ALTRONIC, INC.
712 TRUMBULL AVE.
GIRARD, OHIO 44420

OPERATING MANUAL

EPC-200C

VERSION C

FORM EPC-C OM 4-90

WARNING

TO INSURE RETENTION OF DATA IN MEMORY:

1. DO NOT UNPOWER THE DEVICE WHILE IN THE CONFIGURATION MODE.

2. DO NOT UNPOWER THE DEVICE FOR AT LEAST TWO MINUTES AFTER LEAVING CONFIGURATION MODE.

SECTION 1

GENERAL DESCRIPTION

1.0 DESCRIPTION - ALTRONIC EPC-200C ENGINE PERFORMANCE CONTROLLER

1.1 IGNITION TIMING AND AIR/FUEL RATIO CONTROL

The Altronic EPC-200C Engine Performance Controller is a microprocessor-based electronic control device designed to maximize engine performance and efficiency. The device is specifically designed to control ignition timing and air/fuel ratio on spark-ignited, turbocharged gas engines allowing for the total replacement of traditional pneumatic control systems. Engine RPM plus up to four other analog inputs can be used as control variables; the four analog inputs can be scaled to represent desired engineering units.

IGNITION TIMING is a 4-20 ma output signal and is a function typically of one or more of the following parameters: RPM, fuel manifold pressure, air manifold pressure, air manifold temperature. A fifth, unspecified variable is also available if required.

NOTE: 4 ma = full advance; 20 ma = full retard.

AIR/FUEL RATIO is controlled by controlling the air/fuel pressure ratio. A waste-gate (by-pass valve) in parallel with the engine's 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 (4-20 ma) sent to the waste-gate to compensate in the proper direction. The air/fuel pressure ratio may also be modified as a function of air manifold temperature and/or engine RPM.

NOTE: 4 ma = 0% open (fully closed); 20 ma = 100% open.

Under certain conditions, there can be interaction between the above two functions. 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, thereby providing more energy to the turbocharger so that the air manifold pressure can be increased and brought into the prescribed range. This is the air/fuel override condition. There is also a start override condition where the bypass valve is kept fully closed and ignition timing set to a specific value.

In addition to the two above analog control functions, the EPC-200C also has six (6) user-programmable solid-state relay outputs related to common start-up sequencing functions such as purge, overcrank, crank disconnect, flooding, etc. Another output provides a signal in the event of overspeed, overload or the loss of any input; if this occurs, the ignition timing and waste-gate position are switched to preset values.

1.2 EPC TYPICAL CONTROL FUNCTIONS

A. IGNITION TIMING RETARD

Ignition Timing Retard vs. Engine Speed (s)

Ignition Timing Retard vs. Fuel Manifold Pressure (x)

Ignition Timing Retard vs. Air Manifold Pressure (y)

Ignition Timing Retard vs. Air Manifold Temperature (z)

Ignition Timing Retard vs. Unspecified Analog Variable (v)

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-200C Controller in a PID format.

B. AIR/FUEL RATIO

Air Manifold Pressure vs. Fuel Manifold Pressure (x)

Air Manifold Pressure vs. Engine Speed (s)

Air Manifold Pressure vs. Unspecified Analog Variable (v)

Air Manifold Pressure vs. Air Manifold Temperature (z)

The operating values for the first three variables are calculated separately according to user entered curves, and the combined net effect is implemented by the EPC-200C Controller. The resultant air/fuel ratio can also be directly modified based on air manifold temperature.

C. AUXILIARY OUTPUT FUNCTIONS (typical)

Purge Timer - Ignition On (O/4)

Purge Timer - Starting Fuel On (O/5)

Speed Switch - Crank Disconnect (O/2)

Speed Switch - Running Fuel On (O/3)

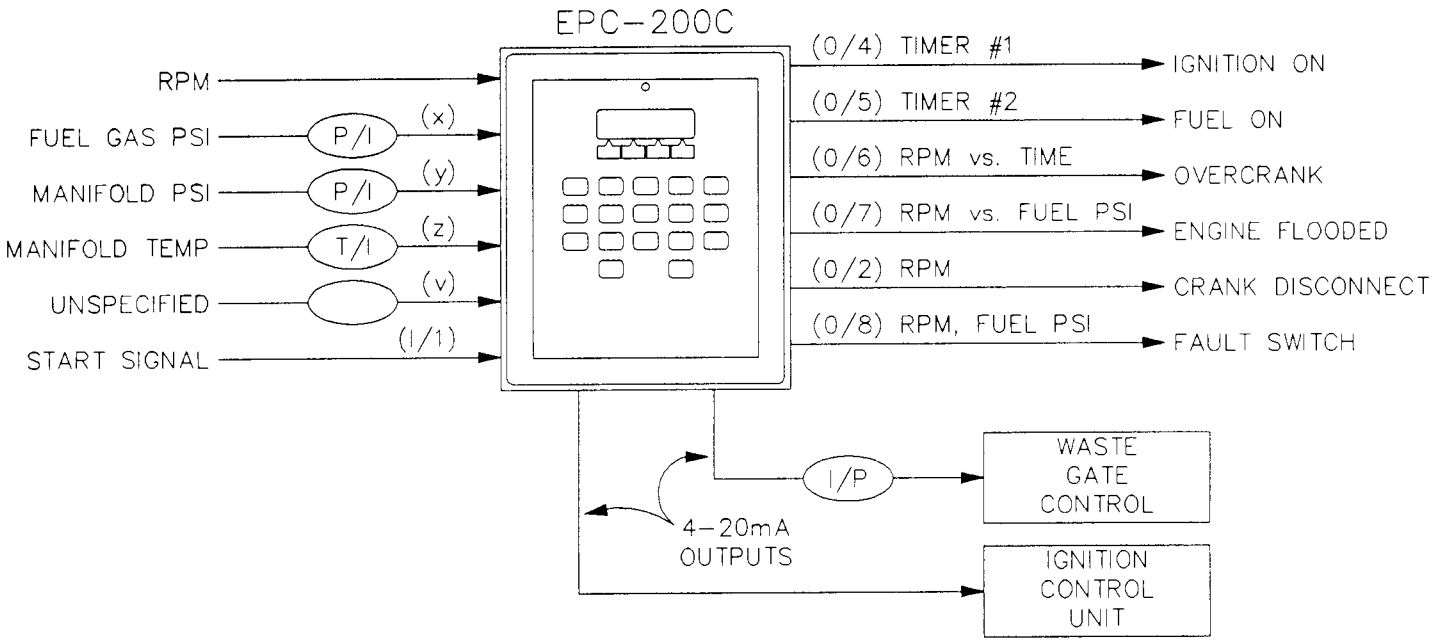
Speed Switch with Timer - Overcrank (O/6)

Speed Switch with Fuel Manifold Pressure Limit - Flooding (O/7)

Fault Switch - Overspeed, Overload, Loss of Input (O/8)

FIG.1

TYPICAL FUNCTIONS - EPC-200C



SECTION 2

REQUIRED DATA

2.0 REQUIRED DATA

2.1 GENERAL - Before the EPC-200C Controller can be used to maximum advantage on a particular engine, the overall function of the desired control system must be clearly defined. It must be decided if the controller will monitor both air/fuel ratio and ignition timing or only one of these functions. Additionally, the use of the available auxiliary functions (crank disconnect, overspeed, purge timers, etc.) should be carefully considered. Once a general outline or block diagram of the desired system has been developed, the actual data assembly can begin.

