Pump Station Monitoring System



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[™]:

VFD VFD VFD VFD P1 P2 P3 P4	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.
201 124	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.
	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.
	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.
	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.
	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.
	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.
	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 Volucaic [™] is the most accurate of the industry while the variable speed pump algorithm is the only plug-in method of the industry.
	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.
	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.
	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.
	SoftMaid [™] is the most advanced wastewater pump station diagnostic software and the perfect mean to analyze high resolution Volucalc [™] data.



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. **Volucale Hybrid™CS** analyzes each main element behavior to extend its useful life and predict failures. Simply transfer the **Volucale**[™] 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

Colucalc 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

Maid Labs



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.





) N	laidDevices Configu uts and outputs Configure usage and	urator d sensors for each input and outp	to use	the Input Outputs	s -	×
↔	Hardware	Function	Sensor	Range	١/O	^
	Pump ctrl 1	Not used			Disabled	
	Pump ctrl 2	Not used			Disabled	
	Pump ctrl 3	Not used			Disabled	
	Pump ctrl 4	Not used			Disabled	
	Expansion	Not used			Disabled	
-	Pump 1	Pump 1 speed	(ustom speed	0 to 3500 RPM	0-10 VDC	
-	Pump 2	Pump 2 speed	ustom speed	0 to 3500 RPM	0-10 VDC	
->	Pump 3	Pump 1 (phase 1)	CT 75A	0 to 75 A	Pump 75 A	
→	Pump 4	Pump 2 (phase 1)	CT 75A	0 to 75 A	Pump 75 A	
<	12 VDC out	Controlled power	Controlled equipment		12 VDC	
	Flow	Not used			Disabled	
+	Relay out 1	Modem power control	Relay		Digital	
←	Relay out 2	Alarm out	Relay		Digital	
-	Level	Alarm out	Custom level	0 to 20 ft	0-5 VDC	
-	Pressure	Vot used	0-100 PSI	0 to 100 PSI	4-20 mA	
	Rain	Volume out	0.01" per pulse	0.01 in per pulse	Pulse	



V.

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.

A MaidDevices Configurator

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?

Identification				
Device Name: PS Andre-Line	•		Serial number:	VH000100
Power source	E	themet communication	S	
AC adapter	C) None	Not connected	
AC with battery backup	Lithium (Standard	Wired network	
External battery	- battery	Cellular modem	Controlled power source	
Internal batteries only		1		
Emiciency based control	1-11-6-24	Level base	energing levels are fired	
Pumps not controlled by Voluca Rumps allomate at each curle	іс пурпа		uperating levels are fixed	different
Pumps anemale at each cycle Maximize use of most officient -			wer weather operating levels are	uneren
when alternating wastes over	10 S per vear		election based on force main are	ssure
but no more than 67 % of the	timo	-ump si	and an based on lorde main pre	adurd .
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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).



Aaid Labs

Before flow-based operation

With flow-based operation during low flow conditions







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**TM **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**TM **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.



VS VARIABLE SPEED

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

	1		2	Station	4				5	6		In E	2	
Date	Energy	Efficiency	Wasted	Money lost	Use of Station	Minimum	Maximum	Rain	Total Volume	Average		Minimum	N	laximum
	Efficiency	Lost	GHG		Use of Station	Level	Level	Rain	Total Volume	Inflow	Flow	Hour	Flow	Hour
Unit:	GPWh	kWh	lb	\$	%	ft	ft	in	US gal	GPM	GPM	hh:mm:ss	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	164,9	10:12:26
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	2686	23:11:27
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	2611	00:11:54
4	1,64	0.62		0,23	3,88	1,22	3,89	0	99841,5	07,55	- ,	01-50-20	212	07:37:15
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	283	18:27:01
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	338,5	23:28:29
Totals and averages:	8 1,73	473,71	0	47,37	3,91	0	8,1	0	3103337,25	69,52	0	16-08-26 18:08	2686	16-08-02 23:11

