

Volucalc Hybrid™

Pump Station Monitoring System

CS CONSTANT
SPEED

The
ONLY
Real Time
Diagnostic
&
Volumetric
Flow Meter

CM CONTROL
MANAGER

The
ONLY
Flow Based
Lift
Station
Operating
system

VS VARIABLE
SPEED

The
ONLY
Plugin
Variable
Frequency
Drive **VFD**
Flow Meter



GREEN TECHNOLOGY
ENERGY SAVINGS
SMART CITY









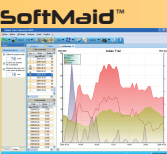
Maid Labs
TECHNOLOGIES

www.maidlabs.com Toll-free: 1-855-875-2144

Volucalc Hybrid™ is the most versatile wastewater pump station monitoring system



What can be connected to the Volucalc Hybrid™:

	<p>4 motor inputs are used for a mix of RPM inputs from VFDs and current clamps. They are used to monitor pump operations, evaluate power consumption and pump speed.</p>
	<p>Volucalc has an integrated Uninterruptible Power Supply circuitry to keep important equipment like the level sensor and cellular modem powered during power failures. Simply add a rechargeable 12-volt battery.</p>
	<p>The WattMeter module adds complete electrical analysis for each pump (one module per pump). The data recorded for each phase are Voltage, Current, RMS power (watt), Power factor and Frequency.</p>
	<p>The digital input can be used to monitor rain, level, check valve operation or any dry contact accessories. The reports will show when, for how long and how many times events occurred or totalized events for pulses.</p>
	<p>2 analog inputs are assigned to the level and the force main pressure. Like all analog inputs, they can be set by software to 4-20 mA, 0-5 Volts, 0-10 Volts and even 0-24 Volts.</p>
	<p>All the unused analog inputs (pumps, level and pressure) can be used to record and report values supplied by other equipment like mag meters and specialized flow meters.</p>
	<p>6 digital outputs can be used to generate different alarms and send flow or volume proportional pulses to a sampler or other equipment like a PLC.</p>
	<p>The flow proportional 4-20 mA output is the simplest way to add high accuracy flow to an existing system. The volumetric flow algorithm of the Volucalc™ is the most accurate of the industry while the variable speed pump algorithm is the only plug-in method of the industry.</p>
	<p>Over 100 different data elements can be transferred to a PLC or other MODBUS compatible devices through its RS485 (<i>RS485 port is supplied on request</i>) and Ethernet port.</p>
	<p>The Ethernet port can be used to communicate via cellular modem, WiFi radio or direct wiring to the MaidMaps Web SCADA application, which displays flow, generates graphs, downloads reports and files, uploads configurations and reports alarm emails and SMS.</p>
	<p>The Volucalc generates impressive and complete reports on site. A USB thumb drive can be used to download these reports and SoftMaid™ compatible files and to upload configurations.</p>
	<p>SoftMaid™ is the most advanced wastewater pump station diagnostic software and the perfect mean to analyze high resolution Volucalc™ data.</p>

Volucalc Hybrid™



The Only Real Time Diagnostic and Volumetric Flowmeter

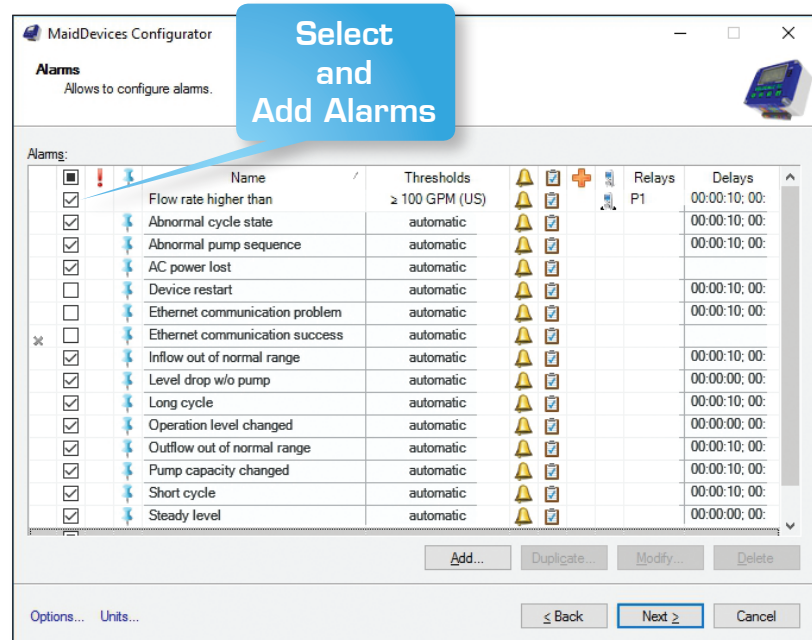
The flow rate accuracy of a volumetric flow formula is equal to its capacity to compensate for all abnormal behaviors, which occurs in one third of the stations. Unfortunately, the Volume/time formula is not enough.

For intelligence, communication and flow in a pump station, simply add what is missing. Get the most advanced technology without replacing existing working equipment. **Volucalc Hybrid™ CS** analyzes each main element behavior to extend its useful life and predict failures. Simply transfer the **Volucalc™** in the new control panel when an upgrade will be required.

A failing controller cannot report that it failed. Unlike PLC controllers, **Volucalc Hybrid™** is a monitoring system optimized to automatically detect several anomalies of the pumping stations. No programming is required by the user to detect strange activities. Any device can generate high or low level alarms, but it takes years of lift station analysis and programming to detect the following abnormal behaviors without special configuration from the users:

- Abnormal sequence of operation of the pumps
- Abnormal variation of the pumped flow rate
- Important variation of the inflow rate
- Abnormally long or short cycle (only CS)
- Abnormal energy consumption
- Abnormal efficiency
- Water level falls with no pumps in operation (level sensor problems or siphon)
- Defective level sensor
- Variation of the operating level of the pumps (float switches or level sensor problems) (CS)
- Lost AC power
- Low battery
- User configurable alarms related to most of the inputs and calculated values like flow

Volucalc Hybrid™ CS
can also be used as an advanced electrical analyzer using the **WattMeter** module.



Volucalc Hybrid™ CS can be used to make quick checks of pumping stations and precisely determine pump capacities in just a few pumping cycles. It is also a generic open channel flow meter. It can be used as a recorder and generator of reports for existing flowmeters.

Other important features:

- Small size ideal for any retrofit
- Reports easily exported in Excel for deeper analysis
- Uses existing level sensors
- Uses a simple clip-on current sensor per pump
- High accuracy volumetric flow calculated every 30 seconds or faster (CS)
- Overflow flow measurement

Volucalc Hybrid™



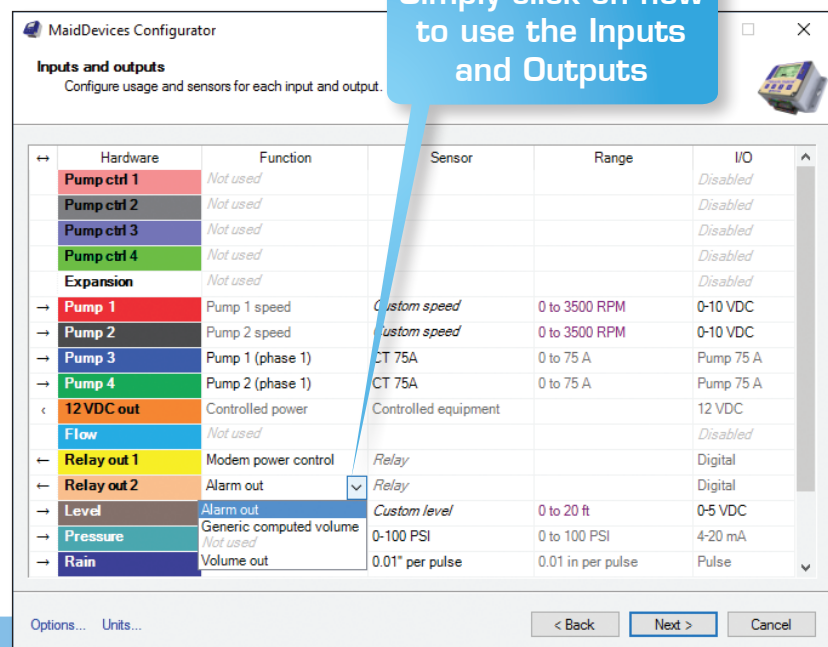
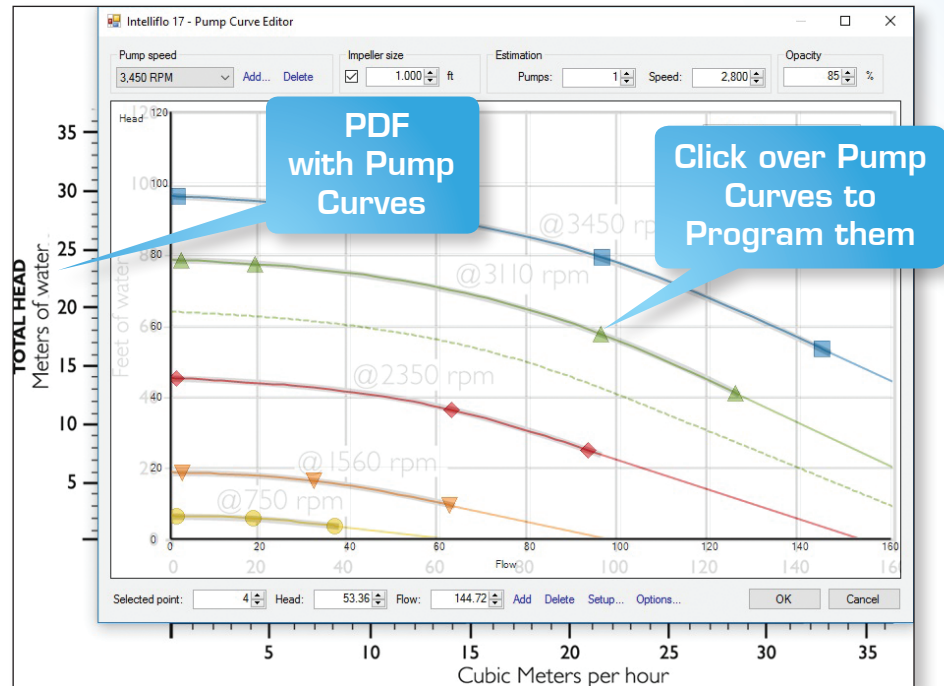
The Only Plugin Variable Speed Pump Flowmeter

