

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.

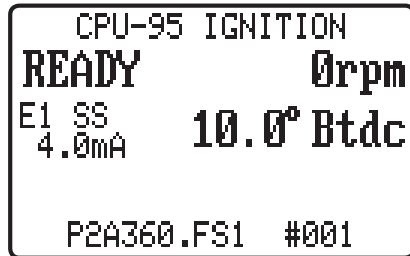
3.0 DISPLAY MODULE USER INTERFACE AND INPUTS

- 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.

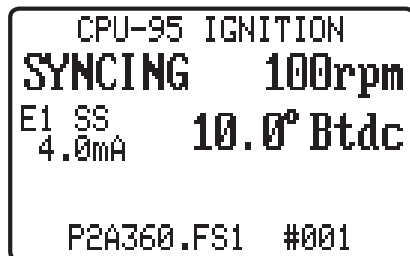
4.0 UNDERSTANDING THE HOME SCREEN

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.

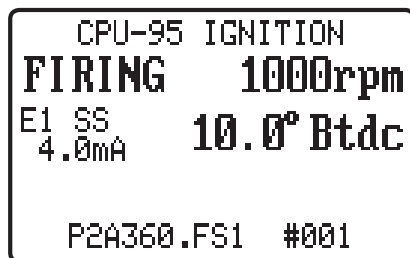
4.2 The **READY** message is displayed when the ignition is ready for the engine to crank for starting.



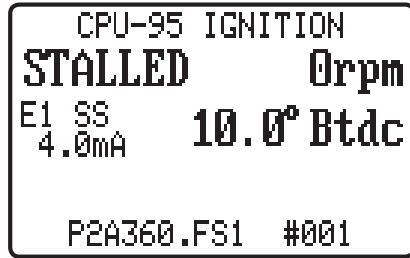
4.3 Once the engine begins turning, the **SYNCING** message is displayed while the ignition system verifies signals from the engine pickups.



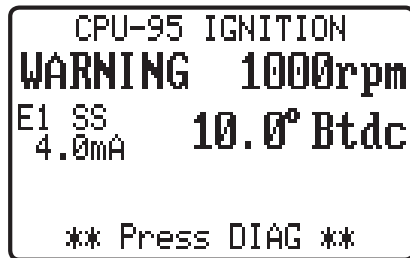
4.4 The **FIRING** message is displayed when the ignition begins firing. Additional data is provided on this screen to describe the selected mode of operation for the ignition. The energy mode (E1,E2,E3) and the single-strike/multi-strike type (SS or MS) are described in the middle of the upper line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



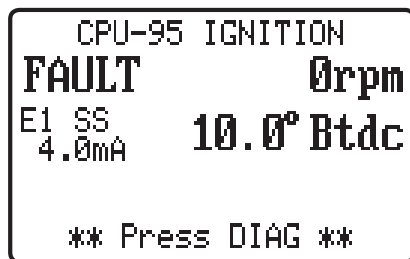
4.5 The **STALLED** message is displayed when a loss of rotation is detected after the ignition is firing and neither a **SHUTDOWN** or **FAULT** has occurred. This signifies that the engine has stopped without any detected cause from the ignition system.



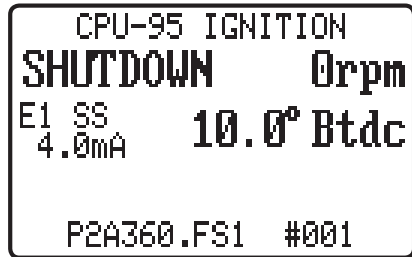
4.6 The **WARNING** message will supersede all of the above home screens if a diagnostic warning condition is present. When a diagnostic warning exists, a **** Press DIAG **** message will appear on the display. The Ignition Module will continue to operate under a warning condition while alerting the 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**.



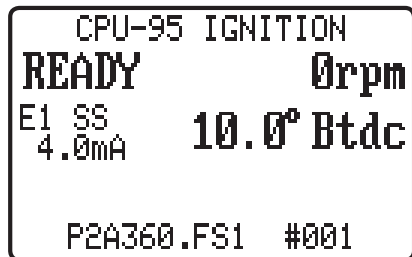
4.8 The **SHUTDOWN** screen will supersede all other home displays if the logic level shutdown input of the Ignition Module or the G-Lead of the output primary connector is grounded or was previously grounded and the engine has not stopped rotating. This screen indicates that the ignition is not firing 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.

```

CPU-95 IGNITION
FIRING 1000rpm
E1 SS 10.0° Btdc
4.0mA
config
P2A360.FS1 #001
Unit 791 950-16
    
```

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

NEXT

```

CPU-95 IGNITION
FIRING 1000rpm
E1 SS 10.0° Btdc
4.0mA
config
04-09-08 14:15
Alt:GRH v2.0
    
```

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

NEXT

```

CPU-95 IGNITION
FIRING 1000rpm
E1 SS 10.0° Btdc
4.0mA
config
LOOP RETARD: 24
4/20ma 0/24ret
    
```

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

NEXT

```

CPU-95 IGNITION
FIRING 1000rpm
E1 SS 10.0° Btdc
4.0mA
config
RPM RETARD: YES
100/200 10/0ret
    
```

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

NEXT

```

CPU-95 IGNITION
FIRING 1000rpm
E1 SS 10.0° Btdc
4.0mA
config
LOCATION:
GIRARD OHIO USA
    
```

LOCATION:
USER SPECIFIED DESCRIPTION

NEXT

```

CPU-95 IGNITION
FIRING 1000rpm
E1 SS 10.0° Btdc
4.0mA
config
ENGINE#:
Number 4 USA-GAS
    
```

ENGINE NUMBER OR DESCRIPTION
USER SPECIFIED DESCRIPTION

NEXT

```

CPU-95 IGNITION
FIRING 1000rpm
E1 SS 10.0° Btdc
4.0mA
config
USER
COMMENTS #1
    
```