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

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

		ſ		Pump 1		12	
Date	Starts	Runtime including pump combinations	Runtime	Average Current	Total Outflow Volume	Efficiency	Capacity
Unit:		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
1		00.30:44	00:30:44	68,12	49203,37		1228 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:	15 ₁₅₆₂	23:28:22	18:44:23	66,14	1562638,12	1,76	1453,94

				Pump 2			
Date	Starts	Runtime including pump combinations	Runtime	Average Current	Total Outflow Volume	Efficiency	Capacity
Unit:		hh:mm:ss	hh:mm:ss	А	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		00:29:50	00:29:50	63,84	4/821,/*	,	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

			Pumps	l and 2		
Date	Starts	Runtime	Average Current	Total Outflow Volume	Efficiency	Capacity
Unit:		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
-						NT/A
	*	00:00:00	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

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



16	Ala	rms And Sus	picious I	Events	
Name	From	17 то	Duration	Threshold	Other Information
Pump cap. changed	16-08-01 04:16	16-08-01 04:16	N/A	18 N/A	19 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

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 VolucalcHybrid[™] instruments.



Complete Menu

The **MaidMaps**TM' 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 **Volucalc Hybrid**TM instruments.



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.

	M	aid Lak	DS ES										Language A	ito detect Flow Mete	er Techno	logy
Home Ma	ip Alarm	ns Reports Control Adn	ninistration	n Profile	FAQ A	bout							Welcom	ne Miami-C)ade! [<u>Loo</u>	Off]
Alarms	log															
Drag a o	olumn he	ader here to group its columr	n													
Alarn	ns : 66 I	Items														
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	9	High Level Alarm Hartley	8	Site 2	Flow	1/30/2017 11:01:10 Alv	1/30/2017 11:29:15 AM	Completed		1/30/2017 11:31:42 AN	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	1	11/20/2016 6:58:51 AN	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 AN	Steve	146022	Above	66.00		in
H 4	E H	Goto 1 Change Pa	geSize 25	50 🗢											Page: 1 o	f1
Current a	nd to ack	nowledge alarms														

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.

Alarm Email



Alam limit name: Lost communication with Volucale Organization: Miami-Dade Location: Demo 146024 Project: Flow Time: 3/23/2016 10:32 AM Severity: Warning Must acknowledge: Yes Senial number: 146,024 This alam must be acknowledged.

View this alarm log Copyright © 2016 Maid Labs. All rights reserved.



- 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.

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

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.