The best source of engine performance data is the information supplied by the engine manufacturer. This data can be supplemented by actual measurements taken on the engine to be controlled.

2.2 DATA REQUIRED - Look at the capability shown in section 1.2. Curves must be developed for any desired relationship shown there. In addition, the ignition timing at start-up must be known.

2.3 FORMATTING DATA FOR THE EPC-200C CONTROLLER - Once the required data for engine control has been assembled and appropriate graphs made, the information must be put into the graph format used by the EPC Controller. The EPC program translates the entered graphs into multiple linear equations to calculate an overall control response to a given set of input conditions. If some functions require a non-linear response, this can be approximated through the use of several linear segments in the entered graph. The chart (section 2.6) shows the number of segments available for each particular control relationship. Sections 2.7, 2.8 and 2.9 show the (x,y) coordinates from the control curve graphs that must be entered via the EPC keyboard. Section 3 describes the functions of the various channels of the Controller.

2.4 LINEAR EQUATIONS - All the performance curves are entered into the EPC Controller simply by entering the (x,y) coordinates of each point where the curve changes direction:

y = the control function (either ign. timing retard or air psi)
x = the input variable (RPM, pressure, temp., etc.)

2.5 GRAPHS (SEE SAMPLES IN SECTION 3 FOR CLARIFICATION)

A. GENERAL - It is suggested that all performance curves be drawn on appropriate graph paper, for example the type shown in this manual. In order to get the proper control operation, it is essential that the graphs be accurately drawn in the format shown including both sign (+,-) and magnitude. NOTE: All ignition timing graphs must be drawn showing ignition RETARD vs. control variable. Graphs provided by engine manufacturers typically show timing ADVANCE; this must be redrawn showing RETARD to get the proper polarity signs for the EPC.

2.6 FUNCTION CHART

DESCRIPTION	NO. OF SEGMENTS AVAILABLE	CHANNELS	EPC EXAMPLE SEE SECTION 3
Ignition Timing Retard vs. Engine Speed	5	31-38	1, 2
Ignition Timing Retard vs. Fuel Manifold Pressure	4	39-44	3, 4
Ignition Timing Retard vs. Air Manifold Pressure	4	45-50	5
Ignition Timing Retard vs. Temperature	4	51-56	6, 7
Ignition Timing Retard vs. Unspecified Variable	4	57-62	8
Air Manifold Pressure vs. Engine Speed	3	63-66	9
Air Manifold Pressure vs. Fuel Manifold Pressure	4	67-72	10, 11
Air Manifold Pressure vs. Unspecified Variable	3	73-76	12
Air Manifold Pressure vs. Temperature	Multiplier	77-79	13

2.7 IGNITION TIMING CONTROL

Numbers in parenthesis (XX) indicate the EPC channel number used.

Output: ITR = ignition timing retard [4-20ma] (05)

Inputs: s = RPM (00)
x = fuel manifold psi (01)
y = air manifold psi (02)
z = air manifold temp. (03)
v = unspecified variable (04)

Input Range	Output	User Entries
Measured Input - s [RPM]	Output Factor - ITRs	
s < (31)	ITRs = (32)	(31),(32)
s = (31) → (33)	ITRs = (32) → (34)	(33),(34)
s = (33) → (35)	ITRs = (34) → (36)	(35),(36)
s = (35) → (37)	ITRs = (36) → (38)	(37),(38)
s > (37)	ITRs = (38)	
Measured Input - x [fuel psi]	Output Factor - ITRx	
x < (39)	ITRx = (40)	(39),(40)
x = (39) → (41)	ITRx = (40) → (42)	(41),(42)
x = (41) → (43)	ITRx = (42) → (44)	(43),(44)
x > (43)	ITRx = (44)	
Measured Input - y [air psi]	Output Factor - ITRy	
y < (45)	ITRy = (46)	(45),(46)
y = (45) → (47)	ITRy = (46) → (48)	(47),(48)
y = (47) → (49)	ITRy = (48) → (50)	(49),(50)
y > (49)	ITRy = (50)	
Measured Input - z [temp.]	Output Factor - ITRz	
z < (51)	ITRz = (52)	(51),(52)
z = (51) → (53)	ITRz = (52) → (54)	(53),(54)
z = (53) → (55)	ITRz = (54) → (56)	(55),(56)
z > (55)	ITRz = (56)	
Measured Input - v [unspecified]	Output Factor - ITRv	
v < (57)	ITRv = (58)	(57),(58)
v = (57) → (59)	ITRv = (58) → (60)	(59),(60)
v = (59) → (61)	ITRv = (60) → (62)	(61),(62)
v > (61)	ITRv = (62)	

Calculate: ITRc = Calculated ignition timing retard
ITRc = ITRs + ITRx + ITRy + ITRz + ITRv

	User Entries
ITRd = Ignition timing retard desired	
If ITRc $\leq$ (12), ITRd = ITRc	(12),(14),(15)
If ITRc $\geq$ (12), ITRd = (12)	(16),(17)

Conditions	Output Instruction
Start override [SO = 1]	Hold ITR = (14)
Normal Operation [SO = AFO = 0]	ITR = ITRd, control in PID format
Air/fuel override [AFO = 1]	
y < y'	ITR = ITRd + 1 deg. $\leq$ (15) + ITRc $\leq$ (12) Hold for (16) secs., then repeat
y $\geq$ y'	ITR = ITR present - 1 deg. $\geq$ ITRd Hold for (17) secs., then repeat
ITR = ITRd and y $\geq$ y', then AFO → 0	ITR = ITRd

NOTE: AIR/FUEL OVERRIDE IS INOPERATIVE WHEN (15) = 0

2.8 AIR/FUEL PRESSURE RATIO CONTROL

Numbers in parenthesis (XX) indicate the EPC channel number used.

