



by **ENOVATION** CONTROLS

# MURPHY **RTR** *READY TO RUN* ML1000

FOR ISUZU 4JJ1T  
& 4LE2 ENGINES



## Installation and Operations Manual

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Section 40

In order to consistently bring you the highest quality, full-featured products, we reserve the right to change our specifications and designs at any time.

**Warranty** - A limited warranty on materials and workmanship is given with this Murphy product. A copy of the warranty may be viewed or printed by going to [www.murphybynovationcontrols.com/warranty](http://www.murphybynovationcontrols.com/warranty)



ENOVATION CONTROLS has made efforts to ensure the reliability of the ML1000 and to recommend safe use practices in system applications. Please note that in any application, operation and controller failures can occur. These failures might result in full control outputs or other outputs that might cause damage to or unsafe conditions in the equipment or process connected to the ML1000.

Good engineering practices, electrical codes and insurance regulations require that you use independent external protective devices to prevent potentially dangerous or unsafe conditions. Assume that the ML1000 can fail with outputs full ON; outputs full OFF; or that other unexpected conditions can occur.

#### **BEFORE BEGINNING INSTALLATION OF THIS MURPHY PRODUCT:**

- A visual inspection of this product before installation for any damage during shipping is recommended.
- Disconnect all electrical power to the machine. Failure to disconnect all electrical power connections before welding can result in damage to the panel and/or its components.
- It is your responsibility to have a qualified technician install the unit and make sure installation confirms with local codes.
- Observe all Warnings and Cautions in each section of these instructions.
- The ML1000 is designed for use in industrial environments. There might be potential difficulties in ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbances.
- Please contact ENOVATION CONTROLS immediately if you have any questions.

**IMPORTANT! False or improper use and operation of electronic products could be dangerous. It is required that point-of-operation guarding devices be installed and maintained. All such devices must meet OSHA and ANSI Machine safety standards. The manufacturer shall not accept any responsibility for installation, application or safety of systems.**



## **WARNING**



**AUTOMATIC  
START**  
Keep hands clear  
at all times.

The ML1000 can be set as an AutoStart Controller. Please be cognizant at all times of hands and other objects that are in close proximity to the machine(s) being controlled as they may commence operation suddenly and without warning.



### LENS CLEANING PROCEDURES



The lens on the display is composed of polycarbonate materials. Use only mild soap and water to clean the lens/display window. Evidence of improper cleaning techniques or chemicals includes cracks, smear marks, scratches or fogged/hazy lenses.

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## Table of Contents

<b>Introduction.....</b>	<b>7</b>
Mounting Dimensions.....	7
Wiring.....	9
Murphy PowerCore® 10 (ML1000) .....	11
User Interface.....	13
<b>Accessing the Menu .....</b>	<b>14</b>
<b>Main Menu .....</b>	<b>14</b>
<b>Start/Stop Settings.....</b>	<b>20</b>
Single Contact Start/Stop .....	20
Two Contact Maintained Start/Stop (commonly known as Floats) .....	20
Pressure, Temperature Transducer Start/Stop .....	20
Local Start Key Start/Stop .....	20
<b>Quick-Start Setup.....</b>	<b>20</b>
Adjusting the Brightness.....	21
Setting to Mechanical Engine.....	21
Setting to J1939 Engine (Factory Default).....	21
Setting to Auto Start on a Single Contact Input.....	21
Setting to Auto Start on Local Start Key.....	21
Setting to Auto Start on Float Inputs .....	22
Setting to Auto Start on Pressure.....	22
Setting to Auto Start on Clock .....	22
Setting to Auto Start on Temperature.....	22
Setting to Run the Engine for a Fixed Period of Time .....	23
<b>Screen Examples .....</b>	<b>23</b>
Additional ML1000 Screens .....	24
Warning and Shut-down Icons .....	27
Icon Troubleshooting.....	29
<b>Menu Glossary .....</b>	<b>29</b>
System .....	29

Engine Settings .....	30
Advanced Engine Settings .....	31
Throttle Menu .....	34
Input / Output Menu .....	35
Application Configuration .....	37
Start / Stop Timers .....	40
Communication .....	41
Modbus Registers .....	42
<b>Specifications .....</b>	<b>47</b>
Electrical.....	47
Environmental .....	47
Mechanical .....	47

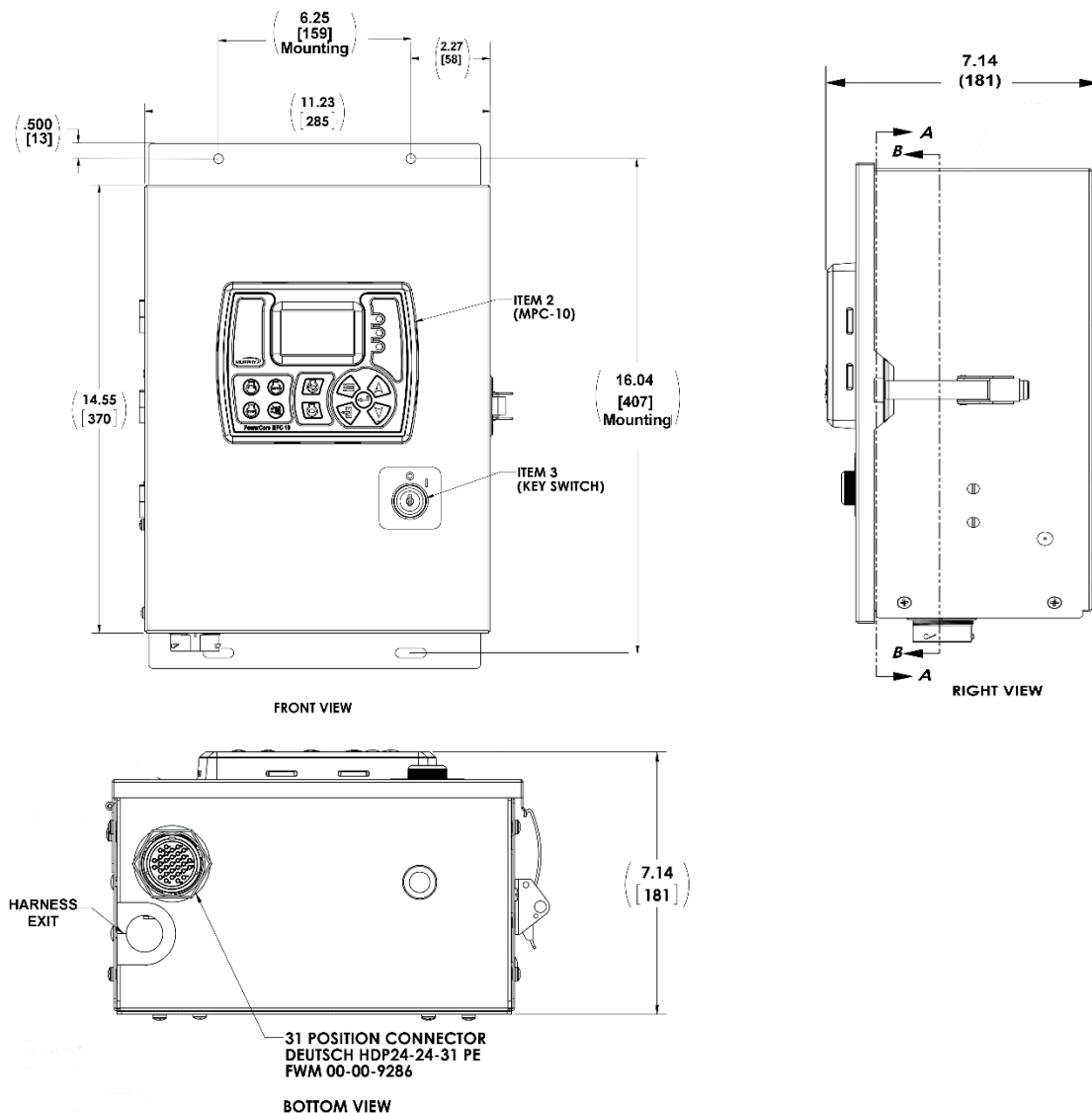
## Introduction

The Murphy Ready to Run Panel family offers users a wide range of control and monitoring solutions for Isuzu engines. The Ready to Run Panel kits allow for a number of mounting configurations. The panels come ready, right out of the box for a quick and easy installation.

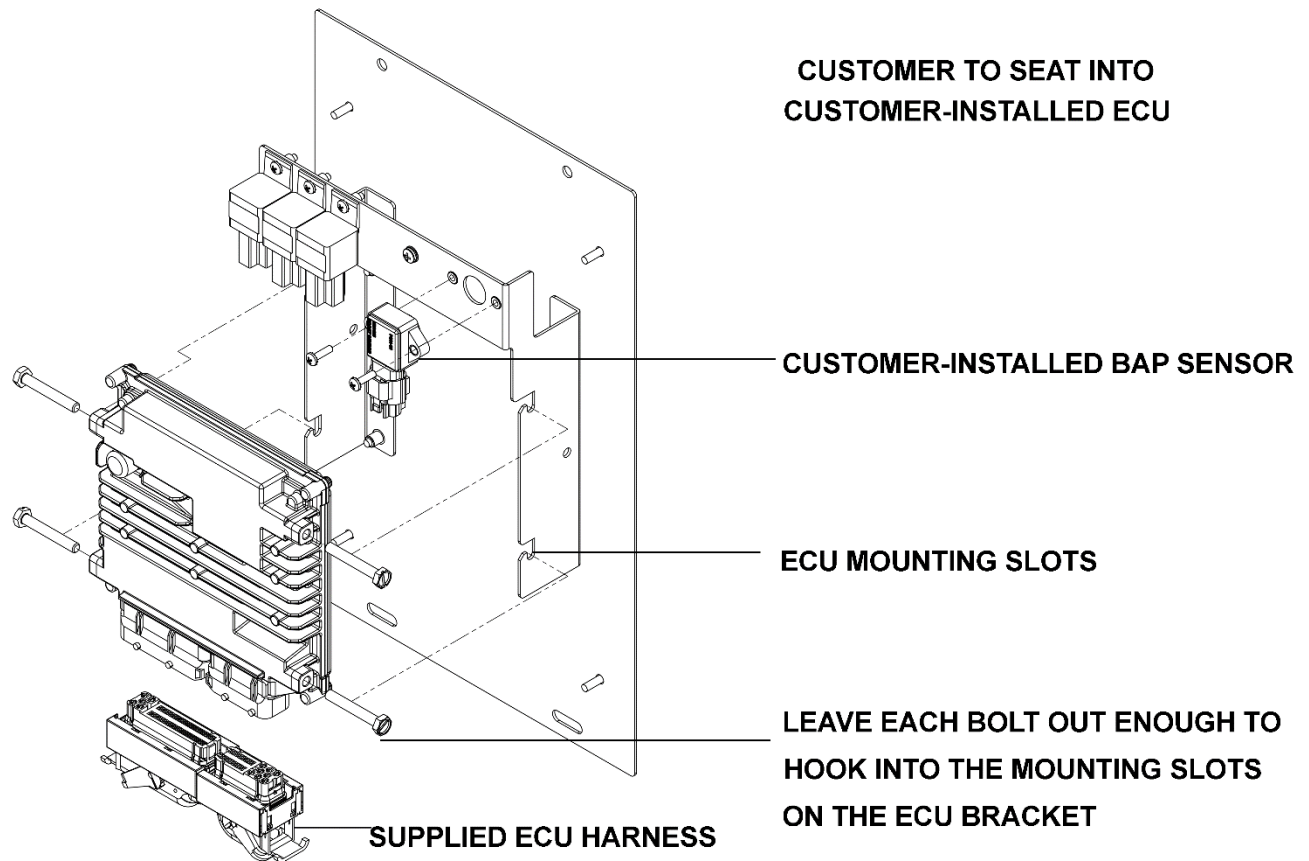
The ML1000 Panel using the PowerCore® MPC-10 Display is configurable from the controller. The features include a built-in shutdown from low oil pressure, high temperature and high speed. An additional shutdown using the included I/O can be configured. This economical auto start solution features RPM set points adjustable from the display. An optional I/O harness is available. The ML1000 can be mounted either from the front or fully enclosed within the panel.