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

User I	Parar	net	ers	HES	944 ru	Ma e André-L	aid Labs Tei .iné, Granby	chno <mark>logies</mark> /, Quebec,	inc Canada J	2J 1E2	Phone	e: 450-375-21 .maidlabs.co	44 om
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lectricity													
nput	Measure	Unit	A/Y	Phase 1 U	N 11. 1	Phase	2 Unbal. 2	Phase 3	3 Unbal.	3 Average	Hour	rs Starts	Susp. events
				Δ: 1-2	%	A: 2-	3 %	Δ: 3-	1 9	%			≤ 10 s
ixed	Voltage	v	Δ	479.4		481.3	3	478.	5	479.7			
ixed	Voltage	V	Y	276.8		277.	9	276.3	3	277.0	/		
lotor 1	Current	A		39.9	0.9	38.	0 -4.0	40.7	7 3.	0 39.5	83.	8 1,902	23
lotor 2	Current	A		34.3	1.9	31.	9 -5.4	34.9	9 3.	5 33.7	242.	2 1,905	9
fotor 3	Current	А		39.0	2.1	36.3	3 -5.0	39.3	3 2.	9 38.2	74.	5 1,968	13
fficiency	8			Power cons	umption	P	ower factor:	_	1.00			Volur	metric flow
umps	Tota kWh	۱ %	Phas kW	e 1 Phase h kWh	2 Ph	ase 3 Wh	Run time hours	Events	Capacity GPM (US)	Pumped v US gal. × 1,	olume 000 %	Efficiency US gal. / wh	Avg cycle hh:mm:ss
	2,593	21.8		871 8	33	889	78.7	1,894	1,355.6	6,403	25.9	2.47	0:02:29
	6,413	53.9	2	178 2.0	20	2,209	228 0	1,900	830.8	11,411	46.2	/ 1.78	0:07:13
	2,066	17.4	Av	erage	of_	70	64.9	1,893	1,461.1	5,685	23.0	2.75	0:02:03
and 2	262	2.2	18	94 nu	mp_	89	4.4	11	1,485.1	393	5 1.6	1.50	0:24:01
and 3	42	0.4	_	opooit		14	0.7			75	0.3	1.78	0:05:56
and 3	524	4.4	G	apacit	·y	179	8.9		VVUI	· 56 ·	3.0	1.40	0:07:08
otal	11,901	100.0	ca	lculati	on	1,088	386.5	🧕 pu	mp i	s the	100 0	.	
nnual En	erav Co	st						_ m	ost	used	C	Cost (ot wast
umps			-	Actual cos	t		% Cor	st if single		% variation	va e	ectric	ity beca
ump 1				3,210 \$	5	21.8	%	12,384 \$	5	-8.7 %	r	umn :	#2 is u
ump 2				7,941 \$	6	53.9	%	17,189 \$	5	26.7 %			
ump 3				2,559 \$	6	17.4	%	11,117 \$	3	-18.0 %		as	normal
ther				1,026 \$	6	7.0	%						
otal				14,736 \$	6	100.0	%						2,446 \$
Extra annu	al electri	ical co	ost if I	nodificatio	ons ar	e not m	ade:				3,6	619 \$	25 %
		(1)	Cost I on	ly one pump woul	d pump eve	erything (2) E	Extra cost of ele	ctricity if each	pump pumps	the same volume	of water		

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

Analysis	P Der	ricecomput	ed flows ×												
a family a family state	Time	_	Period +		Cont	ination	-0	Volume +		Inflow	- Outflow -	Efficiency 4	Press	ure -t	~
Date	Day	Time	Duration Addummus_	Pump 1 state	Pump 2 atote	Pump 3 state	Pump 4	Volume US gal.	Inflow GFM_	Graph	Outlow GPM (US)	Efficiency US gal / wh	Average head	Atter pumps FSI	
3/6/16	Tuesday	7.32.54	0.00 39.00	On				57	88.0		1,454.6	1.797	2.9		
9/6/16	Tuesday	7.33.33	0.09.52.00					921	93.4		0.0				
31'9'6	Tuesday	7.43.25	0.00 38.00	CH I	On	OF	OF	58	91.7		1,495.B	1.976	31		
91%16	Tuesday	7.44.03	0.10.24.00					935	89.9		0.0				
9/6/16	Tuesday	7.54.27	0.00.36.00	On	OT			55	92.0		1,564.7	2.033	2.7		
9/6/16	Tuesday	7.55.03	0.09.51.00					927	94.1		0.0				
9/6/16	Tuesday	204.54	0.00.36.00	0fl	On	CB	08	52	86.9		1,558.0	2.024	2.8		
9/6/16	Tuesday	8:05:30	0.11:37.00	Off		CH .		926	79.7		0.0				
9/6/16	Tuesday	8.17.07	0.00.38.00	On	OF.			49	78.2		1,529.7	1.997	2.7		
9/6/16	Tueeday	8.17.45	0.1217.00					941	76.6		0.0				
9/6/16	Tuesday	8-30-02	0.00-36.00	CH	On	OB	CH.	42	70.7		1.566.9	2,036	27		v

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**[™].



