Operating Instructions

CPU-95 Digital Ignition System with Enhanced Display

Form CPU-95 OI-E 2-10

altronic
HOERBIGER Engine Solutions

1.0 OVERVIEW

1.1 The Altronic CPU-95 Digital Ignition system with enhanced display has been designed for application on natural gas fueled engines. This system is field-programmable and offers a variety of advanced control, emissions reduction, primary and spark diagnostics, self diagnostics, serial communications and engine protection features. The system consists of two main parts: an engine mounted Ignition Module (791950-8/16/18, 791952-18 or 791958-16) and a user interface Display Module (791909-1).

1.2 This document provides instructions and descriptions to be used in the operation of the ignition system, and does not cover physical installation. Reference the installation instructions, form CPU-95 II, for instructions regarding installation and mounting.

2.0 IGNITION MODULE OUTPUT SWITCHES, LED INDICATORS AND CONTROL INPUT

2.1 Three output switches in the Ignition Module provide a means of communicating the current ignition status to other systems. 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 when the ignition is firing or trying to fire. Could be used as a signal to the control system to turn fuel on.

FAULT OUT switch: closed to signal that the ignition has no diagnostic 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. Could be used as a signal to the control system to turn fuel off.

ALARM OUT switch: closed to signal that no unacknowledged faults or warnings are present. Upon detection of a diagnostic fault or warning, this switch will open. This output is designed to control an alarm indicator or sounding device.

2.2 Four red LED indicators are provided inside the ignition unit for troubleshooting purposes:

POWER LED: on to indicate that the unit has power and the microprocessor is running. The Power LED flashes to indicate that the unit has power but is not operating correctly. The Power LED is off to indicate that the unit has no power.

TX LED: flashes to indicate that the ignition unit is transmitting on the RS-485 serial link.

RX LED: flashes to indicate that the ignition unit is receiving on the RS-485 serial link.

ALARM LED: turns on to indicate that a warning or fault is present. The ALARM LED flashes when an acknowledged warning is present.

2.3 One RS-485 serial communications port is provided within the Ignition Module. This port is normally used for communication to the optional Display Module. A PC (personal computer) or a PLC (programmable logic controller) can be connected to the RS-485 port to perform remote monitoring or control functions. The Ignition Module can be operated in a stand-alone mode, but diagnostic and control features would not be accessible. This port is also used to configure the ignition system for its application using a PC and the CPU-95 PC terminal software.

WARNING: DEVIATION FROM THESE INSTRUCTIONS MAY LEAD TO IMPROPER ENGINE OPERATION WHICH COULD CAUSE PERSONAL INJURY TO OPERATORS OR OTHER NEARBY PERSONNEL.

THE IGNITION SYSTEM MUST BE CONFIGURED PRIOR TO USE ON AN ENGINE. REFER TO SECTION 4.9 TO VIEW THE CURRENT CONFIGURATION. REFERENCE FORM CPU-95 PI FOR INSTRUCTIONS DESCRIBING HOW TO CONFIGURE THE IGNITION SYSTEM. VERIFY EEPROM PROGRAMMING PRIOR TO STARTING ENGINE.

NOTE: These instructions pertain to CPU-95 systems equipped with firmware release 4.0, dated 01/01/99 and later. The firmware dates can be displayed from the home screen by pressing "DIAG" and then "ENTER". The date of the installed firmware is viewed:

- ***Top line (LOGIC) applies to the output module firmware date.***
- ***Lower line (DISPLAY) applies to the display module firmware date.***

NOTE: If possible, keep the original shipping container. If future transportation or storage is necessary, this container will provide the optimum protection.

2.4 One digital input is provided inside the ignition system (MISC. INPUT). This logic level input is active when shorted to ground, and is used to control any combination of the following features: one-step retard, spark energy level or multi-strike option. These features are enabled based on the special features configuration settings as described in the programming instructions, form CPU-95 PI.

3.0 DISPLAY MODULE USER INTERFACE AND INPUTS

3.1 Display Module: serves as the user interface for the CPU-95 ignition system. An RS-485 two wire serial communications format is used to connect the Display Module to the Ignition Module. This link communicates between the modules using a proprietary protocol.

3.2 **LCD DISPLAY:** A graphical, back-lit LCD display is used to provide output to the user. A sealed membrane keypad is used to accept user input. The LCD display and the keypad function together to provide an interactive user interface which prompts the user as different functions are selected.

3.3 All actions and adjustments are immediate and are performed on an incremental basis using up and down arrow keys. All keypad adjustments, except individual offset timing adjustments are performed directly in non-volatile EEPROM memory. This EEPROM memory retains previous settings even after an engine shutdown, or an ignition power down.

3.4 Capital letters are used on the LCD display screen to designate an active selection while lower case letters are used to indicate other possible options.

3.5 The Display Module includes an isolated current loop input which can be configured to control spark timing. Reference the programming instructions, form CPU-95 PI.

3.6 One logic level digital input (MISC. INPUT) is available at the Display Module which can be used in the same fashion as the input of the Ignition Module. If either input is shorted to ground, then the MISC. INPUT functions are active.

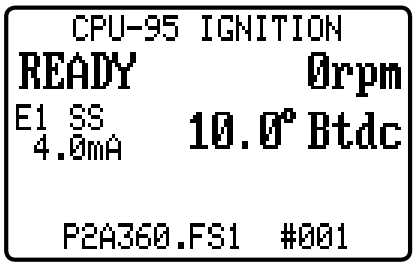
3.7 The display module incorporates a half duplex RS-485 port which is Modbus RTU slave compliant. The protocol used follows the Modicon Modbus RTU standard. For a complete list of the Modbus register addresses, **SEE SECTION 15.0**. The CPU-95 terminal program CD contains a PC-based Modbus compatible monitoring program which can be used to access the ignition data remotely.

3.8 One USB peripheral port. The USB port can be configured to allow programming of the attached ignition module when used with CPU-95 Terminal program V2.0 and above. The USB port can also be configured as another Modbus RTU interface.

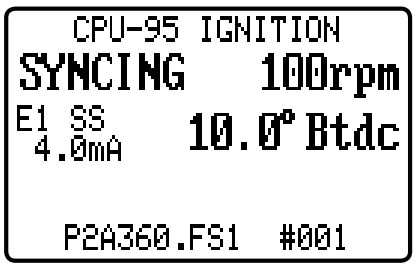
4.0 UNDERSTANDING THE HOME SCREEN

4.1 A series of home screens are used to describe the current status of the ignition system. The LCD display always reverts back to one of the home screens after a keypad operation is completed or times out. The home screen is designed to display the most critical operating parameters on one screen.

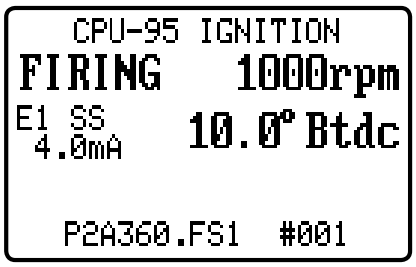
4.2 The **READY** message is displayed when the ignition is ready for the engine to crank for starting.



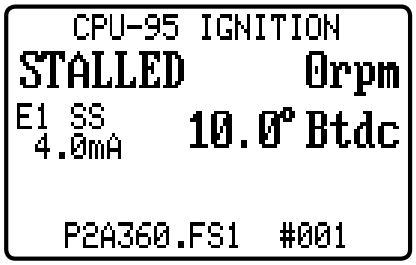
4.3 Once the engine begins turning, the **SYNCING** message is displayed while the ignition system verifies signals from the engine pickups.



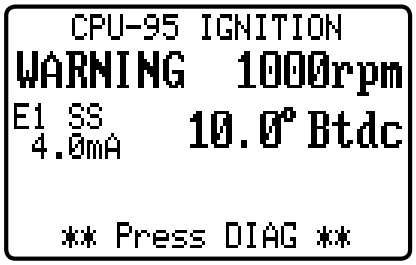
4.4 The **FIRING** message is displayed when the ignition begins firing. Additional data is provided on this screen to describe the selected mode of operation for the ignition. The energy mode (E1,E2,E3) and the single-strike/multi-strike type (SS or MS) are described in the middle of the upper line in small characters.



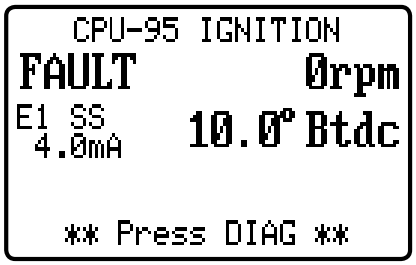
4.5 The **STALLED** message is displayed when a loss of rotation is detected after the ignition is firing and neither a **SHUTDOWN** or **FAULT** has occurred. This signifies that the engine has stopped without any detected cause from the ignition system.



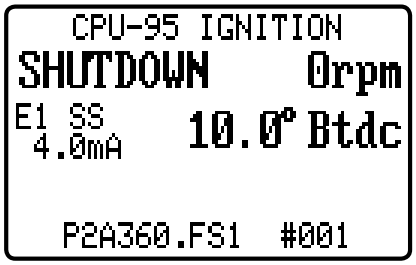
4.6 The **WARNING** message will supersede all of the above home screens if a diagnostic warning condition is present. When a diagnostic warning exists, a ** **Press DIAG** ** message will appear on the display. The Ignition Module will continue to operate under a warning condition while alerting the operator of a potential problem in several ways: by turning on the Alarm LED in the Ignition Module and by changing the state of the Alarm Out switch (switch opens). The Display Module will display the Warning message. The various types of diagnostic warnings are described in **SECTION 10.0**.



4.7 The **FAULT** message will supersede all of the above home screens if a diagnostic fault condition is present. When a diagnostic fault exists, a ** **Press DIAG** ** message will appear on the display. The ignition system will stop operating under a fault condition and will alert the operator to the problem in several ways: by changing the state of the Fire Confirm Out switch (switch opens), by turning on the alarm LED inside the Ignition Module, by changing the state of the Alarm Out switch (switch opens), by changing the state of the Fault Out switch (switch opens), and by displaying the Fault message. The various types of diagnostic faults are described in **SECTION 10.0**.



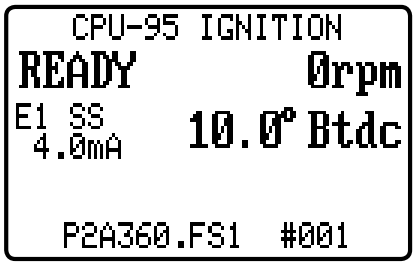
4.8 The **SHUTDOWN** screen will supersede all other home displays if the logic level shutdown input of the Ignition Module or the G-Lead of the output primary connector is grounded or was previously grounded and the engine has not stopped rotating. This screen indicates that the ignition is not firing because a shutdown input was triggered to shutdown the engine. If a diagnostic fault or warning exists while the ignition is in shutdown, a **PRESS DIAG** message will appear on the display. The Fire Confirm Out switch will change state (switch opens) and the other outputs will function as described above based on the existence of faults or warnings.



NOTE: Because EEPROMS can be reconfigured (using a PC and Altronic's configuration software), these comments should be viewed to identify and verify the configuration settings of the ignition prior to operation. Refer to the programming instructions, form CPU-95 PI, for further information on configuration.

4.9 From the **HOME SCREEN**, pressing the NEXT key allows you to cycle through the configuration comments which describe the configuration of the ignition system.

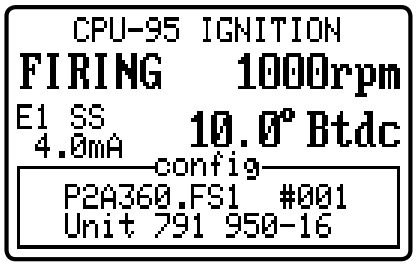
AT



PRESS TO GO TO NEXT

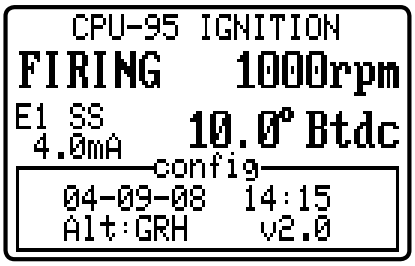
The configuration screens are shown starting on the next page.

The following types of screens can be viewed by pressing NEXT to advance.



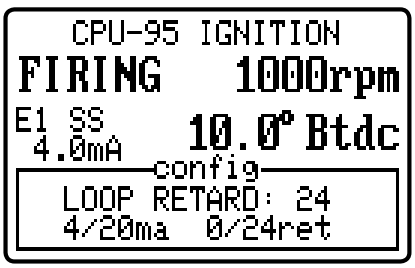
FIRING PATTERN CODE: (P2A360.FS1)
SPECIAL FEATURE CODE: (#001)
(1 STEP DEFAULT)
IGNITION MODULE TYPE: (PART NUMBER)

NEXT



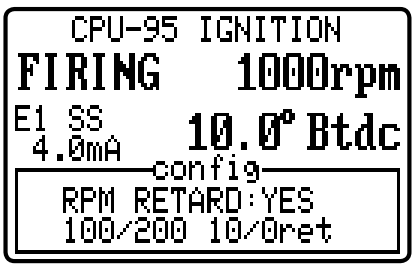
DATE CONFIGURED: (04-09-08)
TIME CONFIGURED: (14:15)
CONFIGURED BY: (Alt:GRH)
TERMINAL VERSION #: (v2.0)

NEXT



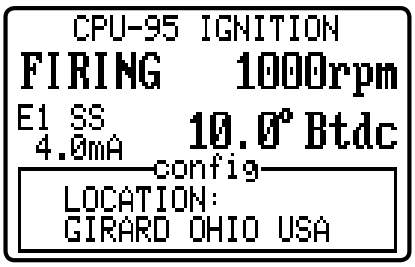
CURRENT LOOP CURVE DESCRIPTION
AT 4mA 0° RETARD
AT 20mA 24° RETARD
USER SPECIFIED DESCRIPTION

NEXT



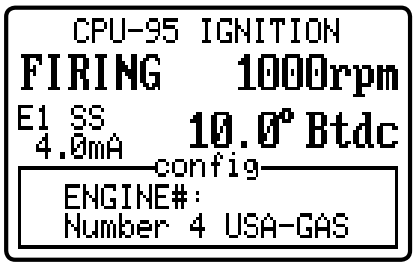
RPM RETARD CURVE DESCRIPTION
RETARD 10° BELOW 100rpm
RAMP TO 0° AT 200rpm
USER SPECIFIED DESCRIPTION

NEXT



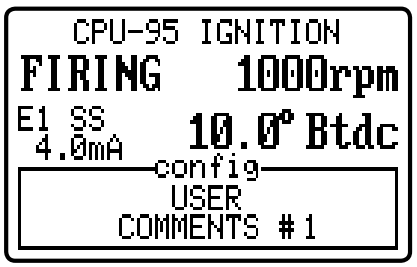
LOCATION:
USER SPECIFIED DESCRIPTION

NEXT



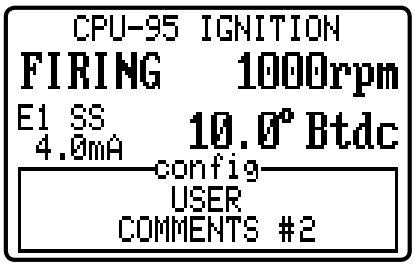
ENGINE NUMBER OR DESCRIPTION
USER SPECIFIED DESCRIPTION

NEXT



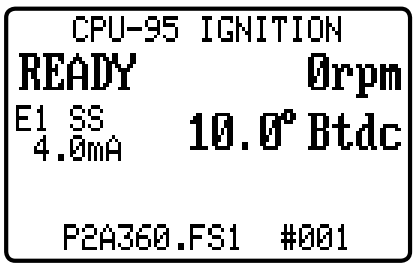
SPECIAL USER COMMENTS AREA #1
USER SPECIFIED COMMENTS

NEXT



SPECIAL USER COMMENTS AREA #2
USER SPECIFIED COMMENTS

NEXT



PRESS NEXT TO RETURN TO HOME SCREEN

NEXT

PRESS ESC. FROM ANY SCREEN TO RETURN TO HOME SCREEN

ESC

BREAKDOWN OF FIRING PATTERN CODE: H4A360.FS100#001

H REPRESENTS THE NUMBER OF OUTPUTS USED, IN THIS CASE 8 (F =6, L = 12, ETC.)

