Product Manual

Programmable Microprocessor-Based Pump Controller for Mechanical Diesel Engines

Part Number: EMGRT1
Customer: The Gorman Rupp Company
Revision: 2.0

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Basic Controller Operation

A. Manual Engine Start / Stop

1. For manual start, put key switch in “Run” position and press “Enter” button to crank engine. When engine is started manually, the controller will operate. To stop the engine, the key needs to be switched to the “Off” position.

B. Automatic Engine Start / Stop

1. For auto start, place key in the “Auto” position. When the single or dual float circuit is closed closed, the controller will begin the engine start sequence. When the single or dual float circuit is opened, the controller will shut the engine off.

1) Introduction

1.1 The EMGRT1 is a microprocessor-based controller for industrial electronic engines with J1939 CAN Bus. It is based on the Controls, Inc. 1410-000 series controller platform with Motorola/Freescale processor.

1.2 The product is housed in an 8"W x 8"H x 4"D polycarbonate enclosure that is rated NEMA 4X. The controller is plug & play with all engine and accessory connectors incorporated into the enclosure.

1.3 The backlit digital display is 1"H x 4"W with two rows of 16 characters. Character height is approximately ½".

1.4 The controller is manual and auto start capable. Auto start and stop can be via:

- 1.4.1 Single Float
- 1.4.2 Dual Float

1.5 Controller specific inputs/alarms are available for E-Stop (Digital), Fuel Level (Analog) with corresponding engine shutdown, LED illumination and digital display message.

1.6 Controller is independent and does not require connection to a laptop computer to change programmable settings.

2) Interface

2.1 Display – The backlit digital display is 1"H x 4"W with two rows of 16 characters. Character height is approximately ½".

2.2 Display Parameters – The six full-time display parameter are:

- Water Temperature (Degrees F)
- Engine RPM
- Oil Pressure (PSI)
- Battery Voltage
- Fuel Level (if fuel level sender installed)
- Engine Hours

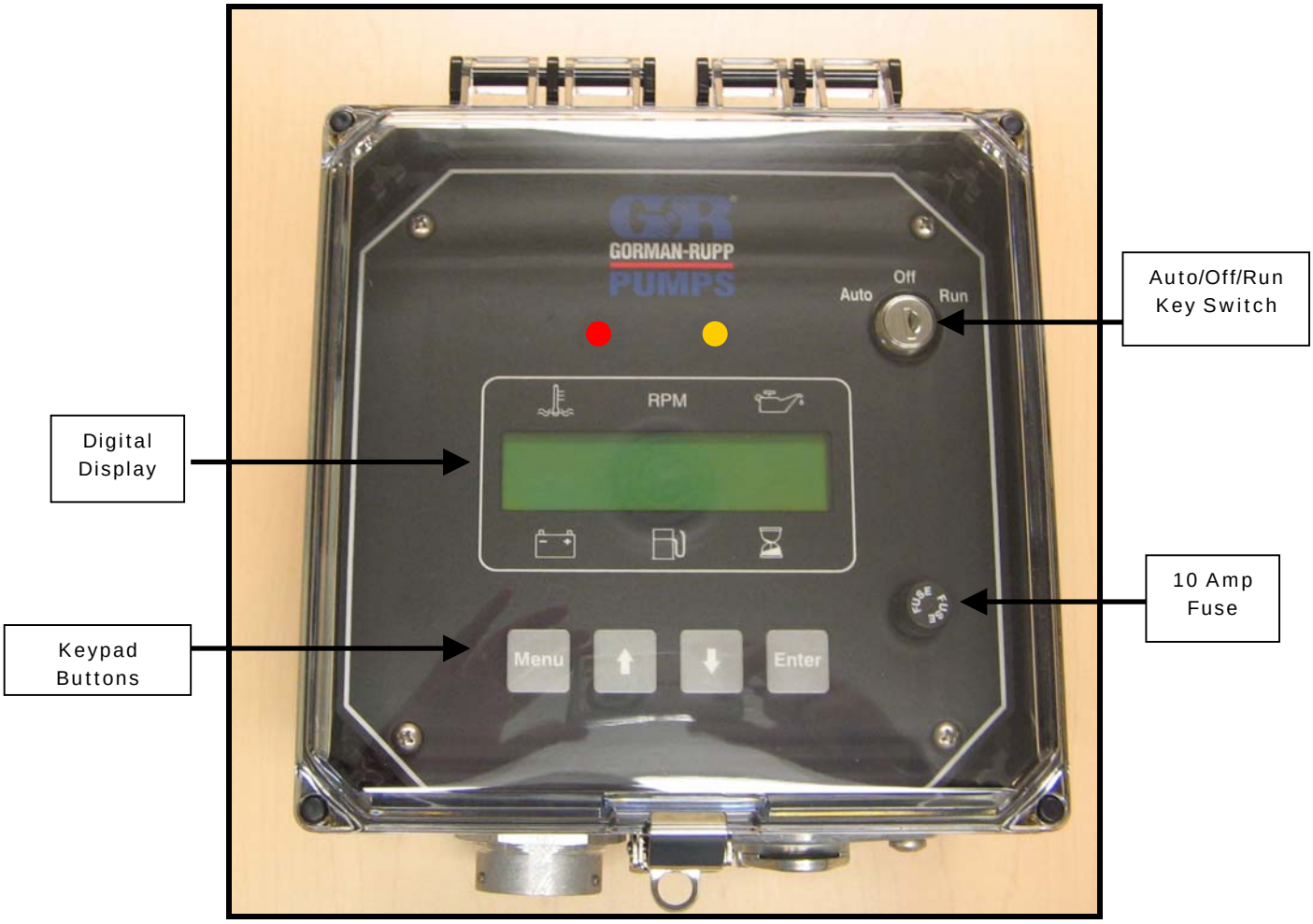
2.3 Menu & Enter Buttons – To access and scroll menus.