SPECIAL USER COMMENTS AREA #1
USER SPECIFIED COMMENTS

NEXT

```

CPU-95 IGNITION
FIRING 1000rpm
E1 SS 10.0° Btdc
4.0mA
config
USER
COMMENTS #2
    
```

SPECIAL USER COMMENTS AREA #2
USER SPECIFIED COMMENTS

NEXT

```

CPU-95 IGNITION
READY 0rpm
E1 SS 10.0° Btdc
4.0mA
P2A360.FS1 #001
    
```

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)
- #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

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

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

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

 P2A360.FS1 #001

PRESS TIMING

THEN AT

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

PRESS ↑

THEN AT

CPU-95 IGNITION
READY 0rpm
 E1 SS 10.0° Btdc
 4.0mA
 global
 ↑ = ADJUST RETARD
 ↓ = SELECT MODE

PRESS ↑

THEN AT

CPU-95 IGNITION
READY 0rpm
 E1 SS 10.0° Btdc
 4.0mA
 global
 MANUAL RETARD
 Esc ↑ 5.8°

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 $N \geq 270$, 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

```

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

P2A360.FS1 #001
    
```

PRESS



THEN AT

```

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

PRESS



THEN AT

```

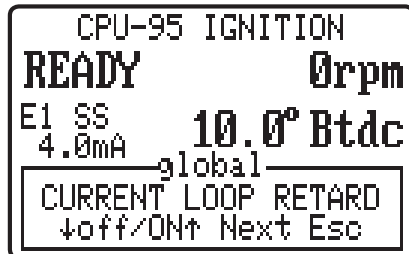
CPU-95 IGNITION
READY 0rpm
E1 SS 10.0° Btdc
4.0mA
global
↑ = ADJUST RETARD
↓ = SELECT MODE
    
```

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

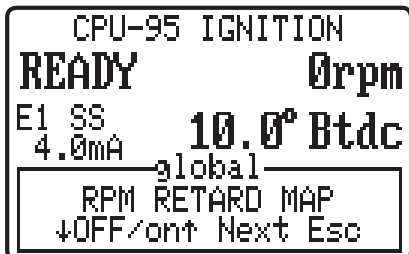


TO EXIT



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



TO EXIT



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

```

CPU-95 IGNITION
READY          0rpm
E1 SS          10.0° Btdc
4.0mA         global
1 STEP RETARD
Next Esc ↑↓ 0.0°
    
```

NOTE: UPPER CASE
1 STEP RET = ON.

OR

```

CPU-95 IGNITION
READY          0rpm
E1 SS          10.0° Btdc
4.0mA         global
1 step retard
Next Esc ↑↓ 0.0°
    
```

NOTE: LOWER CASE
1 STEP RETARD = OFF.

OR

```

CPU-95 IGNITION
READY          0rpm
E1 SS          10.0° Btdc
4.0mA         global
ONE-STEP FEATURE
NOT PRESENT Next Esc
    
```

NOTE: 1 STEP RETARD
NOT CONFIGURED.



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 10.0° Btdc
4.0mA
P2A360.FS1 #001
    
```

PRESS TIMING

THEN AT

```

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

PRESS ↓

THEN AT

```

CPU-95 IGNITION
READY 0rpm
E1 SS 10.0° Btdc
4.0mA
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

```

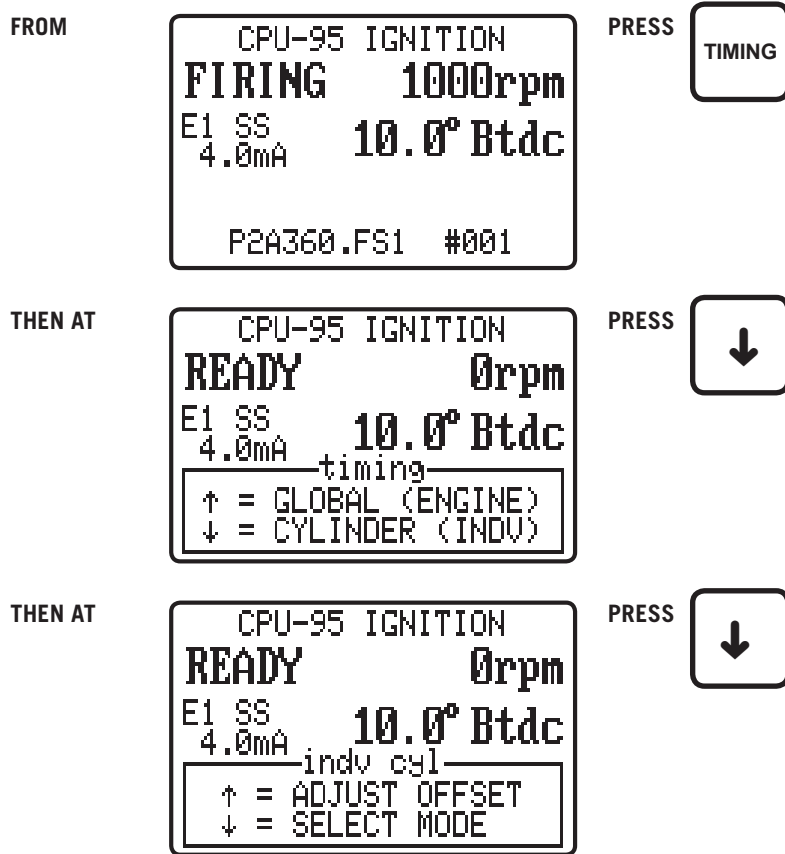
CYL 1(A)
Timing SPARK#'s
0.0°Adv↑ 119 INST
118 CAUG
Spk Offset 118 EAUG
+0 0 COV
    
```

NOTE: 2.5 degrees advance for output A.