Your kit contains a control box, protected ECU mount and engine harness. With an installation time of less than 10 minutes, it makes sense to run your new engine with a Murphy solution.

## Mounting Dimensions



## ECU Mounting (4JJ1T and 4LE2)



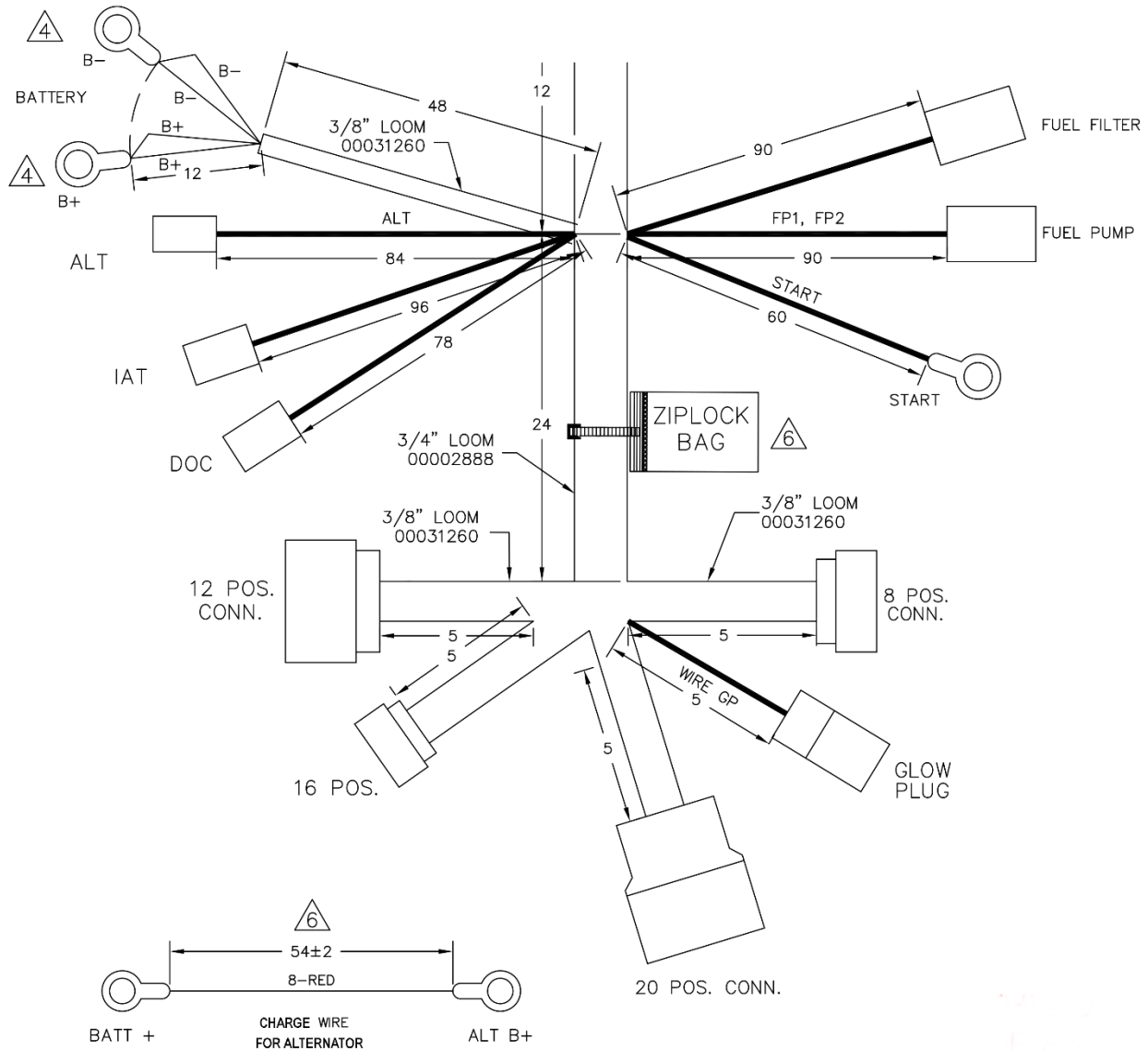
## Accessories

Description	Part Number
I/O Whip harness for ML1000 panel (10' long, 31-position connector)	40000619
I/O Connector kit (31-position connector)	78700046

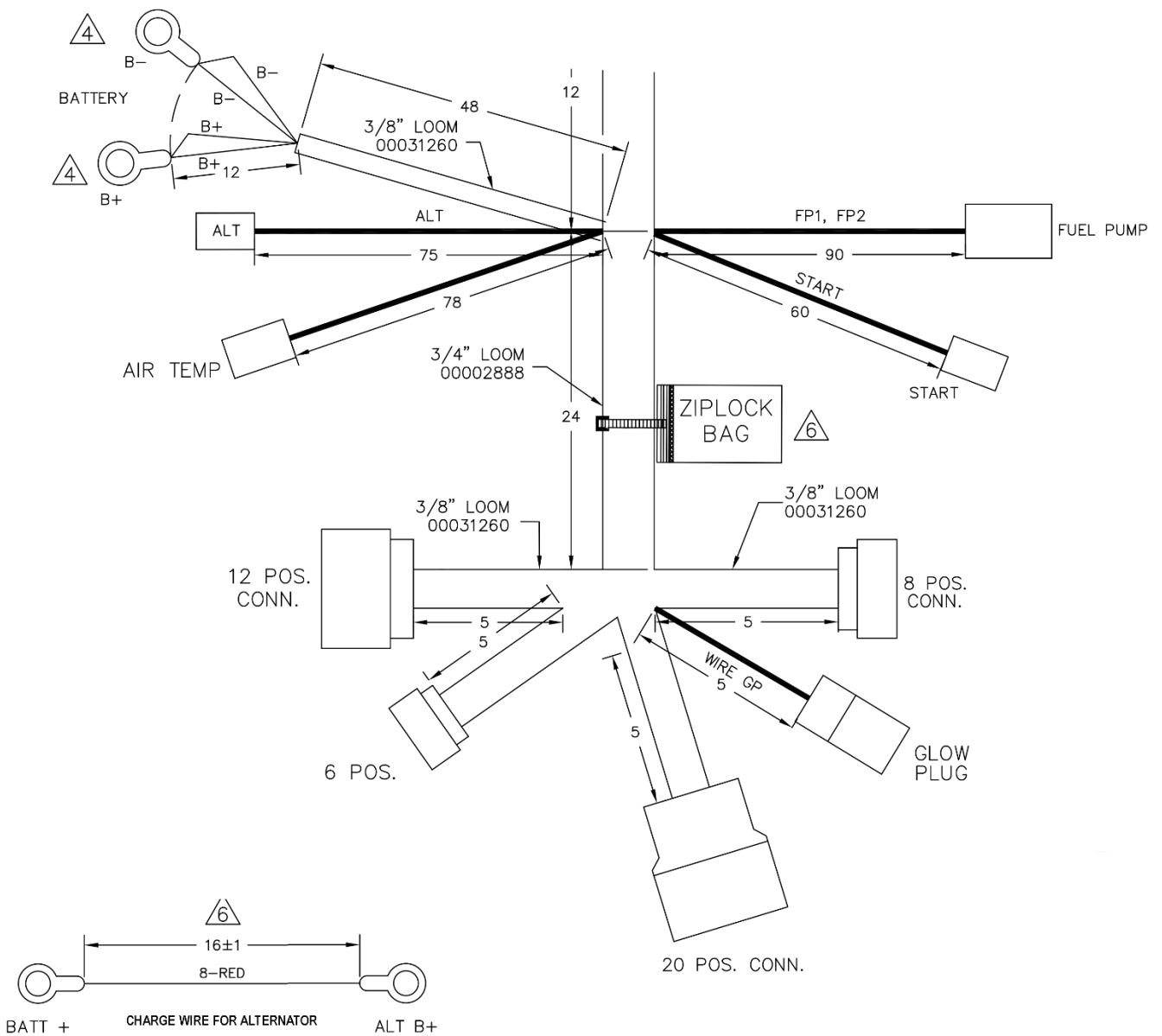


## Wiring

### 4JJ1T Harness



## 4LE2 Harness



## Murphy PowerCore® 10 (ML1000)

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The Murphy PowerCore 10 Controller (ML1000) is a general, all-purpose manual/auto start and manual/auto throttling engine controller designed with rental applications in mind. The controller is purposed primarily for applications where a wide array of inputs and outputs are not required. This is a powerful controller that supports J1939 CAN protocols for electronically governed engines as well as analog sensors on mechanical engines for fault and safety shutdowns.

The ML1000 is flexible in many aspects, with the ability to:

- use in most applications where auto start or auto throttling is required or desired;
- use the same controller on electronically governed J1939 and mechanical engines;
- use the same controller on 12VDC or 24VDC systems;
- assign multiple levels of passcode protection to the menu;
- use as auto start or manual start controller;
- use as manual throttle or auto throttle controller;
- change the input sensor type for the analog inputs;
- use analog inputs as digital ground inputs;
- assign functions and actions to digital inputs;
- use digital inputs as battery positive or ground inputs;
- be mounted in all weather environments;
- be customer mounted in panel of choice.

## Engine Application States

The ML1000 Controller follows a standard operating sequence. This operating sequence is a set of machine states that happen in a predetermined order. Machine states can be set to zero if not needed or adjusted to fit the application. The following states will be executed during the auto sequence, provided that the corresponding timer has not been set to 00:00:00 or the controller has not been placed in a manual mode of operation:

- **Stabilize:** This is a timed state to allow the controller to enable the ECU or any senders without warnings or errors. This timer can be disabled if set up for mechanical engine use.
- **Stopped:** This is a timed state where the engine is ready to be started manually or automatically.
- **Standby:** This is a timed state that will shut off the LCD backlight, heater and CAN transceiver to conserve power while the unit waits for a key press or an automatic start condition.
- **Auto Start Delay: (available in Auto Mode only)** The auto start condition is ignored and must remain active throughout this delay or the delay is reset to zero.
- **Check Safe To Start:** This is a non-timed state that will check to ensure the engine can start safely.
- **Auto Stop Delay: (available in Auto Mode only)** The auto stop condition is ignored and must remain active throughout this delay or the delay is reset to zero.
- **ECU Stabilize Timer:** This delay begins timing when the controller is powered up, in Spindown or when the Standby delays have expired. During this delay, the ECU-enabled output is turned on. The ECU output turns off when the Standby, ETS or Spindown delays begin timing.
- **Prestart Delay 1:** After a start condition has been accepted by the controller, this delay begins timing, and the prestart output turns on. When this delay expires, the output is turned off, and the start sequence continues. **NOTE:** The function selected for Prestart may only

be active in Auto Mode depending on if it is tied to an auto start function only in the Start sequence.

