Volucalc Hybrid™

Variable & Constant Speed Pumps Flow Meter*

The Only VFD Flow Meter

NEMA 4X enclosure with optional cellular or WiFi modem and battery backup

DIN Rail brackets

Front panel door bracket

Maid Labs TECHNOLOGIES

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*Multiple Patents Pending

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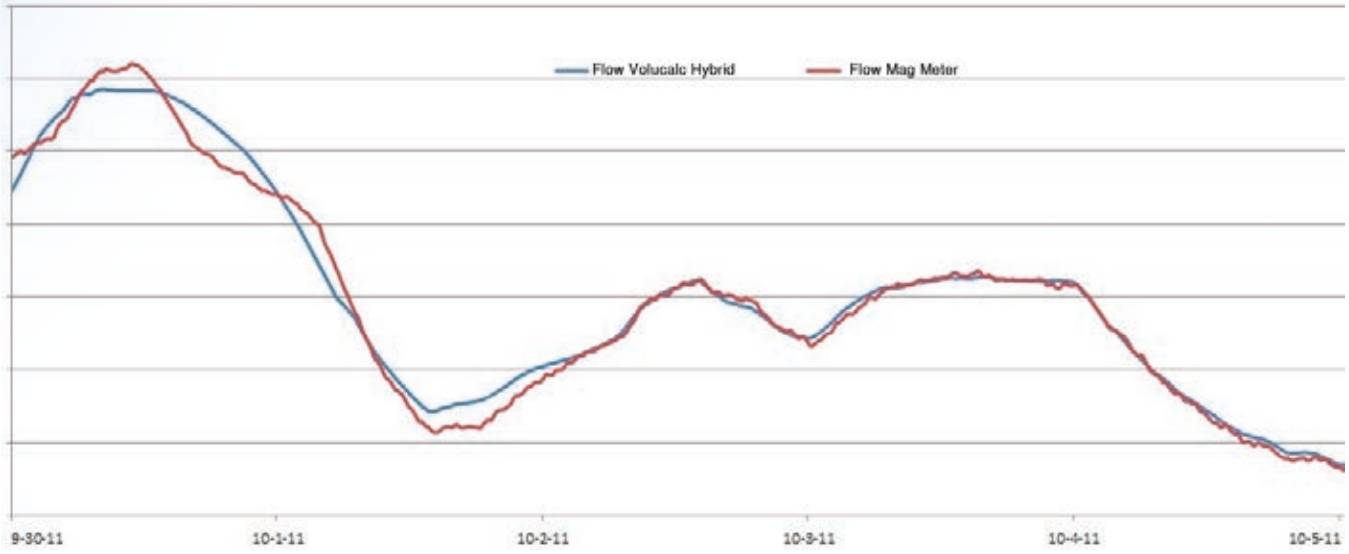
Volucalc Hybrid™

The best wastewater pump station monitoring solution for up to 4 variable speed pumps.



- The Volucalc Hybrid uses calibrated pump curves to derive the flow rate.
- It uses the pump's RPMs from VFDs analog outputs.
- A pump curve calibration is required to maximize the accuracy.
- A 4-20mA analog output is adjusted proportionally to the flow.
- It can generate volumetric pulses (relay contact).
- Without the optional Watt Meter, in lift stations with 3 pumps or less, Volucalc Hybrid uses current sensors to evaluate the electrical energy used for each pumping condition in order to calculate the efficiency of the pumps.
- With the Watt Meter, Volucalc Hybrid calculates precisely the efficiency of each pump.
- Daily pump efficiency in reports is used to detect abnormal events and crosscheck pump curves.
- Multiple alarm types displayed and remotely emailed or texted through MaidMaps Scada.
- Integrates the most advanced volumetric flow algorithm to help in the calibration of the pump curves.
- The optional MerMaid lift station analysis software allows one second high resolution graphic reports.
- Fits any control panel: small compact flow meter measuring 6 x 4 x 2.2 inches.
- Abnormal event detection with relay output:
  - Energy (high variation in electrical consumption)
  - ON & OFF times (short pump start or stops)
  - Level related anomalies
- Communication options: Cellular modem, WiFi Modem, Spread Spectrum Radio and wired to Internet.
- HTML reports downloaded to USB thumb drive or remotely.
- RS485 port and Ethernet port for MODBUS data access.
- Integrated open channel flow formulas to calculate volume lost during SSO events.
- Internal battery charger for external battery to keep the level sensor and communication equipment powered during power failure.

