NGI-5000

Advanced Digital Ignition System

Operation Manual

ALTRONIC

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FORM NGI-5000 OM 08-25 |

WARNING: Deviation from these installation instructions may lead to improper engine operation which could cause personal injury to operators or other nearby personnel.

WARNING: The ignition system must be configured prior to use on an engine. Refer to the Engine Configuration Tool instructions. These instructions cover firmware versions 2.0 and later. Verify EEPROM programming prior to starting the engine.

INTENDED READER: An experienced operator with a thorough understanding of ignition systems. For questions, see your authorized distributor.

1.0 System Overview

1.1 Overview

There are two options available for the NGI-5000:

- **NGI-5000 Logic Module + CPU-2000 Legacy System:** This option allows the original CPU-2000 equipment to be used in conjunction with the upgraded NGI-5000 Logic module.
- **NGI-5000 Full System:** Moving to an NGI-5000 full system offers all-new equipment and features. The NGI-5000 system consists of four main parts:
  - User interface logic module with two built-in high-resolution HDMI screens.
  - Diagnostic Communications Power Module (DCPM).
  - Cylinder Ignition Unit (CIU).
  - New ignition coil with integrated circuits.

The NGI-5000 has a high-performance ST microcontroller and CM4 compute module microprocessor. ST microcontroller handles the position logic and time-critical functions, and the CM4 handles all the communications, display driving, and peripheral functions.

NOTE: If your CM4 is 1.X.X and your system looks like *Figure 1*, refer to the NGI-5000 Legacy Logic Module documentation. NGI-5000 firmware update files can be downloaded from the Altronic GitHub. See section **7.1 Updating Firmware and Software** on page 36 for firmware update instructions.

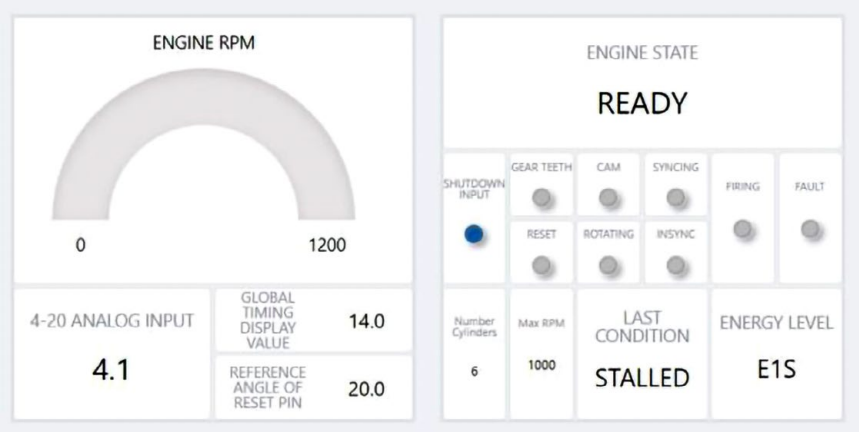

Figure 1

Each option has maintained much of the same CPU-type characteristics that our industry has become accustomed to, such as familiar verbiage, firing pattern codes, inputs, outputs, and operating ignition state machine.

Logic modules with software version 2.0 and later allow the operator to choose between legacy mode, which works with the existing CPU-2000 equipment, and NGI-5000 full system mode, which works in conjunction with the DCPM, CIUs, and NGI-5000 coils. To switch between the two modes, connect to the Engine Configuration Tool and select the type of system installed. Refer to the Engine Configuration Tool instructions. Once configured, the appropriate screens will be displayed, and the proper diagnostic functions will be enabled.

The NGI-5000 Logic Module Legacy Mode is designed to be a drop-in, plug-and-play replacement for the CPU-2000 Logic Module. While the screens are updated, the functions and set up of the system should be familiar to the operator. The new logic module offers increased availability of information using two high-resolution LCD screens, upgraded EEPROM storage, web-based technology for viewing with no proprietary downloaded tools, state-of-the-art computing power, and flexibility for future applications.

Upgrading to the NGI-5000 full system offers everything that comes with a logic module upgrade to the CPU-2000, as well as Varispark technology, real KV measurements, closed loop current spark control, parallel smart supplies, e-fuse technology, and availability of future upgrades such as ion sense and combustion diagnostics.

2.0 Logic Module User Interface

The logic module has two screens, a top screen for quick view and a bottom screen for dynamic viewing. A key feature of the NGI-5000 logic module is the ability to log into the unit with any Ethernet-based host device such as a PC. All technology is browser-based and therefore does not require installation of proprietary tools. It also allows for configurability of the screens for external viewing and launching a new view on the top and bottom module screens.

The top and bottom screens show "Connected" or "Disconnected" in the status bar at the bottom. "Connected" means that the individual screens are connected to the internal web server.

An Ethernet port is available inside the NGI-5000 logic module to allow for connection to a PC:

To view the NGI-5000 Logic Module on an external device:

1. Open the enclosure door and use the port in the lower-left corner labeled ETH 0.
2. In the **Altronic Web Interface (AWI) tool**, enter:
   a. Configuration IP Address: **192.168.1.2**
   b. Port Settings: **8080**

NOTE: Refer to the AWI Connection and Interface Manual for information on configuring your host device with the correct port setting to be able to interface with the NGI-5000 Logic Module.

To access the Engine Configuration Tool:

1. Open the enclosure door and use the port in the lower-left corner labeled ETH 0.
2. In Google Chrome, go to IP address **192.168.1.2** (notice there is no port 8080 at the end).

NOTE: Refer to the Engine Configuration Tool instructions for additional information.

3.0 Description of Output Switches

Three output switches provide a means of communicating the current ignition status to other systems, such as a PLC or basic relay. These switches have isolated outputs and share one common return path which is not referenced to engine or power ground. They will be in the open condition when the unit is unpowered. A typical application would be as a relay or solenoid coil driver.

- **Fire-Confirm Out switch:** Closed to signal that the ignition is running with no faults or ignition warnings. Warnings identified by the Diagnostic Module do not affect this output.
- **Shutdown Out switch:** Closed to signal that the ignition has detected no faults which would result in a self-shutdown. Upon detecting a fault that would result in a self-shutdown of the ignition, this switch will open.
- **Alarm Out switch:** Closed to signal that no un-acknowledged faults or warnings are present. Upon detection of a fault, ignition warning, or diagnostic warning, this switch will open. This output is designed to control an alarm indicator or sounding device.

4.0 Understanding the CIU LEDs

The following LED colors are visible on the CIU for each channel when opening the lid.

The first LED is always green color that ramps up in brightness. If the LED brightness stops changing, then this is an indication that there is something wrong with the micro-controller and a power cycle/reprogramming is needed.

The second LED changes color to indicate the current status:

- **Solid Red:** Normal operation.
- **Blinking Yellow:** The micro-controller is currently in the bootloader and may need to be re-programmed or power cycled.
- **Solid White:** The coil is disconnected from the corresponding CIU channel.

5.0 Understanding the GUI (NGI-5000 Legacy)

5.1 Understanding the Home Screen (NGI-5000 Legacy)

The logic module has two screens. The top screen provides a quick view of basic operational information, and the bottom screen provides dynamic viewing and a touch interface.

5.1.1 Top Screen (NGI-5000 Legacy)

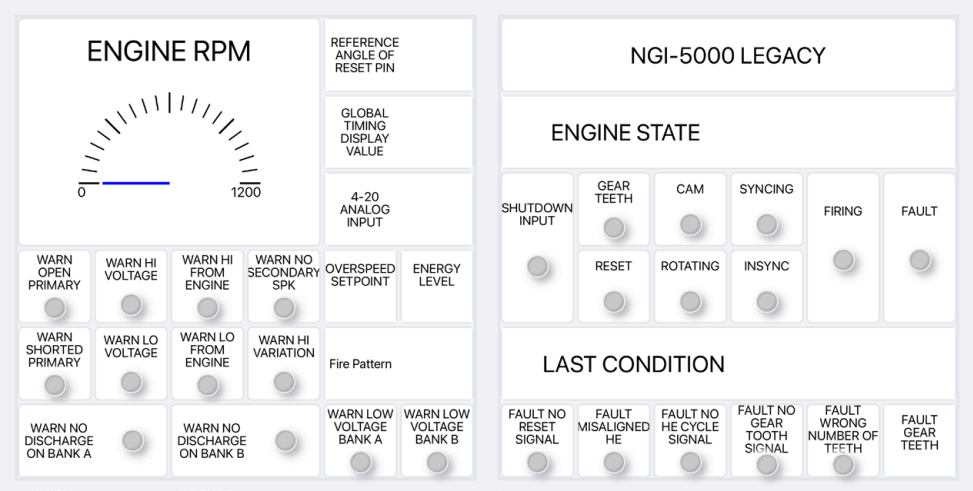

Figure 2

The top screen (*Figure 2*) shows basic operational information of the NGI-5000 Logic module including the programmed number of cylinders, overspeed setting, current energy level, and global timing, and all pickup states. Refer to the Application List for additional information.

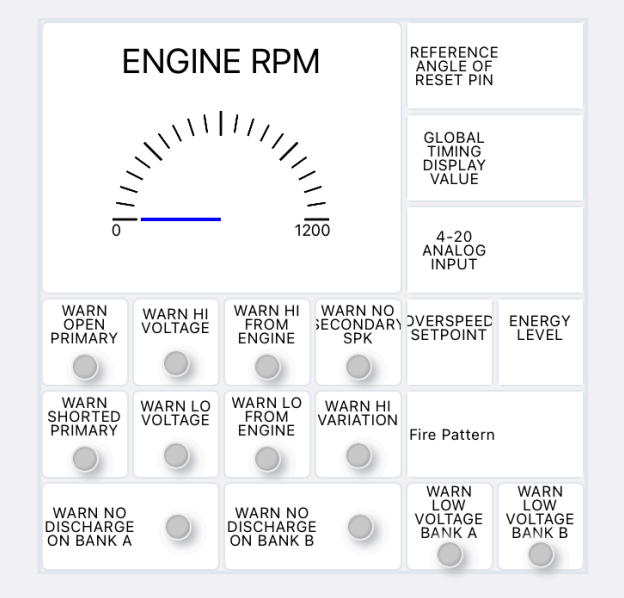

Figure 3

The left side of the screen (*Figure 3*) displays the following information:

- **Engine RPM:** Shows the current engine RPM. The overspeed setpoint is shown on the dial in red.
- **Reference Angle of Reset Pin:** Shows the reset pin angle. The default is 20.0.
- **Global Timing Display Value:** Shows the global ignition timing adjustment affecting all cylinders equally. See section **5.2 Global Timing Screen (NGI-5000 Legacy)** on page 9.
- **4-20 Analog Input:** Indicates the input in mA of the 4-20mA signal.
- **Global Warnings:** The alarm indicators turn on to indicate diagnostic warning conditions. Alarm thresholds are set in the Setup Screen and triggered by the Diagnostic Module. See section **5.3 Setup Screen (NGI-5000 Legacy)** on page 12.
- **Overspeed Setpoint:** Shows the engine overspeed value. Overspeed can be set in increments of 5 RPM to a maximum of 1275 RPM. The default setting is 500.
- **Energy Level:** Shows the base energy level, E1, E2, E3, and the single-strike / multi-strike type (S or M). The default setting is E1S.
- **Fire Pattern:** Shows the firing pattern set in the Engine Configuration Tool. The default setting is A2A. Refer to the Engine Configuration Tool instructions.

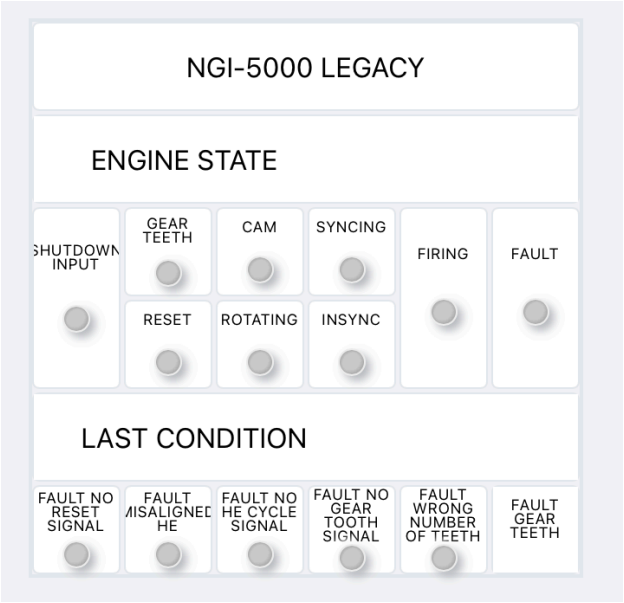

Figure 4

The right side of the screen (*Figure 4*) shows the following information:

- **Engine State:** The current operational state of the NGI-5000. The state input LEDs below the Engine State turn on or off to provide additional system details.
  - **READY (blue):** The ignition system is ready for the engine to begin rotating. The Shutdown Input LED will be on if the shutdown input has been activated.
  - **ROTATING (blue):** The engine is beginning to rotate. The Gear Teeth, Rotating, and Syncing diagnostic indicator LEDS turn on.
  - **SYNCING (cyan):** The ignition system is verifying the signals from the engine pickups. It will stay in Syncing while the RPM is below 15, or the pickups are not in phase, and/or while the shutdown lead is grounded.
  - **TRYING (cyan):** The pickups are synced, and it is trying to send fires and reset to the rest of the system to make sparks. The Reset, CAM, and Insync LEDs turn on.
  - **FIRING (green):** The ignition system is firing. The Firing and IGN Pickups Ok LEDs in the bottom screen turn on.
  - **FIRING(TEST) (green):** Indicates that the system is synthetically firing the ignition in test mode.
  - **FIRING WITH ALARM (yellow):** The ignition system is operating but an ignition or diagnostic warning condition is present.
  - **STALLED (red):** A loss of rotation below 15 RPM is detected after the ignition system begins firing and neither a shutdown or a fault has occurred. This indicates that the engine has stopped without any detected cause from the ignition system.
  - **FAULT (red):** A diagnostic fault condition is present, and the ignition system has ceased operation. The Rotating and Firing LEDS are off, the Fault diagnostic LED is on, and the fault condition is shown in the Last Condition section.
  - **SHUTDOWN[1] (black):** The ignition system is not firing because the shutdown input LED was activated to shut down the engine, or the shutdown input was grounded, but the engine has not stopped rotating.
    - The act of a shutdown is not recognized until the shutdown input changes from ungrounded to grounded while the engine is rotating.
    - When the shutdown is held grounded before rotation (in the Ready state) this can be used for purging. No firings will be sent, the shutdown input LED will be illuminated, and the ignition will stay in the Syncing state while the engine is rotating. When the shutdown is ungrounded, the ignition can then move to the Trying and subsequently the Firing state. If at any point after the shutdown is ungrounded while the engine is rotating, and if it is then re-grounded, the status will move to Shutdown and the ignition will be then locked out until rotation stops.
  - **NO INIT (black):** The position micro-controller and the compute module are not talking. The ignition will need to be diagnosed and possibly reprogrammed.

1 **Up to and including ST firmware 2.0.2:** If the shutdown is re-asserted to ground and caused a shutdown event prior to moving to the Firing state, the last condition will show "Missing Gearteeth". This is a normal Shutdown event; the displayed last condition, "Missing Gearteeth", is incorrect verbiage.

- **State Input LEDs:** The LEDs aid the user in a two staged approach to understand what is happening within the NGI-5000 Logic. The state input LEDs move through their logic, turning on and off depending on their status.
- **Last Condition:** Indicates what happened in the engine state as a result of the shutdown. This notification is persistent as long as power is supplied.
  - **SHUTDOWN**[1]**:** User shut down by the shutdown input.
  - **STALLED:** Engine speed fell below 15 RPM with no other explanation.
  - **OVERSPEED:** Engine speed exceeded user adjustable overspeed setpoint.
  - **MISSING_RESET:** One missing reset during running will trigger.
  - **MISSING_GEARTEETH:** Two resets seen and no gear teeth will trigger.
  - **MISSING_CAM:** One missing CAM during running will trigger.
  - **MISALIGNED_CAM:** If one CAM and RESET do not align, it will trigger.
  - **TOOTH COUNT:** Greater than +/- 4 teeth than configured number of teeth will trigger.
- **Pick-up Faults:**
  - **Fault No Reset Signal:** The gear signal is observed, but no reset signal is present.
  - **Fault Misaligned HE**
  - **Fault No HE Cycle Signal**
  - **Fault No Gear Tooth Signal**
  - **Fault Wrong Number of Teeth [per Reset]:** This fault may indicate inconsistencies in the metal (the pickup is picking up a noise event). Or the pickups are picking up another reset signal.
  - **Fault Gear Teeth:** The number of teeth identified by the Wrong Number of Teeth Per Reset fault condition.

5.1.1.1 Understanding the Diagnostic LEDs

The NGI-5000 has three types of diagnostic LEDs: diagnostic faults, diagnostic warnings, and informational indicator LEDs.

- **Diagnostic faults are critical and the most severe classification of problems.** A diagnostic fault will inhibit the ignition from firing. When a fault is detected, several things will occur:
  - The ignition system will stop firing.
  - The Shutdown Out switch will open.
  - The Fire Confirm Out switch will open.
  - The Alarm Out switch will open.
  - The Engine Status will be FAULT.
  - The corresponding diagnostic fault alarm(s) will turn on.
- **Diagnostic warnings indicate non-critical problems that need attention.** The ignition will continue to fire in the presence of any diagnostic warning.
  - When a warning is detected, several things will occur:
    - The Alarm Out switch will open.
    - The Engine Status will be FIRING WITH ALARM.
    - The corresponding diagnostic warning alarm(s) will turn on.
  - **4-20mA current loop out of range:** If the current loop as specified in the Engine Configuration Tool is outside the configured range. Refer to the Engine Configuration Tool instructions.
  - **Warning Low Voltage Bank A/B:** This means it is not enough primary voltage.
  - **Warning No Discharge Bank A/B:** A fire signal was sent, but the primary voltage was not discharged.
  - With the diagnostic module connected the following diagnostic warnings are also present:
    - Primary Open
    - Primary Short
    - Lo spark voltage
    - Hi spark voltage
    - No secondary spark
    - Lo from engine
    - Hi from engine
    - Hi variation

5.1.2 Bottom Screen (NGI-5000 Legacy)

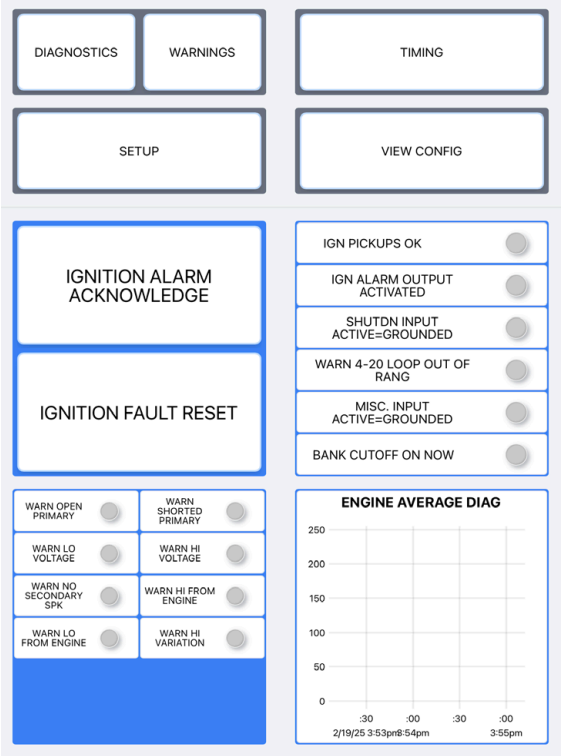

Figure 5

The bottom screen (*Figure 5*) has a dynamic touch interface; the buttons and alarm indicators are described below.

Figure 6

- **Diagnostics button:** Press to open the Diagnostics Screen which shows available diagnostics from the Diagnostic Module. See section **5.5 Diagnostics Screen (NGI-5000 Legacy)** on page 16.
- **Warnings button:** Press to open the Warnings Screen which shows available warnings from the Diagnostic Module. See section **5.6 Warnings Screen (NGI-5000 Legacy)** on page 18.
- **Setup button:** Press to adjust ignition and diagnostic parameters in the Setup Screen. See section **5.3 Setup Screen (NGI-5000 Legacy)** on page 12.
- **Timing button:** Press to adjust spark timing parameters in the Global Timing Screen. See section **5.2 Global Timing Screen (NGI-5000 Legacy)** on page 9.
- **View Config button:** Press to see a read-only view of the ignition configuration for the engine parameters. See section **5.4 View Configuration Screen (NGI-5000 Legacy)** on page 15.

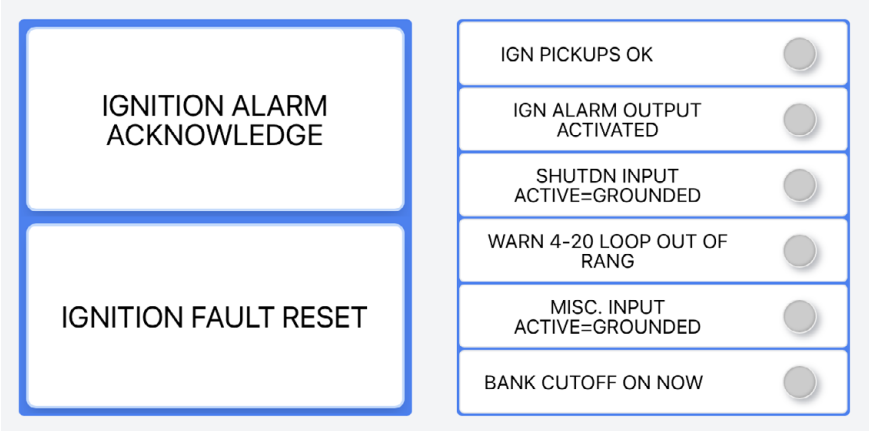

Figure 7

- **Ignition Alarm Acknowledge button:** Press to acknowledge warnings/alarms. Returns the Alarm Out switch to the closed position, and silences any audible alarms or flashers connected to the Alarm Out switch. After viewing and addressing any faults or warnings, the user would then reset and re-arm the ignition system.
- **Ignition Fault Reset button:** Press to reset and re-arm the ignition system. This returns all fault and warning indicators and outputs to the normal condition, resets temporary timing offset values, and re-arms the ignition to begin firing if faults are no longer present.

Input/Output Status Indicators

- **IGN Pickups OK:** Turns on when the ignition system has verified the pickup signals. When off, the pickups have not been synced or validated.
- **IGN Alarm Output Activated:** Turns on when any warning or fault condition is present to indicate that the Alarm Out switch has been opened.
- **Shutdn Input Active=Grounded:** Turns on when shutdown input is grounded.
- **Warn 4-20 Loop Out of Range:** Turns on when the 4-20 signal is outside the limits of 4mA and 20mA.
- **Misc. Input Active=Grounded:** Turns on when the Misc Input terminal is grounded.
- **Bank Cutoff On Now:** Turns on when bank b of the ignition system is turned off. Indicator is active when RPM is less than 200 at startup; or active when MISC input is grounded. Indicator may turn off when the set RPM is reached. In the Engine Configuration Tool, go to Advanced Settings to adjust this setting. Refer to the Engine Configuration Tool instructions.

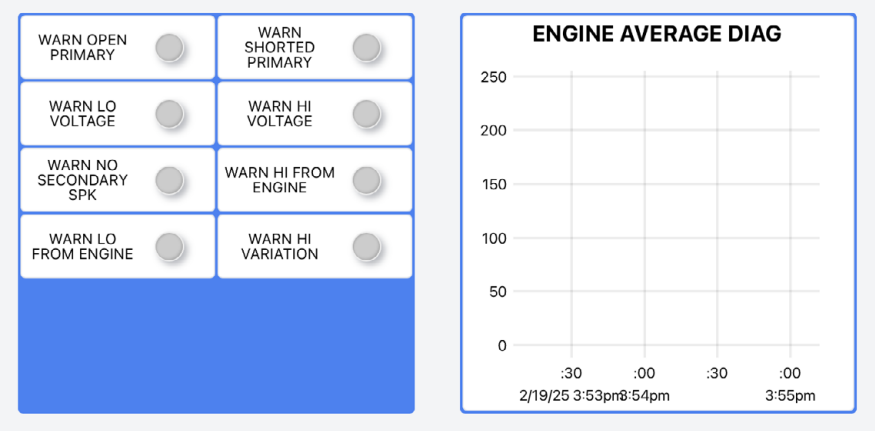

Figure 8

- **Global Warnings:** The alarm indicators turn on to indicate diagnostic warning conditions. Alarm thresholds are set in the Setup Screen and triggered by the Diagnostic Module.
- **Engine Average Diagnostic chart:** Shows the secondary voltage diagnostic across the entire engine represented as the spark reference number (SRN). See section **5.5.2 Understanding and Using the Secondary Spark Diagnostics** on page 16.

