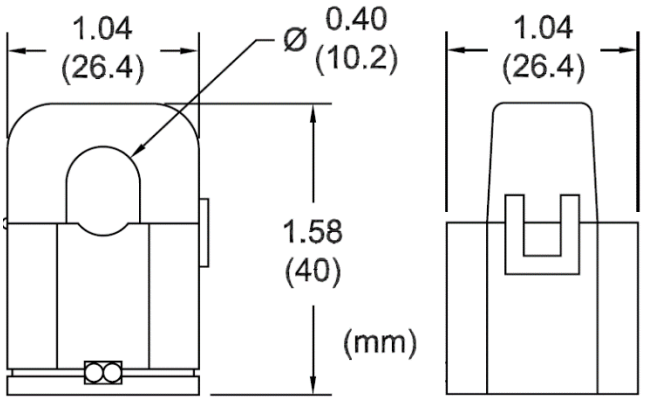
Use a USB drive formatted with FAT16 or FAT32. The amount of files on the key influence the time to copy files.

Follow the USB instructions on page 40.

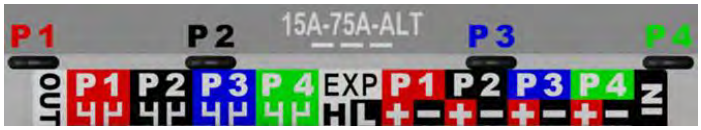


Current Sensor (MLCT75)

The Split-core current transformer MLCT75 is designed to provide a low-cost method for monitoring electrical current. Its unique hinge pressure locking mechanism enables its installation without interrupting the current supply to the pumps or equipment.



For this model of sensor, the RT can be configured to enable a range of 0 to 15 amps and 0 to 75 amps, depending on the settings of the micro-switches (page 12).



Current Sensors (MLCT150 and MLCT300)

The current sensors MLCT150 (150 amps) and MLCT300 (300 amps) use the latest technology in current transformers. They are designed to meet the most stringent industry requirements. All models comply with the standards IEC1010-2-032, 600V, Cat. II.

These sensors have a jaw opening of 30 mm (1.19") and can accommodate wire of 29mm (1.15"). The unique jaw facilitates attachment to the wires.

They are made of polycarbonate and ultrasonically welded, in order to ensure their robustness and comprehensive and lasting reliability.

The use of wound cores improves the performance of high and low end. The accuracy of each model is optimized for its current range.

AC current probes for frequencies from 40Hz to 10kHz.

Panel Door Brackets (MLSUPPANEL)

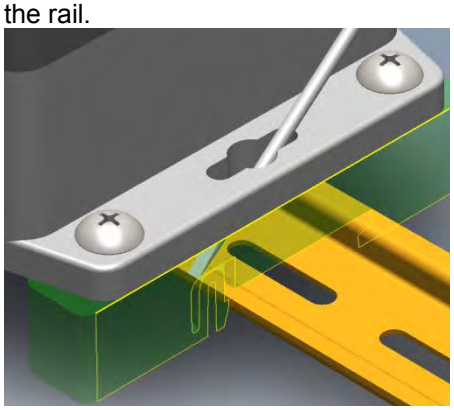
A Stainless Steel bezel, laser cut to perfect size, covers the instrument'shole cutout. Staunless steel screws, washers, nuts and plastic tubular spacers are also part of the Panel door kit.

Once the instrument is fixed, connecters must be removed in order to connect wires to them. If needed, removing the instrument from the panel takes only a minute or so.

DIN Rail Brackets (MLSUPDIN)

The DIN Rails brackets kit includes 2 brackets and 4 Stainless Steel screws.

Clipping the instrument on the rail is automatic. A small screwdriver is required to unclip the instrument from the rail.



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