All of the **Volucalc Hybrid™ CS** features are included in the **Volucalc hybrid™ VS**.

The **Volucalc Hybrid™ VS** uses calibrated pump curves to derive flow rate. Its accuracy is directly proportional to the quality of the calibration. It uses the pump's RPM from the VFDs analog outputs. The instrument's generated reports show daily pump efficiency, which is used to detect abnormal events and crosscheck pump calibration. The integrated **Volucalc Hybrid™ VS** high precision volumetric flow algorithm is useful to calibrate the pump curves.

The Pump Curve Editor allows the user to copy, through its transparent interface, the variable speed pumps curves supplied by a manufacturer. The Configurator generates formulas for these curves so the **Volucalc™** computes the right flow rate whatever the pump's speed at any head.

The included user-friendly **MaidDevice Configurator software** simplifies the setup by offering to the user configuration dialog pages based on its initial choices.



Volucalc Hybrid™



The Only Efficiency and Flow Based Pump Station Control Manager (CM)

All of the **Volucalc Hybrid™ CS** features are included in the **Volucalc Hybrid™ CM**.

Volucalc Hybrid™ CM indicates to PLCs the pumps to operate (maximum 4) at which levels to maximize safely the energy efficiency of the station.

Volucalc Hybrid™ CM indicates to PLCs, through available digital or analog inputs and TCP/IP MODBUS, the pumps to start and stop at which levels to maximize the energy efficiency of the entire pump station while reducing the risks of ever reaching the high-level float. The electricity bill gets lower the day the **Volucalc Hybrid™ CS** is installed.

The Control Manager:

- Calculates the inflow rate in real time using an analog level sensor.
- Automatically calibrates the pump curves because multiple levels of operation are used to increase the efficiency of the pumps.
- Selects levels of operation based on:
 - Real time inflow rate
 - Acceptable run time
 - Force-main pressure
- Selects pump(s) to start based on:
 - Inflow
 - Outflow
 - Efficiency (volume/watt)
 - Head (when available)
 - Number of starts
 - Total run times

Volucalc Hybrid™ CM can be the backup controller of a defective PLC. It is too important to have monitoring equipment capable of reporting that the controller failed. When the controller and the monitor are the same, how can it be trusted?

The screenshot shows the 'General informations' screen of the MaidDevices Configurator. It includes fields for 'Device Name' (PS Andre-Line) and 'Serial number' (VH000100). Under 'Power source', 'AC with battery backup' is selected. Under 'Ethernet communications', 'Standard' is selected. A red box highlights the 'Efficiency based control' and 'Level based efficiency' sections. 'Efficiency based control' has 'Maximize use of most efficient pump' selected. 'Level based efficiency' has 'Dry and wet weather operating levels are different', 'Lag pump start influenced by flow', and 'Pump selection based on force main pressure' selected.

The screenshot shows the 'Level setup' screen of the MaidDevices Configurator. It includes 'Zero level adjustment' fields for 'From sensor to water' (19.685 ft), 'Flow depth' (0.000 ft), and 'Displayed zero' (19.685 ft). It also has 'Other measures' for 'Overflow level' (1 ft) and 'Fast reading' (1.600 ft). A red box highlights the 'Control Levels' section with 'Highest dry day level' (15.75 ft), 'Lowest pump stop level' (2.38 ft), and 'Bottom level of inlet' (12.15 ft). On the right, a 'Preview' graph shows 'Sensor (ft)' and 'System (ft)' levels with various markers for water depth, available height, sensor range, and pump stop/start levels.

A Flow Based Lift Station Operating system changes the level of operation of the pumps based on the flow rate entering the lift station in real time. This increases the capacity of the pumps by reducing the head. It raises its ability to cope with storm surges by lowering the lead level during high flow conditions. Real-Time flow rate is mandatory to respond rapidly to changing conditions. In the first pilot project involving 7 lift stations, the average capacity gain was over 15%.

The flow rates and run times of identical pump pairs were compared in over 150 randomly selected lift stations.

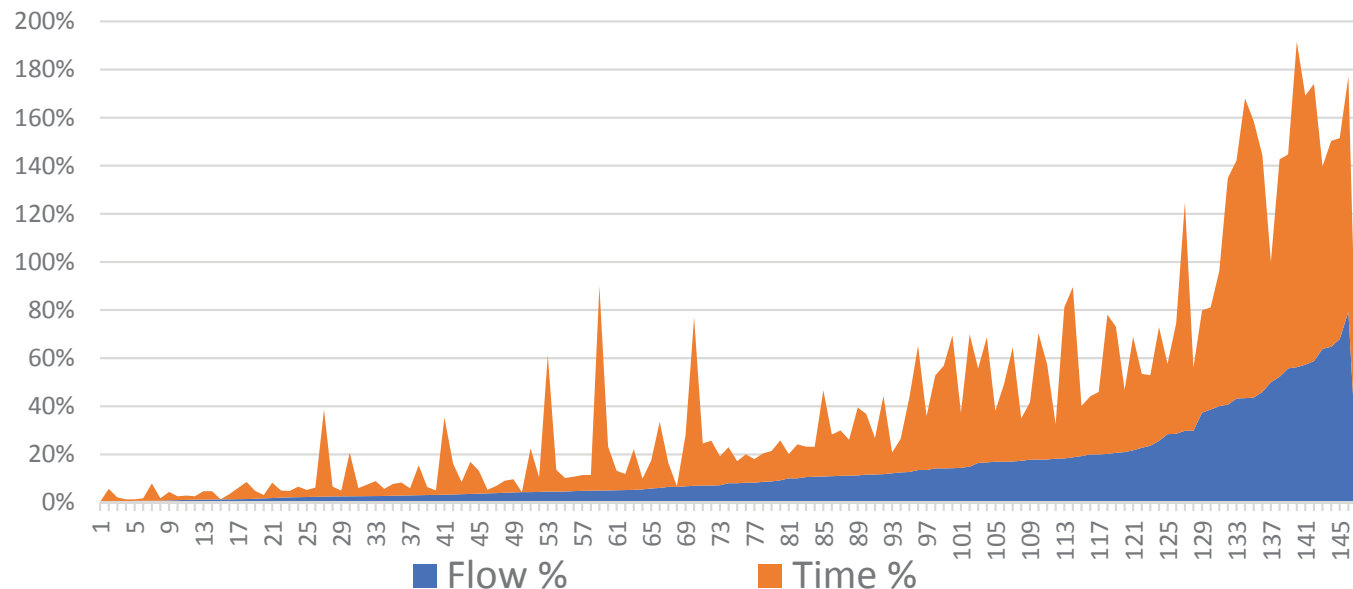
- Half the pumps had a capacity difference of 7% or less
- The average flow rate variation was 14%
- The average run time difference was 28%
- For every percentage gained in capacity, twice that percentage is gained in run time reduction