5.1.3 Opening and Closing Secondary Screens

Pressing the Diagnostics, Warnings, Setup, Timing, or View Config buttons on the bottom screen will open a secondary screen that allows the operator to view and adjust settings. Each secondary screen has a close icon ⓧ in the upper-right corner (*Figure 9*). Press the close icon to return to the home screen.

Figure 9

5.2 Global Timing Screen (NGI-5000 Legacy)

5.2.1 Overview

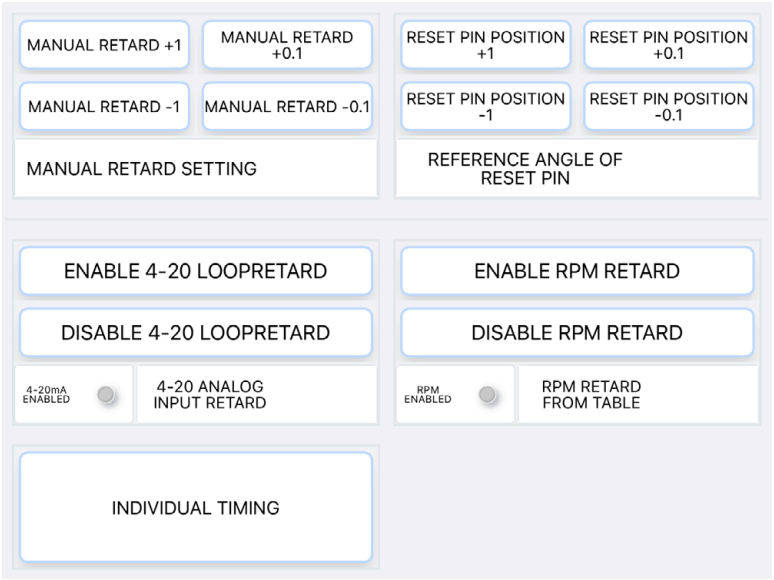

Figure 10

Press the **Timing button** on the bottom screen to open the global timing screen (*Figure 10)*. On this screen, the operator can make adjustments to the global retard, as well as enable or disable timing settings.

5.2.2 Global Retard

Global retard is an adjustment affecting the timing of all cylinders equally. This adjustment is comparable to the manual timing switch of the Altronic II-CPU system. Adjustments made as described below will be in effect until another adjustment is made.

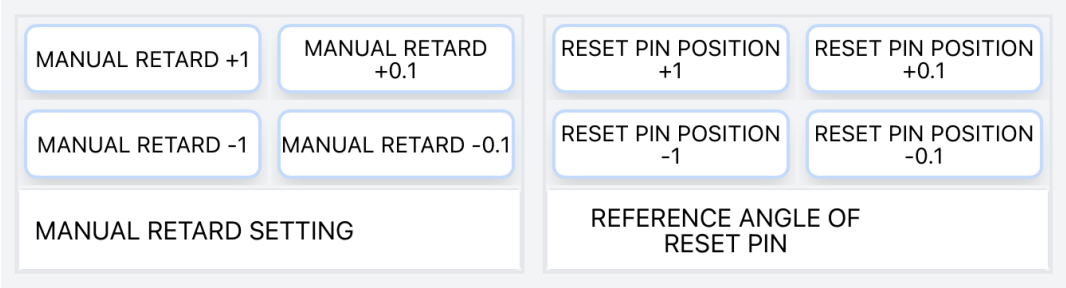

Figure 11

Manual Retard

- **Manual Retard buttons:** Use the buttons to increment or decrement the manual retard in increments of 1.0 degree and 0.1 degree, up to a maximum cumulative retard of 60 degrees.
- **Manual Retard Setting:** Shows the set manual retard. The default setting is 4.0.

Reset Pin Position

- **Reset Pin Position buttons:** Use the buttons to adjust the angle of the reset pin in increments of 1.0 degree or 0.1 degree. This setting allows you to match the displayed timing to the actual spark timing as verified with a timing light.

NOTE: Adjusting the pin position here affects the displayed timing but does NOT change the actual timing of the firings. To adjust the timing, you must physically move the mounted reset or manually adjust the retard.

NOTE: Adjustment of this parameter should be done when all individual cylinder offsets are at zero.

- **Reference Angle of Reset Pin field:** Shows the selected reset pin angle. The default setting is 20.0.

5.2.3 Global Timing Modes

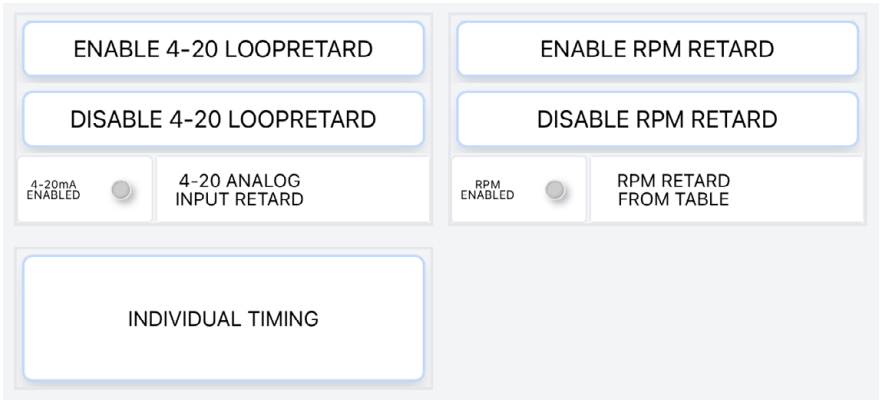

Figure 12

Loopretard

- **Enable/Disable 4-20 Loopretard buttons:** Press to enable or disable the pre-configured retard curve controlled internally by the 4-20 mA current loop input. **NOTE:** 4-20mA loop is programmed in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions.
- **Indicator LED:** Lights up the 4-20 loopretard is enabled.
- **4-20 Analog Input Retard field:** Shows the set 4-20 loopretard.

RPM Retard

- **Enable/Disable RPM Retard buttons:** Press to enable or disable the pre-configured retard curve controlled internally by engine RPM. **NOTE:** RPM retard is programmed in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions.
- **Indicator LED:** Lights up when RPM retard is enabled.
- **RPM Retard From Table field:** Shows the set RPM retard.

5.2.4 Individual Timing Settings

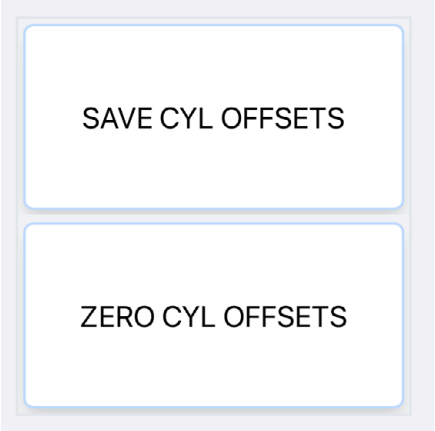

Figure 13

On the Global Timing screen, press the **Individual Timing button**, then select the number of outputs (8, 16, or 32) to open the Individual Timing screen. Here, the operator may advance or retard the timing for each individual cylinder by 0.1 or 0.5.

- **Save Cyl Offsets button**: Saves the current individual offsets to EEPROM memory.
- **Zero Cyl Offsets button:** Resets all cylinder timing offset values back to zero (both temporary memory and EEPROM memory).

NOTE: The **Cyc Timing Offset Adv/Rtd buttons** allow the operator to make individual timing adjustments as needed. Individual timing adjustments should be considered temporary; the ignition will revert back to the values saved in the EEPROM memory on every restart or power-up. To save the adjustments for a power cycle, press the **Save Cyl Offset button**.

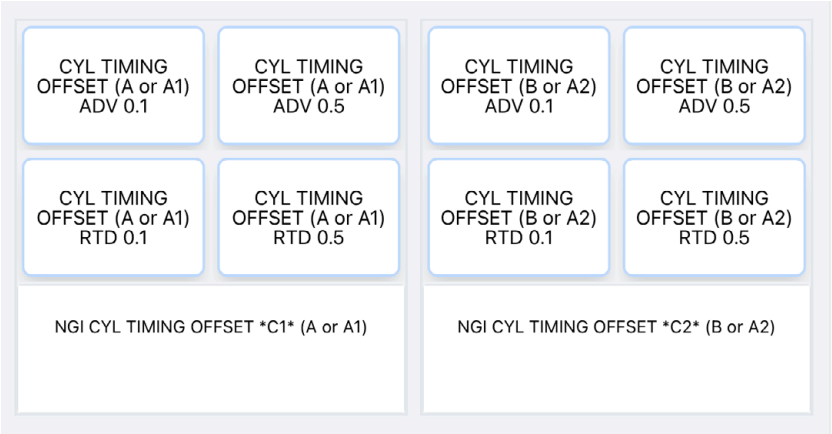

Figure 14

- **Cyc Timing Offset ADV / RTD 0.1 buttons:** Advance or retard the timing offset, up to 3 degrees, in increments of 0.1.
- **Cyc Timing Offset ADV / RTD 0.5 buttons:** Advance or retard the timing offset, up to 3 degrees, in increments of 0.5.

5.3 Setup Screen (NGI-5000 Legacy)

5.3.1 Overview

Figure 15

Press the **Setup button** on the bottom screen to open the Setup screen. On this screen, the operator can set the base energy level, view and set warning thresholds for the diagnostic LEDs on the home screen, and enable or disable multifire, test mode, and the diagnostic module. See *Figure 15*.

NOTE: Any changes made to the setup screen are stored in EEPROM and remain fixed until changed again.

5.3.2 Using the Setup Options

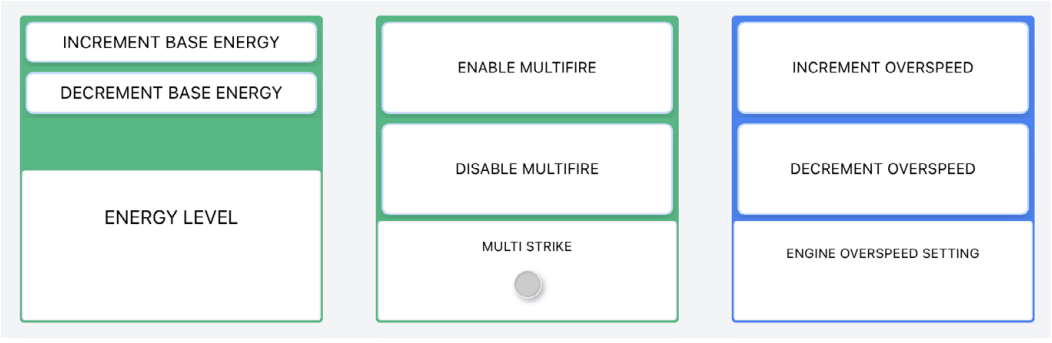

Figure 16

Base Energy

- **Increment/Decrement Base Energy buttons:** Press to set the base energy to E1, E2, or E3. The energy levels are 125 millijoules (E1), 150 millijoules (E2), and 185 millijoules (E3). E1 is the default. When multifire is off, the energy level appears as E1S, E2S, or E3S; when enabled, the energy levels appear as E1M, E2M, E3M.
- **Energy Level field:** Shows the set energy level.

Multifire

- **Enable/Disable Multifire buttons:** Press to enable or disable multifire.
- **Indicator LED:** When illuminated, multi fire is enabled.

Overspeed

- **Increment/Decrement Overspeed buttons:** Press to adjust the engine overspeed.
- **Engine Overspeed Setting field:** Shows the set overspeed.

Diagnostic Thresholds

Figure 17

- **Inc/Dec Lo Spark Diag Thresh buttons:** Press to adjust the Lo Spark Diag Threshold.
- **Lo Spark Diag Thresh field:** Shows the set Lo Spark Diag Threshold.

The following thresholds can be viewed and set in the same manner on the Setup screen:

- Inc/Dec Hi Spark Diag Thresh
- Inc/Dec No Spark Diag Thresh
- Inc/Dec Lo From Engine Thresh
- Inc/Dec Hi From Engine Thresh
- Inc/Dec Hi Variation Thresh
- Inc/Dec E2 Enable Thresh
- Inc/Dec E2 Disable Hysterisis
- Inc/Dec E3 Enable Thresh
- Inc/Dec E3 Disable Hysterisis
- Inc/Dec Lo Spark BankB Thresh
- Inc/Dec Hi Spark BankB Thresh
- Inc/Dec Lo From Eng B Thresh
- Inc/Dec Hi From Eng B Thresh

Test Mode

WARNING: The operator MUST fully purge the engine of combustible mixtures prior to enabling test mode.

NOTE: Before using test mode, it must be enabled in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions.

Ignition test mode can fire all outputs in rotation. This feature can be used to troubleshoot primary wiring and output module operation. Test mode will terminate if rotation of the engine is sensed.

Test mode can be enabled or permanently disabled in the Engine Configuration Tool. When the Engine Config Test Mode Permit LED is gray, test mode is not enabled in the Engine Configuration Tool; when blue, test mode is enabled.

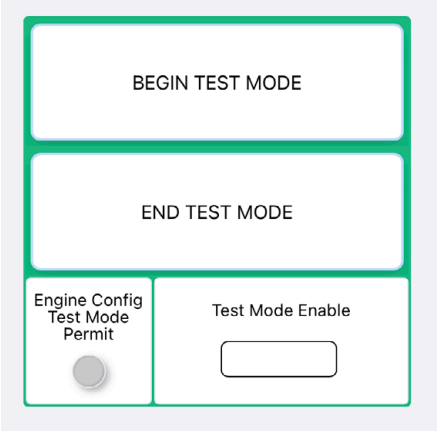

Figure 18

- **Begin/End Test Mode buttons:** Press to enable or disable test mode. **NOTE:** Test mode must be first enabled in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions.
- **Test Mode Enable field:** Enter the RPM desired for the test mode to operate at.
- **Indicator LED:** When the LED is gray, test mode is not enabled in the Engine Configuration Tool; when blue, test mode is enabled.

5.3.3 Enabling/Disabling the Diagnostic Module

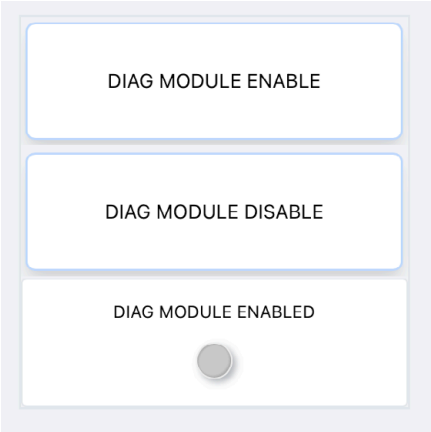

Figure 19

- **Diag Module Enable/Disable buttons:** Press to enable or disable the CPU-2000 diagnostic module.
- **Indicator LED:** Illuminated when diagnostic module is enabled.

5.4 View Configuration Screen (NGI-5000 Legacy)

5.4.1 Overview

Figure 20

Press the **View Config button** on the bottom screen to open the View Configuration screen (*Figure 20)*. On this screen, the operator can view the engine configuration settings set in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions for more information.

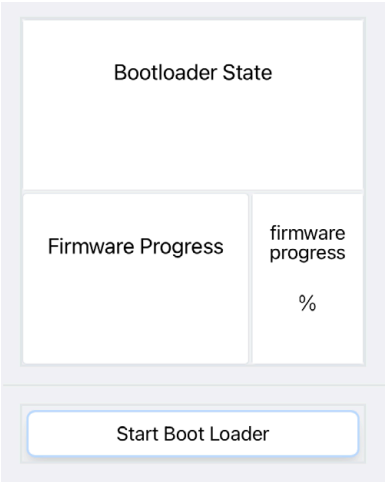

Figure 21

The Bootloader firmware update section is at the bottom of the screen (see *Figure 21*). See section **7.1 Updating Firmware and Software** on page 36 for firmware update instructions.

5.5 Diagnostics Screen (NGI-5000 Legacy)

5.5.1 Overview

Figure 22

Press the **Diagnostics button** on the bottom home screen, then choose your output module type (8, 16, or 32) to open the Diagnostics screen. Here, the operator can see how the ignition is functioning by checking the average KV value (CAVG) and variation (COV) for active spark plugs. See *Figure 22*.

5.5.2 Understanding and Using the Secondary Spark Diagnostics

The spark reference number is a unitless number which correlates with voltage demand at the spark plug and is calculated for every firing of each cylinder. As the voltage increases, the reference number also increases. The number is non-linear and will increase faster at higher voltages (above 20kV). The usefulness of the number lies not in its absolute value, but rather in how the number changes over time as the spark plugs erode. With a little experience, the engine operator will be able to tell when spark plugs require changing.

Abnormal conditions in the ignition system, such as open or short circuits in the primary and secondary wiring, can also be detected.

The following spark reference numbers are available in the NGI-5000 Legacy system:

- **Instantaneous (INST):** The numbers read back from the system in real time.
- **Variation (COV):** The variation in values for the cylinder being viewed.
- **Cyl. Average (CAVG):** The average value for the cylinder being viewed.
- **Minimum Value (MIN):** The minimum CAVG value since the last time reset.
- **Maximum Value (MAX):** The maximum CAVG value since the last time reset. NOTE: The above values are available on a per cylinder (or per coil/spark plug) basis.
- **Eng. Average (EAVG):** The average value for all cylinders of the engine.
- **Group 1 Average (1AVG):** The average value for all outputs of connector group 1.
- **Group 2 Average (2AVG):** The average value for all outputs of connector group 2.

NOTE: The (EAVG) average value indicates the average conditions of the entire engine.

The spark reference number will have a characteristic range depending on the type of coil used. There are known differences between the various types of Altronic coils, and slight variations are normal between coils of the same type. In order to maximize the usefulness of the cylinder spark reference number, it is recommended that all coils be of the same type and vintage (production date). The typical ranges to be expected in normal operation with new spark plugs are shown in *Table 1*:

Coil and No. Per Output	Range
Current 291001 coil (1/output)	095 – 125
Current 291001 coil (2/output)	135 – 175
Current 291001-S coil (1/output)	100 – 130
Current 291001-S coil (2/output)	140 – 185
Current 291008 coil (1/output)	120 – 155
Current 291008 coil (2/output)	085 – 110

Table 1

In addition to the diagnostic warnings the spark reference numbers can also be used for predictive purposes:

- As the numbers increase toward the preset HI SPARK VOLTAGE threshold, the operator knows that a change of spark plugs should be scheduled. With this information, spark plug replacement can be determined on an actual need basis rather than a predetermined schedule. Also, unexpected engine misfiring or shutdowns can be avoided by tracking the reference numbers on a routine basis.
- The reference numbers can provide an early warning of a difference in operation in a given cylinder. A reading higher or lower than other cylinders indicates a potential problem to the operator. This allows further troubleshooting and evaluation to take place before an unexpected operational problem develops.

The spark energy setting has only a small effect on the spark reference number if the spark plug fires correctly. Therefore, the high and low voltage thresholds should hold across energy setting changes if the spark plugs continue to fire normally. On the other hand, a worn plug may not fire consistently on energy setting E1 but will on energy setting E2; in this case there will be a significant difference in the reference number when the energy setting is changed.

Operators may be able to increase spark plug life by using the automatic energy adjustment feature of NGI-5000 Legacy system (go to the Engine Configuration Tool to adjust this setting; refer to the Engine Configuration Tool instructions). In this mode, the system uses the spark reference numbers to establish the lowest required energy level to minimize spark plug erosion rates. To use this feature, the basic setup energy should be set to E1.

The secondary spark diagnostics will operate with either one or two coils connected to each system output lead. Optimum operation is obtained when only one coil is connected to each output lead; in this case, only one spark plug condition effects the spark reference number for that output. When two coils are wired in parallel to a common output lead, the spark reference number will tend to be an average of the condition at the two spark plugs. While deviations between cylinders will be somewhat harder to detect, most of the benefits of the spark reference number can still be realized.

5.6 Warnings Screen (NGI-5000 Legacy)

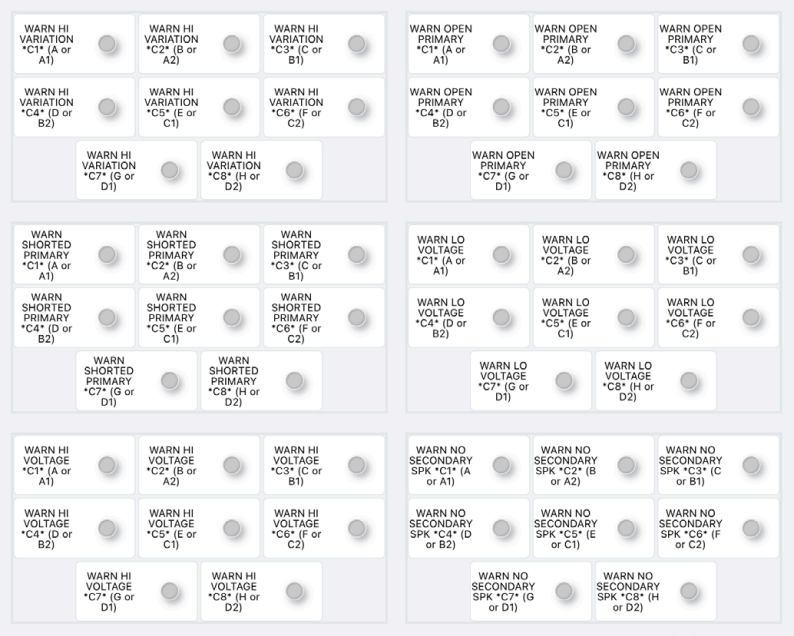

Figure 23

Press the **Warnings button** on the bottom screen, then choose your output module type (8, 16, or 32) to open the Warnings screen (*Figure 23*). On this screen, the operator can determine which cylinder is triggering a global warning LED.

6.0 Understanding the GUI (NGI-5000 Full System)

6.1 The Home Screen (NGI-5000 Full System)

6.1.1 Top Screen

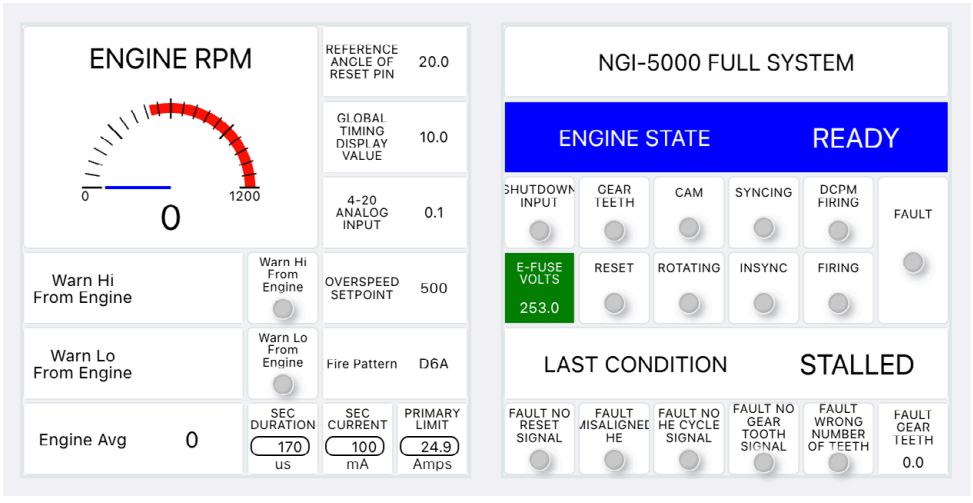

Figure 24

The top screen (*Figure 24*) shows basic operational information of the NGI-5000 Logic module including the programmed number of cylinders, overspeed setting, current energy level, and global timing, and all pickup states. Refer to the Application List for additional information.

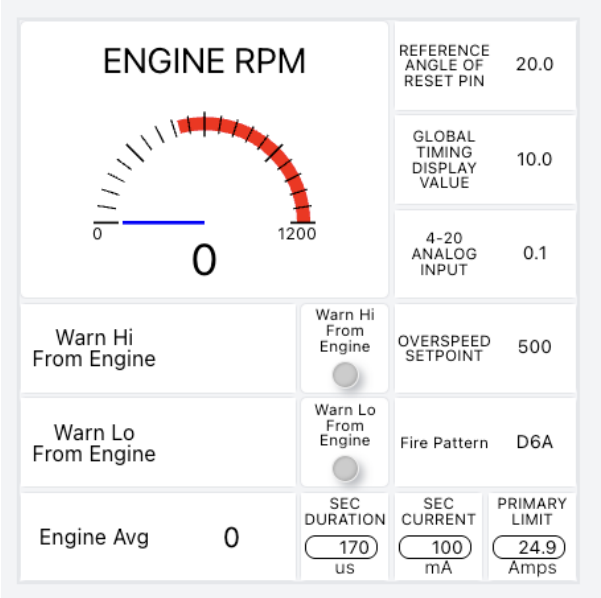

Figure 25

The left side of the top screen (*Figure 25*) displays the following information:

- **Engine RPM:** Shows the current engine RPM. The overspeed setpoint is shown on the dial in red.
- **Reference Angle of Reset Pin:** Shows the reset pin angle. The default is 20.0.
- **Global Timing Display Value:** Shows the global ignition timing adjustment affecting all cylinders equally. See section **5.2 Global Timing Screen (NGI-5000 Legacy)** on page 9.
- **4-20 Analog Input:** Indicates the input in mA of the 4-20mA signal.
- **Overspeed Setpoint:** Shows the engine overspeed value. Overspeed can be set in increments of 5 RPM to a maximum of 1275 RPM. The default setting is 500.
- **Fire Pattern:** Shows the firing pattern set in the Engine Configuration Tool. The default setting is A2A. Refer to the Engine Configuration Tool instructions.
- **Warn Low/High From Engine fields:** The individual cylinders that violate the set thresholds will scroll through in this field. Press the individual cylinder buttons on the bottom screen for coil diagnostics.
- **Warn Low/High From Engine Warning LEDs:** The LEDs light up when the set threshold is exceeded. Input thresholds can be adjusted in the Global CIU screen.
- **Engine Av Field:** Real spark kV value.
- **Sec Duration / Sec Current / Primary Limit:** Shows the secondary duration, current and primary limit from the Global CIU screen.

