MerMaid

Recorder User Guide

Municipal and Industrial Motor Event Recorder

The Mermaid electrical data logger is a small AC and battery powered data logger able to monitor single or 3 phases for up to 3 motors, plus 4 digital and one analog input. It reads every input 10 times per second. A reading is recorded when its value has changed. For most lift stations the data logger will record up to one month of data before the newest data roles over the oldest. Each motor input can be used to record frequency, current or voltage. MerMaid is perfect for preventive maintenance and troubleshooting electrical equipment. The Maid Labs software will indicate which motor/pump has electrical of mechanical issues and the extent of those issues. The MerMaid system can also provide flow analysis, pumping efficiencies and lift station performance.

MERMAID *MLMMD* USER GUIDE

INTRODUCTION

This manual explains the functions and specifications of the **MLMMD** data logger from Maid Labs.

The features are:

- Small volume: 171.4mm x 98.7mm x 64.7mm (6.75in x 3.9in x 2.55in)
- DIN rail or panel mount installation
- Works on 2 C type batteries (alkaline or rechargeable)
- Up to 2 weeks power on batteries
- External AC power supply input
- RS-232 (and optional Ethernet and Wifi)
- 3 motors 3 phases inputs
- Multiple current clamps range
- Motor inputs can be 9 analog (which can be used with optional modules to record 4-20mA, 0-5VDC, 0-10VDC and 0-24VDC)
- Input sampling is 10bits
- Internal temperature sensor
- 1 0-5volt or 4-20mA analog input (software selected)
- 4 dry contact digital inputs
    - 1 for rain gauge or pulse output device
    - 3 other standard digital inputs
- 1 relay output that is alarm triggered
- 17 LED's indicating the input-output state
- 4 MB flash memory for events
- Programmable through RS-232 port
- Backup power when changing batteries
- Automatic RS-232 communication detection
- Pluggable terminal block connections

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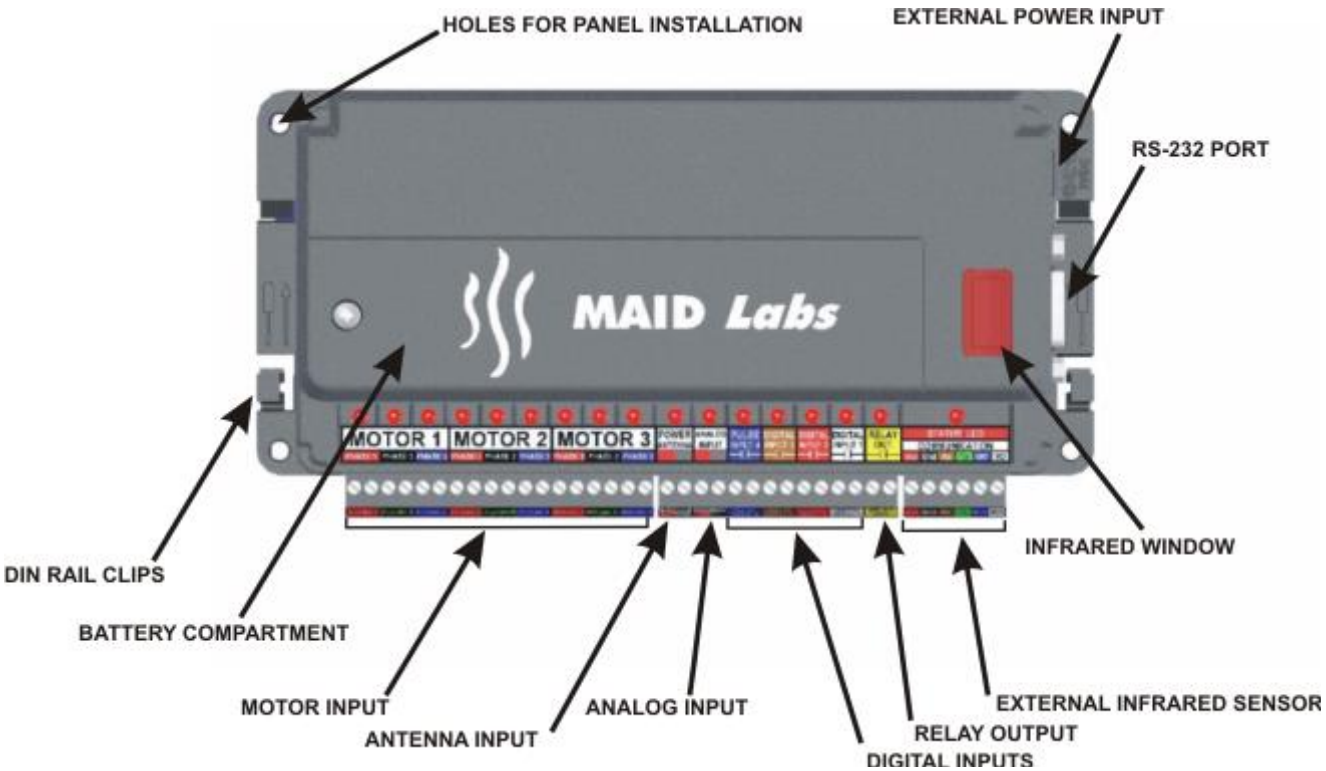
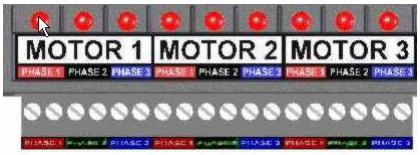


1. MOTOR INPUTS



The motor inputs accepts up to 9 current clamps of different range (figure 1). The **MOTOR 3** input can be used for voltage or power sensing through the MLPT600 600V potential transformer. These inputs can be analog too with a special adapter that converts 0-5V (MLAI05V), 0-10V (MLAI10V), 0-24V (MLAI24V) and 4-20mA (MLAI420A). The motor inputs accept AC or DC. The AC signal must be sinusoidal in nature for the RMS conversion to be exact. The input is limited to 1.5Vrms full scale or 1.36VDC for DC signals. There is no configuration in the data logger. It is configured in the Maid Labs software. All the current clamps or special adapter settings are configured this way. The data logger records an input 0 to 100% full scale and transfers that information to the software. The motor inputs can be used to record frequencies from 20Hz to 180Hz for variable speed drive sampling.

