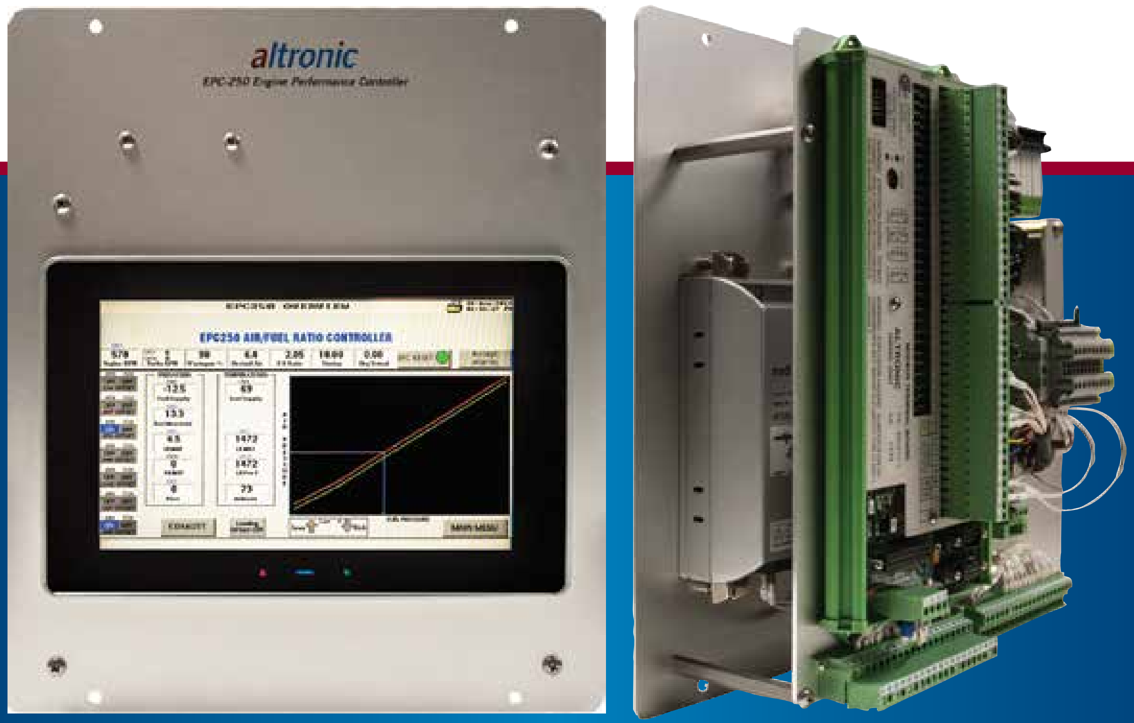
Installation and Operating Instructions

Engine Performance Controller

Form EPC-250 IOI 6-18

altronic



altronic
HOERBIGER Engine Solutions

1.0 SYSTEM DESCRIPTION

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

1.1 The Altronic EPC-250 engine performance controller is a device designed to maximize engine performance and efficiency. The controller is specifically designed to control ignition timing and air/fuel ratio on spark-ignited, turbocharged, fuel-injected gas engines allowing for the total replacement of traditional pneumatic control systems. The EPC-250 is intended as a direct field replacement for the existing legacy EPC-200 with little to no wiring retrofit. The user-friendly interface allows easy configuration of the legacy EPC-200 functionality thru a touch screen display. Visual representation of control parameters via trending can also be displayed on the touch screen to aid in engine tuning.

1.2 In addition to Engine RPM, up to four other analog inputs can be used as control variables. The additional four analog inputs can be scaled to represent desired engineering units.

1.3 The EPC-250 operator interface is built around an 8.4" TFT 23K VGA 640 x 480 pixel LCD display high performance core with integrated functionality. The application's configuration is stored in a non-volatile memory (32MB flash). The EPC-250 incorporates a SD Memory card to increase memory capacity, collect trending and data logging information, and store larger configuration files.

1.4 EPC-250 TYPICAL CONTROL FUNCTIONS

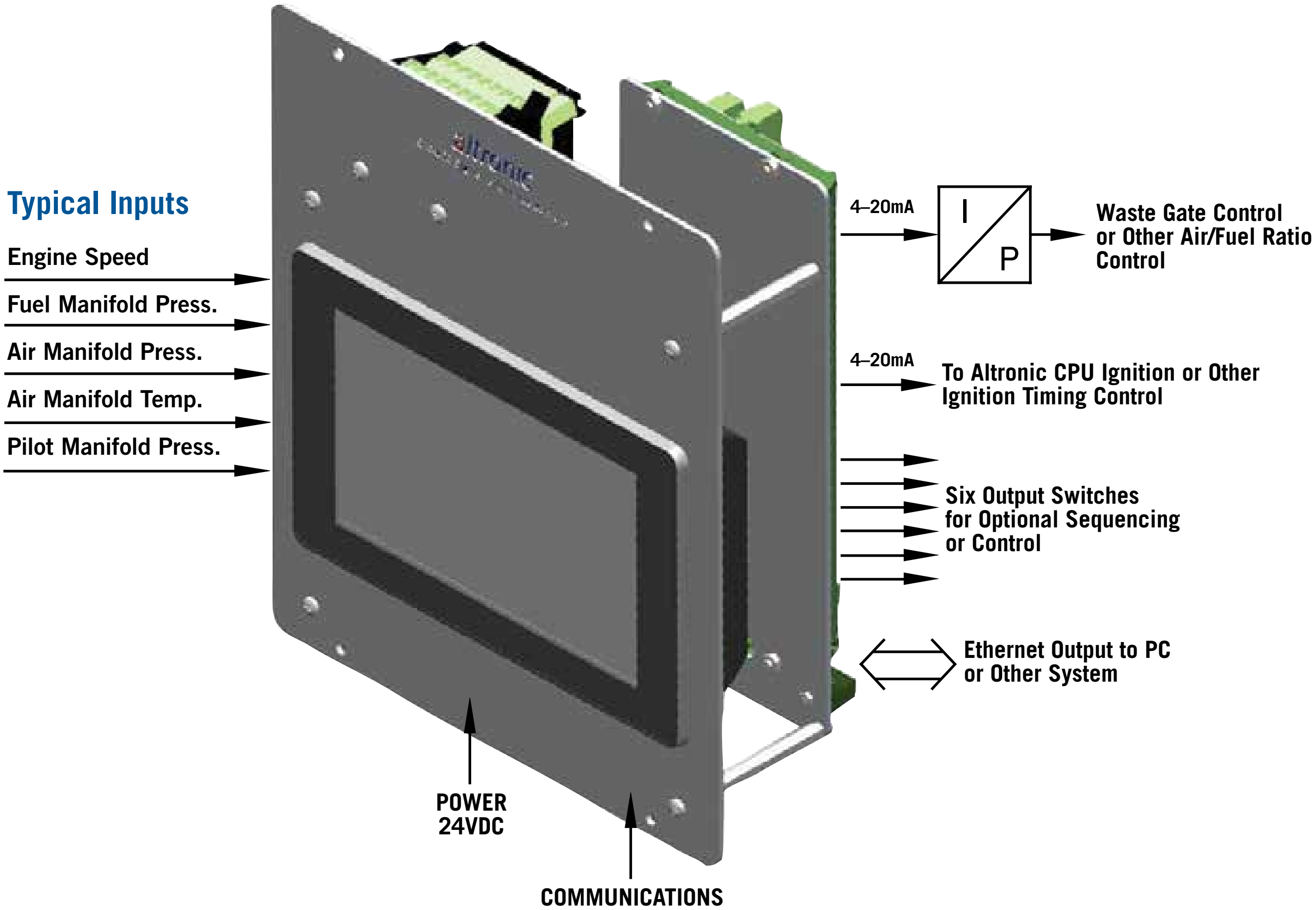
A. IGNITION TIMING RETARD
Ignition Timing Retard vs. Engine Speed
Ignition Timing Retard vs. Fuel Manifold Pressure
Ignition Timing Retard vs. Air Manifold Pressure
Ignition Timing Retard vs. Air Manifold Temperature
Ignition Timing Retard vs. Pilot Manifold Pressure
Ignition Timing Retard vs. Exhaust Manifold Temperature

The operating values for the functions above are calculated separately according to user entered curves, and the combined net effect is implemented by the EPC-250 Controller in a PID format.

B. AIR/FUEL RATIO
Air Manifold Pressure vs. Fuel Manifold Pressure
Air Manifold Pressure vs. Engine Speed
Air Manifold Pressure vs. Exhaust Temperature
Air Manifold Pressure vs. Pilot Manifold Pressure
Air Manifold Pressure vs. Air Manifold Temperature

The operating values for the functions above are calculated separately according to user entered curves, and the combined net effect is implemented by the EPC-250 Controller.

C. AUXILIARY OUTPUT FUNCTIONS (typical)
Spare .... (Output 1)
Speed OP2 .... (Output 2)
Speed OP3 .... (Output 3)
Timer 1 .... (Output 4)
Timer 2 .... (Output 5)
Over Crank .... (Output 6)
Spare .... (Output 7)
Fault .... (Output 8)



2.0 MOUNTING THE EPC-250

2.1 The EPC-250 is preferably panel-mounted off the engine in such a manner as to minimize exposure to vibration. It has been designed as an easy retrofit for the existing EPC-200 with little to no rewiring needed.

2.2 The EPC-250 controller should be mounted within 50 ft. of the exhaust stack of the engine.

2.3 Operating temperature range: -4° – 140°F / -20° – 60°C
Storage temperature range: -20° – 70°C
Storage humidity: 80% maximum relative humidity (non-condensing) from 0 to 50°C.

The EPC-250 is not rain and weather resistant. The mounting site should provide as much protection from inclement weather as possible.

3.0 WIRING

3.1 **Power**

When replacing an EPC-200, remove the 3-pin power terminal from the device and plug it into the power input terminal of the new EPC-250. Power requirement is 24Vdc (48 watt max.).

The EPC-250 is designed to accept the Legacy EPC-200 wiring input termination, which provides an easy swap of the two 20-pin terminals with their pre-wire arrangement.

Proper panel/system ground must be implemented to provide an alternative path for fault current flow, and limit the voltage-rise induced on powered circuits, typically via lightning, welding, voltage spikes, or unintentional contact with higher-voltages.

3.2 **Discrete Inputs Sensor Wiring**

- Normally-open (N/O) sensors are wired with one wire to the bottom terminal strip of the respective sensor number and the other to engine ground, which should be the same as power minus (–). A short jumper from the bottom terminal to the top terminal must be connected for normally-open sensors (see wiring diagrams).
- Normally-closed (N/C) sensors are wired with one wire to the bottom terminal strip and the other to the top terminal strip of the respective sensor number. Note that the short jumper wire must be removed.

Use a wire size between 16 AWG (max.) and 24 AWG (min.) to connect the sensor switches to the terminal strip connector. Strip the insulation back 3/8" and twist the exposed wires tightly together. Insert the exposed wire completely into the terminal strip and securely tighten the clamping screw. Wires running to sensor switches must be in good condition or replaced with new wires. When running wires, take care not to damage the insulation and take precautions against later damage from vibration, abrasion, or liquids in conduits. An explosion-proof conduit is not required. Wires should be protected from damage by running them in a protective conduit or in sheaths when required. In addition, it is essential that the following practices be adhered to:

A. Never run sensor wires in the same conduit with ignition wiring or other high energy wiring such as the AC line power.

B. Keep secondary wires to spark plugs and other high voltage wiring at least eight inches (200mm) away from sensor and sensor wiring.

C. If it becomes necessary to check sensor switch, first DISCONNECT the sensor from the terminal strip of the modbus terminal board. Applying voltage to the Modbus terminal board through the sensor leads may damage the device. The area should be tested as non-hazardous before such testing commences.

3.3 **Analog Sensor Wiring**

For each analog monitored point, select a transducer—either an Altronic pressure or temperature transducer listed above or one that outputs a signal in the range of 0 to 5Vdc or 0 to 25mA. Mount as described above. Use cable assembly 693008-x or similar to wire transducer to the Modbus terminal board. An internal 5 volt sensor supply (500mA max.) is available to power the Altronic transducers; see wiring diagrams. If the 5 volt sensor supply exits the panel, it must be fused with a 0.5 ampere fuse. If 24Vdc powered sensors are used, the 24 volt supply to them must be fused appropriately. Take caution not to damage the insulation when installing and take precautions against later damage from vibration, abrasion, or liquids in conduits.

3.4 **Thermocouples and Thermocouple Extension Wire**

Only ungrounded type J or K thermocouples may be used. Use thermocouple extension wire of the same type as the thermocouple probe to connect to the terminal module. Use stranded thermocouple wire having a moisture-resistant insulation such as PVC; for higher ambient temperatures, Teflon- or fiber-insu-

Note: Voltage and current supplied must be sufficient to operate all transducers used in the installation.

Note: The (+) and (-) terminals of the EPC-250 are polarity sensitive.