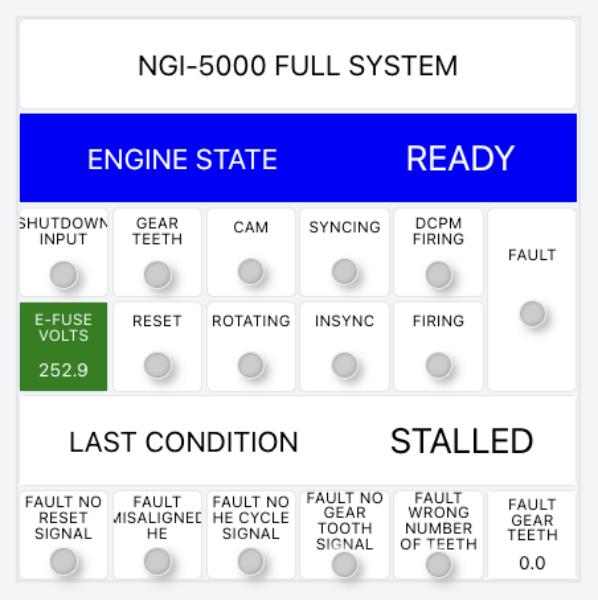

Figure 26

The right side of the top screen (*Figure 26*) shows the following information:

- **Engine State:** The current operational state of the NGI-5000. The state input LEDs below the Engine State turn on or off to provide additional system details.
  - **READY (blue):** The ignition system is ready for the engine to begin rotating. The Shutdown Input LED will be on if the shutdown input has been activated.
  - **ROTATING (blue):** The engine is beginning to rotate. The Gear Teeth, Rotating, and Syncing diagnostic indicator LEDS turn on.
  - **SYNCING (cyan):** The ignition system is verifying the signals from the engine pickups. It will stay in Syncing while the RPM is below 15, or the pickups are not in phase, and/or while the shutdown lead is grounded.
  - **TRYING (cyan):** The pickups are synced, and it is trying to send fires and reset to the rest of the system to make sparks. The Reset, CAM, and Insync LEDs turn on.
  - **FIRING (green):** The ignition system is firing. The Firing and IGN Pickups Ok LEDs in the bottom screen turn on.
  - **FIRING(TEST) (green):** Indicates that the system is synthetically firing the ignition in test mode.
  - **FIRING WITH ALARM (yellow):** The ignition system is operating but an ignition or diagnostic warning condition is present.
  - **STALLED (red):** A loss of rotation below 15 RPM is detected after the ignition system begins firing and neither a shutdown or a fault has occurred. This indicates that the engine has stopped without any detected cause from the ignition system.
  - **FAULT (red):** A diagnostic fault condition is present, and the ignition system has ceased operation. The Rotating and Firing LEDS are off, the Fault diagnostic LED is on, and the fault condition is shown in the Last Condition section.
  - **SHUTDOWN[2] (black):** The ignition system is not firing because the shutdown input LED was activated to shut down the engine, or the shutdown input was grounded, but the engine has not stopped rotating.
    - The act of a shutdown is not recognized until the shutdown input changes from ungrounded to grounded while the engine is rotating.
    - When the shutdown is held grounded before rotation (in the Ready state) this can be used for purging. No firings will be sent, the shutdown input LED will be illuminated, and the ignition will stay in the Syncing state while the engine is rotating. When the shutdown is ungrounded, the ignition can then move to the Trying and subsequently the Firing state. If at any point after the shutdown is ungrounded while the engine is rotating, and if it is then re-grounded, the status will move to Shutdown and the ignition will be then locked out until rotation stops.
  - **NO INIT (black):** The position micro-controller and the compute module are not talking. The ignition will need to be diagnosed and possibly reprogrammed.

2 **Up to and including ST firmware 2.0.2:** If the shutdown is re-asserted to ground and caused a shutdown event prior to moving to the Firing state, the last condition will show "Missing Gearteeth". This is a normal Shutdown event; the displayed last condition, "Missing Gearteeth", is incorrect verbiage.

- **State Input LEDs:** The LEDs aid the user in a two staged approach to understand what is happening within the NGI-5000 Logic. The state input LEDs move through their logic, turning on and off depending on their status.
- **DCPM Firing LED:** The DCPM sees that primary current (Amps) is flowing through the primary of the coil. Typical primary current for the NGI-5000 coil is greater than 18 Amps. Check the primary open threshold on the Global CIU screen. As long as the primary currents that are visible on the individual CIU screens are above the primary open threshold on the current (e.g. 15 A), it will say that the CIU has delivered energy (if at least a third of the CIUs are delivering energy). This will cause the DCPM Firing indicator to light up, move from trying to firing, and allow the fire confirm output switch to change state.
- **E-Fuse Volts:** Shows the current voltage. The background is green if the e-fuse status is good; the background is red if the voltage is too low (200V or lower). Refer to the DCPM screen for additional diagnostic information.
- **Last Condition:** Indicates what happened in the engine state as a result of the shutdown. This notification is persistent as long as power is supplied.
  - **SHUTDOWN²:** User shut down by the shutdown input.
  - **STALLED:** Engine speed fell below 15 RPM with no other explanation.
  - **OVERSPEED:** Engine speed exceeded user adjustable overspeed setpoint.
  - **MISSING_RESET:** One missing reset during running will trigger.
  - **MISSING_GEARTEETH:** Two resets seen and no gear teeth will trigger.
  - **MISSING_CAM:** One missing CAM during running will trigger.
  - **MISALIGNED_CAM:** If one CAM and RESET do not align, it will trigger.
  - **TOOTH COUNT:** Greater than +/- 4 teeth than configured number of teeth will trigger.
- **Pick-up Faults:**
  - **Fault No Reset Signal:** The gear signal is observed, but no reset signal is present.
  - **Fault Misaligned HE**
  - **Fault No HE Cycle Signal**
  - **Fault No Gear Tooth Signal**
  - **Fault Wrong Number of Teeth [per Reset]:** This fault may indicate inconsistencies in the metal (the pickup is picking up a noise event). Or the pickups are picking up another reset signal.
  - **Fault Gear Teeth:** The number of teeth identified by the Wrong Number of Teeth Per Reset fault condition.

6.1.1.1 Understanding the Diagnostic LEDs

The NGI-5000 has three types of diagnostic LEDs: diagnostic faults, diagnostic warnings, and informational indicator LEDs.

- **Diagnostic faults are critical and the most severe classification of problems.** A diagnostic fault will inhibit the ignition from firing. When a fault is detected, several things will occur:
  - The ignition system will stop firing.
  - The Shutdown Out switch will open.
  - The Fire Confirm Out switch will open.
  - The Alarm Out switch will open.
  - The Engine Status will be FAULT.
  - The corresponding diagnostic fault alarm(s) will turn on.
- **Diagnostic warnings indicate non-critical problems that need attention.** The ignition will continue to fire in the presence of any diagnostic warning.
  - When a warning is detected, several things will occur:
    - The Alarm Out switch will open.
    - The Engine Status will be FIRING WITH ALARM.
    - The corresponding diagnostic warning alarm(s) will turn on.
  - **4-20mA current loop out of range:** If the current loop as specified in the Engine Configuration Tool is outside the configured range. Refer to the Engine Configuration Tool instructions.
  - **Warning Low Voltage Bank A/B:** This means it is not enough primary voltage.
  - **Warning No Discharge Bank A/B:** A fire signal was sent, but the primary voltage was not discharged.

- With the diagnostic module connected the following diagnostic warnings are also present:
  - Primary Open
  - Primary Short
  - Lo spark voltage
  - Hi spark voltage
  - No secondary spark
  - Lo from engine
  - Hi from engine
  - Hi variation

6.1.2 Bottom Screen

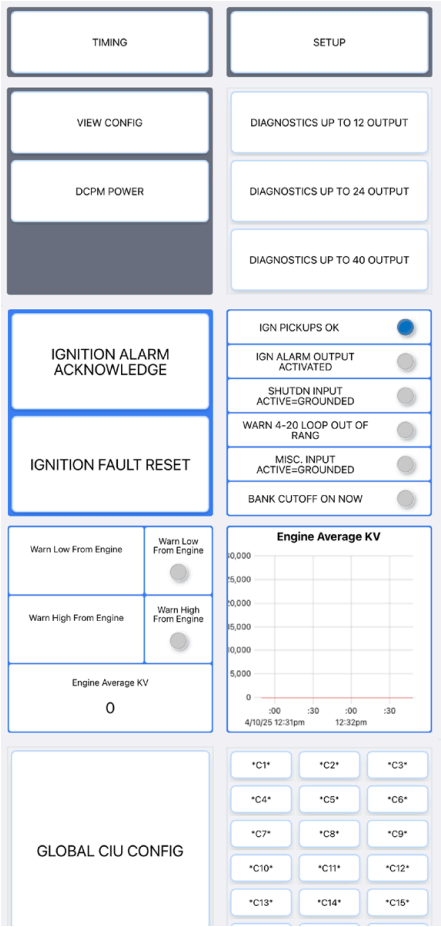

Figure 27

The bottom screen (*Figure 27*) has a dynamic touch interface; the buttons and alarm indicators are described on the following pages.

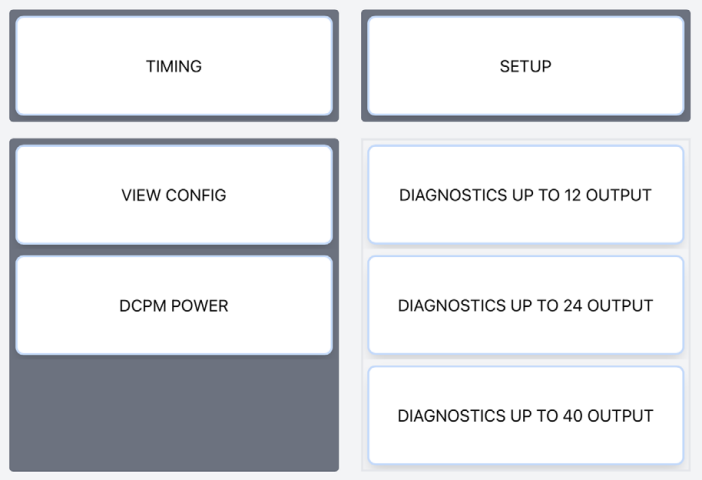

Figure 28

- **Timing button:** Press to adjust spark timing parameters in the Global Timing screen. See section **6.2 Timing Screen (NGI-5000 Full System)** on page 25.
- **View Config button:** Press to see a read-only view of the ignition configuration for the engine parameters. See section **6.4 View Configuration Screen (NGI-5000 Full System)** on page 30.
- **DCPM Power button:** Press to open the Power screen to see the current status of power supply 1 and 2, turn the power supplies on or off, and see the voltage. See section **6.5 DCPM Power Screen (NGI-5000 Full System)** on page 31.
- **Setup button:** Press to adjust ignition and diagnostic parameters in the Setup screen. See section **6.3 Setup Screen (NGI-5000 Full System)** on page 28.
- **Diagnostics buttons:** Press the button for the number of outputs (12, 24 or 40) to open the Diagnostics screen which shows available diagnostics from the Diagnostic Module. See section **6.6 Diagnostics Screens (NGI-5000 Full System)** on page 31.

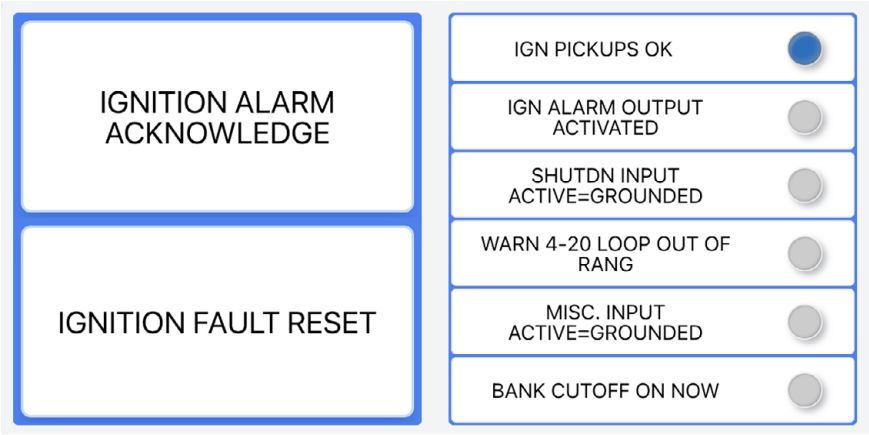

Figure 29

- **Ignition Alarm Acknowledge button:** Press to acknowledge warnings/alarms. Returns the Alarm Out switch to the closed position, and silences any audible alarms or flashers connected to the Alarm Out switch. After viewing and addressing any faults or warnings, the user would then reset and re-arm the ignition system.
- **Ignition Fault Reset button:** Press to reset and re-arm the ignition system. This returns all fault and warning indicators and outputs to the normal condition, resets temporary timing offset values, and re-arms the ignition to begin firing if faults are no longer present.

Input/Output Status Indicators:

- **IGN Pickups OK:** Turns on when the ignition system has verified the pickup signals. When off, the pickups have not been synced or validated.
- **IGN Alarm Output Activated:** Turns on when any warning or fault condition is present to indicate that the Alarm Out switch has been opened.

- **Shutdn Input Active=Grounded:** Turns on when shutdown input is grounded.
- **Warn 4-20 Loop Out of Range:** Turns on when the 4-20 signal is outside the limits of 4mA and 20mA.
- **Misc. Input Active=Grounded:** Turns on when the Misc Input terminal is grounded.
- **Bank Cutoff On Now:** Turns on when bank b of the ignition system is turned off. Indicator is active when RPM is less than 200 at startup; or active when MISC input is grounded. Indicator may turn off when the set RPM is reached. In the Engine Configuration Tool, go to Advanced Settings to adjust this setting. Refer to the Engine Configuration Tool instructions.

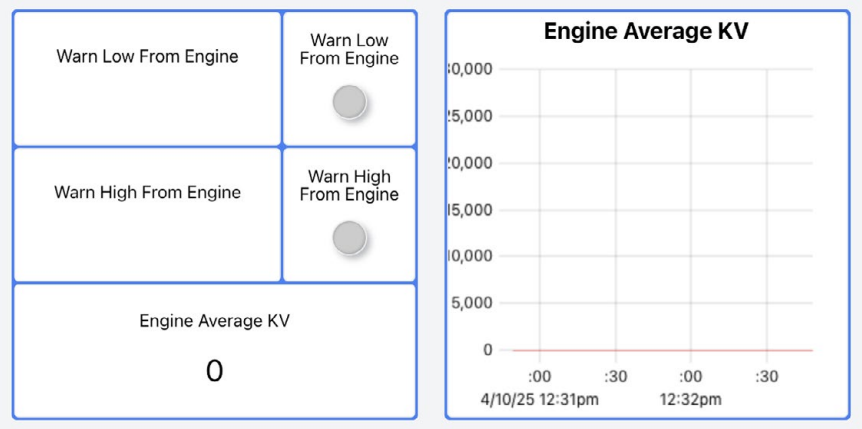

Figure 30

- **Warn Low/High From Engine fields:** The individual cylinders that violate the set thresholds will scroll through in this field. Press the individual cylinder buttons on the bottom screen for coil diagnostics.
- **Warn Low/High From Engine Warning LEDs:** The LEDs light up when the set threshold is exceeded. Input thresholds can be adjusted in the Global CIU screen.
- **Engine Av Field:** Real spark kV value.
- **Engine Average KV Chart:** Shows the real-time engine average values.

Figure 31

- **Global CIU Config Button:** Press to open the Global CIU Configuration screen. See section **6.7 CIU Global Configuration Screen (NGI-5000 Full System)** on page 32.
- **Individual CIU Buttons:** Press to open the configuration screen for the selected CIU. See section **6.7.2 Adjusting Individual CIU Settings** on page 34.

6.1.3 Opening and Closing Secondary Screens

Pressing the Timing, Setup, View Config, Diagnostics, DCPM Power, Global CIU Config, or individual CIU buttons on the bottom screen will open a secondary screen that allows the operator to view and adjust settings. Each secondary screen has a close icon ⓧ in the upper-right corner (*Figure 32*). Press the close icon to return to the home screen.

Figure 32

6.2 Timing Screen (NGI-5000 Full System)

6.2.1 Overview

Figure 33

Press the **Timing button** on the bottom screen to open the global timing screen. On this screen, the operator can make adjustments to the global retard, as well as enable or disable timing settings. See *Figure 33*.

6.2.2 Global Retard

Global retard is an adjustment affecting the timing of all cylinders equally. This adjustment is comparable to the manual timing switch of the Altronic II-CPU system. Adjustments made as described below will be in effect until another adjustment is made.

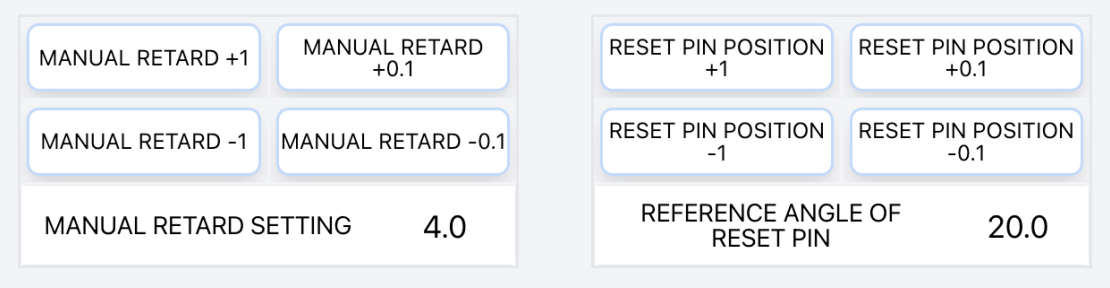

Figure 34

Manual Retard

- **Manual Retard buttons:** Use the buttons to increment or decrement the manual retard in increments of 1.0 degree and 0.1 degree, up to a maximum cumulative retard of 60 degrees.
- **Manual Retard Setting:** Shows the set manual retard. The default setting is 4.0.

Reset Pin Position

- **Reset Pin Position buttons:** Use the buttons to adjust the angle of the reset pin in increments of 1.0 degree or 0.1 degree. This setting allows you to match the displayed timing to the actual spark timing as verified with a timing light.

NOTE: Adjusting the pin position here affects the displayed timing but does NOT change the actual timing of the firings. To adjust the timing, you must physically move the mounted reset or manually adjust the retard.

NOTE: Adjustment of this parameter should be done when all individual cylinder offsets are at zero.

- **Reference Angle of Reset Pin field:** Shows the selected reset pin angle. The default setting is 20.0.

6.2.3 Global Timing Modes

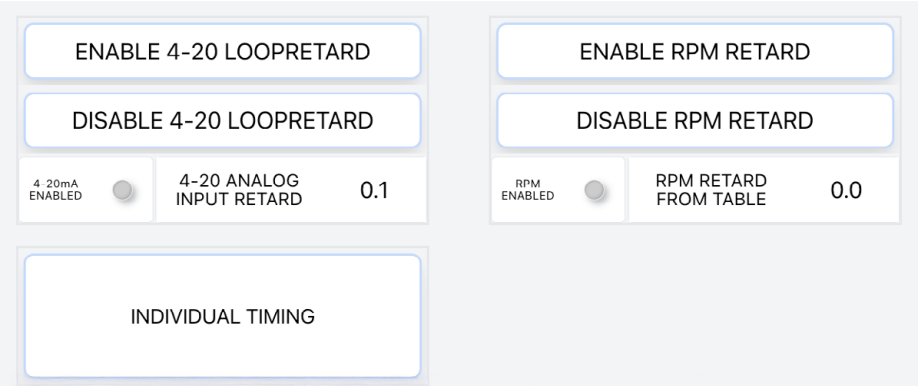

Figure 35

Loopretard

- **Enable/Disable 4-20 Loopretard buttons:** Press to enable or disable the pre-configured retard curve controlled internally by the 4-20 mA current loop input. **NOTE:** 4-20mA loop is programmed in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions.
- **Indicator LED:** Lights up the 4-20 loopretard is enabled.
- **4-20 Analog Input Retard field:** Shows the set 4-20 loopretard.

RPM Retard

- **Enable/Disable RPM Retard buttons:** Press to enable or disable the pre-configured retard curve controlled internally by engine RPM. **NOTE:** RPM retard is programmed in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions.
- **Indicator LED:** Lights up when RPM retard is enabled.
- **RPM Retard From Table field:** Shows the set RPM retard.

6.2.4 Individual Timing Settings

On the Global Timing screen, press the **Individual Timing button**, then select the number of outputs (8, 16, or 32) to open the Individual Timing screen. Here, the operator may advance or retard the timing for each individual cylinder by 0.1 or 0.5.

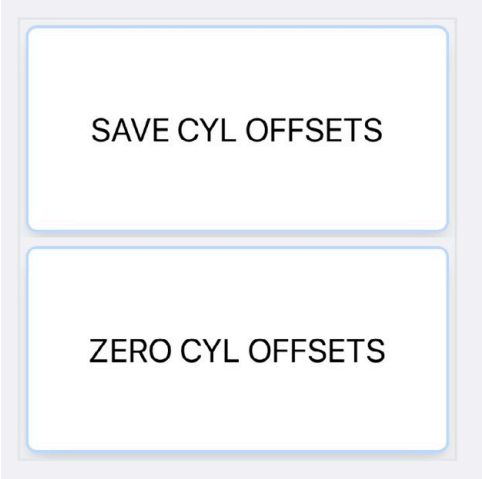

Figure 36

- **Save Cyl Offsets button**: Saves the current individual offsets to EEPROM memory.
- **Zero Cyl Offsets button:** Resets all cylinder timing offset values back to zero (both temporary memory and EEPROM memory).

NOTE: The **Cyc Timing Offset Adv/Rtd buttons** allow the operator to make individual timing adjustments as needed. Individual timing adjustments should be considered temporary; the ignition will revert back to the values saved in the EEPROM memory on every restart or power-up. To save the adjustments for a power cycle, press the **Save Cyl Offset button**.

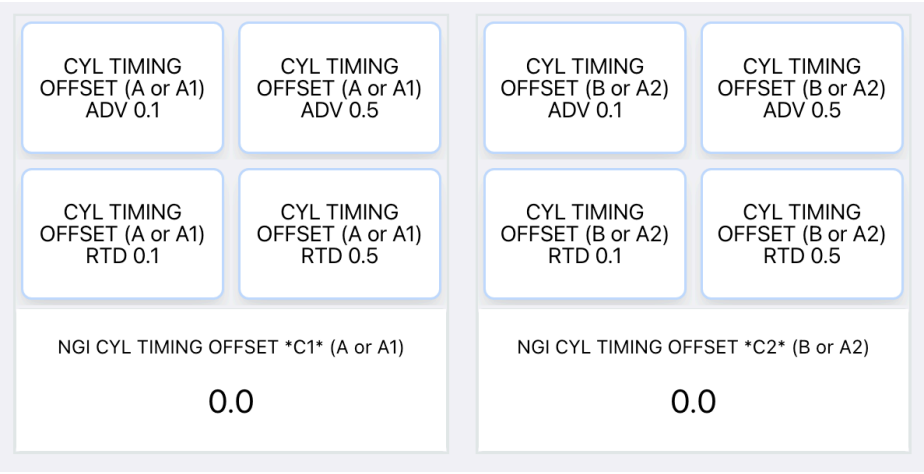

Figure 37

- **Cyc Timing Offset ADV / RTD 0.1 buttons:** Advance or retard the timing offset, up to 3 degrees, in increments of 0.1.
- **Cyc Timing Offset ADV / RTD 0.5 buttons:** Advance or retard the timing offset, up to 3 degrees, in increments of 0.5.