2.4 Up / Down Buttons – For menu navigation.

2.5 Key Switch – Auto / Off / Run

2.6 Fuse – 10 amp fuse

2.7 Amber (Pre Alarm) LED and Red (Alarm) LED located above the digital display.



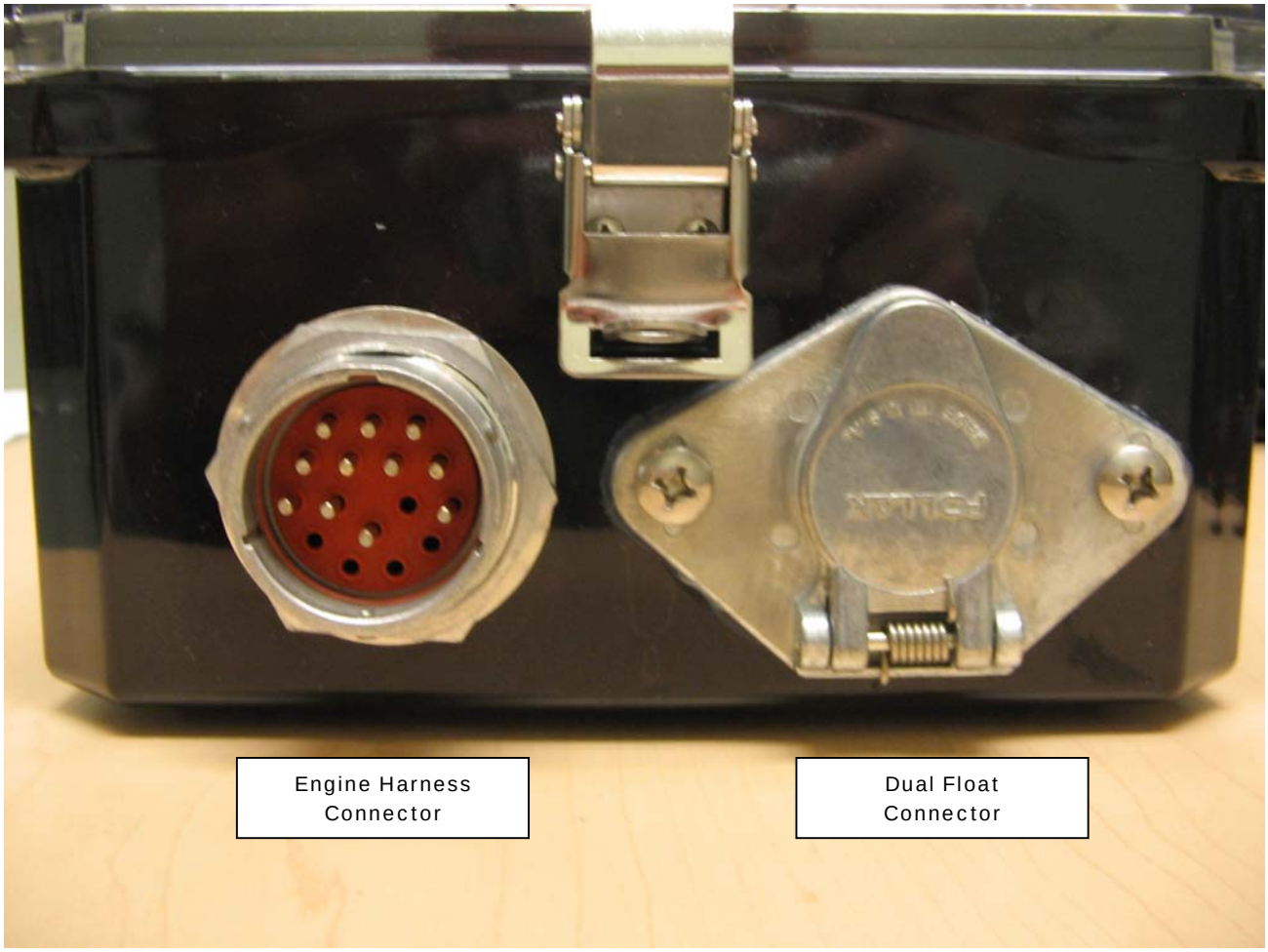
3) Enclosure

3.1 The product is housed in an 8”W x 8”H x 4”D polycarbonate enclosure that is rated NEMA 4X.

3.2 The enclosure is hinged. Door is held by four screws that are removable for internal access.

3.3 The controller is plug & play with all engine and accessory connectors incorporated into the enclosure. These connections include:

- Engine Harness Connector – 16 Pin Deutsch Plug
- Float Connector – Pollack Single / Dual Float. Use two normally open contacts which when both closed will start the engine. When the low contact open, the engine will stop.



4) Engine Start & Stop

4.1 The controller is manual and auto start capable.

4.1.1 Manual Start – With the key in the manual start position, a display message of “Press Enter to Start” will appear. Pressing the Enter button will crank the engine. The engine is shut down by turning the key to the Off position.

4.1.2 Auto Start - Single or Dual Float - USE TWO NORMALLY OPEN CONTACTS WHICH WHEN BOTH ARECLOSED, THE CONTROLLER WILL START THE ENGINE. WHENTHE LOW FLOAT OPENS, THE ENGINE WILL BE STOPPED.

5) Engine Speed Control (Throttle Control)

5.1 None

6) Engine Faults