- Prestart Delay 2 (Precrank): After a start condition has been accepted by the controller, this delay begins timing, and the prestart output turns on. When this delay expires, the output is turned off, and the start sequence continues. During this delay, the controller checks for faults, J1939 com, etc. NOTE: The function selected for Prestart may only be active in Auto Mode depending on if it is tied to an auto start function only in the Start sequence.
- Prestart Delay 2 (crank through): After a start condition has been accepted by the controller, this delay begins timing, and the prestart output turns on. When this delay expires, the output remains on, and the start sequence continues. The output turns off when the engine starts. During this delay, the controller checks for faults, J1939 com, etc. NOTE: The function selected for Prestart may only be active in Auto Mode depending on if it is tied to an auto start function only in the Start sequence.
- Crank: This is a timed state to try and start the engine.
- Crank Rest: This is a timed state to rest the starter between cranks in case the engine did not start during the crank state.
- False Start Check: This is a non-timed state that will ensure the engine stays above the crank cut RPM after cranking.
- Warm-up: **(available in Auto mode only)** This is a timed state that will allow the engine to change from idle to desired warm-up RPM after starting. Warm-up will only set as low as the minimum RPM set point.
- Line Fill 1: **(available in Auto mode only)** This is a timed state that will exit if the timer times out or the pressure set point for this state is reached.
- Line Fill 2: **(available in Auto mode only)** This is a timed state that will exit if the timer times out or the pressure set point for this state is reached.
- Running Loaded: This is a non-timed state that the controller will stay in until a stop condition occurs.
- Cool-down: **(available in Auto mode only)** This is a timed state that will allow the engine to run at a desired speed to cool down before allowing to go into a stopped state.
- Spindown: The time allotted for the engine to stop all revolutions and be in a stopped state with no frequency.
- Post Crank Lockout Delay (setup): This delay begins timing when the engine starts. During this delay, the selected function is ignored. When this delay expires, the selected function is armed. During the duration of this delay, the selected function can cycle from active to not active and not reset the delay.
- Post Warm-Up Lockout Delay (setup): This delay begins timing when the warm-up delay expires. During this delay, the selected function is ignored. When this delay expires, the selected function is armed. During the duration of this delay, the selected function can cycle from active to not active and not reset the delay.
- Bubble Lockout Delay (setup): This delay begins timing when the selected function is active. If the selected function is removed during this delay, the delay resets to zero. If the selected function remains active throughout this delay, the selected action will occur.

## User Interface

The keypad on the ML1000 is comprised of 11 tactile buttons. This section describes the functions of each button.



The buttons have the following functions:

- **Start Key** – Allows the operator to start sequence in Manual Mode or initiate an auto start sequence when in Auto Mode.
- **Stop Key** – Allows the operator to initiate the stop sequence in either mode of operation. As a safety feature, the stop key will skip the cool-down state when it is pressed twice or held in auto mode. Once shut down, the controller will enter manual mode to eliminate an auto crank condition if the auto start condition is still present.
- **Auto Key** – Allows the operator to change from Auto to Manual or Manual to Auto Mode by confirming the Auto selection.
- **Alarm Silence Key** – Allows the operator to acknowledge alarms on the controller when warnings and shutdowns are present.
- **Manual Throttle Increase Key** – Allows the operator to manually increase the engine throttle in Manual Mode.
- **Manual Throttle Decrease Key** – Allows the operator to manually decrease the engine throttle in Manual Mode.
- **Menu Key** – Allows the operator to get in and out of the menus.
- **Back Key** – Allows the operator to move back one step while in the menu.
- **Enter Key** – Allows the operator to enter a value in the menu when selected and is used to acknowledge internal and external alarms/shutdowns.
- **Up Key** – Allows the operator to navigate up through the menu and page forward on the main pages.
- **Down Key** – Allows the operator to navigate down through the menu and page reverse on the main pages.

## Accessing the Menu



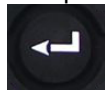
To access the ML1000 menu, press the menu button:

The following screen will display to enter the password (3482):

Enter Passcode		
▲ 0000 ▼		
Stopped		00:29:55
% Soot	% DEF	Manual

Figure 2: Enter Passcode

The password will be entered left to right. Utilize the up and down arrows, and press the Enter button



after each correct number: Entering this password will allow full access to the menu. If you enter the wrong password, it will reset the display to 0000, allowing you to restart the entering process.

**NOTE:** There are three passcodes available in the ML1000 controller: Low Security, Medium Security and High Security. These three passcodes are based on the level of security needed to access certain parameters within the menu. As a factory default, all menu items are listed as low security and accessible by any user with the 3482 passcode. To learn more about passcode security and changing the security levels, please refer to the Configuration Tool manual for the ML1000.

## Main Menu

The ML1000 controller is incredibly versatile within the menu structure. The operator is able to change many parameters and settings from the face without the need of a PC tool, if desired. **The controller must be in its stopped state in order to change a setting in the menu.** (The Tier 4 menu is the sole exception). Described below are the main sections of the controller's menu. **Cycling power to the controller is recommended after making changes to set points and input/output.**

System		
Engine Settings		
Advanced Engine Settings		
Stabilize		00:00:00
0 % Soot	0 % DEF	Manual

Figure 3: Main Menu, page 1

## System

The controller System menu provides the operator with the ability to set the:

- Date/Time
- Pressure, Temperature, Flow and Level Units
- Language
- Brightness
- Backlight Control
- Standby Timer
- Service Reminders and several other system settings. Review System under the Menu Glossary section of this manual for a full list and definition of each setting.

## Engine Settings

The Engine Settings menu allows the operator to establish common user-configurable parameters that would be changed from factory default settings when pairing the controller to an engine. This menu allows the operator to choose whether the engine is J1939 or mechanical; the engine's speed source; the minimum and maximum RPM the operator requires/allows the engine to run; warm-up/cool-down settings; and other common engine settings. Review Engine Settings under the Menu Glossary section of this manual for a full list and definition of each setting.

## Advanced Engine Settings

The Advanced Engine Settings menu allows the operator to set up the less common user-configurable parameters that are not in the Engine Settings menu and which would be changed from factory-default settings when pairing the controller to an engine. This menu allows the operator to set items such as the J1939 address claim for the controller, ECU Source Address, ECU hour select, crank attempts, crank disconnect speed and other user-specific engine settings. Review Advanced Engine Settings under the Menu Glossary section of this manual for a full list and definition of each setting.

Throttle		
Input/Output		
Application Configuration		
Stabilize		00:00:00
0 % Soot	0 % DEF	Manual

Figure 4: Main Menu page 2

## Throttle

The Throttle menu allows the operator to set up the items for throttling the engine such as throttle type, rate of RPM increase/decrease, throttle Inc/Dec pulse time and other parameters pertaining to throttling of the engine. Review Throttle under the Menu Glossary section of this manual for a full list and definition of each setting.

## Input / Output

The Input/Output menu allows the user to establish the I/O needed for the application. This includes Digital Inputs, Analog Inputs, Relay Outputs and Digital Outputs. This menu is tied to other aspects of the controller menu such as Auto Start Functions, Analog Inputs for Mechanical Engine setup, Warning / Shut-down functions and all outputs needed for starting/controlling the engine and alerting the user.

The Digital Inputs of this menu can be configured from the face of the controller to accept three types of inputs as the Active state of the input.

- High, B(+)
- Low, B(-)
- Open

The Analog Inputs of this menu can be configured from the face of the controller to accept one of four types of senders:

- Resistive
- 4-20mA
- 0-5VDC
- Analog.Digital (B- for additional Digital Inputs)

The Outputs are configurable for the operator to choose which output function to use with the desired output type as shown below.

- Relay [10A, Form C]
- Digital Out [1A, B(+)]
- Digital Out [1A, B(-)]

**NOTE:** Although the functionality exists to set all analog and digital inputs to the same function, Enovation Controls strongly advises against this.



## Application Configuration

The Application Configuration menu is where an operator will set up the controller's Auto Start Functions and Auto Throttle Methods, if the intended use is as an auto start and/or auto throttling controller. Depending on which application is chosen in the menu, there are certain auto start functions and auto throttling methods hidden that are not pertinent to the application chosen. This automatic hiding feature allows for a simpler, more intuitive controller menu in the ML1000. Review Application Configuration under the Menu Glossary section of this manual for the full list and definition of each setting.

**NOTE:** Discharge Pressure is the only pressure type available for Auto Start/Stop and/or Auto Throttle control by pressure.

### ***Pump All Purpose***

The Pump All Purpose application houses auto start functions and auto throttling methods of the controller for common pumps used in rental applications.

The auto start functions and auto throttle methods are:

#### Auto Start/Stop Functions

- Single Contact
- Local Start (Green Start key)
- Two Contact Maintained (Dual Floats)

#### Auto Throttle Methods

- Running Loaded RPM
- Pressure Transducer (will require an analog input setting)

### ***Air Compressor***

The Air Compressor application houses the auto start functions and auto throttle methods meant to be used on all engine-driven air compressor applications. The ML1000 allows for the compressor to start/stop and maintain a desired pressure during operation.

The auto start functions and auto throttle methods to choose from are:

#### Auto Start/Stop Functions

- Single Contact (will require a digital input for start and stop)
- Local Start (green start key)
- Pressure Transducer (will require an analog input)

#### Auto Throttle Methods

- Running Loaded RPM
- Pressure Transducer (will require an analog input setting)

### ***Hose Reel Irrigation***

The Hose Reel Irrigation application houses the auto start functions and auto throttle methods meant to be used on hose reel irrigation systems. The ML1000 allows for the hose reel pump to auto start with several methods, including the Local Start key which may be the most used in this application. The key feature of this application is the auto throttling method. This feature allows the controller to manage the pump's throttle in order to maintain a pressure in the hose during irrigation.

The auto start functions and auto throttle methods to choose from are:

#### Auto Start/Stop Functions

- Single Contact (will require a digital input for start and stop)
- Local Start
- Two Contact Maintained

#### Auto Throttle Methods

- Pressure Transducer (will require an analog input)

### **Frost Protection**

The Frost Protection application houses the auto start functions and auto throttle methods meant to be used on frost protection systems. This application allows for a wind machine, sprinkler or other forms of frost protection using single contact or a temperature transducer.

The auto start functions and auto throttle methods to choose from are:

#### Auto Start/Stop Functions

- Single Contact (will require a digital input for start and stop)
- Temperature Transducer (will require an analog input for start and stop)

#### Auto Throttle Methods

- Running Loaded RPM

### **Chipper**

The Chipper application houses the auto start functions and engage/disengage methods meant to be used on chippers. The operator can also choose between chipper types, On-Off-On or Dumping.

The functions available are:

#### Auto Start/Stop Functions

- Single Contact (will require a digital input for start and stop)
- Local Start Key

#### Engage RPM

#### Disengage RPM

#### Disengage Delay

#### Chipper Feed System

- On-Off-On
- Dumping

Start/Stop Timers		
Communication		
Stabilize		00:00:00
0 % Soot	0 % DEF	Manual

Figure 5: Main Menu page 3

## **Start / Stop Timers**

The Start/Stop Timers menu provides the operator the ability to add a countdown timer and start/stop times. The countdown timer allows for the operator to set a desired countdown time and walk away from the engine for a controlled shutdown when the timer expires. There are three Start/Stop Timers the operator can choose from within this menu that allows for the specific day and hour the controller will start and stop utilizing the internal clock. Review Start/Stop Timers under Menu Glossary section of this manual for full list and definition of each setting.

**NOTE:** Start / Stop timers work in conjunction with other Start / Stop types. If the engine is already running from another Start / Stop type when a Start / Stop timer occurs, the Start / Stop timer is ignored. Once the engine is started by the Start / Stop timer, the timer must expire for a controlled shutdown to occur.

## Communication

The Communications menu allows the operator to choose the type of RS485 communications such as PVA Gauge, Modbus or Local Display. The menu also allows for the operator to choose the RS485 slave address and RS485 Serial setup. Review Communication under the Menu Glossary section of this manual for a full list and definition of each setting.

## Start/Stop Settings

There are five automatic start/stop types in the ML1000. Each is detailed below.