Output: WGP = waste gate positioner [4-20ma] (06)

Inputs: s = RPM (00)
x = fuel manifold psi (01)
y = air manifold psi (02)
z = air manifold temp. (03)
v = unspecified variable (04)

Input Range	Output	User Entries
Measured Input - s [RPM]	Output Factor - y's	
s < (63)	y'cs = (64)	(63),(64)
s = (63) → (65)	y'cs = (64) → (66)	(65),(66)
s > (65)	y'cs = (65)	
Measured Input - x [fuel psi]	Output Factor - y'x	
x < (67)	y'cx = (68)	(67),(68)
x = (67) → (69)	y'cx = (68) → (70)	(69),(70)
x = (69) → (71)	y'cx = (70) → (72)	(71),(72)
x > (71)	y'cx = (72)	
Measured Input - v [unspecified]	Output Factor - y'v	
v < (73)	y'cv = (74)	(73),(74)
v = (73) → (75)	y'cv = (74) → (76)	(75),(76)
v > (75)	y'cv = (76)	
For all z	(77) = (78)z + (79)	(78),(79)

Calculate: y'c = calculated air manifold psi (07)
y'c = (y's + y'x + y'v) X (77)

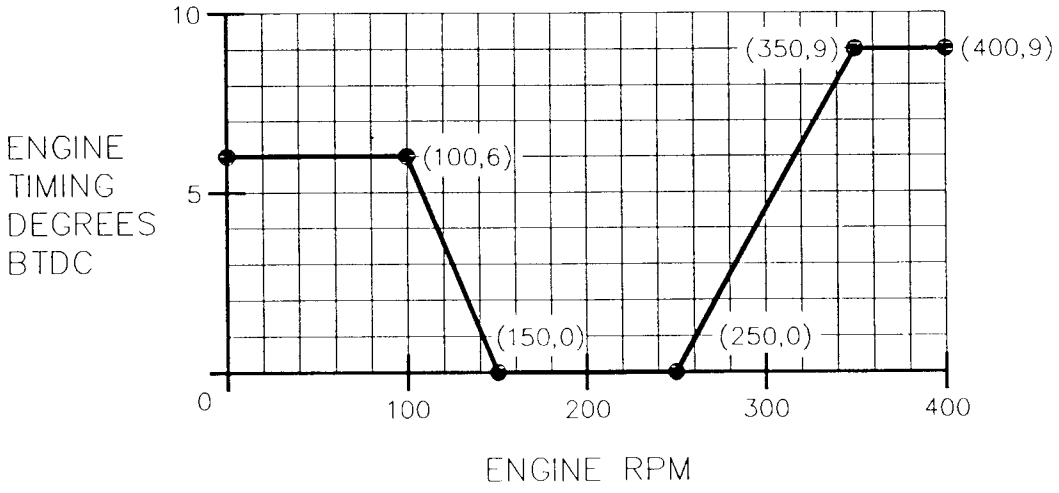
User Entries
Display (77)

Condition	Output Instruction
y = y'c	Hold WGP
y < y'c	Decrease WGP (PID format)
y > y'c	Increase WGP (PID format)
If WGP = 0% and y < y'c, then AFO = 1	Hold WGP = 0%
If in start override [SO = 1]	WGP = 0%

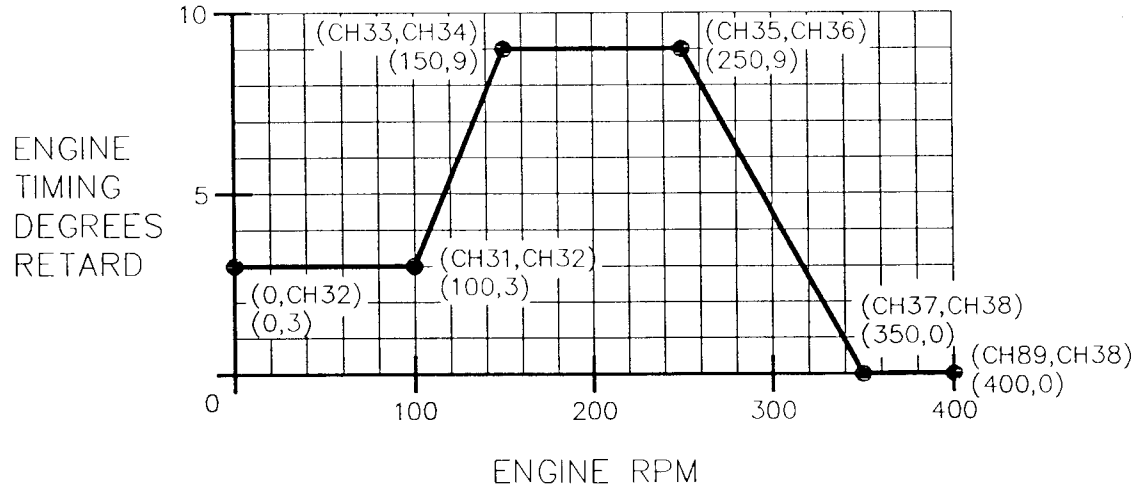
FIG.2

TYPICAL EPC GRAPHS

DATA SUPPLIED BY ENGINE MANUFACTURE



ABOVE GRAPH REDRAWN IN EPC DATA FORMAT



2.9 DISCRETE OUTPUT CHANNELS

Numbers in parenthesis (XX) indicate EPC channel number used.

SYMBOL	TYPE	DESCRIPTION	USER ENTRIES
I/1	Input	Start override (SO)	None
O/2	Output N.C.	RPM setpoint, speed exceeds (80)	(80)
O/3	Output N.O.	RPM setpoint, speed exceeds (81)	(81)
O/4	Output N.C.	Time delay (82) from end of SO [1 → 0]	(82)
O/5	Output N.O.	Time delay (83) from end of SO [1 → 0]	(83)
O/6	Output N.C.	Permissive lost if time from end of SO [1 → 0] is longer than time (84) and speed is below (85)	(84), (85)
O/7	Output N.C.	Permissive lost if fuel psi is greater than (86) and speed is below (87)	(86), (87)
O/8	Output N.C.	Permissive lost if x [fuel psi] $\geq$ (88) or if s [RPM] $\geq$ (89) or if any input signal x,y,z,v or s is lost When O/8 trips: ITR = (09); WGP = (10) First out fault indication in CH 91.	(88), (89) (09), (10)

SECTION 3

CHANNEL DESCRIPTION

3.0 EPC CHANNEL DESCRIPTION

OVERVIEW:

A. DISPLAY ONLY CHANNELS

00*	Engine speed (s)
01*	Analog input no. 1, fuel manifold pressure (x)
02*	Analog input no. 2, air manifold pressure (y)
03*	Analog input no. 3, air manifold temperature (z)
04*	Analog input no. 4, unspecified variable (v)
05*	Ignition Timing Retard (ITR) output
06*	Waste Gate Position (WGP) output (% open)
07*	Calculated air manifold pressure
08*	Ignition timing (degrees BTDC)

B. OVERRIDING CONSTANTS

09	Default value - ITR
10	Default value - WGP
11	Full advance timing point (degrees BTDC)
12	ITR - maximum limit
13	Time delay before O/8 active
14	ITR during start override
15	ITR limit in air/fuel override
16	Time between retard steps - air/fuel override
17	Time between advance steps - air/fuel override

C. SCALING FACTORS

18	Scaling - degrees of retard for ITR output
19-21	Scaling - analog input no. 1, fuel manifold pressure (x)
22-24	Scaling - analog input no. 2, air manifold pressure (y)
25-27	Scaling - analog input no. 3, air manifold temperature (z)
28-30	Scaling - analog input no. 4, unspecified variable (v)

D. IGNITION TIMING RETARD (ITR) CURVE COORDINATES

31-38	ITR vs. RPM coordinates (s)
39-44	ITR vs. fuel manifold pressure coordinates (x)
45-50	ITR vs. air manifold pressure coordinates (y)
51-56	ITR vs. air manifold temperature coordinates (z)
57-62	ITR vs. unspecified variable coordinates (v)

E. CALCULATED AIR MANIFOLD PRESSURE (Y'C) CURVE COORDINATES

63-66	y'c vs. RPM coordinates (s)
67-72	y'c vs. fuel manifold pressure coordinates (x)
73-76	y'c vs. unspecified variable coordinates (v)

F. TEMPERATURE CORRECTION FACTORS - Y'C

77*	Temperature correction multiplier
78	Slope of temperature multiplier
79	Offset of temperature multiplier

* Display only channels; no data entered on these channels.

G. DISCRETE OUTPUTS

80	RPM limit to trip O/2
81	RPM limit to trip O/3
82	Time limit to trip output O/4
83	Time limit to trip output O/5
84	Time limit for output O/6
85	Safe RPM for output O/6
86	Pressure limit for output O/7
87	Safe RPM for output O/7
88	Pressure to trip O/8 - default mode
89	RPM limit to trip O/8 - default mode

H. DIAGNOSTIC CHANNELS

90*	Error message
91*	First-out fault for output O/8

I. PI RESPONSE FACTORS

92	Reset response control - ITR
93	Proportional band control - WGP
94	Reset response control - WGP

J. SET-UP CHANNELS

98	No. of sensed teeth (500 max.)
99	Password/configuration

* Display only channels; no data entered on these channels.

CHANNELS 00-08: DISPLAY ONLY CHANNELS

Channels 00-08 are used to display data as described below. No data is inputted on these channels.

CHANNEL 00: Displays engine RPM.

CHANNEL 01: Displays the present value of analog input no. 1 (x), typically fuel manifold pressure.

CHANNEL 02: Displays the present value of analog input no. 2 (y), typically air manifold pressure.

CHANNEL 03: Displays the present value of analog input no. 3 (z), typically air manifold temperature.

CHANNEL 04: Displays the present value of analog input no. 4 (v), for example, exhaust temperature.

CHANNEL 05: Displays the output value of Ignition Timing Retard (ITR) in degrees which is internally calculated by the EPC.
NOTE: 4 ma output = no retard; 20 ma output = full retard.

CHANNEL 06: Displays the Waste Gate Position (WGP) in Per Cent Open.
NOTE: 4 ma output = 0% Open; 20 ma output = 100% Open.

CHANNEL 07: Displays the Desired Air Manifold Pressure (y'c) which is internally calculated by the EPC. The EPC compares this to the actual Air Manifold Pressure (Channel 02) and continually seeks to adjust the Waste Gate position to bring the reading of Channel 02 equal to the desired value shown on Channel 07.

CHANNEL 08: Displays the Ignition Timing point in degrees BTDC (positive number) or ATDC (negative number).
NOTE: Channel 08 = Channel 11 minus Channel 05.

CHANNELS 09-17: OVERRIDING CONSTANTS

Channels 09-17 are values which control certain aspects of the EPC program overriding the normal control curves.

CHANNEL 09: (required) DEFAULT VALUE OF ITR (degrees of retard) - This is the value of Ignition Timing Retard that will be outputted if the default output O/8 is tripped. A compromise timing value that is safe under all conditions should be chosen for this entry.

CHANNEL 10: (required) DEFAULT VALUE OF WGP (in % open) - This is the Waste Gate Position in Per Cent Open that will be outputted if the Default Output O/8 is tripped. A compromise value that is safe under all conditions should be chosen for this entry.

CHANNEL 11: (required) FULL ADVANCE TIMING (degrees BTDC) - Enter the value of Ignition Timing in degrees BTDC when the EPC is outputting zero retard. This input must be correct for Channel 08 to give the correct Ignition Timing value during operation. NOTE: If the full advance timing is altered at the ignition system, the value in Channel 11 must be changed accordingly.

CHANNEL 12: (required) MAX. VALUE OF ITR (degrees of retard) - Enter the maximum amount of Ignition Timing Retard to be allowed under any condition. This limit may depend on the ignition system being used or may be a limit imposed by the particular engine application.

CHANNEL 13: (required) TIME DELAY AFTER START-UP BEFORE ARMING DEFAULT OUTPUT O/8 (secs.) Enter the maximum amount of time that the Default Output O/8 should be locked-out after the Start Override signal ends. This lock-out time is required to allow the engine to start and stabilize before the Default Output is armed.

CHANNEL 14: (required) VALUE OF ITR DURING START OVERRIDE (degrees of retard) - Enter the value of Ignition Timing Retard desired during start override when input I/1 is active.

CHANNEL 15: (optional) MAX. VALUE OF ITR ALLOWED IN AIR/FUEL OVERRIDE (degrees of retard) Enter the maximum value of Ignition Timing Retard to be allowed during Air/Fuel Override mode. This limits how far the ignition timing may be retarded in an effort to increase exhaust temperature for increased turbocharger output (boost). A typical value is 2 degrees.

CHANNEL 16: (optional) TIME DELAY BETWEEN RETARD STEPS DURING AIR/FUEL OVERRIDE (secs.) Enter the time delay between ignition timing RETARD steps during the Air/Fuel Override mode. This delay is required to allow the engine to respond to the increments of ignition timing retard which are implemented to obtain additional exhaust temperature and thus additional air capability from the turbocharger. A typical value is 120 seconds.