4 REPRESENTS THE CYCLE TYPE OF THE ENGINE

- 2 = TWO-CYCLE
- 4 = FOUR-CYCLE

A REPRESENTS THE ALTRONIC PATTERN CODE (SEE FORM CPU-95 AL)

360 REPRESENTS THE NUMBER OF GEAR TEETH OR HOLES TO BE SENSED

F REPRESENTS A DESIGNATOR FOR CPU-95 VERSION 1

S REPRESENTS THE CURRENT LOOP RETARD CURVE TYPE

- A = 0° AT 4MA / 48° AT 20MA
- B = 0° AT 4MA / 36° AT 20MA
- C = 0° AT 4MA / 24° AT 20MA
- D = 0° AT 4MA / 16° AT 20MA
- E = 0° AT 4MA / 8° AT 20MA
- N = SPECIAL NON-STANDARD TIMING CURVE VS. CURRENT OR RPM, NON-FACTORY PROGRAMMED
- S = SPECIAL NON-STANDARD TIMING CURVE VS. CURRENT OR RPM, FACTORY PROGRAMMED
- X = NO CURRENT LOOP CURVE

100 REPRESENTS THE SPECIAL VERSION NUMBER (ONLY EXISTS FOR TYPES N AND S)

NOTE: This number must be selected and properly documented by the originator.

#001 REPRESENTS THE SPECIAL FEATURE CODE (TOTAL SUM OF ALL SELECTED OPTIONS; 001=DEFAULT)

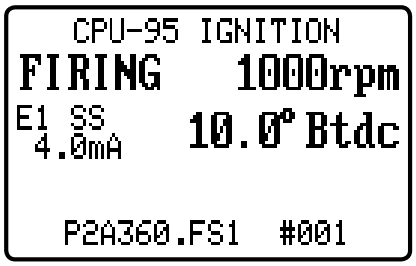
- 064 = FORCE MULTI-STRIKE WHEN RPM IS LESS THAN 250
- 032 = FORCE MAX ENERGY WHEN RPM IS LESS THAN 250
- 016 = USE 1 STEP RETARD WHEN RPM IS LESS THAN 250
- 004 = FORCE MULTI-STRIKE WHEN MISC INPUT IS GROUNDED
- 002 = FORCE MAX ENERGY WHEN MISC INPUT IS GROUNDED
- 001 = USE 1 STEP RETARD WHEN MISC INPUT IS GROUNDED

5.0 ADJUSTING GLOBAL RETARD

5.1 Global retard is an adjustment affecting the timing of all cylinders equally. This adjustment can be equated to the manual timing switch of the Altronic CPU-90 system. Adjustments made as described below will be in effect until another adjustment is made.

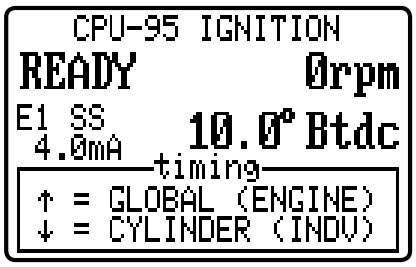
5.2 To adjust global retard:

FROM



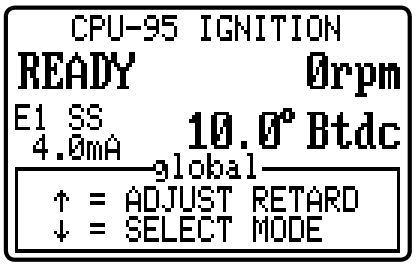
PRESS TIMING

THEN AT



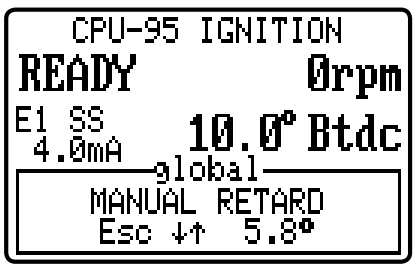
PRESS ↑

THEN AT



PRESS ↑

THEN AT



NOTE: RESULTANT TIMING SHOWN ON BOTTOM LINE.

PRESS TO INCREASE RETARD ↑ **PRESS TO DECREASE RETARD** ↓ **PRESS TO EXIT** ESC

5.3 The increment of timing change is dependent on the number of holes or teeth being sensed. The minimum timing change is defined as follows.

If N < 270, then Increment = "45/N" degrees

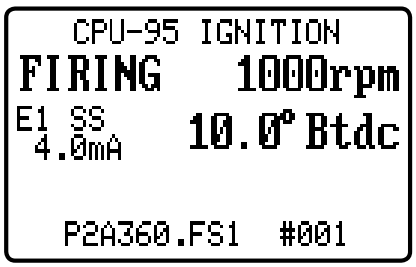
If N ≥ 270, then timing increment is "90/N" degrees, where N = no. of holes or teeth.

5.4 Global spark timing is determined based on the sum of several spark retard components which include manual retard, current loop retard, rpm retard, and one step retard. The range of total retard is limited to 255 X timing increment. When the sum of all retard components reaches 255 X timing increment, the actual timing will be at the retard limit.

6.0 SELECTION OF GLOBAL TIMING MODES

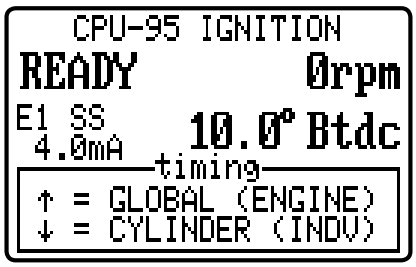
6.1 Several options exist with regard to global timing modes. Once the global timing mode menu is entered as described below, the status of each option can be viewed and changed.

FROM



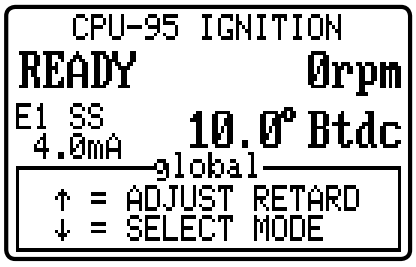
PRESS TIMING

THEN AT



PRESS ↑

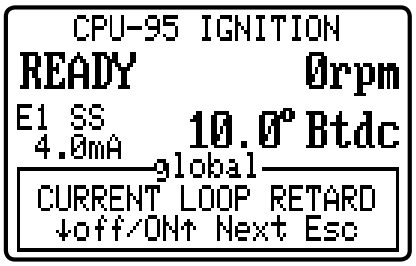
THEN AT



PRESS ↓

6.2 The first mode selection can enable or disable the pre-configured retard curve controlled by the 4-20 mA current loop input. The choices are ON or OFF, with the active selection displayed in capital letters. A PC is required to configure the 4-20 mA curve; reference the programming instructions, form CPU-95 PI. When the current loop is on, the current loop value is displayed (xx.x mA) with the "A" capitalized. When the current loop is off, the value is displayed (xx.x ma) with the lower case "a".

AT

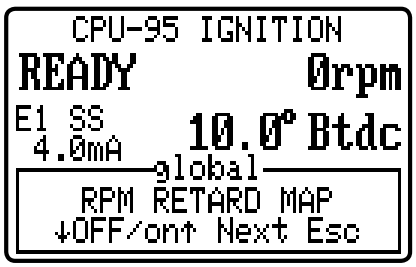


NOTE: DISPLAY SHOWS CURRENT LOOP ON.

TO TURN ON ↑ **TO TURN OFF** ↓ **FOR NEXT OPTION** NEXT **TO EXIT** ESC

6.3 The next mode selection can enable or disable the pre-configured retard curve controlled internally by engine RPM. To configure the RPM retard curve, reference form CPU-95 PI.

AT THE NEXT OPTION SCREEN

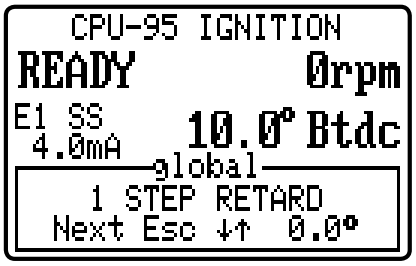


NOTE: DISPLAY SHOWS RPM MAP OFF.

TO TURN ON ↑ **TO TURN OFF** ↓ **FOR NEXT OPTION** NEXT **TO EXIT** ESC

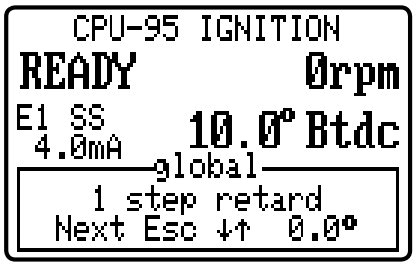
6.4 The next mode selection can increase or decrease the one-step retard value. The first screen below is displayed when one-step retard is both configured and is active. The second screen below is displayed when the one-step retard is configured but not active. The default configuration selects one-step retard to be controlled by the Misc. Input terminal. The additional retard would be implemented when the input is grounded. The third screen below is displayed when the one-step retard feature is not configured. The actual engine timing is displayed on this screen so the effect of 1 step retard can be seen during adjustments (if the Misc Input terminal is grounded).

AT THE NEXT OPTION SCREEN



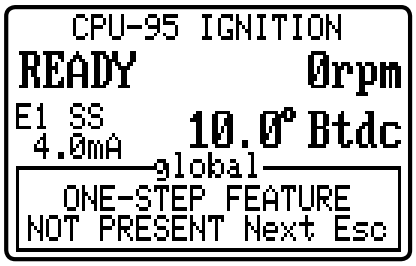
NOTE: UPPER CASE 1 STEP RET = ON.

OR



NOTE: LOWER CASE 1 STEP RETARD = OFF.

OR



NOTE: 1 STEP RETARD NOT CONFIGURED.

TO INCREASE ↑ **TO DECREASE** ↓ **TO GO BACK TO FIRST** NEXT **TO EXIT** ESC

7.0 ADJUSTING INDIVIDUAL OFFSETS

7.1 The timing of individual cylinders can be offset by up to 3 degrees of advance or retard from the global timing of the engine. Adjustments made as described below should be considered temporary. The ignition will revert back to the values saved in EEPROM memory on every reset, start or power-up. To save temporary adjustments to EEPROM memory SEE SECTION 8.0.

NOTE: In applications with narrow firing angles, the adjustment range may be limited.

7.2 Enter the individual timing adjustment menu as described below.

FROM

```
   CPU-95 IGNITION
FIRING    1000rpm
E1 SS
 4.0mA    10.0° Btdc


   P2A360.FS1  #001
```

PRESS TIMING

THEN AT

```
   CPU-95 IGNITION
READY        0rpm
E1 SS
 4.0mA    10.0° Btdc
      timing
 ↑ = GLOBAL (ENGINE)
 ↓ = CYLINDER (INDV)
```

PRESS ↓

THEN At

```
   CPU-95 IGNITION
READY        0rpm
E1 SS
 4.0mA    10.0° Btdc
      indv cyl
  ↑ = ADJUST OFFSET
  ↓ = SELECT MODE
```

PRESS ↑

NOTE: The output identification characters can be configured. SEE SECTION 9.0

7.3 The individual timing adjustment screen identifies the primary output to be adjusted, and the degrees of offset in use for the output.

THEN AT

```
CYL  1(A)
Timing        SPARK#'s
 0.0°Adv↓↑   119 INST
             118 CAVG
Spk Offset   118 EAVG
   +0          0 COV
```

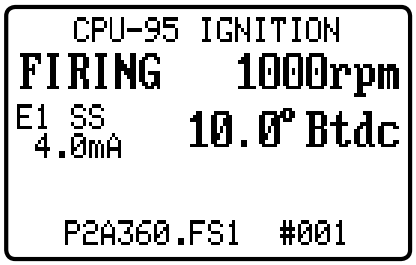
NOTE: 2.5 degrees advance for output A.

TO ADVANCE ↑ **TO RETARD** ↓ **TO SELECT NEXT CYL.** NEXT **TO EXIT** ESC

8.0 INDIVIDUAL CYLINDER OFFSET MODES

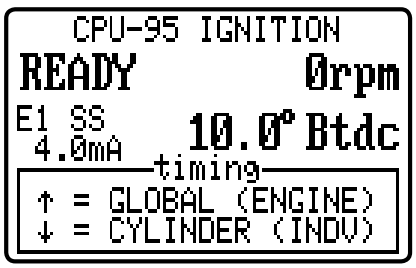
8.1 Two additional functions with regard to individual cylinder timing offsets are provided. These functions can be accessed from the individual timing mode menu which can be entered as described below.