6.3 Setup Screen (NGI-5000 Full System)

NOTE: Many settings that were located on the Setup screen in the NGI-5000 Legacy System have been moved to the CIU Global Configuration screen. Refer to section **6.7 CIU Global Configuration Screen (NGI-5000 Full System)** on page 32 for additional information.

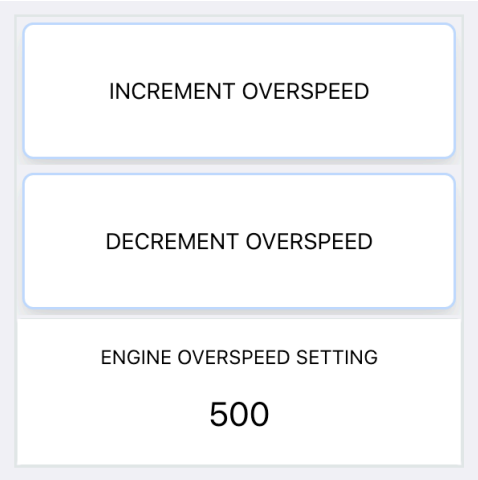

Figure 38

- **Increment/Decrement Overspeed buttons:** Press to adjust the engine overspeed.
- **Engine Overspeed Setting field:** Shows the set overspeed.

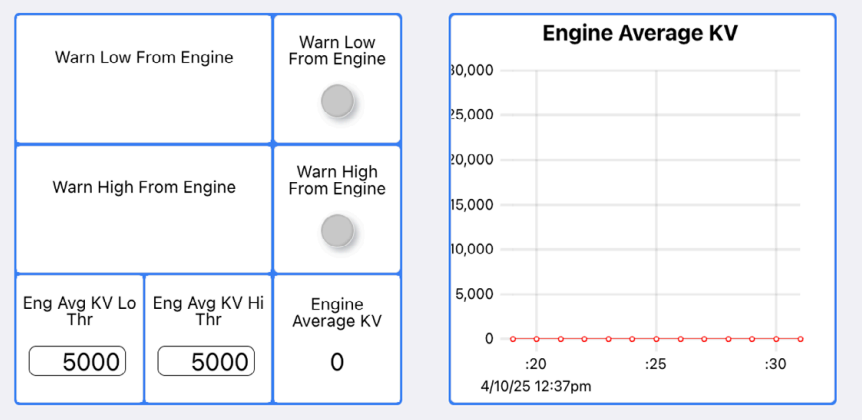

Figure 39

- **Warn Low/High From Engine:** Scrolls through the individual cylinders that violate the set thresholds. Press the individual cylinder buttons on the bottom screen for coil diagnostics.
- **Warn Low/High From Engine indicators:** Indicators light up when the set threshold is reached.
- **Eng Av KV Lo/Hi Thr fields:** Enter the low and high engine average thresholds. For example, if the high and low values are set to 1,000 and the engine average is 10,000, any cylinder that hits 9,000 or 11,000 would trip an alarm for being out of range of the engine average.
- **Engine Average KV:** Current engine average.
- **Engine Average KV Chart:** Shows the real-time engine average values.

6.3.1 Using Test Mode

Test Mode

> **WARNING:** The operator MUST fully purge the engine of combustible mixtures prior to enabling test mode.

NOTE: Before using test mode, it must be enabled in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions.

Ignition test mode can fire all outputs in rotation. This feature can be used to troubleshoot primary wiring and output module operation. Test mode will terminate if rotation of the engine is sensed.

Test mode can be enabled or permanently disabled in the Engine Configuration Tool. When the Engine Config Test Mode Permit LED is gray, test mode is not enabled in the Engine Configuration Tool; when blue, test mode is enabled.

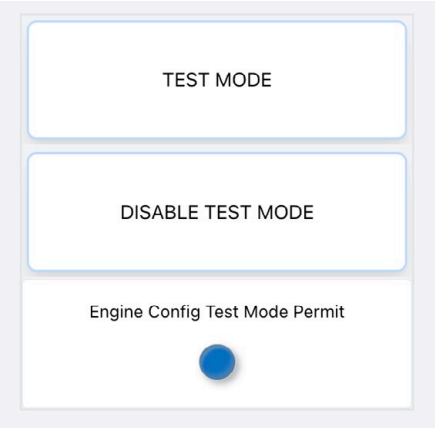

Figure 40

- **Test Mode / Disable Test Mode buttons:** Press to enable or disable test mode. **NOTE:** Test mode must be first enabled in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions.
- **Indicator LED:** When the LED is gray, test mode is not enabled in the Engine Configuration Tool; when blue, test mode is enabled.

6.4 View Configuration Screen (NGI-5000 Full System)

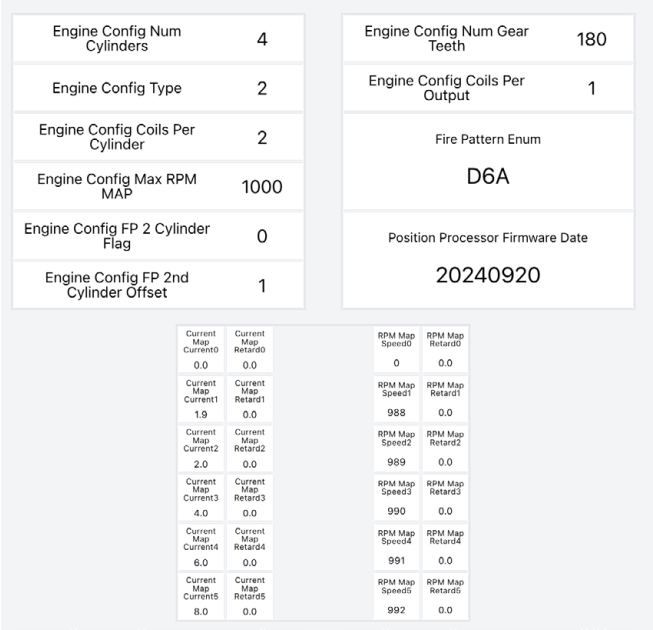

Figure 41

Press the **View Config button** on the bottom screen to open the View Configuration screen (*Figure 41*). On this screen, the operator can view the engine configuration settings set in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions.

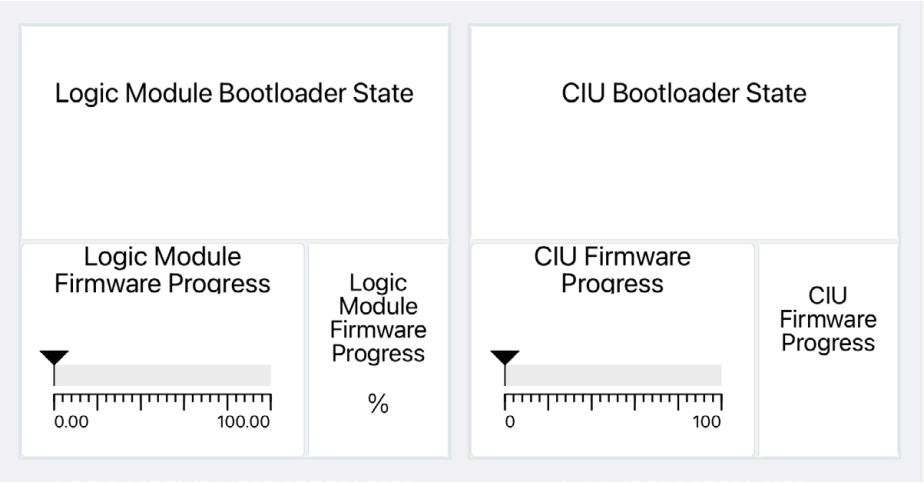

Figure 42

The bootloader firmware update section is at the bottom of the screen (*Figure 42*). See section **7.1 Updating Firmware and Software** on page 36 for firmware update instructions.

6.5 DCPM Power Screen (NGI-5000 Full System)

6.5.1 Overview

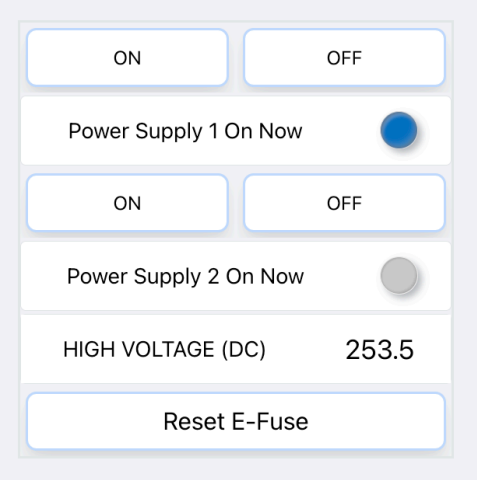

Figure 43

Press the **DCPM Power button** on the bottom screen to open the Power screen (*Figure 43*). On this screen, the operator can see the current status of power supply 1 and 2, turn the power supplies on or off, and see the voltage. The default power-up setting is power supply ON and power supply 2 OFF. If the e-fuse trips, it can be reset by pressing the **Reset E-Fuse button**.

6.6 Diagnostics Screens (NGI-5000 Full System)

Press the **Diagnostics button** on the bottom home screen, then choose your output module type (8, 16, or 32) to open the Diagnostics screen. Here, the operator can see how the ignition is functioning by checking the average KV value (CAVG), see *Figure 44*, and variation (COV), see *Figure 45*, for active spark plugs.

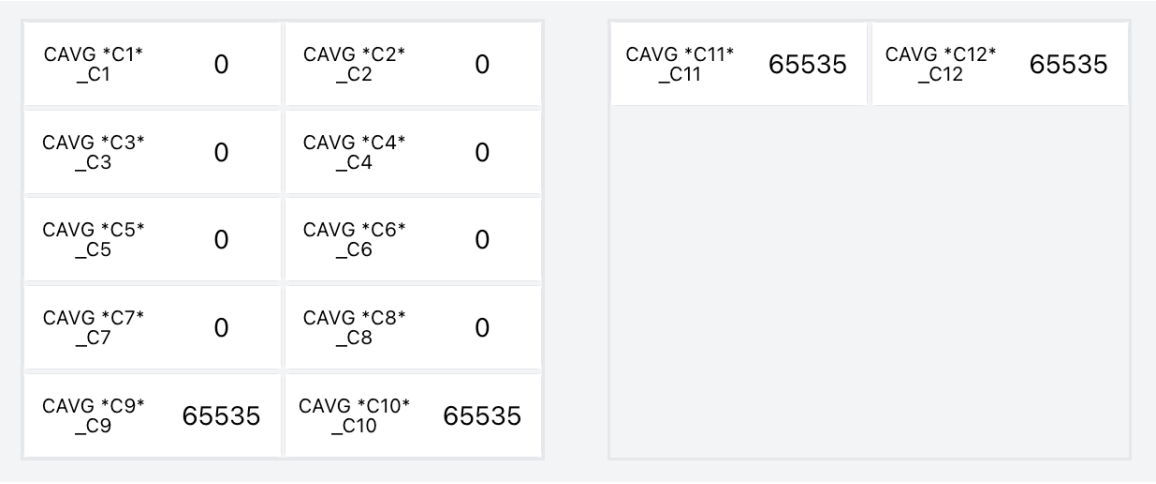

Figure 44

NOTE: A CAVG value of "65535" indicates the CIU is not receiving a firing signal from the DCPM.

Figure 45

6.7 CIU Global Configuration Screen (NGI-5000 Full System)

6.7.1 Overview

Press the **Global CIU Config button** on the bottom screen to open the CIU Global Configuration screen. Changes made to this screen are global and are applied to all CIUs.

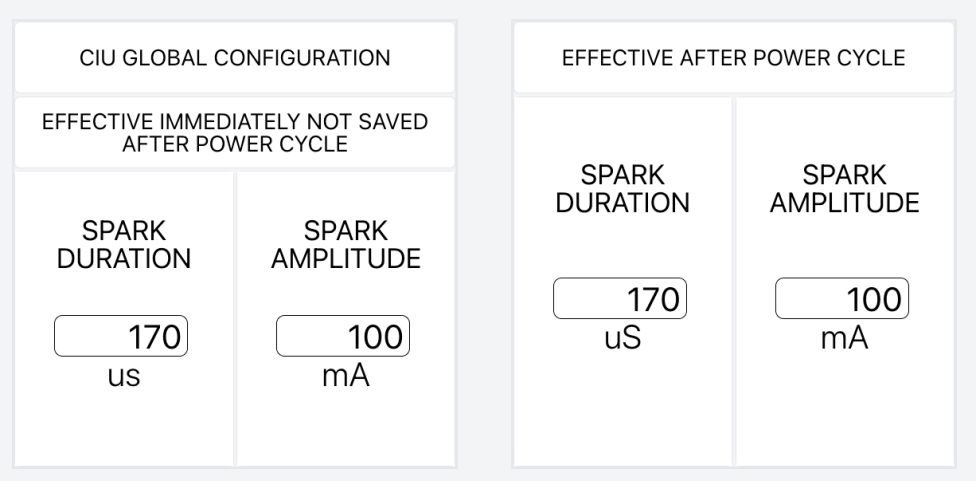

Figure 46

- **Spark Duration:** Length of the spark duration in µs
- **Spark Amplitude:** Height of the spark in mA.

NOTE: The settings on the left are effective immediately – no power cycle is required (any changes are lost if a power cycle is performed). The settings on the right are **NOT** effective immediately; they are only effective **after** a power cycle.

Figure 47

The CIU has built in secondary current spark control and diagnostics including secondary peak KV, COV, and primary current.

In this section, the operator may adjust the CIU diagnostic thresholds.

- **Primary Open Threshold:** The way the logic module knows that it is okay to set the fire confirm output is by the CIU's primary energy delivered register.
  - This is based on the primary current and the threshold for low primary current.
  - When the sensed primary current during the firing is above this threshold, the primary energy delivered indicator is set and the system will know that the corresponding CIU output is delivering energy.
  - A good value is between 7 and 15 amps.
- **HI COV Threshold:** Enter the high COV threshold for all CIUs.
- **Low/High KV Threshold:** This is the threshold for low/high spark demand.
- **Eng Avg KV Hi/Low Thr:** Enter the low and high engine average thresholds. For example, if the high and low values are set to 1,000 and the engine average is 10,000, any cylinder that hits 9,000 or 11,000 would trip an alarm for being out of range of the engine average.

Additional Parameters

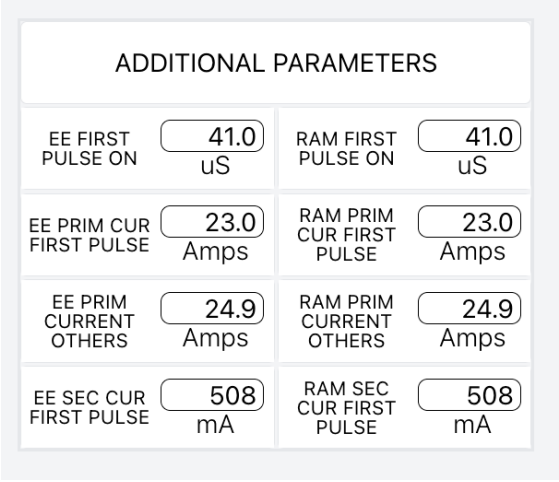

Figure 48

The primary current measurement is also used to protect the hardware from too much current.

IMPORTANT NOTE: Additional parameters do not typically need to be adjusted from the defaults. Consult Altronic before adjusting parameters.

- **EE First Pulse On:** How long the first pulse, tuned to achieve spark breakdown and limit breakdown current.
- There are 2 threshold settings:
  - **EE/RAM Prim Cur First Pulse:** The first threshold is for the beginning of the spark.
  - **EE/RAM Prim Current Others:** The second threshold is for the rest of the spark. This is because the primary current is usually lower at the beginning of the spark.
- No more energy will be delivered to the spark when the primary current is above the corresponding threshold.
- There is a corresponding LED on the AWI screen that indicates that the primary current was over one of the thresholds (primary current trip).
- There are 2 secondary current thresholds:
  - **EE/RAM Sec Cir First Pulse:** The secondary current threshold for the first pulse:
    - This should be set to 500 mA as a default to make sure there is a breakdown.
    - The first primary pulse will be the full programmed length.
    - If needed, the first secondary current threshold can be set lower to only deliver enough energy to breakdown. NOTE: This could prolong spark plug life, but setting the threshold too low could cause a misfire.
  - The secondary current of the rest of the spark:
    - The CIU will try to hold the secondary current at this threshold.
    - Can be set anywhere between 50 and 300 mA.

6.7.2 Adjusting Individual CIU Settings

To view the settings for an individual CIU, scroll to the bottom of the home screen, and press the button for an individual CIU to open the Individual CIU Configuration screen. Here the length and height of the spark can be set for the individual CIU.

NOTE: The cylinder name and fire pattern are mapped to the fire output sequence (*C1*, *C2*, *C3*, etc.) in the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions. For example, in *Figure 49*, CIU *C1* is mapped to CIU 1L.

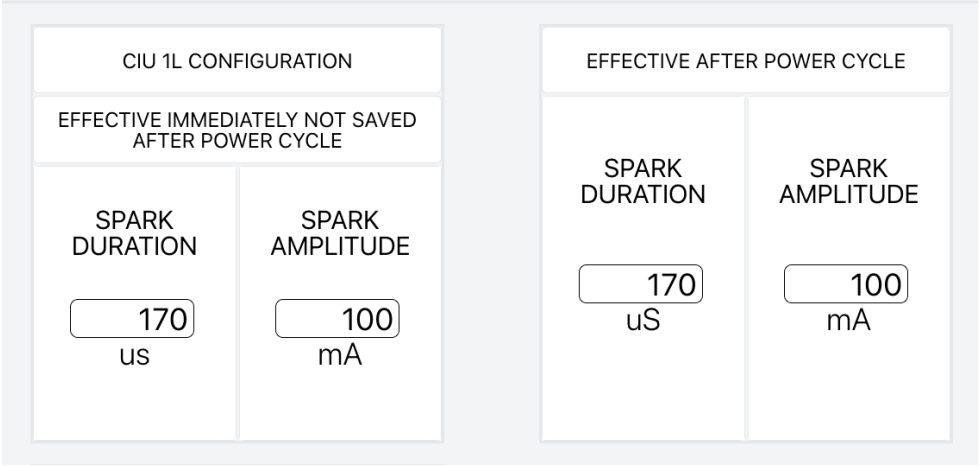

Figure 49

NOTE: Just as in the Global CIU Configuration screen, the settings on the left are effective immediately – no power cycle is required (any changes are lost if a power cycle is performed). The settings on the right are **NOT** effective immediately; they are only effective **after** a power cycle. See *Figure 49*.

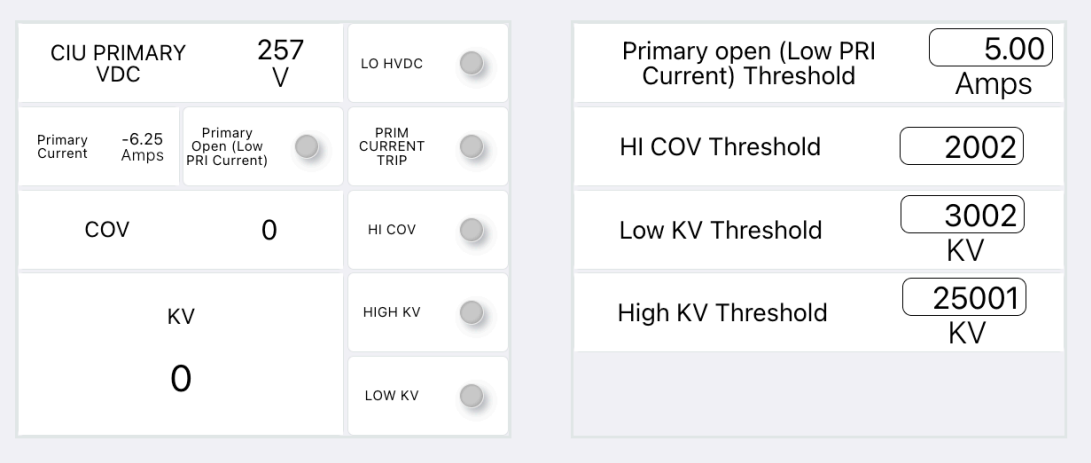

Figure 50

This section (*Figure 50*) shows the performance of the selected CIU for diagnostic purposes: the primary VDC in volts, primary current in Amps, low primary current alarm, current COV and KV. The warning/alarm indicators, Low HVDC, Prim Current Trip, Hi COV, High KV, Low KV, indicate any issues with the CIU.

NOTE: Primary Current will show -6.25 when the CIU is receiving a fire signal. When the primary is open, a fire signal is received, and it will generally read around 0.

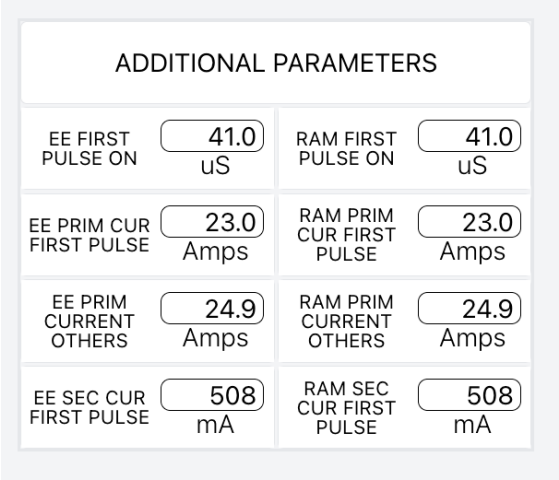

Figure 51

Additional parameters (*Figure 51*) for individual CIUs are the same as those that may be set globally. Refer to section **6.7 CIU Global Configuration Screen (NGI-5000 Full System)** on page 32 for additional information.

IMPORTANT NOTE: Additional parameters do not typically need to be adjusted from the defaults. Consult Altronic before adjusting parameters.

7.0 Diagnostics (NGI-5000 Full System)

7.1 Updating Firmware and Software

If your CM4 is 2.X.X, the firmware update process is completed through the Engine Configuration Tool. Refer to the Engine Configuration Tool instructions for additional information. Please complete the following steps in order:

1. Download the firmware update files from the Altronic GitHub.
2. Connect the NGI-5000 to your computer via Ethernet, using port ETH 0.
3. In Google Chrome, type the IP address for the Engine Configuration Tool in the address bar to open it: **192.168.1.2**
4. Click the blue **Update button** in the bottom-right corner. See *Figure 52*.
5. Select the device to be updated from the dropdown list, and click the **Update button**.

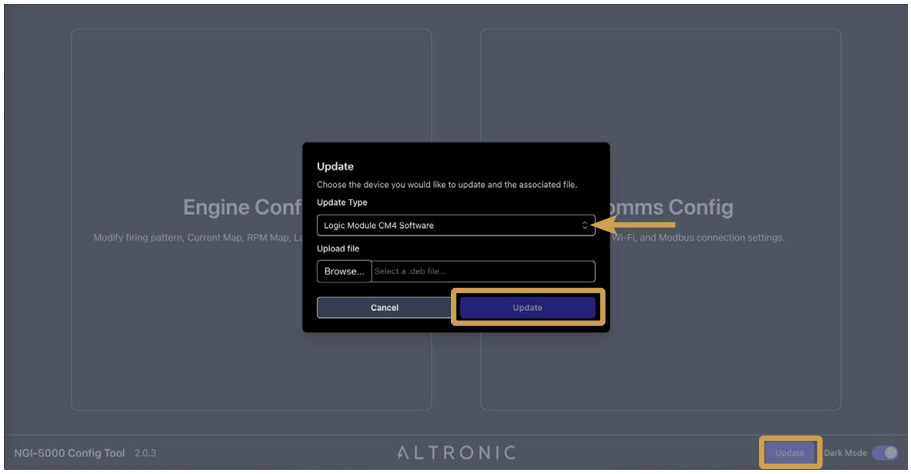

Figure 52

6. Follow the onscreen prompts to complete the update. **NOTE:** Check the bootloader firmware update section at the bottom of the View Config screen for update progress.
7. Repeat for all devices with available updates.

NOTE: If your CM4 is 1.X.X and your system looks like *Figure 53*, refer to the NGI-5000 Legacy Logic Module documentation to update your firmware.