CHANNEL 17: (optional) TIME DELAY BETWEEN ADVANCE STEPS DURING AIR/FUEL OVERRIDE (secs.) Enter the time delay between ignition timing ADVANCE steps during the Air/Fuel Override mode. This delay is required to allow the engine to respond to the increments of ignition timing advance as additional air is being made available by the turbocharger. A typical value is 5 seconds.

CHANNEL 18: IGNITION TIMING RETARD RANGE (required)

Channel 18 is the range of Ignition Timing Retard (in degrees) represented by the 4-20 ma ITR output signal. This number should equal the range of the particular ignition system being used:

Altronic II-CPU:	48.0 degrees - memory chip code A
	36.0 degrees - memory chip code B
	24.0 degrees - memory chip code C
Altronic III-CPU:	8.0 degrees - memory chip code D, 2-cycle
	16.0 degrees - memory chip code D, 4-cycle

CHANNELS 19-30: ANALOG INPUT SCALING (required)

Channels 19-30 scale the four analog input signals. The inputs must be a nominal 1-5 volt or 4-20 ma signal.

Example: Analog input no. 1 is fuel pressure with a transducer with a nominal range of 0-15 psi.

Actual voltage output with 0 psi:	1.15	(Channel 19)
Engineering Units (psi) @ Min. signal:	00.0	(Channel 20)
Engineering Units (psi) @ 5V. signal:	14.9	(Channel 21)

This process is repeated for all analog inputs being used. The table below gives the channel numbers for each particular analog input:

	ANALOG INPUT			
	NO. 1	NO. 2	NO. 3	NO. 4
* MINIMUM VOLTAGE ..... CHAN.	19	22	25	28
** ENGR. UNITS AT MIN. V. INPUT... CHAN.	20	23	26	29
** ENGR. UNITS AT 5V. INPUT..... CHAN.	21	24	27	30

* The MINIMUM VOLTAGES should be entered in the form X.XX.

** For each analog input, the engineering units at MIN. voltage input must be entered BEFORE the engineering units at 5V. input. When entering the engineering units at minimum voltage, enter the decimal point and the appropriate number of entries (zeros if necessary) to give the desired resolution at 5V. EXAMPLES:

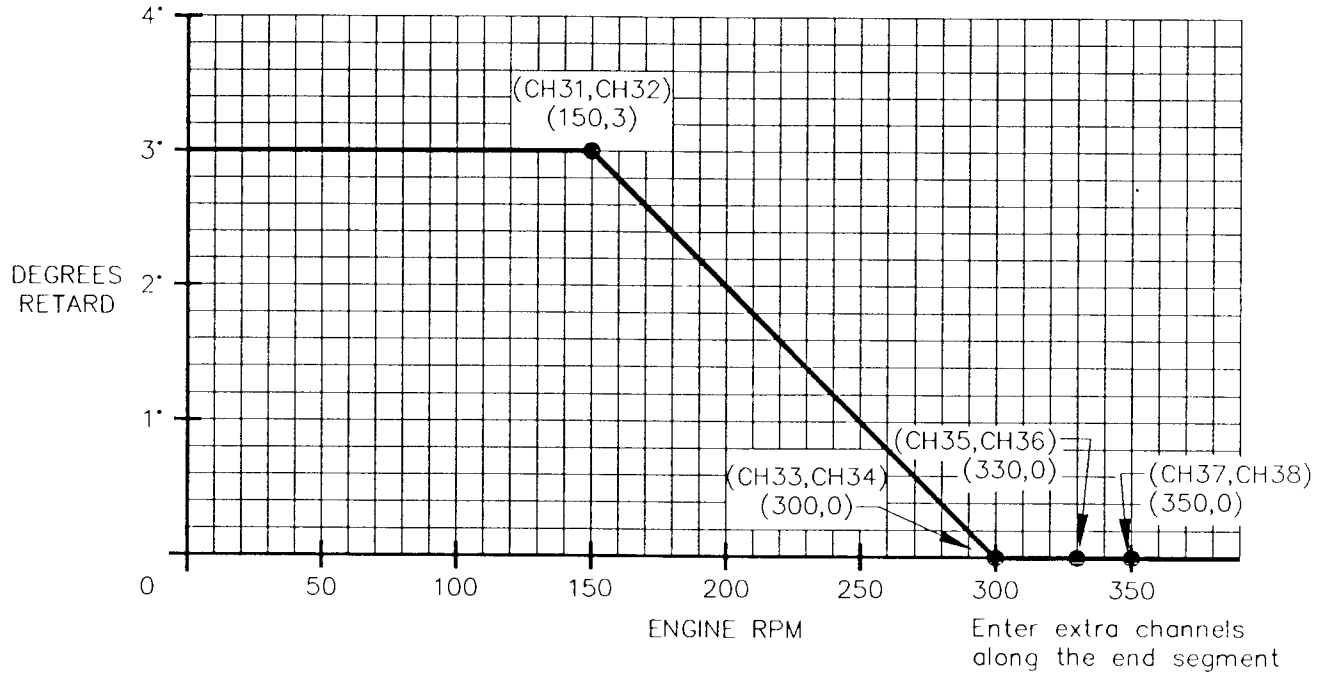
If range is 0 - 15 psi, enter 0.0 (15.0 @ 5V.)
If range is 0 -100 psi, enter 0.0 (100.0 @ 5V.)

NOTE: It is recommended that pressures be entered with one digit after the decimal point (XX.X) and temperatures be entered in whole numbers (XXX) for ease of reading on the EPC display. Any desired format not exceeding four significant figures may be used but the format must be the same for both the MIN. V. and 5V. engineering unit entries.