The data logger and software requires a minimum detection level for each motor-current input. This minimum level is set at 5% of full scale. For example, if the current clamps are rated at 300 Amps, the minimum current required to be recorded is 15Amps. The logger can read values down to 2% however, the 5% minimum insures the logger will timestamp the data properly.

The frequency of each motor/pump is also monitored through the phase1current clamp input.

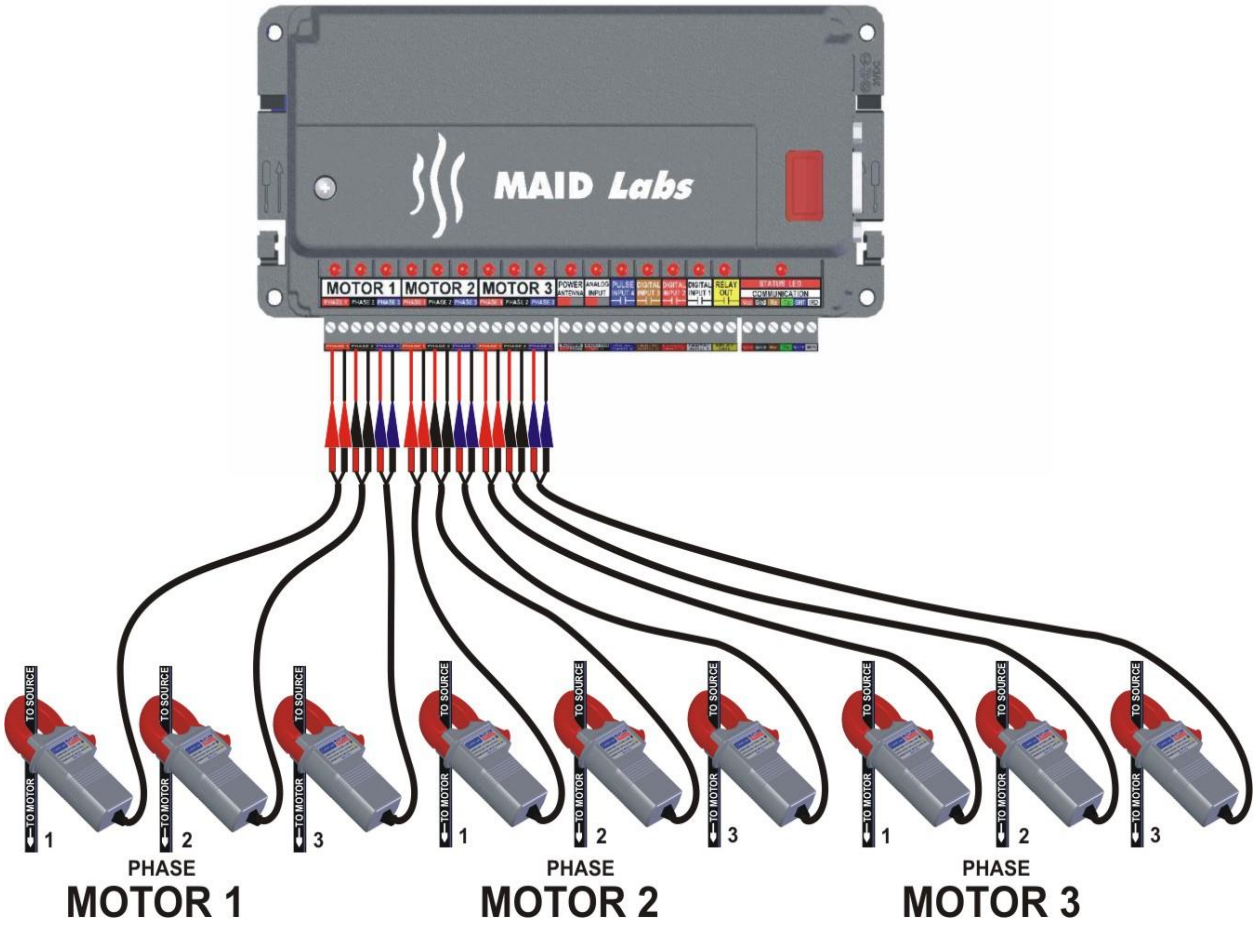


FIGURE 1: Connections for 9 current clamps

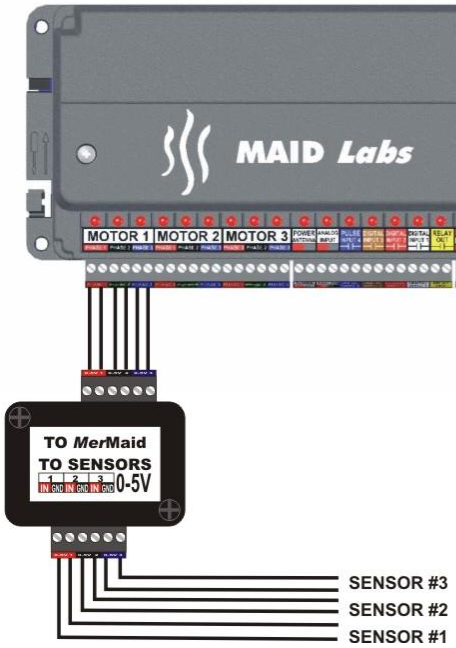


FIGURE 2: Connections for analog interface MLAIXXX

2. ANALOG INPUT

The analog input is configured for 0-5V or 4-20mA through the Palm or Maid Labs software. It is sampled at 10 bits. The positive connection is on the left of the connector with negative or ground on the right. The analog input is polarity sensitive and records only a positive signal. The input includes overvoltage protection if the input is connected improperly. A wiring example is shown in figure 3. The 24V power supply is for this example only. The user can have another voltage supplying this loop.