FROM



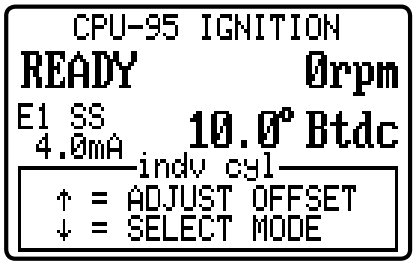
PRESS TIMING

THEN AT



PRESS ↓

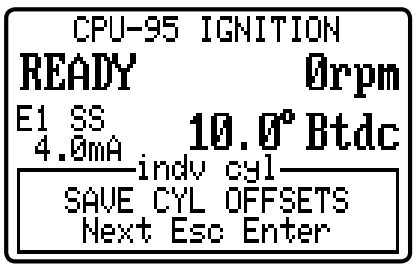
THEN AT



PRESS ↓

8.2 The first function is used to save the current (temporary) individual offsets to EEPROM memory. When this is done, the ignition will load these offset settings every time the engine starts or reset is pressed. Reference **SECTION 7.0** to adjust individual (temporary) offsets.

AT THE FIRST OPTION SCREEN



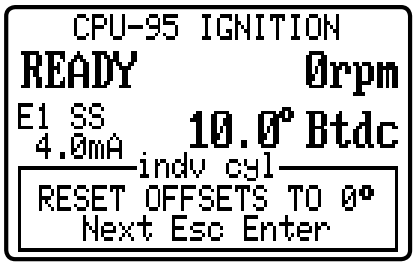
PRESS TO SAVE OFFSETS ENTER

PRESS FOR NEXT OPTION NEXT

PRESS TO EXIT ESC

8.3 The next mode function can be used to reset all cylinder offset values to zero (both temporary memory and EEPROM memory).

AT THE NEXT OPTION SCREEN

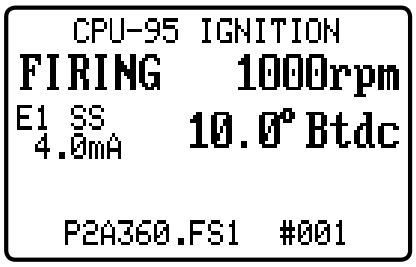


PRESS to RESET OFFSETS **ENTER** **press FOR NEXT OPTION** **NEXT** **PRESS to exit** **ESC**

9.0 SETUP CONTROL OPTIONS

9.1 Additional control settings and display features can be accessed under the setup menu. Changes made under the Setup menu are stored in EEPROM and remain fixed until changed again. The Setup menu can be entered as described below.

FROM



PRESS [SETUP]

9.2 The first setup screen permits the operator to enable or disable the Multi-Strike feature.

Note 1: A special feature can be selected during configuration to force Multi-Strike to be active below 250 rpm, or when the Misc. Input is grounded. This feature is not active in a standard configuration.

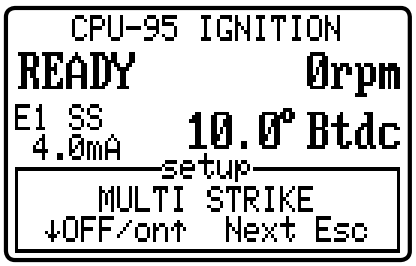
Note 2: The Multi-Strike feature is automatically turned off above 1050 rpm.

Note 3: The use of Multi-Strike firings may tend to accelerate spark plug electrode erosion.

Note 4: The Multi-Strike feature fires the spark plug 2 times per event (~1100usec apart).

Note 5: On 791958-16 unit only: The Multi-Strike feature is replaced by the VariSpark long duration (~2000 usec) spark.

AT



TO TURN ON MULTI [↑] **TO TURN off MULTI** [↓] **FOR NEXT option** [NEXT] **TO EXIT** [ESC]

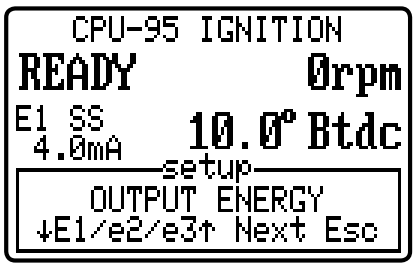
9.3 The next setup screen permits the operator to select one of three ignition energy levels (E1,E2,E3). The energy levels are 75 millijoules (E1), 100 millijoules (E2), 125 millijoules (E3).

Note 1: A special feature can be selected during configuration to use the maximum energy level below 250 rpm, or when the Misc Input is grounded. This feature is not active in a standard configuration.

Note 2: The energy is automatically limited to E2 when Multi-Strike is active.

Note 3: The use of higher spark energy may tend to accelerate spark plug electrode erosion.

AT

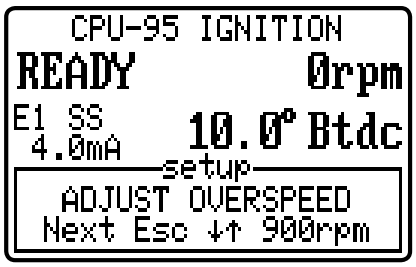


NOTE: Energy level E1 is displayed.

TO INCREASE ↑ **TO DECREASE** ↓ **FOR NEXT OPTION** NEXT **TO EXIT** ESC

9.4 The next setup screen is used to adjust the engine overspeed setpoint. The setpoint can be adjusted in increments of 10 rpm to a maximum of 2550 rpm.

AT

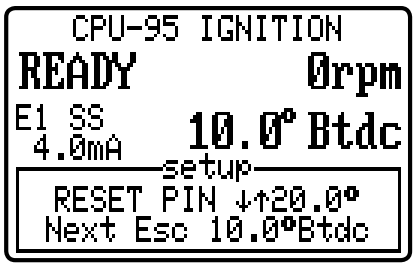


TO INCREASE ↑ **TO DECREASE** ↓ **FOR NEXT OPTION** NEXT **TO EXIT** ESC

9.5 The next setup screen is used to specify the exact position of the reset pin. Both the reset position and the engine timing are displayed. Adjustments are made here to make the displayed timing match the actual spark timing as verified with a timing light. This adjustment effects the displayed timing but does NOT change the actual timing of the firings.

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

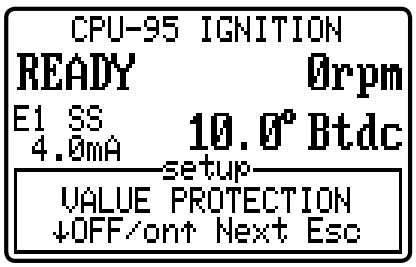
AT



TO INCREASE ↑ **TO DECREASE** ↓ **FOR NEXT OPTION** NEXT **TO EXIT** ESC

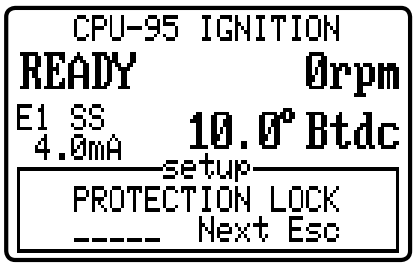
9.6 The next setup screen is used to enable or disable **VALUE PROTECTION** of all user values in the EEPROM memory. When protection is on, none of the EEPROM settings under the Setup or Timing menus can be changed. This feature can be used to provide limited protection from random changes by inexperienced operators.

AT



TO TURN ON PRO-TECTION ↑ **TO TURN OFF PRO-TECTION** ↓ **FOR NEXT OPTION** NEXT **TO EXIT** ESC

The **VALUE PROTECTION** can be password protected. The password **PROTECTION LOCK** is enabled when programming options from the PC terminal program. See the Programming Instructions, form CPU-95 PI for details. When password protection is enabled the following menu appears instead of the **VALUE PROTECTION** menu.

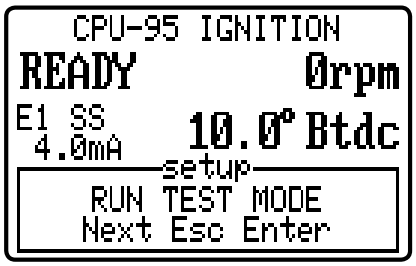


To enter the password press, use the function keys F1, F2, F3, F4 where F1=1, F2=2, F3=3, F4=4 where the number entered is equal to the user assigned five digit password. After the last digit of the proper password is entered, the **VALUE PROTECTION** menu shown above will appear. If the password is not known, press the ESC key to exit or the NEXT key to go on to the next setup menu.

9.7 The last setup screen permits the operator to enter an ignition test mode. This test mode can fire all outputs in rotation, or individual outputs at a slow rate. This feature can be used to troubleshoot primary wiring and Output Module operation. Test mode will terminate if rotation of the engine is sensed. Diagnostic features do not function while in test mode.

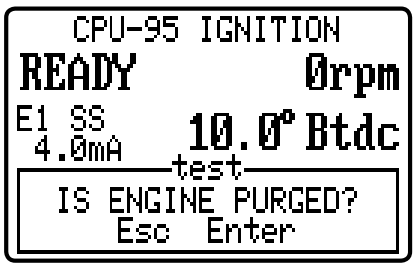
NOTE: The Test-Mode is enabled by the user during initial setup of display module from PC terminal program. See form CPU-95 PI for details.

AT



PRESS FOR TEST MODE ENTER **PRESS FOR NEXT OPTION** NEXT **PRESS TO EXIT** ESC

THEN BEFORE STARTING TEST MODE

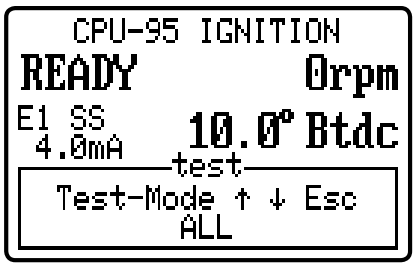


PRESS TO VERIFY PURGED ENTER **PRESS TO EXIT** NEXT

WARNING: The operator MUST fully purge the engine of combustible mixtures prior to selecting the test mode operation. Pressing the enter key again is a confirmation of this action.

Then the test mode screen indicates that the ignition is firing and permits the operator to select the output to be fired.

AT



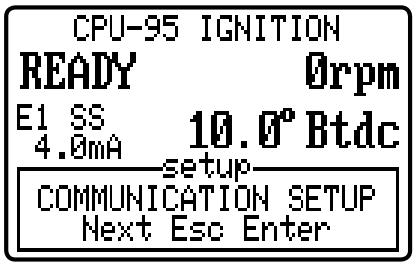
PRESS TO SELECT PREVIOUS OUTPUT ↑ **PRESS TO SELECT THE NEXT OUTPUT** ↓ **PRESS TO EXIT** ESC

Test-Mode selection rotates as described below.

MODEL #	ROTATION SEQUENCE
791950-8:	ALL, A, B, C, D, E, F, K, L
791950-16, 791958-16:	ALL, A, B, C, D, E, F, K, L, M, N, P, R, S, T, U, V, ALL
791950-18:	ALL, A, B, C, D, E, F, G, H, K, L, M, N, P, R, S, T, U, V, ALL
791952-18:	ALL (Individual output test mode not available.)

9.8 The communications menu allows the adjustment of various aspects of the display module's two user ports.

AT

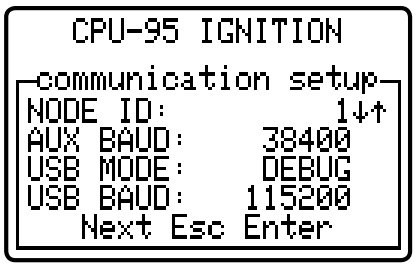


PRESS TO ACCESS THE MENU — ENTER

PRESS TO GO TO THE NEXT MENU — NEXT

PRESS TO EXIT — ESC

AT



PRESS TO MODIFY THE VALUE — ↑ ↓

PRESS TO ADVANCE TO THE NEXT SELECTION — ENTER

PRESS TO GO TO THE NEXT MENU — NEXT

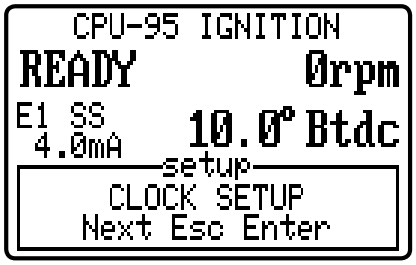
PRESS TO EXIT — ESC

Node ID can be set anywhere from 1 to 254. The auxiliary RS-485 (Modbus RTU) port can have the following baud rates 9600, 19200, 38400, 57600, 115200. Always no parity, 8 data bits, and 1 stop bit (N81). The USB port has the following modes: **TERMINAL**, **MODBUS RTU**, and **DEBUG**. The **TERMINAL** mode allows the display to act as a go between for programming the CPU-95 ignition directly. This will work for CPU-95 Terminal Program version 2.0 and above. Baud rate selection in the **TERMINAL** mode is unnecessary as the terminal program accesses the USB port natively. The **MODBUS RTU** mode follows the node ID, and the USB baud rate. This mode uses the virtual com port driver that is a part of the USB driver on the CDROM. The USB port virtual com port baud rate can be set to the following: 9600, 19200, 38400, 57600, 115200. The **DEBUG** mode is used by the factory for testing purposes.

9.9 The **CLOCK SETUP** menu is used to set the desired calendar date and time used by the datalog feature of the display module.

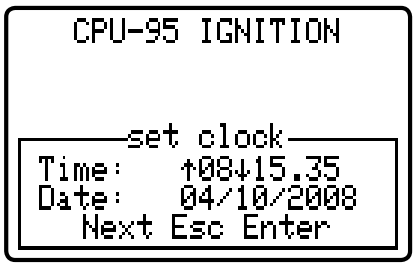
NOTE: The display module's real time clock does not automatically adjust for daylight savings time.