NOTE: A power supply with an NEC Class 2 or Limited Power Source (LPS) and SELV rating is to be used. This type of power supply provides isolation to accessible circuits from hazardous voltage levels generated by a mains power supply due to single faults. SELV is an acronym for "safety extra-low voltage." Safety extra-low voltage circuits shall exhibit voltages safe to touch both under normal operating conditions and after a single fault, such as a breakdown of a layer of basic insulation or after the failure of a single component has occurred.

IMPORTANT: Pressure transducers will withstand overloads as high as 1.5 times rated pressure. If the overload rating is exceeded, failure may occur. Pressure fluctuations occur in most reciprocating systems; pick the transducer with a rating high enough to prevent overload by peak pressures of pulsations. It is recommended that a pressure snubber be used which will reduce the peak pressure applied to the transducer. The life of the transducer will be extended with the use of a snubber or pulsation dampener.

IMPORTANT: Do not exceed the absolute maximum rating of the transducers, 350°F (176°C) for the 691202/203-300 or 450°F (232°C) for the 691212/213-450. Care should be taken to protect the wiring and connectors from contact with hot surfaces.

lated thermocouple wire is recommended. To ensure that an accurate signal is transmitted to the device, avoid any added junctions, splices and contact with other metals. On unused channels, leave the small jumper wire supplied with the system in place. Be careful not to damage the insulation when installing and take precautions against later damage from vibration, abrasion, or liquids in conduits. In addition, it is essential that the following practices be adhered to:

A. Never run sensor wires in the same conduit with ignition wiring or other high energy wiring such as AC line power.

B. Keep secondary wires to spark plugs and other high voltage wiring at least eight inches (200mm) away from sensor and sensor wiring.

3.5 RS-485 Communications

The EPC-250 incorporates a half-duplex RS-485 port via the HMI which is Modbus RTU slave compliant with the Modbus terminal board.

NODE: 1
BAUD RATE: 38.4K
DATA BITS: 8
PARITY: No
STOP BITS: 1
Baud Rate, Data Bits, Parity, and Stop Bits are fixed and cannot be changed.

The node number indicated by the mechanical switch on the Modbus Terminal Board must be set to position 1.

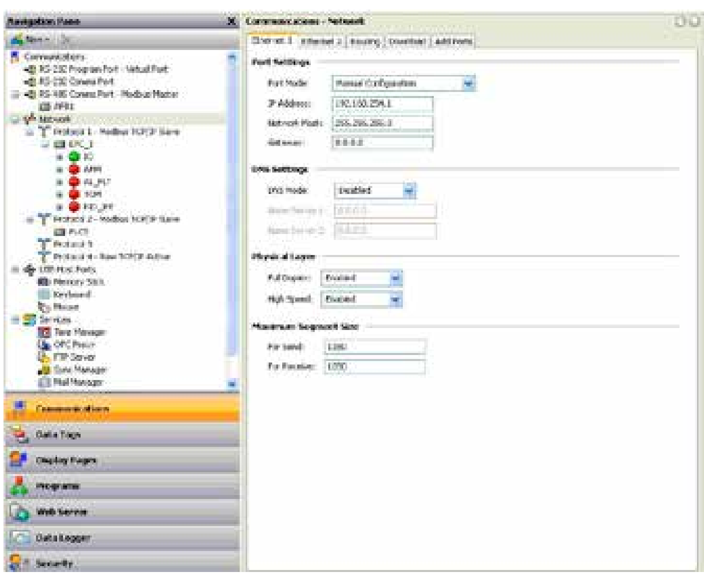
3.6 HMI Ethernet Communications

The IP network configuration of the EPC-250 is edited via the network icon in the navigation pane. The pane has been purposely configured and is not accessible for security purposes. If a specific network configuration is required it should be requested during ordering.

Ethernet communication can be established at either 10 Base-T or 100 Base-TX. The device's RJ45 jack is wired as a NIC (Network Interface Card). For example, when wiring to a hub or switch use a straight-through cable, but when connecting to another NIC use a crossover cable. A default Ethernet port has been dedicated with the following configuration:

PROTOCOL: Modbus TCP/IP Slave
PORT MODE: Manual Configuration
IP ADDRESS: 192.168.254.1
NETWORK MASK: 255.255.255.0
GATEWAY: 0.0.0.0

A specific Network configuration can be program on request when ordering a unit.



3.7 **Touch Icons**
There are three soft keys below the display area that have been programmed to a designated page. The home icon is the Main Menu page, Blue dash Air PID SETPOINTS page and Exclamation ICon takes user to the Alarms page.

3.8 **SD Memory Card**
SD slot accepts standard capacity cards up to 4Gbyte. SD Memory cards can be used for configuration transfers, larger configurations, data logging and trending. They are available at most computer and office supply retailers.

Note: Do not remove or insert the SD Memory card while power is applied. A card with a larger capacity may be used. Cards MUST be formatted to 2GB and use the FAT 16 file system. The card must remain inserted while operating the EPC-250.

4.0 TERMINAL BOARD

4.1 The Modbus Terminal Board (MTB) is the input card to the HMI. Pressure and temperature input signals are accept via the two terminal connections for each Channel. Each channel is predetermined by the wiring schematic of figure 4. Sensors 2, 3, 7 and 27 are pre-wired based on the Legacy EPC-200 existing terminal connection. All other sensors will be wired directly to the MTB terminal connection. These sensors can be used for either a normally-open switch, normally-closed switch, or analog inputs including K- or J-type thermocouples. These are listed as channels 01–30. They accept industry-standard transducer signals in the range of 0-5Vdc.

4.2 The Modbus Terminal Board is designed to operate with industry-standard voltage—or current-amplified—output transducers in the range of 0-5Vdc or 0-25mA. Four series of transducers are available from Altronic: pressure transducers (691201-x, 691204-x) and temperature transducers (691202/203-300, 691212/213-450).

4.3 **Pressure Transducers**
The pressure transducers (Altronic P/N 691201-x and P/N 691204-x) are packaged in a rugged, sealed case with a NPT pressure port, a corrosion resistant media cavity, and a Metri-Pack connector. The ranges available are 0-15, 0-25, 0-50, 0-100, 0-300, 0-500, 0-1000, 02000, and 0-5000PSIG for the 691201-x series; and 0-15, 0-20, 0-30, 0-50, 0-100, 0-300, 0-500PSIA for the 691204-x series. All have an overload rating of 1.5 times full scale without damage. The three wires from the transducer are: +5 volt excitation, +0.5 to 4.5 volt output, and minus return.

4.4 **Temperature Transducer**
The temperature transducers (Altronic P/N 691202-300, 691203-300 with a temperature measurement range of +5 to 300°F and the 691212-450, 691213-450 with a temperature range of -40 to +450°F) are packaged in a sealed, stainless steel housing with a 5/8" 18 UNF threaded body, and a Metri-Pack connector. During configuration the standard calibration for the 691202/203-300 sensor is selected as dEG1 and the standard calibration for the 691212/213-450 is selected by choosing dEG2. The three wires from the transducer are: +5 volt excitation, temperature output voltage, and minus return. These wires connect directly to the terminal board using cable assembly P/N 693008-x.

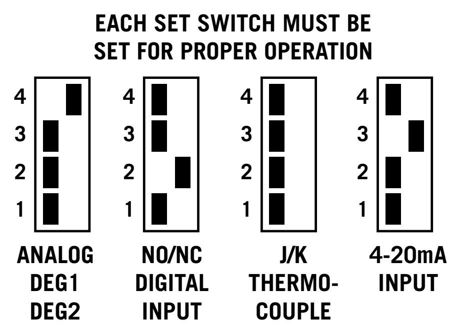
4.5 **Thermocouple Inputs**
The terminal board can accept industry standard type J or K thermocouples. Automatic cold junction compensation is built-in. The units can be configured to °F or °C. Both a high and low setpoint is associated with each channel. The monitor can read type J thermocouples between -76°F and +1382°F (-60°C and +750°C) and type K thermocouples between -76°F and +1472°F (-60°C and +800°C).

4.6 **N/O and N/C Inputs**
The inputs can also accept standard normally-open and normally-closed contacts. Refer to figure 2 for proper wiring of these types of inputs.

4.7 **4-20mA Inputs**
The terminal board can accept 4-20mA inputs by selecting the internally connected 200 ohm resistors, creating a termination voltage of .8 to 4.0 volts. The jumper wires between the + and – terminals for that channel must be connected for proper operation.

4.8 For each input, the corresponding CHANNEL SWITCH must be set according to the input type. Switches are turned ON by moving them toward the ANALOG OUT labeling.

4.9 Digital outputs 1 through 8 turn on to common ground when closed. Outputs 1 through 8 are rated at 500mA, 60V.



5.0 HAZARDOUS AREA OPERATION

5.1 The EPC-250 is CSA certified for CLASS I, DIVISION 2, GROUPS C and D areas, when mounted in a suitable enclosure.

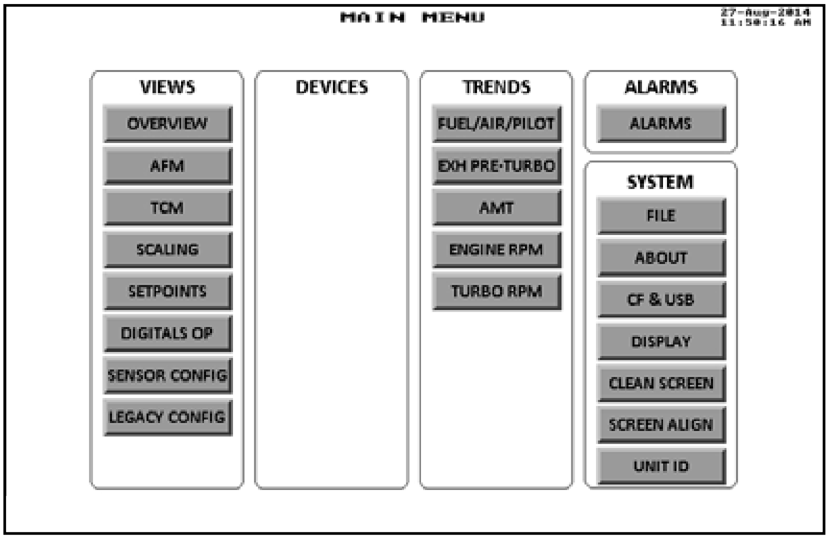
In addition, the following requirements must be met (refer to NFPA standard No. 493):

- The low voltage sensor switch wires within the panel enclosure must be kept at least two (2) inches away from other wiring. Run the sensor switch wires leaving the panel in a separate conduit from all other wiring and keep them separate.
- Wiring to the sensors must have a grade of insulation capable of with- standing an AC voltage of 500 volts RMS.
- Sensor wires must be run in separate conduits and junction boxes from high voltage wires such as ignition, fuel valve, and other high voltage wiring.

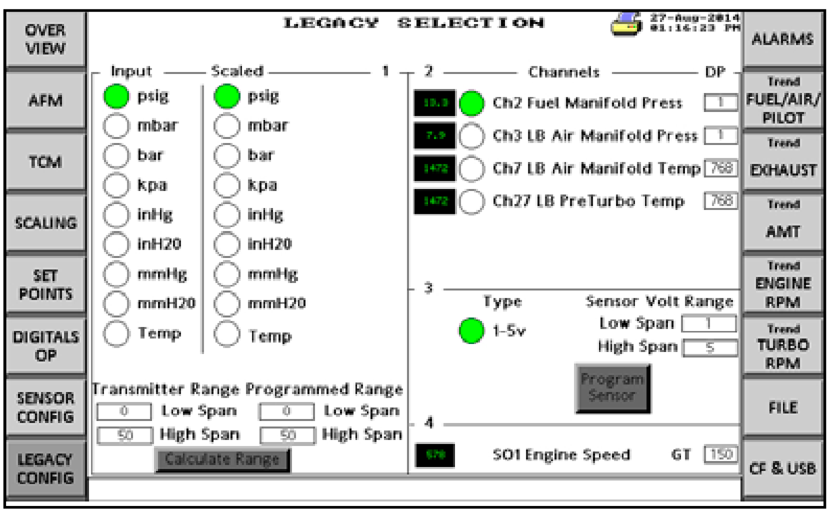
6.0 SEQUENCE OF OPERATION

6.1 Apply power to unit. The display will automatically revert to the OVERVIEW page as the home page on start-up.

6.2 Pressing the Menu button displays the MAIN MENU screen.



6.3 Press LEGACY CONFIG to view the configuration screen for the legacy EPC-200 inputs.



When replacing an existing EPC-200, the end devices require configuration within this screen as described below prior to calibrating any channel.

6.4 **Section 1 (Input/Scaled)**
Nine different device types can each be scaled to the desired units. Each pressure signal can be displayed in 8 different units.