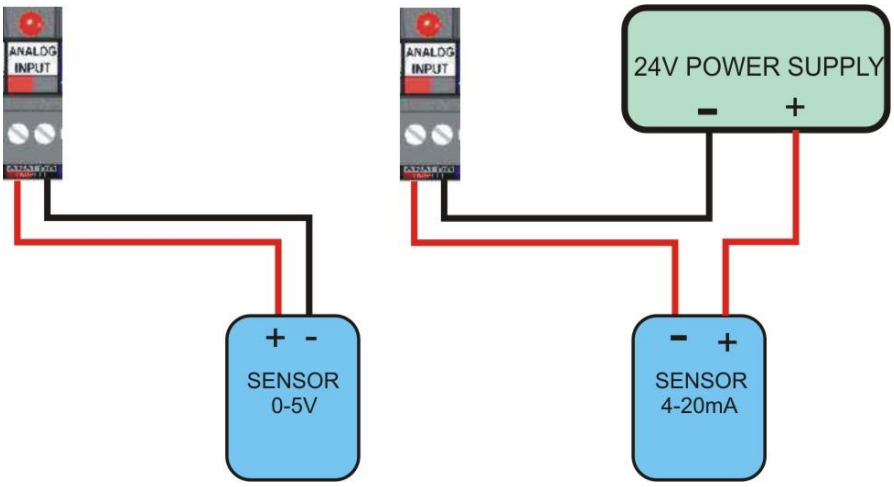


FIGURE 3: Analog input wiring example

3. DIGITAL INPUT 4 (PULSE)

This input is used to sample instruments with a pulse output. It can be a rain gauge or a flow meter, for example. The positive connection is on the left of the connector with negative or ground on the right. The sampling rate has limitations for this input. The pulse rate must not be less than 2 seconds to be recorded. If the pulse rate is less than 2 seconds the input maynot be recorded and could be missed completely. The input level is 0-5V (TTL) or dry contact , reference (figure 4). The signal recorded is triggered by the falling edge of a dry contact (figure 5).

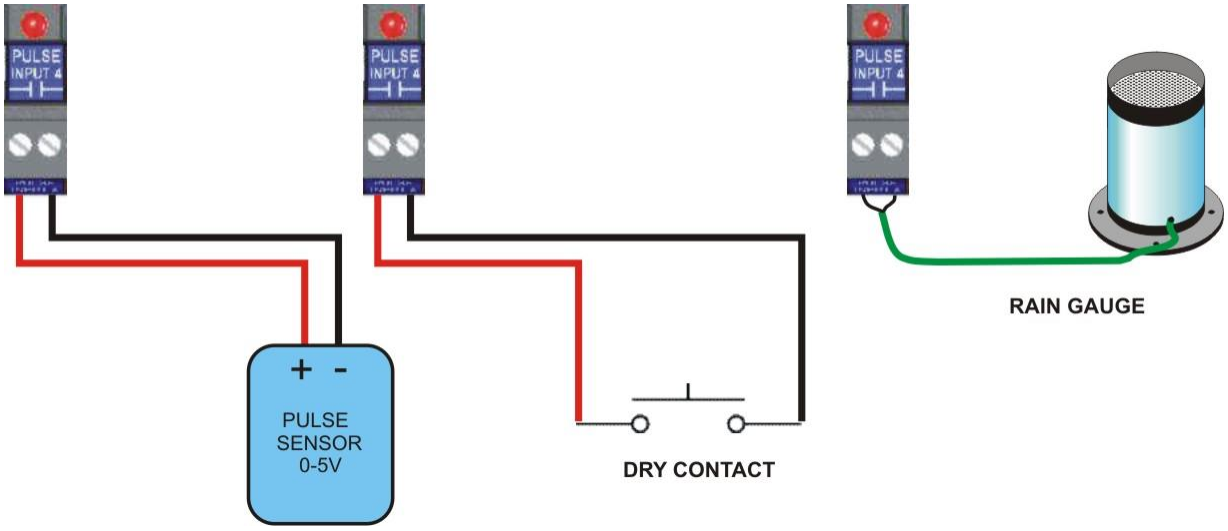


FIGURE 4: Digital input 4 connection example

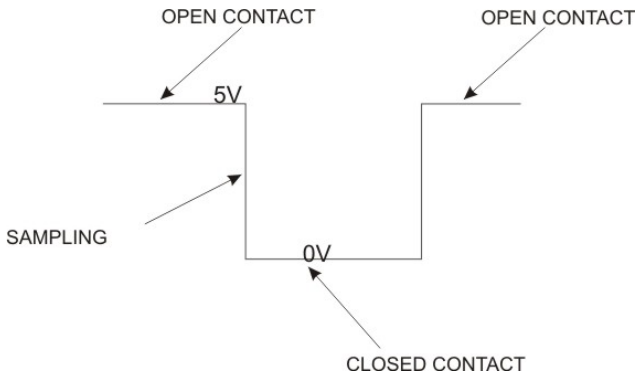
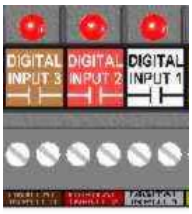


FIGURE 5: Sampling for digital input 4

4. DIGITAL INPUT 1, 2 AND 3



Digital inputs 1, 2 and 3 are 0-5V (TTL) level types. They can accept a dry contact similar to the digital input 4. The wiring is the same as the digital input 4 (figure 4)however, the input sampling is recorded on the rising and falling edge of the input signal (figure 6). For a dry contact, the closure and the opening of the contact is going to be recorded.