AT



PRESS TO ACCESS THE MENU ENTER **PRESS TO GO TO THE NEXT MENU** NEXT **PRESS TO EXIT** ESC

AT



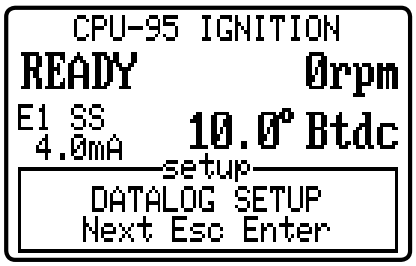
PRESS TO MODIFY THE VALUE ↑ ↓

PRESS TO ADVANCE TO THE NEXT SELECTION ENTER **PRESS TO GO TO THE NEXT MENU** NEXT **PRESS TO EXIT** ESC

9.10 The Display Module supports data logging of the information normally available from the display of the CPU-95. The unit retains 255 datalogs which are stored in a FIFO (first in, first out) manner. When 255 logs are stored, the oldest log is purged and the newest added. The oldest data is stored as log no. 255 and the newest as no. 1; there is also a copy of the current values available as datalog 0. The datalogs can be accessed by the special PC terminal program supplied with the unit or by a special Modbus command sent by the user-supplied PLC or computer system. More detailed information is provided on the terminal CD.

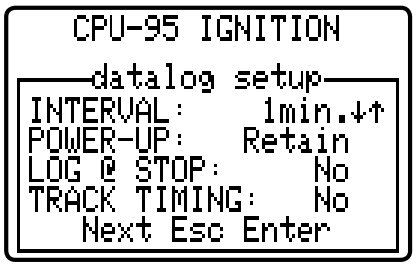
The **DATALOG SETUP** menu appears after the **COMMUNICATION SETUP** menu. If datalogs are not being used, press the NEXT key to proceed to the **CYLINDER LABELS** menu.

AT



PRESS TO ENTER THE DATALOG MENU ENTER **PRESS TO GO TO THE NEXT MENU** NEXT **PRESS TO EXIT** ESC

AT



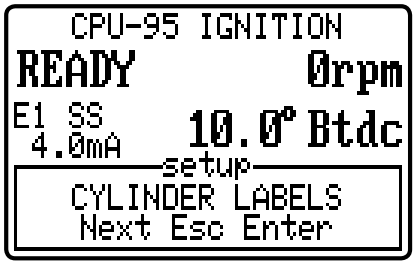
PRESS TO MODIFY THE VALUE ↑ ↓

PRESS TO ADVANCE TO THE NEXT SELECTION ENTER **PRESS TO GO TO THE NEXT MENU** NEXT **PRESS TO EXIT** ESC

It is possible to setup the system so that any change to the ignition timing will trigger a datalog event (an exception report). Exception reports are automatically generated for alarms or shutdowns.

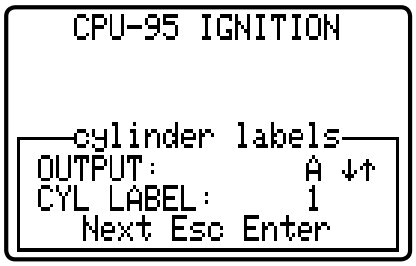
9.11 The **CYLINDER LABELS** menu allows the user to associate two alphanumeric cylinder designators with the output lead on the CPU-95.

AT



PRESS TO ACCESS THE MENU ENTER **PRESS TO GO TO THE NEXT MENU** NEXT **PRESS TO EXIT** ESC

AT



PRESS TO MODIFY THE VALUE ↑ ↓

PRESS TO ADVANCE TO THE NEXT SELECTION ENTER **PRESS TO GO TO THE NEXT MENU** NEXT **PRESS TO EXIT** ESC

10.0 CPU-95 DIAGNOSTICS

NOTE: Diagnostic FAULTS will supersede diagnostic WARNINGS.

10.1 A diagnostic fault represents the most severe classification of problems. The presence of a diagnostic fault will inhibit the ignition from firing. When a fault is detected several things will occur:

Ignition will stop firing.

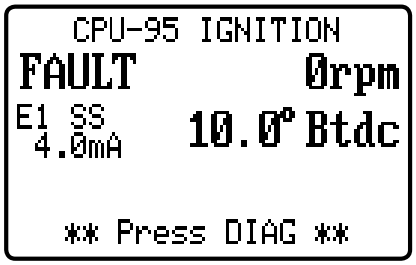
Fire Confirm Out switch will open.

Fault Out switch will open.

Alarm Out switch will open.

Alarm LED in the ignition unit will turn on.

Home status will read FAULT, and the bottom line will read PRESS DIAG.

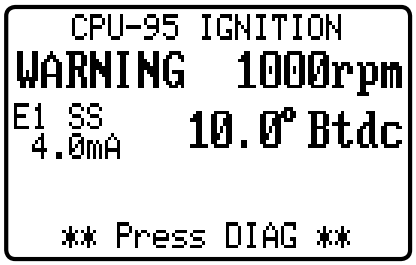


10.2 A diagnostic warning represents the least severe classification of problems. The ignition will continue to fire in the presence of a diagnostic warning. When a warning is detected, several things will occur:

Alarm Out switch will open.

Alarm LED in the ignition unit will turn on.

Home status will read WARNING, and the bottom line will read PRESS DIAG.



10.3 If the Alarm Out switch is being used to turn on an audible alarm or flasher, the user can acknowledge the alarm as described below.

PRESS 

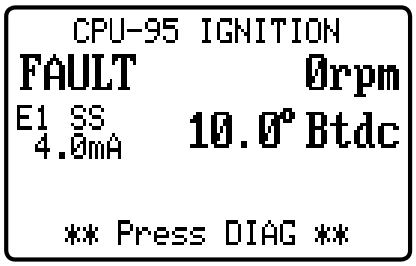
Acknowledgment of the alarm results in the following until a reset is commanded or until another fault or warning may occur.

Alarm Out switch will return to its closed position.

Alarm LED will flash to indicate that an alarm is present but acknowledged.

10.4 When a fault or warning is present, the operator can display the actual cause of the diagnostic as depicted below.

FROM THE HOME SCREEN



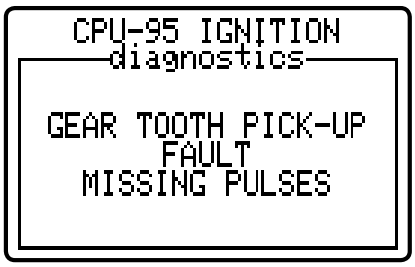
PRESS DIAG

Then from the diagnostic description screens use the following keys.

PRESS TO VIEW NEXT ENTER **OR PRESS TO VIEW NEXT** NEXT **PRESS TO EXIT** ESC

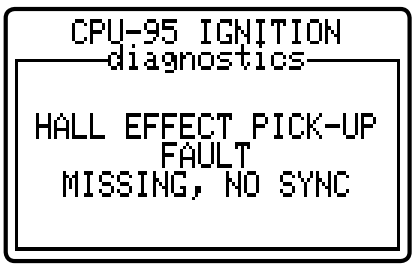
10.5 Diagnostic Fault screens, in order of display priority:

When zero gear-tooth pulses are seen between two reset pulses.



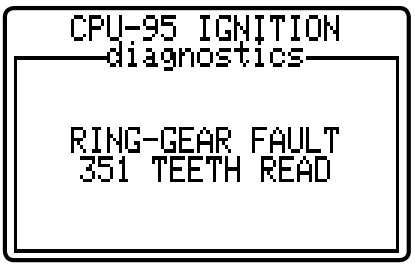
When too many gear-tooth pulses are seen without a reset pulse.

When there are no Hall-effect pickup pulses or when the pick-ups are not synchronized.



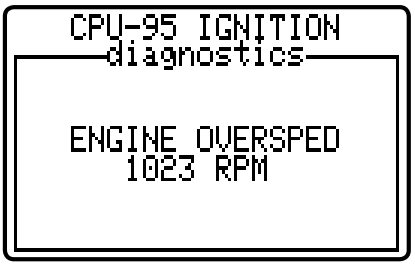
When too many or too few gear-tooth pulses are seen between reset pulses.

The received number of pulses is displayed.



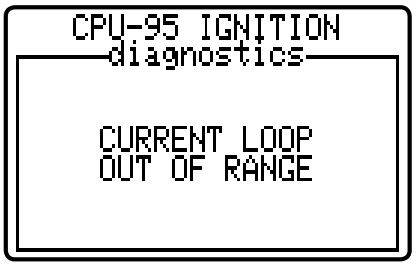
When the engine speed exceeds the overspeed setpoint.

Maximum observed speed is also displayed.

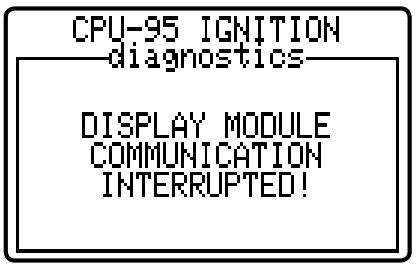


10.6 Diagnostic Warning screens, in order of display priority:

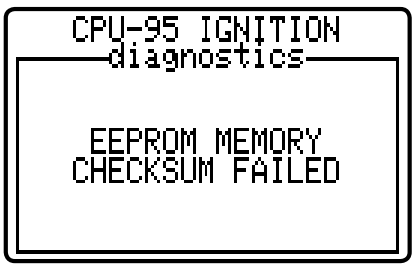
This screen indicates that the current-loop has deviated outside the limits of 2 mA and 22 mA. The current loop follows the configured curve which is specified from 0-25 mA. This diagnostic is active only if the current loop retard is on.



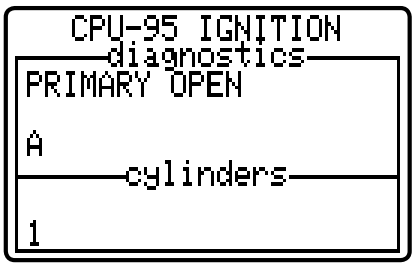
This screen indicates that at some point no loop data was received from the Display Module. In this condition, the timing for 0 mA is used. This test is active only if the current loop retard is on.



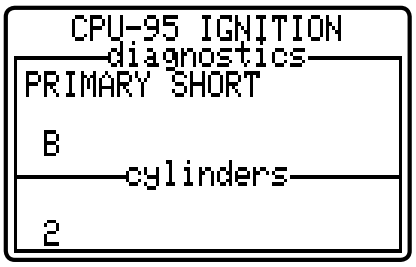
This screen indicates that the firing pattern configuration data saved in EEPROM memory is incorrect or incomplete. The EEPROM memory must be reprogrammed or replaced.



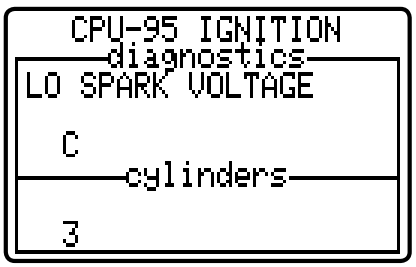
This screen indicates that diagnostics have identified an open circuit on the primary output pin A (Cyl 1). Normally indicates faulty wiring or a failed coil.



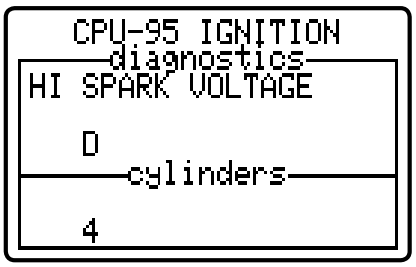
This screen indicates that diagnostics have identified a short circuit condition on the primary output pin B (Cyl 2). This would normally indicate a coil is miswired, or the primary wire is shorted.



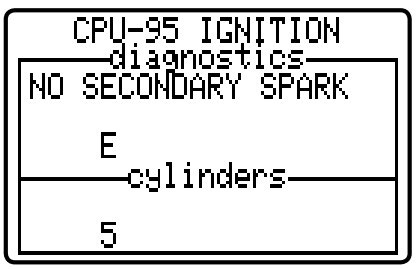
This screen indicates that the diagnostics have identified a low spark demand condition on the plug at the C coil (Cyl 3). This is often caused by a shorted spark plug or shorted secondary wire.



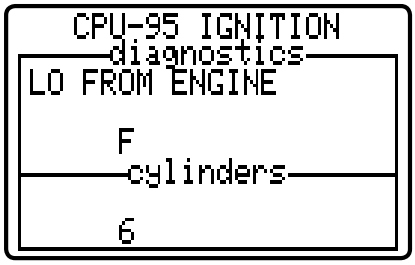
This screen indicates that the diagnostics have identified a high spark demand condition on the spark plug at the D coil (Cyl 4). This is often caused by worn spark plugs.



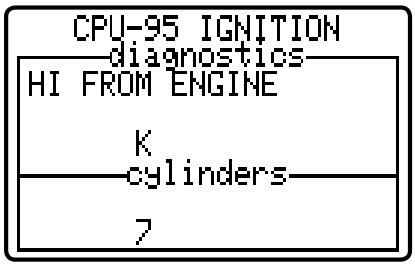
This screen indicates that the diagnostics have identified a no spark condition on the plug at the E coil (Cyl 5). No spark occurred since the demand was greater than the output capability of the coil.



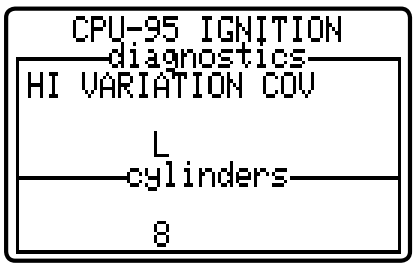
This screen indicates that the diagnostics have detected a condition where the average value of output F (Cyl 6) is significantly lower than the average of all the active outputs on the engine.



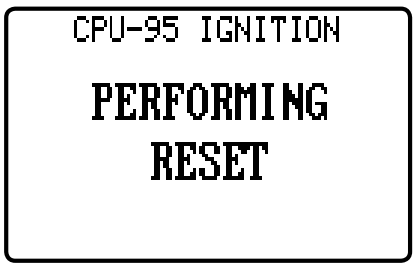
This screen indicates that the diagnostics have detected a condition where the average value of output K (Cyl 7) is significantly higher than the average of all the active outputs on the engine.



This screen indicates that the Diagnostic Module has detected that output L (Cyl 8) is firing with significant cycle-to-cycle variation.



10.7 After all of the diagnostics have been read, the user can reset the warnings and faults by pressing the reset key as pictured below.