** Extreme results were removed.*

Major Benefits:

- **Run time reduction by 200% of the capacity gained (see chart "Pump Capacity Variation vs Run Time Variation")**
- **Energy usage savings equal to run time reduction.**
- **Maintenance costs also decrease by the same percentage.**
- **Infrastructure wear slows down.**
- **Increased storm surge resistance**
- **Lower grease build-up.**

Pump Capacity Variation vs Run Time Variation

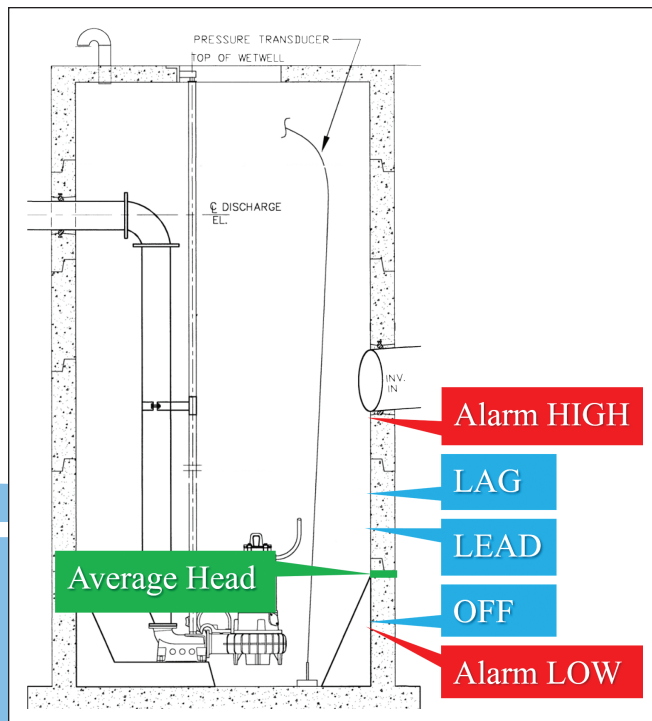


The following table shows how to evaluate the benefits of this technology for a collection system.

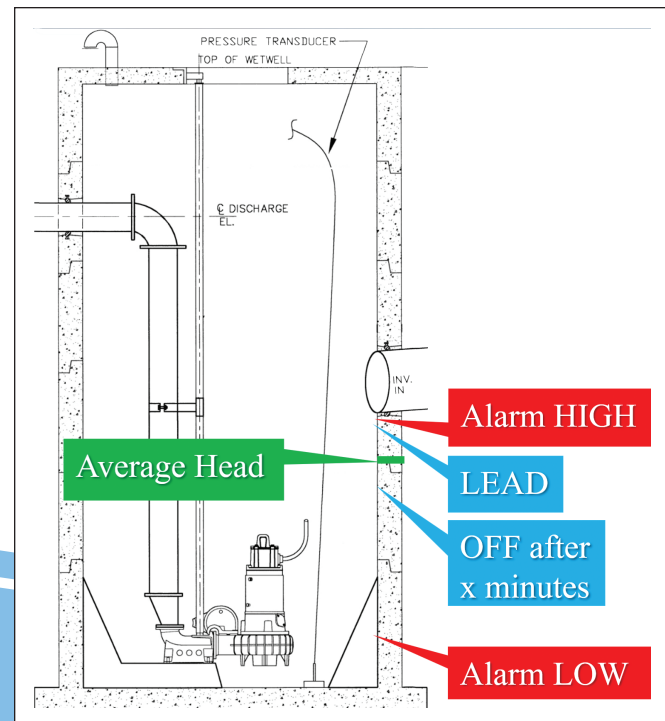
	Stop	Lead	Lag	High	High High	Avg Var	Avg Flow	Avg Flow	Variation
	ft	ft	ft	ft	ft	Level	Low	High	Capacity
Highway 98S	1.25	4.97	6.49	7.99	9.75	5.76	1275	1410	11%
Parkway University Center	0.74	2.34	4.04	4.51	6.25	3.84	270	320	19%
Heron Place	1	3.99	4.5	6	7.75	4.38	200	240	20%
Autumnwood Grove	1.04	2.87	3.5	5	6.75	3.92	422	475	13%
Highlands Town Center	1.35	4.19	4.6	6	7.75	4.11	577	635	10%
Highlands Town Center East	1	3.5	4.5	5	6.75	3.63	150	185	23%
Highlands Town Center #2	1	5	5.49	6.28	8	4.14	220	270	23%
						4.25			17%

- List the lift stations, the levels of operation of the pumps and their maximum safe levels.
- The goal is to calculate the average variation of the level of operation possible in each of the lift station. The Actual Average Level of operation is (Lead level minus the Stop level)/2.
- The reduced time of operation, electric and maintenance cost and wear of the equipment will be twice the pump capacity percentage gain.
- The percentage of gain in pump capacity is (Avg Flow High – Avg Flow Low)/Avg Flow Low.
- The Potential Level of Operation when the flow rate is low is the (Highest Safe Level minus the Lag level)/2. Instead of the Lag level, a higher or lower level than the Lag can be selected in order to run the pumps for a minimum time duration.
- The Variation Level (Avg Val Level) is the difference between the Actual Average Level and the Potential Level of Operation. It is not required to calculate the pump flow rate but it is nice to know.
- The pump curves are required to evaluate the flow rate of the pumps at the Actual Average Level (Avf Flow Low) and the Potential Level of Operation (Avg Flow High).

Before flow-based operation



With flow-based operation during low flow conditions



Volucalc Hybrid™



Volucalc Hybrid™ CM recommends the following:

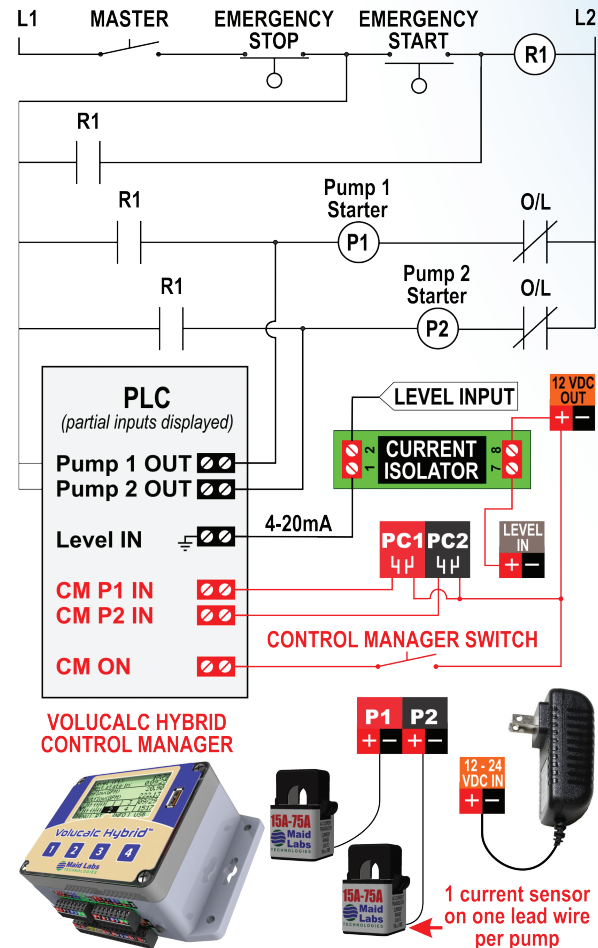
- Using the most efficient pump when possible
- Starting the pump with the highest flow rate before reaching the lag level
- Adjusting operation levels based on inflow:
 - Start and stop pumps at higher level when inflow is low
 - Start and stop pumps at lower level when inflow is high
 - Start lag pump when inflow is higher than outflow for more than specific time

The following partial electrical diagram shows how to connect the **Volucalc Hybrid™ CM** to the PLC of a duplex station with level sensor. A switch should be installed to accept Volucalc's suggestions.

PLC programs are easy to edit to add all these money-saving features.

If the station's PLC becomes defective, Volucalc can momentarily be used as the main controller. A switch (double throw with poles equal to the number of pumps) must be installed to transfer the control to the **Volucalc Hybrid™ CM** and back to the PLC.

High and low level floats should always be installed with an analog level sensor. Volucalc detects abnormal level readings before they become catastrophic, but even the level sensor needs backup.



To increase the efficiency and performance of variable speed pumps, the level of operation of the pumps should be adjusted proportionally to the flow rate entering the lift station.

Standard variable speed lift stations are programmed to keep a fixed level by raising or lowering the pump's speed and number of pumps. Like for constant speed pumps, this level is usually set low in the station in order to increase the volumetric capacity of the well during extreme flow conditions.