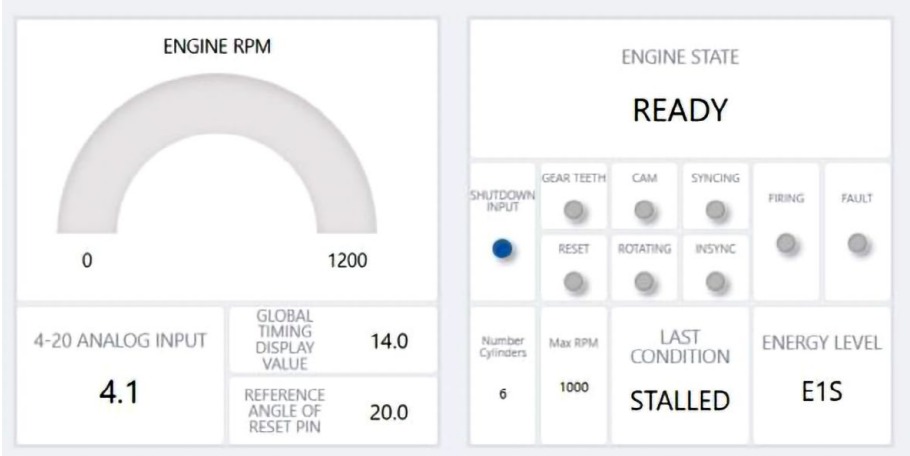

Figure 53

8.0 Communications

The NGI-5000 Logic module supports 2-wire RS485 Communications:

- Connect to terminals PM(+) and PM(-)
- 9600 Baud, None, 1

8.1 10000 Logic Module Registers

Register	Label	Key	ReadOnly / ReadWrite	Type
1	IGN SHUTDOWN FLAG	SHUTDWNFLGBOOL	ReadOnly	BOOL
2	IGN WARNING FLAG	WARNINGFLGBOOL	ReadOnly	BOOL
3	IGN FAULT FLAG	FAULTFLGBOOL	ReadOnly	BOOL
4	IGN FIRED FLAG	FIREDFLGBOOL	ReadOnly	BOOL
5	IGN ALARM OUTPUT ACTIVATED	ALRMOUTBOOL	ReadOnly	BOOL
6	IGN FIRING FLAG	FIRINGFLGBOOL	ReadOnly	BOOL
7	IGN PICKUPS OK	PICKUPSOKBOOL	ReadOnly	BOOL
8	IGN ENGINE ROTATING	ENGNROTBOOL	ReadOnly	BOOL
9	SHUTDN INPUT 1=ACTIVE=GROUNDED	SHUTDWNINBOOL	ReadOnly	BOOL
10	BANK CUTOFF ON NOW	spare100010	ReadOnly	BOOL
11	MISC. INPUT 1=ACTIVE=GROUNDED	spare100011	ReadOnly	BOOL
12	ONE STEP ACTIVE NOW	spare100012	ReadOnly	BOOL
13	ENERGY LEVEL E1 NOW	ENRGLVLE1	ReadOnly	BOOL
14	ENERGY LEVEL E2 NOW	ENRGLVLE2	ReadOnly	BOOL
15	ENERGY LEVEL E3 NOW	ENRGLVLE3	ReadOnly	BOOL
16	MULTI STRIKE NOW	MULTISTRKNOW	ReadOnly	BOOL
17	FAULT NO GEAR TOOTH SIGNAL	FLTNOGT	ReadOnly	BOOL
18	FAULT NO RESET SIGNAL	FLTNORESET	ReadOnly	BOOL
19	FAULT NO HE CYCLE SIGNAL	FLTNOHE	ReadOnly	BOOL
20	FAULT WRONG NUMBER OF TEETH	FAULTTEETH	ReadOnly	BOOL
21	FAULT OVERSPEED SHUTDOWN	FLTOVRSPD	ReadOnly	BOOL
22	FAULT MISALIGNED CAM	FLTMISLNDCAM	ReadOnly	BOOL
23	spare	spare100023		
24	FAULT FIRMWARE CHECKSUM ERR	FLTFRIMWARECHKSUM	ReadOnly	BOOL
25	WARN LOW VOLTAGE BANK A	WARNLOWVOLTA	ReadOnly	BOOL
26	WARN LOW VOLTAGE BANK B	WARNLOWVOLTB	ReadOnly	BOOL
27	WARN NO DISCHARGE ON BANK A	WARNNODSCHBNKA	ReadOnly	BOOL
28	WARN NO DISCHARGE ON BANK B	WARNNODSCHBNKB	ReadOnly	BOOL
29	WARN 4-20 LOOP OUT OF RANG	WARN420LOOP	ReadOnly	BOOL
30	WARN FAIL TO DETECT DIAG UNIT	WARNNODIAGUNIT	ReadOnly	BOOL
31	WARN EEPROM CHECKSUM FAIL	WARNEECHKSUM	ReadOnly	BOOL
32	WARN FAIL DETECT DISP BOARD	WARNNODISPLAY	ReadOnly	BOOL
33	WARN NO DISCHARGE ON *C1* (A or A1)	WARNNODSCHRGA	ReadOnly	BOOL

34	WARN NO DISCHARGE ON *C3* (C or B1)	WARNNODSCHRGC	ReadOnly	BOOL
35	WARN NO DISCHARGE ON *C5* (E or C1)	WARNNODSCHRGE	ReadOnly	BOOL
36	WARN NO DISCHARGE ON *C7* (G or D1)	WARNNODSCHRGG	ReadOnly	BOOL
37	WARN NO DISCHARGE ON *C9* (J or E1)	WARNNODSCHRGJ	ReadOnly	BOOL
38	WARN NO DISCHARGE ON *C11* (L or F1)	WARNNODSCHRGL	ReadOnly	BOOL
39	WARN NO DISCHARGE ON *C13* (R or G1)	WARNNODSCHRGR	ReadOnly	BOOL
40	WARN NO DISCHARGE ON *C15* (T or H1)	WARNNODSCHRGT	ReadOnly	BOOL
41	WARN NO DISCHARGE ON *C17* (J1)	WARNNODSCHRGJ1	ReadOnly	BOOL
42	WARN NO DISCHARGE ON *C19* (K1)	WARNNODSCHRGK1	ReadOnly	BOOL
43	WARN NO DISCHARGE ON *C21* (L1)	WARNNODSCHRGL1	ReadOnly	BOOL
44	WARN NO DISCHARGE ON *C23* (M1)	WARNNODSCHRGM1	ReadOnly	BOOL
45	WARN NO DISCHARGE ON *C25* (R1)	WARNNODSCHRGR1	ReadOnly	BOOL
46	WARN NO DISCHARGE ON *C27* (S1)	WARNNODSCHRGS1	ReadOnly	BOOL
47	WARN NO DISCHARGE ON *C29* (T1)	WARNNODSCHRGT1	ReadOnly	BOOL
48	WARN NO DISCHARGE ON *C31* (U1)	WARNNODSCHRGU1	ReadOnly	BOOL
49	WARN NO DISCHARGE ON *C2* (B or A2)	WARNNODSCHRGB	ReadOnly	BOOL
50	WARN NO DISCHARGE ON *C4* (D or B2)	WARNNODSCHRGD	ReadOnly	BOOL
51	WARN NO DISCHARGE ON *C6* (F or C2)	WARNNODSCHRGF	ReadOnly	BOOL
52	WARN NO DISCHARGE ON *C8* (H or D2)	WARNNODSCHRGH	ReadOnly	BOOL
53	WARN NO DISCHARGE ON *C10* (K or E2)	WARNNODSCHRGK	ReadOnly	BOOL
54	WARN NO DISCHARGE ON *C12* (M or F2)	WARNNODSCHRGM	ReadOnly	BOOL
55	WARN NO DISCHARGE ON *C14* (S or G2)	WARNNODSCHRGS	ReadOnly	BOOL
56	WARN NO DISCHARGE ON *C16* (U or H2)	WARNNODSCHRGU	ReadOnly	BOOL
57	WARN NO DISCHARGE ON *C18* (J2)	WARNNODSCHRGJ2	ReadOnly	BOOL
58	WARN NO DISCHARGE ON *C20* (K2)	WARNNODSCHRGK2	ReadOnly	BOOL
59	WARN NO DISCHARGE ON *C22* (L2)	WARNNODSCHRGL2	ReadOnly	BOOL
60	WARN NO DISCHARGE ON *C24* (M2)	WARNNODSCHRGM2	ReadOnly	BOOL
61	WARN NO DISCHARGE ON *C26* (R2)	WARNNODSCHRGR2	ReadOnly	BOOL
62	WARN NO DISCHARGE ON *C28* (S2)	WARNNODSCHRGS2	ReadOnly	BOOL
63	WARN NO DISCHARGE ON *C30* (T2)	WARNNODSCHRGT2	ReadOnly	BOOL
64	WARN NO DISCHARGE ON *C32* (U2)	WARNNODSCHRGU2	ReadOnly	BOOL
65	PROTECTION ENABLED EEPROM	PROTECTEEPROM	ReadOnly	BOOL
66	SERIAL RETARD ENABLED EEPROM	SERIALRTD	ReadOnly	BOOL
67	RPM RETARD MAP ENABLED EEPROM	RPMMAP	ReadOnly	BOOL
68	4-20ma RET MAP ENABLED EEPROM	MAP420	ReadOnly	BOOL
69	BASE ENERGY E1 SELECT EEPROM	ENERGYE1	ReadOnly	BOOL
70	BASE ENERGY E2 SELECT EEPROM	ENERGYE2	ReadOnly	BOOL
71	BASE ENERGY E3 SELECT EEPROM	ENERGYE3	ReadOnly	BOOL
72	MULTI-STRIKE SELECT EEPROM	MULTISTRIKE	ReadOnly	BOOL
73	spare	spare100073	ReadOnly	BOOL
74	spare	spare100074	ReadOnly	BOOL
75	spare	spare100075	ReadOnly	BOOL

76	spare	spare100076	ReadOnly	BOOL
77	spare	spare100077	ReadOnly	BOOL
78	FW 2000 PRESENT IN IGNITION	FW2KPRSNT	ReadOnly	BOOL
79	2 OUTPUTS PER CYLINDER MODE	TWOOUTPCYL	ReadOnly	BOOL
80	32 OUTPUT MODE (1=32, 0=16)	OUTMODE32	ReadOnly	BOOL
81	DIAG MODULE DETECT TOGGLE BIT	DIAGDETECTTGGL	ReadOnly	BOOL
82	1=REQUEST RESET OF MIN/MAX	REQRSTMINMAX	ReadOnly	BOOL
83	1=REQUEST RESET OF ALARMS	REQRSTALRMS	ReadOnly	BOOL
84	1=SELECT HI DIAG FREQUENCY	SELCTHIDIAGFREQ	ReadOnly	BOOL
85	1=DIAG 2000 DETECTED BY IGN	DIAGDETECTED	ReadOnly	BOOL
86	1=DIAG MODULE ENABLE REQUEST	DIAGENREQ	ReadOnly	BOOL
87	1=RPM ABOVE MIN/MAX THRESHOLD	RPMABVMINMAX	ReadOnly	BOOL
88	1=DIAG READY FROM IGNITION	DIAGRDY	ReadOnly	BOOL
89	DIAG MODULE DETECT REPLY BIT	DIAGDETECTRPLY	ReadOnly	BOOL
90	1=RESET MIN MAX CONFIRM BIT	CONFMINMAXRST	ReadOnly	BOOL
91	1=RESET ALARMS CONFIRM BIT	CONFALRMRST	ReadOnly	BOOL
92	1=NEW DIAG ALARM DETECTED	NEWDIAGALRM	ReadOnly	BOOL
93	1=DUAL BANK DIAGNOSTIC F/W	DUALBANKDIAGFW	ReadOnly	BOOL
94	1=DIAG MODULE READY BIT	DIAGMODRDY	ReadOnly	BOOL
95	1=FIRE OVERRUN FLAG A (NO RST)	spare100095	ReadOnly	BOOL
96	1=FIRE OVERRUN FLAG B (NO RST)	spare100096	ReadOnly	BOOL
97	WARN OPEN PRIMARY (global)	WARNOPENPRI	ReadOnly	BOOL
98	WARN SHORTED PRIMARY (global)	WARNSHORTPRI	ReadOnly	BOOL
99	WARN LO VOLTAGE (global)	WARNLOVOLT	ReadOnly	BOOL
100	WARN HI VOLTAGE (global)	WARNHIVOLT	ReadOnly	BOOL
101	WARN NO SECONDARY SPK (global)	WARNNOSECSPK	ReadOnly	BOOL
102	WARN HI FROM ENGINE (global)	WARNHIENGINE	ReadOnly	BOOL
103	WARN LO FROM ENGINE (global)	WARNLOWENGINE	ReadOnly	BOOL
104	WARN HI VARIATION (global)	WARNHIVARIATION	ReadOnly	BOOL
105	WARN OPEN PRIMARY *C1* (A or A1)	WARNOPENPRIA	ReadOnly	BOOL
106	WARN SHORTED PRIMARY *C1* (A or A1)	WARNSHORTPRIA	ReadOnly	BOOL
107	WARN LO VOLTAGE *C1* (A or A1)	WARNLOVOLTA	ReadOnly	BOOL
108	WARN HI VOLTAGE *C1* (A or A1)	WARNHIVOLTA	ReadOnly	BOOL
109	WARN NO SECONDARY SPK *C1* (A or A1)	WARNNOSECSPKA	ReadOnly	BOOL
110	WARN HI FROM ENGINE *C1* (A or A1)	WARNHIENGINEA	ReadOnly	BOOL
111	WARN LO FROM ENGINE *C1* (A or A1)	WARNLOENGINEA	ReadOnly	BOOL
112	WARN HI VARIATION *C1* (A or A1)	WARNHIVARIATIONA	ReadOnly	BOOL
113	WARN OPEN PRIMARY *C2* (B or A2)	WARNOPENPRIB	ReadOnly	BOOL
114	WARN SHORTED PRIMARY *C2* (B or A2)	WARNSHORTPRIB	ReadOnly	BOOL
115	WARN LO VOLTAGE *C2* (B or A2)	WARNLOVOLTB	ReadOnly	BOOL
116	WARN HI VOLTAGE *C2* (B or A2)	WARNHIVOLTB	ReadOnly	BOOL

117	WARN NO SECONDARY SPK *C2* (B or A2)	WARNNOSECSPKB	ReadOnly	BOOL
118	WARN HI FROM ENGINE *C2* (B or A2)	WARNHIENGINEB	ReadOnly	BOOL
119	WARN LO FROM ENGINE *C2* (B or A2)	WARNLOENGINEB	ReadOnly	BOOL
120	WARN HI VARIATION *C2* (B or A2)	WARNHIVARIATIONB	ReadOnly	BOOL
121	WARN OPEN PRIMARY *C3* (C or B1)	WARNOPENPRIC	ReadOnly	BOOL
122	WARN SHORTED PRIMARY *C3* (C or B1)	WARNSHORTPRIC	ReadOnly	BOOL
123	WARN LO VOLTAGE *C3* (C or B1)	WARNLOVOLTC	ReadOnly	BOOL
124	WARN HI VOLTAGE *C3* (C or B1)	WARNHIVOLTC	ReadOnly	BOOL
125	WARN NO SECONDARY SPK *C3* (C or B1)	WARNNOSECSPKC	ReadOnly	BOOL
126	WARN HI FROM ENGINE *C3* (C or B1)	WARNHIENGINEC	ReadOnly	BOOL
127	WARN LO FROM ENGINE *C3* (C or B1)	WARNLOENGINEC	ReadOnly	BOOL
128	WARN HI VARIATION *C3* (C or B1)	WARNHIVARIATIONC	ReadOnly	BOOL
129	WARN OPEN PRIMARY *C4* (D or B2)	WARNOPENPRID	ReadOnly	BOOL
130	WARN SHORTED PRIMARY *C4* (D or B2)	WARNSHORTPRID	ReadOnly	BOOL
131	WARN LO VOLTAGE *C4* (D or B2)	WARNLOVOLTD	ReadOnly	BOOL
132	WARN HI VOLTAGE *C4* (D or B2)	WARNHIVOLTD	ReadOnly	BOOL
133	WARN NO SECONDARY SPK *C4* (D or B2)	WARNNOSECSPKD	ReadOnly	BOOL
134	WARN HI FROM ENGINE *C4* (D or B2)	WARNHIENGINED	ReadOnly	BOOL
135	WARN LO FROM ENGINE *C4* (D or B2)	WARNLOENGINED	ReadOnly	BOOL
136	WARN HI VARIATION *C4* (D or B2)	WARNHIVARIATIOND	ReadOnly	BOOL
137	WARN OPEN PRIMARY *C5* (E or C1)	WARNOPENPRIE	ReadOnly	BOOL
138	WARN SHORTED PRIMARY *C5* (E or C1)	WARNSHORTPRIE	ReadOnly	BOOL
139	WARN LO VOLTAGE *C5* (E or C1)	WARNLOVOLTE	ReadOnly	BOOL
140	WARN HI VOLTAGE *C5* (E or C1)	WARNHIVOLTE	ReadOnly	BOOL
141	WARN NO SECONDARY SPK *C5* (E or C1)	WARNNOSECSPKE	ReadOnly	BOOL
142	WARN HI FROM ENGINE *C5* (E or C1)	WARNHIENGINEE	ReadOnly	BOOL
143	WARN LO FROM ENGINE *C5* (E or C1)	WARNLOENGINEE	ReadOnly	BOOL
144	WARN HI VARIATION *C5* (E or C1)	WARNHIVARIATIONE	ReadOnly	BOOL
145	WARN OPEN PRIMARY *C6* (F or C2)	WARNOPENPRIF	ReadOnly	BOOL
146	WARN SHORTED PRIMARY *C6* (F or C2)	WARNSHORTPRIF	ReadOnly	BOOL
147	WARN LO VOLTAGE *C6* (F or C2)	WARNLOVOLTF	ReadOnly	BOOL
148	WARN HI VOLTAGE *C6* (F or C2)	WARNHIVOLTF	ReadOnly	BOOL
149	WARN NO SECONDARY SPK *C6* (F or C2)	WARNNOSECSPKF	ReadOnly	BOOL
150	WARN HI FROM ENGINE *C6* (F or C2)	WARNHIENGINEF	ReadOnly	BOOL
151	WARN LO FROM ENGINE *C6* (F or C2)	WARNLOENGINEF	ReadOnly	BOOL
152	WARN HI VARIATION *C6* (F or C2)	WARNHIVARIATIONF	ReadOnly	BOOL
153	WARN OPEN PRIMARY *C7* (G or D1)	WARNOPENPRIG	ReadOnly	BOOL
154	WARN SHORTED PRIMARY *C7* (G or D1)	WARNSHORTPRIG	ReadOnly	BOOL
155	WARN LO VOLTAGE *C7* (G or D1)	WARNLOVOLTG	ReadOnly	BOOL
156	WARN HI VOLTAGE *C7* (G or D1)	WARNHIVOLTG	ReadOnly	BOOL
157	WARN NO SECONDARY SPK *C7* (G or D1)	WARNNOSECSPKG	ReadOnly	BOOL

158	WARN HI FROM ENGINE *C7* (G or D1)	WARNHIENGINEG	ReadOnly	BOOL
159	WARN LO FROM ENGINE *C7* (G or D1)	WARNLOENGINEG	ReadOnly	BOOL
160	WARN HI VARIATION *C7* (G or D1)	WARNHIVARIATIONG	ReadOnly	BOOL
161	WARN OPEN PRIMARY *C8* (H or D2)	WARNOPENPRIH	ReadOnly	BOOL
162	WARN SHORTED PRIMARY *C8* (H or D2)	WARNSHORTPRIH	ReadOnly	BOOL
163	WARN LO VOLTAGE *C8* (H or D2)	WARNLOVOLTH	ReadOnly	BOOL
164	WARN HI VOLTAGE *C8* (H or D2)	WARNHIVOLTH	ReadOnly	BOOL
165	WARN NO SECONDARY SPK *C8* (H or D2)	WARNNOSECSPKH	ReadOnly	BOOL
166	WARN HI FROM ENGINE *C8* (H or D2)	WARNHIENGINEH	ReadOnly	BOOL
167	WARN LO FROM ENGINE *C8* (H or D2)	WARNLOENGINEH	ReadOnly	BOOL
168	WARN HI VARIATION *C8* (H or D2)	WARNHIVARIATIONH	ReadOnly	BOOL
169	WARN OPEN PRIMARY *C9* (J or E1)	WARNOPENPRIJ	ReadOnly	BOOL
170	WARN SHORTED PRIMARY *C9* (J or E1)	WARNSHORTPRIJ	ReadOnly	BOOL
171	WARN LO VOLTAGE *C9* (J or E1)	WARNLOVOLTJ	ReadOnly	BOOL
172	WARN HI VOLTAGE *C9* (J or E1)	WARNHIVOLTJ	ReadOnly	BOOL
173	WARN NO SECONDARY SPK *C9* (J or E1)	WARNNOSECSPKJ	ReadOnly	BOOL
174	WARN HI FROM ENGINE *C9* (J or E1)	WARNHIENGINEJ	ReadOnly	BOOL
175	WARN LO FROM ENGINE *C9* (J or E1)	WARNLOENGINEJ	ReadOnly	BOOL
176	WARN HI VARIATION *C9* (J or E1)	WARNHIVARIATIONJ	ReadOnly	BOOL
177	WARN OPEN PRIMARY *C10* (K or E2)	WARNOPENPRIK	ReadOnly	BOOL
178	WARN SHORTED PRIMARY *C10* (K or E2)	WARNSHORTPRIK	ReadOnly	BOOL
179	WARN LO VOLTAGE *C10* (K or E2)	WARNLOVOLTK	ReadOnly	BOOL
180	WARN HI VOLTAGE *C10* (K or E2)	WARNHIVOLTK	ReadOnly	BOOL
181	WARN NO SECONDARY SPK *C10* (K or E2)	WARNNOSECSPKK	ReadOnly	BOOL
182	WARN HI FROM ENGINE *C10* (K or E2)	WARNHIENGINEK	ReadOnly	BOOL
183	WARN LO FROM ENGINE *C10* (K or E2)	WARNLOENGINEK	ReadOnly	BOOL
184	WARN HI VARIATION *C10* (K or E2)	WARNHIVARIATIONK	ReadOnly	BOOL
185	WARN OPEN PRIMARY *C11* (L or F1)	WARNOPENPRIL	ReadOnly	BOOL
186	WARN SHORTED PRIMARY *C11* (L or F1)	WARNSHORTPRIL	ReadOnly	BOOL
187	WARN LO VOLTAGE *C11* (L or F1)	WARNLOVOLTL	ReadOnly	BOOL
188	WARN HI VOLTAGE *C11* (L or F1)	WARNHIVOLTL	ReadOnly	BOOL
189	WARN NO SECONDARY SPK *C11* (L or F1)	WARNNOSECSPKL	ReadOnly	BOOL
190	WARN HI FROM ENGINE *C11* (L or F1)	WARNHIENGINEL	ReadOnly	BOOL
191	WARN LO FROM ENGINE *C11* (L or F1)	WARNLOENGINEL	ReadOnly	BOOL
192	WARN HI VARIATION *C11* (L or F1)	WARNHIVARIATIONL	ReadOnly	BOOL
193	WARN OPEN PRIMARY *C12* (M or F2)	WARNOPENPRIM	ReadOnly	BOOL
194	WARN SHORTED PRIMARY *C12* (M or F2)	WARNSHORTPRIM	ReadOnly	BOOL
195	WARN LO VOLTAGE *C12* (M or F2)	WARNLOVOLTM	ReadOnly	BOOL
196	WARN HI VOLTAGE *C12* (M or F2)	WARNHIVOLTM	ReadOnly	BOOL
197	WARN NO SECONDARY SPK *C12* (M or F2)	WARNNOSECSPKM	ReadOnly	BOOL
198	WARN HI FROM ENGINE *C12* (M or F2)	WARNHIENGINEM	ReadOnly	BOOL