6.1 Engine Faults - In the case of an engine parameter is measured outside of the normal operating range, the control panel will shut the engine down by opening the run circuit. A red LED will illuminate above the LCD display and the LCD will display a text message describing which shutdown occurred.

6.1.1 Low Oil Pressure - Engine shutdown if below 15 PSI for 5 seconds.

6.1.2 High Engine Temperature – Engine shutdown if above 235 degrees F for 5 seconds.

6.1.3 Over Speed – Engine RPM is above 2550 for 1 second.

6.1.4 Low Fuel Level – Fuel Level is measured below 1% for 5 seconds.

7) Controller Specific Alarms

7.1 The controller monitors additional “system” inputs directly including:

7.1.1 Emergency Stop (Digital) - An Emergency Stop button can be attached to Term 12 on the control board. Use a normally open button, which closes to ground. A shut down will occur when active.

7.1.2 Fuel Level Sender (Analog) - A Fuel Level Sender can be attached to Term 7 on the control board. Use a 240 to 33 ohm scale for a 0 to 100% display. Attaching a fuel sender will automatically change the LCD to display Fuel Level. A pre alarm is programmed at 20%. A shutdown is programmed at 1%.

7.1.3 Low Water Level Switch (Digital) - A Low Water Level switch can be attached to Term 5 on the control board. Use a normally open switch, which closes to ground. A shut down will occur when active.

7.1.4 Low Oil Level Switch - A Low Oil Level switch can be attached to Term 6 on the control board. Use a normally open switch, which closes to ground. A shut down will occur when active.