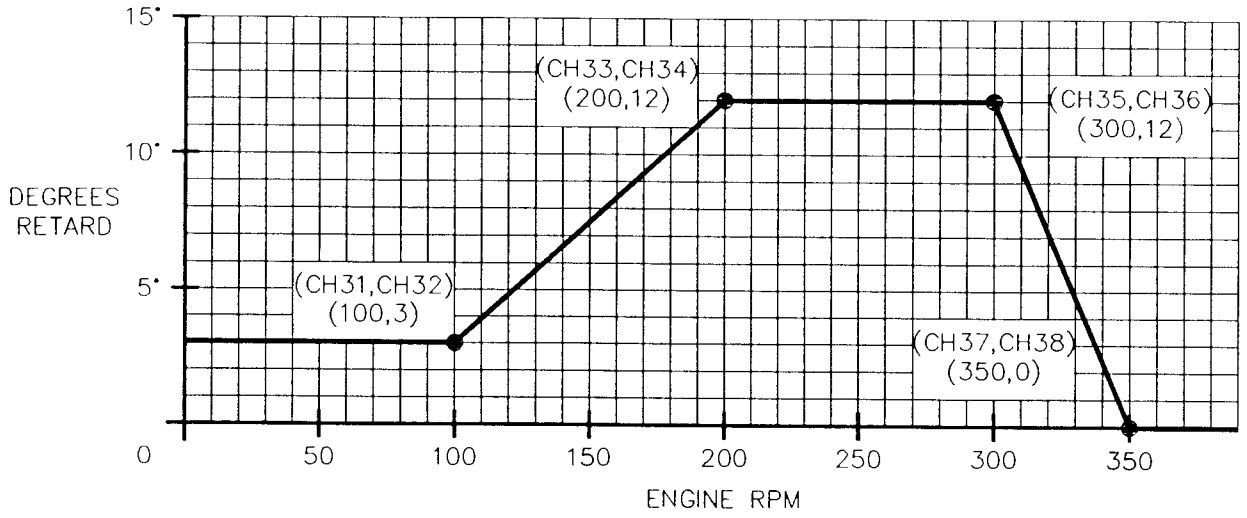
CHANNELS 31–38: CURVE COORDINATES – ITRs VS. RPM (s) (optional)

Make a graph of the desired Ignition Timing Retard (ITR) vs. RPM (s). Three sloped segments are available with the timing remaining constant starting from zero RPM to the start of the first segment and constant from the end of the third segment to the overspeed RPM entered in Channel 89. If this function is not used, zero (0) should be entered in Channels 31 to 38. Two examples are shown below:

EXAMPLE 1 – Typical curve not requiring all available segments.



EXAMPLE 2 – Theoretical curve requiring all available segments.

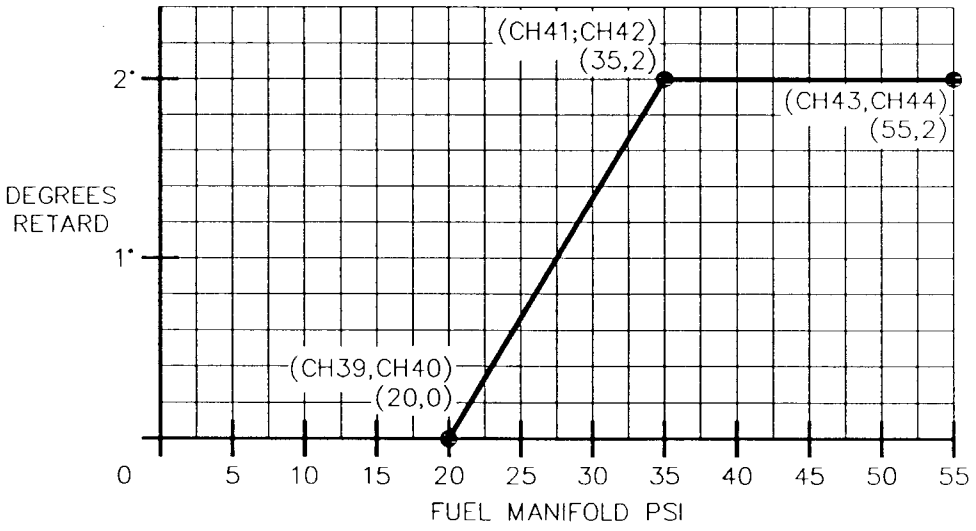


NOTE: If the particular application does not require an Ignition Timing change vs. RPM, use ITR vs. Fuel Manifold Pressure as the basic curve.

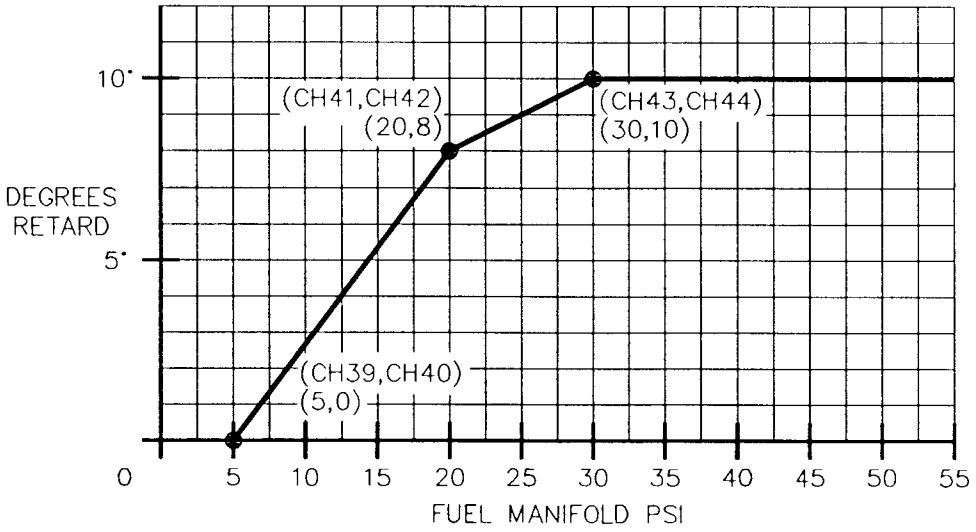
CHANNELS 39–44: CURVE COORDINATES – ITRx VS. FUEL MANIFOLD PRESSURE (x)

Make a graph of the desired Ignition Timing Retard (ITR) vs. Fuel Manifold Pressure (x). Fuel Manifold Pressure is a representation of engine load and this graph should be thought of as a modifier to the ITR vs. RPM graphs (unless there is no timing change vs. RPM in which case engine load probably is the basic factor). Two sloped segments are available with the timing remaining constant from zero Fuel Manifold Pressure to the start of the first segment and constant from the end of the second segment to the overload pressure value entered in Channel 88.

EXAMPLE 3 – Typical curve.