199	WARN LO FROM ENGINE *C12* (M or F2)	WARNLOENGINEM	ReadOnly	BOOL
200	WARN HI VARIATION *C12* (M or F2)	WARNHIVARIATIONM	ReadOnly	BOOL
201	WARN OPEN PRIMARY *C13* (R or G1)	WARNOPENPRIR	ReadOnly	BOOL
202	WARN SHORTED PRIMARY *C13* (R or G1)	WARNSHORTPRIR	ReadOnly	BOOL
203	WARN LO VOLTAGE *C13* (R or G1)	WARNLOVOLTR	ReadOnly	BOOL
204	WARN HI VOLTAGE *C13* (R or G1)	WARNHIVOLTR	ReadOnly	BOOL
205	WARN NO SECONDARY SPK *C13* (R or G1)	WARNNOSECSPKR	ReadOnly	BOOL
206	WARN HI FROM ENGINE *C13* (R or G1)	WARNHIENGINER	ReadOnly	BOOL
207	WARN LO FROM ENGINE *C13* (R or G1)	WARNLOENGINER	ReadOnly	BOOL
208	WARN HI VARIATION *C13* (R or G1)	WARNHIVARIATIONR	ReadOnly	BOOL
209	WARN OPEN PRIMARY *C14* (S or G2)	WARNOPENPRIS	ReadOnly	BOOL
210	WARN SHORTED PRIMARY *C14* (S or G2)	WARNSHORTPRIS	ReadOnly	BOOL
211	WARN LO VOLTAGE *C14* (S or G2)	WARNLOVOLTS	ReadOnly	BOOL
212	WARN HI VOLTAGE *C14* (S or G2)	WARNHIVOLTS	ReadOnly	BOOL
213	WARN NO SECONDARY SPK *C14* (S or G2)	WARNNOSECSPKS	ReadOnly	BOOL
214	WARN HI FROM ENGINE *C14* (S or G2)	WARNHIENGINES	ReadOnly	BOOL
215	WARN LO FROM ENGINE *C14* (S or G2)	WARNLOENGINES	ReadOnly	BOOL
216	WARN HI VARIATION *C14* (S or G2)	WARNHIVARIATIONS	ReadOnly	BOOL
217	WARN OPEN PRIMARY *C15* (T or H1)	WARNOPENPRIT	ReadOnly	BOOL
218	WARN SHORTED PRIMARY *C15* (T or H1)	WARNSHORTPRIT	ReadOnly	BOOL
219	WARN LO VOLTAGE *C15* (T or H1)	WARNLOVOLTT	ReadOnly	BOOL
220	WARN HI VOLTAGE *C15* (T or H1)	WARNHIVOLTT	ReadOnly	BOOL
221	WARN NO SECONDARY SPK *C15* (T or H1)	WARNNOSECSPKT	ReadOnly	BOOL
222	WARN HI FROM ENGINE *C15* (T or H1)	WARNHIENGINET	ReadOnly	BOOL
223	WARN LO FROM ENGINE *C15* (T or H1)	WARNLOENGINET	ReadOnly	BOOL
224	WARN HI VARIATION *C15* (T or H1)	WARNHIVARIATIONT	ReadOnly	BOOL
225	WARN OPEN PRIMARY *C16* (U or H2)	WARNOPENPRIM16	ReadOnly	BOOL
226	WARN SHORTED PRIMARY *C16* (U or H2)	WARNSHRTPRIM16	ReadOnly	BOOL
227	WARN LO VOLTAGE *C16* (U or H2)	WARNLOV16	ReadOnly	BOOL
228	WARN HI VOLTAGE *C16* (U or H2)	WARNHIV16	ReadOnly	BOOL
229	WARN NO SECONDARY SPK *C16* (U or H2)	WARNNOSECSPK16	ReadOnly	BOOL
230	WARN HI FROM ENGINE *C16* (U or H2)	WARNHIENG16	ReadOnly	BOOL
231	WARN LO FROM ENGINE *C16* (U or H2)	WARNLOENG16	ReadOnly	BOOL
232	WARN HI VARIATION *C16* (U or H2)	WARNHIVAR16	ReadOnly	BOOL
233	WARN OPEN PRIMARY *C17* (J1)	WARNOPENPRIM17	ReadOnly	BOOL
234	WARN SHORTED PRIMARY *C17* (J1)	WARNSHRTPRIM17	ReadOnly	BOOL
235	WARN LO VOLTAGE *C17* (J1)	WARNLOV17	ReadOnly	BOOL
236	WARN HI VOLTAGE *C17* (J1)	WARNHIV17	ReadOnly	BOOL
237	WARN NO SECONDARY SPK *C17* (J1)	WARNNOSECSPK17	ReadOnly	BOOL
238	WARN HI FROM ENGINE *C17* (J1)	WARNHIENG17	ReadOnly	BOOL
239	WARN LO FROM ENGINE *C17* (J1)	WARNLOENG17	ReadOnly	BOOL

240	WARN HI VARIATION *C17* (J1)	WARNHIVAR17	ReadOnly	BOOL
241	WARN OPEN PRIMARY *C18* (J2)	WARNOPENPRIM18	ReadOnly	BOOL
242	WARN SHORTED PRIMARY *C18* (J2)	WARNSHRTPRIM18	ReadOnly	BOOL
243	WARN LO VOLTAGE *C18* (J2)	WARNLOV18	ReadOnly	BOOL
244	WARN HI VOLTAGE *C18* (J2)	WARNHIV18	ReadOnly	BOOL
245	WARN NO SECONDARY SPK *C18* (J2)	WARNNOSECSPK18	ReadOnly	BOOL
246	WARN HI FROM ENGINE *C18* (J2)	WARNHIENG18	ReadOnly	BOOL
247	WARN LO FROM ENGINE *C18* (J2)	WARNLOENG18	ReadOnly	BOOL
248	WARN HI VARIATION *C18* (J2)	WARNHIVAR18	ReadOnly	BOOL
249	WARN OPEN PRIMARY *C19* (K1)	WARNOPENPRIM19	ReadOnly	BOOL
250	WARN SHORTED PRIMARY *C19* (K1)	WARNSHRTPRIM19	ReadOnly	BOOL
251	WARN LO VOLTAGE *C19* (K1)	WARNLOV19	ReadOnly	BOOL
252	WARN HI VOLTAGE *C19* (K1)	WARNHIV19	ReadOnly	BOOL
253	WARN NO SECONDARY SPK *C19* (K1)	WARNNOSECSPK19	ReadOnly	BOOL
254	WARN HI FROM ENGINE *C19* (K1)	WARNHIENG19	ReadOnly	BOOL
255	WARN LO FROM ENGINE *C19* (K1)	WARNLOENG19	ReadOnly	BOOL
256	WARN HI VARIATION *C19* (K1)	WARNHIVAR19	ReadOnly	BOOL
257	WARN OPEN PRIMARY *C20* (K2)	WARNOPENPRIM20	ReadOnly	BOOL
258	WARN SHORTED PRIMARY *C20* (K2)	WARNSHRTPRIM20	ReadOnly	BOOL
259	WARN LO VOLTAGE *C20* (K2)	WARNLOV20	ReadOnly	BOOL
260	WARN HI VOLTAGE *C20* (K2)	WARNHIV20	ReadOnly	BOOL
261	WARN NO SECONDARY SPK *C20* (K2)	WARNNOSECSPK20	ReadOnly	BOOL
262	WARN HI FROM ENGINE *C20* (K2)	WARNHIENG20	ReadOnly	BOOL
263	WARN LO FROM ENGINE *C20* (K2)	WARNLOENG20	ReadOnly	BOOL
264	WARN HI VARIATION *C20* (K2)	WARNHIVAR20	ReadOnly	BOOL
265	WARN OPEN PRIMARY *C21* (L1)	WARNOPENPRIM21	ReadOnly	BOOL
266	WARN SHORTED PRIMARY *C21* (L1)	WARNSHRTPRIM21	ReadOnly	BOOL
267	WARN LO VOLTAGE *C21* (L1)	WARNLOV21	ReadOnly	BOOL
268	WARN HI VOLTAGE *C21* (L1)	WARNHIV21	ReadOnly	BOOL
269	WARN NO SECONDARY SPK *C21* (L1)	WARNNOSECSPK21	ReadOnly	BOOL
270	WARN HI FROM ENGINE *C21* (L1)	WARNHIENG21	ReadOnly	BOOL
271	WARN LO FROM ENGINE *C21* (L1)	WARNLOENG21	ReadOnly	BOOL
272	WARN HI VARIATION *C21* (L1)	WARNHIVAR21	ReadOnly	BOOL
273	WARN OPEN PRIMARY *C22* (L2)	WARNOPENPRIM22	ReadOnly	BOOL
274	WARN SHORTED PRIMARY *C22* (L2)	WARNSHRTPRIM22	ReadOnly	BOOL
275	WARN LO VOLTAGE *C22* (L2)	WARNLOV22	ReadOnly	BOOL
276	WARN HI VOLTAGE *C22* (L2)	WARNHIV22	ReadOnly	BOOL
277	WARN NO SECONDARY SPK *C22* (L2)	WARNNOSECSPK22	ReadOnly	BOOL
278	WARN HI FROM ENGINE *C22* (L2)	WARNHIENG22	ReadOnly	BOOL
279	WARN LO FROM ENGINE *C22* (L2)	WARNLOENG22	ReadOnly	BOOL
280	WARN HI VARIATION *C22* (L2)	WARNHIVAR22	ReadOnly	BOOL

281	WARN OPEN PRIMARY *C23* (M1)	WARNOPENPRIM23	ReadOnly	BOOL
282	WARN SHORTED PRIMARY *C23* (M1)	WARNSHRTPRIM23	ReadOnly	BOOL
283	WARN LO VOLTAGE *C23* (M1)	WARNLOV23	ReadOnly	BOOL
284	WARN HI VOLTAGE *C23* (M1)	WARNHIV23	ReadOnly	BOOL
285	WARN NO SECONDARY SPK *C23* (M1)	WARNNOSECSPK23	ReadOnly	BOOL
286	WARN HI FROM ENGINE *C23* (M1)	WARNHIENG23	ReadOnly	BOOL
287	WARN LO FROM ENGINE *C23* (M1)	WARNLOENG23	ReadOnly	BOOL
288	WARN HI VARIATION *C23* (M1)	WARNHIVAR23	ReadOnly	BOOL
289	WARN OPEN PRIMARY *C24* (M2)	WARNOPENPRIM24	ReadOnly	BOOL
290	WARN SHORTED PRIMARY *C24* (M2)	WARNSHRTPRIM24	ReadOnly	BOOL
291	WARN LO VOLTAGE *C24* (M2)	WARNLOV24	ReadOnly	BOOL
292	WARN HI VOLTAGE *C24* (M2)	WARNHIV24	ReadOnly	BOOL
293	WARN NO SECONDARY SPK *C24* (M2)	WARNNOSECSPK24	ReadOnly	BOOL
294	WARN HI FROM ENGINE *C24* (M2)	WARNHIENG24	ReadOnly	BOOL
295	WARN LO FROM ENGINE *C24* (M2)	WARNLOENG24	ReadOnly	BOOL
296	WARN HI VARIATION *C24* (M2)	WARNHIVAR24	ReadOnly	BOOL
297	WARN OPEN PRIMARY *C25* (R1)	WARNOPENPRIM25	ReadOnly	BOOL
298	WARN SHORTED PRIMARY *C25* (R1)	WARNSHRTPRIM25	ReadOnly	BOOL
299	WARN LO VOLTAGE *C25* (R1)	WARNLOV25	ReadOnly	BOOL
300	WARN HI VOLTAGE *C25* (R1)	WARNHIV25	ReadOnly	BOOL
301	WARN NO SECONDARY SPK *C25* (R1)	WARNNOSECSPK25	ReadOnly	BOOL
302	WARN HI FROM ENGINE *C25* (R1)	WARNHIENG25	ReadOnly	BOOL
303	WARN LO FROM ENGINE *C25* (R1)	WARNLOENG25	ReadOnly	BOOL
304	WARN HI VARIATION *C25* (R1)	WARNHIVAR25	ReadOnly	BOOL
305	WARN OPEN PRIMARY *C26* (R2)	WARNOPENPRIM26	ReadOnly	BOOL
306	WARN SHORTED PRIMARY *C26* (R2)	WARNSHRTPRIM26	ReadOnly	BOOL
307	WARN LO VOLTAGE *C26* (R2)	WARNLOV26	ReadOnly	BOOL
308	WARN HI VOLTAGE *C26* (R2)	WARNHIV26	ReadOnly	BOOL
309	WARN NO SECONDARY SPK *C26* (R2)	WARNNOSECSPK26	ReadOnly	BOOL
310	WARN HI FROM ENGINE *C26* (R2)	WARNHIENG26	ReadOnly	BOOL
311	WARN LO FROM ENGINE *C26* (R2)	WARNLOENG26	ReadOnly	BOOL
312	WARN HI VARIATION *C26* (R2)	WARNHIVAR26	ReadOnly	BOOL
313	WARN OPEN PRIMARY *C27* (S1)	WARNOPENPRIM27	ReadOnly	BOOL
314	WARN SHORTED PRIMARY *C27* (S1)	WARNSHRTPRIM27	ReadOnly	BOOL
315	WARN LO VOLTAGE *C27* (S1)	WARNLOV27	ReadOnly	BOOL
316	WARN HI VOLTAGE *C27* (S1)	WARNHIV27	ReadOnly	BOOL
317	WARN NO SECONDARY SPK *C27* (S1)	WARNNOSECSPK27	ReadOnly	BOOL
318	WARN HI FROM ENGINE *C27* (S1)	WARNHIENG27	ReadOnly	BOOL
319	WARN LO FROM ENGINE *C27* (S1)	WARNLOENG27	ReadOnly	BOOL
320	WARN HI VARIATION *C27* (S1)	WARNHIVAR27	ReadOnly	BOOL
321	WARN OPEN PRIMARY *C28* (S2)	WARNOPENPRIM28	ReadOnly	BOOL

322	WARN SHORTED PRIMARY *C28* (S2)	WARNSHRTPRIM28	ReadOnly	BOOL
323	WARN LO VOLTAGE *C28* (S2)	WARNLOV28	ReadOnly	BOOL
324	WARN HI VOLTAGE *C28* (S2)	WARNHIV28	ReadOnly	BOOL
325	WARN NO SECONDARY SPK *C28* (S2)	WARNNOSECSPK28	ReadOnly	BOOL
326	WARN HI FROM ENGINE *C28* (S2)	WARNHIENG28	ReadOnly	BOOL
327	WARN LO FROM ENGINE *C28* (S2)	WARNLOENG28	ReadOnly	BOOL
328	WARN HI VARIATION *C28* (S2)	WARNHIVAR28	ReadOnly	BOOL
329	WARN OPEN PRIMARY *C29* (T1)	WARNOPENPRIM29	ReadOnly	BOOL
330	WARN SHORTED PRIMARY *C29* (T1)	WARNSHRTPRIM29	ReadOnly	BOOL
331	WARN LO VOLTAGE *C29* (T1)	WARNLOV29	ReadOnly	BOOL
332	WARN HI VOLTAGE *C29* (T1)	WARNHIV29	ReadOnly	BOOL
333	WARN NO SECONDARY SPK *C29* (T1)	WARNNOSECSPK29	ReadOnly	BOOL
334	WARN HI FROM ENGINE *C29* (T1)	WARNHIENG29	ReadOnly	BOOL
335	WARN LO FROM ENGINE *C29* (T1)	WARNLOENG29	ReadOnly	BOOL
336	WARN HI VARIATION *C29* (T1)	WARNHIVAR29	ReadOnly	BOOL
337	WARN OPEN PRIMARY *C30* (T2)	WARNOPENPRIM30	ReadOnly	BOOL
338	WARN SHORTED PRIMARY *C30* (T2)	WARNSHRTPRIM30	ReadOnly	BOOL
339	WARN LO VOLTAGE *C30* (T2)	WARNLOV30	ReadOnly	BOOL
340	WARN HI VOLTAGE *C30* (T2)	WARNHIV30	ReadOnly	BOOL
341	WARN NO SECONDARY SPK *C30* (T2)	WARNNOSECSPK30	ReadOnly	BOOL
342	WARN HI FROM ENGINE *C30* (T2)	WARNHIENG30	ReadOnly	BOOL
343	WARN LO FROM ENGINE *C30* (T2)	WARNLOENG30	ReadOnly	BOOL
344	WARN HI VARIATION *C30* (T2)	WARNHIVAR30	ReadOnly	BOOL
345	WARN OPEN PRIMARY *C31* (U1)	WARNOPENPRIM31	ReadOnly	BOOL
346	WARN SHORTED PRIMARY *C31* (U1)	WARNSHRTPRIM31	ReadOnly	BOOL
347	WARN LO VOLTAGE *C31* (U1)	WARNLOV31	ReadOnly	BOOL
348	WARN HI VOLTAGE *C31* (U1)	WARNHIV31	ReadOnly	BOOL
349	WARN NO SECONDARY SPK *C31* (U1)	WARNNOSECSPK31	ReadOnly	BOOL
350	WARN HI FROM ENGINE *C31* (U1)	WARNHIENG31	ReadOnly	BOOL
351	WARN LO FROM ENGINE *C31* (U1)	WARNLOENG31	ReadOnly	BOOL
352	WARN HI VARIATION *C31* (U1)	WARNHIVAR31	ReadOnly	BOOL
353	WARN OPEN PRIMARY *C32* (U2)	WARNOPENPRIM32	ReadOnly	BOOL
354	WARN SHORTED PRIMARY *C32* (U2)	WARNSHRTPRIM32	ReadOnly	BOOL
355	WARN LO VOLTAGE *C32* (U2)	WARNLOV32	ReadOnly	BOOL
356	WARN HI VOLTAGE *C32* (U2)	WARNHIV32	ReadOnly	BOOL
357	WARN NO SECONDARY SPK *C32* (U2)	WARNNOSECSPK32	ReadOnly	BOOL
358	WARN HI FROM ENGINE *C32* (U2)	WARNHIENG32	ReadOnly	BOOL
359	WARN LO FROM ENGINE *C32* (U2)	WARNLOENG32	ReadOnly	BOOL
360	WARN HI VARIATION *C32* (U2)	WARNHIVAR32	ReadOnly	BOOL

8.2 30000 Modbus Registers

Register	Label	Key	ReadOnly / ReadWrite	Type
1	ENGINE RPM 1RPM/BIT	RPMdisp	ReadOnly	INT16
2	MAX SEEN RPM 5RPM/BIT	RPMmax	ReadOnly	INT16
3	ENGINE OVERSPEED SETTING 5/BIT	ENGOVRSPEED	ReadOnly	INT16
4	FAULT GEAR TEETH 0.25/BIT	GTFAULT	ReadOnly	INT16
5	4-20 ANALOG INPUT 0.10ma/bit	FOURTO20IN	ReadOnly	INT16
6	COUNTS TO DEGREES SCALER	COUNT2DEG	ReadOnly	INT16
7	GLOBAL TIMING DISPLAY VALUE	GLBLTIMING	ReadOnly	INT16
8	MANUAL RETARD SETTING	RetManual	ReadOnly	INT16
9	ONESTEP RETARD SETTING	oneStepRTRD	ReadOnly	INT16
10	ANALOG RETARD FROM TABLE	ANALOGRTRDTBL	ReadOnly	INT16
11	RPM RETARD FROM TABLE	RPMRTRD	ReadOnly	INT16
12	SERIAL RETARD FROM REMOTE	SERIALRTRDRMT	ReadOnly	INT16
13	MAX INDIVIDUAL OFFSET	MAXINDVOFFSET	ReadOnly	INT16
14	STANDARD INDIVIDUAL OFFSET	STDINDVOFFSET	ReadOnly	INT16
15	REFERENCE ANGLE OF RESET PIN	REFANGLERST	ReadOnly	INT16
16	NUMBER OF CYLINDERS	NUMCYLINDERS	ReadOnly	INT16
17	ENGINE AVERAGE DIAG	BNKACAVG	ReadOnly	INT16
18	ENGINE AVERAGE DIAG BANK B	BNKBCAVG	ReadOnly	INT16
19	LO SPARK DIAG THRESHOLD	LOSPKTHRESH	ReadOnly	INT16
20	HI SPARK DIAG THRESHOLD	HISPKTHRESH	ReadOnly	INT16
21	NO SPARK DIAG THRESHOLD	NOSPKTHRESH	ReadOnly	INT16
22	LO FROM ENGINE THRESHOLD	LOENGTHRESH	ReadOnly	INT16
23	HI FROM ENGINE THRESHOLD	HIENGTHRESH	ReadOnly	INT16
24	HI VARIATION THRESHOLD	HIVARTHRESH	ReadOnly	INT16
25	E2 ENABLE THRESHOLD	E2ENABLETHRESH	ReadOnly	INT16
26	E2 DISABLE HYSTERISIS	E2DISABLEHYST	ReadOnly	INT16
27	E3 ENABLE THRESHOLD	E3ENABLETHRESH	ReadOnly	INT16
28	E3 DISABLE HYSTERISIS	E3DISABLEHYST	ReadOnly	INT16
29	LO SPARK BANK B THRESHOLD	LOSPKTHRESHB	ReadOnly	INT16
30	HI SPARK BANK B THRESHOLD	HISPKTHRESHB	ReadOnly	INT16
31	LO FROM ENG B THRESHOLD	LOENGTHRESHB	ReadOnly	INT16
32	HI FROM ENG B THRESHOLD	HIENGTHRESHB	ReadOnly	INT16
33	CYL TIMING OFFSET *C1* (A or A1)	CINDVTMG01	ReadOnly	UINT16
34	CYL TIMING OFFSET *C2* (B or A2)	CINDVTMG02	ReadOnly	UINT16
35	CYL TIMING OFFSET *C3* (C or B1)	CINDVTMG03	ReadOnly	UINT16
36	CYL TIMING OFFSET *C4* (D or B2)	CINDVTMG04	ReadOnly	UINT16
37	CYL TIMING OFFSET *C5* (E or C1)	CINDVTMG05	ReadOnly	UINT16
38	CYL TIMING OFFSET *C6* (F or C2)	CINDVTMG06	ReadOnly	UINT16

39	CYL TIMING OFFSET *C7* (G or D1)	CINDVTMG07	ReadOnly	UINT16
40	CYL TIMING OFFSET *C8* (H or D2)	CINDVTMG08	ReadOnly	UINT16
41	CYL TIMING OFFSET *C9* (J or E1)	CINDVTMG09	ReadOnly	UINT16
42	CYL TIMING OFFSET *C10* (K or E2)	CINDVTMG10	ReadOnly	UINT16
43	CYL TIMING OFFSET *C11* (L or F1)	CINDVTMG11	ReadOnly	UINT16
44	CYL TIMING OFFSET *C12* (M or F2)	CINDVTMG12	ReadOnly	UINT16
45	CYL TIMING OFFSET *C13* (R or G1)	CINDVTMG13	ReadOnly	UINT16
46	CYL TIMING OFFSET *C14* (S or G2)	CINDVTMG14	ReadOnly	UINT16
47	CYL TIMING OFFSET *C15* (T or H1)	CINDVTMG15	ReadOnly	UINT16
48	CYL TIMING OFFSET *C16* (Y or H2)	CINDVTMG16	ReadOnly	UINT16
49	CYL TIMING OFFSET *C17* (J1)	CINDVTMG17	ReadOnly	UINT16
50	CYL TIMING OFFSET *C18* (J2)	CINDVTMG18	ReadOnly	UINT16
51	CYL TIMING OFFSET *C19* (K1)	CINDVTMG19	ReadOnly	UINT16
52	CYL TIMING OFFSET *C20* (K2)	CINDVTMG20	ReadOnly	UINT16
53	CYL TIMING OFFSET *C21* (L1)	CINDVTMG21	ReadOnly	UINT16
54	CYL TIMING OFFSET *C22* (L2)	CINDVTMG22	ReadOnly	UINT16
55	CYL TIMING OFFSET *C23* (M1)	CINDVTMG23	ReadOnly	UINT16
56	CYL TIMING OFFSET *C24* (M2)	CINDVTMG24	ReadOnly	UINT16
57	CYL TIMING OFFSET *C25* (R1)	CINDVTMG25	ReadOnly	UINT16
58	CYL TIMING OFFSET *C26* (R2)	CINDVTMG26	ReadOnly	UINT16
59	CYL TIMING OFFSET *C27* (S1)	CINDVTMG27	ReadOnly	UINT16
60	CYL TIMING OFFSET *C28* (S2)	CINDVTMG28	ReadOnly	UINT16
61	CYL TIMING OFFSET *C29* (T1)	CINDVTMG29	ReadOnly	UINT16
62	CYL TIMING OFFSET *C30* (T2)	CINDVTMG30	ReadOnly	UINT16
63	CYL TIMING OFFSET *C31* (U1)	CINDVTMG31	ReadOnly	UINT16
64	CYL TIMING OFFSET *C32* (U2)	CINDVTMG32	ReadOnly	UINT16
65	DEFAULT OFFSET *C1* (A or A1)	CINDVDEF01	ReadOnly	UINT16
66	DEFAULT OFFSET *C2* (B or A2)	CINDVDEF02	ReadOnly	UINT16
67	DEFAULT OFFSET *C3* (C or B1)	CINDVDEF03	ReadOnly	UINT16
68	DEFAULT OFFSET *C4* (D or B2)	CINDVDEF04	ReadOnly	UINT16
69	DEFAULT OFFSET *C5* (E or C1)	CINDVDEF05	ReadOnly	UINT16
70	DEFAULT OFFSET *C6* (F or C2)	CINDVDEF06	ReadOnly	UINT16
71	DEFAULT OFFSET *C7* (G or D1)	CINDVDEF07	ReadOnly	UINT16
72	DEFAULT OFFSET *C8* (H or D2)	CINDVDEF08	ReadOnly	UINT16
73	DEFAULT OFFSET *C9* (J or E1)	CINDVDEF09	ReadOnly	UINT16
74	DEFAULT OFFSET *C10* (K or E2)	CINDVDEF10	ReadOnly	UINT16
75	DEFAULT OFFSET *C11* (L or F1)	CINDVDEF11	ReadOnly	UINT16
76	DEFAULT OFFSET *C12* (M or F2)	CINDVDEF12	ReadOnly	UINT16
77	DEFAULT OFFSET *C13* (R or G1)	CINDVDEF13	ReadOnly	UINT16
78	DEFAULT OFFSET *C14* (S or G2)	CINDVDEF14	ReadOnly	UINT16
79	DEFAULT OFFSET *C15* (T or H1)	CINDVDEF15	ReadOnly	UINT16