7.2 In the case of a fault, the engine will be shut down, the red LED will illuminate and a message will appear on the digital display defining the specific shutdown condition.

7.3 To clear alarms, it is necessary to eliminate the cause of the alarm and cycle power to the controller (turn off and back on).

8) External Connectors

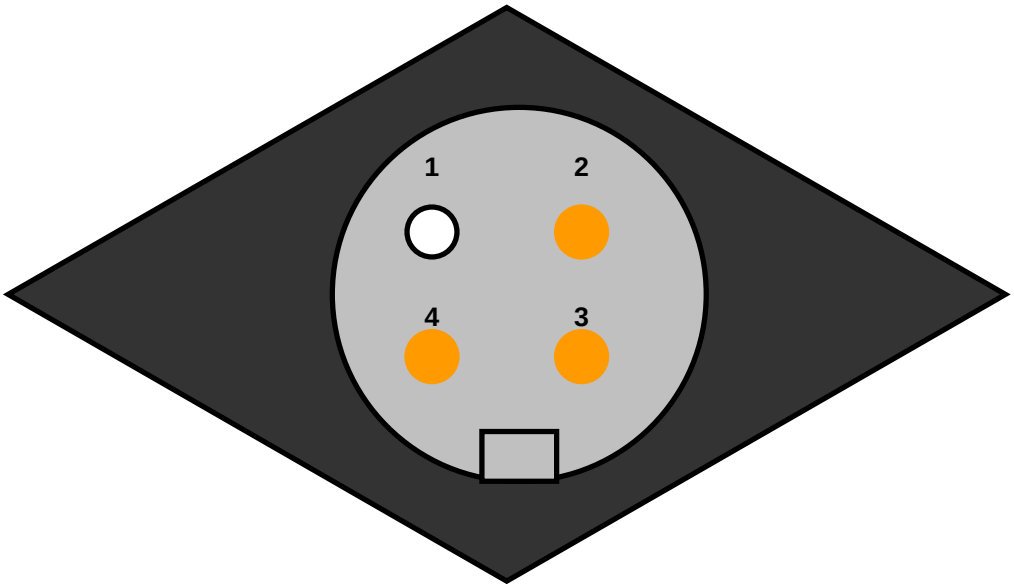
8.1 Engine Connection - The controller is connected to the engine via a 16-pin Deutsch plug. The pin out for the engine harness is shown below.

Pin S	Battery + to Controller	Pin H	Temperature
Pin D	Battery + to Start Slave Relay	Pin C	Oil Pressure
Pin F	Battery -	Pin G	Battery + to Alt. Excite
Pin R	Battery + to Fuel Solenoid	Pin J	Battery + to Pre Heat Relay
Pin P	MPU +	Pin A	MPU -

8.2 Float Connection - The controller is connected to the float system via a four pin, Pollack plug. The pin out for the engine harness is shown below. All float contacts are assumed Normally Open.

8.2.1 Single Float Connection – Connect Float between terminals 1 and 3.

8.2.2 Dual Float Connection – Connect Low Float between 1 and 4. Connect High Float between 2 and 3.



9) Controller Menus

9.1 The control panel has menus to view engine and controller parameters. These menus are accessible via a four-button pad located on the face of the control panel.

9.2 Available Menus

Sender Configuration:	Speed signal and overspeed settings.
Control Functions:	Glow plug and auto start settings.
Discrete Input Configurations	(View only)

9.3 Menu Access & Navigation

9.3.1 Entering Menus

1. Press and hold the MENU key & simultaneously press the ENTER key.

9.3.2 Navigation

1. Press MENU to select the next menu category.
2. Press UP to view or edit the specific screen(s) in the category.
3. Use the UP and DOWN keys to move among the screens in the category.
4. Press MENU at any time within a category to jump back to the inner ring

9.3.3 Password Entry

The password screen is provided to restrict the edit of sensitive values to authorized personnel. Not entering a password permits viewing, but no editing of restricted values. Upon encountering the password screen, a series of dashes will be displayed. To enter the password:

1. Press ENTER to begin editing. The password zeroes will be bracketed.
2. Use the UP and DOWN keys to set the first (leftmost) digit, as you would for a cylinder combination lock.
3. Press ENTER to freeze that digit and move to the next one on the right.
4. Repeat steps 2 and 3 until all digits have been set. After the final digit is set, the brackets automatically disappear.
5. Press the UP key to proceed to the next screens.