The pump controller should be programmed to use the flow proportional output of the Volucalc Hybrid CM for Variable Speed pumps and adjust the level of operation according to the flow rate. When the flow rate is low, the operating level should be as high as it is safe to be. When the flow rate is high, the operating level should be as low as possible.

Monthly report as downloaded to a USB drive

	Minimum or maximum value
	Value out of monthly normals
	Value out of predefined range

Date	Station				In				In			
	Energy Efficiency	Efficiency Lost	Wasted GHG	Money lost	Use of Station	Minimum Level	Maximum Level	Rain	Total Volume	Average Inflow	Minimum Flow	Maximum Hour
Unit:	GPWh	kWh	lb	\$	%	ft	ft	in	US gal	GPM	GPM	hh:mm:ss
1	1,88	2,84	N/A	0,28	3,71	1,21	3,89	0	95764,46	66,5	11,8	05:45:27
2	0,28	287,95	N/A	28,8	3,69	1,22	5,34	0	93830,1	65,16	16,8	05:17:47
3	0,7	104,29	N/A	10,43	4,19	1,3	4,66	0	104312,21	72,44	7,94	05:30:49
4	1,64	0,62	N/A	0,23	3,88	1,22	3,89	0	99841,3	66,5	11,8	05:45:27
30	1,82	3,21	N/A	0,32	3,98	1,2	3,89	0	101125,99	70,23	13,5	04:17:04
31	1,83	2,95	N/A	0,3	3,94	1,22	3,89	0	100362,22	69,7	14,7	03:33:01
Totals and averages:	1,73	473,71	0	47,37	3,91	0	8,1	0	3103337,25	69,52	0	16-08-26 18:08

The most complete on-site generated reports of the industry

About water coming in the station:

- 1 Efficiency of the station (volume/watt)
- 2 Green House Gas caused by inefficiency
- 3 Wasted money due to lack of efficiency
- 4 % of use of the pumps compared to their combined capacity
- 5 Total volume that came in the station
- 6 Average inflow rate
- 7 Maximum and minimum inflow rates with time of occurrence
- 8 Monthly Totals and Averages

About the pumps and combination of pumps:

- 9 Number of starts
- 10 Runtime single and combinations
- 11 Average current (one phase)
- 12 Volume pumped by pump
- 13 Efficiency per pump (higher value means less expensive to operate)
- 14 Pump flow rate
- 15 Monthly Totals and Averages

About Alarms and Suspicious events

- 16 Type of event
- 17 Date, time and duration of occurrence
- 18 Alarming value
- 19 Comments

Date	Pump 1				Pump 2		
	Starts	Runtime including pump combinations	Runtime	Average Current	Total Outflow Volume	Efficiency	Capacity
Unit:	hh:mm:ss	hh:mm:ss	hh:mm:ss	A	US gal	GPWh	GPM
1	50	00:28:56	00:28:56	70,46	47452,39	1,87	1640,06
2	40	05:03:14	00:50:53	56,58	67958,74	1,89	1335,58
3	48	02:17:05	01:47:46	51,84	78085,39	1,12	724,58
4	52	00:30:44	00:30:44	68,12	49203,37	1,87	1238,56
30	52	00:34:04	00:34:04	66	49839,29	1,78	1462,99
31	51	00:33:27	00:33:27	65,52	48957,48	1,79	1463,6
Totals and averages:	1562	23:28:22	18:44:23	66,14	1562638,12	1,76	1453,94

Date	Pump 2				Pump 1		
	Starts	Runtime including pump combinations	Runtime	Average Current	Total Outflow Volume	Efficiency	Capacity
Unit:	hh:mm:ss	hh:mm:ss	hh:mm:ss	A	US gal	GPWh	GPM
1	49	00:27:44	00:27:44	67,46	46560,18	2	1678,85
2	38	04:35:34	00:23:13	65,45	38002,84	2,01	1636,88
3	47	01:42:42	01:13:23	50,85	53348,65	1,15	726,99
4	52	00:29:50	00:29:50	63,84	47841,74	1,87	1276,94
30	52	00:33:37	00:33:37	62,08	50257,63	1,93	1495,02
31	52	00:33:45	00:33:45	61,51	50022,51	1,93	1482,15
Totals and averages:	1557	21:43:09	16:59:10	64,05	1500872,12	1,89	1518,21

Date	Pumps 1 and 2				Pumps 1 and 2		
	Starts	Runtime	Average Current	Total Outflow Volume	Efficiency	Capacity	
Unit:	hh:mm:ss	hh:mm:ss	A	US gal	GPWh	GPM	
1	0	00:00:00	0	N/A	0	N/A	
2	1	04:12:21	86,1	651990	2,41	2583,67	
3	0	00:29:19	88,96	75729,73	2,33	2583,16	
4	0	00:00:00	0	N/A	0	N/A	
30	0	00:00:00	0	N/A	0	N/A	
31	0	00:00:00	0	N/A	0	N/A	
Totals and averages:	2	04:43:59	99,87	730796,75	1,86	2165,01	

Alarms And Suspicious Events					
Name	From	To	Duration	Threshold	Other Information
Pump cap. changed	16-08-01 04:16	16-08-01 04:16	N/A	N/A	N/A
Pump cap. changed	16-08-01 04:49	16-08-01 04:49	N/A	N/A	N/A
Pump cap. changed	16-08-01 22:06	16-08-01 22:06	N/A	N/A	N/A

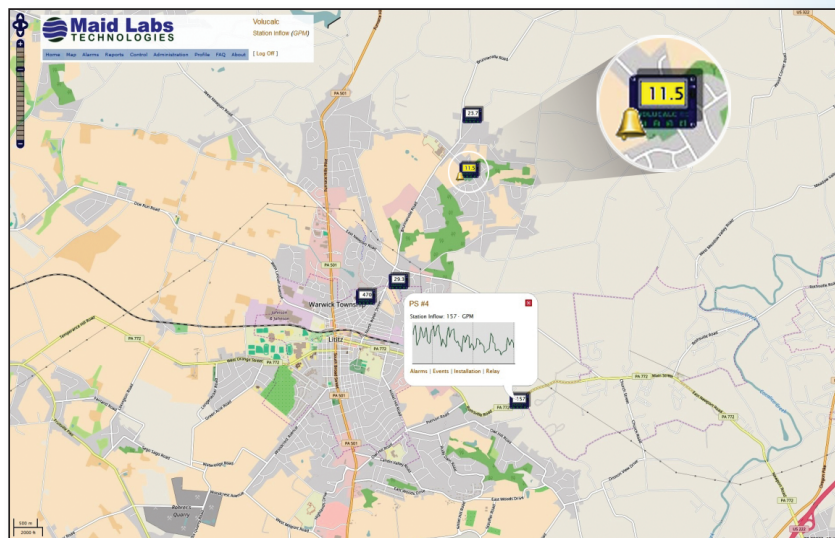
Any Web browser can open this HTML formatted report. It can be exported and opened by Excel as a formatted spreadsheet.

MaidMaps™

MaidMaps™ is a Web-based SCADA application that allows users to remotely view on their computers, tablets or phones, the following data in real time: flows, levels, alarms and other important data. The information displayed is recorded by Maid Labs devices. This SCADA software indicates on a user editable map the location of the instrument and the current measurement values.

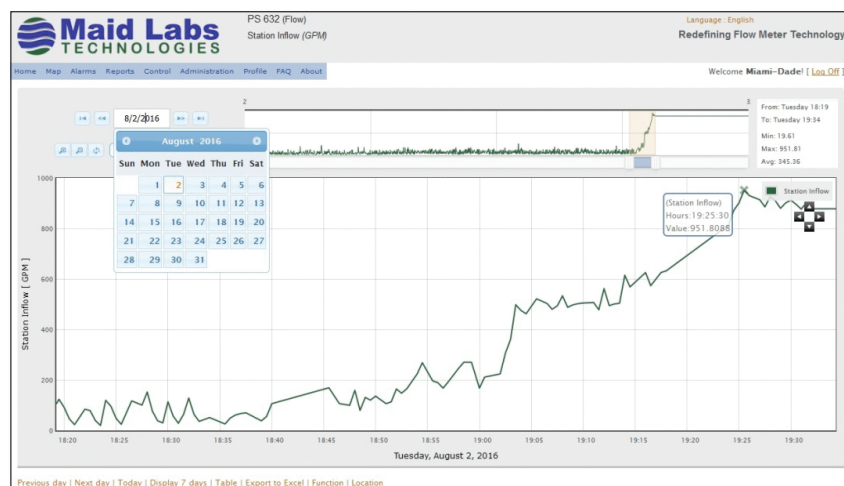
- Real time data viewing, reports and alarm monitoring
- To remotely set up and retrieve data from any number of Maid Labs Devices using an Ethernet, Wi-Fi or cellular connection
- All data can be downloaded for backup and analysis purposes

MaidMaps can display graphically all types of measurements listed here. It's easy to



zoom in and to go straight to a day or week of interest. It is one click away from having it exported to Excel with the data table used to create the graph.