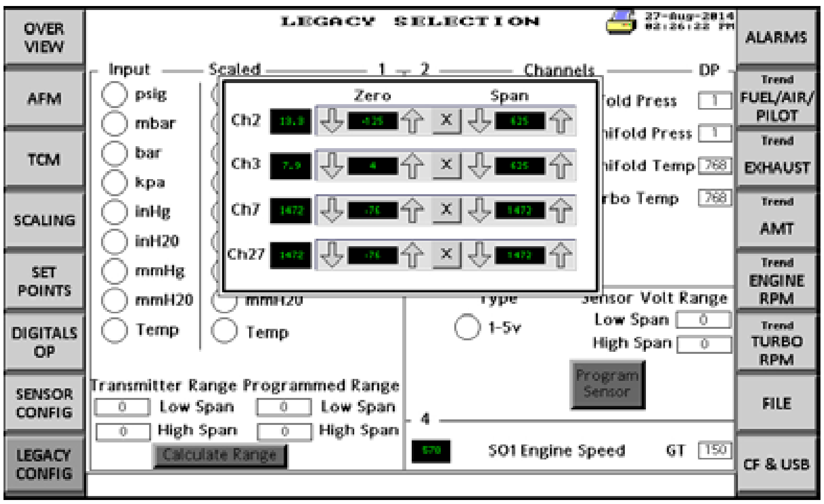
6.5 **Transmitter Range**

Each input channel requires a low and high span of the transmitter range and is a user input for the program to calculate the range for each designated input channel. Ensure that the units and span matches the selected device. The calculated range value will be used to calculate the desired units to be displayed. The displayed value of the programmed range is the calculated range based on the units selected. This value is also an aid to calibrating the sensor span in the calibration page.

6.6 **Section 2 (Channels)**

Allows the user to select the channel to be configured, with the option of adding decimal points to the value. A calibration pop-up window is available when selecting the desired channel value; it allows adjusting of the Zero and Span of the transmitter for each of the four channels.

The Up/Down arrows can be used to approach the desired span value. If a precise value is desired, click the input box for that signal and enter the value.



6.7 **Decimal Point (DP)**

Used to set the number of decimal places to display.

6.8 **Section 3 (Type)**

Legacy configuration will only allow for a 1-5V transmitter range, imitating the limitations of the EPC-200. A Sensor Volt Range span is available for custom voltage devices.

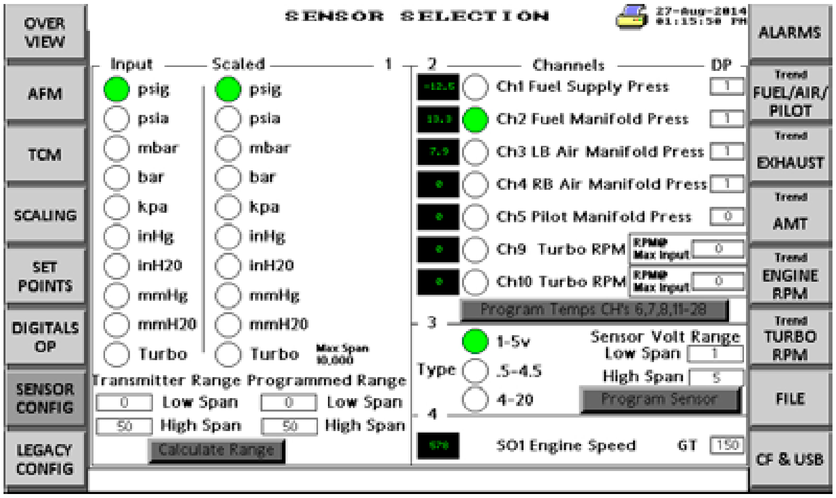
6.9 **Section 4 (Engine Speed)**

Displays the actual RPM value and allows the user to enter the gear tooth count or pulses per revolution for the engine.

6.10 From the Menu button, select AFM (Air/Fuel Menu) to display the Air/Fuel ratio curve configuration. By default the program assumes the PID page as the home position. In addition to the PID control page, five supplementary control functions can be selected.

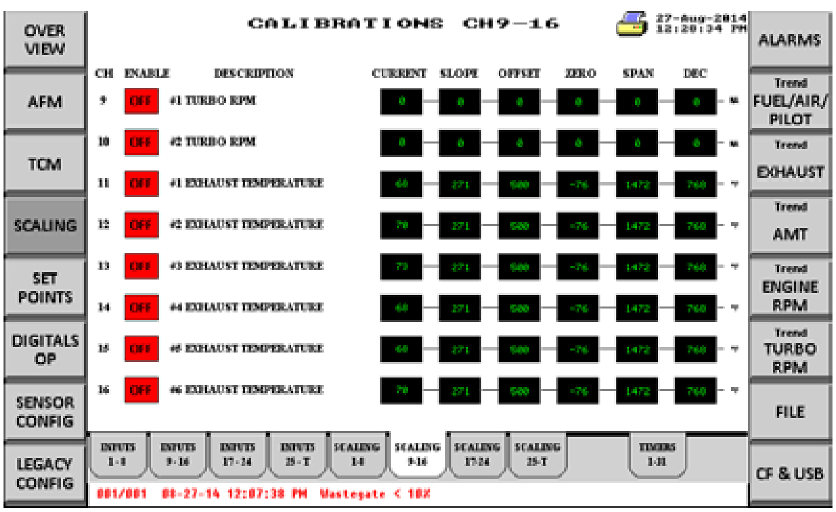
6.11 In addition to the legacy sensor configuration page, a second option is available that allows two addition sensor type to be use. The EPC-250 accepts .5–4.5V and 4–20mA inputs which must be programmed within this configuration page. Before the input can be programmed as 4-20mA it must be selected on the terminal board by the CHANNEL SWITCH that internally connects a 200

Ohm resister creating a termination voltage of .8 to 4.0 volts. The jumper wires between the (+) and (–) terminals for that channel must be connected.



7.0 Analog Inputs Calibration

The EPC-250 allows 31 analog inputs which have been carefully pre-assigned to a dedicated channel which can be enabled for any application as needed. When using any of the inputs it must be Enabled and calibrated thru its group page as shown below.



7.1 **CH (Channel)**
Denotes the channel number to be configured (1–31).

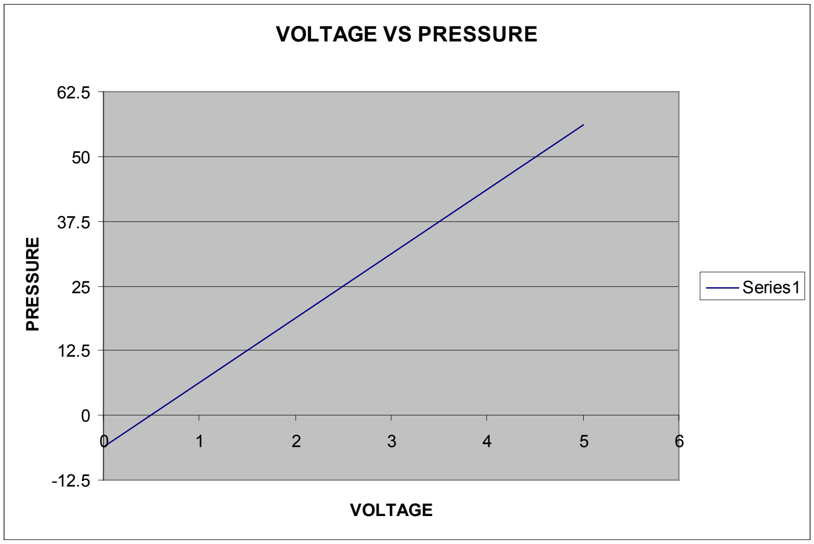
7.2 **Enable**
Each input channel can be enabled/disabled by pressing the Off/On button on each calibration page. When the input channel is enabled, all alarms and shutdown setpoints for the input become active.

7.3 **Current**
Displays the actual reading of the input in Analog-Digital Conversion (ADC) value.

7.4 Slope

To properly understand how to configure the channel when using a none Standard (Altronic Sensor), it is first necessary to know how the sensor relationship between voltage and displayed value (pressure, temperature, other) works.

A standard 0.0 – 50PSI sensor will be examined. For the Altronic style sensor, .5V will display 0.0PSI and 4.5V will display 50.0PSI. Refer to Voltage vs Pressure chart.



As those 2 points are created in the chart, a line may be drawn between them showing the relationship between voltage and pressure.

At 0V, the displayed value (according to the chart) would be -6.25 and 5V would be 56.25 PSI. It is rounded to -6.2 and 56.2 for one decimal point placement. Register 40115 is set for -125 and 40116 is set for 625. This corresponds to -12.5 and 62.5 with register 40268 set for 1 for the decimal point.

40113 correspond to the offset of the 0V point. Using the -6.25 value for the low, the difference between this value and -12.5 is (-6.25-(-12.5) = 6.25

The overall value of the sensor is 62.5 – (-12.5) = 75.0

To calculate the value, use the following expression:
(6.25/75.0) * 65535 = 5461. The slightly greater value for Modbus register 40114 of 5464 was due to some slight errors due to internal protection circuits. With this offset value, 0V in would yield a displayed value of -6.2 for this example. A larger number could give you, lets say 0 PSI for 0V and a smaller number (0) would yield -12.5 for 0V.

40113 is responsible for showing the slope of the line. This can be calculated as follows:

40113 = 256 * ((change in Y) / (total range of Y)) /
((change in voltage) / (total range of voltage))

40113 = 256 * ((50 - 0) / (62.5 – (-12.5))) / ((4.5 - .5) / 5)

40113 = 256 * ((50 / (75)) / (4 / 5)

40113 = 256 * (.6666) / (0.8)

40113 = 213.12

This value should be rounded to 213.

This number should never be greater than 512.

Note: Total range of voltage will always be 5V.

7.5 Offset

The offset is the difference between 0V y coordinate of the xy plot and the 0V reference of the linear curve based on the particular sensor being used.

7.6 **Zero**
This user input represents the lower limit of the transducer span.

7.7 **Span**
This user input represents the higher limit of the transducer span.

7.8 **Dec**
User input for the amount of decimal places to display

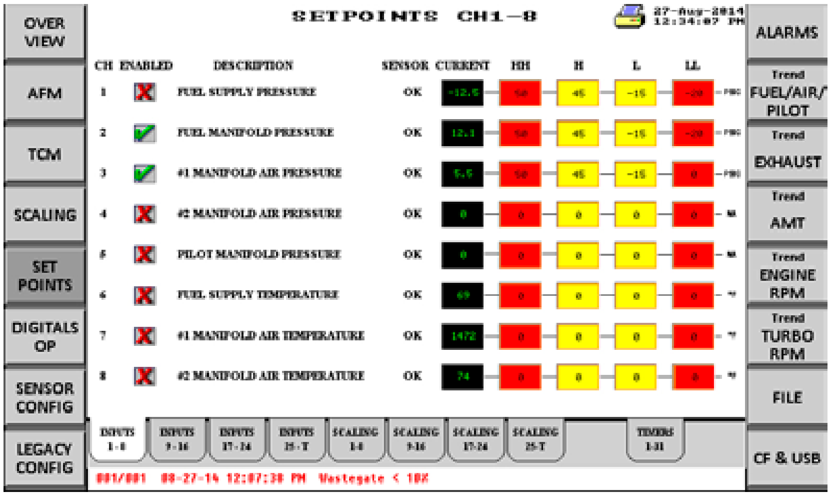
7.9 **TRANSDUCER TABLE**
When displaying/modifying, it is important to the set the Modbus registers for the proper data type. For example, if the displayed value is -125 for a signed integer, it will display as 65410 as an unsigned integer.

TRANSDUCER	SLOPE, X	OFFSET, B	ZERO	SPAN	D.P. CONFIG	COMMENTS
0-50	213	5464	-125	625	1	
0-100	213	5464	-250	1250	1	
0-300	213	5464	-750	375	1	
0-500	213	5464	-1250	6250	0	
0-1000	213	5464	-250	1250	0	
0-2000	213	5464	-500	2500	0	
0-5000	213	5464	-1250	6250	0	
VOLTMETER	255	0	0	500	2	
0-100.0%, 4-20mA	267	-76	-250	1250	1	
dEG1	432	0	0	300	0	
dEG2	300	0	-143	675	256	
J-TC	271	500	-76	1382	512	
K-TC	271	500	-76	1472	768	
DIG INPUT N/O	213	5464	-125	625	1025	0 = OK, 1 = FAULT
DIG INPUT N/C	213	5464	-125	625	1281	0 = OK, 1 = FAULT

To display the thermocouples in Celsius, replace the ‘-76’ with ‘-60’ for both and replace 1382 and 1472 with ‘750’ and ‘800’ respectively. These ranges should never be changed due to linearization tables.

8.0 ANALOG CONTROL INPUTS

For each of the dedicated input channels a HH/LL shutdown or alarm can be forced if enabled in the calibration page. The EPC-250 will annunciate the first in shutdown and lists all other shutdowns and alarms. This must be acknowledged by the operator by pushing Reset.