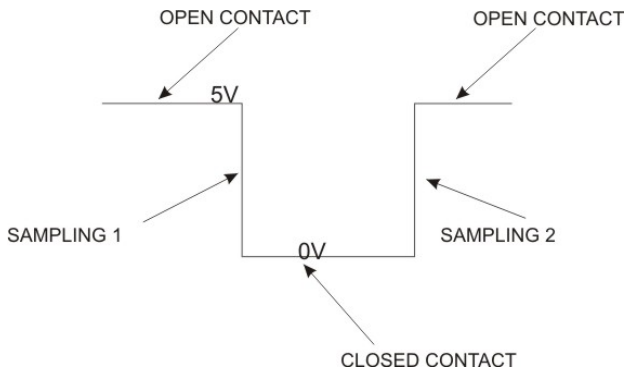


FIGURE 6: Sampling for input 1, 2 and 3

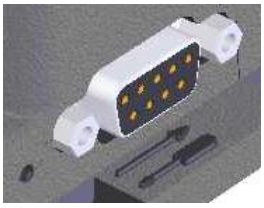
5. RELAY OUTPUT

The relay output is for alarm triggering purpose. It may be used to activate an external alarm device in a panel, for example. This alarm is configured by the Palm or Maid Labs software. The alarm output choices are:

-High current
-Low frequency
-High frequency
-Low batteries
-No communication
-Unbalanced phases
-Temperature
-Analog input

In most of these alarms there are other configuration settings for the level and duration of the alarm (see Mermaid Palm or Maid Labs Software manual for addition information). The relay output can be used to control a signal or indicate a condition. The output is limited to 0.5A @125Vac. The relay will latch and will stay latched after power is removed from the data logger.

6. RS-232 PORT



This RS-232 port is used for communicate with the Maid Labs software. Recommended port settings for the computer are set to COM1 (which is the default mode for that port). The length of the RS-232 cable supplied with the data logger is 6 feet (1.8 meters). Review the Maid Labs software manual for additional port settings information.

7. EXTERNAL POWER INPUT

The AC adapter plugs into the external power input jack. The **MLPS1** power supply comes standard with the MerMaid data logger. The MLPS1 supplies 3.3VDC @ 2A. All external power supplies must be approved by **Maid Labs**. The switching between external and internal power is done automatically inside the unit. The data logger will switch to internal power if the external supply fails or drops below 2 volts. This event would be recorded as a power failure.

FIGURE 9: External power supply MLPS1

8. BATTERY POWER

The data logger is powered with 2 industrial C type batteries (figure 10). These batteries should be alkaline or rechargeable. It is not recommended to use regular (carbon-zinc) batteries because the lower battery life. The recommended rechargeable batteries are nickel-cadmium (NiCad) or nickel-metal hybrid (NiMH) types. There is a control switch inside the battery compartment to select alkaline or rechargeable (figure 11). The user can take a small screwdriver, or pen, to switch between the two. The left position is for alkaline and the right for rechargeable (figure 12). The data logger is shipped with the battery switch set to the alkaline position as default.