### Single Contact Start/Stop

---

The Single Contact Start/Stop is when a remote contact closes and remains closed for auto start and reopens for auto stop.

### Two Contact Maintained Start/Stop (commonly known as Floats)

---

The Two Contact Maintained Start/Stop is when both contacts close for auto start and both contacts open for auto stop (not momentarily).

### Pressure, Temperature Transducer Start/Stop

---

A transducer can be used for Auto Start/Stop when needed for the application. There are set points that allow the operator to enter the appropriate values.

#### NOTES:

This same transducer can be used for Auto Start/Stop and Auto Throttling if the application supports transducer control.

Discharge pressure is the only pressure type available for Auto Start/Stop and/or Auto Throttle control by pressure.

### Local Start Key Start/Stop

---

The Local Start Key function uses the green and red buttons on the front interface for auto start and stop.

## Quick-Start Setup

The following sections provide a walk-through of the steps necessary for some of the various configurations and settings available on the ML1000 Controller. **Cycling power to the controller is recommended after making changes to set points.**

Stepping through the Menu will be depicted as follows:

Menu/System/Contrast directs the operator to go into the Menu first, then look for a parameter titled System and press **[Enter]** to go into the System menu. Then look for a parameter titled Contrast and press **[Enter]** to go into the Contrast menu, etc.

## Adjusting the Brightness

---

1. Access **Menu/System/Brightness** and press **[Enter]**.
2. Utilize the Up and Down arrows to adjust the Brightness (values of 0 to 100), and press **[Enter]** when the desired number appears.
3. Press the **[Menu]** key to leave the Menu Setup screens.

**NOTE:** The brightness of the display will not change until the enter key is pressed.

## Setting to Mechanical Engine

---

1. Access **Menu/Engine Settings/Engine Type** and press **[Enter]**. Choose **Mechanical** and press **[Enter]**.
2. Down arrow to **Speed Source** and press **[Enter]**, and select either Alternator or Magnetic Pickup and press **[Enter]**.
3. Down arrow to **Speed Calibration**, and press **[Enter]**.
4. Utilize the Up and Down arrows to establish the appropriate number of flywheel teeth or engine alternator pulses, and press **[Enter]**.
5. Press the **[Back]** key once. Down arrow to **Input/Output**, and press **[Enter]**.
6. Access **Analog Inputs**, and assign one Analog input for Oil Pressure and one for Coolant Temperature. Press **[Enter]** to save the settings.
7. Press the **[Back]** key twice to access Relay and Digital Outputs.
8. Assign relay outputs for Crank and Fuel.

**NOTE:** DO3 and DO4 are factory set to Throttle Decrease and Throttle Increase for the AT03069 Throttle Actuator.

9. Press the **[Menu]** key to leave the Menu Setup screens.

## Setting to J1939 Engine (Factory Default)

---

1. Access **Menu/Engine Settings/Engine Type** and press **[Enter]**. Choose **J1939**, and press **[Enter]**.
2. Arrow down to Speed Source, and press **[Enter]**. Select J1939 and press **[Enter]**.
3. Press the **[Back]** key once. Arrow down to Throttle menu and press the **[Enter]** key twice. Select desired throttle type and press **[Enter]**.
4. Ensure the analog inputs are not set to oil pressure or coolant temp (disable or change to something else). Some ECUs require an external oil pressure sender. Although some ECUs require an external oil pressure sender, this is an exception but can be done within the controller.
5. Press the **[Menu]** key to leave the Setup screens.

## Setting to Auto Start on a Single Contact Input

---

1. Access **Menu/Application Configuration/Auto Start\_Stop Function/Single Contact** (available in all applications).
2. Press **[Back]** once, and select **Input / Output/Digital Inputs**.
3. Assign the Function of Single Contact Start/Stop to one of the Digital Inputs.
4. Press the **[Menu]** key to leave Setup.

## Setting to Auto Start on Local Start Key

---

1. Access **Menu/Application Configuration/Auto Start\_Stop Function/Local Start Key** and press **[Enter]** (not available for Frost Protection).
2. Press the **[Menu]** key to leave the Menu Setup screens.

## Setting to Auto Start on Float Inputs

---

1. Access **Menu/Application Configuration/Auto Start\_Stop Function** (only available in Pump All Purpose).
2. Highlight Single Contact or Two Contact Maintained and press **[Enter]**.
3. Press **[Back]** once and access **Input/Output/Digital Inputs**. Select a Digital Input to modify.
4. Assign the appropriate input for the selected DI.

**NOTE:** If Single Contact is chosen, only one digital input needs to be configured. If Two Contact (Maintained) is chosen, two digital inputs need to be configured - one for start and one for stop.

5. Ensure the appropriate number of Digital Inputs is configured (as per the Note above), and press the **[Menu]** key to leave Setup.

## Setting to Auto Start on Pressure

---

1. Access **Menu/Application Configuration/Auto Start\_Stop Function/Pressure Transducer**, and press **[Enter]** (only available in Air Compressor).
2. Complete the parameters that apply (i.e., Maintain Pressure, Start/Stop Pressure, etc.).
3. Press **[Back]** twice, and access **Input\_Output/Analog Inputs**.
4. Select an Analog Input to modify.
5. Assign the appropriate pressure input for the selected AI.
6. Configure Sensor in the Sensor setup menu.
7. Press the **[Menu]** key to leave Setup.

## Setting to Auto Start on Clock

---

### NOTES:

- 1) Ensure the correct date and time are established in the System menu prior to establishing the Auto Start on Clock settings.
  - 2) The ML1000 has the ability to establish three different Start/Stop dates and times. If desired, repeat steps 2-4 for subsequent Timers.
  - 3) The Countdown Timer is separate from the internal clock. This is a run time after a Key Start is initiated. When this timer expires, an auto stop will occur.
  - 4) The Clock start timer that started the engine is the only timer that stops the engine.
1. Access **Menu/Start\_Stop Timers**, and select the first Start/Stop Timer.
  2. Select Start Day 1 and then select the appropriate day or Daily.
  3. Select Start Time 1 and establish the hour, minute and second to start.
  4. Establish the Stop Day and Time as in steps 2-3.

## Setting to Auto Start on Temperature

---

1. Access **Menu/Application Configuration/Frost Protection/Auto Start\_Stop Function/Temperature Transducer**. Press **[Enter]**.
2. Arrow down to **Temperature Transducer**.
3. Establish a Start and Stop Temperature, and press **[Back]** twice.
4. Access **Input\_Output/Analog Inputs**, and select an Analog Input.
5. Assign the appropriate temperature input for the selected AI.
6. Press the **[Menu]** key to leave Setup.

# Setting to Run the Engine for a Fixed Period of Time

The operator is able to use the countdown timer to run in auto for a specific amount of time. This feature is only used when local key is selected in the auto start method. An auto stop will occur when either the countdown run timer expires or a local key stop occurs.

- 1. Access **Menu/Start\_Stop Timers/Countdown Timer**.
- 2. Set the hours, minutes and seconds desired for the running of the engine, and press **[Enter]**.
- 3. Press the **[Menu]** key to leave Setup.

**NOTE:** When the Countdown Timer is set for a countdown, the controller will always countdown upon an auto start until the timer is set to 0.

## Screen Examples

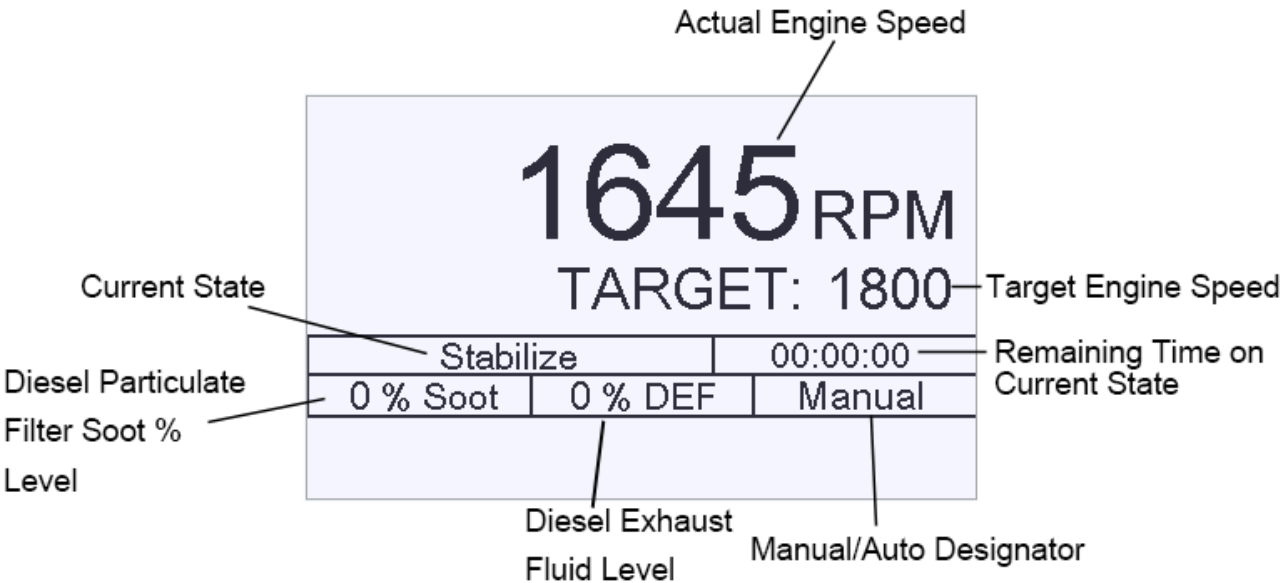


Figure 6: Screen Example

## Additional ML1000 Screens

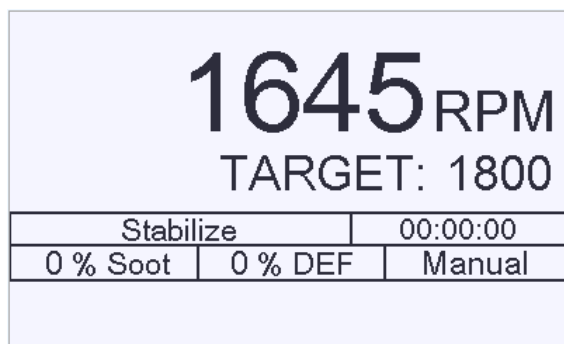


Figure 7: Main Screen

This is the main screen, and it displays actual and target RPM, Mode of Operation, Timer progress, % Soot Level, % DEF Level and current State, along with icons and warnings.

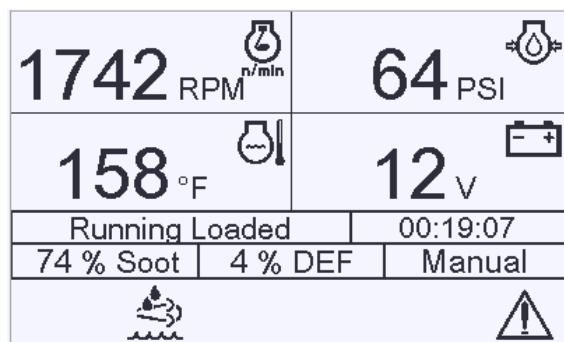


Figure 8: 4 Up Screen

This is the first 4 up screen, displaying engine RPM, oil pressure, engine temperature and battery voltage. If alternate parameters are desired, these may be changed using the free ML1000 software configuration tool.