If the correct password was entered earlier, navigating back over the password entry screen will show the password as a row of stars. The password approval state is retained as long as the panel is powered up.

9.3.4 Editing

Some screens permit parameter changes.

1. Press ENTER to start editing. The value on the screen will be surrounded by brackets. On password-protected screens, brackets appear only when the correct password was entered earlier.
2. Use the UP and DOWN keys to adjust the value. In the case of a selection list, the various possible selections will be shown in a ring. In the case of a variable number, press the appropriate key to step up/down. For larger changes, press and hold the UP or DOWN key. (The value will step faster as the key is held down. Stepping will stop when preset value limits are reached or the key is released.)
3. Press ENTER to save the new value. The brackets will disappear.
4. To skip the edit and retain the old value, press MENU instead of ENTER.

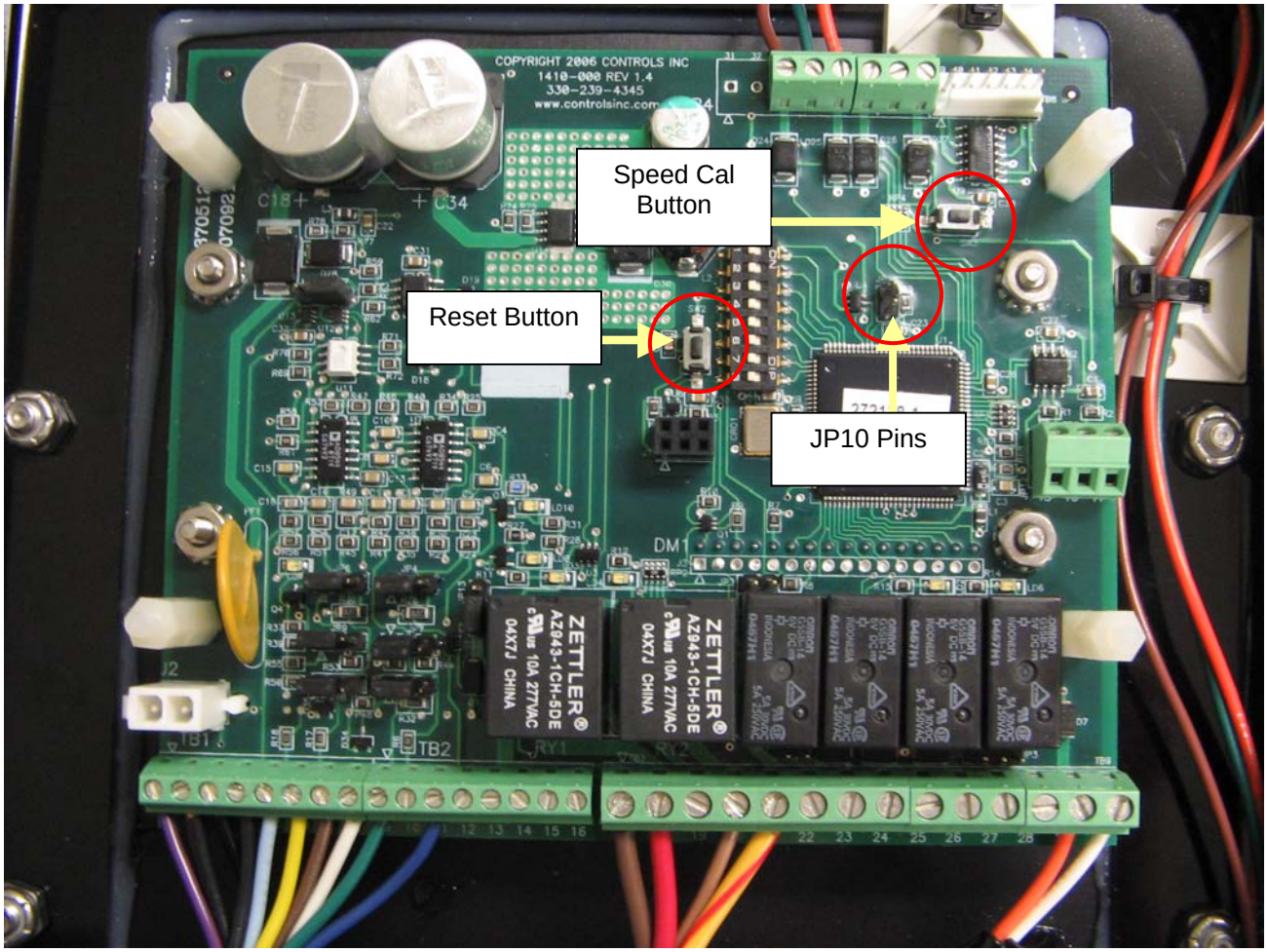
9.3.5 Exiting

1. Press and hold the MENU key & simultaneously press the ENTER key.