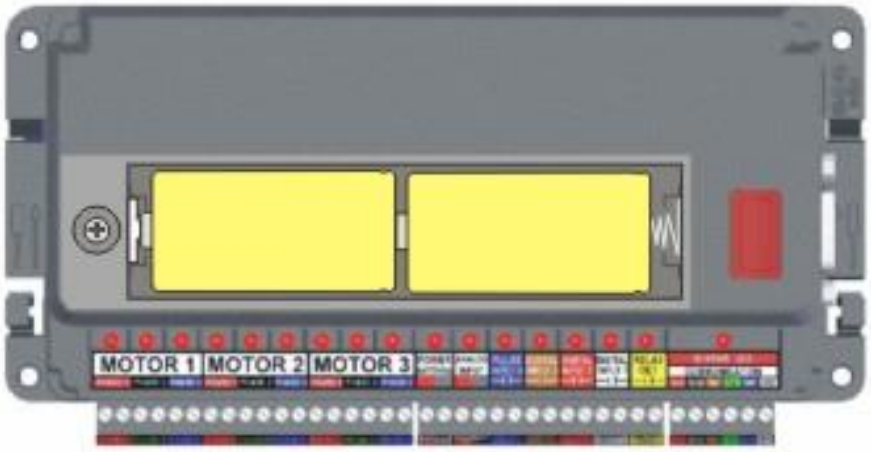


FIGURE 10: Battery compartment view

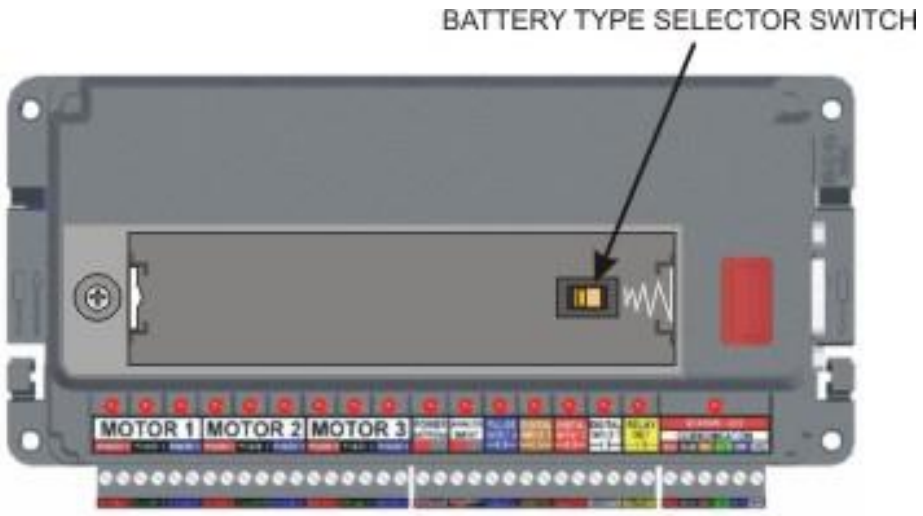


FIGURE 11: Battery switch

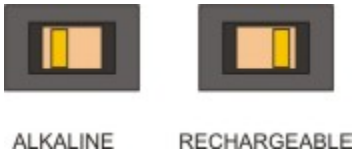


FIGURE 12: Battery selection

Rechargeable batteries are charged automatically when the switch is set to **rechargeable**. The AC power adapter must to be plugged into the external power plug and will take up to 15hres if the batteries are completely empty. The charging and discharge rates are different for rechargeable batteries. The NiCad batteries have a "memory" effect which is due to a partial discharge and recharge cycle that degrades the internal structure of the battery electrode. If that occurs, the capacity of the battery is going to be greatly reduced. The NiMH batteries are not subject to this degrading effect and have a power capacity that is 2 to 3 times greater than the NiCad's. The Mermaid data logger doesn't take into account the type of rechargeable batteries being used. Therefor the user must monitor the batteries to insure a full charge.

The batteries must be an industrial type to provide a good temperature range. The data logger includes reverse battery protection and will not function if the batteries are inserted incorrectly.

The data logger's minimum voltage range is 1.8Vdc and will not continue to operate below this level. Batteries must be replaced or recharge when the voltage drops to 2.0Vdc to insure proper battery backup to the AC supply.

When the MerMaid does not have AC power available or needs to operate solely on batteries, the fresh batteries will power the logger for approximately 21 days (± 2 days). The data will be stored in non-volatile memory however, if the battery voltage drops to 1.8 volts and powers off, the memory may become corrupted. The MerMaid data logger was designed to utilize AC power as the primary source for normal operations.

- **Battery replacement**

Alkaline batteries should be replaced when the voltage has dropped to 2.0Vdc and should always be replaced with fresh or fully charged batteries. The voltage level can be viewed in the Maid Labs software while connected to the data logger (refer to Maid Labs software manual).or with a volt-meter.

Note: Remove batteries when not in use. Batteries installed in the logger, will continue to discharge without the AC power adapter attached.

Rechargeable batteries must be fully charged before the logger is deployed. If the batteries have been offline for a while, the battery changing circuit will activate when external power is supply is attached. The time required is different depending on type and voltage level of the rechargeable batteries. When new or recharged batteries are installed and/or the AC adapter is plugged in, the **STATUS LED** will flash rapidly indicating a capacitor recharge condition. This operation can take about 5 minutes. When the charge cycle is completed the **STATUS LED** will flash every 2 seconds indicating a normal condition.

Note: When first powering the logger use the AC adapter to keep from depleting the battery voltage.

9. LED's

There are 17 LED's that indicates the input and output status of the data logger. The LED's are configured in the Palm or Maid Labs software to display the following LED display mode:

- Always off
- Active inputs
- Active inputs – After recent communications
- Active inputs – For next 8 hours
- Active inputs – Only when power supply is used

When a input is activated, the LED corresponding to that input will flash on at 2 seconds interval indicating the sampling period. The LED's will flash continuously while the serial (RS-232) port is connected.

Note: The LED's are a good visual indicator but, the battery current consumption is high. Do not activate the LED's when the batteries are the only power source.

10. FIRMWARE UPDATE

The data logger firmware can be updated by the user. This is done through the Maid Labs software with the "**Upgrade Device Firmware"** command located in the "Tools" section. The upgrade is done through the RS-232 port with the most recent version of Maid Labs software. When the download to the instrument is active, the **STATUS LED** will flash rapidly to indicate the update. The operation will take about 3 minutes and is over when the led stops flashing.

CAUTION: Do not attempt to update the firmware without AC power and fresh batteries installed.

11. CURRENT CLAMPS (CT's)

The MerMaid data logger supports a wide range of current clamps from 5 to 1500 Amps. First determine the type of study (hydraulic or motor/pump analysis) to be performed. For hydraulic or flow studies the logger only needs a single current clamp on phase-one of the motor/pump input. To analysis 3 phase motor/pump or lift station performance three current clamps (-KIT) per motor/pump are required for each input.

Note: Single phase motors or pumps only require the single current clamps for flow or station performance studies.

MLCT05-15-75
Selectable mini-clamp sensor with current ranges of 5, 15 and 75 Amp.

MLCT05-15-75KIT
Same as above, except (3) three current clamps per motor/pump input connector.

The MLCT5-15-75 are selectable and calibrated ±1% for each current selection. This series is used for small (fractional to 30hp) motors/pumps.

MLCT150 - Single phase, 150 Amp clamp-on current sensor.

MLCT150KIT - 3 phase, 150 Amp clamp-on current sensors
The MLCT150 can be used to record current values from 7.5 to 150Amps. This series is used on small to medium (15 to 85hp) motor/pumps.

MLCT300 – Single phase, 300 Amp clamp-on current sensor (same style as above).

MLCT300KIT – 3 phase 300 Amp clamp-on current sensors (same style as above).