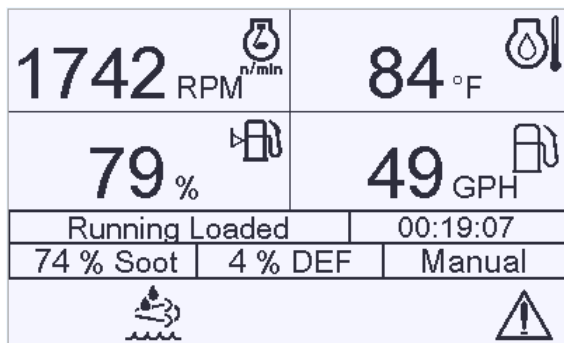


Figure 9: Another 4 Up Screen

This is the second 4 up screen, displaying engine RPM, engine temperature, fuel level and GPH. If alternate parameters are desired, these may be changed using the free ML1000 software configuration tool.



Start <input type="button" value="Active"/> Stop <input type="button" value="Inactive"/>	Throttle  Maintain 63 92 PSI
Stabilize	
00:00:00	
33 % Soot	72 % DEF
Manual	

Figure 10: Auto Start/Stop Type

This screen displays the auto start/stop type and will also illustrate the throttling method for the auto start/stop.

System Information		
Isuzu	0.00 HRS	
00 / Jan / 00	Sunday	12:00:00 AM
SW: 00 . 00 . 000000 . 00	00 . 00 . 0000	
P/N: 40-09-0060	S/N: N / A	

Figure 12: System Information

This screen displays the date, day, time, software version number, configuration revision number, engine manufacturer, part number (if available) and serial number (if available). This page will assist Technical Services Support should their services be needed.

Digital Output Status		
DO 1	Not Used	Off
DO 2	Not Used	Off
DO 3	Not Used	Off
DO 4	Not Used	Off
Stabilize		00:00:00
0 % Soot	0 % DEF	Manual

Figure 13: Digital Output Status

This screen will allow the operator to see what the digital output functions are set to without accessing the menu and the active setting which informs the user of the output status.

Relay Status		
R 1	Not Used	Off
R 2	Not Used	Off
R 3	Not Used	Off
Stabilize		00:00:00
0 % Soot	0 % DEF	Manual

Figure 14: Relay Status

This screen will allow the operator to see what the relay status functions are set to without accessing the menu and the active setting which informs the user of the relay status.

Digital Input Status			Digital Input Status		
DI 1	Disabled	B-	DI 4	Low Coolant Level	B-
DI 2	Auto Start Maintained	B-	DI 5	Low Lube Oil Level	B-
DI 3	Auto Stop Maintained	B-			
Stabilize		00:00:00	Stabilize		00:00:00
0 % Soot	0 % DEF	Manual	0 % Soot	0 % DEF	Manual

Figure 15: Digital Input Status screens

These screens will allow the operator to see what the digital input functions are set to without accessing the menu and the active setting which informs the user of the input status.

Analog Input Status		
AI 1 0-5V Suction Pressure		
AI 2 Murphy Oil Temp		
AI 3 0-5V Discharge Pressure		
Stabilize		00:00:00
0 % Soot	0 % DEF	Manual

Figure 16: Analog Input Status

This screen displays the Analog Input's function selected in the menu for each input.







Service Life Remaining			Service Life Remaining		
Oil Life Remaining		0.0 Hrs	Fuel Filter Life		0.0 Hrs
Oil Filter Life Remaining		0.0 Hrs	Air Filter Life		0.0 Hrs
Belt Life Remaining		0.0 Hrs	Overhaul Life		0.0 Hrs
Battery Life Remaining		0.0 Hrs			
Stabilize		00:00:00	Stabilize		00:00:00
0 % Soot	0 % DEF	Manual	0 % Soot	0 % DEF	Manual

Figure 17: Service Life Remaining Screens












These screens provide a list of service reminders and the hours left until the internal alarm will display the services needed. When 0 hours is reached, the hours will continue to count down in negative numbers.


## Warning and Shut-down Icons

The following ISO icons can be displayed at the bottom of the ML1000 screen to designate that a warning or shut-down situation has occurred.

Icon	Description
	Displays when an active and unacknowledged DTC warning exists. The icon will only disappear if the fault has been acknowledged and is no longer active.
	Displays when an active (unacknowledged) DTC shutdown exists.
	Gear Box Pressure
	Fuel Rate
	Fuel Level
	Flow Rate

Continued on next page

Icon	Description
	Engine Shutdown
	Engine Oil Level
	Discharge Pressure
	Current Oil Pressure
	Current RPM
	Ambient Temperature
	Oil Temperature
	System Level
	Suction Pressure
	Percent Load at Current RPM
	Current Engine Temperature

Icon	Description
	Battery Voltage

## Icon Troubleshooting

The warnings and shutdowns internally generated by the controller will show an Internal Fault on the top of the screen when a fault is displayed. Check all fluid levels and pressures. Ensure the cooling system and engine are functioning properly.

The warnings and shutdowns the ECU generates will also be accompanied by a cause for the error. Consult with the engine manufacturer regarding fault codes shown on the screen.

If everything checks out normal, consider checking the set points or the bypass timer(s) to ensure the ranges are within normal operating settings.

## Menu Glossary

### System

**Date/Time:** allows the setting of the controller's date and time.

**Pressure Units:** allows the selection of psi, kPa or BAR for pressure designation. **Factory set to PSI.**

**Temperature Units:** allows the selection of Fahrenheit or Celsius for temperature designation. **Factory set to Fahrenheit.**

**Level Units:** allows the selection of Feet or Meters for Level designation. **Factory set to Feet.**

**Flow Units:** allows the selection of gal/min (US), gal/min (UK) and lpm (Liters Per Minute) for flow designation. **Factory set to gal/min (US).**

**Language:** select desired language: English, French, German, Spanish, Italian. **Factory set to English.**

**Brightness:** allows the backlight of the screen to be adjusted. **Factory set to 90.**

**Backlight Control:** turns off (disables) or on (enables) the screen's backlight. **Factory set to Enable.**

**Standby Timer:** setting this timer (HH:MM:SS) allows the screen the designated amount of time before the controller goes into Standby mode. **Factory set to 00:30:00.**

**Service Reminders:** when the service reminder is set to 0, the alarms will be disabled; however, the countdown will continue and will show the numbers as negative numbers as it counts down past 0 for the following parameters: **All service reminders factory set to 0 Hrs**

- Oil Life
- Oil Filter Life
- Belt Life
- Battery Life

Fuel Filter Life  
Air Filter Life  
Overhaul Life  
Reset All

**Stored Fault Codes:** allows the operator to query the Engine ECU for review of its stored fault codes.

**Auto / Manual:** allows the controller to power up in either Manual or Auto Mode of operation depending on the selection chosen. The operator can enable Manual only and not have the choice of auto on power up. **Factory set to Manual.**

**Green LED:** select either Auto Operation or Running Loaded for the built-in green LED.

**Restore Factory Defaults:** allows the operator to reset all settings back to default.

**View Event History:** allows the viewing of stored alarms.

**Clear Event History:** allows the clearing of stored events (alarms).

**Alt/Excite Control:** enable or disable the dedicated output for Alt/Excite and arming the Alt Fail shutdown.

**ECU Diagnostic Mode:** This puts the ECU in Diagnostic Mode.

**Clear ECU Fault Code:** This clears the stored faults in the ECU but you must have it in ECU Diagnostic Mode)

## Engine Settings

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**Engine Type:** allows the selection between J1939 and Mechanical. If Mechanical is chosen, some parameters associated with J1939 will no longer appear in the menu. **Factory set to J1939.**

**Engine Manufacturer:** allows the selection of the specific engine manufacturer (i.e., Caterpillar, Cummins, John Deere, Deutz, Kubota, Yanmar, JCB, Volvo, FPT, Isuzu, GM, Other). **Factory set to Isuzu.**

**Engine Emission:** allows the selection of the emissions controls (i.e., Tier 3 or less, Interim Tier 4 or Tier 4 / EU Stage IIIA, IIIB). **Factory set to Tier 3 or Less.**

**Tier 4:** (only appears if Interim Tier 4 or Tier 4 / EU Stage IIIA, IIIB is chosen) allows the automatic running or inhibition of regeneration and/or the requesting of a regeneration. Note: Inhibiting the Regen may cause the engine to de-rate or shut down if the soot level is too high. Recommend leaving this setting in Auto Regen. The ECU may not allow the Regen request if certain parameters do not meet the engine manufacturer's requested levels.

**Auto/Inhibit regen:** factory set to Auto

**Request Regen:** yes/no. Factory set to No

**DEF Gauge:** yes/no. Factory set to No

**Percent Soot Gauge:** yes/no. Factory set to No

**Regen Screen:** yes/no. Factory set to No

**Speed Source:** allows the selection of the appropriate speed source of the engine (i.e., J1939, Alternator or Magnetic Pickup). **Factory set to J1939.**

**Speed Calibration:** allows the setting of the correct number of flywheel teeth or engine alternator pulses for mechanical engines. **Factory set to 150.**

**Warm-Up Speed:** allows the setting of the speed of the engine during the warm-up phase. This speed setting must be at or above the minimum engine speed setting. **Factory set to 900 RPM.**

**Warm-Up Delay:** allows the operator to set the desired warm-up time/delay for the engine. This is the length of time the engine will run at a lower speed for its warm-up cycle. **Factory set to 00.03.00.**

**Minimum Engine Speed:** allows the setting of the lowest engine speed for continual operation. The controller will not allow the engine to throttle under the minimum engine speed when maintaining discharge pressure. **Factory set to 1000 RPM.**

**Running Loaded RPM:** the engine will maintain this RPM when in the AT LOAD state. **Factory set to 1800 rpm.**

**Maximum Engine Speed:** allows the setting of the highest engine speed for continual operation. The controller will not allow the engine to throttle above the maximum engine speed when maintaining discharge pressure. **Factory set to 2200 RPM.**

**Cool-Down Speed:** allows the setting of the speed of the engine while it is cooling down. This speed setting must be at or above the minimum engine speed setting. **Factory set to 900 RPM.**

**Cool-Down Delay:** allows the operator to set the desired cool-down time/delay for the engine. This is the length of time the engine will run at a lower speed for its cool-down cycle. **Factory set to 00.03.00.**

## **Advanced Engine Settings**

---

**J1939 Address Claim:** allows the setting of the address for the controller used in the J1939 engine setting. **Factory set to 3.**

**ECU Source Address:** source address of the ECU being connected to. Normally set to 0, 1 or 2. **Factory set to 0.**

**ECU Hour Select:** choose from ECU Hours (engine hours reported by the ECU) or Internal (hours calculated internally by the ML1000) provided the RPM>50. **Factory set to ECU Hours.**

**Crank Attempts:** format of 1.00 to 20.00. The number of times the engine will attempt to start before providing an overcrank shutdown. **Factory set to 3.**

**Crank Disconnect Speed:** the speed at which the crank will disconnect barring other input parameters. **Factory set to 500 RPM.**

**Timers/Delays:** establish operational settings for:

Auto Start Delay: the auto start condition must remain active throughout this delay for an auto start to occur. If the auto start condition is removed during this delay, the delay is reset to zero. **Factory set to 00.00.03**

Auto Stop Delay: this auto stop condition must remain active throughout this delay for an auto stop to occur. If the auto stop condition is removed during this delay, the delay is reset to zero. **Factory set to 00.00.03**

ECU Stabilize Timer: on start-ups, this delay allows the ECU to stabilize and broadcast on the CAN bus prior to actual cranking. **Factory set to 00.00.05**

Crank Time: this is the length of time the crank output is turned on during cycle cranking. **Factory set to 00.00.10**

Crank Rest: this is the length of time the crank output is turned off during cycle cranking. **Factory set to 00.00.10**

Prestart Delay 1: after an auto start condition has been accepted by the controller, this delay begins timing, and the prestart #1 output turns on. When this delay expires, the output is turned off, and the auto sequence continues. **Factory set to 00.00.00**

Prestart Delay 2: after an auto start condition has been accepted by the controller, this delay begins timing, and the prestart #2 output turns on. **Factory set to 00.00.00**

Prestart Delay 2 Mode: this setting determines if the prestart #2 output is active through the crank state or only through the prestart #2 state. **Factory set to PreCrank.**

Spindown Timer: this delay begins timing when there is no call to run and the engine speed is zero. No auto start functions will occur until this delay expires. **Factory set to 00.00.30. Cannot set below 00.00.05**

Post Crank Lockout Setup: this is a setup for a delay that begins timing when the engine actually starts. During this delay, the selected functions are ignored. When this delay expires, the selected functions are armed. During the duration of this delay, the selected functions can cycle from active to not active and not reset the delay.