MaidMaps can be used to download **SoftMaid™** compatible files from the **VolucalHybrid™** instruments.



MaidMaps™ is useful to download and upload instrument configurations and firmware upgrades. It is the most popular add on to Maid Labs Technologies' instruments.

Select function to display
<ul style="list-style-type: none"> • Devices' default function • Alarms' state • Hardware revisions • Software versions
<ul style="list-style-type: none"> • AC Power • Capacity Pumps 1, 2, 3 & 4 • Digital Event • External battery • Flow • Generic Analog 1 to 6 • Level • Overflow state • Pressure tap • Pressure used water • Pumps status • Rain • Relay State • Station Inflow • Station Outflow

Complete Menu

The **MaidMaps™** Menu allows the creation of user profiles, instrument and alarm configurations, selection of graphs and data tables to be displayed, and files to be downloaded or uploaded. The table to the right shows the types of data that can be graphically displayed and recorded by the **Volucal Hybrid™** instruments.

Map	Alarms	Reports	Control	Administration	Profile
Normal	Active alarms	Chart	Relays	Configurations	User information
Full screen	Alarms Configuration	Events		Devices	Regional settings
All locations	Alarms log	Recent events		Installations	Selected units
	Device alarms configs	Latest events		Locations	Organization information
		Device reports		Product hardware	Log off
		Configurations changes		Products	
				Projects	
				SMS Providers	
				Users	

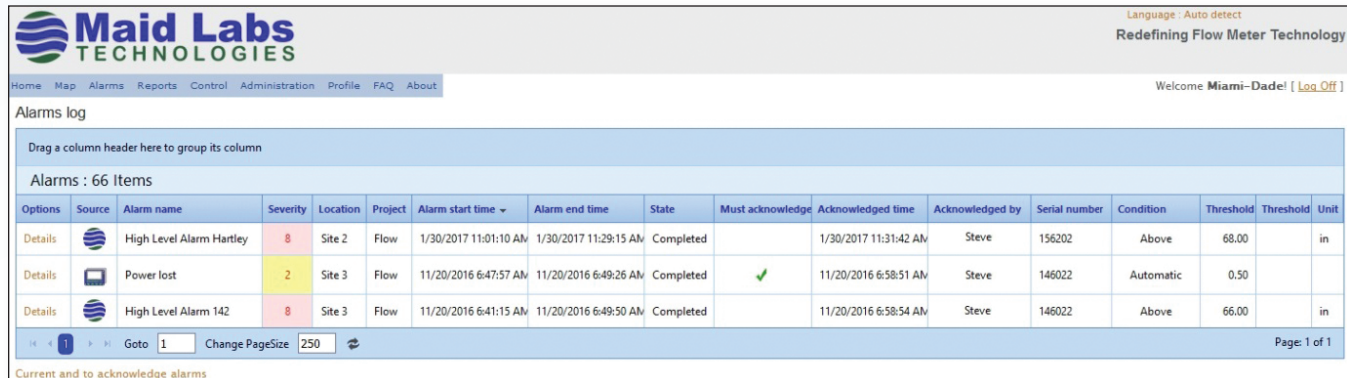
Measurements




Default types of measurements, like the flow for a flow meter, are displayed based on the model of the instrument and the “project” selected. A project can be tap water pressure, waste water collection or other names given by the user, so qualified employees view only meaningful information. The list on the previous page shows all the different types of data that can be displayed on the map, which can be edited by the user.

Alarms

The Alarm log displays all alarms in chronological order and who took care of it based on their login access. It shows when and who received alarms and if and when they were acknowledged.

Recipients receive emails (see next page), even if the problem is a communication problem.



Options	Source	Alarm name	Severity	Location	Project	Alarm start time	Alarm end time	State	Must acknowledge	Acknowledged time	Acknowledged by	Serial number	Condition	Threshold	Threshold	Unit
Details		High Level Alarm Hartley	8	Site 2	Flow	1/30/2017 11:01:10 AM	1/30/2017 11:29:15 AM	Completed		1/30/2017 11:31:42 AM	Steve	156202	Above	68.00		in
Details		Power lost	2	Site 3	Flow	11/20/2016 6:47:57 AM	11/20/2016 6:49:26 AM	Completed	✓	11/20/2016 6:58:51 AM	Steve	146022	Automatic	0.50		
Details		High Level Alarm 142	8	Site 3	Flow	11/20/2016 6:41:15 AM	11/20/2016 6:49:50 AM	Completed		11/20/2016 6:58:54 AM	Steve	146022	Above	66.00		in

The following alarms are detected automatically by the **Volucalc Hybrid™** and reported by **MaidMaps™**:

- Abnormal cycle
- Abnormal pump sequence
- AC power lost
- Device restart
- Ethernet communication problem
- Inflow out of range
- Level drops without pumps in operation
- Long cycle
- Operation level changed
- Pump outflow out of range
- Pump capacity changed
- Short cycle
- Level not changing
- User defined alarms

Communication

The instruments can be connected directly through the Ethernet port, Wi-Fi or Cellular modem. The data is transmitted to the server in real time or on a time-based frequency. When a value exceeds a warning or alarm limit, the values, warnings and alarms are immediately transferred to the MaidMaps server, which can send an SMS or email to the right person.

The welcome page allows a user to select a field of interest, like Flow or Tap Water Pressure, then see relevant data all over the network.

Visual indicators like colors and icons are added to the instrument's symbol and measurement to inform about communication (✕) and alarm (🔔) problems, or when values exceed warning or alarm levels. If an abnormal value is displayed, clicking on the instrument's symbol opens a micro-chart of the last hour and useful links like Alarms, Events and Relay.

Firewall Security

Both versions of the **Volucalc Hybrid™**, communicate via the Internet to the MaidMaps server. The instruments access the server like a computer downloads a web page. This way, the server does not need to break through firewalls to get

the data from private locations when connected by Wi-Fi or cable. Instead of requesting a web page, the instrument transmits its latest data and receives back commands, new setups or firmware, if necessary.

MaidMaps™ and SoftMaid™ have the following features

Feature	MaidMaps	SoftMaid
SoftMaid wastewater pump station diagnostic software		●
Dual backup servers	●	
Data retention (months)	12	
One second data resolution		●
Number of users	Unlimited	
User configurable alarms	●	
Alarms notifications by email and SMS	●	
Multiple lines of data per chart		●
1 to 7 days of data per graph	●	
1 to 31 days of data per chart		●
Multiple preconfigured charts and reports for wastewater pump stations		●
Monthly report	■	■
Detailed pump cycle report for diagnostic		●
Automatic Firmware upgrades	●	
Export to Excel and PDF	■	■
Online real-time access	●	

■ = MaidMaps and SoftMaid have variations of this feature.

- Unlimited number of Maid Labs instruments
- Highly detailed web map updated by user
- Data update frequency based on individual instrument setup and cellular service costs
- Remote real time data displayed
- Changing displayed data types or accessing graphs is usually only 2 mouse clicks away.
- All data can be downloaded by the user.
- When an alarm occurs, a warning symbol attaches itself to the instrument's icon on the map.

Alarm Email



Redefining Flow Meter Technology

An alarm occurred

To Miami-Dade users,

Alarm limit name: Lost communication with Volucalc

Organization: Miami-Dade

Location: Demo 146024

Project: Flow

Time: 3/23/2016 10:32 AM

Severity: Warning

Must acknowledge: Yes

Serial number: 146,024

This alarm must be acknowledged.