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)	A		
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	á		
MLPLCABLE-FT	Cable length required for MLPLR			
MLCELETH	Cellular modem with Ethernet port (Ethernet cable and power supply cable included)			
	BUY WITH MILMZMDATA data services (page 15).	9		
MLWIFIPICO	FIPICO 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	-150 4-2905		

Part Number	Description							
MLENCHMD-TR	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).							
MLSUPPANEL	Bezel and attachments to fix Volucalc Hybrid™ to panel door (Instrument not included)							
MLSUPDIN	Brackets to fix Volucalc on Din Rail (Instrument and rail not included)							
MLWM480D (for 3 phases 480 volts motor or electrical equipment)	Watt Meter: AC Power Measurement, True Power, kWh Reactive Power, VARs, Power Factor, Individual Phase Measurements The Watt Meter is a kilowatt hour (kWh) energy and power meter that communicates to Voluce aloc Hubbid TM on							
MLWM600Y (for 3 phases 600 volts motor or electrical equipment)	 The Walt Meter is a knowat hour (whit) energy and power mater that communicates to VOICEALE 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. Measurements: Phase A, B, C, and sum of all phases True RMS Power: Wats 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) Features: 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 							
MLWM240D (for 1 phase 240 Volts motor or electrical equipment)								
MLWM208Y (for 1 phase 120 Volts motor or electrical equipment)								



Volucalc Hybrid[™] QUOTATION FORM

SELE	CT WHAT	YOU	NEED	(Check the i	tems that	you war	nt us to q	uote c	nn)			
VC	Pumps' t	уре	Variable MLVC-VS or Constant MLVC-CS									
12	Number of	pumps	Nu	Number of current sensors required					Specify			
3 4	1, 2, 3 or 4		1 per pump				Pur	mp size (HP) or curren	t per leg			
		Curr	ent sense	ors (select	s (select size and quantity for each pump station)							
	Pump size or bette	er, current	of one leg		Part number Range Description							
	For pumps betwee	For pumps between .5 HP and 40 HP					75 Amps		Mini current sensor 75 Amps			
	For pumps betwee	en 40 HP a	nd 100 HP		MLCT150)	150 Amps		Current sensor 150 Amps			
	For pumps betwee	en 100 HP	and 250 HP		MLCT300)	300 Amps	300 Amps Current sense		nsor 300 Amps		
	For pumps betwee	For pumps between 250 HP and 1000 HP				500	1500 Amps		Current sensor 1500Amps			
		Le	evel sense	ors - The e	s - The existing system can be used if available							
	Not required for co	onstant spe	ed pumps, u	nless Real Time	Flow is want	ed. <i>Cable</i>	length must	t be spe	cified.			
	Туре	Part nu	Imber	Range			Descrip	tion		Cable Length		
	Ultrasonic	MLUS-6	VI (6 m / 19.7 ft	ı / 19.7 ft Ultrasonic level sensor (c				/ 2 ft)	ft		
	Pressure	Pressure MLPLR			Level press	ure sensor	for wastewa	ater lift s	lift stationft			
	Existing Sensor MLISO420 Loop Powered 4-20 mA Isolator to use with existing level sensor									r		
	Communica	tion P	art num	per Se	ervice				Description			
	Cellular	Cellular MLCELETH			abs	Cellular modem with Ethernet port						
\square	Wifi	Wifi MLWIFIPICO			WiFi interface modu				е			
\square	Others	V	′olucalc	Hybrid™	can commun	icate throu	gh most TC	P/IP co	mpatible hardware			
	Other ac	cessori	es Pa	art numbe	r			Desc	ription			
	Force main pressure gauge MLP			PSVL	SVL 100 PS1 Pressure sensor (cable 5 m / 16 ft).							
\Box	Rain Gauge MLP			RG	G National Weather Services approved. 0.01" (0.254mm) per pulse					ılse		
$\overline{\bigcirc}$	NEMA4X enclosur	NEMA4X enclosure MLE			NCHMD-TR With transparent cover (-TR), with opaque cover (-GR)							
	Front panel door bracket MLS			SUPPANEL	UPPANEL Brackets to fix Volucalc [™] on panel door							
	DIN Rail brackets	UPDIN Brackets to fix Volucalc [™] on Din Rail										
				MaidMa	aps SCAD	A Web	Applicati	on				
					Part Number- Number of years							
	Ма	aidMaps			MLMAPS							
	Cellul	ar Servic	es	MLCELDATA								
	Cellula	ar Activat	ion	MLCELDATA-ACT								
	Watt Mete	er (selec	t model ba	sed on elect	rical servic	e types.	Call Maio	d Labs	if your applicatior	n is not listed)		
	Part number	Part number Vac Line to Neutra		al Vac Line	Vac Line to Line		Neutral Required		Comments			
	MLWM208Y	VM208Y 120		208-	208-240		YES		Mostly for 1 phase 120 Volts pumps			
$\overline{\bigcirc}$	MLWM600Y	347		60	00	YES		Со	Common in Canada			
\Box	MLWM240D	MLWM240D N/A		208-	208-240		NO		Mostly for 1 phase 240 Volts pumps			
\Box	MLWM480D		N/A	400-	-480		NO	Co	mmon in USA			
	High Accu	racy Cu	rrent Sen	sors Only f	or Watt I	Neter ((Call Maid	Labs	if your application	is not listed)		
	Pump size or bette	Part nu	ımber	Range	[Descript	iption					
	For pumps between .5 HP and 20 HP			MLHA	CT25	25 Amps	25 Amps Curre		nt sensor 25 Amps			
	For pumps betwee	For pumps between 20 HP and 80 HP			CT100	100 Am	os (Current sensor 100 Amps				
	For pumps betwee	MLHA	CT250	250 Am	os (Current	urrent sensor 250 Amps					