8.1 **CH (Channel)**
Denotes the channel number to be configured (1–31).

8.2 **Enable**
Displays if the input's shutdown/alarm capabilities have been enable/disable by pressing the Off/On button on each calibration page. A check mark denotes enabled while an X represents disabled.

8.3 **Sensor**
Displays the status of the sensor. A fault status will be displayed if the sensor connection goes open or in a the case of a failed device.

8.4 **Current**
Displays the actual reading of the input in Analog-Digital Conversion (ADC) value.

8.5 **HH (High High)**
High High Shutdown Setpoint

8.6 **H (High)**
High Alarm

8.7 **L (Low)**
Low Alarm

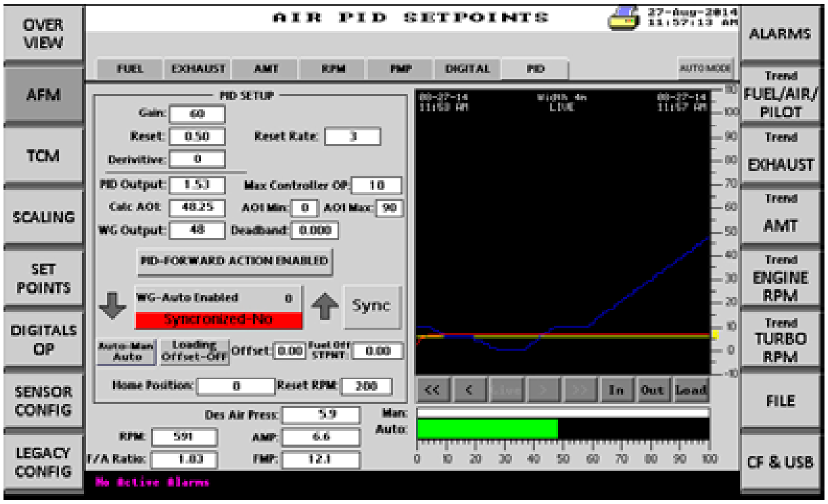
8.8 **LL (Low Low)**
Low Low Shutdown Setpoint

9.0 AIR/FUEL RATIO

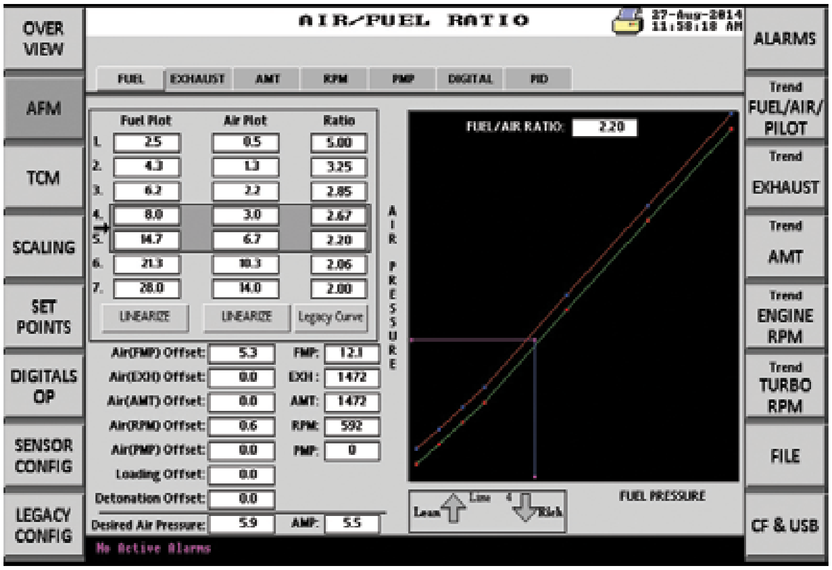
Before the EPC-250 controller can be used to its maximum advantage, the overall function of the control system must be clearly defined. It must be decided whether the controller will monitor both air/fuel ratio and ignition timing or only one of these functions. If replacing an EPC-200, obtain the existing running parameters and use the legacy configuration to enter the values for the air/fuel curve. If this information is not available, use the engine performance data supplied by the engine manufacturer. This data can be supplemented with actual measurements taken on the engine.

Air Manifold Pressure vs. Fuel Manifold pressure
Air Manifold Pressure vs. Exhaust Temperature
Air Manifold Pressure vs. Air Manifold Temperature
Air Manifold Pressure vs. Speed
Air Manifold Pressure vs. Pilot Manifold Pressure

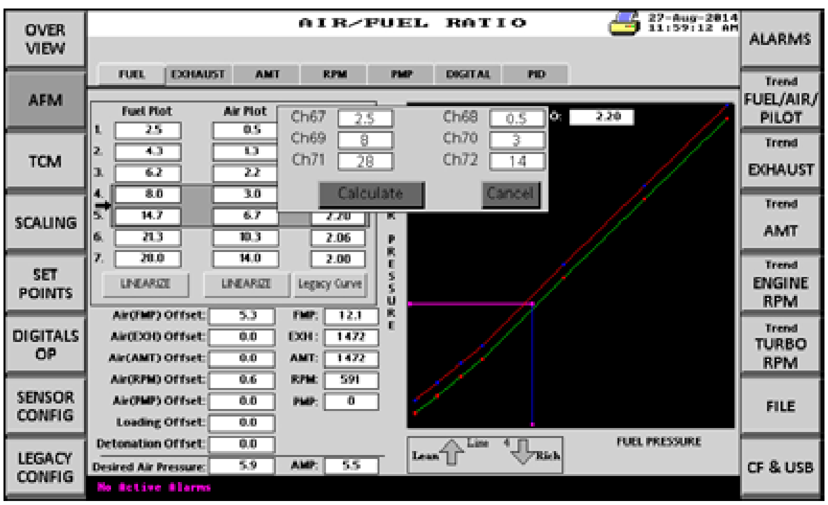
The operating values for the above functions are calculated separately according to user-entered curves, and the combined net effect is implemented by the EPC-250 Controller. The resultant air/fuel ratio can also be directly modified based on air manifold temperature.



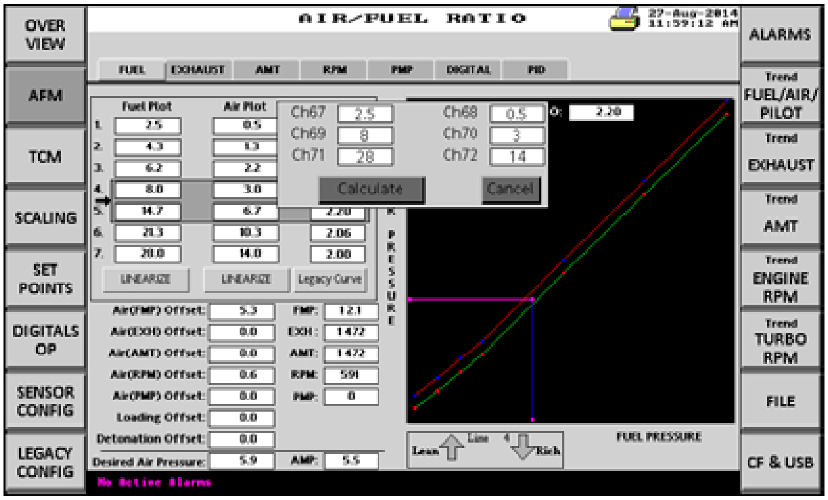
9.1 Air/fuel ratio is controlled by regulating the air/fuel pressure ratio. A waste gate (by-pass valve), in parallel with the turbocharger, is opened or closed to decrease or increase the air manifold pressure. The desired air manifold pressure is a function mainly of fuel pressure. The actual measured air manifold pressure is compared to the desired calculated value and a signal (4-20mA) is sent to the waste gate to compensate in the proper direction.



When replacing an EPC-200, enter the existing three point values of the air/fuel curve by pressing the Legacy Curve button.



All the performance curves are entered into the EPC-250 Controller simply by entering the (x,y) coordinates of each point of the seven line segments. In the legacy configuration Channels 67 and 68 correspond to the first point (x = fuel, y = air), Channels 69 and 70 automatically become the fourth line segment, and Channels 71 and 72 determine the end point of the curve. Pressing the Calculate button automatically calculates the curve using the three points of the 3-line segment of the legacy EPC-200 application and generates the the required coordinates to complete the linear 7-segment curve. The air/fuel ratio for that particular line segment is also calculated for each segment which can be manually adjusted by clicking on the desired value. The program also has the capability of linearizing the curve based on two known values (first and seventh). Seven individual control offsets can be programmed. The desired air pressure is the sum of all offsets.



9.2 Fuel plot

These values are obtained from the engine manufacturer or from an existing EPC-200 configuration for the specific engine (air/fuel ratio curve). They must be entered in ascending order from 1 to 7 (minimum to maximum) to obtain a positive slope (y=mx+b). The fuel values represent the x coordinates of the line equation. During operation the program calculates the line segment at that instant which is indicated by the gray boxed area with an indicating arrow using the four points of the gray box. This indicator changes as fuel pressure increases or decreases. This helps the operator know which segment the EPC-250 is using to calculate the air/fuel ratio in that instant. The calculated value (desired air manifold pressure) of the 4-point line segment is compared to the actual air manifold pressure. The difference between the two values is the input to the PID calculations.

9.3 Air plot

These values are obtained from the engine manufacturer or from the EPC-200 for the specific engine (air/fuel ratio curve). This value represents the Y value of the line coordinate. It represents the input value of channel 3 (air manifold pressure).

9.4 Ratio

To enter a specific air/fuel ratio, press the corresponding data box to calculate the air data point. This value corresponds to the fuel manifold pressure divided by the air manifold pressure.

9.5 Offset

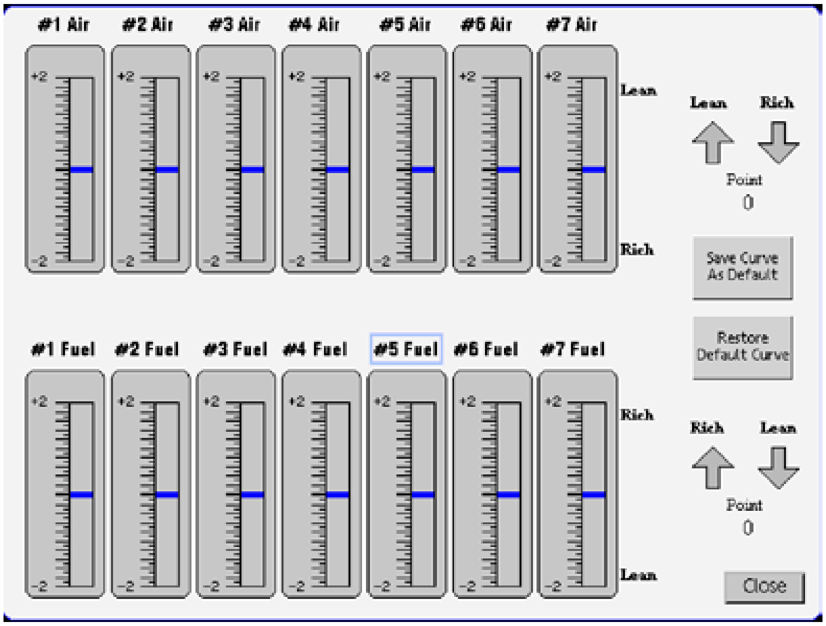
Each page represents an offset that can be used to manipulate the base air/fuel offset. The fuel offset is the main parameter for control of the air/fuel ratio. The desired air pressure is the sum of all offsets.

9.6 **Lean/Rich**

Pushing the Lean/Rich button displays a page which indicates any changes made to the base air/fuel ratio post commissioning. Pressing the Save Curve As Default button saves the commissioning air/fuel data points to memory. The vertical graphs are set to zero. Modifications to the air/fuel ratio will be shown as an increasing or decreasing level. This allows the operator to see any changes post commissioning. If required, pressing the Restore Default Curve button will restore the parameters that were used prior to the last change.

CAUTION: The waste gate must be in manual before this operation is executed. Failure to do so will lead to an engine shutdown or backfire.

Once an EPC-250 is programmed and is controlling an engine, the control program may be fine tuned in order to attain optimum fuel efficiency, emissions and/or performance. This can typically be accomplished using the Rich or Lean arrow buttons to make small advances in ignition timing or slight adjustments to the air/fuel ratio.



9.7 **Lean/Rich Arrows**

The EPC-250 allows the operator to easily change the air/fuel ratio if needed. The controller will determine which segment will be affected when pressing the Lean or Rich arrow. Typically, pressing the Lean arrow will add air, thereby lowering the exhaust temperature. Pressing the Rich arrow will subtract air, thereby raising the exhaust temperature. This feature increases or decreases the two values of the Air Plot Curve in the gray box.

CAUTION: This feature is for making small changes to an engine that is in good running condition; it is not intended for correcting mechanical malfunction or operationnal issues such as an overloaded engine.

10.0 AIR PID SETPOINTS

PID control continuously compares the process variable to the control setpoint and calculates an error value. The error is used to calculate the value of the control variable.