PRESS TO EXIT **ESC** **PRESS** **RESET**

Pressing the reset key performs all of the following actions:

- **Clears all diagnostic warnings from memory.**
- **Clears all diagnostic faults from memory.**
- **Clears a latched shutdown condition when the input is no longer grounded.**
- **Causes temporary cylinder timing offsets to be overwritten from EEPROM memory.**

11.0 UNDERSTANDING AND USING THE SECONDARY SPARK DIAGNOSTICS

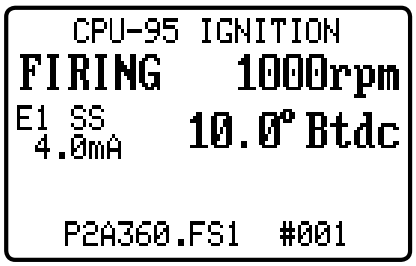
11.1. The spark reference number is a unitless number which correlates with voltage demand at the spark plug and is calculated for every firing of each cylinder. As the voltage increases, the reference number also increases. The number is non-linear and will increase faster at higher voltages (above 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.

11.2 The reference "cylinder spark data" number can be viewed separately for each ignition output (cylinder) in two ways, and compared to the average of the entire engine:

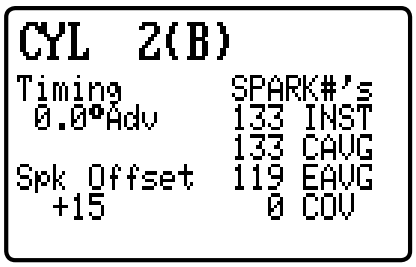
Instantaneous value: shown in ( )

Cylinder average value: cavg

FROM THE HOME SCREEN



PRESS TO VIEW DISPLAY SCREEN [F1]



PRESS TO VIEW NEXT CYLINDER [F1]

TO VIEW GRAPH OF CURRENT CYLINDER [F3]

PRESS TO ADJUST SPARK OFFSET [F4]

PRESS TO VIEW NEXT CYLINDER [NEXT]

PRESS TO EXIT [ESC]

11.3 The offset adjustment screen (F4) permits the operator to adjust an offset to the spark reference number (± 15 counts) to compensate for minor variations in reference numbers between individual coils of the same type and voltage demand.

> ***NOTE: Improper use of this feature may limit the effectiveness of the diagnostic system and result in spark reference numbers that mask real or create false problems.***

FROM THE HOME SCREEN

```
    CPU-95 IGNITION
FIRING    1000rpm
E1 SS     10.0° Btdc
 4.0mA

   P2A360.FS1  #001
```

PRESS TO VIEW DISPLAY SCREEN [F1]

```
CYL  2(B)
Timing        SPARK#'s
 0.0°Adv     133 INST
             132 CAVG
Spk Offset   119 EAVG
  +15↓↑        0 COV
```

PRESS TO VIEW NEXT CYLINDER [F4]

PRESS TO VIEW NEXT CYLINDER [NEXT]

PRESS TO EXIT [ESC]

PRESS TO VIEW BASE DISPLAY [F1]

11.4 The spark reference number is used in conjunction with comparative thresholds to set diagnostic codes for several different ignition system and spark plug conditions. When a threshold is violated twice in a row, the corresponding diagnostic flag is set for the appropriate cylinder. The diagnostic flags are latching and will exist until the unit is restarted or until a reset or power-down occurs.

Open Primary	**CAVG < 1**
Shorted Primary	**CAVG < 50**
Low Spark Voltage	**CAVG < user programmable threshold (typ. 100)**
High Spark Voltage	**CAVG > user programmable threshold (typ. 180), also Forces E2**
No Secondary Spark	**CAVG > user programmable threshold (typ. 250), also Forces E3**
Low From Engine	**(EAVG - CAVG) > user programmable threshold (typ. 20)**
High From Engine	**(CAVG - EAVG) > user programmable threshold (typ. 20)**

11.5 The spark reference number is also used to automatically change spark energy for different ignition system conditions. The minimum energy setting is selected under the Setup Menu **(SEE SECTION 9.3)**. Energy will automatically be adjusted in response to the engine average spark reference number (EAVG) based on four individual thresholds listed below. Additionally, spark energy will automatically be increased when a High Spark Voltage or No Secondary Spark warning exists for any cylinder.

Auto Enable E2	**EAVG > user programmable threshold (typical 200)**
Auto Disable E2	**EAVG < user programmable threshold (typical 190)**
Auto Enable E3	**EAVG > user programmable threshold (typical 205)**
Auto Disable E3	**EAVG < user programmable threshold (typical 195)**

11.6 The above user programmable thresholds need to be adjusted based on the type of coil being used and on the operating characteristics (specifically, voltage demand) of the engine. There are known differences between 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). This will aid greatly in detecting variations in one cylinder vs. the general trend in the engine. The typical ranges to be expected in normal operation with new spark plugs are:

Older 501061 (blue) coils:	**70 to 90**
Current 501061 (blue) coils:	**90 to 120**
Current 591010 (red) coils:	**120 to 140**
Current 501061-S (shielded blue) coils:	**110 to 130**
Current 591007 / 591011A / 591011B coils:	**70 to 90**

11.7 The indicated thresholds were designed to be adjustable so that the user can customize these diagnostics to fit the specific needs of each engine. It will take some testing and adjustment to obtain thresholds that optimize the use of these features. For maximum benefit, the spark reference number for each cylinder should be recorded at normal operating load with new spark plugs installed and then monitored over a period of time for changes. The **HI SPARK VOLTAGE** alarm level should be set (typically) at 180 initially and can be adjusted as experience dictates. A gradual increase in the spark reference number is expected over time as the spark plug electrodes erode.

11.8 In addition to energy control and the diagnostic flags, the reference numbers can also be used for predictive purposes:

A. As the numbers increase toward the preset **HI SPARK VOLTAGE** threshold **(SEE SECTION 12.3)**, the operator knows that a change of spark plugs should be scheduled. With this information, this function 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.

B. The reference numbers can provide an early warning of a difference in operation in a given cylinder(s). A reading higher (or lower) than the other cylinders, when such a difference is not normally present, tells the operator of a potential problem; this allows further troubleshooting and evaluation to take place before an unexpected operational problem develops. **(SEE SECTION 12.5, 12.6.)**

11.9 Other Information regarding the spark reference number:

A. The spark energy setting has only a small effect on the reference number if the spark plug fires correctly. Therefore, the high and low voltage thresholds should hold across the energy settings if the spark plugs continue to fire correctly. 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 operating initially with new spark plugs on E1 energy setting and use the **HI SPARK VOLTAGE** alarm as an indicator to manually increase the energy progressively to E3.

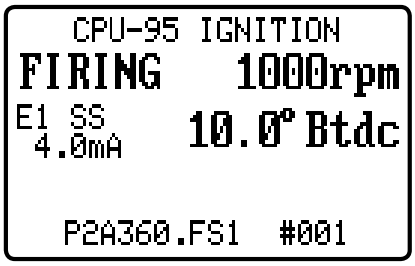
B. The spark reference number is designed to work with one coil per output. Where two coils are connected to the same primary lead, the number will tend to be an average of the conditions at the two spark plugs. While some of the benefits of the spark reference number can still be realized, the usefulness of the number in detecting deviations between cylinders (alarm levels) will be reduced.

NOTE: See Section 11.5 for automatic system adjustment of ignition energy.

12.0 THRESHOLD ADJUSTMENT SCREENS

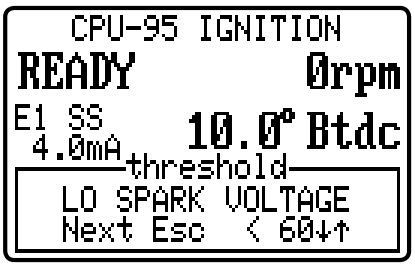
12.1 Nine threshold adjustment screens enable the operator to calibrate thresholds used to diagnose potential ignition problems and control ignition energy based on the spark reference numbers. All of the threshold screens have the same button functions as described with the first threshold screen. All thresholds are accessed under the F2 key.

FROM



PRESS TO VIEW FIRST THRESHOLD SCREEN [F2]

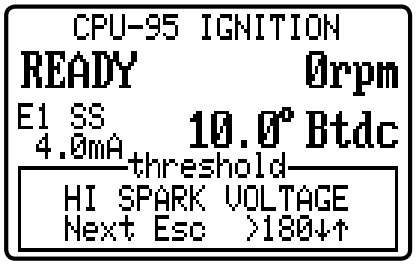
12.2 If the CAVG reference number of a cylinder is below the **LO SPARK VOLTAGE** threshold, a diagnostic warning for that cylinder will occur. This test will identify a low voltage demand condition which may result from a shorted coil, secondary lead or spark plug. To disable diagnostic, set value to zero.



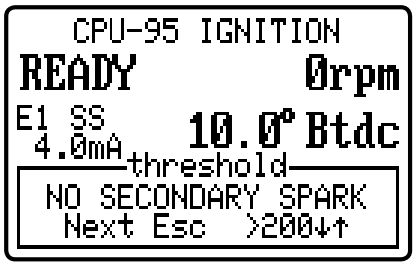
PRESS TO VIEW NEXT CYLINDER [F2] **TO VIEW GRAPH OF CURRENT CYLINDER** [NEXT] **PRESS TO ADJUST SPARK OFFSET** [ESC]

PRESS TO INCREASE THRESHOLD [↑] **PRESS TO DECREASE THRESHOLD** [↓]

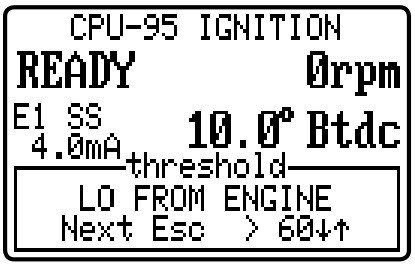
12.3 If the CAVG reference number of a cylinder is above the **HI SPARK VOLTAGE** threshold, a diagnostic warning for that cylinder will occur. When a high spark warning is present, the ignition energy will automatically be increased to at least E2. This test will identify a high voltage demand condition which may result, for example, from worn spark plugs or poor air-fuel ratio control. To disable, set to 255.



12.4 If the CAVG reference number of a cylinder is above the **NO SECONDARY SPARK** threshold, a diagnostic warning for that cylinder will occur. When a no secondary spark warning is present, the ignition energy will automatically be increased to E3 as long as the system is not in multi-strike mode. This test will identify cylinder firings that do not result in a spark — an open circuit condition at the secondary of the coil resulting from a worn spark plug, or a disconnected or failed secondary wire. To disable, set to 255.

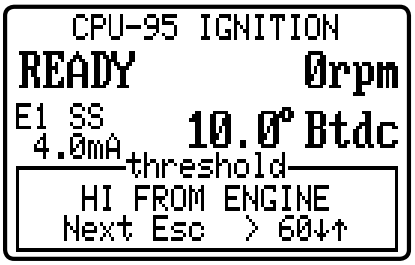


12.5 If the difference between EAVG and CAVG reference numbers is greater than the **LO FROM ENGINE** threshold, a diagnostic warning for that cylinder will occur. This test will identify a cylinder whose voltage demand is too far below the average engine voltage demand.



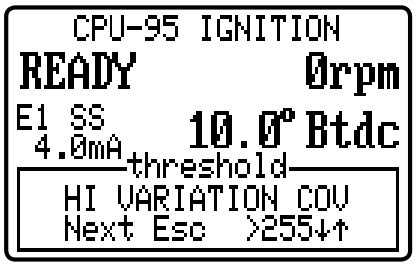
Default = 60

12.6 If the difference between CAVG and EAVG reference numbers is greater than the **HI FROM ENGINE** threshold, a diagnostic warning for that cylinder will occur. This test will identify a cylinder whose voltage demand is too far above the average engine voltage demand.



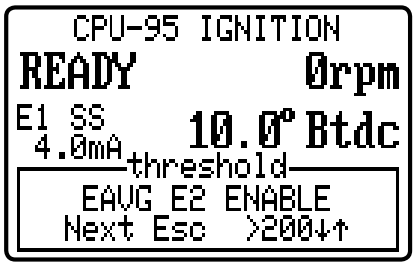
Default = 60

12.7 If the COV reference number is greater than the **HI VARIATION COV** threshold, a diagnostic warning for that cylinder will occur. This test will identify a cylinder whose cycle-to-cycle voltage demand has become erratic.



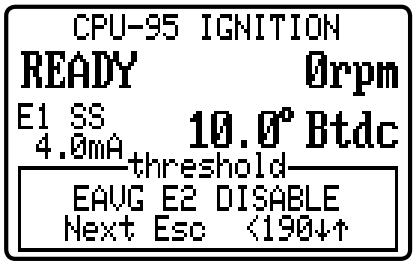
Default = 255 (disabled)

12.8 If the EAVG reference number is greater than the **EAVG E2 ENABLE** threshold, the energy will be increased to at least E2. This feature can be used to automatically increase the spark energy as the voltage demand of the engine increases.



Default = 200

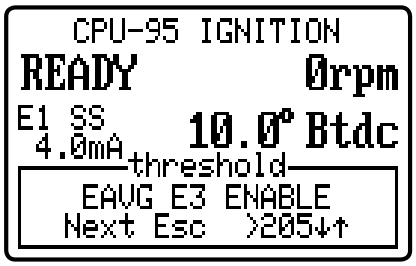
12.9 If the energy is at level E2 and if the base energy setting under the Setup key is E1, then the **EAVG E2 DISABLE** threshold setting is used to automatically decrease the energy from E2.



Default = 190

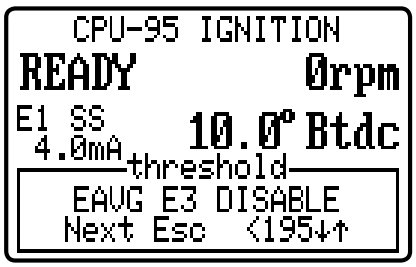
NOTE: This threshold must be at least 2 counts below the EAVG E2 ENABLE threshold. SEE SECTION 12.8

12.10 If the EAVG reference number is greater than the **EAVG E3 ENABLE** threshold, the energy will be increased to level E3 if multi-strike is not active. This feature can be used to automatically increase to the maximum energy to attempt to keep the engine running until worn plugs can be serviced.



Default = 205

12.11 If the energy is at E3 and if the base energy setting under the Setup key is not E3, then the **EAVG E3 DISABLE** threshold setting is used to automatically decrease the energy from E3.