Å

Volucal HybridTM CS CONSTANT Technical specifications

Front		Technical s	specifications	VS VARIABLE SPEED					
Revel (*): 1722 0.00790 0.00700 0.0070 0.0070 0.0070 0.0070 0.0070 0.00700 0.00700	Bottom	Тор	Right						
Volucaic Hybrid [®]		•	:	2.19 in 5.55 cm					
→ 5,7 in → 14,5 cm →	← 5,7 in 14,5 cm →	← 5,7 in→	 <3.94 in 10 cm 	→					
Name and Item No.	Volucalc Hybrid™ ML	VC							
Product type: MLVC-VS MLVC-CS	 Variable speed pump flow mete Real time volumetric flow meter Open channel flow meter Derived flow meter Watt Meter option for power an 	r (MLVC-VS only) d energy metering							
Types of data recorded and displayed (always time stamped)	Flow, level, pump capacity, run tim annual operational cost in \$. With N RMS power (watt), frequency, VA (a	e, number of starts, abnormal beha Vatt Meter option: Voltage and curr apparent power), VAR (reactive pow	viors, time and vol ent per phase, pov /er)	lume of overflow, ver factor, True					
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)	± 1.5 % for most lift station with in Volumetric can be used to properly	let above pump operating levels calibrate the variable speed pump	curves						
Open channel flow accuracy and calibrations available	Accuracy related to level sensor and flow equation used Weirs: • Rectangular with and without end contractions • V-notch (or triangular) • Trapezoidal (or Cipolletti) Flumes: • Palmer-Bowlus • Parshall Formulas: • Manning • California pipe • Standard or polynomial formula • Lookun table								
Digital input	1 x 1 Hz								
Analog inputs	6 Total: 4 x Pump current, 4-20m 2 x 4-20mA, 0-5v, 0-10v.	A, 0-5v, 0-10v, 0-24v and 0-24v mostly used for level and pi	ressure						
Reading speed and accuracy of analog input	40 Hz with average every second. ±	0.1 %.							
Outputs	6 x dry contacts 1 x self-powered 4-20mA analog o	utput							
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	± 3°C Internal temperature sensor a	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 (RS4	185 must be provided by customer)	1						
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	1 11 m m 1		74.00.5					
Accessories	access, SoftMaid [™] diagnostic software, Watt Meter, brackets								
Warranty	3 years, parts and labor								
MaidMaps functions	Alarms, Email, SMS, geographic m	ap displaying flow, report downloa	d						

Maid Labs

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