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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					
	Energy Efficiency	Efficiency Lost	Wasted GHG	Money lost	Use of Station	Minimum Level	Maximum Level	Rain	Total Volume	Average Inflow	Minimum		Maximum	
											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			3,88	1,22	3,89	0	99841,5				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:	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

Date	Pump 1						
	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
4			00:30:44	68,12	49283,37		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:	1562	23:28:22	18:44:23	66,14	1562638,12	1,76	1453,94

Date	Pump 2						
	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	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	63,84	47821,74		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						
	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	
4		00:00:00	0	N/A	0		
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		

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 (next page).	
MLWIFIPICO	WiFi interface module provides 360° coverage at a range of up to 500 m (1640 ft.)	
MLPSVL	Force main pressure gauge 100 PS1 Pressure sensor	
MLPSCABLE-FT	Cable length required for MLPSVL	
MLRG	Rain gauge US National Weather Services approved. 0.01" (0.0254 mm) per pulse	
MLENCHMD-TR	NEMA 4X enclosure 10 x 8 x 4 inches with transparent cover (-TR) or opaque cover (-GR) (Instrument, battery, cellular modem and pass-through fittings not included)	

Part Number	Description
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 motors or electrical equipment)
 	
MLWM600Y
(for 3 phases 600 volts motors or electrical equipment)
 	
MLWM240D
(for 1 phase 240 Volts motors or electrical equipment)
 	
MLWM208Y
(for 1 phase 120 Volts motors 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 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.
	Measurements:
	• Phase A, B, C, and sum of all phases
	  • True RMS Power: Watts
	  • Reactive Power: VARs
	  • Power Factor
	  • True RMS Energy: Kilo-Watthours 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

MLSOFTM1 (1 license) **MLSOFTM5** (5 licenses) (Included with MaidMaps Plus)	**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 of 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 

MaidMaps SCADA

MaidMaps Plus MLMAPS-1 MLMAPS-3 MLMAPS-5	**MaidMaps *Plus*** Web interface with 1, 3 or 5 years access per unit (MerMaid Software included). • Uses Web browsers for real time monitoring, advanced studies and reports. • To remotely set up and retrieve data from any number of Maid Labs devices using an Ethernet, Wifi or cellular connection. The following instruments are compatible with MaidMaps • Maximum data retention period of the MaidMaps Free version is 2 months, but all data can be downloaded for backup **Features of the paid version:** • Changing setups remotely, • Email and SMS notifications, • Automatic firmware upgrade, • Free technical support, • Free MerMaid software, • 12-month data retention, • Unlimited number of users, • Export to Excel and PDF, • Free modem (with 3-year contract), • Cellular service.
With Cellular access MLM2MDATA-1 MLM2MDATA-3 MLM2MDATA-5	
Cellular Activation MLCELDATA-ACT	

The Unlimited number of Maid Labs instruments are remotely viewed on a highly detailed Web map. The data update frequency is based on individual instrument setup and cellular service costs. Changing displayed data types or accessing graphs is usually only 2 mouse clicks away.

The default data retention period of the Free version is 2 months, but 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. Accessing the alarm registry and acknowledging it is also 2 clicks away.

Comparative chart

Feature	Free	Plus
MerMaid wastewater pump station diagnostic software		●
Dual backup servers	●	●
Data retention (months)	2	12
One second data resolution		◆
Number of users	1	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		■
Free technical support by Maid Labs		●
Cellular services		●
Free Modem (with 3 year plan)		●

◆ = Part of MerMaid
■ = MaidMaps Plus and MerMaid have variations of this feature.