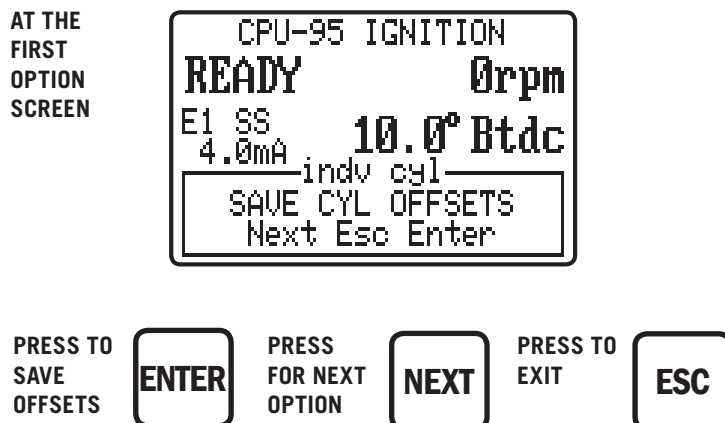
TO ADVANCE ↑ TO RETARD ↓ TO SELECT NEXT CYL. NEXT TO EXIT ESC

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.



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.



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

```
CPU-95 IGNITION
READY          0rpm
E1 SS         10.0° Btdc
4.0mA indv cyl
RESET OFFSETS TO 0°
Next Esc Enter
```

PRESS to
RESET
OFFSETS



press
FOR NEXT
OPTION

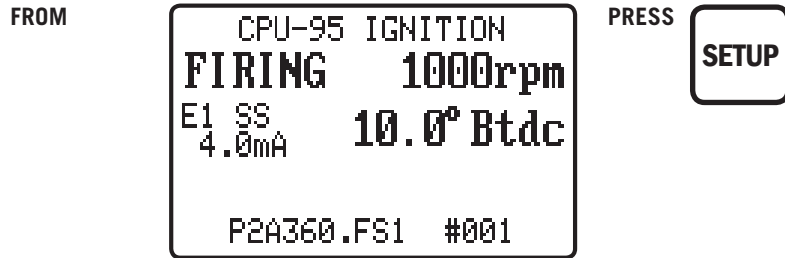


PRESS to
exit



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.



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

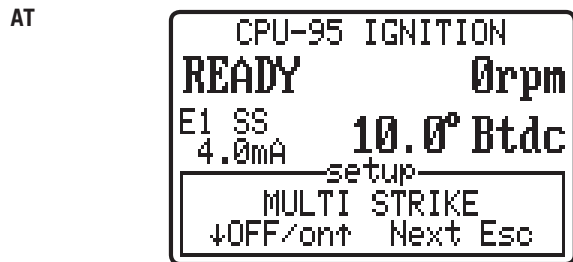
Note 1: A special feature can be selected during configuration to force Multi-Strike to be active below 250 rpm, or when the Misc. Input is grounded. This feature is not active in a standard configuration.

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.



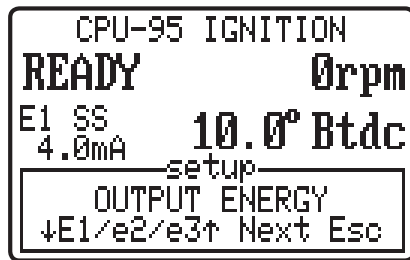
9.3 The next setup screen permits the operator to select one of three ignition energy levels (E1,E2,E3). The energy levels are 75 millijoules (E1), 100 millijoules (E2), 125 millijoules (E3).

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

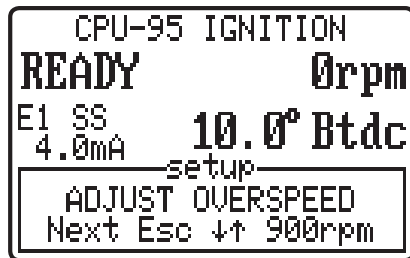


TO EXIT



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

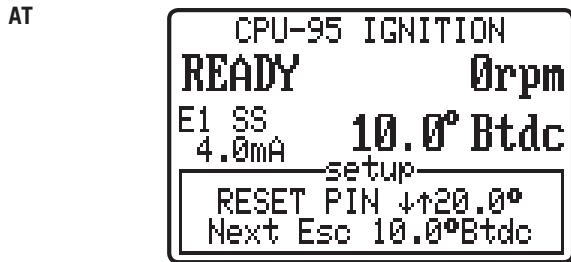


TO EXIT

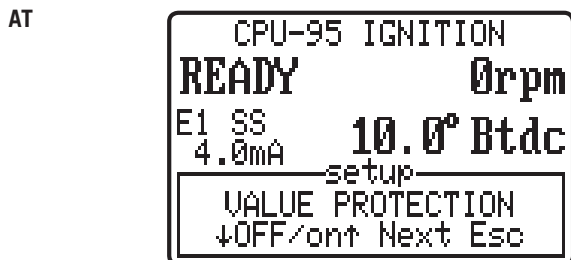


9.5 The next setup screen is used to specify the exact position of the reset pin. Both the reset position and the engine timing are displayed. Adjustments are made here to make the displayed timing match the actual spark timing as verified with a timing light. This adjustment effects the displayed timing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

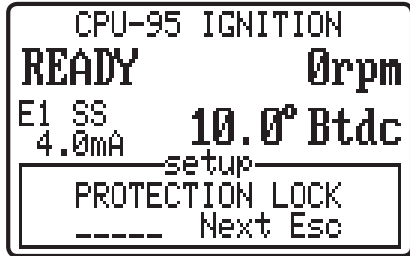
NOTE: Adjustment of this parameter should be done while individual cylinder offsets are all at zero.



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.



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.