   Leaving during editing will abandon the edit and the old value will be retained. Exiting has no effect on the password approval. To clear the approved password state, power cycle the panel.

9.4 Reset to Factory Settings – The factory default settings can be reset in two ways:

9.4.1 Reset Procedure (See picture below)

1. Turn the key to the Auto position.
2. Open the enclosure to access the circuit board.
3. Make connection between two pins labeled “JP10” with screwdriver.
4. Push micro button down and release.



9.5 Factory Settings

Engine Settings

Sender	*Type*	*LLPA*	*LLA*	*HLPA*	*HLA*
Speed	MPU	Na	Na	Na	2550
Oil Press	SW to PSI	20	15	Na	Na
Engine Temp	SW to F	Na	Na	230	235
Fuel Level	SW to %	20	1	Na	Na
Battery	Analog	12/24		15/30	

LLPA = Low Level Pre Alarm HLPA = High Level Pre Alarm
LLA = Low Level Alarm HLA = High Level Alarm Na = Not Activated

Control Settings

Parameter	*Setting*	*PA*	*A*	*AWRO*
Number of Cranks	5			
Crank Duration	10 Sec			
Crank Rest Duration	10 Sec			
Optional Digital Inputs				
Digital Input 1	Low Water Level	Na		Yes
Digital Input 2	Low Oil Level	Na		Yes

PA = Pre Alarm A = Alarm AWRO = Alarm While Running Only

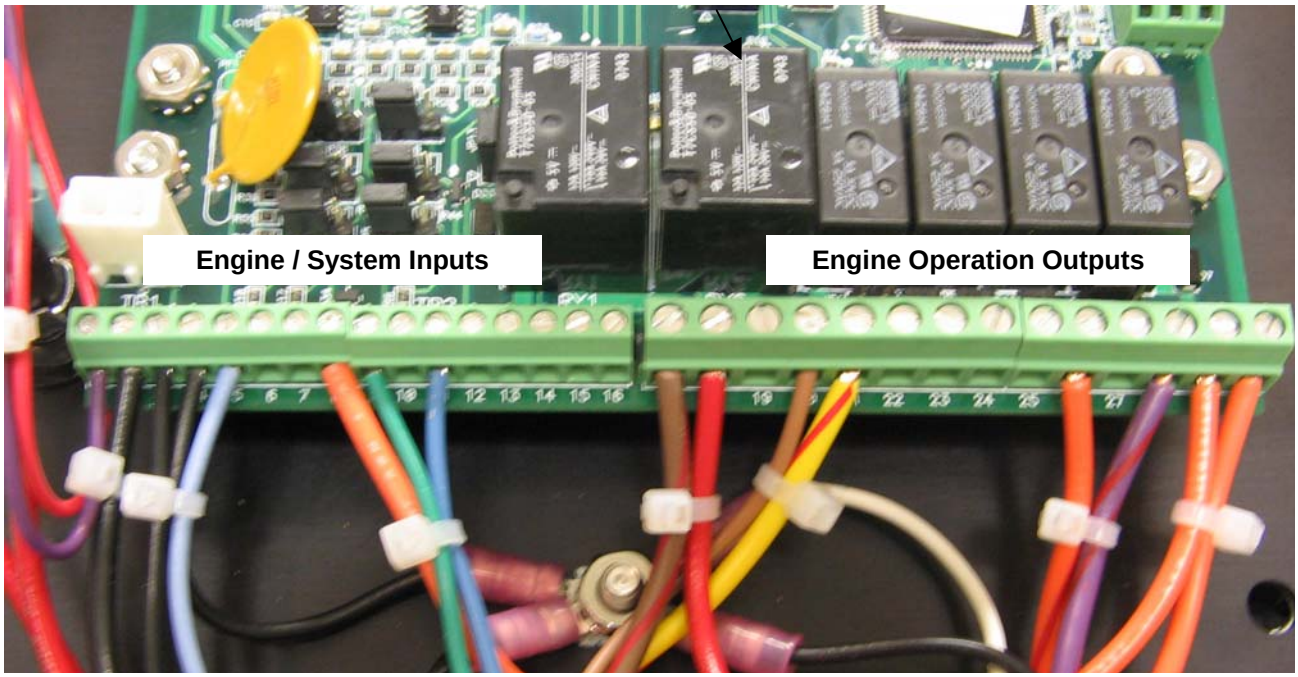
RPM Calibration (Speed Set Procedure)