The control variable has three components:
Proportional Control, **I**ntegral Control, and **D**erivative Control

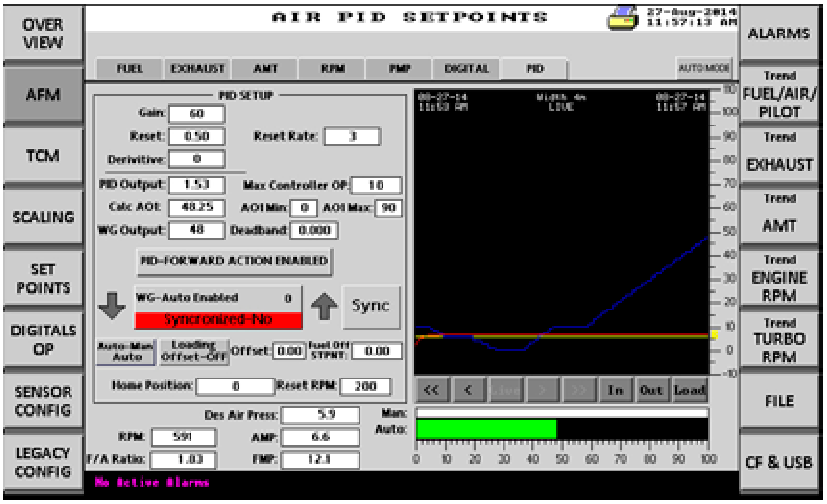
PID control is developed from complex mathematics; a full explanation is beyond the scope of this manual, but the theory can be simplified as in the following subsections.

Proportional Control (Gain)
The proportional component of the control variable is the main output of the PID control. It calculates an output amount that is proportional to the error. The larger the error, the larger the proportional component will be (in an attempt to make the process variable equal to the control setpoint). Proportional control alone cannot eliminate all the error.

Integral Control (Reset)
The integral control component is proportional to both the error and the length of time the error exists. The larger the error and the longer the error exists, the larger the integral component will be (in an attempt to make the process variable equal to the control setpoint). The integral control component is used to eliminate all remaining error.

Derivative Control
The derivative control component is proportional to the rate of the change of the error. The faster the process variable moves away from the control setpoint, the larger the derivative control component will be (in an attempt to quickly return the process variable to equal the control setpoint).

CAUTION: It is recommended that all changes to the PID parameters be done by a qualified instrument technician. Incorrect settings can cause faulty operation or unit malfunction/ damage.



10.1 **Gain**
The EPC-250 uses proportional control, which is the inverse of gain. Lowering the proportional value decreases the controller output. Inversely, increasing the gain value increases the controller output. A typical starting gain value is 60 to 100.

10.2 **Reset**
The Reset value adds to the gain control value. A typical reset value is 0.5.

10.3 **Derivative**
The Derivative helps to minimize over shoot. The typical derivative range is 0 to 10. Increasing the number increases controller sensitivity.

10.4 **Reset Rate**
Shows how often the PID error is calculated. The value range is from 1 to 10.

10.5 **PID Output**
The PID output is the error calculation. A well-tuned engine with a 0.2PSI difference between desired and actual air pressure should generate a PID Output of 0.7 maximum. This can be used to adjust the gain setting. Refer to the trend until there is minimal oscillation on the waste gate output.

10.6 **Max Controller Output:**
Max Controller Output limits the maximum PID output. During large engine swings this function governs the PID output in order to prevent the PID from chasing the engine swings, thereby avoiding an output that is too large to control. The range of this value is from 1 to 99.

10.7 **AO1 Min/AO1 Max**
This is Analog Output 1 on the I/O board. This output is scaled from 0 to 100, where 0 equals 4mA and 100 equals 20mA. AO1 Min/AO1 Max limits the lower and upper range of the analog output. This is useful if the waste gate sticks when it is below or above a certain value.

10.8 **Calc AO1**
This is the Calculated Analog Output.

10.9 **WG Output**
This is the actual position of the waste gate.

10.10 **Deadband**
If the desired air manifold pressure is above or below the actual air manifold pressure by the amount of the deadband value, the controller will respond to this error appropriately. For example, with a deadband of zero, any difference between the actual and the desired air manifold pressure will initiate a controller response. With a deadband of 1, the desired air manifold pressure must be greater or less than 1 to initiate a controller output. This can be used with a pulsating air manifold pressure signal.

10.11 **PID-Forward Action Enabled**
This is used to control the mode of the PID signal from forward acting to reverse acting. In forward acting mode 0 = 4mA, 100 = 20mA. In reverse acting mode 0 = 20mA and 100 = 4mA.

10.12 **WG-Auto Enabled**
This button toggles the waste gate control from auto to manual. Pushing the Sync button makes the manual waste gate setpoint equal to the auto waste gate output, but does not automatically switch the output to auto/manual or manual/auto. Once synchronized, the WG-Auto Enabled button turns green. Pressing the Auto/Manual button switches the controller to manual/auto or auto/manual. The Sync button is required to prevent an engine shutdown due to a difference between controller output (4-20mA) in manual mode and controller output (4-20mA) in auto mode. The greater the difference, the more time will be required for the values to synchronize.

10.13 **Home position**
If enabled, the waste gate output will revert to the home position during a fault or an engine shutdown. Entering a negative value in the RPM setpoint box keeps the controller in automatic mode. Entering a positive value enables the home position feature. During an engine shutdown the waste gate will move to the home position setpoint. When the engine is started the controller will go into automatic mode when the RPM is greater than the RPM setpoint.

Note: The home position is typically closer to the running position. In the case of a 2400 Superior the home position would be 100. This engine cannot have any air while starting in ramping to idle.

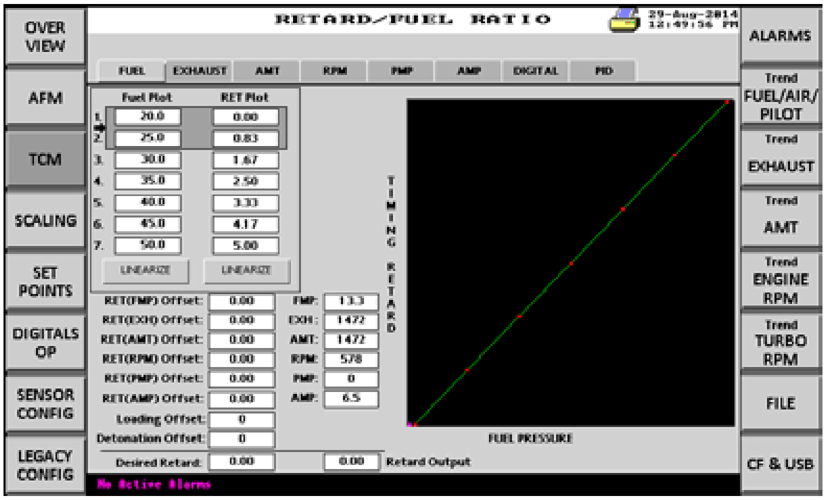
10.14 **Auto/Manual**
In Auto the EPC-250 automatically goes into controlling mode when RPM is above the home position reset value. In Manual mode the reset button on the home page must be pressed in order to enter the auto mode. When input 31 is closed, exceeding the top or bottom limit will reset the EPC-250 if it is in manual mode.

10.15 **Reset RPM**
When the engine RPM is greater than the Reset RPM value, the controller will enter auto mode.

11.0 TIMING RETARD

Ignition timing is a 4–20mA output signal and is a function typically of one or more of the following parameters:

Timing Retard vs. Fuel Manifold pressure
Timing Retard vs. Exhaust Temperature
Timing Retard vs. Air Manifold Temperature
Timing Retard vs. Speed
Timing Retard vs. Pilot Manifold Pressure
Timing Retard vs. Air Manifold Pressure

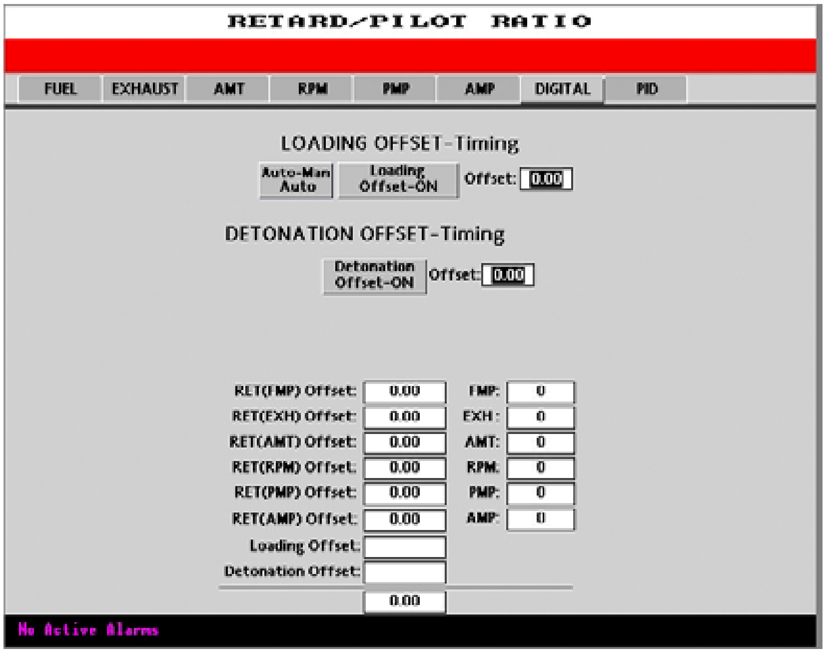


The operating values for the functions above are calculated separately according to user-entered curves, and the Offset is implemented by the EPC-250 Controller.

Under certain conditions, there can be interaction between the Air/Fuel Ratio and the Timing Retard function. If sufficient air manifold pressure cannot be achieved—even with the bypass valve fully closed—the ignition timing can be retarded to increase the exhaust temperature. This provides more energy to the turbocharger so that the air manifold pressure can be increased and brought into the desired range. This is the Air/Fuel Ratio Override condition. There is also a Start Override condition where the bypass valve is kept fully closed and ignition timing is set to a specific value.

11.1 Digital

This feature is used to compensate for typical turbo lag or a slow-acting waste gate. An engine can undergo fast loading or slow loading. When loading slowly, the turbo has time to react to the demand for air and there is no turbo delay. When loading fast, it is difficult for the turbo to keep up with the demand due to turbo delay.



11.2 Auto-Man Auto

Pressing the Auto-Man Auto button enables or disables the Loading Offset-ON button. In Auto, digital input 29 turns on the Loading Offset. In Man Auto, the Loading Offset-ON button turns on the Loading Offset

11.3 Loading Offset

The Loading Offset adds an offset to the desired air pressure when activated. The offset is removed when the fuel manifold pressure reaches the Fuel Off STPNT.

The Loading Offset can be used in a variety of ways, but the most logical use is during loading of a compressor. Closing digital input 29, or pressing the Load Offset-ON button adds a predetermined amount of air (thus raising the air pressure) just before or during loading. This feature reduces the need to load an engine slowly or detune the governor while it is waiting for air.

The above feature works similarly on the Timing Offset. When activated the timing will advance or retard to give best performance while loading. Likewise, it will be turned off when the fuel pressure reaches a chosen setpoint.

11.4 Fuel Pressure Setpoint

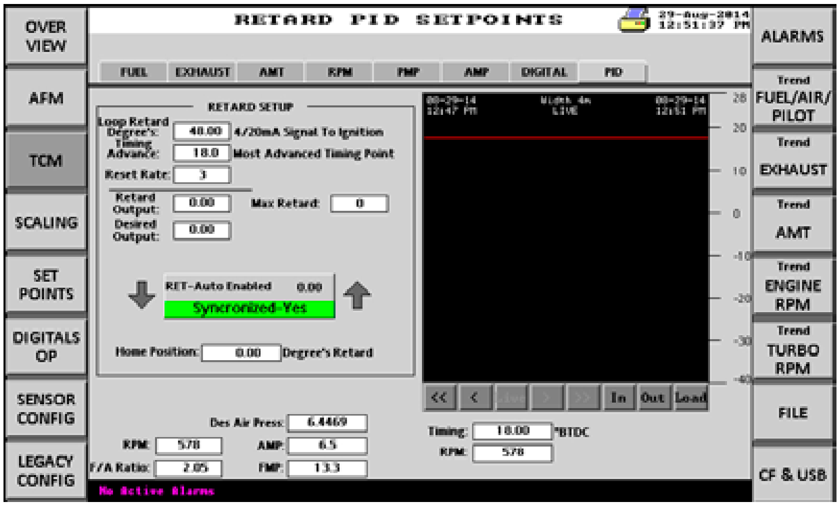
The fuel pressure setpoint is latching and will not reactivate if the fuel pressure goes below the set value. This is unlatched when the engine is restarted.

11.5 Detonation Offset

The detonation offset is added when digital input 30 is closed. This feature can be connected to OPSW2 on the DET1600/1610 or a PLC detonation output.