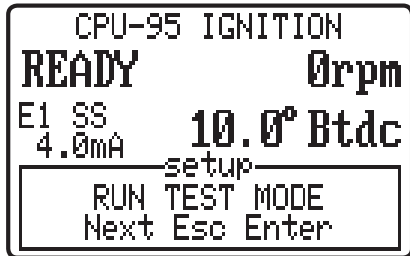


To enter the password press, use the function keys F1, F2, F3, F4 where F1=1, F2=2, F3=3, F4=4 where the number entered is equal to the user assigned five digit password. After the last digit of the proper password is entered, the **VALUE PROTECTION** menu shown above will appear. If the password is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

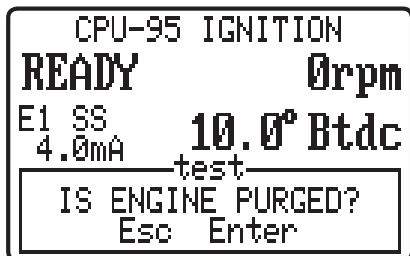
- 9.7 The last setup screen permits the operator to enter an ignition test mode. This test mode can fire all outputs in rotation, or individual outputs at a slow rate. This feature can be used to troubleshoot primary wiring and Output Module operation. Test mode will terminate if rotation of the engine 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



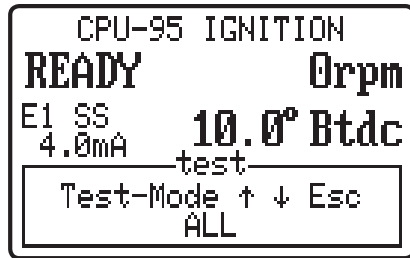
THEN BEFORE STARTING TEST MODE



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

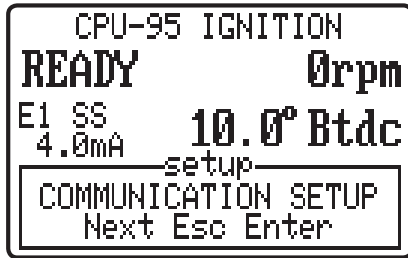


Test-Mode selection rotates as described below.

| 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



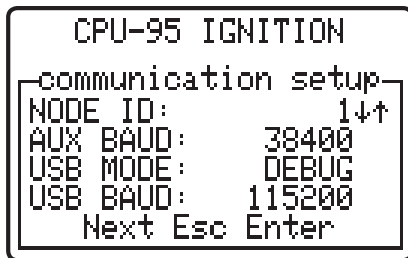
PRESS TO
GO TO THE
NEXT MENU



PRESS TO
EXIT



AT



PRESS TO
MODIFY
THE VALUE



PRESS TO
ADVANCE TO
THE NEXT
SELECTION



PRESS TO
GO TO THE
NEXT MENU



PRESS TO
EXIT

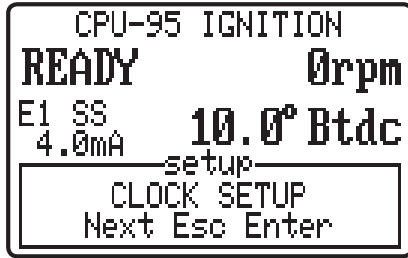


Node ID can be set anywhere from 1 to 254. The auxiliary RS-485 (Modbus RTU) port can have the following baud rates 9600, 19200, 38400, 57600, 115200. Always no parity, 8 data bits, and 1 stop bit (N81). The USB port has the following modes: **TERMINAL**, **MODBUS RTU**, and **DEBUG**. The **TERMINAL** 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



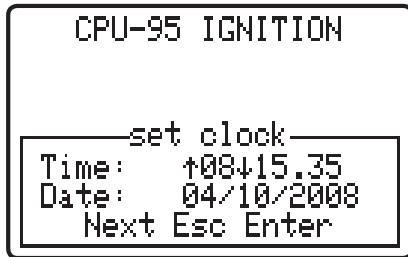
PRESS TO
GO TO THE
NEXT MENU



PRESS TO
EXIT



AT



PRESS TO
MODIFY
THE VALUE



PRESS TO
ADVANCE TO
THE NEXT
SELECTION



PRESS TO
GO TO THE
NEXT MENU



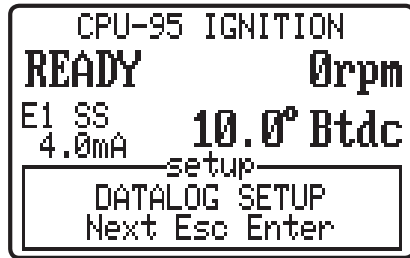
PRESS TO
EXIT



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



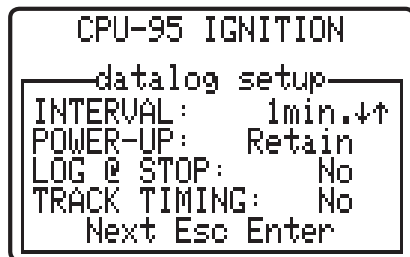
PRESS TO
GO TO THE
NEXT MENU



PRESS TO
EXIT



AT



PRESS TO
MODIFY
THE VALUE



PRESS TO
ADVANCE TO
THE NEXT
SELECTION



PRESS TO
GO TO THE
NEXT MENU



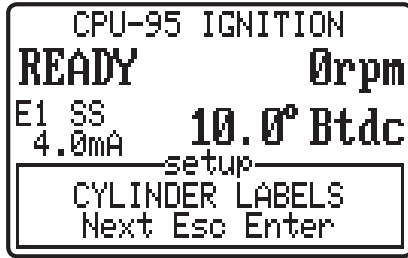
PRESS TO
EXIT



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



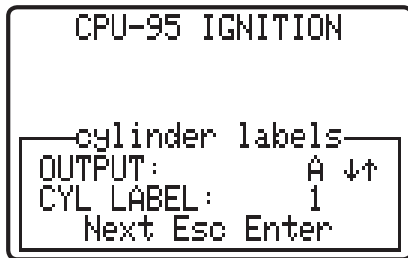
PRESS TO
GO TO THE
NEXT MENU



PRESS TO
EXIT



AT



PRESS TO
MODIFY
THE VALUE



PRESS TO
ADVANCE TO
THE NEXT
SELECTION



PRESS TO
GO TO THE
NEXT MENU



PRESS TO
EXIT

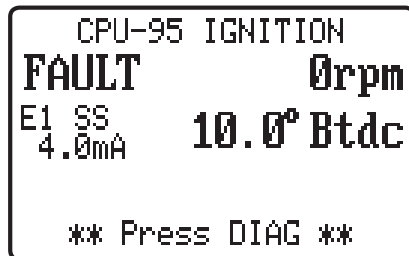


10.0 CPU-95 DIAGNOSTICS

NOTE: Diagnostic FAULTS will supersede diagnostic WARNINGS.