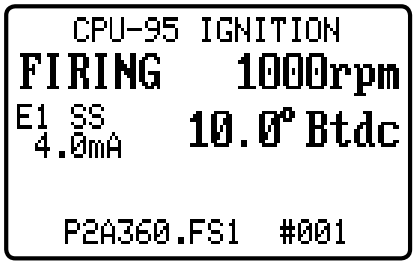
Default = 195

NOTE: This threshold must be at least 2 counts below EAVG E3 ENABLE threshold. SEE SECTION 12.10

13.0 GRAPHING

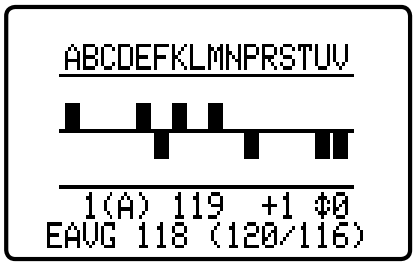
13.1 The display module has two graphs of the spark diagnostic data.

FROM



PRESS F3

13.2 The first graph shows all cylinders CAVG (cylinder average) spark diagnostic number in relation the EAVG (engine average).



PRESS TO TOGGLE BETWEEN OUTPUT LEAD AND CYLINDER LABEL — MAN

PRESS TO INCREASE/ DECREASE THE ZOOM — ↑ ↓

PRESS TO INCREMENT THE CYLINDER BEING VIEWED — NEXT

PRESS TO ACCESS THE CURRENT SELECTED CYLINDER GRAPH — F3

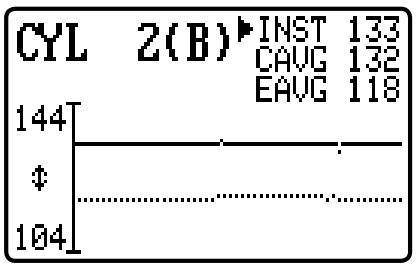
PRESS TO VIEW THE CURRENT SELECTED CYLINDER — F1

PRESS TO ADJUST THE CURRENT SELECTED CYLINDER SPARK OFFSET — F4

PRESS TO ADJUST THE CURRENT SELECTED CYLINDER TIMING OFFSET — TIMING

PRESS TO EXIT — ESC

13.3 The second graph shows each individual cylinder. The solid line is the cylinder data while the dashed line is the engine average. In this picture, 144 corresponds to the spark number that is top of the graph and 104 is the bottom.



PRESS TO TOGGLE BETWEEN GRAPHING INST AND CAVG — **MAN**

PRESS TO CHANGE THE LAYOUT OF THE GRAPH — **ENTER**

PRESS TO VIEW THE DATALOG GRAPH — **AUTO**

PRESS TO ADVANCE TO THE NEXT CYLINDER — **NEXT**

PRESS TO ACCESS THE GRAPH IN SECTION 13.2 — **F3**

PRESS TO VIEW THE CURRENT SELECTED CYLINDER — **F1**

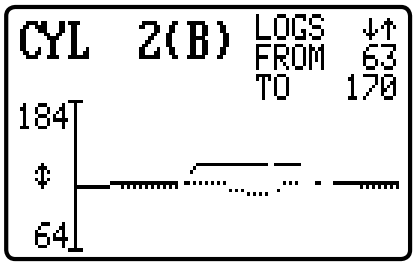
PRESS TO ADJUST THE CURRENT SELECTED CYLINDER SPARK OFFSET — **F4**

PRESS TO ADJUST THE CURRENT SELECTED CYLINDER TIMING OFFSET — **TIMING**

PRESS TO EXIT — **ESC**

Pressing ENTER the first time will display ↓↑ and allows the user to move the graphed lines up and down using the arrow keys. This changes the spark number used for the top and bottom limits of the graph. Pressing ENTER the second time will display the ↕ and allows the user to change the zoom level using the arrow keys. Pressing ENTER a third time exits the adjustments.

13.4 The datalog graph allows the user to view the history of a given cylinder.



PRESS TO CHANGE THE RANGE OF DATA LOGS USED

PRESS TO CHANGE THE LAYOUT OF THE GRAPH

PRESS TO VIEW THE "LIVE" GRAPH

PRESS TO ADVANCE TO THE NEXT CYLINDER

PRESS TO ACCESS THE GRAPH IN SECTION 13.2

PRESS TO VIEW THE CURRENT SELECTED CYLINDER

PRESS TO ADJUST THE CURRENT SELECTED CYLINDER SPARK OFFSET

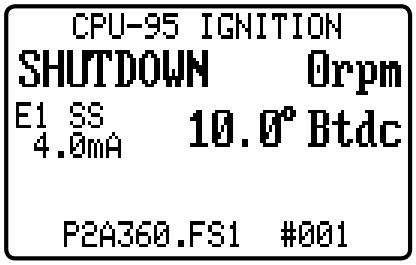
PRESS TO ADJUST THE CURRENT SELECTED CYLINDER TIMING OFFSET

PRESS TO EXIT

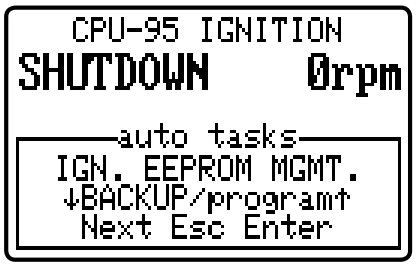
14.0 IGNITION CLONING

14.1 Backing up the CPU-95 eeprom.

FROM



PRESS AUTO

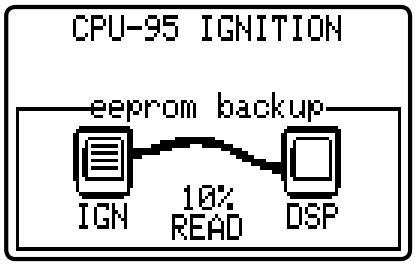


PRESS TO SELECT PROGRAM OPTION ↑ **PRESS TO BEGIN THE SELECTED OPTION** ENTER **PRESS TO EXIT** ESC

If a previous ignition has been stored in the display module, an overwrite confirmation is displayed.

PRESS TO CONTINUE WITH THE BACKUP ENTER **PRESS TO EXIT** ESC

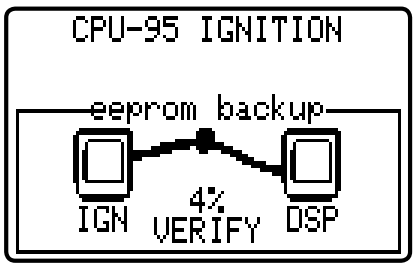
The first phase of the backup is to read the ignition eeprom contents.



PRESS TO ABORT

ESC

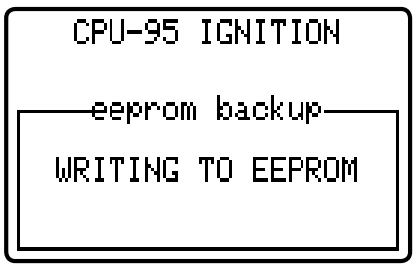
The second phase is to read the ignition again for verification.



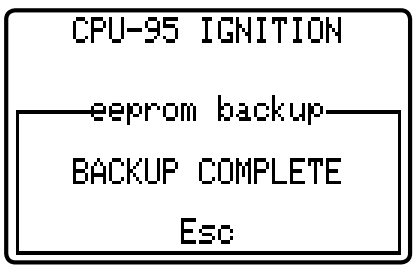
PRESS TO ABORT

ESC

After reading and verifying, the contents are written to the eeprom of the display module.



Done.

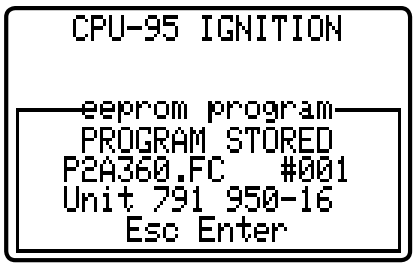


PRESS TO EXIT

ESC

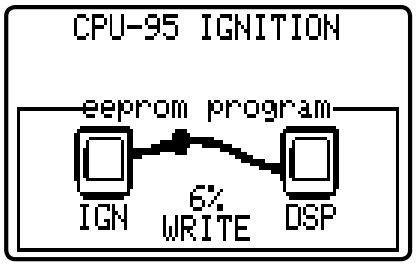
14.2 Programming the CPU-95 EEPROM

It is possible to program the CPU-95 system through the enhanced display, P/N 791909-1, via USB, from a computer without a RS485 card. Refer to programming instructions CPU-95 PI 4-08. The user must first confirm the program option.

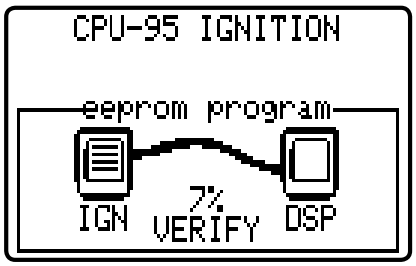


PRESS TO CONTINUE PROGRAMMING **ENTER** **PRESS TO EXIT** **ESC**

The display module now writes the eeprom contents of the CPU-95 ignition.

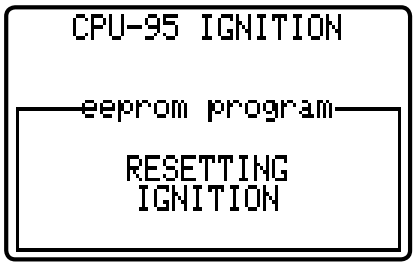


Next, the display module will read back what was written for verification.



With verification complete, the ignition is reset.

WARNING: THE CPU-95 MUST BE PROGRAMMED PRIOR TO USE. REFER TO PROGRAMMING INSTRUCTIONS CPU-95 PI 4-08.



Done.

PRESS TO EXIT **ESC**

15.0 CPU-95 MODBUS REGISTER LIST

The CPU-95 is compliant with the Modicon Modbus RTU standard. The CPU-95 Terminal program CD contains a PC-based Modbus-compatible monitoring program. Maximum number of registers that can be read at one time is limited to 32. Maximum number of booleans that can be read at one time is limited to 256. The default configuration is 19200 baud, 8 Data bits, No Parity, 1 Stop bit (19200 8N1). The MODBUS address list is on the following pages.

The 10xxx registers are read-only binary and support Modbus standard function 1. These registers are read in multiples of 8 (1 byte) addressed at each 8 bit boundary (10001-10008, etc.). A single Boolean read from registers 10001 to 10064 can be made which will return all 64 values as a group of 8 bytes. These registers also support an Altronic custom function 101 which will return a descriptive label for each specific register. The custom label function can be used to reduce the need for the Modbus master to maintain a current listing of all of the register labels for each unit.

Enhanced Display Modbus Register 10000				
Register	**Label**	**0**	**1**	**Notes**
10001	IGN SHUTDOWN FLAG	No	Yes	
10002	IGN WARNING FLAG	No	Yes	
10003	IGN FAULT FLAG	No	Yes	
10004	IGN FIRED FLAG	No	Yes	
10005	IGN ALARM OUTPUT ACTIVATED	No	Yes	
10006	IGN FIRING FLAG	No	Yes	
10007	IGN PICKUPS OK	No	Yes	
10008	IGN ENGINE ROTATING	No	Yes	
10009	spare			
10010	spare			
10011	spare			
10012	ONE STEP ACTIVE NOW	No	Yes	
10013	ENERGY LEVEL E1 NOW	No	Yes	
10014	ENERGY LEVEL E2 NOW	No	Yes	
10015	ENERGY LEVEL E3 NOW	No	Yes	
10016	MULTI STRIKE NOW	No	Yes	
10017	FAULT NO GEAR TOOTH SIGNAL	OK	Fault	
10018	FAULT NO MAGNETIC RESET SIGNAL	OK	Fault	
10019	FAULT NO CYCLE RESET SIGNAL	OK	Fault	
10020	FAULT WRONG NUMBER OF TEETH	OK	Fault	
10021	FAULT OVERSPEED SHUTDOWN	OK	Fault	
10022	spare			
10023	spare			
10024	FAULT FIRMWARE CHECKSUM ERR	OK	Fault	
10025	spare			
10026	spare			
10027	spare			
10028	spare			
10029	WARN 4-20 LOOP OUT OF RANGE	OK	Warning	

Register	Label	0	1	Notes
10030	spare			
10031	WARN EEPROM CHECKSUM FAIL	OK	Warning	
10032	WARN FAIL DETECT DISP MODULE	OK	Warning	
10033	spare			
10034	WARN HI VOLTAGE	OK	Warning	
10035	WARN NO SECONDARY SPK	OK	Warning	
10036	WARN LO FROM ENGINE	OK	Warning	
10037	WARN HI FROM ENGINE	OK	Warning	
10038	WARN LO VOLTAGE	OK	Warning	
10039	WARN PRIMARY SHORT	OK	Warning	
10040	WARN PRIMARY OPEN	OK	Warning	
10041	PROTECTION ENABLED EEPROM	No	Yes	
10042	SERIAL RETARD ENABLED EEPROM	No	Yes	
10043	RPM RETARD MAP ENABLED EEPROM	No	Yes	
10044	4-20ma RET MAP ENABLED EEPROM	No	Yes	
10045	BASE ENERGY E1 SELECT EEPROM	No	Yes	
10046	BASE ENERGY E2 SELECT EEPROM	No	Yes	
10047	BASE ENERGY E3 SELECT EEPROM	No	Yes	
10048	MULTI-STRIKE SELECT EEPROM	No	Yes	
10049	FIRE CONFIRM OUTPUT	No	Firing	
10050	SHUTDOWN OUTPUT	Shutdown	No	
10051	ALARM OUTPUT	Alarm	No	
10052	spare			
10053	TRANSCODER	4x	8x	
10054	SKIP CONTROL (internal)			
10055	CMDPAGE2 (internal)			
10056	TWO CYCLE	No	Yes	
10057	spare			
10058	spare			
10059	spare			
10060	CHKPAGE2 (interal)			
10061	MISC INPUT	No	Yes	
10062	MISC REMOTE INPUT	No	Yes	
10063	spare			
10064	spare			
10065	20 OUTPUT MODULE	No	Yes	
10066	18 OUTPUT MODULE	No	Yes	
10067	DUAL CAPACITOR MODULE	No	Yes	
10068	WITH FILTER MODULE	No	Yes	
10069	spare			
10070	spare			
10071	spare			
10072	spare			