The above feature works similarly to the Air Offset, but will advance or retard the timing when digital input 30 is closed.

12.0 RETARD PID SETPOINTS



12.1 **Loop Retard Degrees**
This user input value is the range of Ignition Timing Retard (in degrees) represented by the 4-20mA Ignition Retard Output signal. This number should equal the range of the particular ignition on the engine.

12.2 **Timing Advance**
This input represents the actual rated engine timing—the most advanced timing at which the engine is designed to run under normal conditions.

12.3 **Reset Rate**
Determines the rate at which the program reacts to the output.

12.4 **RETOutput**
Calculated value of the actual output as the program cycles through the sequence.

12.5 **DESOutput**
This value represents a total sum of all the active retard offsets.

12.6 **Ret-Auto Enable**
The retard feature can be controlled manually via the up and down arrows, adding a unit of travel by each.

12.7 **Home Position**
Position in degrees to which the timing should revert on startup following an EPC-250 shutdown reset.

12.8 **Timing**
Timing value minus offset.

13.0 DIGITAL INPUTS/OUTPUTS

Outputs 2-8 are set-up for the common functions of a typical installation.

SYMBOL	TYPE	DESCRIPTION	EPC LEGACY ENTRY	EPC-250 RELAY
I/1	Input	Start Override	None	CRI1
O/2	Output N.C.	RPM setpoint, speed exceeds	(80)	CRO2
O/3	Output N.O.	RPM Setpoint, speed exceeds	(81)	CRO3
O/4	Output N.C.	Time Delay	(82)	CRO4
O/5	Output N.O.	Time Delay	(83)	CRO5
O/6	Output N.C.	Over Crank – On if time expires and RPM is less than setpoint	(84) , (85)	CRO6
O/7	Output N.C.	Flooding – On if RPM Less than setpoint and FMP greater than set point	(86) , (87)	CRO7
O/8	Output N.C.	Fault		CRO8

13.1 **Start Override Input 1 (I/1)**
Can be used for various speed switch functions such as crank disconnect. O/2 is tripped when the entered RPM is reached after start-up.

13.2 **Engine RPM to Trip Output 2 (O/2)**
Can be used for various speed switch functions such as crank disconnect. O/2 is tripped when the entered RPM is reached after start-up.

13.3 **Engine Rpm to Trip Output 3 (O/3)**
A second speed switch similar to O/2, except that O/3 is tripped when the entered RPM is reached after start-up.

13.4 **Time Interval After End of Start Override Signal to Trip Output 4 (O/4)**
O/4 will trip after the entered time interval (in seconds) expires following the end of the start override signal.

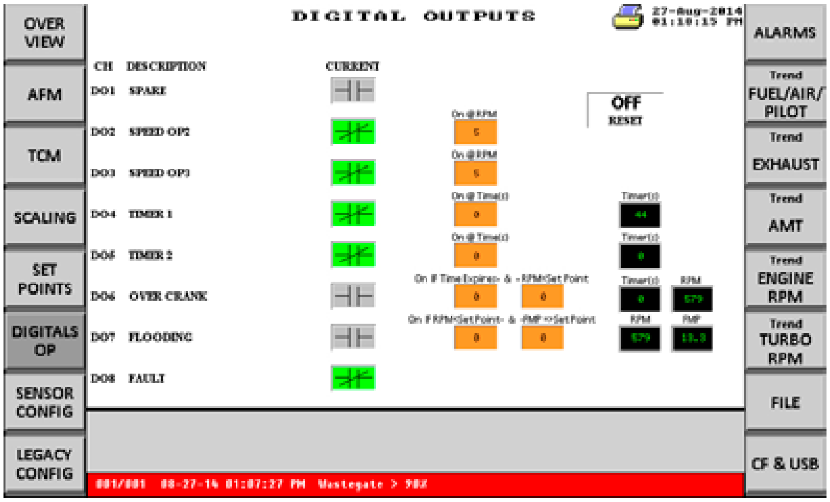
13.5 **Time Interval After End of Start Override Signal to Trip Output 5 (O/5)**
O/5 will trip after the entered time interval (in seconds) expires following the end of the start override signal.

13.6 **Overcrank Function, Trips Output 6 (O/6)**
O/6 will trip if the RPM entered is not reached in the time interval (in seconds) entered in the O/6 timer following the end of the start override signal.

13.7 **Flooding Function, Trips Output 7 (O/7)**
O/7 will trip if the RPM entered is not reached before the fuel pressure entered in the O/7 input box is exceeded.

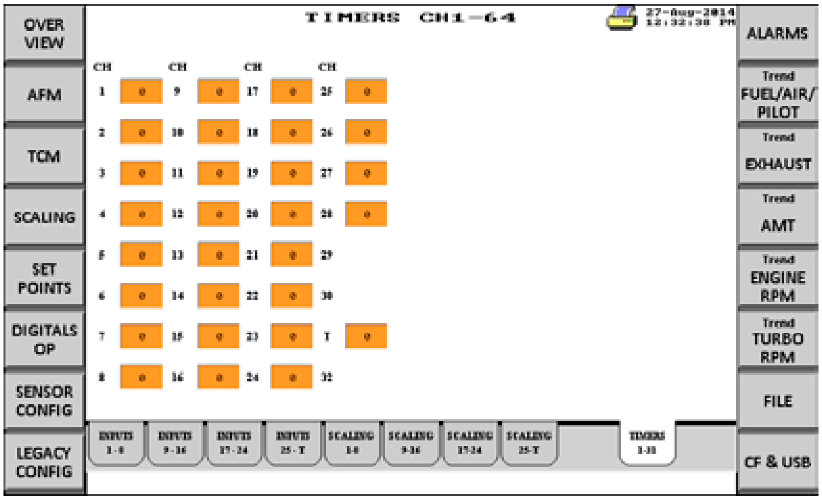
13.8 **FAULT**

Output 0/8 will trip when any of the shutdown setpoint or device limits have been exceeded.

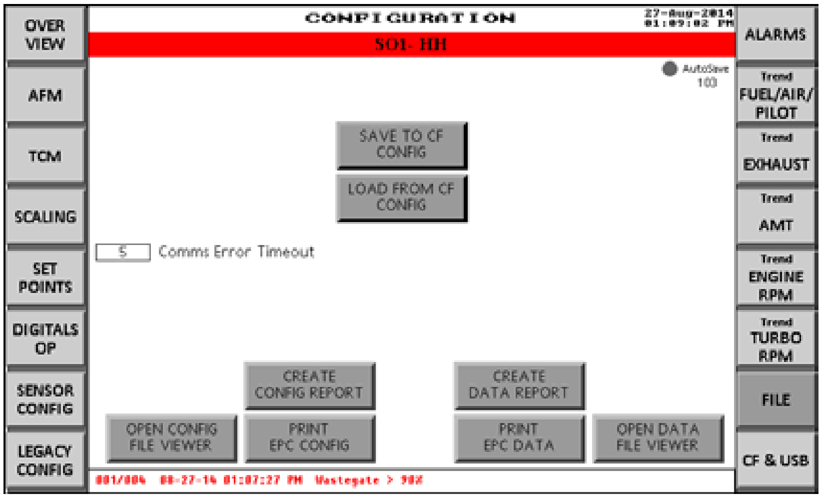


14.0 TIMERS

A second function of the EPC-250 controller is to perform shutdown and alarms. The EPC-250 uses a standard class B timer (in seconds) for every input that adds a delay to the shutdown and alarm to debounce and eliminate nuisance shutdowns.



15.0 Configuration



15.1 **SAVE TO CF CONFIG**
The EPC-250 provides the capability of saving the configuration of each channel to the SD Memory card.

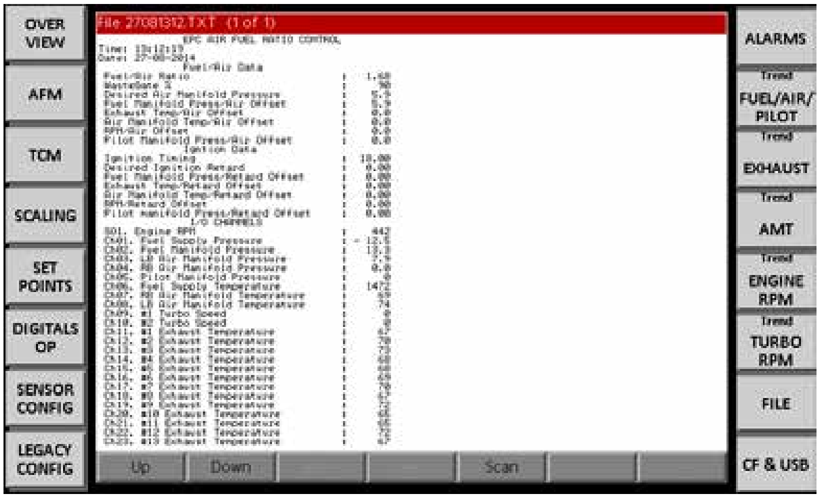
15.2 **LOAD FROM CF CONFIG**
The saved configuration of section 15.1 can be recalled and loaded to a new application or back to the original EPC-250 in case of data loss.

15.3 **CREATE CONFIG REPORT**
A report of the configuration saved in the SD Memory card can be generated by using this function

15.4 **OPEN CONFIG FILE VIEWER**
Allows the user to view the configured file in a readable format (.TXT).

15.5 **PRINT EPC CONFIG**
A hard copy can be printed if the EPC-250 is connected to a printer.

15.6 **CREATE DATA REPORT**
A report of the working data (press, temps, air/fuel ratio…etc)



15.7 **PRINT EPC DATA**
A hard copy can be printed if the EPC-250 is connected to a printer.

15.8 **OPEN DATA FILE VIEWER**
Allows the user to view the data in a readable format (.TXT).

16.0 MODBUS ADDRESS LIST

REGISTERS	DESCRIPTION	DATA TYPE	CHANNEL
30001	CHANNEL 1	SWAPPED FP	
30002			
30003	CHANNEL 2	SWAPPED FP	
30004			
30005	CHANNEL 3	SWAPPED FP	
30006			
30007	CHANNEL 4	SWAPPED FP	
30008			
30009	CHANNEL 5	SWAPPED FP	
30010			
30011	CHANNEL 6	SWAPPED FP	
30012			
30013	CHANNEL 7	SWAPPED FP	
30014			
30015	CHANNEL 8	SWAPPED FP	
30016			
30017	CHANNEL 9	SWAPPED FP	
30018			
30019	CHANNEL 10	SWAPPED FP	
30020			
30021	CHANNEL 11	SWAPPED FP	
30022			
30023	CHANNEL 12	SWAPPED FP	
30024			
30025	CHANNEL 13	SWAPPED FP	
30026			
30027	CHANNEL 14	SWAPPED FP	
30028			
30029	CHANNEL 15	SWAPPED FP	
30030			
30031	CHANNEL 16	SWAPPED FP	
30032			
30033	CHANNEL 17	SWAPPED FP	
30034			
30035	CHANNEL 18	SWAPPED FP	
30036			
30037	CHANNEL 19	SWAPPED FP	

REGISTERS	DESCRIPTION	DATA TYPE	CHANNEL
30038			
30039	CHANNEL 20	SWAPPED FP	
30040			
30041	CHANNEL 21	SWAPPED FP	
30042			
30043	CHANNEL 22	SWAPPED FP	
30044			
30045	CHANNEL 23	SWAPPED FP	
30046			
30047	CHANNEL 24	SWAPPED FP	
30048			
30049	CHANNEL 25	SWAPPED FP	
30050			
30051	CHANNEL 26	SWAPPED FP	
30052			
30053	CHANNEL 27	SWAPPED FP	
30054			
30055	CHANNEL 28	SWAPPED FP	
30056			
30057	CHANNEL 29	SWAPPED FP	
30058			
30059	CHANNEL 30	SWAPPED FP	
30060			
30061	SPEED	SWAPPED FP	
30062			
30063	AMBIENT TEMPERATURE	UNSIGNED INT	Displayed in 'tenths' of Kelvins. 2954 = 295.4K = 22.4C
30064	CHANNEL 31	0, or 1 (digital input only)	
30065	CHANNEL 32	0, or 1 (digital input only)	
30066	firmware month	ASCII	
30067	firmware date	ASCII	
30068	firmware year	ASCII	
40067	Special analog out #1, occurs when ch32 is tripped. See section 6.4.		
40068	Special analog out #2, occurs when ch32 is tripped. See section 6.4.		
40069	SLOPE, X	SIGNED INT	1
40070	OFFSET, B	SIGNED INT	1
40071	MINIMUM DISPLAYED NUMBER	SIGNED INT	1
40072	MAXIMUM DISPLAYED NUMBER	SIGNED INT	1
40073	SLOPE, X	SIGNED INT	2
40074	OFFSET, B	SIGNED INT	2
40075	MINIMUM DISPLAYED NUMBER	SIGNED INT	2
40076	MAXIMUM DISPLAYED NUMBER	SIGNED INT	2
40077	SLOPE, X	SIGNED INT	3