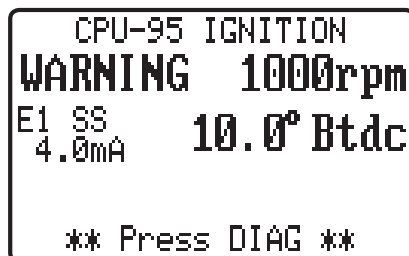
10.1 A diagnostic fault represents the most severe classification of problems. The presence of a diagnostic fault will inhibit the ignition from firing. When a fault is detected several things will occur:

- 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.

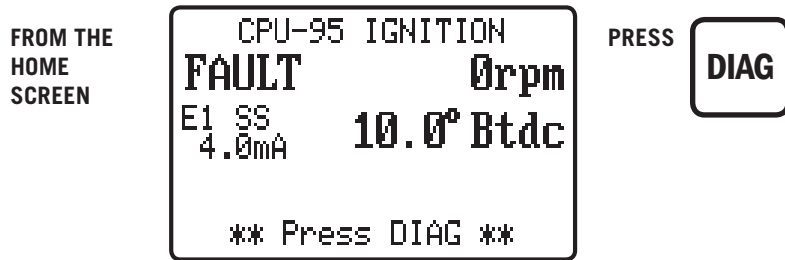
PRESS



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.

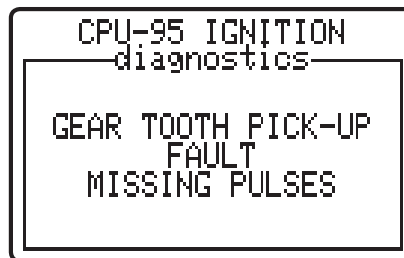


Then from the diagnostic description screens use the following keys.

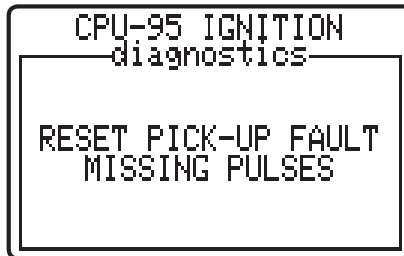


10.5 Diagnostic Fault screens, in order of display priority:

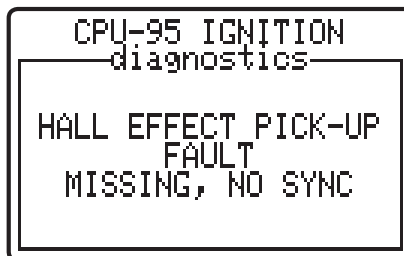
When zero gear-tooth pulses are seen between two reset pulses.



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

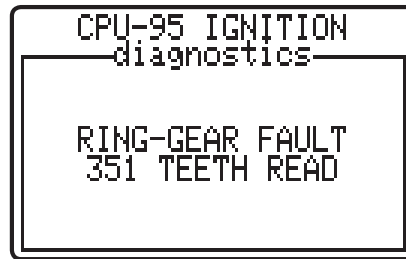


When there are no Hall-effect pickup pulses or when the pickups are not synchronized.



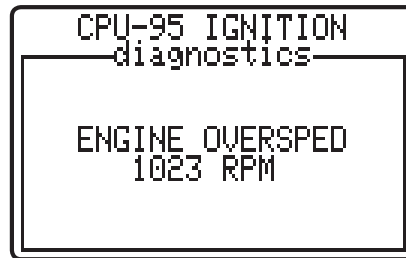
When too many or too few gear-tooth pulses are seen between reset pulses.

The received number of pulses is displayed.



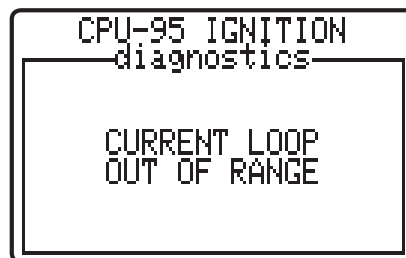
When the engine speed exceeds the overspeed setpoint.

Maximum observed speed is also displayed.

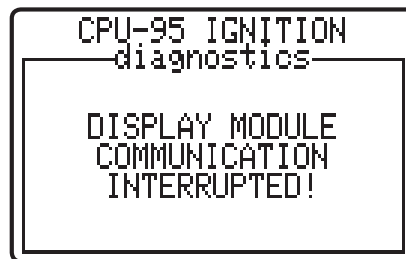


10.6 Diagnostic Warning screens, in order of display priority:

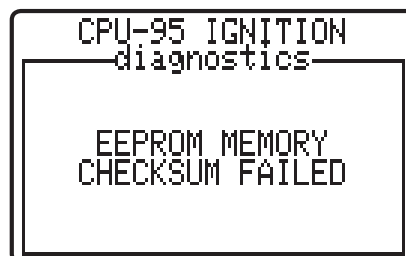
This screen indicates that the current-loop has deviated outside the limits of 2 mA and 22 mA. The current loop follows the configured curve which is specified from 0-25 mA. This diagnostic is active only if the current loop retard is on.



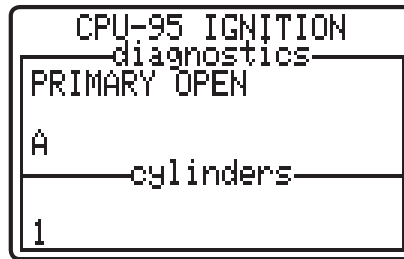
This screen indicates that at some point no loop data was received from the Display Module. In this condition, the timing for 0 mA is used. This test is active only if the current loop retard is on.