80	DEFAULT OFFSET *C16* (H2)	CINDVDEF16	ReadOnly	UINT16
81	DEFAULT OFFSET *C17* (J1)	CINDVDEF17	ReadOnly	UINT16
82	DEFAULT OFFSET *C18* (J2)	CINDVDEF18	ReadOnly	UINT16
83	DEFAULT OFFSET *C19* (K1)	CINDVDEF19	ReadOnly	UINT16
84	DEFAULT OFFSET *C20* (K2)	CINDVDEF20	ReadOnly	UINT16
85	DEFAULT OFFSET *C21* (L1)	CINDVDEF21	ReadOnly	UINT16
86	DEFAULT OFFSET *C22* (L2)	CINDVDEF22	ReadOnly	UINT16
87	DEFAULT OFFSET *C23* (M1)	CINDVDEF23	ReadOnly	UINT16
88	DEFAULT OFFSET *C24* (M2)	CINDVDEF24	ReadOnly	UINT16
89	DEFAULT OFFSET *C25* (R1)	CINDVDEF25	ReadOnly	UINT16
90	DEFAULT OFFSET *C26* (R2)	CINDVDEF26	ReadOnly	UINT16
91	DEFAULT OFFSET *C27* (S1)	CINDVDEF27	ReadOnly	UINT16
92	DEFAULT OFFSET *C28* (S2)	CINDVDEF28	ReadOnly	UINT16
93	DEFAULT OFFSET *C29* (T1)	CINDVDEF29	ReadOnly	UINT16
94	DEFAULT OFFSET *C30* (T2)	CINDVDEF30	ReadOnly	UINT16
95	DEFAULT OFFSET *C31* (U1)	CINDVDEF31	ReadOnly	UINT16
96	DEFAULT OFFSET *C32* (U2)	CINDVDEF32	ReadOnly	UINT16
97	CAVG *C1* (A or A1)	CAVG01	ReadOnly	INT16
98	CAVG *C2* (B or A2)	CAVG02	ReadOnly	INT16
99	CAVG *C3* (C or B1)	CAVG03	ReadOnly	INT16
100	CAVG *C4* (D or B2)	CAVG04	ReadOnly	INT16
101	CAVG *C5* (E or C1)	CAVG05	ReadOnly	INT16
102	CAVG *C6* (F or C2)	CAVG06	ReadOnly	INT16
103	CAVG *C7* (G or D1)	CAVG07	ReadOnly	INT16
104	CAVG *C8* (H or D2)	CAVG08	ReadOnly	INT16
105	CAVG *C9* (J or E1)	CAVG09	ReadOnly	INT16
106	CAVG *C10* (K or E2)	CAVG10	ReadOnly	INT16
107	CAVG *C11* (L or F1)	CAVG11	ReadOnly	INT16
108	CAVG *C12* (M or F2)	CAVG12	ReadOnly	INT16
109	CAVG *C13* (R or G1)	CAVG13	ReadOnly	INT16
110	CAVG *C14* (S or G2)	CAVG14	ReadOnly	INT16
111	CAVG *C15* (T or H1)	CAVG15	ReadOnly	INT16
112	CAVG *C16* (U or H2)	CAVG16	ReadOnly	INT16
113	CAVG *C17* (J1)	CAVG17	ReadOnly	INT16
114	CAVG *C18* (J2)	CAVG18	ReadOnly	INT16
115	CAVG *C19* (K1)	CAVG19	ReadOnly	INT16
116	CAVG *C20* (K2)	CAVG20	ReadOnly	INT16
117	CAVG *C21* (L1)	CAVG21	ReadOnly	INT16
118	CAVG *C22* (L2)	CAVG22	ReadOnly	INT16
119	CAVG *C23* (M1)	CAVG23	ReadOnly	INT16
120	CAVG *C24* (M2)	CAVG24	ReadOnly	INT16

121	CAVG *C25* (R1)	CAVG25	ReadOnly	INT16
122	CAVG *C26* (R2)	CAVG26	ReadOnly	INT16
123	CAVG *C27* (S1)	CAVG27	ReadOnly	INT16
124	CAVG *C28* (S2)	CAVG28	ReadOnly	INT16
125	CAVG *C29* (T1)	CAVG29	ReadOnly	INT16
126	CAVG *C30* (T2)	CAVG30	ReadOnly	INT16
127	CAVG *C31* (U1)	CAVG31	ReadOnly	INT16
128	CAVG *C32* (U2)	CAVG32	ReadOnly	INT16
129	COV *C1* (A or A1)	COV01	ReadOnly	INT16
130	COV *C2* (B or A2)	COV02	ReadOnly	INT16
131	COV *C3* (C or B1)	COV03	ReadOnly	INT16
132	COV *C4* (D or B2)	COV04	ReadOnly	INT16
133	COV *C5* (E or C1)	COV05	ReadOnly	INT16
134	COV *C6* (F or C2)	COV06	ReadOnly	INT16
135	COV *C7* (G or D1)	COV07	ReadOnly	INT16
136	COV *C8* (H or D2)	COV08	ReadOnly	INT16
137	COV *C9* (J or E1)	COV09	ReadOnly	INT16
138	COV *C10* (K or E2)	COV10	ReadOnly	INT16
139	COV *C11* (L or F1)	COV11	ReadOnly	INT16
140	COV *C12* (M or F2)	COV12	ReadOnly	INT16
141	COV *C13* (R or G1)	COV13	ReadOnly	INT16
142	COV *C14* (S or G2)	COV14	ReadOnly	INT16
143	COV *C15* (T or H1)	COV15	ReadOnly	INT16
144	COV *C16* (U or H2)	COV16	ReadOnly	INT16
145	COV *C17* (J1)	COV17	ReadOnly	INT16
146	COV *C18* (J2)	COV18	ReadOnly	INT16
147	COV *C19* (K1)	COV19	ReadOnly	INT16
148	COV *C20* (K2)	COV20	ReadOnly	INT16
149	COV *C21* (L1)	COV21	ReadOnly	INT16
150	COV *C22* (L2)	COV22	ReadOnly	INT16
151	COV *C23* (M1)	COV23	ReadOnly	INT16
152	COV *C24* (M2)	COV24	ReadOnly	INT16
153	COV *C25* (R1)	COV25	ReadOnly	INT16
154	COV *C26* (R2)	COV26	ReadOnly	INT16
155	COV *C27* (S1)	COV27	ReadOnly	INT16
156	COV *C28* (S2)	COV28	ReadOnly	INT16
157	COV *C29* (T1)	COV29	ReadOnly	INT16
158	COV *C30* (T2)	COV30	ReadOnly	INT16
159	COV *C31* (U1)	COV31	ReadOnly	INT16
160	COV *C32* (U2)	COV32	ReadOnly	INT16
161	DIAG OFFSET *C1* (A or A1)	DIAGOFST01	ReadOnly	INT16

162	DIAG OFFSET *C2* (B or A2)	DIAGOFST02	ReadOnly	INT16
163	DIAG OFFSET *C3* (C or B1)	DIAGOFST03	ReadOnly	INT16
164	DIAG OFFSET *C4* (D or B2)	DIAGOFST04	ReadOnly	INT16
165	DIAG OFFSET *C5* (E or C1)	DIAGOFST05	ReadOnly	INT16
166	DIAG OFFSET *C6* (F or C2)	DIAGOFST06	ReadOnly	INT16
167	DIAG OFFSET *C7* (G or D1)	DIAGOFST07	ReadOnly	INT16
168	DIAG OFFSET *C8* (H or D2)	DIAGOFST08	ReadOnly	INT16
169	DIAG OFFSET *C9* (J or E1)	DIAGOFST09	ReadOnly	INT16
170	DIAG OFFSET *C10* (K or E2)	DIAGOFST10	ReadOnly	INT16
171	DIAG OFFSET *C11* (L or F1)	DIAGOFST11	ReadOnly	INT16
172	DIAG OFFSET *C12* (M or F2)	DIAGOFST12	ReadOnly	INT16
173	DIAG OFFSET *C13* (R or G1)	DIAGOFST13	ReadOnly	INT16
174	DIAG OFFSET *C14* (S or G2)	DIAGOFST14	ReadOnly	INT16
175	DIAG OFFSET *C15* (T or H1)	DIAGOFST15	ReadOnly	INT16
176	DIAG OFFSET *C16* (U or H2)	DIAGOFST16	ReadOnly	INT16
177	DIAG OFFSET *C17* (J1)	DIAGOFST17	ReadOnly	INT16
178	DIAG OFFSET *C18* (J2)	DIAGOFST18	ReadOnly	INT16
179	DIAG OFFSET *C19* (K1)	DIAGOFST19	ReadOnly	INT16
180	DIAG OFFSET *C20* (K2)	DIAGOFST20	ReadOnly	INT16
181	DIAG OFFSET *C21* (L1)	DIAGOFST21	ReadOnly	INT16
182	DIAG OFFSET *C22* (L2)	DIAGOFST22	ReadOnly	INT16
183	DIAG OFFSET *C23* (M1)	DIAGOFST23	ReadOnly	INT16
184	DIAG OFFSET *C24* (M2)	DIAGOFST24	ReadOnly	INT16
185	DIAG OFFSET *C25* (R1)	DIAGOFST25	ReadOnly	INT16
186	DIAG OFFSET *C26* (R2)	DIAGOFST26	ReadOnly	INT16
187	DIAG OFFSET *C27* (S1)	DIAGOFST27	ReadOnly	INT16
188	DIAG OFFSET *C28* (S2)	DIAGOFST28	ReadOnly	INT16
189	DIAG OFFSET *C29* (T1)	DIAGOFST29	ReadOnly	INT16
190	DIAG OFFSET *C30* (T2)	DIAGOFST30	ReadOnly	INT16
191	DIAG OFFSET *C31* (U1)	DIAGOFST31	ReadOnly	INT16
192	DIAG OFFSET *C32* (U2)	DIAGOFST32	ReadOnly	INT16
193	spare193	spare300193	ReadOnly	UINT16
194	spare194	spare300194	ReadOnly	UINT16
195	spare195	spare300195	ReadOnly	UINT16
196	spare196	spare300196	ReadOnly	UINT16
197	spare197	spare300197	ReadOnly	UINT16
198	spare198	spare300198	ReadOnly	UINT16
199	spare199	spare300199	ReadOnly	UINT16
200	spare200	spare300200	ReadOnly	UINT16
201	spare201	spare300201	ReadOnly	UINT16
202	spare202	spare300202	ReadOnly	UINT16

203	spare203	spare300203	ReadOnly	UINT16
204	spare204	spare300204	ReadOnly	UINT16
205	spare205	spare300205	ReadOnly	UINT16
206	spare206	spare300206	ReadOnly	UINT16
207	spare207	spare300207	ReadOnly	UINT16
208	spare208	spare300208	ReadOnly	UINT16
209	spare209	spare300209	ReadOnly	UINT16
210	firmware date	TUINT32	ReadOnly	UINT32
212	TEST INT32	TINT32	ReadOnly	INT32
214	firmware progress	TFLT32	ReadOnly	FLOAT32
220	TEST 220	T220	ReadOnly	UINT16
227	TEST 227	T227	ReadOnly	UINT16
230	TEST 230	T230	ReadOnly	UINT16
253	CYCLE AND COM CONFIG DATA	CONFIGCYCCOM	ReadOnly	INT16
254	ID CODE FOR LOGIC SER PORT	IDCODEMB	ReadOnly	INT16
255	KEYCMD REQUEST REGISTER	KEYCMD	ReadOnly	INT16
256	KEYCMD DATA REGISTER	KEYCMDDAT	ReadOnly	INT16
371	ENGINE STATE	ENGSTATE	ReadOnly	INT16
372	SYNCING FLAG	FLGSYNCING	ReadOnly	UINT16
373	INSYNC FLAG	FLGINSYNC	ReadOnly	UINT16
374	FIRING FLAG	FLGFIRING	ReadOnly	UINT16
375	STALLED FLAG	FLGSTALLED	ReadOnly	UINT16
376	FAULT FLAG	FLGFAULT	ReadOnly	UINT16
377	SHUTDOWN INPUT	FLGSHTDWN	ReadOnly	UINT16
378	ROTATING FLAG	FLGROTATING	ReadOnly	UINT16
379	OVERSPEED FLAG	FLGOVERSPD	ReadOnly	UINT16
380	GEAR TOOTH SEEN	FLGGTSEEN	ReadOnly	UINT16
381	RST SEEN	FLGRSTSEEN	ReadOnly	UINT16
382	CAM SEEN	FLGCAMSEEN	ReadOnly	UINT16
383	GEARTEETH PER RESET	GTPERRST	ReadOnly	UINT16
384	GEARTEETH SINCE RESET	GTSINCERST	ReadOnly	UINT16
385	GEARTEETH PER CAM	GTPERCAM	ReadOnly	UINT16
386	GEARTEETH SINCE CAM	GTSINCECAM	ReadOnly	UINT16
387	LAST CONDITION	LSTCOND	ReadOnly	UINT16
388	ENERGY LEVEL	ENRGLVL	ReadOnly	UINT16
401	1R P Secondary Voltage	CYL1kv	ReadOnly	UINT16
402	4R P Secondary Voltage	CYL2kv	ReadOnly	UINT16
403	3R P Secondary Voltage	CYL3kv	ReadOnly	UINT16
404	2R P Secondary Voltage	CYL4kv	ReadOnly	UINT16
405	5R P Secondary Voltage	CYL5kv	ReadOnly	UINT16
406	1R O Secondary Voltage	CYL6kv	ReadOnly	UINT16

407	4R O Secondary Voltage	CYL7kv	ReadOnly	UINT16
408	3R O Secondary Voltage	CYL8kv	ReadOnly	UINT16
409	2R O Secondary Voltage	CYL9kv	ReadOnly	UINT16
410	5R O Secondary Voltage	CYL10kv	ReadOnly	UINT16
411	1L P Secondary Voltage	CYL11kv	ReadOnly	UINT16
412	4L P Secondary Voltage	CYL12kv	ReadOnly	UINT16
413	3L P Secondary Voltage	CYL13kv	ReadOnly	UINT16
414	2L P Secondary Voltage	CYL14kv	ReadOnly	UINT16
415	5L P Secondary Voltage	CYL15kv	ReadOnly	UINT16
416	1L O Secondary Voltage	CYL16kv	ReadOnly	UINT16
417	4L O Secondary Voltage	CYL17kv	ReadOnly	UINT16
418	3L O Secondary Voltage	CYL18kv	ReadOnly	UINT16
419	2L O Secondary Voltage	CYL19kv	ReadOnly	UINT16
420	5L O Secondary Voltage	CYL20kv	ReadOnly	UINT16
421	CYL 21 Secondary Voltage	CYL21kv	ReadOnly	UINT16
422	CYL 22 Secondary Voltage	CYL22kv	ReadOnly	UINT16
423	CYL 23 Secondary Voltage	CYL23kv	ReadOnly	UINT16
424	CYL 24 Secondary Voltage	CYL24kv	ReadOnly	UINT16
425	CYL 25 Secondary Voltage	CYL25kv	ReadOnly	UINT16
426	CYL 26 Secondary Voltage	CYL26kv	ReadOnly	UINT16
427	CYL 27 Secondary Voltage	CYL27kv	ReadOnly	UINT16
428	CYL 28 Secondary Voltage	CYL28kv	ReadOnly	UINT16
429	CYL 29 Secondary Voltage	CYL29kv	ReadOnly	UINT16
430	CYL 30 Secondary Voltage	CYL30kv	ReadOnly	UINT16
431	CYL 31 Secondary Voltage	CYL31kv	ReadOnly	UINT16
432	CYL 32 Secondary Voltage	CYL32kv	ReadOnly	UINT16
433	CYL 33 Secondary Voltage	CYL33kv	ReadOnly	UINT16
434	CYL 34 Secondary Voltage	CYL34kv	ReadOnly	UINT16
435	CYL 35 Secondary Voltage	CYL35kv	ReadOnly	UINT16
436	CYL 36 Secondary Voltage	CYL36kv	ReadOnly	UINT16
437	CYL 37 Secondary Voltage	CYL37kv	ReadOnly	UINT16
438	CYL 38 Secondary Voltage	CYL38kv	ReadOnly	UINT16
439	CYL 39 Secondary Voltage	CYL39kv	ReadOnly	UINT16
440	CYL 40 Secondary Voltage	CYL40kv	ReadOnly	UINT16
500	Engine Config Num Cylinders	eNumCyl		INT16
501	Engine Config Type	eType		INT16
502	Engine Config Coils Per Cylinder	eCoilPerCyl		INT16
503	Engine Config Max RPM	eMaxRpm		INT16
504	Engine Config FP 2 Cylinder Flag	eFp2cyl		INT16
505	Engine Config FP 2nd Cylinder Offset	eFp2ndCylOfst		INT16
506	Engine Config Num Gear Teeth	eGearTeeth		INT16

507	Engine Config Output Module	eOutputMod		INT16
508	Engine Config Coils Per Output	eCoilPerOutp		INT16
509	FireA Angle0	eFireA0		INT16
510	FireA Angle1	eFireA1		INT16
511	FireA Angle2	eFireA2		INT16
512	FireA Angle3	eFireA3		INT16
513	FireA Angle4	eFireA4		INT16
514	FireA Angle5	eFireA5		INT16
515	FireA Angle6	eFireA6		INT16
516	FireA Angle7	eFireA7		INT16
517	FireA Angle8	eFireA8		INT16
518	FireA Angle9	eFireA9		INT16
519	FireA Angle10	eFireA10		INT16
520	FireA Angle11	eFireA11		INT16
521	FireA Angle12	eFireA12		INT16
522	FireA Angle13	eFireA13		INT16
523	FireA Angle14	eFireA14		INT16
524	FireA Angle15	eFireA15		INT16
525	FireA Angle16	eFireA16		INT16
526	FireA Angle17	eFireA17		INT16
527	FireA Angle18	eFireA18		INT16
528	FireA Angle19	eFireA19		INT16
529	FireB Angle0	eFireB0		INT16
530	FireB Angle1	eFireB1		INT16
531	FireB Angle2	eFireB2		INT16
532	FireB Angle3	eFireB3		INT16
533	FireB Angle4	eFireB4		INT16
534	FireB Angle5	eFireB5		INT16
535	FireB Angle6	eFireB6		INT16
536	FireB Angle7	eFireB7		INT16
537	FireB Angle8	eFireB8		INT16
538	FireB Angle9	eFireB9		INT16
539	FireB Angle10	eFireB10		INT16
540	FireB Angle11	eFireB11		INT16
541	FireB Angle12	eFireB12		INT16
542	FireB Angle13	eFireB13		INT16
543	FireB Angle14	eFireB14		INT16
544	FireB Angle15	eFireB15		INT16
545	FireB Angle16	eFireB16		INT16
546	FireB Angle17	eFireB17		INT16
547	FireB Angle18	eFireB18		INT16

548	FireB Angle19	eFireB19		INT16
549	Current Map Current0	eCurMap0c		INT16
550	Current Map Retard0	eCurMap0r		INT16
551	Current Map Current1	eCurMap1c		INT16
552	Current Map Retard1	eCurMap1r		INT16
553	Current Map Current2	eCurMap2c		INT16
554	Current Map Retard2	eCurMap2r		INT16
555	Current Map Current3	eCurMap3c		INT16
556	Current Map Retard3	eCurMap3r		INT16
557	Current Map Current4	eCurMap4c		INT16
558	Current Map Retard4	eCurMap4r		INT16
559	Current Map Current5	eCurMap5c		INT16
560	Current Map Retard5	eCurMap5r		INT16
561	Current Map Current6	eCurMap6c		INT16
562	Current Map Retard6	eCurMap6r		INT16
563	Current Map Current7	eCurMap7c		INT16
564	Current Map Retard7	eCurMap7r		INT16
565	Current Map Current8	eCurMap8c		INT16
566	Current Map Retard8	eCurMap8r		INT16
567	Current Map Current9	eCurMap9c		INT16
568	Current Map Retard9	eCurMap9r		INT16
569	Current Map Current10	eCurMap10c		INT16
570	Current Map Retard10	eCurMap10r		INT16
571	Current Map Current11	eCurMap11c		INT16
572	Current Map Retard11	eCurMap11r		INT16
573	Current Map Current12	eCurMap12c		INT16
574	Current Map Retard12	eCurMap12r		INT16
575	Current Map Current13	eCurMap13c		INT16
576	Current Map Retard13	eCurMap13r		INT16
577	Current Map Current14	eCurMap14c		INT16
578	Current Map Retard14	eCurMap14r		INT16
579	RPM Map Speed0	eRpmMap0s		INT16
580	RPM Map Retard0	eRpmMap0r		INT16
581	RPM Map Speed1	eRpmMap1s		INT16
582	RPM Map Retard1	eRpmMap1r		INT16
583	RPM Map Speed2	eRpmMap2s		INT16
584	RPM Map Retard2	eRpmMap2r		INT16
585	RPM Map Speed3	eRpmMap3s		INT16
586	RPM Map Retard3	eRpmMap3r		INT16
587	RPM Map Speed4	eRpmMap4s		INT16
588	RPM Map Retard4	eRpmMap4r		INT16

589	RPM Map Speed5	eRpmMap5s		INT16
590	RPM Map Retard5	eRpmMap5r		INT16
591	RPM Map Speed6	eRpmMap6s		INT16
592	RPM Map Retard6	eRpmMap6r		INT16
593	RPM Map Speed7	eRpmMap7s		INT16
594	RPM Map Retard7	eRpmMap7r		INT16
595	RPM Map Speed8	eRpmMap8s		INT16
596	RPM Map Retard8	eRpmMap8r		INT16
597	RPM Map Speed9	eRpmMap9s		INT16
598	RPM Map Retard9	eRpmMap9r		INT16
599	RPM Map Speed10	eRpmMap10s		INT16
600	RPM Map Retard10	eRpmMap10r		INT16
601	RPM Map Speed11	eRpmMap11s		INT16
602	RPM Map Retard11	eRpmMap11r		INT16
603	RPM Map Speed12	eRpmMap12s		INT16
604	RPM Map Retard12	eRpmMap12r		INT16
605	RPM Map Speed13	eRpmMap13s		INT16
606	RPM Map Retard13	eRpmMap13r		INT16
607	RPM Map Speed14	eRpmMap14s		INT16
608	RPM Map Retard14	eRpmMap14r		INT16
609	Engine Config Advanced Timing Value	eAtv		INT16
610	Engine Config Advanced Energy Value	eAev		INT16
611	Engine Config Advanced Fire Value	eAfv		INT16
612	Engine Config Test Mode Permit	eTmPermit	ReadOnly	INT16
613	Fire Pattern Enum	eFireEnum		INT16
614	Engine Config System Type	eOutMod		INT16
615	Engine Config Chksum	eChksum		INT16
616	Engine Config Go	eGo		INT16
1000	Bootloader State	BOOTSTATE		UINT16
1001	RESERVED500	DIAGALRM01	ReadOnly	UINT16
1002	RESERVED501	DIAGALRM02	ReadOnly	UINT16
1003	RESERVED502	DIAGALRM03	ReadOnly	UINT16
1004	RESERVED503	DIAGALRM04	ReadOnly	UINT16
1005	RESERVED504	DIAGALRM05	ReadOnly	UINT16
1006	RESERVED505	DIAGALRM06	ReadOnly	UINT16
1007	RESERVED506	DIAGALRM07	ReadOnly	UINT16
1008	RESERVED507	DIAGALRM08	ReadOnly	UINT16
1009	RESERVED508	DIAGALRM09	ReadOnly	UINT16
1010	RESERVED509	DIAGALRM10	ReadOnly	UINT16
1011	RESERVED510	DIAGALRM11	ReadOnly	UINT16
1012	RESERVED511	DIAGALRM12	ReadOnly	UINT16