The MLCT300 series records current values from 30 to 300Amps and can be used on medium to large (30 to 150hp) motor/pumps.

MLCT1500 - Precision 1500A current clamp.

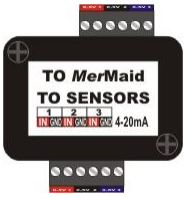
The MLCT1500 precision current clamps record current from 30 to 1500Amps and are use on large 100 to 800hp motor/pumps. Note, the MLCT1500 is not a clamp-on style CT and must be installed be a certified electrician.

Important: CAUTION, HIGH VOLTAGE. Please use the appropriate precautions when installing or removing any monitoring equipment.

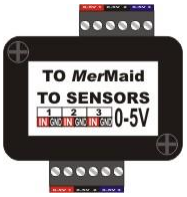
12. SENSORS

These sensors are used to interface different signals to a format acceptable for the data logger inputs. The models are:

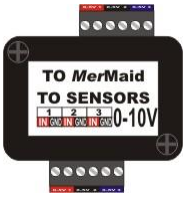
- **ANALOG INTERFACE**



MLAI420A - converts 4-20mA current loops for Mermaid motor inputs.



MLAI05V - converts 0-5V voltage for Mermaid motor inputs.



MLAI10V - converts 0-10V voltage for Mermaid motor inputs.

The user must respect the polarity of the connections on the data logger. All the ground (GND) terminals are connected together in the unit and must be connected to the common ground terminal of the sensor supplying the signal. An example of connections with this adapter is shown in figure 16.

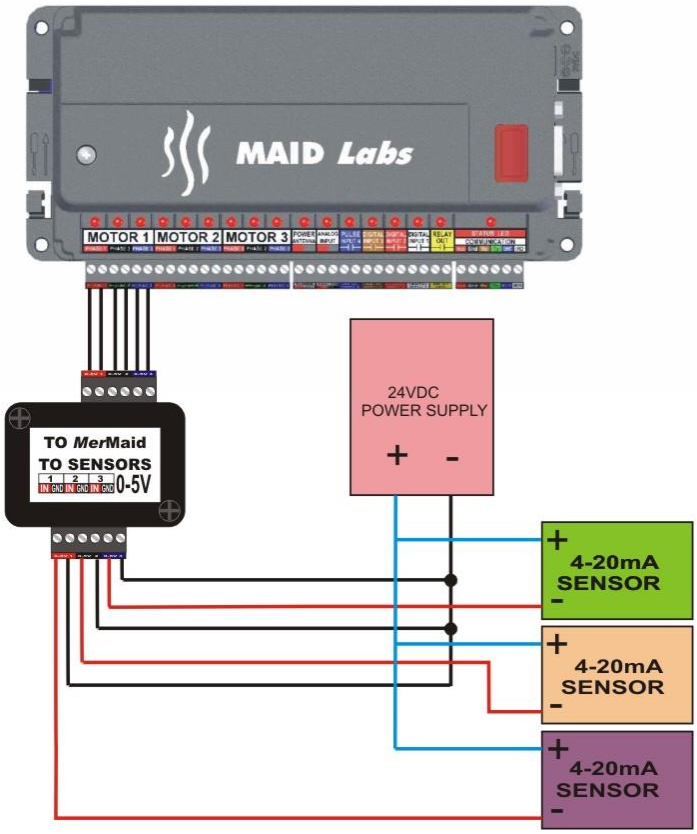


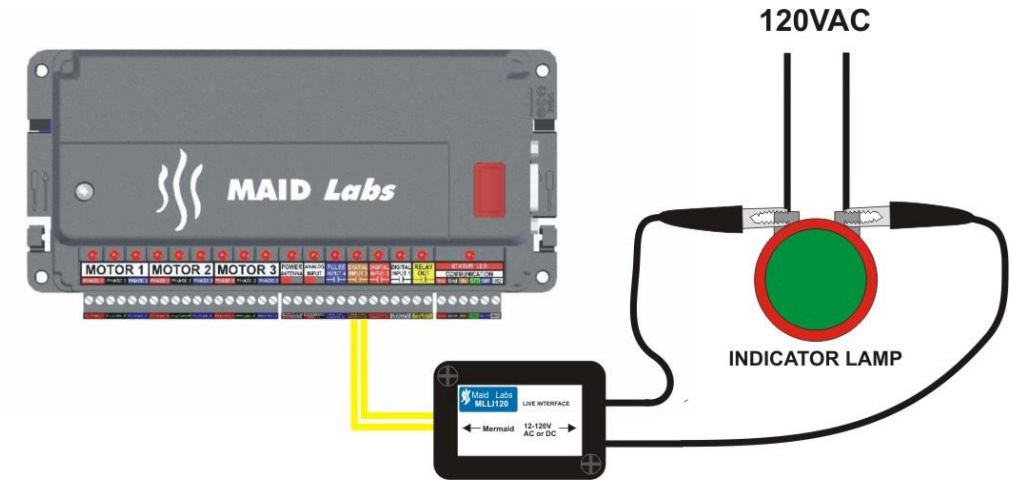
FIGURE 16: MLAI420A connection example

- **LIVE INTERFACE**

MLLI120

This sensor is a live interface that the user can input with a 12V to 120V AC or DC signal that is going to be converted to an electronic switch closing when that voltage is present. It simulates a dry contact on the data logger side. The unit is completely isolated from the signal it samples. There is no polarity at the input or the output of the unit. This interface can be used, for example, to monitor a panel alarm light (figure 17). Even if the light is defective, the unit should work.