Post Crank Lockout Time. **Factory set to 00.00.30**  
Post Crank Lockout 1. **Factory set to Low Oil Pressure**  
Post Crank Lockout 2. **Factory set to High Engine Temperature**  
Post Crank Lockout 3. **Factory set to Disabled**  
Post Crank Lockout 4. **Factory set to Disabled**  
Post Crank Lockout 5. **Factory set to Disabled**

Post Warm-Up Lockout Setup: this is a setup for a delay that begins timing when the warm-up delay expires. During this delay, the selected functions are ignored. When this delay expires, the selected functions are armed. During the duration of this delay, the selected functions can cycle from active to not active and not reset the delay.

Post Warm-up Lockout Time. **Factory set to 00.00.00**  
Post Warm-up Lockout 1. **Factory set to Disabled**  
Post Warm-up Lockout 2. **Factory set to Disabled**  
Post Warm-up Lockout 3. **Factory set to Disabled**  
Post Warm-up Lockout 4. **Factory set to Disabled**  
Post Warm-up Lockout 5. **Factory set to Disabled**

Bubble Lockout Setup: this is a setup for a delay that begins timing when the selected functions are active. If the selected functions are removed during this delay, the delay resets to zero. If the selected functions remain active throughout this delay, the selected action for the parameter will occur.

Bubble Lockout Time. **Factory set to 00.00.00**  
Bubble Lockout 1. **Factory set to Disabled**  
Bubble Lockout 2. **Factory set to Disabled**  
Bubble Lockout 3. **Factory set to Disabled**  
Bubble Lockout 4. **Factory set to Disabled**  
Bubble Lockout 5. **Factory set to Disabled**



**Warnings and Shutdowns:** establish alerts for the listed parameters.

Low Oil Pressure Shutdown: a shutdown will occur when the pressure reaches this set point.  
**Factory set to 10 PSI**

Low Oil Pressure Warning: an alarm will occur when the pressure reaches this set point. **Factory set to 15 PSI**

High Engine Temp Shutdown: a shutdown will occur when the temperature reaches this set point.  
**Factory set to 225 F**

High Engine Temp Warning: an alarm will occur when the temperature reaches this set point.  
**Factory set to 210 F**

High Oil Temp Shutdown: a shutdown will occur when the temperature reaches this set point.  
**Factory set to 225 F**

High Oil Temp Warning: an alarm will occur when the temperature reaches this set point. **Factory set to 210 F**

Low Fuel Level Shutdown: a shutdown will occur when the level reaches this set point. **Factory set to 5%**

Low Fuel Level Warning: an alarm will occur when the level reaches this set point. **Factory set to 10%**

High Battery Warning: an alarm will occur when the VDC reaches this set point. **Factory set to 16.0 VDC**

Low Battery Warning: an alarm will occur when the VDC reaches this set point. **Factory set to 10.0 VDC**

Weak Battery Warning: an alarm will occur when the VDC reaches this set point. **Factory set to 6.0 VDC**

Underspeed Shutdown: a shutdown will occur when the engine speed reaches this set point.  
**Factory set to 0 RPM**

Overspeed Shutdown: a shutdown will occur when the engine speed reaches this set point. **Factory set to 2400 RPM**

High Level Warning: an alarm will occur if the level reaches this set point. **Factory set to 0.0 FT**

High Level Shutdown: a shutdown will occur if the level reaches this set point. **Factory set to 0.0 FT**

Low Level Warning: an alarm will occur if the level reaches this set point. **Factory set to 0.0 FT**

Low Level Shutdown: a shutdown will occur if the level reaches this set point. **Factory set to 0.0 FT**

High Flow Warning: an alarm will occur if the flow reaches this set point. **Factory set to 0 GPM**

High Flow Shutdown: a shutdown will occur if the flow reaches this set point. **Factory set to 0 GPM**

Low Flow Warning: an alarm will occur if the flow reaches this set point. **Factory set to 0 GPM**

Low Flow Shutdown: a shutdown will occur if the flow reaches this set point. **Factory set to 0 GPM**

High Discharge Pressure Warning: an alarm will occur when the pressure reaches this set point. **Factory set to 0 PSI**

High Discharge Pressure Shutdown: a shutdown will occur when the pressure reaches this set point. **Factory set to 0 PSI**

Low Discharge Pressure Warning: an alarm will occur when the pressure reaches this set point. **Factory set to 0 PSI**

Low Discharge Pressure Shutdown: a shutdown will occur when the pressure reaches this set point. **Factory set to 0 PSI**

High Suction Pressure Warning: an alarm will occur when the pressure reaches this set point. **Factory set to 0 PSI**

High Suction Pressure Shutdown: a shutdown will occur when the pressure reaches this set point. **Factory set to 0 PSI**

Low Suction Pressure Warning: an alarm will occur when the pressure reaches this set point. **Factory set to 0 PSI**

Low Suction Pressure Shutdown: a shutdown will occur when the pressure reaches this set point. **Factory set to 0 PSI**

High Gearbox Pressure Warning: an alarm will occur when the pressure reaches this set point. **Factory set to 0 PSI**

High Gearbox Pressure Shutdown: a shutdown will occur when the pressure reaches this set point. **Factory set to 0 PSI**

Low Gearbox Pressure Warning: an alarm will occur when the pressure reaches this set point. **Factory set to 0 PSI**

Low Gearbox Pressure Shutdown: a shutdown will occur when the pressure reaches this set point. **Factory set to 0 PSI**

## Throttle Menu

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**Throttle Type:** allows the selection of J1939 TSC1, Pulse Inc/Dec or Analog 0-5VDC as the throttle type for the engine. **Factory set to J1939 TSC1.**

J1939 TSC1: this setting will be used when an electronic engine is used for J1939 Throttling. (Verify with Engine Dealer this type of throttling is accepted on the specific engine.)

Pulse Inc/Dec: this setting will be used when throttling a mechanical engine, when using a throttle actuator and also on an electronic engine using digital pulses into the ECU for throttling.

### **Auto Throttle Type: Factory set to NON PID Auto Throttle.**

NON PID Auto Throttle: this type does not use the PID adjustments found in the Transducer setups in the Application menu.

PID Auto Throttle: this type does use the PID adjustments found in the Transducer setups in the Application menu.

**Press Target RPM Step Size:** this is the step size of the target RPM when pressing and quickly releasing the push button. The actual rate of change is much higher when throttling in auto vs. manually with the push buttons. **Factory set to 10 RPM per each press of the button.**

**Hold Target RPM Step Size:** this is the step size of the target RPM when pressing and holding the push button. The actual rate of change is much higher when throttling in auto vs. manually with the push buttons. **Factory set to 50 RPM per second when holding the button in.**

**Throttle Deadband RPM:** format of # RPM. Plus/minus value added to the target to provide a range of RPM during which the throttle is not active. No throttling will occur when the engine RPM is within the RPM deadband. **Factory set to 25 RPM.** (Only appears when Pulse Inc/Dec is chosen for the Throttle Type)

**Throttle Inc/Dec Pulse:** format of # mS. The amount of time to pulse the throttle. Increase this value for faster engine response, or decrease this value for slower engine response. **Factory set to 50mS.** (Only appears when Pulse Inc/Dec is chosen)

**Throttle Inc/Dec Pulse Delay:** format of # mS. The amount of delay time before pulsing the throttle. Increase this value for slower engine response, or decrease this value for faster engine response. **Factory set to 250mS.** (Only appears when Pulse Inc/Dec is chosen)

**Throttle Inc Rate:** the rate the engine is signaled to increase in RPM. **Factory set to 200 RPMs.**

**Throttle Dec Rate:** the rate the engine is signaled to decrease in RPM. **Factory set to 200 RPMs.**

## **Input / Output Menu**

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**Digital Inputs (1-6):** for each of the digital inputs, the ability to select the following parameters exists:

- Digital input 1. **Factory set to Disabled**
- Digital Input 2. **Factory set to Auto Start Maintained**
- Digital Input 3. **Factory set to Auto Stop Maintained**
- Digital Input 4. **Factory set to Low Coolant Level**
- Digital Input 5. **Factory set to Low Lube Oil Level**

Function:

- Disabled
- Single Contact Start/Stop
- Auto Start Maintained
- Auto Stop Maintained
- Remote Alarm Acknowledge
- Low Fuel Level
- Fuel Leak
- Fuel Filter Restriction
- Low Lube Oil Level
- Low Coolant Level

Remote Stop  
 Remote Manual/Auto  
 Idle Engine  
 Remote Throttle Inc  
 Remote Throttle Dec  
 Water in Fuel  
 No Flow  
 User 1  
 User 2  
 Pivot Alignment

Active

B- (ground input to a function chosen above) **Factory Default**  
 B+ (battery positive to a function chosen above).  
 Open (sender/switch is open)

Action

Not Used  
 Warning  
 Shutdown **Factory Default** (Depending on Function)  
 Shutdown, Controlled (will shut down through the normal sequence of operation if a chosen function listed above occurs)  
 Relay Control (used to control one of the relay outputs)

**Analog Inputs (1-3):** for each of the analog inputs, the ability to select the following parameters exists:

Analog input 1. **Factory set to Disabled**  
 Analog Input 2. **Factory set to Disabled**  
 Analog Input 3. **Factory set to Disabled**

Function:

Disabled  
 4-20mA Suction Pressure  
 0-5V Suction Pressure  
 4-20mA Discharge Pressure  
 0-5V Discharge Pressure  
 4-20mA System Level  
 4-20mA Flow Rate  
 4-20mA Ambient Temp  
 0-5V Ambient Temp  
 Datcon Oil Pressure  
 Murphy Oil Pressure  
 VDO5 Bar Oil Pressure  
 VDO7 Bar Oil Pressure  
 Murphy Coolant Temp  
 Datcon Coolant Temp  
 VDO Coolant Temp  
 Murphy Fuel Level  
 VDO Fuel Level  
 Datcon Fuel Level  
 Murphy Oil Temp  
 Datcon Oil Temp  
 VDO Oil Temp  
 Analog.Digital1

Sensor Setup (This menu only appears when a transducer [4-20mA or 0-5V] is selected for an analog input.)  
 Ambient Temp (0-5V) or (4-20mA)

Discharge Pressure (0-5V) or (4-20mA)  
Suction Pressure (0-5V) or (4-20mA)  
Flow Rate (4-20mA)  
System Level (4-20mA)

**Relay (1-3) and Digital (1-4) Outputs:** these same parameters are used for both the Relay and Digital Outputs.

Relay 1. **Factory set to Crank, Starter Solenoid**

Relay 2. **Factory set to ECU Enable**

Relay 3. **Factory set to Common Alarm**

DO1 (B+, 1A) **Factory set to Not Used (Not in Auto)**

DO2 (B+, 1A). **Factory set to Engine Running**

DO3 (B-, 1A). **Factory set to ECU Diagnostic Mode**

DO4 (B-, 1A). **Factory set to Clear ECU Fault Codes**

**Prestart 1 Delay** Please see Timers on page 40.

**Prestart 2 Delay** Please see Timers on page 40.

**Crank** Please see Timers on page 40.

**Fuel** Please see Timers on page 40.

**ECU Enable** Used for enabling the ECU on electronic engines. This output is on any time the controller is powered up or in the crank/run state. It's turned off if the controller is in the standby state.