[View this alarm log](#)

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SoftMaid™

Download a **100%**
operational trial version
from the SoftMaid™ Web page

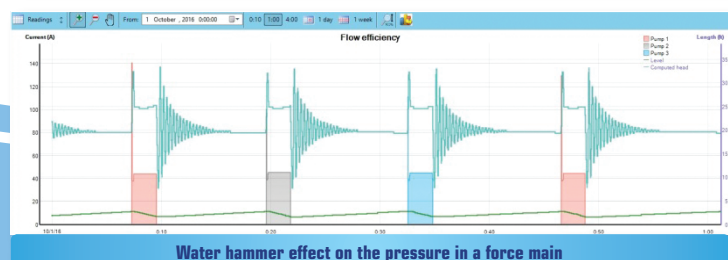
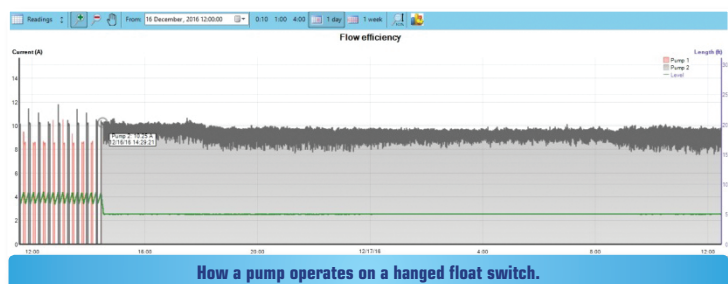
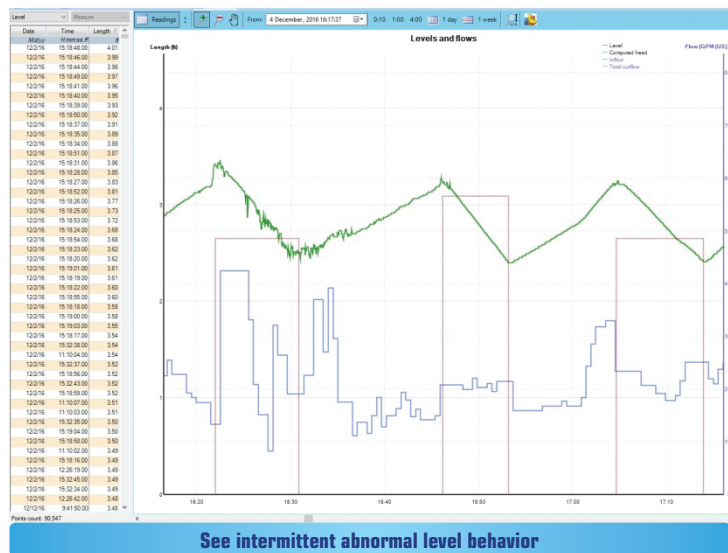
SoftMaid™ is the only Software designed specifically to analyze all **Municipal and industrial data** related to Wastewater pump stations in order to automatically discover and highlight abnormal behaviors before they become emergencies. To achieve these goals:

- **Data is collected by the existing SCADA system (at one second resolution) or by our Volucalc Hybrid instrument in real time and on site.**
- **Flow is calculated using the most advanced and accurate cycle based and real time volumetric flow algorithms ever patented.**
- **Electrical behavior is evaluated using voltage, current, power factor, power consumption, sequence of operations, time of operation and time off.**
- **Pump efficiency is utilized to compare pumps at their most meaningful units of measurement: dollars per volume pumped.**

SoftMaid™ is the professional choice for engineering flow modeling and assessments, maintenance analysis, inflow & infiltration trending, efficiency and operational costs reporting, improved SCADA flow totals and many more.

SoftMaid™ analyzes each main element behavior to extend its useful life and predict failures. One third of all electrical equipment has humanly undetectable intermittent abnormal behaviors. Detecting a problem at an early stage and planning its correction accordingly is the least expensive way to handle its maintenance.

SoftMaid™ was created to help prioritize the maintenance department tasks or the upgrade schedule by showing the operational cost of defective or less efficient equipment.



Unlike PLC controllers and SCADA software, **SoftMaid™** is a diagnostic software optimized to automatically detect several anomalies of pumping stations. This means it does not require any programming by the user to detect strange activities. It is easy to program a volumetric flow formula to calculate flow when everything is normal but the professional manager needs to know as early as possible about abnormal behaviors and their costs. It takes years of lift station analysis and programming to detect the following abnormal behaviors* without special configuration from the users:

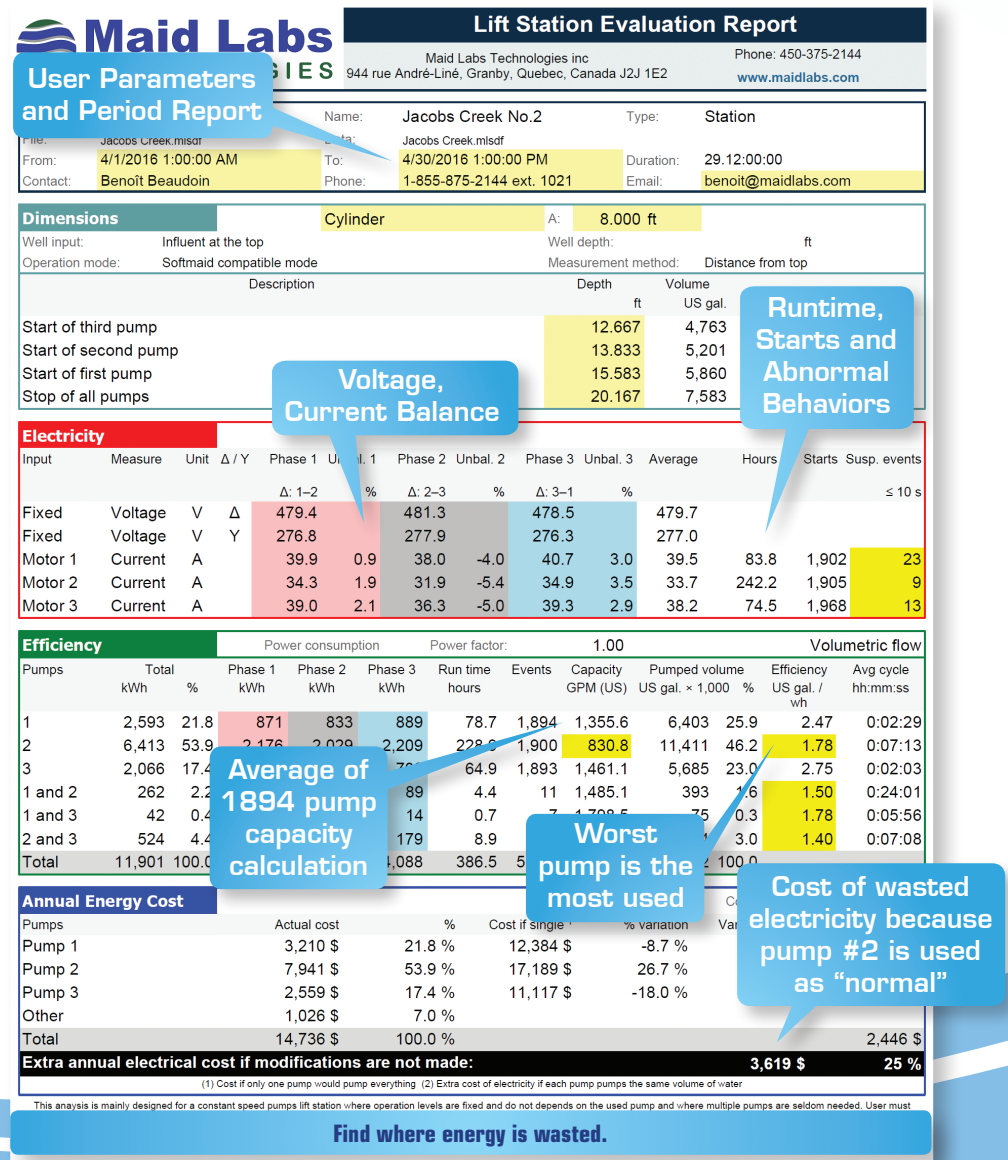
- **Pumps abnormal sequence of operations**
 - **Abnormal variation of the pumped flow rate**
 - **Important variation of the inflow rate**
 - **Abnormally long or short cycle**
 - **Abnormal energy consumption**
 - **Abnormal efficiency**
 - **Water level falls with no pumps in operation (level sensor problems or siphon)**
 - **Defective level sensor**
 - **Variation of the operating level of the pumps (float switches or level sensor problems)**
 - **User configurable alarms related to most of the inputs and calculated values like flow**
- * This is done automatically and in real time by the Volucalc hybrid CS

Other important features:

- **Reports easily exported in Excel for custom analysis**
- **High accuracy volumetric flow calculated every 30 seconds or faster (with analog level data)**

SoftMaid™ integrates the utility cost per Kilowatt, the amount of watt used by each pump and their pumped volumes to report dollars lost by the least efficient pumps. It shows that the worst pumps are almost always used the most! Now, it is possible to know which one they are.

SoftMaid™ transforms simple tipping bucket rain gauge data into powerful inflow and infiltration graph. When rain data are available, the software displays on the same graph dry day and wet day flow, their variation (infiltration related to rain) and rain.



Pump curves are impacted by many factors including force-main pressure, fluctuations, inflow rate changes, and impeller wear to name a few. **SoftMaid™** presents the most accurate capacities under extreme conditions in which lift stations operate. The flow rate accuracy of a volumetric flow formula is equal to its capacity to compensate for all abnormal behaviors imaginable, which occurs in one third of the stations. No, the Volume/time formula is not enough! This is why our most basic volumetric flow algorithm is this one below and the real time volumetric flow algorithm (not displayed) is even more complicated.