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

Number of pumps	Pumps' type	Number of current sensors required	Specify
1, 2, 3 or 4	Variable	1 per pump	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
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 lenght must be specified.*

	Part number	Range	Description	Cable Length
Ultrasonic	**MLUS-6M**	6 m / 19.7 ft	Ultrasonic level sensor (deadband 0.6 m / 2 ft)	_____ ft
Pressure	**MLPLR**	Adjustable	Level pressure sensor for wastewater lift station	_____ ft

Communication	Part number	Service	Description
Cellular	**MLCELETH**	By Maid Labs	Cellular modem with Ethernet port
Wifi	**MLWIFIPICO**		WiFi interface module
Others	Volucalc Hybrid 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
NEMA4X enclosure	**MLENCHMD-TR**	With transparent cover (-TR), with opaque cover (-GR)
Front panel door bracket	**MLSUPPANEL**	Brackets to fix Volucalc on panel door
DIN Rail brackets	**MLSUPDIN**	Brackets to fix Volucalc on Din Rail

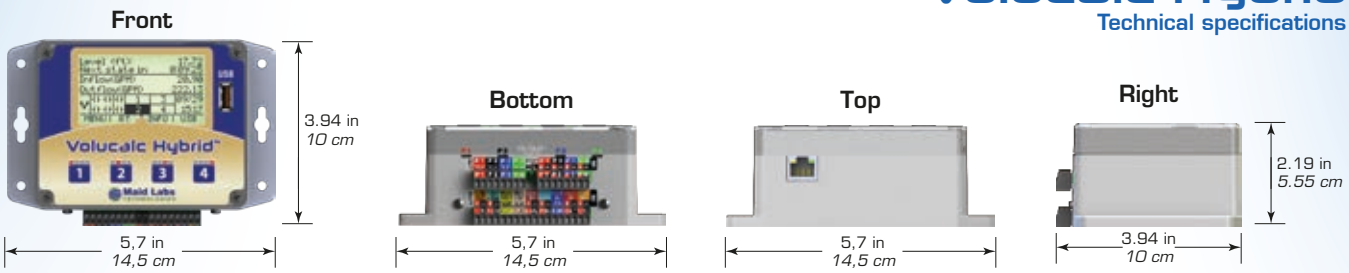
Watt Meter (select model based on electrical service types. Call Maid Labs if your application is not listed)

Electrical service types	Part number	Vac Line to Neutral	Vac Line to Line	Neutral Required	Comments
Single-Phase 120V with neutral Single-Phase 3-Wire 120/240V 3-Phase 4-Wire Wye 120/208V	**MLWM208Y**	120	208-240	YES	Mostly for 1 phase 120 Volts pumps
Single-Phase 347V with neutral 3-Phase 4-Wire Wye 347/600V	**MLWM600Y**	347	600	YES	Common in Canada
Single-Phase 208V (No neutral) Single-Phase 240V (No neutral) Single-Phase 3-Wire 120/240V 3-Phase 3-Wire Delta 208V–240V (No neutral) 3-Phase 4-Wire Wye 120/208V	**MLWM240D**	N/A	208-240	NO	Mostly for 1 phase 240 Volts pumps
3-Phase 3-Wire Delta 480V (No neutral) 3-Phase 4-Wire Wye 277/480V	**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
For pumps between .5 HP and 20 HP	**MLHACT25**	25 Amps	Current sensor 25 Amps
For pumps between 20 HP and 80 HP	**MLHACT100**	100 Amps	Current sensor 100 Amps
For pumps between 80 HP and 200 HP	**MLHACT250**	250 Amps	Current sensor 250 Amps

Volucalc Hybrid™
Technical specifications



Name and Item No.	Volucalc Hybrid MLVC
Product type	• Variable speed pump flow meter, • 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 behaviours, time and volume of overflow, annual operational cost in $. With Watt Meter option: Voltage per phase, current per phase for each pump, power factor, True RMS power (watt), frequency, VA (apparent power), VAR (reactive power)
Variable speed pump flow accuracy	Between ± 20 % (badly calibrated) to 3 % (properly calibrated). Accuracy is directly proportional to the quality of the calibration done at the station.
Volumetric flow accuracy (normal operation)	± 1.5 % for most lift station with inlet above pump operating levels. Volumetric is 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: • 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 • Lookup table.
Digital inputs	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. ± 0.1 %.
Outputs	6 x dry contacts 1 x 4-20mA output self-powered.
Alarms detected and displayed Action taken when alarms: Relay activation. With MaidMaps: email, SMS, colour changes on geographic 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 while pumps are not in operation).
Temperature	± 3°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 required 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. (14.5 cm) x (9.9 cm) 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, MerMaid diagnostic software, Watt Meter
Warranty	3 years, parts and labor
MaidMaps functions	Email, SMS, geographic map displays pump operation, report download

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