Register	Label	0	1	Notes
10073	MISC.	USE ONESTEP		
10074	MISC.	FIRE MAX ENERGY		
10075	MISC.	FIRE MULTISTRIKE		
10076	spare			
10077	RPM < 200 USE ONESTEP	No	Yes	
10078	RPM < 200 FIRE MAX ENERGY	No	Yes	
10079	RPM < 200 FIRE MULTI	No	Yes	
10080	spare			
10081	spare			
10082	spare			
10083	spare			
10084	spare			
10085	WITH OFFSET	No	Yes	
10086	TEST DENY (internal)			
10087	TEST ACT (internal)			
10088	TEST REQ (internal)			
10089	spare (A or A1)			
10090	WARN HI VOLTAGE (A or A1)	OK	Warning	
10091	WARN NO SECONDARY SPK (A or A1)	OK	Warning	
10092	WARN LO FROM ENGINE (A or A1)	OK	Warning	
10093	WARN HI FROM ENGINE (A or A1)	OK	Warning	
10094	WARN LO VOLTAGE (A or A1)	OK	Warning	
10095	WARN SHORTED PRIMARY (A or A1)	OK	Warning	
10096	WARN OPEN PRIMARY (A or A1)	OK	Warning	
10097	spare (B or A2)	OK	Warning	
10098	WARN HI VOLTAGE (B or A2)	OK	Warning	
10099	WARN NO SECONDARY SPK (B or A2)	OK	Warning	
10100	WARN LO FROM ENGINE (B or A2)	OK	Warning	
10101	WARN HI FROM ENGINE (B or A2)	OK	Warning	
10102	WARN LO VOLTAGE (B or A2)	OK	Warning	
10103	WARN SHORTED PRIMARY (B or A2)	OK	Warning	
10104	WARN OPEN PRIMARY (B or A2)	OK	Warning	
10105	spare (C or B1)	OK	Warning	
10106	WARN HI VOLTAGE (C or B1)	OK	Warning	
10107	WARN NO SECONDARY SPK (C or B1)	OK	Warning	
10108	WARN LO FROM ENGINE (C or B1)	OK	Warning	
10109	WARN HI FROM ENGINE (C or B1)	OK	Warning	
10110	WARN LO VOLTAGE (C or B1)	OK	Warning	
10111	WARN SHORTED PRIMARY (C or B1)	OK	Warning	
10112	WARN OPEN PRIMARY (C or B1)	OK	Warning	
10113	spare (D or B2)	OK	Warning	
10114	WARN HI VOLTAGE (D or B2)	OK	Warning	
10115	WARN NO SECONDARY SPK (D or B2)	OK	Warning	

Register	Label		0	1	Notes
10116	WARN LO FROM ENGINE	(D or B2)	OK	Warning	
10117	WARN HI FROM ENGINE	(D or B2)	OK	Warning	
10118	WARN LO VOLTAGE	(D or B2)	OK	Warning	
10119	WARN SHORTED PRIMARY	(D or B2)	OK	Warning	
10120	WARN OPEN PRIMARY	(D or B2)	OK	Warning	
10121	spare	(E or C1)	OK	Warning	
10122	WARN HI VOLTAGE	(E or C1)	OK	Warning	
10123	WARN NO SECONDARY SPK	(E or C1)	OK	Warning	
10124	WARN LO FROM ENGINE	(E or C1)	OK	Warning	
10125	WARN HI FROM ENGINE	(E or C1)	OK	Warning	
10126	WARN LO VOLTAGE	(E or C1)	OK	Warning	
10127	WARN SHORTED PRIMARY	(E or C1)	OK	Warning	
10128	WARN OPEN PRIMARY	(E or C1)	OK	Warning	
10129	spare	(F or C2)	OK	Warning	
10130	WARN HI VOLTAGE	(F or C2)	OK	Warning	
10131	WARN NO SECONDARY SPK	(F or C2)	OK	Warning	
10132	WARN LO FROM ENGINE	(F or C2)	OK	Warning	
10133	WARN HI FROM ENGINE	(F or C2)	OK	Warning	
10134	WARN LO VOLTAGE	(F or C2)	OK	Warning	
10135	WARN SHORTED PRIMARY	(F or C2)	OK	Warning	
10136	WARN OPEN PRIMARY	(F or C2)	OK	Warning	
10137	spare	(K or D1)	OK	Warning	
10138	WARN HI VOLTAGE	(K or D1)	OK	Warning	
10139	WARN NO SECONDARY SPK	(K or D1)	OK	Warning	
10140	WARN LO FROM ENGINE	(K or D1)	OK	Warning	
10141	WARN HI FROM ENGINE	(K or D1)	OK	Warning	
10142	WARN LO VOLTAGE	(K or D1)	OK	Warning	
10143	WARN SHORTED PRIMARY	(K or D1)	OK	Warning	
10144	WARN OPEN PRIMARY	(K or D1)	OK	Warning	
10145	spare	(L or D2)	OK	Warning	
10146	WARN HI VOLTAGE	(L or D2)	OK	Warning	
10147	WARN NO SECONDARY SPK	(L or D2)	OK	Warning	
10148	WARN LO FROM ENGINE	(L or D2)	OK	Warning	
10149	WARN HI FROM ENGINE	(L or D2)	OK	Warning	
10150	WARN LO VOLTAGE	(L or D2)	OK	Warning	
10151	WARN SHORTED PRIMARY	(L or D2)	OK	Warning	
10152	WARN OPEN PRIMARY	(L or D2)	OK	Warning	
10153	spare	(M or E1)	OK	Warning	
10154	WARN HI VOLTAGE	(M or E1)	OK	Warning	
10155	WARN NO SECONDARY SPK	(M or E1)	OK	Warning	
10156	WARN LO FROM ENGINE	(M or E1)	OK	Warning	
10157	WARN HI FROM ENGINE	(M or E1)	OK	Warning	
10158	WARN LO VOLTAGE	(M or E1)	OK	Warning	

Register	Label		0	1	Notes
10159	WARN SHORTED PRIMARY	(M or E1)	OK	Warning	
10160	WARN OPEN PRIMARY	(M or E1)	OK	Warning	
10161	spare	(N or E2)	OK	Warning	
10162	WARN HI VOLTAGE	(N or E2)	OK	Warning	
10163	WARN NO SECONDARY SPK	(N or E2)	OK	Warning	
10164	WARN LO FROM ENGINE	(N or E2)	OK	Warning	
10165	WARN HI FROM ENGINE	(N or E2)	OK	Warning	
10166	WARN LO VOLTAGE	(N or E2)	OK	Warning	
10167	WARN SHORTED PRIMARY	(N or E2)	OK	Warning	
10168	WARN OPEN PRIMARY	(N or E2)	OK	Warning	
10169	spare	(P or F1)	OK	Warning	
10170	WARN HI VOLTAGE	(P or F1)	OK	Warning	
10171	WARN NO SECONDARY SPK	(P or F1)	OK	Warning	
10172	WARN LO FROM ENGINE	(P or F1)	OK	Warning	
10173	WARN HI FROM ENGINE	(P or F1)	OK	Warning	
10174	WARN LO VOLTAGE	(P or F1)	OK	Warning	
10175	WARN SHORTED PRIMARY	(P or F1)	OK	Warning	
10176	WARN OPEN PRIMARY	(P or F1)	OK	Warning	
10177	spare	(R or F2)	OK	Warning	
10178	WARN HI VOLTAGE	(R or F2)	OK	Warning	
10179	WARN NO SECONDARY SPK	(R or F2)	OK	Warning	
10180	WARN LO FROM ENGINE	(R or F2)	OK	Warning	
10181	WARN HI FROM ENGINE	(R or F2)	OK	Warning	
10182	WARN LO VOLTAGE	(R or F2)	OK	Warning	
10183	WARN SHORTED PRIMARY	(R or F2)	OK	Warning	
10184	WARN OPEN PRIMARY	(R or F2)	OK	Warning	
10185	spare	(S or K1)	OK	Warning	
10186	WARN HI VOLTAGE	(S or K1)	OK	Warning	
10187	WARN NO SECONDARY SPK	(S or K1)	OK	Warning	
10188	WARN LO FROM ENGINE	(S or K1)	OK	Warning	
10189	WARN HI FROM ENGINE	(S or K1)	OK	Warning	
10190	WARN LO VOLTAGE	(S or K1)	OK	Warning	
10191	WARN SHORTED PRIMARY	(S or K1)	OK	Warning	
10192	WARN OPEN PRIMARY	(S or K1)	OK	Warning	
10193	spare	(T or K2)	OK	Warning	
10194	WARN HI VOLTAGE	(T or K2)	OK	Warning	
10195	WARN NO SECONDARY SPK	(T or K2)	OK	Warning	
10196	WARN LO FROM ENGINE	(T or K2)	OK	Warning	
10197	WARN HI FROM ENGINE	(T or K2)	OK	Warning	
10198	WARN LO VOLTAGE	(T or K2)	OK	Warning	
10199	WARN SHORTED PRIMARY	(T or K2)	OK	Warning	
10200	WARN OPEN PRIMARY	(T or K2)	OK	Warning	
10201	spare	(U or L1)	OK	Warning	

Register	Label		0	1	Notes
10202	WARN HI VOLTAGE	(U or L1)	OK	Warning	
10203	WARN NO SECONDARY SPK	(U or L1)	OK	Warning	
10204	WARN LO FROM ENGINE	(U or L1)	OK	Warning	
10205	WARN HI FROM ENGINE	(U or L1)	OK	Warning	
10206	WARN LO VOLTAGE	(U or L1)	OK	Warning	
10207	WARN SHORTED PRIMARY	(U or L1)	OK	Warning	
10208	WARN OPEN PRIMARY	(U or L1)	OK	Warning	
10209	spare	(V or L2)	OK	Warning	
10210	WARN HI VOLTAGE	(V or L2)	OK	Warning	
10211	WARN NO SECONDARY SPK	(V or L2)	OK	Warning	
10212	WARN LO FROM ENGINE	(V or L2)	OK	Warning	
10213	WARN HI FROM ENGINE	(V or L2)	OK	Warning	
10214	WARN LO VOLTAGE	(V or L2)	OK	Warning	
10215	WARN SHORTED PRIMARY	(V or L2)	OK	Warning	
10216	WARN OPEN PRIMARY	(V or L2)	OK	Warning	
10217	spare	(M1)	OK	Warning	
10218	WARN HI VOLTAGE	(M1)	OK	Warning	
10219	WARN NO SECONDARY SPK	(M1)	OK	Warning	
10220	WARN LO FROM ENGINE	(M1)	OK	Warning	
10221	WARN HI FROM ENGINE	(M1)	OK	Warning	
10222	WARN LO VOLTAGE	(M1)	OK	Warning	
10223	WARN SHORTED PRIMARY	(M1)	OK	Warning	
10224	WARN OPEN PRIMARY	(M1)	OK	Warning	
10225	spare	(M2)	OK	Warning	
10226	WARN HI VOLTAGE	(M2)	OK	Warning	
10227	WARN NO SECONDARY SPK	(M2)	OK	Warning	
10228	WARN LO FROM ENGINE	(M2)	OK	Warning	
10229	WARN HI FROM ENGINE	(M2)	OK	Warning	
10230	WARN LO VOLTAGE	(M2)	OK	Warning	
10231	WARN SHORTED PRIMARY	(M2)	OK	Warning	
10232	WARN OPEN PRIMARY	(M2)	OK	Warning	
10233	spare	(N1)	OK	Warning	
10234	WARN HI VOLTAGE	(N1)	OK	Warning	
10235	WARN NO SECONDARY SPK	(N1)	OK	Warning	
10236	WARN LO FROM ENGINE	(N1)	OK	Warning	
10237	WARN HI FROM ENGINE	(N1)	OK	Warning	
10238	WARN LO VOLTAGE	(N1)	OK	Warning	
10239	WARN SHORTED PRIMARY	(N1)	OK	Warning	
10240	WARN OPEN PRIMARY	(N1)	OK	Warning	
10241	spare	(N2)	OK	Warning	
10242	WARN HI VOLTAGE	(N2)	OK	Warning	
10243	WARN NO SECONDARY SPK	(N2)	OK	Warning	
10244	WARN LO FROM ENGINE	(N2)	OK	Warning	

Register	Label	0	1	Notes
10245	WARN HI FROM ENGINE (N2)	OK	Warning	
10246	WARN LO VOLTAGE (N2)	OK	Warning	
10247	WARN SHORTED PRIMARY (N2)	OK	Warning	
10248	WARN OPEN PRIMARY (N2)	OK	Warning	
10249 – 10256	RESERVED			

Enhanced Display Modbus Register 30000

Register	Label	Units	Size (bits)	Min	Max	Notes
30001	ENGINE RPM	1 RPM/bit	16			
30002	MAX SEEN RPM	10 RPM/bit	16			
30003	OVERSPEED SETTING	10 RPM/bit	16			
30004	FAULT GEAR TEETH COUNTS	counts	16			
30005	4-20 ANALOG INPUT	0.098mA/bit	16			
30006	COUNTS TO DEGREES SCALER	-	16			
30007	GLOBAL TIMING DISPLAY VALUE	-	16			
30008	MANUAL RETARD SETTING	-	16			
30009	ONESTEP RETARD SETTING	-	16			
30010	ANALOG RETARD FROM TABLE	-	16			
30011	RPM RETARD FROM TABLE	-	16			
30012	SERIAL RETARD FROM REMOTE	-	16			
30013	MAX INDIVIDUAL OFFSET	-	16			
30014	STANDARD INDIVIDUAL OFFSET	-	16			
30015	REFERENCE ANGLE OF RESET PIN		16			
30016	NUMBER OF CYLINDERS	-	16			
30017	ENGINE AVERAGE DIAG	-	16			
30018	LO SPARK DIAG THRESHOLD	-	16			
30019	HI SPARK DIAG THRESHOLD	-	16			
30020	NO SPARK DIAG THRESHOLD	-	16			
30021	LO FROM ENGINE THRESHOLD	-	16			
30022	HI FROM ENGINE THRESHOLD	-	16			
30023	RESERVED	-	16	0	65535	
30024	E2 ENABLE THRESHOLD	-	16			
30025	E2 DISABLE HYSTERISIS	-	16			
30026	E3 ENABLE THRESHOLD	-	16			
30027	E3 DISABLE HYSTERISIS	-	16			
30028	CYL TIMING OFFSET (A,A,A1)	-	16			
30029	CYL TIMING OFFSET (B,B,A2)	-	16			
30030	CYL TIMING OFFSET (C,C,B1)	-	16			
30031	CYL TIMING OFFSET (D,D,B2)	-	16			
30032	CYL TIMING OFFSET (E,E,C1)	-	16			
30033	CYL TIMING OFFSET (F,F,C2)	-	16			
30034	CYL TIMING OFFSET (K,G,D1)	-	16			