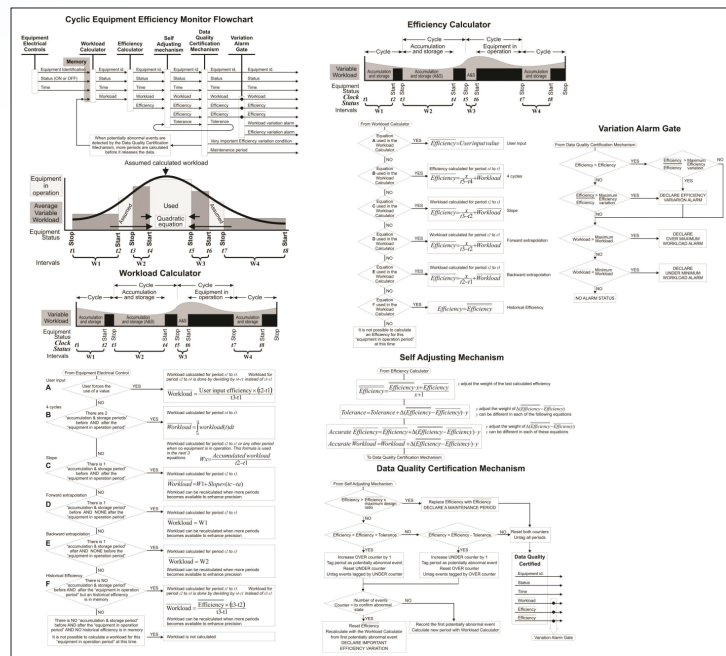
Many elements of the Maid Labs algorithm including the Efficiency Calculator, Variation Alarm Gate, Self-Adjusting Mechanism and Data Quality Certification mechanism are there to detect abnormal behaviors and trends in order to select the most appropriate formula to use to increase to the maximum the

accuracy of the results for every cycle. All of this is performed each time flow in or out is calculated.

Volucalc Hybrid™ records all its data at a frequency

Time		Period	Combination			Volume	Inflow	Graph	Outflow	Efficiency	Pressure
Date	Day	Time	Pump 1	Pump 2	Pump 3	Pump 4	US gal	CFM	GPM (US)	Efficiency / %	Average head / PSI
9/6/16	Tuesday	7:32:54	0:00:39.00	On	On	On	57	88.0	1,454.6	1.797	2.9
9/6/16	Tuesday	7:32:54	0:09:52.00	On	On	On	921	93.4	0.0	0.0	0.0
9/6/16	Tuesday	7:43:25	0:00:38.00	On	On	On	58	91.7	1,495.8	1.976	3.1
9/6/16	Tuesday	7:44:03	0:10:24.00	On	On	On	935	89.9	0.0	0.0	0.0
9/6/16	Tuesday	7:54:27	0:00:36.00	On	On	On	55	92.0	1,564.7	2.033	2.7
9/6/16	Tuesday	7:55:03	0:09:51.00	On	On	On	927	94.1	0.0	0.0	0.0
9/6/16	Tuesday	8:04:54	0:00:36.00	On	On	On	52	86.9	1,558.0	2.024	2.8
9/6/16	Tuesday	8:05:30	0:11:37.00	On	On	On	926	79.7	0.0	0.0	0.0
9/6/16	Tuesday	8:17:07	0:00:38.00	On	On	On	49	78.2	1,529.7	1.997	2.7
9/6/16	Tuesday	8:17:45	0:12:17.00	On	On	On	941	76.6	0.0	0.0	0.0
9/6/16	Tuesday	8:30:02	0:00:36.00	On	On	On	42	70.7	1,566.9	2.036	2.7

of one second. **SoftMaid™** was customized to extract these data and show the results in the most useful graphs. It is the perfect complement to **Volucalc Hybrid™**.



Download a **100%** operational trial version from the **SoftMaid™** Web page

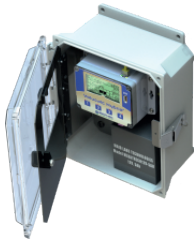


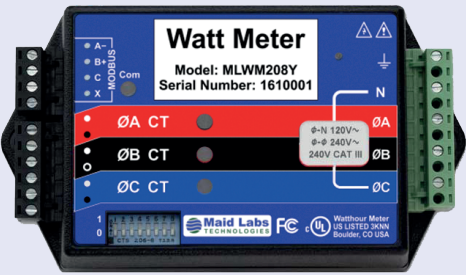
If your SCADA software can generate a file with at least for each event the date and time of identified pump start and stop, then **SoftMaid™** will be the most useful add-on to your system. If you also have electrical information like current, then you'll add electrical and efficiency analysis to the reports, which transforms data into dollar amount.

SoftMaid™ Wastewater Pump Station Diagnostic Software

- Multiple measurements per chart
- Events per cycle for diagnostic
- Infiltration (Inflow vs average dry day flow and rain)
- Inflow vs Pump capacity per cycle and rain
- Level vs Pump capacity per cycle
- Level, Inflow, Pump capacity per cycle
- Force main pressure vs Pump capacity per cycle
- Current on all pumps.
- Graph for periods longer than 7 days
- One second data recording frequency (based on input variation)
- Variable speed pump RPM vs Inflow
- Second monthly report format

Volucalc Hybrid™ Accessories

Part Number	Description	
MLCT75	Mini current sensor 75 Amps (For pumps between .5 HP and 40 HP)	
MLCT150	Current sensor 150 Amps (For pumps between 40 HP and 100 HP)	
MLCT300	Current sensor 300 Amps (For pumps between 100 HP and 250 HP. Higher capacity available)	
MLUS-6M	Ultrasonic level sensor (deadband 0.6 m / 2 ft) (Wall bracket not included - Cable length must be specified)	
MLSUPUS	14 inch (35 cm) Wall bracket for ultrasonic sensors Ultrasonic sensor and extension module not included)	
MLSUPUS-EXT	10 inch (30 cm) Wall bracket extension module for ultrasonic sensor	
MLPLR	Level pressure sensor for wastewater lift station with range of 7.6m (25ft). Custom range available	
MLPLCABLE-FT	Cable length required for MLPLR	
MLCELETH	Cellular modem with Ethernet port (Ethernet cable and power supply cable included) Buy with MLM2MDATA data services (page 15).	
MLWIFIPICO	WiFi interface module provides 360° coverage at a range of up to 500 m (1640 ft.)	
MLPSVL	Force main pressure gauge 100 PSI Pressure sensor	
MLPSCABLE-FT	Cable length required for MLPSVL	
MLRG	Rain gage US National Weather Services approved. 0.01" (0.254 mm) per pulse	
MLISO420	Loop Powered 4-20 mA Isolator, juste sous le Rain Gauge	

Part Number	Description
MLENCHMD-TR	<p>NEMA 4X enclosure 10 x 8 x 4 inches (25 x 20 x 10 cm) with transparent cover (-TR) or opaque cover (-GR) (Instrument, battery, cellular modem and passthrough fittings not included).</p> 
MLSUPPANEL	<p>Bezel and attachments to fix Volucalc Hybrid™ to panel door (Instrument not included)</p> 
MLSUPDIN	<p>Brackets to fix Volucalc on Din Rail (Instrument and rail not included)</p> 
MLWM480D (for 3 phases 480 volts motor or electrical equipment)	<p>Watt Meter: AC Power Measurement, True Power, kWh Reactive Power, VARs, Power Factor, Individual Phase Measurements</p> <p>The Watt Meter is a kilowatt hour (kWh) energy and power meter that communicates to Volucalc Hybrid™ on a EIA RS-485 network. It measures 1, 2, or 3 phases with voltages from 120 to 600 volts Vac and currents from 5 to 6,000 amps in delta (phase to phase) and wye (phase to neutral) configurations.</p> <p>Measurements:</p> <ul style="list-style-type: none"> • Phase A, B, C, and sum of all phases <ul style="list-style-type: none"> • True RMS Power: Watts • Reactive Power: VARs • Power Factor • True RMS Energy: Kilowatt hour kWh • Reactive Energy: kVAR-hours (All Phases) • AC Line Frequency • RMS Voltage: (Phase A, B, C) • Computed RMS Current: (Phase A, B, C) <p>Features:</p> <ul style="list-style-type: none"> • 0.5% nominal accuracy • True RMS power even with leading or lagging power factor and chopped or distorted waveforms • Measure variable speed drive pumps and motors • Uses safe split core CT's (current transformers) for quick installation • UL, cUL Listed 
MLWM600Y (for 3 phases 600 volts motor or electrical equipment)	
MLWM240D (for 1 phase 240 Volts motor or electrical equipment)	
MLWM208Y (for 1 phase 120 Volts motor or electrical equipment)	