Your control system may need to be calibrated to display the correct RPM on the LCD.

1) After installing control system, start the engine and set the speed to 1500 RPM using an external tachometer. *(The EMGRT1 is shipped from factory with 30 teeth flywheel setting.)*
2) Press the circuit board mounted button labeled SW3. It is located next in the upper right corner of the pcb.
3) The controller will calculate the correct number of pulses per revolution to obtain an accurate RPM display.

   The crank disconnect and over speed settings are also calculated from this calibration.

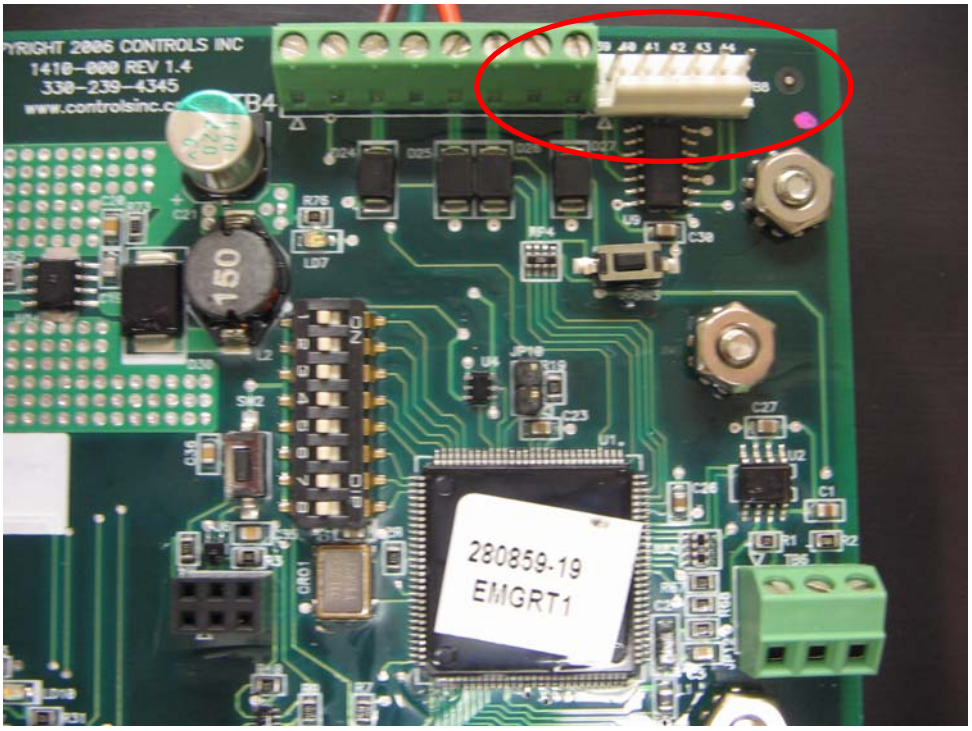
10) Terminal Strip Connections



10.1 Below is a list of connection definitions for circuit board mounted terminal connectors

10.1.1 PCB Version 1410-000 V1.4.

1	Battery Positive	16	
2	Battery Negative	17	Power to Fuel System (10A DC Max)
3	MPU+	18	Battery Positive Relay Common
4	MPU-	19	
5	Fuel Level Sender 240-33 ohm	20	Alternator Excite (D+)
6	Low Water Level Switch	21	Power Crank Solenoid (10A DC Max)
7	Low Oil Level Switch	22	Fault Common
8	Remote Start Input	23	Fault Normally Open
9	Engine Temp Sender	24	Fault Normally Closed (5A DC max)
10		25	Pre Alarm Common
11	Oil Pressure Sender 240-33 ohm	26	Pre Alarm Normally Open (5A DC max)
12	Emergency Stop	27	
		28	Glow Plug Normally Open (5A DC max)