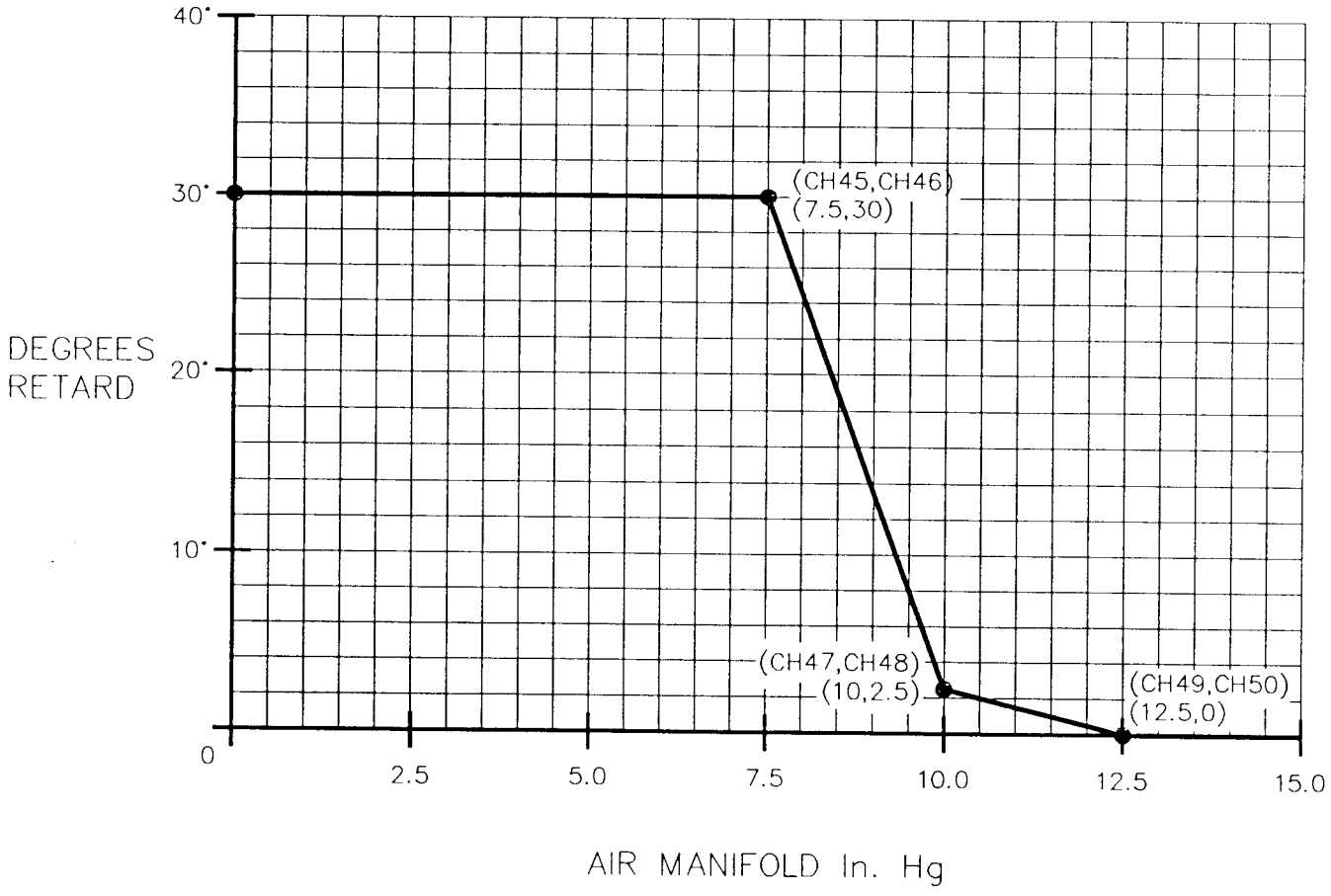
EXAMPLE 4 – Theoretical curve requiring all available segments.



CHANNELS 45–50 : CURVE COORDINATES – ITRy VS. AIR MANIFOLD PRESSURE (y)

This graph can be used to advance the ignition timing following a large initial retard for turbocharger warm–up (especially on 2–cycle engines). By using Air Manifold Pressure as the control variable, you are assured that the timing will not advance too rapidly. Two sloped segments are available with the timing remaining constant from zero Air Manifold Pressure to the start of the first segment and constant from the end of the second segment.

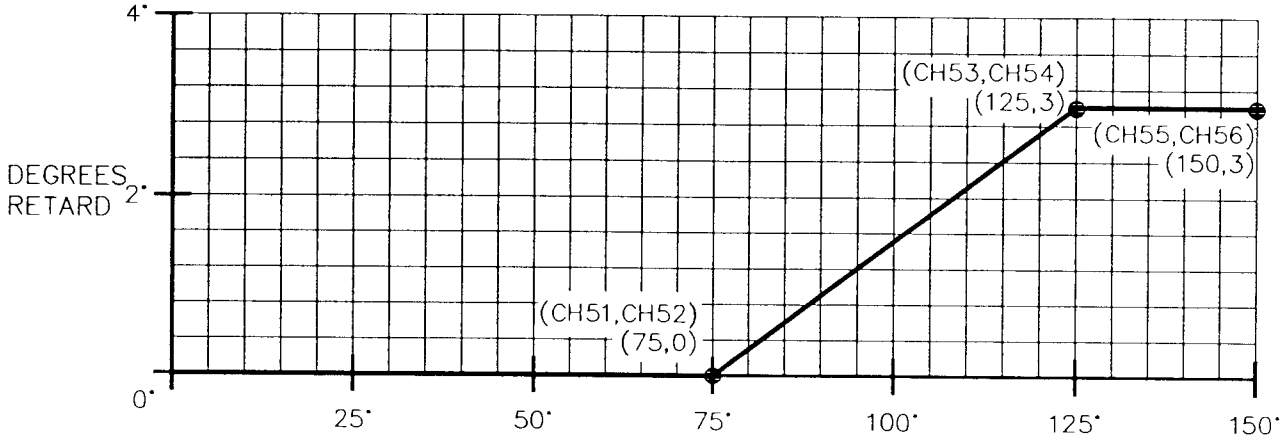
EXAMPLE 5 – Typical curve for use of ITR vs. Air Manifold Pressure.