Register	Label	Units	Size (bits)	Min	Max	Notes
30035	CYL TIMING OFFSET (L,H,D2)	-	16			
30036	CYL TIMING OFFSET (M,K,E1)	-	16			
30037	CYL TIMING OFFSET (N,L,E2)	-	16			
30038	CYL TIMING OFFSET (P,M,F1)	-	16			
30039	CYL TIMING OFFSET (R,N,F2)	-	16			
30040	CYL TIMING OFFSET (S,P,K1)	-	16			
30041	CYL TIMING OFFSET (T,R,K2)	-	16			
30042	CYL TIMING OFFSET (U,S,L1)	-	16			
30043	CYL TIMING OFFSET (V,T,L2)	-	16			
30044	CYL TIMING OFFSET (U,M1)	-	16			
30045	CYL TIMING OFFSET (V,M2)	-	16			
30046	CYL TIMING OFFSET (N1)	-	16			
30047	CYL TIMING OFFSET (N2)	-	16			
30048	CAVG (A,A,A1)	-	16			
30049	CAVG (B,B,A2)	-	16			
30050	CAVG (C,C,B1)	-	16			
30051	CAVG (D,D,B2)	-	16			
30052	CAVG (E,E,C1)	-	16			
30053	CAVG (F,F,C2)	-	16			
30054	CAVG (K,G,D1)	-	16			
30055	CAVG (L,H,D2)	-	16			
30056	CAVG (M,K,E1)	-	16			
30057	CAVG (N,L,E2)	-	16			
30058	CAVG (P,M,F1)	-	16			
30059	CAVG (R,N,F2)	-	16			
30060	CAVG (S,P,K1)	-	16			
30061	CAVG (T,R,K2)	-	16			
30062	CAVG (U,S,L1)	-	16			
30063	CAVG (V,T,L2)	-	16			
30064	CAVG (U,M1)	-	16			
30065	CAVG (V,M2)	-	16			
30066	CAVG (N1)	-	16			
30067	CAVG (N2)	-	16			
30068	DIAG OFFSET (A,A,A1)	-	16			
30069	DIAG OFFSET (B,B,A2)	-	16			
30070	DIAG OFFSET (C,C,B1)	-	16			
30071	DIAG OFFSET (D,D,B2)	-	16			
30072	DIAG OFFSET (E,E,C1)	-	16			
30073	DIAG OFFSET (F,F,C2)	-	16			
30074	DIAG OFFSET (K,G,D1)	-	16			
30075	DIAG OFFSET (L,H,D2)	-	16			
30076	DIAG OFFSET (M,K,E1)	-	16			
30077	DIAG OFFSET (N,L,E2)	-	16			

Register	Label	Units	Size (bits)	Min	Max	Notes
30078	DIAG OFFSET (P,M,F1)	-	16			
30079	DIAG OFFSET (R,N,F2)	-	16			
30080	DIAG OFFSET (S,P,K1)	-	16			
30081	DIAG OFFSET (T,R,K2)	-	16			
30082	DIAG OFFSET (U,S,L1)	-	16			
30083	DIAG OFFSET (V,T,L2)	-	16			
30084	DIAG OFFSET (U,M1)	-	16			
30085	DIAG OFFSET (V,M2)	-	16			
30086	DIAG OFFSET (N1)	-	16			
30087	DIAG OFFSET (N2)	-	16			
30088	COV (A,A,A1)	-	16			
30089	COV (B,B,A2)	-	16			
30090	COV (C,C,B1)	-	16			
30091	COV (D,D,B2)	-	16			
30092	COV (E,E,C1)	-	16			
30093	COV (F,F,C2)	-	16			
30094	COV (K,G,D1)	-	16			
30095	COV (L,H,D2)	-	16			
30096	COV (M,K,E1)	-	16			
30097	COV (N,L,E2)	-	16			
30098	COV (P,M,F1)	-	16			
30099	COV (R,N,F2)	-	16			
30100	COV (S,P,K1)	-	16			
30101	COV (T,R,K2)	-	16			
30102	COV (U,S,L1)	-	16			
30103	COV (V,T,L2)	-	16			
30104	COV (U,M1)	-	16			
30105	COV (V,M2)	-	16			
30106	COV (N1)	-	16			
30107	COV (N2)	-	16			
30108 – 30127	RESERVED	-	16	0	65535	
30128	FAULT GEAR TEETH ACTUAL	-	16			
30129	4-20 ANALOG INPUT	mA * 10	16			
30130	GLOBAL TIMING DISPLAY	degrees * 10	16			
30131	MANUAL RETARD SETTING	degrees * 10	16			
30132	ONESTEP RETARD SETTING	degrees * 10	16			
30133	ANALOG RETARD FROM TBL	degrees * 10	16			
30134	RPM RETARD FROM TBL	degrees * 10	16			
30135	SERIAL RETARD	degrees * 10	16			
30136	REF. ANGLE OF RESET PIN	degrees * 10	16			
30137	MAX INDIVIDUAL OFFSET	degrees * 10	16			
30138	CYL TIM. OFF. (A,A,A1)	degrees * 10	16			

Register	Label	Units	Size (bits)	Min	Max	Notes
30139	CYL TIM. OFF. (B,B,A2)	degrees * 10	16			
30140	CYL TIM. OFF. (C,C,B1)	degrees * 10	16			
30141	CYL TIM. OFF. (D,D,B2)	degrees * 10	16			
30142	CYL TIM. OFF. (E,E,C1)	degrees * 10	16			
30143	CYL TIM. OFF. (F,F,C2)	degrees * 10	16			
30144	CYL TIM. OFF. (K,G,D1)	degrees * 10	16			
30145	CYL TIM. OFF. (L,H,D2)	degrees * 10	16			
30146	CYL TIM. OFF. (M,K,E1)	degrees * 10	16			
30147	CYL TIM. OFF. (N,L,E2)	degrees * 10	16			
30148	CYL TIM. OFF. (P,M,F1)	degrees * 10	16			
30149	CYL TIM. OFF. (R,N,F2)	degrees * 10	16			
30150	CYL TIM. OFF. (S,P,K1)	degrees * 10	16			
30151	CYL TIM. OFF. (T,R,K2)	degrees * 10	16			
30152	CYL TIM. OFF. (U,S,L1)	degrees * 10	16			
30153	CYL TIM. OFF. (V,T,L2)	degrees * 10	16			
30154	CYL TIM. OFF. (U,M1)	degrees * 10	16			
30155	CYL TIM. OFF. (V,M2)	degrees * 10	16			
30156	CYL TIM. OFF. (N1)	degrees * 10	16			
30157	CYL TIM. OFF. (N2)	degrees * 10	16			
30158 – 30240	RESERVED	-	16	0	65535	
30241	InStat 001-016	-	16			
30242	InStat 017-032	-	16			
30243	InStat 033-048	-	16			
30244	InStat 049-064	-	16			
30245	InStat 065-080	-	16			
30246	InStat 081-096	-	16			
30247	InStat 097-112	-	16			
30248	InStat 113-128	-	16			
30249	InStat 129-144	-	16			
30250	InStat 145-160	-	16			
30251	InStat 161-176	-	16			
30252	InStat 177-192	-	16			
30253	InStat 193-208	-	16			
30254	InStat 209-224	-	16			
30255	InStat 225-240	-	16			
30256	InStat 241-256	-	16			
30257 – 30384	RESERVED	-	16	0	65535	

Enhanced Display Modbus Register 40000							
Register	**Label**	**Units**	**Bits**	**Min**	**Max**	**Default**	**Notes**
40001	MANUAL RETARD SETTING	degrees * 10	16	0	65535	0	
40002	CYLINDER TIMING OFFSET (A,A,A1)	degrees * 10	16	0	65535	0	
40003	CYLINDER TIMING OFFSET (B,B,A2)	degrees * 10	16	0	65535	0	
40004	CYLINDER TIMING OFFSET (C,C,B1)	degrees * 10	16	0	65535	0	
40005	CYLINDER TIMING OFFSET (D,D,B2)	degrees * 10	16	0	65535	0	
40006	CYLINDER TIMING OFFSET (E,E,C1)	degrees * 10	16	0	65535	0	
40007	CYLINDER TIMING OFFSET (F,F,C2)	degrees * 10	16	0	65535	0	
40008	CYLINDER TIMING OFFSET (K,G,D1)	degrees * 10	16	0	65535	0	
40009	CYLINDER TIMING OFFSET (L,H,D2)	degrees * 10	16	0	65535	0	
40010	CYLINDER TIMING OFFSET (M,K,E1)	degrees * 10	16	0	65535	0	
40011	CYLINDER TIMING OFFSET (N,L,E2)	degrees * 10	16	0	65535	0	
40012	CYLINDER TIMING OFFSET (P,M,F1)	degrees * 10	16	0	65535	0	
40013	CYLINDER TIMING OFFSET (R,N,F2)	degrees * 10	16	0	65535	0	
40014	CYLINDER TIMING OFFSET (S,P,K1)	degrees * 10	16	0	65535	0	
40015	CYLINDER TIMING OFFSET (T,R,K2)	degrees * 10	16	0	65535	0	
40016	CYLINDER TIMING OFFSET (U,S,L1)	degrees * 10	16	0	65535	0	
40017	CYLINDER TIMING OFFSET (V,T,L2)	degrees * 10	16	0	65535	0	
40018	CYLINDER TIMING OFFSET (U,M1)	degrees * 10	16	0	65535	0	
40019	CYLINDER TIMING OFFSET (V,M2)	degrees * 10	16	0	65535	0	
40020	CYLINDER TIMING OFFSET (N1)	degrees * 10	16	0	65535	0	
40021	CYLINDER TIMING OFFSET (N2)	degrees * 10	16	0	65535	0	
40022 – 40215	RESERVED	-	16	0	65535	0	
40216	CYLINDER LABEL (A,A,A1)	-	16	0	65535	0	
40217	CYLINDER LABEL (B,B,A2)	-	16	0	65535	0	
40218	CYLINDER LABEL (C,C,B1)	-	16	0	65535	0	
40219	CYLINDER LABEL (D,D,B2)	-	16	0	65535	0	
40220	CYLINDER LABEL (E,E,C1)	-	16	0	65535	0	
40221	CYLINDER LABEL (F,F,C2)	-	16	0	65535	0	
40222	CYLINDER LABEL (K,G,D1)	-	16	0	65535	0	
40223	CYLINDER LABEL (L,H,D2)	-	16	0	65535	0	
40224	CYLINDER LABEL (M,K,E1)	-	16	0	65535	0	
40225	CYLINDER LABEL (N,L,E2)	-	16	0	65535	0	
40226	CYLINDER LABEL (P,M,F1)	-	16	0	65535	0	
40227	CYLINDER LABEL (R,N,F2)	-	16	0	65535	0	
40228	CYLINDER LABEL (S,P,K1)	-	16	0	65535	0	
40229	CYLINDER LABEL (T,R,K2)	-	16	0	65535	0	
40230	CYLINDER LABEL (U,S,L1)	-	16	0	65535	0	
40231	CYLINDER LABEL (V,T,L2)	-	16	0	65535	0	
40232	CYLINDER LABEL (U,M1)	-	16	0	65535	0	
40233	CYLINDER LABEL (V,M2)	-	16	0	65535	0	
40234	CYLINDER LABEL (N1)	-	16	0	65535	0	

Register	Label	Units	Bits	Min	Max	Default	Notes
40235	CYLINDER LABEL (N2)	-	16	0	65535	0	
40236	Modbus RTU Node ID	-	16	1	254	1	
40237	Auxiliary Port Baud Rate	-	16	0	4	0	0=9.6k, 1=19.2k, 2=38.4k, 3=57.6k, 4=115.2k
40238	USB Port Mode	-	16	0	2	0	0=Terminal, 1=Modbus, 2=Debug
40239	USB Port Baud Rate	-	16	0	4	0	0=9.6k, 1=19.2k, 2=38.4k, 3=57.6k, 4=115.2k
40240	Datalog Interval	seconds	16	0	11	2	
40241	Datalog Power On Erase	-	16	0	1	0	0=No, 1=Yes
40242	Datalog Continue Log At Stop	-	16	0	1	0	0=No, 1=Yes
40243	Datalog Track Timing Change	-	16	0	1	0	0=No, 1=Yes
40244	Test Mode Availability	-	16	0	2	1	
40245	Value Protect Password (Keys)	-	16	0	65535	0	
40246	Value Protect Password (Keys)	-	16	0	65535	0	
40247	Value Protect Password (Keys)	-	16	0	65535	0	
40248	Value Protect Password (Keys)	-	16	0	65535	0	
40249	Value Protect Password (Keys)	-	16	0	65535	0	
40250	Cylinder Bar Graph Center	-	16	20	235	130	
40251	Cyl Bar Graph Counts Per Point	counts	16	1	5	2	
40252	EAVG Bar Graph Spread	-	16	1	255	30	
40253	RTC Year	year	16	2007	2099	0	
40254	RTC Date	-	16	0	65535	0	msb=month, lsb=day
40255	RTC Time	-	16	0	65535	0	msb=hour, lsb=minutes
40256	Key Commands	-	16	0	65535	0	

SPECIFICATIONS

POWER: 24VDC @ 150mA NOMINAL, 32VDC @ 250mA MAX.
ENCLOSURE: WEATHERPROOF, POWDER COATED ALUMINUM
FIELD CONNECTIONS: PLUG-IN TERMINAL STRIPS ON BACK
CONTROL INPUTS:

1. RS-485 SERIAL COMMUNICATIONS PORT
2. MISCELLANEOUS INPUT – ONE STEP RETARD (DEFAULT), ALSO MULTI-STRIKE, MAX. ENERGY LEVEL (CONFIGURED THROUGH P.C.)
3. 4–20mA CURRENT LOOP INPUT
4. AUXILIARY RS-485 MODBUS RTU PORT
5. USB