10.2 TTL Outputs

10.2.1 When active the outputs sink to 0 VDC.

10.2.2 When not active, the outputs stay at +5 VDC

39	Low Oil Pressure Shutdown
40	High Temp Shutdown
41	Low Fuel Level Shutdown
42	Over Speed Shutdown
43	Over Crank Shutdown
44	Engine Run Indicator

11) Dipswitches

11.1 Dipswitch Definitions

Dipswitch 1	Not Used
Dipswitch 2	Not Used
Dipswitch 3	Not Used
Dipswitch 4	Not Used
Dipswitch 5	Turn ON to enable the Self Charging Battery System (SCBS)
Dipswitch 6	Not Used
Dipswitch 7	Not Used
Dipswitch 8	Not Used

NOTE: Glow plug and auto start time delays are enabled via the "Sender Configuration" menu.

11.2 Changing Dipswitch Settings - When making a dipswitch setting change, it is necessary to cycle the power to the controller before the new setting becomes active. (except dip switch 2)

12) Self Charging Battery System

The Self Charging Battery System (SCBS) included with this control is designed to maintain a high level of battery capacity during extended periods of standby operation. However, care must be taken when using this system due to the ability of the control to start and run the engine while in the "Auto" mode.

Conditions

1) Control must be in "Auto".

2) Dipswitch 5 must be in the ON position.

3) Displayed DC Voltage must be at or below 12.2 VDC for 1 minute.

Results

1) Control will begin the 8-second countdown to starting.

2) Control will start and run the engine at the programmed Warm Up speed for 15 minutes. During this run the display will flash a message of "Engine Start Low Battery Charge".

3) Control will stop the engine and wait a minimum of 60 minutes before the SCBS will initiate another run.

13) Warranty

CONTROLS, INC. is herein called “Seller”. The person, firm or corporation to whom or which the sale is made is herein called “Buyer”. Seller warrants to the Buyer that all products furnished under this order will conform to Seller’s specification, drawings as described in its current catalog or quotation and will be free from defects in materials and workmanship. Seller must approve other special requirements asked for by the Buyer in its purchase order in writing. Parts replaced or repaired in the warranty period shall carry the unexpired portion of the original warranty. The foregoing is subject to the provisions that in no case will the total warranty period extend beyond twelve (12) months from date seller ships equipment from point of sale.

The Liability of Seller hereunder is limited to replacing or repairing at Seller’s factory any part or parts which have been returned to the Seller and which are proved by buyer as defective or not conforming to Seller’s specifications, drawings or other written descriptions, accepted by Seller, provided that such part or parts are returned by the buyer within thirty (30) days after such defect is discovered. All items returned to Seller for repair or replacement must be sent freight prepaid to its factory. Buyer must obtain Seller’s Return Goods Authorization prior to returning items. The above conditions must be met if warranty is valid. Seller will not be liable for any damage done by unauthorized repair work, unauthorized misapplication in non-suitable environment.

In no event shall the Seller be liable for loss, damage, or expense directly or indirectly arising from the use of the units, or from any other cause, except as expressly stated in the warranty. Seller makes no warranties, express or implied, including any warranty as to merchantability of fitness for a particular purpose or use. Seller is not liable for and buyer waives any right or action it has or may have against seller for any consequential or special damages arising out of any breach of warranty, and for any damages buyer may claim for damage to any property or injury or death to any person arising out of its purchase or the use, operation or maintenance of the product. Seller will not be liable for any labor subcontracted or performed by buyer for preparation of warranted item for return to Seller’s factory or for preparation work for field repair or replacement. The Seller will not consider invoicing of Seller for labor either performed or subcontracted by buyer as a liability. This warranty shall be exclusive of any and all other warranties express or implied and may be modified only by a writing signed by an officer of the Seller. With respect to accessories supplied by Seller, but manufactured by others, there is no warranty of any kind, express or implied, and specifically there is no warranty of merchantability or fitness, except as may be set forth in any warranty the manufactures have made to Seller and which can be passed to the Buyer.