REGISTERS	DESCRIPTION	DATA TYPE	CHANNEL
40078	OFFSET, B	SIGNED INT	3
40079	MINIMUM DISPLAYED NUMBER	SIGNED INT	3
40080	MAXIMUM DISPLAYED NUMBER	SIGNED INT	3
40081	SLOPE, X	SIGNED INT	4
40082	OFFSET, B	SIGNED INT	4
40083	MINIMUM DISPLAYED NUMBER	SIGNED INT	4
40084	MAXIMUM DISPLAYED NUMBER	SIGNED INT	4
40085	SLOPE, X	SIGNED INT	5
40086	OFFSET, B	SIGNED INT	5
40087	MINIMUM DISPLAYED NUMBER	SIGNED INT	5
40088	MAXIMUM DISPLAYED NUMBER	SIGNED INT	5
40089	SLOPE, X	SIGNED INT	6
40090	OFFSET, B	SIGNED INT	6
40091	MINIMUM DISPLAYED NUMBER	SIGNED INT	6
40092	MAXIMUM DISPLAYED NUMBER	SIGNED INT	6
40093	SLOPE, X	SIGNED INT	7
40094	OFFSET, B	SIGNED INT	7
40095	MINIMUM DISPLAYED NUMBER	SIGNED INT	7
40096	MAXIMUM DISPLAYED NUMBER	SIGNED INT	7
40097	SLOPE, X	SIGNED INT	8
40098	OFFSET, B	SIGNED INT	8
40099	MINIMUM DISPLAYED NUMBER	SIGNED INT	8
40100	MAXIMUM DISPLAYED NUMBER	SIGNED INT	8
40101	SLOPE, X	SIGNED INT	9
40102	OFFSET, B	SIGNED INT	9
40103	MINIMUM DISPLAYED NUMBER	SIGNED INT	9
40104	MAXIMUM DISPLAYED NUMBER	SIGNED INT	9
40105	SLOPE, X	SIGNED INT	10
40106	OFFSET, B	SIGNED INT	10
40107	MINIMUM DISPLAYED NUMBER	SIGNED INT	10
40108	MAXIMUM DISPLAYED NUMBER	SIGNED INT	10
40109	SLOPE, X	SIGNED INT	11
40110	OFFSET, B	SIGNED INT	11
40111	MINIMUM DISPLAYED NUMBER	SIGNED INT	11
40112	MAXIMUM DISPLAYED NUMBER	SIGNED INT	11
40113	SLOPE, X	SIGNED INT	12
40114	OFFSET, B	SIGNED INT	12
40115	MINIMUM DISPLAYED NUMBER	SIGNED INT	12
40116	MAXIMUM DISPLAYED NUMBER	SIGNED INT	12
40117	SLOPE, X	SIGNED INT	13
40118	OFFSET, B	SIGNED INT	13
40119	MINIMUM DISPLAYED NUMBER	SIGNED INT	13
40120	MAXIMUM DISPLAYED NUMBER	SIGNED INT	13

REGISTERS	DESCRIPTION	DATA TYPE	CHANNEL
40121	SLOPE, X	SIGNED INT	14
40122	OFFSET, B	SIGNED INT	14
40123	MINIMUM DISPLAYED NUMBER	SIGNED INT	14
40124	MAXIMUM DISPLAYED NUMBER	SIGNED INT	14
40125	SLOPE, X	SIGNED INT	15
40126	OFFSET, B	SIGNED INT	15
40127	MINIMUM DISPLAYED NUMBER	SIGNED INT	15
40128	MAXIMUM DISPLAYED NUMBER	SIGNED INT	15
40129	SLOPE, X	SIGNED INT	16
40130	OFFSET, B	SIGNED INT	16
40131	MINIMUM DISPLAYED NUMBER	SIGNED INT	16
40132	MAXIMUM DISPLAYED NUMBER	SIGNED INT	16
40133	SLOPE, X	SIGNED INT	17
40134	OFFSET, B	SIGNED INT	17
40135	MINIMUM DISPLAYED NUMBER	SIGNED INT	17
40136	MAXIMUM DISPLAYED NUMBER	SIGNED INT	17
40137	SLOPE, X	SIGNED INT	18
40138	OFFSET, B	SIGNED INT	18
40139	MINIMUM DISPLAYED NUMBER	SIGNED INT	18
40140	MAXIMUM DISPLAYED NUMBER	SIGNED INT	18
40141	SLOPE, X	SIGNED INT	19
40142	OFFSET, B	SIGNED INT	19
40143	MINIMUM DISPLAYED NUMBER	SIGNED INT	19
40144	MAXIMUM DISPLAYED NUMBER	SIGNED INT	19
40145	SLOPE, X	SIGNED INT	20
40146	OFFSET, B	SIGNED INT	20
40147	MINIMUM DISPLAYED NUMBER	SIGNED INT	20
40148	MAXIMUM DISPLAYED NUMBER	SIGNED INT	20
40149	SLOPE, X	SIGNED INT	21
40150	OFFSET, B	SIGNED INT	21
40151	MINIMUM DISPLAYED NUMBER	SIGNED INT	21
40152	MAXIMUM DISPLAYED NUMBER	SIGNED INT	21
40153	SLOPE, X	SIGNED INT	22
40154	OFFSET, B	SIGNED INT	22
40155	MINIMUM DISPLAYED NUMBER	SIGNED INT	22
40156	MAXIMUM DISPLAYED NUMBER	SIGNED INT	22
40157	SLOPE, X	SIGNED INT	23
40158	OFFSET, B	SIGNED INT	23
40159	MINIMUM DISPLAYED NUMBER	SIGNED INT	23
40160	MAXIMUM DISPLAYED NUMBER	SIGNED INT	23
40161	SLOPE, X	SIGNED INT	24
40162	OFFSET, B	SIGNED INT	24
40163	MINIMUM DISPLAYED NUMBER	SIGNED INT	24

REGISTERS	DESCRIPTION	DATA TYPE	CHANNEL
40164	MAXIMUM DISPLAYED NUMBER	SIGNED INT	24
40165	SLOPE, X	SIGNED INT	25
40166	OFFSET, B	SIGNED INT	25
40167	MINIMUM DISPLAYED NUMBER	SIGNED INT	25
40168	MAXIMUM DISPLAYED NUMBER	SIGNED INT	25
40169	SLOPE, X	SIGNED INT	26
40170	OFFSET, B	SIGNED INT	26
40171	MINIMUM DISPLAYED NUMBER	SIGNED INT	26
40172	MAXIMUM DISPLAYED NUMBER	SIGNED INT	26
40173	SLOPE, X	SIGNED INT	27
40174	OFFSET, B	SIGNED INT	27
40175	MINIMUM DISPLAYED NUMBER	SIGNED INT	27
40176	MAXIMUM DISPLAYED NUMBER	SIGNED INT	27
40177	SLOPE, X	SIGNED INT	28
40178	OFFSET, B	SIGNED INT	28
40179	MINIMUM DISPLAYED NUMBER	SIGNED INT	28
40180	MAXIMUM DISPLAYED NUMBER	SIGNED INT	28
40181	SLOPE, X	SIGNED INT	29
40182	OFFSET, B	SIGNED INT	29
40183	MINIMUM DISPLAYED NUMBER	SIGNED INT	29
40184	MAXIMUM DISPLAYED NUMBER	SIGNED INT	29
40185	SLOPE, X	SIGNED INT	30
40186	OFFSET, B	SIGNED INT	30
40187	MINIMUM DISPLAYED NUMBER	SIGNED INT	30
40188	MAXIMUM DISPLAYED NUMBER	SIGNED INT	30
40209	PULSES PER REVOLUTION / 2	UNSIGNED INT	
40257	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	1
40258	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	2
40259	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	3
40260	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	4
40261	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	5
40262	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	6
40263	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	7
40264	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	8
40265	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	9
40266	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	10
40267	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	11
40268	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	12
40269	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	13
40270	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	14
40271	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	15
40272	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	16
40273	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	17

REGISTERS	DESCRIPTION	DATA TYPE	CHANNEL
40274	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	18
40275	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	19
40276	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	20
40277	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	21
40278	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	22
40279	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	23
40280	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	24
40281	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	25
40282	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	26
40283	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	27
40284	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	28
40285	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	29
40286	DECIMAL POINT / SENSOR CONFIG	UNSIGNED INT	30

40769	DIGITAL OUTPUTS	UNSIGNED INT, LSB	
40770	ANALOG OUTPUT #1	UNSIGNED INT	0-4095
40771	ANALOG OUTPUT #2	UNSIGNED INT	0-4095
40772	MODBUS WRITE PROTECT	UNSIGNED IT	5300H = WRITE ENABLE

NOTE: Modbus write commands will NOT be accepted unless the 40772 register contains 5300h. This may be used to protect against accidental writes to critical memory locations.

Firmware version 10-01-14 contains additional Modbus registers starting at 41025 to 42048. These registers may be used for scratch pad memory locations for the application. There is a 100k write limit for all Modbus / EEPROM locations.