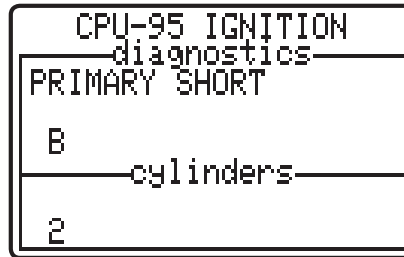
This screen indicates that the firing pattern configuration data saved in EEPROM memory is incorrect or incomplete. The EEPROM memory must be reprogrammed or replaced.



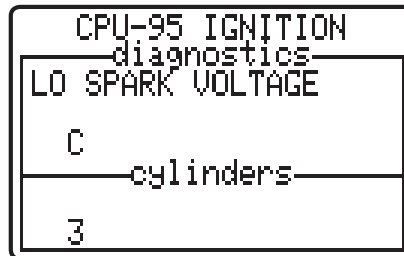
This screen indicates that diagnostics have identified an open circuit on the primary output pin A (Cyl 1). Normally indicates faulty wiring or a failed coil.



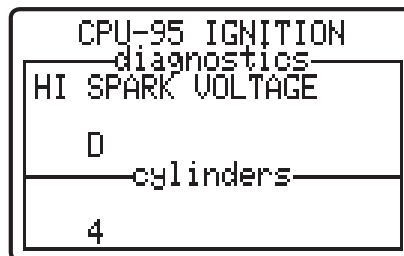
This screen indicates that diagnostics have identified a short circuit condition on the primary output pin B (Cyl 2). This would normally indicate a coil is miswired, or the primary wire is shorted.



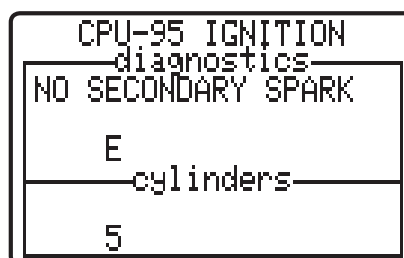
This screen indicates that the diagnostics have identified a low spark demand condition on the plug at the C coil (Cyl 3). This is often caused by a shorted spark plug or shorted secondary wire.



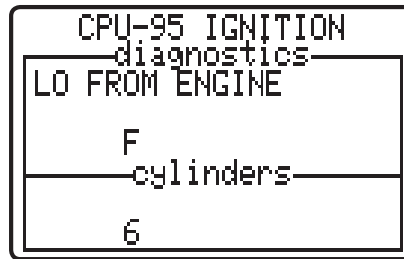
This screen indicates that the diagnostics have identified a high spark demand condition on the spark plug at the D coil (Cyl 4). This is often caused by worn spark plugs.



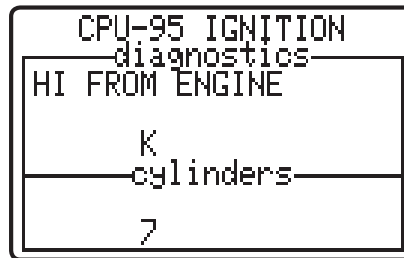
This screen indicates that the diagnostics have identified a no spark condition on the plug at the E coil (Cyl 5). No spark occurred since the demand was greater than the output capability of the coil.



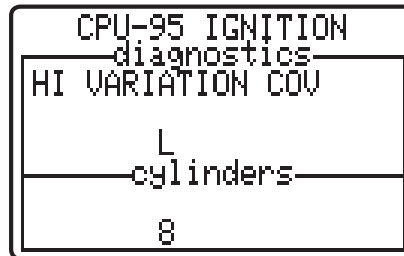
This screen indicates that the diagnostics have detected a condition where the average value of output F (Cyl 6) is significantly lower than the average of all the active outputs on the engine.



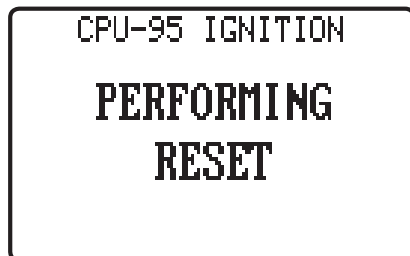
This screen indicates that the diagnostics have detected a condition where the average value of output K (Cyl 7) is significantly higher than the average of all the active outputs on the engine.



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



PRESS



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

```

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
133 CAUG
Spk Offset 119 EAUG
+15 0 COV
    
```

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.

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

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.

- 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

```

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

P2A360.FS1 #001
    
```

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.

```

CPU-95 IGNITION
READY 0rpm
E1 SS 10.0° Btdc
4.0mA threshold
LO SPARK VOLTAGE
Next Esc < 60↑↑
    
```

PRESS
TO VIEW
NEXT
CYLINDER

F2

TO VIEW
GRAPH OF
CURRENT
CYLINDER

NEXT

PRESS
TO ADJUST
SPARK
OFFSET

ESC

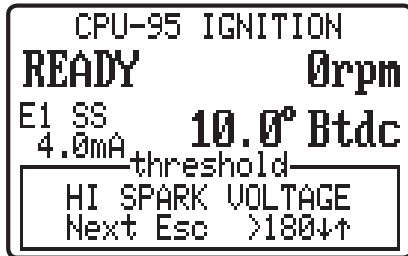
PRESS TO
INCREASE
THRESHOLD

↑

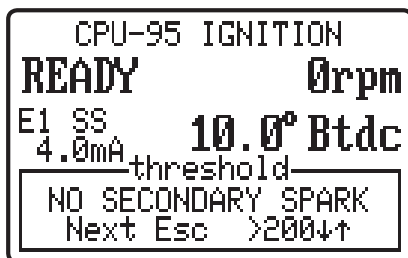
PRESS TO
DECREASE
THRESHOLD

↓

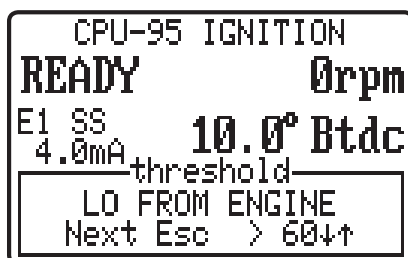
- 12.3 If the CAVG reference number of a cylinder is above the **HI SPARK VOLTAGE** threshold, a diagnostic warning for that cylinder will occur. When a high spark warning is present, the ignition energy will automatically be increased to at least E2. This test will identify a high voltage demand condition 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.

```

CPU-95 IGNITION
READY          0rpm
E1 SS         10.0° Btdc
4.0mA threshold
HI FROM ENGINE
Next Esc > 60↑
    
```