FIGURE 17: MLLI120 connection example



- **STEP-DOWN VOLTAGE TRANSFORMER**

MLPT600 - is a step-down transformer designed to converts 3 phase 670VAC voltage to 1.5VAC signal acceptable for the data logger motor input. This used to monitor and record the motor/pump supply voltage continuously in the logger. The MLPT600 connects to "Motor 3/Volts" input of the data logger and is fuse protected. The input wiring harness are either Wye (phase to ground) or Delta (phase to phase) depending on the panels electrical layout. If the motor 3 input is use to monitor a pump for triplex stations, simply sample the voltage with a multi-meter and insert the voltage in the MAID Labs software station file.

13. INSTALLATION

The data `logger can be installed on a standard DIN rail as in figure 21.

FIGURE 21: DIN rail installation of Mermaid MLMMD

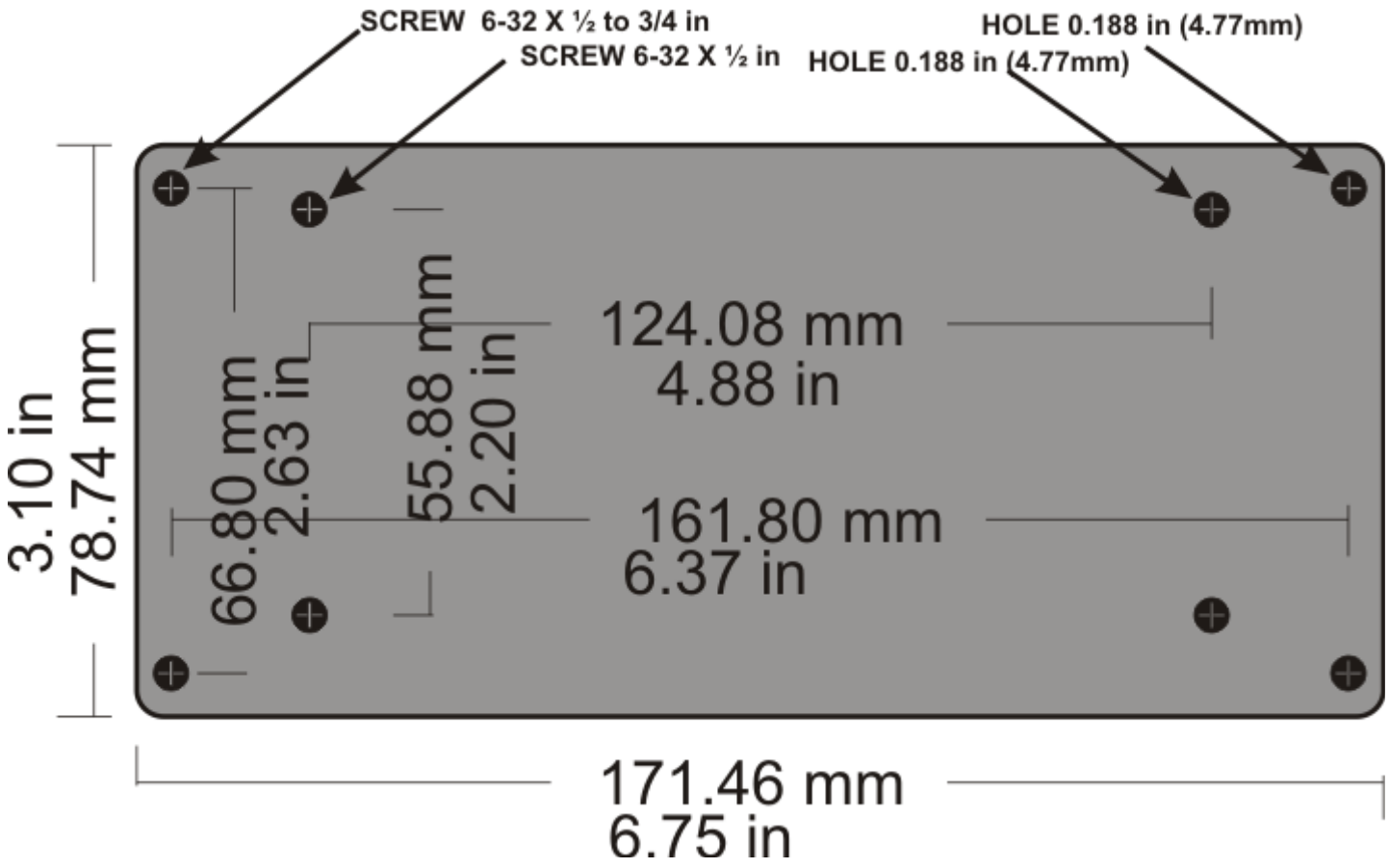
For temporary installations, install logger in a panel using 4 screws (6-32 X ¾" inches) in the 4 corner mounting holes. A drilling template is supplied in appendix 2 at the end of this document.