DRAWINGS SECTION

FIGURE 1 — MODBUS TERMINAL BOARD

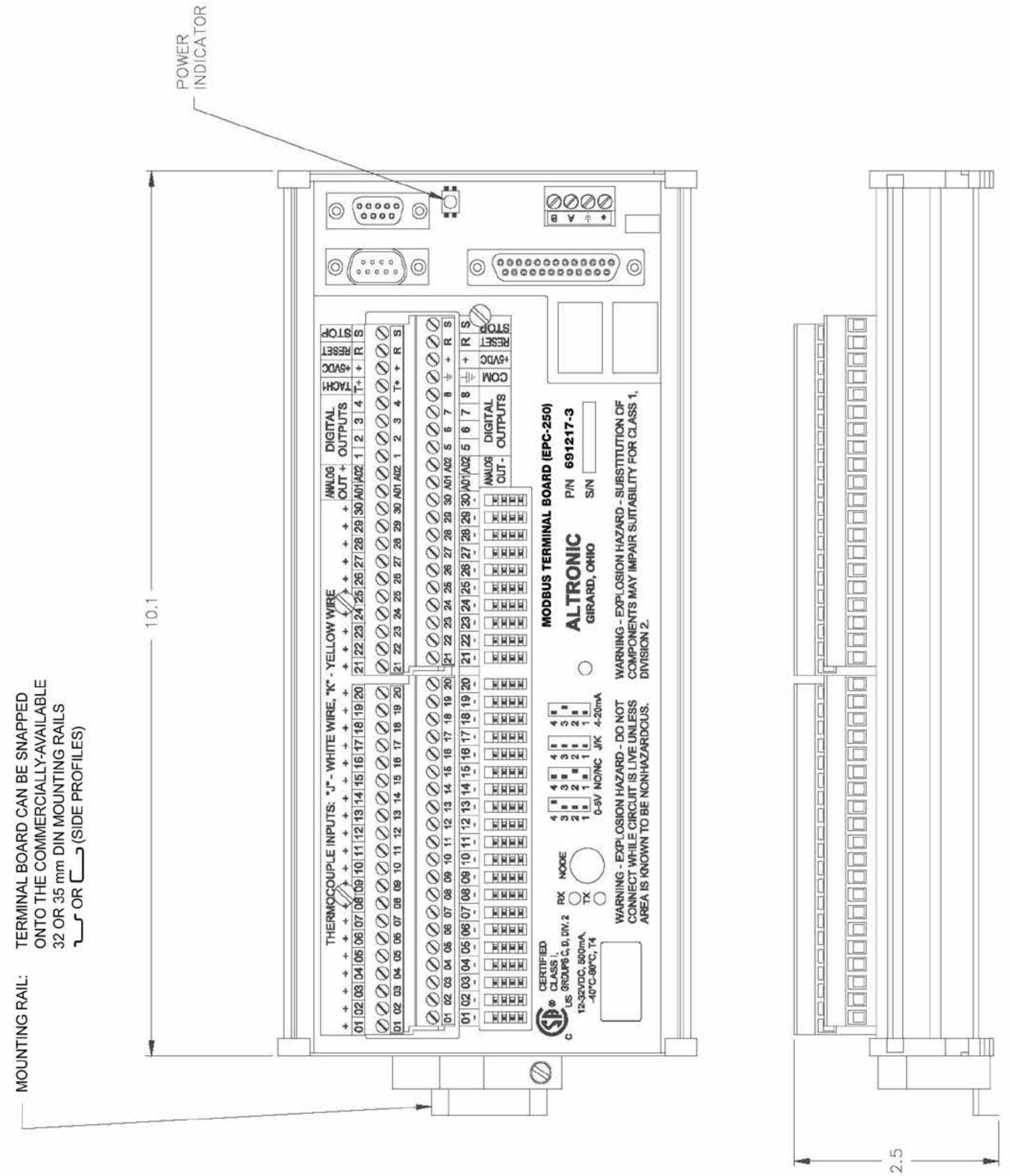
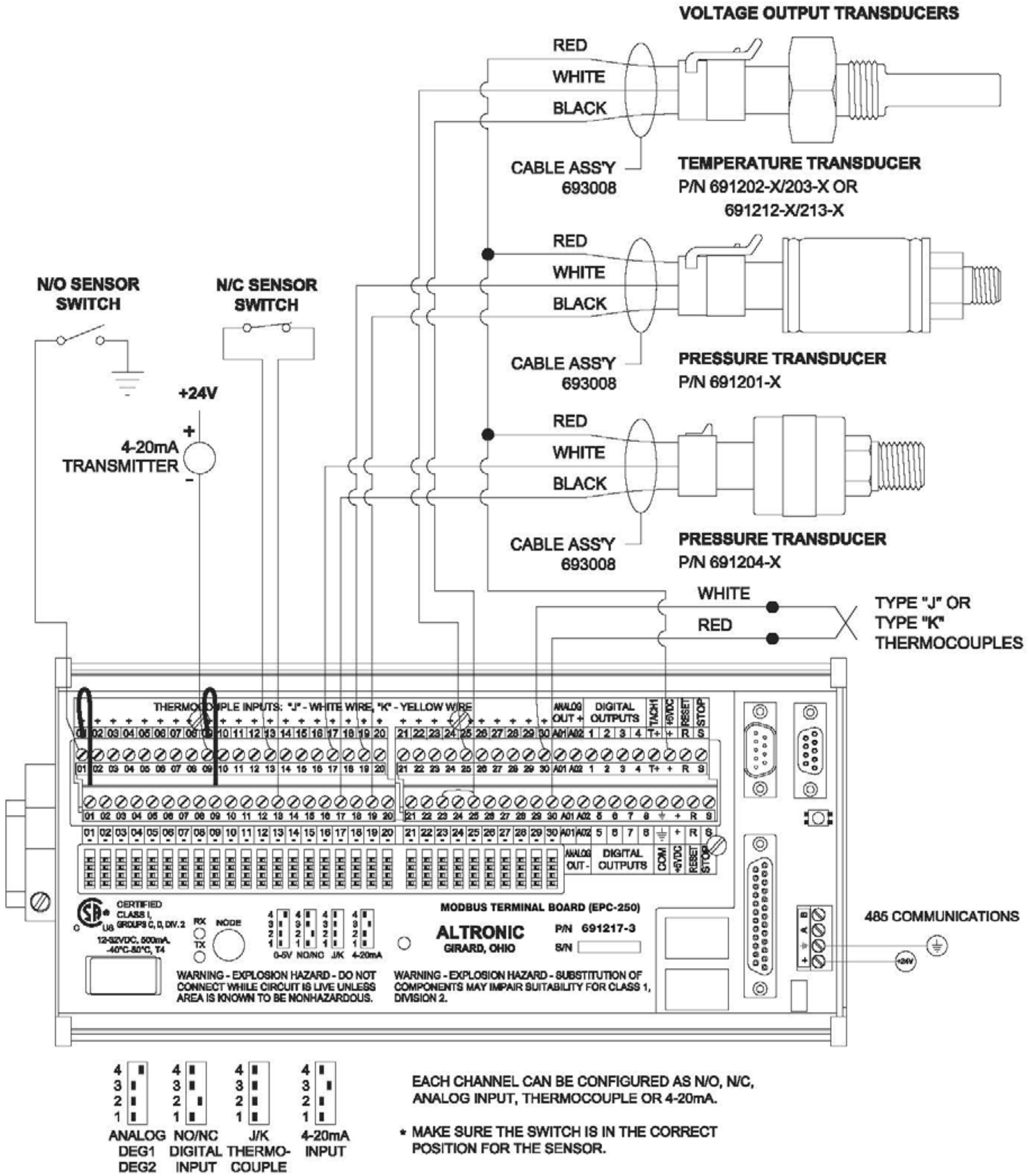


FIGURE 2 — WIRING DIAGRAM, SENSOR AND TRANSDUCER INPUTS/POWER



NOTE:

1. N/O SENSOR SWITCH MUST HAVE JUMPER IN PLACE BETWEEN TOP ROW AND BOTTOM ROW OF TERMINAL BLOCK. POWER SUPPLY MINUS AND SENSOR GROUND MUST BOTH BE COMMON.
2. N/C SENSOR SWITCH, REMOVE JUMPER AND PLACE SWITCH WIRES, ONE IN TOP ROW OTHER IN BOTTOM ROW.
3. ALL UNUSED INPUTS MUST HAVE JUMPER WIRE IN PLACE.
4. THE +5VDC INTERNAL SUPPLY OUTPUT IS LIMITED TO 500 mA MAXIMUM. IF THIS SUPPLY EXITS THE PANEL, IT MUST BE FUSED WITH A 0.5 AMPERE FUSE. BOTH +5VDC TERMINALS ARE ELECTRICALLY CONNECTED TOGETHER. TWO TERMINALS ARE PROVIDED FOR WIRING CONVENIENCE ONLY.
5. 24 VOLT POWER TO 4-20mA TRANSMITTERS MUST HAVE A COMMON GROUND TO POWER SUPPLY FOR TERMINAL MODULES.

FIGURE 3 — EPC-250 MOUNTING DIMENSIONS

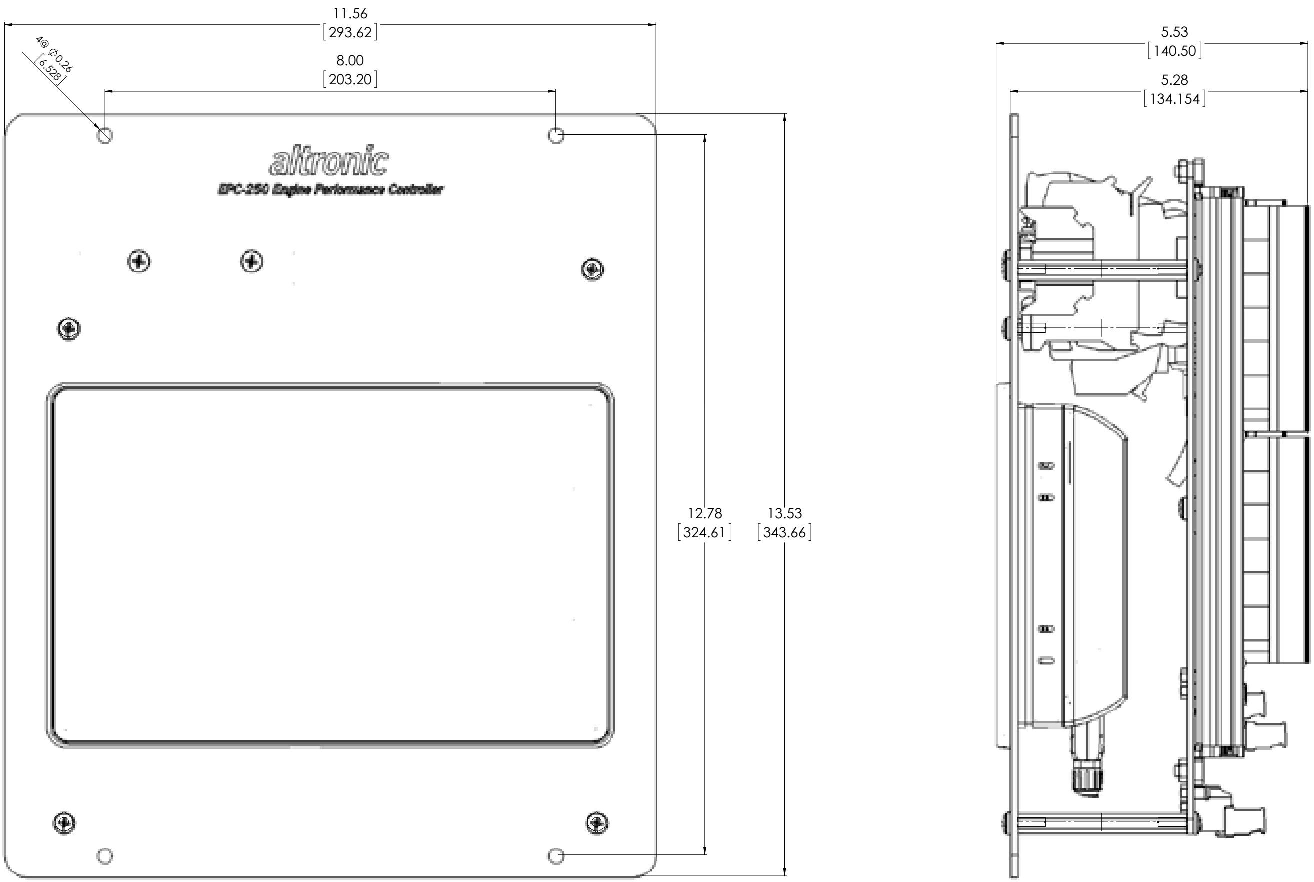


FIGURE 4 — EPC-200/250 WIRING DIAGRAM

altronic

TITLE EPC-250/200 ELECTRICAL CONNECTION

DRAWING NO. TO BE DETERM

NO	MTB	CHANNEL DESCRIPTION	EPC 1-20	EPC 21-40	RELAY TERM	RELAY TERM	FUSE#	TERM#	HARNESS 6	WIRE GUAGE	LENGHT "
1	T+	MAGNETIC PICKUP	01							22	
2	G	MAGNETIC PICKUP	02							22	
3	SH	MAGNETIC PICKUP	03					G		22	
4		UNUSED	04							-	
5		UNUSED	05							-	
6		UNUSED	06							-	
7		UNUSED	07							-	
8	–2	CH2 – FUEL MANIFOLD PRESS	08							22	
9	+2	CH2 – FUEL MANIFOLD PRESS	09							22	
10	–3	CH3 – AIR MANIFOLD PRESS	10							22	
11	+3	CH3 – AIR MANIFOLD PRESS	11							22	
12	–7	CH7 – AIR MANIFOLD TEMP	12							22	
13	+7	CH7 – AIR MANIFOLD TEMP	13							22	
14	–27	CH27 – EXHAUST MANIFOLD TEMP	14							22	
15	+27	CH27 – EXHAUST MANIFOLD TEMP	15							22	
16	–AO2	AO2 – IGNITION TIMING	16							22	
17	+AO2	AO2 – IGNITION TIMING	17							22	
18	–AO1	AO1 – AIR/FUEL RATIO OUTPUT	18							22	
19	+AO1	AO1 – AIR/FUEL RATIO OUTPUT	19							22	
20		INSTRUMENT 24VDC	20							18	
21		CH21 – INSTRUMENT (+ 24VDC)		21						18	
22		UNUSED		22						-	
23		UNUSED		23						-	
24		DIGITAL INPUT 1, CRI–A2		24	A2					22	
25		DIGITAL INPUT 1, CRI–A1		25	A1					22	
26		DIGITAL OUTPUT 1, CRO–1 11		26	11					22	
27		DIGITAL OUTPUT 1, CRO–1 12		27	12					22	
28		DIGITAL OUTPUT 2, CRO–2 11		28	11					22	
29		DIGITAL OUTPUT 2, CRO–2 14		29	14					22	
30		DIGITAL OUTPUT 3, CRO–3 11		30	11					22	
31		DIGITAL OUTPUT 3, CRO–3 12		31	12					22	
32		DIGITAL OUTPUT 4, CRO–4 11		32	11					22	
33		DIGITAL OUTPUT 4, CRO–4 14		33	14					22	
34		DIGITAL OUTPUT 5, CRO–5 11		34	11					22	
35		DIGITAL OUTPUT 5, CRO–5 12		35	12					22	
36		DIGITAL OUTPUT 6, CRO–6 11		36	11					22	
37		DIGITAL OUTPUT 6, CRO–6 12		37	12					22	
38		DIGITAL OUTPUT 7, CRO–7 11		-	11					22	
39		DIGITAL OUTPUT 7, CRO–7 12		-	12					22	
40		DIGITAL OUTPUT 8, CRO–8 11		38	11					22	
41		DIGITAL OUTPUT 8, CRO–8 14		39	14					22	
42		INSTRUMENT (–)24VDC		40						22	
43	01	DIGITAL OUTPUT 1, CRO–1				A1			1		
44	02	DIGITAL OUTPUT 2, CRO–2				A1			2		
45	03	DIGITAL OUTPUT 3, CRO–3				A1			3		
46	04	DIGITAL OUTPUT 4, CRO–4				A1			4		
47	05	DIGITAL OUTPUT 5, CRO–5				A1			5		
48	06	DIGITAL OUTPUT 6, CRO–6				A1			6		
49	07	DIGITAL OUTPUT 7, CRO–7				A1			7		
50	08	DIGITAL OUTPUT 8, CRO–8				A1			8		
51	R+	DIGITAL INPUT1, CRI–11				11					
52	R–	DIGITAL INPUT1, CRI–14				14