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.

```

CPU-95 IGNITION
READY          0rpm
E1 SS         10.0° Btdc
4.0mA threshold
HI VARIATION COV
Next Esc >255↑
    
```

Default = 255 (disabled)

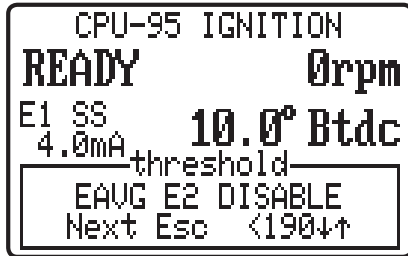
- 12.8 If the EAVG reference number is greater than the **EAVG E2 ENABLE** threshold, the energy will be increased to at least E2. This feature can be used to automatically increase the spark energy as the voltage demand of the engine increases.

```

CPU-95 IGNITION
READY          0rpm
E1 SS         10.0° Btdc
4.0mA threshold
EAVG E2 ENABLE
Next Esc >200↑
    
```

Default = 200

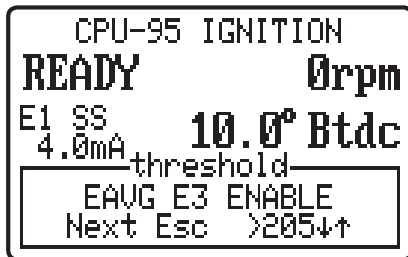
- 12.9 If the energy is at level E2 and if the base energy setting under the Setup key is E1, then the **EAVG E2 DISABLE** threshold setting is used to automatically decrease the energy from E2.



Default = 190

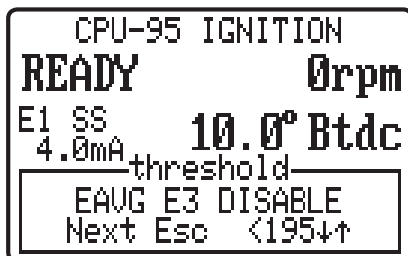
NOTE: This threshold must be at least 2 counts below the EAVG E2 ENABLE threshold. SEE SECTION 12.8

- 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.

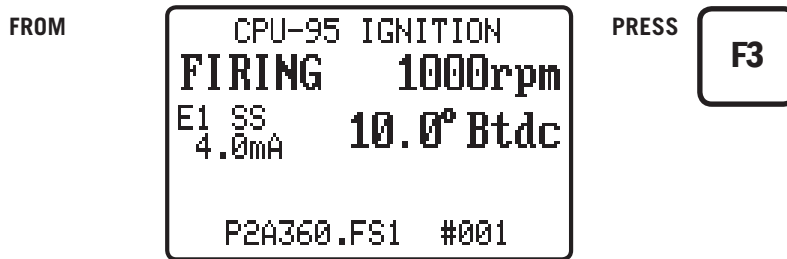


Default = 195

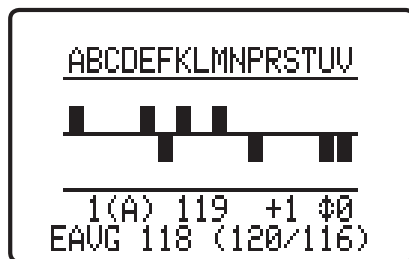
NOTE: This threshold must be at least 2 counts below EAVG E3 ENABLE threshold. SEE SECTION 12.10

13.0 GRAPHING

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



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



PRESS TO
INCREASE/
DECREASE
THE ZOOM



PRESS TO INCREMENT
THE CYLINDER BEING
VIEWED



PRESS TO ACCESS THE
CURRENT SELECTED
CYLINDER GRAPH



PRESS TO VIEW THE
CURRENT SELECTED
CYLINDER



PRESS TO ADJUST THE
CURRENT SELECTED
CYLINDER SPARK OFFSET



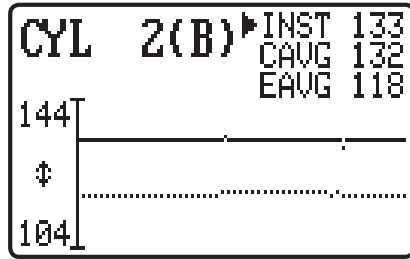
PRESS TO ADJUST THE
CURRENT SELECTED
CYLINDER TIMING OFFSET



PRESS TO EXIT



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



PRESS TO CHANGE THE
LAYOUT OF THE GRAPH



PRESS TO VIEW THE
DATALOG 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

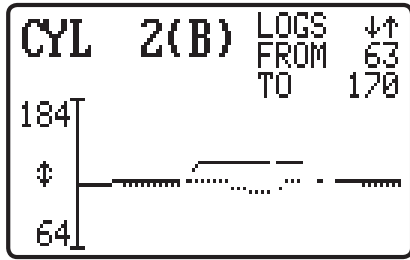


PRESS TO EXIT



Pressing ENTER the first time will display \updownarrow 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 \up 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

```

CPU-95 IGNITION
SHUTDOWN      0rpm
E1 SS        10.0° Btdc
4.0mA
P2A360.FS1 #001
    
```