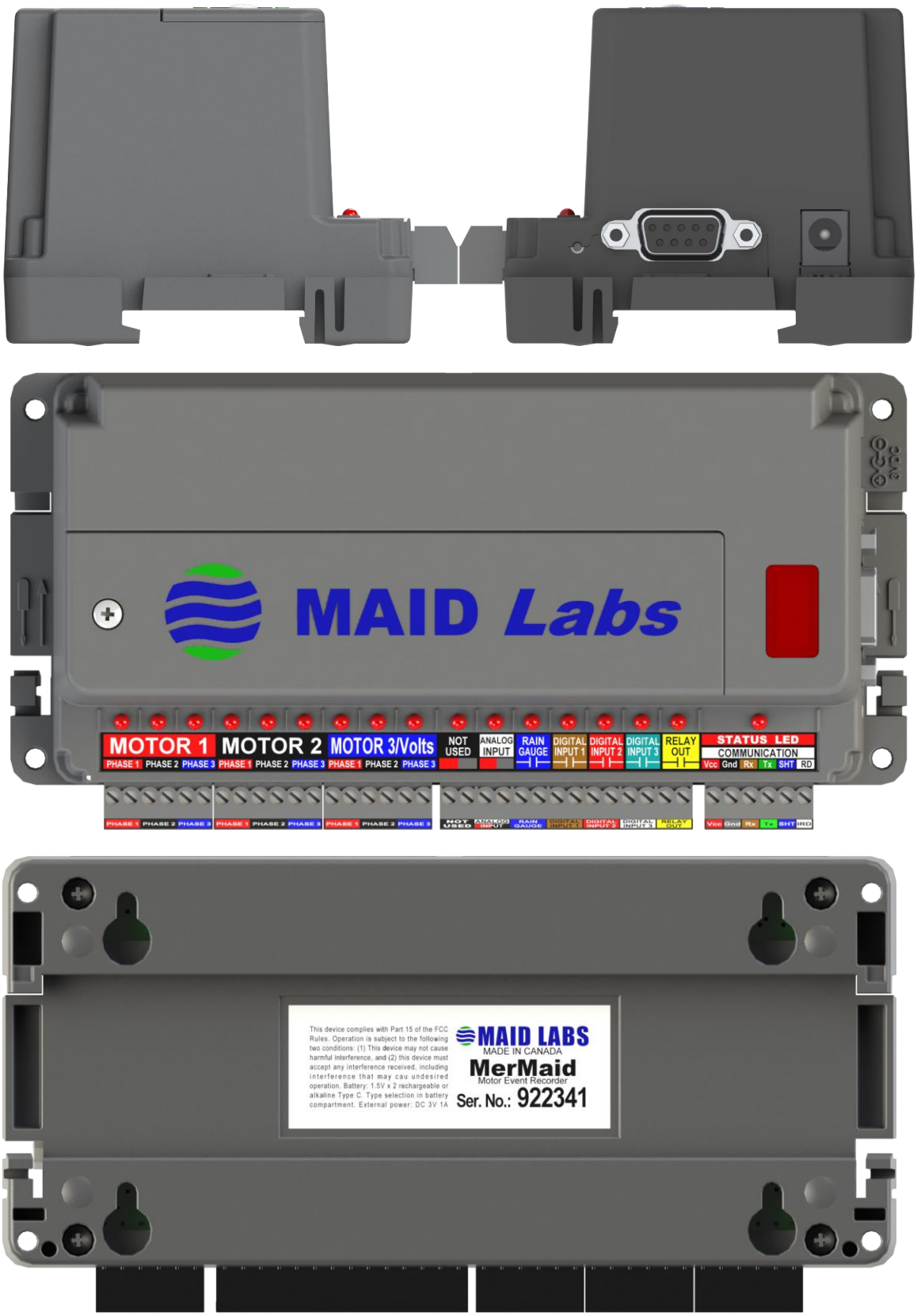
Important: CAUTION, HIGH VOLTAGE IS ANY VOLTAGE OVER 600 VAC, and may be resent within the "Motor Control Center" (MCC) electrical panel. Please use the appropriate precautions when installing or removing any monitoring equipment.

TECHNICAL SPECIFICATIONS

MerMaid Datalogger	
Size HxWxD	3 x 2.5 x 6.75 in. (8x 6.5 x 17.2 cm)
Weight	1 lb (0.45 kg) including 2 C alkaline batteries
Material	Polyphenylene oxide
Power	2 type C alkaline or rechargeable batteries (switch selectable). Battery inversion protection. 3VDC 2Amp power supply. Internal power source backup while changing batteries.
Battery Life in Operation	Up to 2 weeks of operation. 1,000,000 reading per day and 15,000 records per day.
Storage Temperature	-40 to140°F (-40 to60°C)
Operation Temperature	0 to 140°F (-18 to 60°C)
Data Storage and Communication	
Capacity	500,000 records
Storage Mode	Rollover
Record Algorithms	All motor start, stop and digital input change of state are recorded. Current, frequency and analog input are recorded when their value change - every 0.1 seconds. Maximum of 10 events per second per input.
Program Memory	Flash memory. Firmware updated through the MerMaid's software.
Data retrieval	Direct RS-232 connection.
Data Analysis	Computer with MerMaid software: Accuracy of ±1% of totalized flow and ±5% cycle to cycle.
Input and Output	
Motor inputs	9 current / frequency transducers or clamps. Input is 10 bits sampled.
Power failure	Power supply source detection
Analog Input	1 grounded input, 10bits sampled 4 to 20 mA or 0 to 5 V, Palm selectable.
Pulse Input	1 C contact like pulse from a rain gauge. Capture = 5ms minimum @ 2 seconds period.
Digital Inputs	3 C contacts. Max. Frequency = 10Hz all inputs changing at the same time. Single pulse capture = 5ms minimum @ 1 second period.

APPENDIX 2
DRILLING TEMPLATE FOR DATALOGGER MLMMD




MAID Labs
MOTOR 1
MOTOR 2
MOTOR 3/Volts
PHASE 1 PHASE 2 PHASE 3
NOT USED
ANALOG INPUT
RAIN GAUGE
DIGITAL INPUT 1
DIGITAL INPUT 2
DIGITAL INPUT 3
RELAY OUT
STATUS LED
COMMUNICATION
Vcc Gnd Rx Tx SHT RD
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cau undesired operation. Battery: 1.5V x 2 rechargeable or alkaline Type C. Type selection in battery compartment. External power: DC 3V 1A
MAID LABS
MADE IN CANADA
MerMaid
Motor Event Recorder
Ser. No.: 922341

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