1013	RESERVED512	DIAGALRM13	ReadOnly	UINT16
1014	RESERVED513	DIAGALRM14	ReadOnly	UINT16
1015	RESERVED514	DIAGALRM15	ReadOnly	UINT16
1016	RESERVED515	DIAGALRM16	ReadOnly	UINT16
1017	RESERVED516	DIAGALRM17	ReadOnly	UINT16
1018	RESERVED517	DIAGALRM18	ReadOnly	UINT16
1019	RESERVED518	DIAGALRM19	ReadOnly	UINT16
1020	RESERVED519	DIAGALRM20	ReadOnly	UINT16
1021	RESERVED520	DIAGALRM21	ReadOnly	UINT16
1022	RESERVED521	DIAGALRM22	ReadOnly	UINT16
1023	RESERVED522	DIAGALRM23	ReadOnly	UINT16
1024	RESERVED523	DIAGALRM24	ReadOnly	UINT16
1025	RESERVED524	DIAGALRM25	ReadOnly	UINT16
1026	RESERVED525	DIAGALRM26	ReadOnly	UINT16
1027	RESERVED526	DIAGALRM27	ReadOnly	UINT16
1028	RESERVED527	DIAGALRM28	ReadOnly	UINT16
1029	RESERVED528	DIAGALRM29	ReadOnly	UINT16
1030	RESERVED529	DIAGALRM30	ReadOnly	UINT16
1031	RESERVED530	DIAGALRM31	ReadOnly	UINT16
1032	RESERVED531	DIAGALRM32	ReadOnly	UINT16
1033	DIAG MAX *C1* (A or A1)	DIAGMAX01	ReadOnly	UINT16
1034	DIAG MAX *C2* (B or A2)	DIAGMAX02	ReadOnly	UINT16
1035	DIAG MAX *C3* (C or B1)	DIAGMAX03	ReadOnly	UINT16
1036	DIAG MAX *C4* (D or B2)	DIAGMAX04	ReadOnly	UINT16
1037	DIAG MAX *C5* (E or C1)	DIAGMAX05	ReadOnly	UINT16
1038	DIAG MAX *C6* (F or C2)	DIAGMAX06	ReadOnly	UINT16
1039	DIAG MAX *C7* (G or D1)	DIAGMAX07	ReadOnly	UINT16
1040	DIAG MAX *C8* (H or D2)	DIAGMAX08	ReadOnly	UINT16
1041	DIAG MAX *C9* (J or E1)	DIAGMAX09	ReadOnly	UINT16
1042	DIAG MAX *C10* (K or E2)	DIAGMAX10	ReadOnly	UINT16
1043	DIAG MAX *C11* (L or F1)	DIAGMAX11	ReadOnly	UINT16
1044	DIAG MAX *C12* (M or F2)	DIAGMAX12	ReadOnly	UINT16
1045	DIAG MAX *C13* (R or G1)	DIAGMAX13	ReadOnly	UINT16
1046	DIAG MAX *C14* (S or G2)	DIAGMAX14	ReadOnly	UINT16
1047	DIAG MAX *C15* (T or H1)	DIAGMAX15	ReadOnly	UINT16
1048	DIAG MAX *C16* (Y or H2)	DIAGMAX16	ReadOnly	UINT16
1049	DIAG MAX *C17* (J1)	DIAGMAX17	ReadOnly	UINT16
1050	DIAG MAX *C18* (J2)	DIAGMAX18	ReadOnly	UINT16
1051	DIAG MAX *C19* (K1)	DIAGMAX19	ReadOnly	UINT16
1052	DIAG MAX *C20* (K2)	DIAGMAX20	ReadOnly	UINT16
1053	DIAG MAX *C21* (L1)	DIAGMAX21	ReadOnly	UINT16

1054	DIAG MAX *C22* (L2)	DIAGMAX22	ReadOnly	UINT16
1055	DIAG MAX *C23* (M1)	DIAGMAX23	ReadOnly	UINT16
1056	DIAG MAX *C24* (M2)	DIAGMAX24	ReadOnly	UINT16
1057	DIAG MAX *C25* (R1)	DIAGMAX25	ReadOnly	UINT16
1058	DIAG MAX *C26* (R2)	DIAGMAX26	ReadOnly	UINT16
1059	DIAG MAX *C27* (S1)	DIAGMAX27	ReadOnly	UINT16
1060	DIAG MAX *C28* (S2)	DIAGMAX28	ReadOnly	UINT16
1061	DIAG MAX *C29* (T1)	DIAGMAX29	ReadOnly	UINT16
1062	DIAG MAX *C30* (T2)	DIAGMAX30	ReadOnly	UINT16
1063	DIAG MAX *C31* (U1)	DIAGMAX31	ReadOnly	UINT16
1064	DIAG MAX *C32* (U2)	DIAGMAX32	ReadOnly	UINT16
1065	DIAG MIN *C1* (A or A1)	DIAGMIN01	ReadOnly	UINT16
1066	DIAG MIN *C2* (B or A2)	DIAGMIN02	ReadOnly	UINT16
1067	DIAG MIN *C3* (C or B1)	DIAGMIN03	ReadOnly	UINT16
1068	DIAG MIN *C4* (D or B2)	DIAGMIN04	ReadOnly	UINT16
1069	DIAG MIN *C5* (E or C1)	DIAGMIN05	ReadOnly	UINT16
1070	DIAG MIN *C6* (F or C2)	DIAGMIN06	ReadOnly	UINT16
1071	DIAG MIN *C7* (G or D1)	DIAGMIN07	ReadOnly	UINT16
1072	DIAG MIN *C8* (H or D2)	DIAGMIN08	ReadOnly	UINT16
1073	DIAG MIN *C9* (J or E1)	DIAGMIN09	ReadOnly	UINT16
1074	DIAGMIN *C10* (K or E2)	DIAGMIN10	ReadOnly	UINT16
1075	DIAGMIN *C11* (L or F1)	DIAGMIN11	ReadOnly	UINT16
1076	DIAG MIN *C12* (M or F2)	DIAGMIN12	ReadOnly	UINT16
1077	DIAG MIN *C13* (R or G1)	DIAGMIN13	ReadOnly	UINT16
1078	DIAG MIN *C14* (S or G2)	DIAGMIN14	ReadOnly	UINT16
1079	DIAG MIN *C15* (T or H1)	DIAGMIN15	ReadOnly	UINT16
1080	DIAG MIN *C16* (Y or H2)	DIAGMIN16	ReadOnly	UINT16
1081	DIAG MIN *C17* (J1)	DIAGMIN17	ReadOnly	UINT16
1082	DIAG MIN *C18* (J2)	DIAGMIN18	ReadOnly	UINT16
1083	DIAG MIN *C19* (K1)	DIAGMIN19	ReadOnly	UINT16
1084	DIAG MIN *C20* (K2)	DIAGMIN20	ReadOnly	UINT16
1085	DIAG MIN *C21* (L1)	DIAGMIN21	ReadOnly	UINT16
1086	DIAG MIN *C22* (L2)	DIAGMIN22	ReadOnly	UINT16
1087	DIAG MIN *C23* (M1)	DIAGMIN23	ReadOnly	UINT16
1088	DIAG MIN *C24* (M2)	DIAGMIN24	ReadOnly	UINT16
1089	DIAG MIN *C25* (R1)	DIAGMIN25	ReadOnly	UINT16
1090	DIAG MIN *C26* (R2)	DIAGMIN26	ReadOnly	UINT16
1091	DIAG MIN *C27* (S1)	DIAGMIN27	ReadOnly	UINT16
1092	DIAG MIN *C28* (S2)	DIAGMIN28	ReadOnly	UINT16
1093	DIAG MIN *C29* (T1)	DIAGMIN29	ReadOnly	UINT16
1094	DIAG MIN *C30* (T2)	DIAGMIN30	ReadOnly	UINT16

1095	DIAG MIN *C31* (U1)	DIAGMIN31	ReadOnly	UINT16
1096	DIAG MIN *C32* (U2)	DIAGMIN32	ReadOnly	UINT16
1097	DIAG REAL *C1* (A or A1)	DIAGREAL01	ReadOnly	UINT16
1098	DIAGREAL *C2* (B or A2)	DIAGREAL02	ReadOnly	UINT16
1099	DIAG REAL *C3* (C or B1)	DIAGREAL03	ReadOnly	UINT16
1100	DIAG REAL *C4* (D or B2)	DIAGREAL04	ReadOnly	UINT16
1101	DIAG REAL *C5* (E or C1)	DIAGREAL05	ReadOnly	UINT16
1102	DIAG REAL *C6* (F or C2)	DIAGREAL06	ReadOnly	UINT16
1103	DIAG REAL *C7* (G or D1)	DIAGREAL07	ReadOnly	UINT16
1104	DIAG REAL *C8* (H or D2)	DIAGREAL08	ReadOnly	UINT16
1105	DIAG REAL *C9* (J or E1)	DIAGREAL09	ReadOnly	UINT16
1106	DIAG REAL *C10* (K or E2)	DIAGREAL10	ReadOnly	UINT16
1107	DIAG REAL *C11* (L or F1)	DIAGREAL11	ReadOnly	UINT16
1108	DIAG REAL *C12* (M or F2)	DIAGREAL12	ReadOnly	UINT16
1109	DIAG REAL *C13* (R or G1)	DIAGREAL13	ReadOnly	UINT16
1110	DIAG REAL *C14* (S or G2)	DIAGREAL14	ReadOnly	UINT16
1111	DIAG REAL *C15* (T or H1)	DIAGREAL15	ReadOnly	UINT16
1112	DIAG REAL *C16* (Y or H2)	DIAGREAL16	ReadOnly	UINT16
1113	DIAG REAL *C17* (J1)	DIAGREAL17	ReadOnly	UINT16
1114	DIAG REAL *C18* (J2)	DIAGREAL18	ReadOnly	UINT16
1115	DIAG REAL *C19* (K1)	DIAGREAL19	ReadOnly	UINT16
1116	DIAG REAL *C20* (K2)	DIAGREAL20	ReadOnly	UINT16
1117	DIAG REAL *C21* (L1)	DIAGREAL21	ReadOnly	UINT16
1118	DIAG REAL *C22* (L2)	DIAGREAL22	ReadOnly	UINT16
1119	DIAG REAL(*C23*(M1)	DIAGREAL23	ReadOnly	UINT16
1120	DIAG REAL *C24* (M2)	DIAGREAL24	ReadOnly	UINT16
1121	DIAG REAL *C25* (R1)	DIAGREAL25	ReadOnly	UINT16
1122	DIAG REAL *C26* (R2)	DIAGREAL26	ReadOnly	UINT16
1123	DIAG REAL *C27* (S1)	DIAGREAL27	ReadOnly	UINT16
1124	DIAG REAL *C28* (S2)	DIAGREAL28	ReadOnly	UINT16
1125	DIAG REAL *C29* (T1)	DIAGREAL29	ReadOnly	UINT16
1126	DIAG REAL *C30* (T2)	DIAGREAL30	ReadOnly	UINT16
1127	DIAG REAL *C31* (U1)	DIAGREAL31	ReadOnly	UINT16
1128	DIAG REAL *C32* (U2)	DIAGREAL32	ReadOnly	UINT16
1129	DIAG FILT B	DIAGFILTB	ReadOnly	UINT16

8.3 40000 Modbus Registers

Register	Label	Key	ReadOnly / ReadWrite	Type
33	CYL TIMING OFFSET *C1* (A or A1)	CINDVTMGWR01	ReadWrite	INT16
34	CYL TIMING OFFSET *C2* (B or A2)	CINDVTMGWR02	ReadWrite	INT16

35	CYL TIMING OFFSET *C3* (C or B1)	CINDVTMGWR03	ReadWrite	INT16
36	CYL TIMING OFFSET *C4* (D or B2)	CINDVTMGWR04	ReadWrite	INT16
37	CYL TIMING OFFSET *C5* (E or C1)	CINDVTMGWR05	ReadWrite	INT16
38	CYL TIMING OFFSET *C6* (F or C2)	CINDVTMGWR06	ReadWrite	INT16
39	CYL TIMING OFFSET *C7* (G or D1)	CINDVTMGWR07	ReadWrite	INT16
40	CYL TIMING OFFSET *C8* (H or D2)	CINDVTMGWR08	ReadWrite	INT16
41	CYL TIMING OFFSET *C9* (J or E1)	CINDVTMGWR09	ReadWrite	INT16
42	CYL TIMING OFFSET *C10* (K or E2)	CINDVTMGWR10	ReadWrite	INT16
43	CYL TIMING OFFSET *C11* (L or F1)	CINDVTMGWR11	ReadWrite	INT16
44	CYL TIMING OFFSET *C12* (M or F2)	CINDVTMGWR12	ReadWrite	INT16
45	CYL TIMING OFFSET *C13* (R or G1)	CINDVTMGWR13	ReadWrite	INT16
46	CYL TIMING OFFSET *C14* (S or G2)	CINDVTMGWR14	ReadWrite	INT16
47	CYL TIMING OFFSET *C15* (T or H1)	CINDVTMGWR15	ReadWrite	INT16
48	CYL TIMING OFFSET *C16* (U or H2)	CINDVTMGWR16	ReadWrite	INT16
49	CYL TIMING OFFSET *C17* (J1)	CINDVTMGWR17	ReadWrite	INT16
50	CYL TIMING OFFSET *C18* (J2)	CINDVTMGWR18	ReadWrite	INT16
51	CYL TIMING OFFSET *C19* (K1)	CINDVTMGWR19	ReadWrite	INT16
52	CYL TIMING OFFSET *C20* (K2)	CINDVTMGWR20	ReadWrite	INT16
53	CYL TIMING OFFSET *C21* (L1)	CINDVTMGWR21	ReadWrite	INT16
54	CYL TIMING OFFSET *C22* (L2)	CINDVTMGWR22	ReadWrite	INT16
55	CYL TIMING OFFSET *C23* (M1)	CINDVTMGWR23	ReadWrite	INT16
56	CYL TIMING OFFSET *C24* (M2)	CINDVTMGWR24	ReadWrite	INT16
57	CYL TIMING OFFSET *C25* (R1)	CINDVTMGWR25	ReadWrite	INT16
58	CYL TIMING OFFSET *C26* (R2)	CINDVTMGWR26	ReadWrite	INT16
59	CYL TIMING OFFSET *C27* (S1)	CINDVTMGWR27	ReadWrite	INT16
60	CYL TIMING OFFSET *C28* (S2)	CINDVTMGWR28	ReadWrite	INT16
61	CYL TIMING OFFSET *C29* (T1)	CINDVTMGWR29	ReadWrite	INT16
62	CYL TIMING OFFSET *C30* (T2)	CINDVTMGWR30	ReadWrite	INT16
63	CYL TIMING OFFSET *C31* (U1)	CINDVTMGWR31	ReadWrite	INT16
64	CYL TIMING OFFSET *C32* (U2)	CINDVTMGWR32	ReadWrite	INT16
255	KEY COMMAND	KEYPRS	ReadWrite	UINT32
257	Engine Config Num Cylinders	cNumCyl		INT16
258	Engine Config Type	cType		INT16
259	Engine Config Coils Per Cylinder	cCoilPerCyl		INT16
260	Engine Config Max RPM	cMaxRpm		INT16
261	Engine Config FP 2 Cylinder Flag	cFp2cyl		INT16
262	Engine Config FP 2nd Cylinder Offset	cFp2ndCylOfst		INT16
263	Engine Config Num Gear Teeth	cGearTeeth		INT16
264	Engine Config Output Module	cOutputMod		INT16
265	Engine Config Coils Per Output	cCoilPerOutp		INT16
266	FireA Angle0	cFireA0		INT16

267	FireA Angle1	cFireA1		INT16
268	FireA Angle2	cFireA2		INT16
269	FireA Angle3	cFireA3		INT16
270	FireA Angle4	cFireA4		INT16
271	FireA Angle5	cFireA5		INT16
272	FireA Angle6	cFireA6		INT16
273	FireA Angle7	cFireA7		INT16
274	FireA Angle8	cFireA8		INT16
275	FireA Angle9	cFireA9		INT16
276	FireA Angle10	cFireA10		INT16
277	FireA Angle11	cFireA11		INT16
278	FireA Angle12	cFireA12		INT16
279	FireA Angle13	cFireA13		INT16
280	FireA Angle14	cFireA14		INT16
281	FireA Angle15	cFireA15		INT16
282	FireA Angle16	cFireA16		INT16
283	FireA Angle17	cFireA17		INT16
284	FireA Angle18	cFireA18		INT16
285	FireA Angle19	cFireA19		INT16
286	FireB Angle0	cFireB0		INT16
287	FireB Angle1	cFireB1		INT16
288	FireB Angle2	cFireB2		INT16
289	FireB Angle3	cFireB3		INT16
290	FireB Angle4	cFireB4		INT16
291	FireB Angle5	cFireB5		INT16
292	FireB Angle6	cFireB6		INT16
293	FireB Angle7	cFireB7		INT16
294	FireB Angle8	cFireB8		INT16
295	FireB Angle9	cFireB9		INT16
296	FireB Angle10	cFireB10		INT16
297	FireB Angle11	cFireB11		INT16
298	FireB Angle12	cFireB12		INT16
299	FireB Angle13	cFireB13		INT16
300	FireB Angle14	cFireB14		INT16
301	FireB Angle15	cFireB15		INT16
302	FireB Angle16	cFireB16		INT16
303	FireB Angle17	cFireB17		INT16
304	FireB Angle18	cFireB18		INT16
305	FireB Angle19	cFireB19		INT16
306	Current Map Current0	cCurMap0c		INT16
307	Current Map Retard0	cCurMap0r		INT16

308	Current Map Current1	cCurMap1c		INT16
309	Current Map Retard1	cCurMap1r		INT16
310	Current Map Current2	cCurMap2c		INT16
311	Current Map Retard2	cCurMap2r		INT16
312	Current Map Current3	cCurMap3c		INT16
313	Current Map Retard3	cCurMap3r		INT16
314	Current Map Current4	cCurMap4c		INT16
315	Current Map Retard4	cCurMap4r		INT16
316	Current Map Current5	cCurMap5c		INT16
317	Current Map Retard5	cCurMap5r		INT16
318	Current Map Current6	cCurMap6c		INT16
319	Current Map Retard6	cCurMap6r		INT16
320	Current Map Current7	cCurMap7c		INT16
321	Current Map Retard7	cCurMap7r		INT16
322	Current Map Current8	cCurMap8c		INT16
323	Current Map Retard8	cCurMap8r		INT16
324	Current Map Current9	cCurMap9c		INT16
325	Current Map Retard9	cCurMap9r		INT16
326	Current Map Current10	cCurMap10c		INT16
327	Current Map Retard10	cCurMap10r		INT16
328	Current Map Current11	cCurMap11c		INT16
329	Current Map Retard11	cCurMap11r		INT16
330	Current Map Current12	cCurMap12c		INT16
331	Current Map Retard12	cCurMap12r		INT16
332	Current Map Current13	cCurMap13c		INT16
333	Current Map Retard13	cCurMap13r		INT16
334	Current Map Current14	cCurMap14c		INT16
335	Current Map Retard14	cCurMap14r		INT16
336	RPM Map Speed0	cRpmMap0s		INT16
337	RPM Map Retard0	cRpmMap0r		INT16
338	RPM Map Speed1	cRpmMap1s		INT16
339	RPM Map Retard1	cRpmMap1r		INT16
340	RPM Map Speed2	cRpmMap2s		INT16
341	RPM Map Retard2	cRpmMap2r		INT16
342	RPM Map Speed3	cRpmMap3s		INT16
343	RPM Map Retard3	cRpmMap3r		INT16
344	RPM Map Speed4	cRpmMap4s		INT16
345	RPM Map Retard4	cRpmMap4r		INT16
346	RPM Map Speed5	cRpmMap5s		INT16
347	RPM Map Retard5	cRpmMap5r		INT16
348	RPM Map Speed6	cRpmMap6s		INT16

349	RPM Map Retard6	cRpmMap6r		INT16
350	RPM Map Speed7	cRpmMap7s		INT16
351	RPM Map Retard7	cRpmMap7r		INT16
352	RPM Map Speed8	cRpmMap8s		INT16
353	RPM Map Retard8	cRpmMap8r		INT16
354	RPM Map Speed9	cRpmMap9s		INT16
355	RPM Map Retard9	cRpmMap9r		INT16
356	RPM Map Speed10	cRpmMap10s		INT16
357	RPM Map Retard10	cRpmMap10r		INT16
358	RPM Map Speed11	cRpmMap11s		INT16
359	RPM Map Retard11	cRpmMap11r		INT16
360	RPM Map Speed12	cRpmMap12s		INT16
361	RPM Map Retard12	cRpmMap12r		INT16
362	RPM Map Speed13	cRpmMap13s		INT16
363	RPM Map Retard13	cRpmMap13r		INT16
364	RPM Map Speed14	cRpmMap14s		INT16
365	RPM Map Retard14	cRpmMap14r		INT16
366	Engine Config Advanced Timing Value	cAtv		INT16
367	Engine Config Advanced Energy Value	cAev		INT16
368	Engine Config Advanced Fire Value	cAfv		INT16
369	Engine Config Permit Test Mode	cTmPermit		INT16
370	Fire Pattern Enum	cFireEnum		INT16
371	Engine Config System Type	cOutMod		INT16
372	Engine Config Chksum	cChksum		INT16
373	Engine Config Go	cGo		INT16
374	Test Mode Enable	tmEnable	ReadWrite	INT16
375	Test Mode RPM	tmRPM	ReadWrite	INT16
376	spare373	spare400373	ReadWrite	INT16
377	spare374	spare400374	ReadWrite	INT16
533	CYL TIMING OFFSET *C1* (A or A1)	NINDVTMGWR01	ReadWrite	INT16
534	CYL TIMING OFFSET *C2* (B or A2)	NINDVTMGWR02	ReadWrite	INT16
535	CYL TIMING OFFSET *C3* (C or B1)	NINDVTMGWR03	ReadWrite	INT16
536	CYL TIMING OFFSET *C4* (D or B2)	NINDVTMGWR04	ReadWrite	INT16
537	CYL TIMING OFFSET *C5* (E or C1)	NINDVTMGWR05	ReadWrite	INT16
538	CYL TIMING OFFSET *C6* (F or C2)	NINDVTMGWR06	ReadWrite	INT16
539	CYL TIMING OFFSET *C7* (G or D1)	NINDVTMGWR07	ReadWrite	INT16
540	CYL TIMING OFFSET *C8* (H or D2)	NINDVTMGWR08	ReadWrite	INT16
541	CYL TIMING OFFSET *C9* (J or E1)	NINDVTMGWR09	ReadWrite	INT16
542	CYL TIMING OFFSET *C10* (K or E2)	NINDVTMGWR10	ReadWrite	INT16
543	CYL TIMING OFFSET *C11* (L or F1)	NINDVTMGWR11	ReadWrite	INT16
544	CYL TIMING OFFSET *C12* (M or F2)	NINDVTMGWR12	ReadWrite	INT16

545	CYL TIMING OFFSET *C13* (R or G1)	NINDVTMGWR13	ReadWrite	INT16
546	CYL TIMING OFFSET *C14* (S or G2)	NINDVTMGWR14	ReadWrite	INT16
547	CYL TIMING OFFSET *C15* (T or H1)	NINDVTMGWR15	ReadWrite	INT16
548	CYL TIMING OFFSET *C16* (U or H2)	NINDVTMGWR16	ReadWrite	INT16
549	CYL TIMING OFFSET *C17* (J1)	NINDVTMGWR17	ReadWrite	INT16
550	CYL TIMING OFFSET *C18* (J2)	NINDVTMGWR18	ReadWrite	INT16
551	CYL TIMING OFFSET *C19* (K1)	NINDVTMGWR19	ReadWrite	INT16
552	CYL TIMING OFFSET *C20* (K2)	NINDVTMGWR20	ReadWrite	INT16
553	CYL TIMING OFFSET *C21* (L1)	NINDVTMGWR21	ReadWrite	INT16
554	CYL TIMING OFFSET *C22* (L2)	NINDVTMGWR22	ReadWrite	INT16
555	CYL TIMING OFFSET *C23* (M1)	NINDVTMGWR23	ReadWrite	INT16
556	CYL TIMING OFFSET *C24* (M2)	NINDVTMGWR24	ReadWrite	INT16
557	CYL TIMING OFFSET *C25* (R1)	NINDVTMGWR25	ReadWrite	INT16
558	CYL TIMING OFFSET *C26* (R2)	NINDVTMGWR26	ReadWrite	INT16
559	CYL TIMING OFFSET *C27* (S1)	NINDVTMGWR27	ReadWrite	INT16
560	CYL TIMING OFFSET *C28* (S2)	NINDVTMGWR28	ReadWrite	INT16
561	CYL TIMING OFFSET *C29* (T1)	NINDVTMGWR29	ReadWrite	INT16
562	CYL TIMING OFFSET *C30* (T2)	NINDVTMGWR30	ReadWrite	INT16
563	CYL TIMING OFFSET *C31* (U1)	NINDVTMGWR31	ReadWrite	INT16
564	CYL TIMING OFFSET *C32* (U2)	NINDVTMGWR32	ReadWrite	INT16
565	CYL TIMING OFFSET *C33* 33	NINDVTMGWR33	ReadWrite	INT16
566	CYL TIMING OFFSET *C34* 34	NINDVTMGWR34	ReadWrite	INT16
567	CYL TIMING OFFSET *C35* 35	NINDVTMGWR35	ReadWrite	INT16
568	CYL TIMING OFFSET *C36* 36	NINDVTMGWR36	ReadWrite	INT16
569	CYL TIMING OFFSET *C37* 37	NINDVTMGWR37	ReadWrite	INT16
570	CYL TIMING OFFSET *C38* 38	NINDVTMGWR38	ReadWrite	INT16
571	CYL TIMING OFFSET *C39* 39	NINDVTMGWR39	ReadWrite	INT16
572	CYL TIMING OFFSET *C40* 40	NINDVTMGWR40	ReadWrite	INT16

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