PRESS

AUTO

```

CPU-95 IGNITION
SHUTDOWN      0rpm
-----auto tasks-----
IGN. EEPROM MGMT.
↓BACKUP/program↑
Next Esc Enter
    
```

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.

```

CPU-95 IGNITION
-----eeprom backup-----
OVERWRITE STORED
P2A180.FS123#097
Unit 791 950-16
Esc Enter
    
```

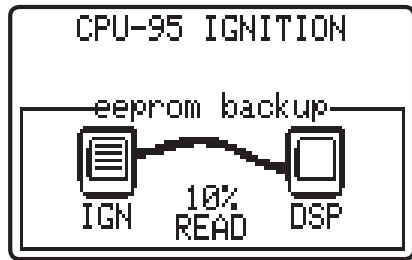
PRESSTO
CONTINUE
WITH THE
BACKUP

ENTER

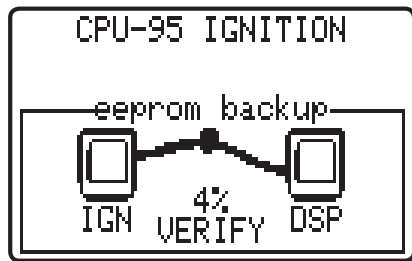
PRESSTO
EXIT

ESC

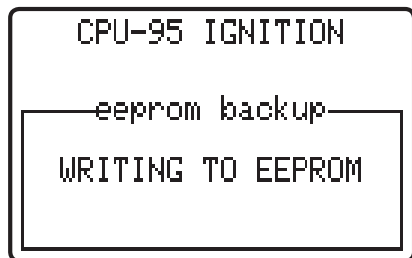
The first phase of the backup is to read the ignition eeprom contents.



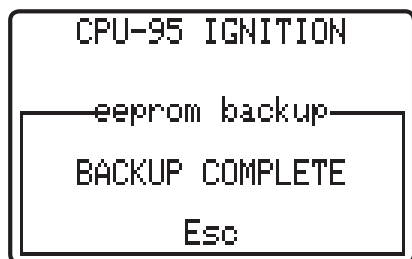
The second phase is to read the ignition again for verification.



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



Done.

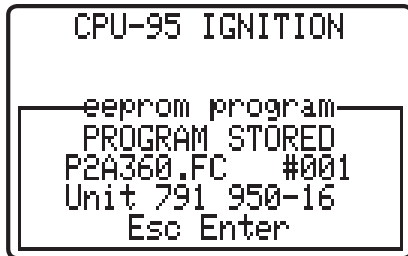


PRESS TO
EXIT



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.



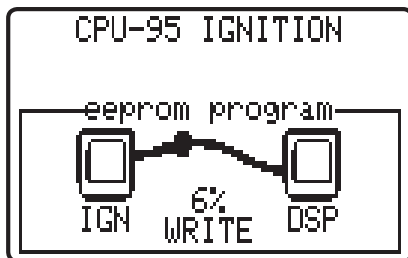
PRESS TO
CONTINUE
PROGRAMMING



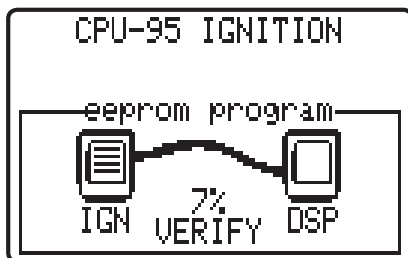
PRESS TO
EXIT



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.

```
CPU-95 IGNITION
-----
EEPROM PROGRAM
RESETTING
IGNITION
```

Done.

```
CPU-95 IGNITION
-----
EEPROM PROGRAM
PROGRAMMING
COMPLETE
Esc
```

PRESS TO
EXIT



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 HI FROM ENGINE | OK | Warning | |
| 10037 | WARN LO 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 (internal) | | | |
| 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 HI FROM ENGINE (A or A1) | OK | Warning | |
| 10093 | WARN LO 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 HI FROM ENGINE (B or A2) | OK | Warning | |
| 10101 | WARN LO 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 HI FROM ENGINE (C or B1) | OK | Warning | |
| 10109 | WARN LO 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 HI FROM ENGINE (D or B2) | | OK | Warning | |
| 10117 | WARN LO 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 HI FROM ENGINE (E or C1) | | OK | Warning | |
| 10125 | WARN LO 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 HI FROM ENGINE (F or C2) | | OK | Warning | |
| 10133 | WARN LO 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 HI FROM ENGINE (K or D1) | | OK | Warning | |
| 10141 | WARN LO 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 HI FROM ENGINE (L or D2) | | OK | Warning | |
| 10149 | WARN LO 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 HI FROM ENGINE (M or E1) | | OK | Warning | |
| 10157 | WARN LO 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 HI FROM ENGINE | (N or E2) | OK | Warning | |
| 10165 | WARN LO 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 HI FROM ENGINE | (P or F1) | OK | Warning | |
| 10173 | WARN LO 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 HI FROM ENGINE | (R or F2) | OK | Warning | |
| 10181 | WARN LO 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 HI FROM ENGINE | (S or K1) | OK | Warning | |
| 10189 | WARN LO 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 HI FROM ENGINE | (T or K2) | OK | Warning | |
| 10197 | WARN LO 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 HI FROM ENGINE (U or L1) | OK | Warning | |
| 10205 | WARN LO 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 HI FROM ENGINE (V or L2) | OK | Warning | |
| 10213 | WARN LO 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 HI FROM ENGINE (M1) | OK | Warning | |
| 10221 | WARN LO 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 HI FROM ENGINE (M2) | OK | Warning | |
| 10229 | WARN LO 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 HI FROM ENGINE (N1) | OK | Warning | |
| 10237 | WARN LO 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 HI FROM ENGINE (N2) | OK | Warning | |

| Register | Label | 0 | 1 | Notes |
|---------------|----------------------------|----|---------|-------|
| 10245 | WARN LO 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