**Shutdown** This output turns on when a fault shutdown occurs.

**Common Alarm** This output turns on when either a shut-down or a non shut-down warning occurs.

**Remote Alarm** This output turns on when a either a shut-down or a non shut-down warning occurs.

**Not in Auto** This output turns on when the controller is in the manual mode.

**Engine Running** This output turns on after the engine actually starts and off when the engine stops.

**Throttle Increase / Throttle Decrease** The increase and decrease outputs are used for the pulse inc/dec throttling type.

**Digital Input (1-5)** A digital input can be assigned to turn on a digital output.

**Analog (1-3) Digital** An analog input configured to be a digital input can be assigned to turn on a digital output.

**Feed Engage** This is for chipper control.

**Feed Disengage** This is for chipper control.

## Application Configuration

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NOTE: It is highly recommended to perform a Restore Factory Defaults in the System menu after changing applications for the same controller.

### Application

**Pump All Purpose:** The Pump All Purpose application houses the auto start functions and auto throttle methods meant to be used on most engine-driven pump applications. This application allows for pumps of many variations to be used in a manual/auto start environment utilizing the more common auto start and throttling functions. **Factory Default.**

**Air Compressor:** The Air Compressor application houses the auto start functions and auto throttle methods meant to be used on most engine-driven air compressor applications. The ML1000 allows for the compressor to start/stop and maintain a desired pressure during operation.

**Hose Reel Irrigation:** The Hose Reel Irrigation application houses the auto start functions and auto throttle methods meant to be used on hose reel irrigation systems. The ML1000 allows for the hose reel

pump to auto start with several methods, including the Local Key Start which may be the most used in this application. The key feature of this application is the auto throttling method. This feature allows the controller to manage the pump's throttle in order to maintain a pressure in the hose during irrigation.

Frost Protection: The Frost Protection application houses the auto start functions and auto throttle methods meant to be used on frost protection systems. This application allows for wind machine, sprinkler or other forms of frost protection using single contact or a temperature transducer.

Chipper: The ML1000 must be in the Manual mode for both Chipper Auto and Chipper Manual (Autofeed Override). The chipper application has settings required for the operation:

**Engage RPM.** In the Chipper Auto mode, the engine speed when the Feed Engage output will be activated. **Factory set to 2200 RPM.**

**Disengage RPM.** In the Chipper Auto mode, the engine speed when the Feed Disengage output will be activated. **Factory set to 1800 RPM.**

**Disengage Delay.** The amount of time the Feed Disengage output is active. **Factory set to 50mSec.**

**Chipper Feed System.** Operation of the outputs. **Factory set to ON-OFF-ON.**

#### **Chipper type: ON-OFF-ON:**

##### **CHIPPER AUTO MODE**

1. (2) Control outputs, Engage and Disengage are off prior to start up.
2. The engine is started manually using the ML1000 and throttled manually up to the Engage RPM set point:
  - a. The Engage output turns on.
3. If during normal operation, the engine speed drops to the Disengage RPM set point:
  - a. The Engage output turns off.
  - b. The Disengage output turns on.
  - c. The Disengage delay begins timing. This is the amount of time the disengage (reverse) output is turned on for Chipper applications. **Factory set to 50 mS.**
4. When the Disengage delay expires:
  - a. The Disengage output turns off.
5. When the engine speed rises to the Engage RPM set point:
  - a. The Engage output turns on.

##### **CHIPPER MANUAL MODE (AUTOFEED OVERRIDE)**

1. The engine speed must be below the Disengage RPM set point to use the Autofeed Override feature. An RPMs TOO HIGH warning will appear if the Autofeed Override menu is accessed while the engine speed is higher than the Disengage RPM set point.
2. The operator enters the password to access the main menu.
3. Once in the main menu, the operator holds down the Enter button for 5 seconds.
4. The Autofeed Override menu will appear in the Feed Off mode.
5. For Feed Forward, the operator first presses and holds the Up Arrow, then presses and holds the Enter button, holding both for 5 seconds.
6. The Engage output turns on.
7. The display will read Feed Forward.
8. For Feed Reverse, the operator first presses and holds the Down Arrow, then presses and holds the Enter button, holding both for 5 seconds.
9. The Engage output turns off.
10. The Disengage output turns on.
11. The display will read Feed Reverse.
12. For Feed Off, the operator presses and holds the Enter button for 5 seconds.
13. If on, the Engage output turns off.
14. If on, the Disengage output turns off.
15. The display will read Feed Off.
16. To exit the Autofeed Override feature, press and hold the Back button for 5 seconds. This will return the controller to the main menu. Press the menu button to return to the front display.

**Chipper type: DUMPING:**

**CHIPPER AUTO MODE**

1. (2) Control outputs, Engage and Disengage are off prior to start up.
2. The engine is started manually using the ML1000 and throttled manually up to the Engage RPM set point:
3. The Engage output turns on.
4. If during normal operation, the engine speed drops to the Disengage RPM set point:
  - a. The Engage output remains on.
  - b. The Disengage output turns on.
  - c. The Disengage delay begins timing.
5. When the Disengage delay expires:
  - a. The Engage output turns off.
  - b. The Disengage output turns off.
6. When the engine speed rises to the Engage RPM set point:
  - a. The Engage output turns on.

**CHIPPER MANUAL MODE (AUTOFEED OVERRIDE)**

1. The engine speed must be below the Disengage RPM set point to use the Autofeed Override feature. An RPMs TOO HIGH warning will appear if the Autofeed Override menu is accessed while the engine speed is higher than the Disengage RPM set point.
2. The operator enters the password to access the main menu.
3. Once in the main menu, the operator holds down the Enter button for 5 seconds.
4. The Autofeed Override menu will appear in the Feed Off mode.
5. For Feed Forward, the operator first presses and holds the Up Arrow, then presses and holds the Enter button, holding both for 5 seconds:
  - a. The Engage output turns on.
  - b. The display will read Feed Forward.
6. For Feed Reverse, the operator first presses and holds the Down Arrow, then presses and holds the Enter button, holding both for 5 seconds:
  - a. The Engage output remains on.
  - b. The Disengage output turns on.
  - c. The display will read Feed Reverse.
7. For Feed Off, the operator presses and holds the Enter button for 5 seconds:
  - a. The Engage output turns off.
  - b. If on, the Disengage output turns off.
  - c. The display will read Feed Off.
8. To exit the Autofeed Override feature, press and hold the Back button for 5 seconds. This will return the controller to the main menu. Press the menu button to return to the front display.

**Auto Start / Stop Function**

Single Contact (Pump All Purpose, Air Compressor, Hose Reel Irrigation, Frost Protection, Chipper)  
Local Start Key (Pump All Purpose, Air Compressor, Hose Reel Irrigation, Chipper)  
Two Contact Maintained (Pump All Purpose) **Factory Default**  
Pressure Transducer (Air Compressor)  
Temperature Transducer (Frost Protection)

**Auto Throttle Method**

Running Loaded RPM (Pump All Purpose, Air Compressor, Frost Protection) **Factory Default**  
Pressure Transducer (Pump All Purpose, Air Compressor, Hose Reel Irrigation)

**Pressure Transducer**

**Maintain Pressure.** The engine will be throttled between the min. and max. RPM set points to maintain this pressure. **Factory set to 0 psi.**

**Deadband Pressure.** This extends above and below the maintain set point. No throttling occurs while the pressure is in the deadband. When throttling to pressure, it is not recommended to enter 0 psi for the deadband value. This may cause hunting and erratic engine RPMs to occur. **Factory set to 2 psi.**

**Line Fill 1 Speed.** The engine is throttled to this speed after warm-up to purge the line. **Factory set to 900 RPM.**

**Line Fill 1 Delay.** This is the time the engine is held at the Line Fill 1 speed. **Factory set to 00.00.00.**

**Line Fill 1 Pressure.** The engine is held at the Line Fill 1 Speed until either this pressure set point is reached or the Delay expires. **Factory set to 0 psi.**

**Line Fill 2 Speed.** The engine is throttled to this speed after Line Fill 1 to purge the line. **Factory set to 900 RPM.**

**Line Fill 2 Delay.** This is the time the engine is held at the Line Fill 2 speed. **Factory set to 00.00.00.**

**Line Fill 2 Pressure.** The engine is held at the Line Fill 2 Speed until either this pressure set point is reached or the Delay expires. **Factory set to 0 psi.**

**Line Fill 2** features only available when Hose Reel is selected in the Applications menu.

**Pressure P.** Allows adjustment if using PID throttling. **Factory set to 0.020.**

**Pressure I.** Allows adjustment if using PID throttling. **Factory set to 0.020.**

**Pressure D.** Allows adjustment if using PID throttling. **Factory set to 0.001.**

#### **Level (Flow, Suction Transducers) Transducer**

The controller supports these transducers for display and alarms only. No control such as start stop or throttling is available.

#### **Temperature Transducer**

**Start Temperature.** When the temperature drops to this set point, an auto start will occur. **Factory set to 32 F**

**Stop Temperature.** When the temperature rises to this set point, an auto stop will occur. **Factory set to 32 F**

### **Start / Stop Timers**

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**NOTE:** When the engine is started using one of the start timers, the timer which started the engine is the timer which will stop the engine. Other start/stop timers will be ignored if they happen to overlap from the timer that starts the engine.

This section allows the setting of the timers to start and stop the engine. There are three timers, each with a Start Day and a Stop Day, a Start Time and a Stop Time. This is based on the internal real-time clock.

**Countdown Timer:** the countdown timer will be active upon every auto start up until the time is changed or disabled. It is used when it is desirable for a machine to run for a specific amount of time unmonitored and then shut itself off when that time has expired or when a local key stop occurs. Format of HH:MM:SS.

**Start / Stop Timer (1-3):** each of the three timers contains the ability to select from the following parameters:

**Days of the week are factory set to Off**

**Start and stop times are factory set to 12.00.00 AM**

Start Day

Sunday

Monday

Tuesday

Wednesday

Thursday

Friday

Saturday



Daily  
Off  
Start Time: format of HH:MM:SS  
Stop Day:  
Sunday  
Monday  
Tuesday  
Wednesday  
Thursday  
Friday  
Saturday  
Daily  
Off  
Stop Time: format of HH:MM:SS

## Communication

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### Communication Type:

PVA Gauge: this function will be used if utilizing PVA Gauges on the RS485 Modbus.

Modbus: this function will be used if using a SCADA or telemetry device for polling the Modbus register list. See Modbus Register Map. **Factory Default.**

Local Display: (for future use) this function will be used to connect the display to a remote viewing application. This can be a program running on a PC or another ML1000 set up as a remote viewer.

**Slave Address.** This is the Modbus slave node number. **Factory set to 1.**

Serial Setup.

Baudrate. **Factory set to 19200.**

Stopbits. **Factory set to 1.**

Parity. **Factory set to None.**

PV CAN Backlight Enable. **Factory set to Off.**

CAN Termination. **Factory set to Enable.**

**PV CAN Backlight Enable:** ON / OFF. **Factory set to Off**

**Terminating Resistor:** Enable/Disable. This menu selection signifies whether or not the controller uses the internal CAN terminating resistor.

## Modbus Registers

NOTE: The registers labeled Read/Write will allow the operator to change values through the Modbus as a temporary modification. If power is cycled to the ML1000, the values changed via Modbus will revert back to the last value entered locally.