Volucalc Hybrid™ QUOTATION FORM

SELECT WHAT YOU NEED (Check the items that you want us to quote on)



<input type="checkbox"/> V	<input type="checkbox"/> C	Pumps' type	Variable MLVC-VS or Constant MLVC-CS
<input type="checkbox"/> 1	<input type="checkbox"/> 2	Number of pumps	Number of current sensors required
<input type="checkbox"/> 3	<input type="checkbox"/> 4	1, 2, 3 or 4	1 per pump
		Specify	Pump size (HP) or current per leg

Current sensors (select size and quantity for each pump station)			
Pump size or better, current of one leg	Part number	Range	Description
<input type="checkbox"/> For pumps between .5 HP and 40 HP	MLCT75	75 Amps	Mini current sensor 75 Amps
<input type="checkbox"/> For pumps between 40 HP and 100 HP	MLCT150	150 Amps	Current sensor 150 Amps
<input type="checkbox"/> For pumps between 100 HP and 250 HP	MLCT300	300 Amps	Current sensor 300 Amps
<input type="checkbox"/> 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 is wanted. <i>Cable length must be specified.</i>				
Type	Part number	Range	Description	Cable Length
<input type="checkbox"/> Ultrasonic	MLUS-6M	6 m / 19.7 ft	Ultrasonic level sensor (deadband 0.6 m / 2 ft)	_____ ft
<input type="checkbox"/> Pressure	MLPLR	Adjustable	Level pressure sensor for wastewater lift station	_____ ft
<input type="checkbox"/> Existing Sensor	MLIS0420	Loop Powered 4-20 mA Isolator to use with existing level sensor		

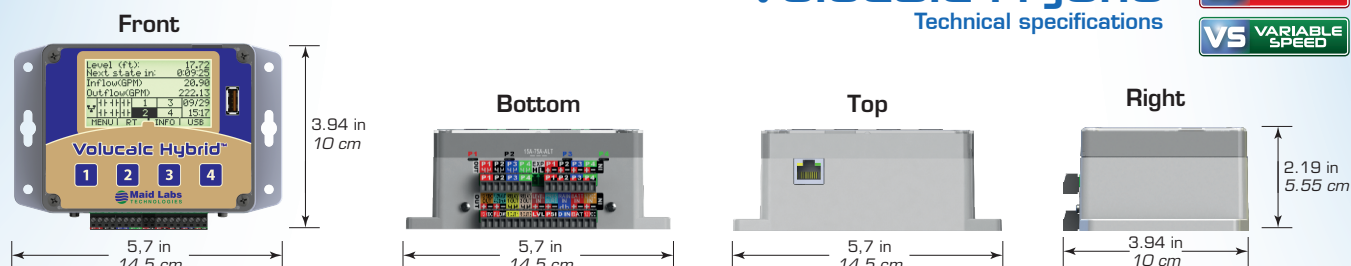
Communication	Part number	Service	Description
<input type="checkbox"/> Cellular	MLCELETH	By Maid Labs	Cellular modem with Ethernet port
<input type="checkbox"/> Wifi	MLWIFIPICO		WiFi interface module
<input type="checkbox"/> Others	Volucalc Hybrid™ can communicate through most TCP/IP compatible hardware		

Other accessories	Part number	Description
<input type="checkbox"/> Force main pressure gauge	MLPSVL	100 PS1 Pressure sensor (cable 5 m / 16 ft).
<input type="checkbox"/> Rain Gauge	MLRG	National Weather Services approved. 0.01" (0.254mm) per pulse
<input type="checkbox"/> NEMA4X enclosure	MLENCHMD-TR	With transparent cover (-TR), with opaque cover (-GR)
<input type="checkbox"/> Front panel door bracket	MLSUPPANEL	Brackets to fix Volucalc™ on panel door
<input type="checkbox"/> DIN Rail brackets	MLSUPDIN	Brackets to fix Volucalc™ on Din Rail

MaidMaps SCADA Web Application	
Per Year	Part Number
<input type="checkbox"/> MaidMaps	MLMAPS
<input type="checkbox"/> Cellular Services	MLCELDATA
<input type="checkbox"/> Cellular Activation (Only once)	MLCELDATA-ACT

Watt Meter (select model based on electrical service types. Call Maid Labs if your application is not listed)				
Part number	Vac Line to Neutral	Vac Line to Line	Neutral Required	Comments
<input type="checkbox"/> MLWM208Y	120	208-240	YES	Mostly for 1 phase 120 Volts pumps
<input type="checkbox"/> MLWM600Y	347	600	YES	Common in Canada
<input type="checkbox"/> MLWM240D	N/A	208-240	NO	Mostly for 1 phase 240 Volts pumps
<input type="checkbox"/> MLWM480D	N/A	400-480	NO	Common in USA

High Accuracy Current Sensors Only for Watt Meter (Call Maid Labs if your application is not listed)			
Pump size or better, current of one leg	Part number	Range	Description
<input type="checkbox"/> For pumps between .5 HP and 20 HP	MLHACT25	25 Amps	Current sensor 25 Amps
<input type="checkbox"/> For pumps between 20 HP and 80 HP	MLHACT100	100 Amps	Current sensor 100 Amps
<input type="checkbox"/> For pumps between 80 HP and 200 HP	MLHACT250	250 Amps	Current sensor 250 Amps



Name and Item No.	Volucalc Hybrid™ MLVC
Product type: MLVC-VS MLVC-CS	<ul style="list-style-type: none"> Variable speed pump flow meter (MLVC-VS only) Real time volumetric flow meter Open channel flow meter Derived flow meter Watt Meter option for power and energy metering
Types of data recorded and displayed (always time stamped)	Flow, level, pump capacity, run time, number of starts, abnormal behaviors, time and volume of overflow, annual operational cost in \$. With Watt Meter option: Voltage and current per phase, power factor, True RMS power (watt), frequency, VA (apparent power), VAR (reactive power)
Variable speed pump flow accuracy	Between $\pm 20\%$ (badly calibrated) and $\pm 3\%$ (properly calibrated) Accuracy is directly proportional to the quality of the calibration and the installation
Volumetric flow accuracy (normal operation)	$\pm 1.5\%$ for most lift station with inlet above pump operating levels Volumetric can be used to properly calibrate the variable speed pump curves
Open channel flow accuracy and calibrations available	Accuracy related to level sensor and flow equation used Weirs: <ul style="list-style-type: none"> Rectangular with and without end contractions V-notch (or triangular) Trapezoidal (or Cipolletti) Flumes: <ul style="list-style-type: none"> Palmer-Bowlus Parshall Formulas: <ul style="list-style-type: none"> Manning California pipe Standard or polynomial formula Lookup table
Digital input	1 x 1 Hz
Analog inputs	6 Total: 4 x Pump current, 4-20mA, 0-5v, 0-10v, 0-24v and 2 x 4-20mA, 0-5v, 0-10v, 0-24v mostly used for level and pressure
Reading speed and accuracy of analog input	40 Hz with average every second. $\pm 0.1\%$.
Outputs	6 x dry contacts 1 x self-powered 4-20mA analog output
Alarms detected and displayed Action taken when alarms: Relay activation. With MaidMaps: email, SMS, color changes on map	Level, Extreme flow, Hydraulic (high variation in pump capacity), Energy (high variation in electricity consumption), Alternation (pumps not alternating normally), ON and OFF times (pumps start or stop for very short period), Operating time (high variation not caused by inflow), Level related anomalies, (e.g. water level falls with no pumps in operation)
Temperature	$\pm 3^{\circ}\text{C}$ Internal temperature sensor accuracy
Memory	10 years of data
Power supply	12-24 VDC 1 AMP (included), 12v battery backup (not included)
Integrated Battery Charger	For 12v lead acid battery (MLBATRECH12V)
Communication Interface	USB port, Ethernet and RS485 (RS485 must be provided by customer)
Display	Backlit graphic 128 x 64
Keyboard	4 soft keys
Dimension inches (cm)	5.7 in. x 3.9 in. x 2.14 in. 5.7 x 3.9 x 2.14 inches (14.5 x 9.9 x 5.5 cm)
Weight	0.5 lb/0.22 kg
Accessories	Current sensor, pressure sensor, level sensor, Wi-Fi adaptor, cellular modem, MaidMaps™ SCADA web access, SoftMaid™ diagnostic software, Watt Meter, brackets
Warranty	3 years, parts and labor
MaidMaps functions	Alarms, Email, SMS, geographic map displaying flow, report download