REGISTER #	TYPE	DESCRIPTION
40001	Read Only	Running Hours MSB
40002	Read Only	Running Hours LSB
40003	Read Only	Current RPM
40004	Read Only	Modbus Voltage
40005	Read Only	Current Oil Pressure
40006	Read Only	Current Engine Temperature
40007	Read Only	Current Engine State:
		0 = ECU Stabilize Delay timing
		1 = Engine Stopped
		2 = Controller in Standby Mode
		3 = Prestart Delay 1 Timing
		4 = Check Safe to Start
		5 = Prestart 2 Delay Timing
		6 = Crank on
		7 = Crank Rest
		8 = False Start Check
		9 = Warmup Delay Timing
		10 = Line Fill 1 Delay Timing
		11 = Line Fill 2 Delay Timing
		12 = Running Loaded
		13 = Cooldown Delay Timing
		14 = Reserved
		15 = Spindown Delay Timing
40008	Read Only	Shutdown Status: The following is a description of bits:
		Bit 0 Overspeed SD Status: (1) yes (0) no
		Bit 1 Underspeed SD Status: (1) yes (0) no
		Bit 2 Overcrank SD Status: (1) yes (0) no
		Bit 3 Low Oil Pressure SD Status: (1) yes (0) no
		Bit 4 High Engine Temperature SD Status: (1) yes (0) no
		Bit 5 Low Fuel SD Status: (1) yes (0) no
		Bit 6 Low Discharge Pressure SD Status: (1) yes (0) no
		Bit 7 High Discharge Pressure SD Status: (1) yes (0) no
		Bit 8 Speed Signal Lost SD Status: (1) yes (0) no
		Bit 9 Low Lube Level SD Status: (1) yes (0) no
		Bit 10 Fuel Leak SD Status: (1) yes (0) no
		Bit 11 Fuel Filter Restriction SD Status: (1) yes (0) no

		Bit 12	Reserved
		Bit 13	Reserved
		Bit 14	Reserved
		Bit 15	(MSB) Remote Stop: (1) yes (0) no
40009	Read Only	Shutdown Status: The following is a description of the bits:	
		Bit 0	Coolant Level SD Status: (1) yes (0) no
		Bit 1	High Level SD Status: (1) yes (0) no
		Bit 2	Low Level SD Status: (1) yes (0) no
		Bit 3	High Flow SD Status: (1) yes (0) no
		Bit 4	Low Flow SD Status: (1) yes (0) no
		Bit 5	Reserved
		Bit 6	Reserved
		Bit 7	Water in Fuel SD Status: (1) yes (0) no
		Bit 8	Low Suction SD Status: (1) yes (0) no
		Bit 9	High Suction SD Status: (1) yes (0) no
		Bit 10	Reserved
		Bit 11	High Engine Oil Temperature SD Status: (1) yes (0) no
		Bit 12	Low Gear Box Pressure SD Status: (1) yes (0) no
		Bit 13	High Gear Box Pressure SD Status: (1) yes (0) no
		Bit 14	Reserved
		Bit 15	Red Lamp Status: (1) yes (0) no
40010	Read Only	Current Discharge Pressure. kPa	
40011	Read Only	Current System Level. Feet	
40012	Read/Write	Modbus Start Stop: (1) yes (0) no	
40013	Read/Write	RPM Run Speed	
40014	Read Only	Current Ambient Temperature. Celsius	
40015	Read Only	Auto / Manual Mode: (1) Auto (0) Manual	
40016 through 40037	Read Only	Reserved.	
40038	Read/Write	Pressure Start Engine. kPa	
40039	Read/Write	Pressure Stop Engine. kPa	
40040	Read/Write	Pressure Maintain Value. kPa	
40041	Read/Write	Reserved.	
40042	Read/Write	Reserved.	
40043	Read/Write	Reserved.	
40044	Read/Write	Reserved.	
40045	Read/Write	Reserved.	
40046 - 40200	Read Only	Reserved.	

40201	Read Only	Version.App.1
40202	Read Only	Version.App.2
40203	Read Only	Version.App.3
40204	Read Only	Version.App.4
40205	Read Only	Version.Config.1
40206	Read Only	Version.Config.2
40207	Read Only	Version.Config.3
40208	Read Only	Serial Number
40210	Read Only	J1939.Engine.Catalyst Tank Level
40211	Read Only	J1939.Engine.Diesel Particulate Filter 1 Soot Load Percent
40212	Read Only	J1939.Transmit.Diesel Particulate Filter Regeneration Inhibit Switch
40213	Read Only	J1939.Engine.Diesel Particulate Filter Active Regen Inhibited Due to Inhibit Switch
		Bit 0 (LSB) Inhibited Due to Inhibit Switch: (1) yes (0) no
		Bit 1 Reserved
		Bit 2 Reserved
		Bit 3 Reserved
		Bit 4 Reserved
		Bit 5 Reserved
		Bit 6 Reserved
		Bit 7 Reserved
		Bit 8 Reserved
		Bit 9 Reserved
		Bit 10 Reserved
		Bit 11 Reserved
		Bit 12 Reserved
		Bit 13 Reserved
		Bit 14 Reserved
		Bit 15 (MSB) Reserved
40214	Read Only	State Timer.
40215	Read Only	Engine RPM Set Point.
40216	Read Only	AllPurposeAutoStartFunction:
		Bit 0 Single Contact
		Bit 1 Local Start Key
		Bit 2 Two Contact Maintained
		Bit 3 Reserved
		Bit 4 Pressure Transducer
		Bit 5 Level Transducer
		Bit 6 Flow Transducer
40217	Read/Write	Pressure Deadband. kPa
40218	Read/Write	Reserved.
40219	Read/Write	Reserved.

40220	Read/Write	Start Temperature. Celsius
40221	Read/Write	Stop Temperature. Celsius
40222	Read Only	Current Ambient Temperature. Celsius
40223	Read/Write	Reserved.
40224	Read/Write	RPM Low Idle
40225	Read Only	Service Reminder: Air Filter Life.
40226	Read Only	Service Reminder: Air Filter Life Remaining.
40227	Read Only	Service Reminder: Battery Life.
40228	Read Only	Service Reminder: Battery Life Remaining.
40229	Read Only	Service Reminder: Belt Life.
40230	Read Only	Service Reminder: Belt Life Remaining.
40231	Read Only	Service Reminder: Fuel Filter Life.
40232	Read Only	Service Reminder: Fuel Filter Life Remaining.
40233	Read Only	Service Reminder: Oil Filter Life.
40234	Read Only	Service Reminder: Oil Filter Life Remaining.
40235	Read Only	Service Reminder: Oil Life.
40236	Read Only	Service Reminder: Oil Life Remaining.
40237	Read Only	Service Reminder: Overhaul Life.
40238	Read Only	Service Reminder: Overhaul Life Remaining.
40239	Read Only	Current Fuel Level
40240	Read/Write	Save Changes to Modbus: (1) yes (0) no
40241	Read Only	Modbus EEPROM Saved: (1) yes (0) no
40242	Read Only	Warning Status: The following is a description of bits:
		Bit 0 Low Fuel Warn Status: (1) yes (0) no
		Bit 1 Fuel Leak Warn Status: (1) yes (0) no
		Bit 2 Fuel Filter Restriction Warn Status: (1) yes (0) no
		Bit 3 Low Lube Level Warn Status: (1) yes (0) no
		Bit 4 Coolant Level Warn Status: (1) yes (0) no
		Bit 5 Water in Fuel Warn Status: (1) yes (0) no
		Bit 6 No Flow Warn Status: (1) yes (0) no
		Bit 7 High Engine Oil Temperature Warn Status: (1) yes (0) no
		Bit 8 Low Oil Pressure Warn Status: (1) yes (0) no
		Bit 9 High Engine Temperature Warn Status: (1) yes (0) no
		Bit 10 High Discharge Pressure Warn Status: (1) yes (0) no
		Bit 11 Low Discharge Pressure Warn Status: (1) yes (0) no
		Bit 12 High Suction Warn Status: (1) yes (0) no
		Bit 13 Low Suction Warn Status: (1) yes (0) no
		Bit 14 High Level Warn Status: (1) yes (0) no
		Bit 15 Low Level Warn Status: (1) yes (0) no
40243	Read Only	Warning Status: The following is a description of bits:
		Bit 0 High Flow Warn Status: (1) yes (0) no

		Bit 1	Low Flow Warn Status: (1) yes (0) no
		Bit 2	High Pump Oil Temperature Warn Status: (1) yes (0) no
		Bit 3	Reserved
		Bit 4	Low Gear Box Pressure Warn Status: (1) yes (0) no
		Bit 5	High Gear Box Pressure Warn Status: (1) yes (0) no
		Bit 6	Reserved
		Bit 7	Air Filter Restriction Warn Status: (1) yes (0) no
		Bit 8	Oil Filter Restriction Warn Status: (1) yes (0) no
		Bit 9	Reserved
		Bit 10	High Engine Oil Pressure Warn Status: (1) yes (0) no
		Bit 11	Reserved
		Bit 12	Run To Destruct Warn Status: (1) yes (0) no
		Bit 13	Battery High Warn Status: (1) yes (0) no
		Bit 14	Battery Low Warn Status: (1) yes (0) no
		Bit 15	Amber Lamp Status: (1) yes (0) no

## PC Configuration Software

The ML1000 controller is released utilizing Enovation Controls' PowerVision Configuration Studio® software. With PowerVision, engineering will be able to deliver quicker software updates with the flexibility of a software developer's environment. The new addition of PowerVision to this controller gives Enovation Controls the ability to provide a free-of-charge, basic PC configuration program to change default parameters in the controller to all customers.

The simplified version of PowerVision that will be utilized to create the configuration for the ML1000 Controller will be available via download from our website (forum).

<http://forum.fwmurphy.com/viewforum.php?f=49>

Customers who require a developer's environment to change or add additional functionality in the controller may do so in their own time without waiting or paying non-recurring engineering fees (also referred to as NRE) to make the changes (requires purchase of the full version of PowerVision Configuration Studio).

## Specifications

### Electrical

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**Power Input:** 8-32 VDC, protected against reverse battery polarity and load dump

**Display:** 2.7" Monochrome, Transflective, White Backlight LCD

**Power Consumption:** 18W max without 2 1A High-sides active, 146W max with 2 1A High-sides active

#### Communications

**1-CAN:** J1939

**USB:** 2.0B (Only supported for programming)

**RS485:** Modbus RTU

**Connection:** DT06-12SA PO12 (Gray)  
DT06-12SB-PO12 (Black)  
DT06-12SC-PO12 (Green)

**Keyboard:** 11 Tactile Feedback Buttons

#### Inputs

**5-Digital Inputs:** configurable (high/low)

**3-Analog Inputs:** configurable (4-20mA, 0-5V, resistive)

#### 1-Frequency Input:

Supporting Magnetic Pickup:

(30 Hz – 10 kHz, 2.0 VAC – 120 VAC)

Supporting Engine Alternator:

(30 Hz – 10 kHz, 4.5 VRMS – 90 VRMS)

#### Outputs

**3-Relays:** 10A, SPDT, Form C (30 VDC @ 10A max.), 30A maximum aggregate @ 85C

**2-Low-side Outputs:** 1A

**2-High-side Outputs:** 1A

**Real-time clock:** with battery backup

### Environmental

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**Operating Temperature:** -40°F to 185°F (-40°C to +85°C)

**Storage Temperature:** -40°F to 185°F (-40°C to +85°C)

**Protection:** IP 67 front and back. Panel seal is IP66 when used with accessory gasket.

**Emissions:** SAE J1113, 2004/108/EC

**Immunity:** SAE J1113, 2004/108/EC

**Vibration:** Random vibration, 7.86 Grms (5-2000 Hz), 3 axes

**Shock:** ± 50G in axis

### Mechanical

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**Case Material:** Polycarbonate/ABS

**Keypad/Gasket Material:** Silicone

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