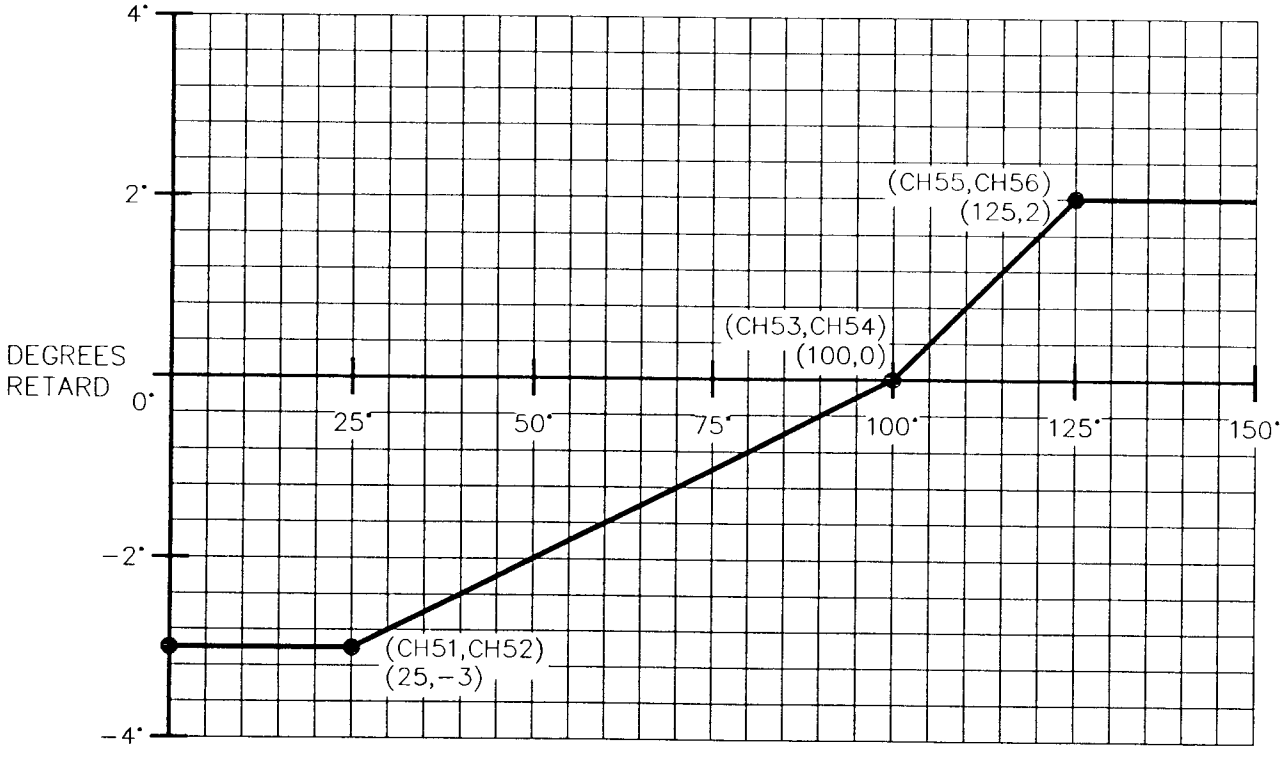
CHANNELS 51–56: CURVE COORDINATES – ITRz VS. AIR MANIFOLD TEMPERATURE (z)

Make a graph of the desired Ignition Timing Retard (ITR) vs. Temperature (z). Two sloped segments are available with the timing remaining constant from zero degrees to the start of the first segment and constant from end of the second segment. This graph should be thought of as a modifier to the Ignition Timing Retard vs. RPM graph.

EXAMPLE 6 – Typical curve with one sloped segment.



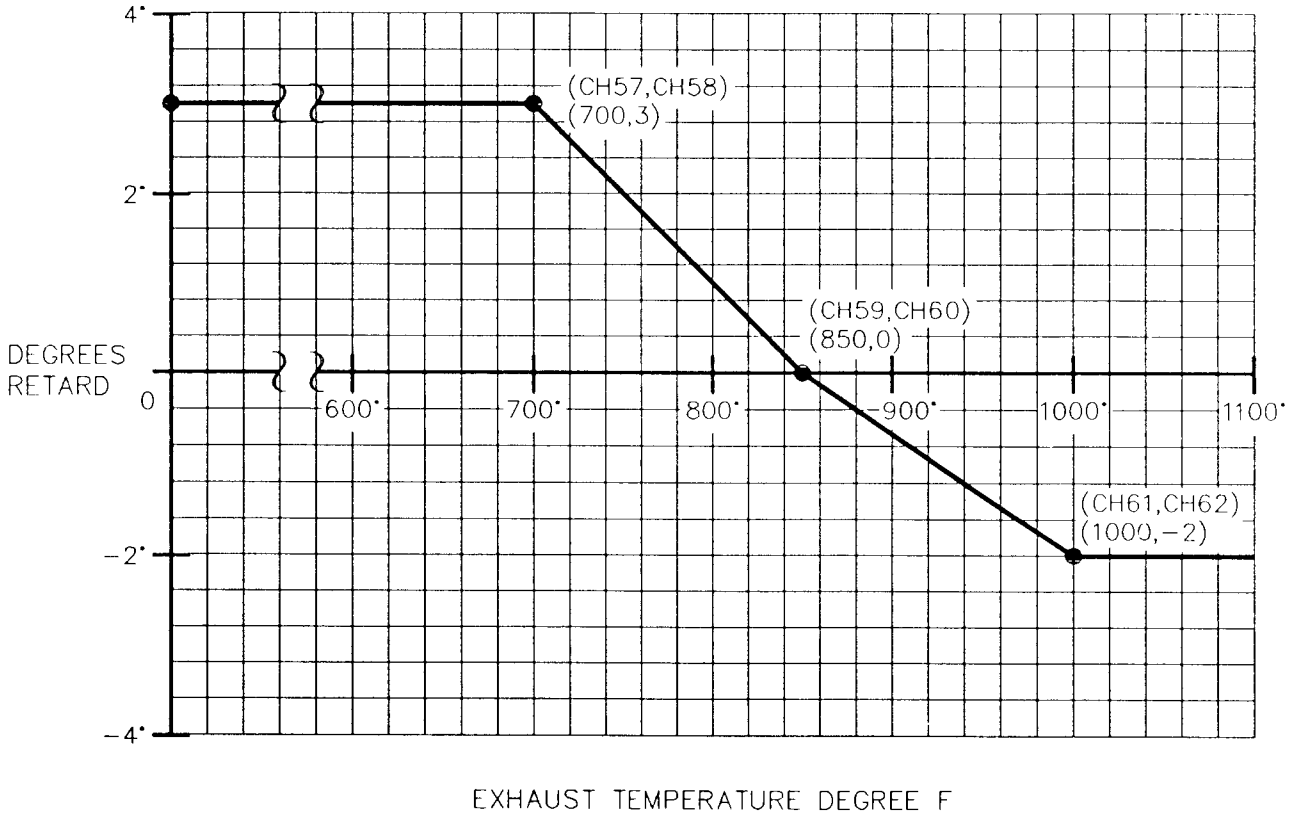
EXAMPLE 7 – Theoretical curve requiring all available segments.



CHANNELS 57–62: CURVE COORDINATES – ITRv VS. UNSPECIFIED VARIABLE (v)

The Unspecified Variable curve is available as an additional modifier of the basic Ignition Timing vs. RPM curves. The format is identical to that with the other input signals. A typical use is shown below.

EXAMPLE 8 – Curve for ITRv vs. Exhaust Temperature.

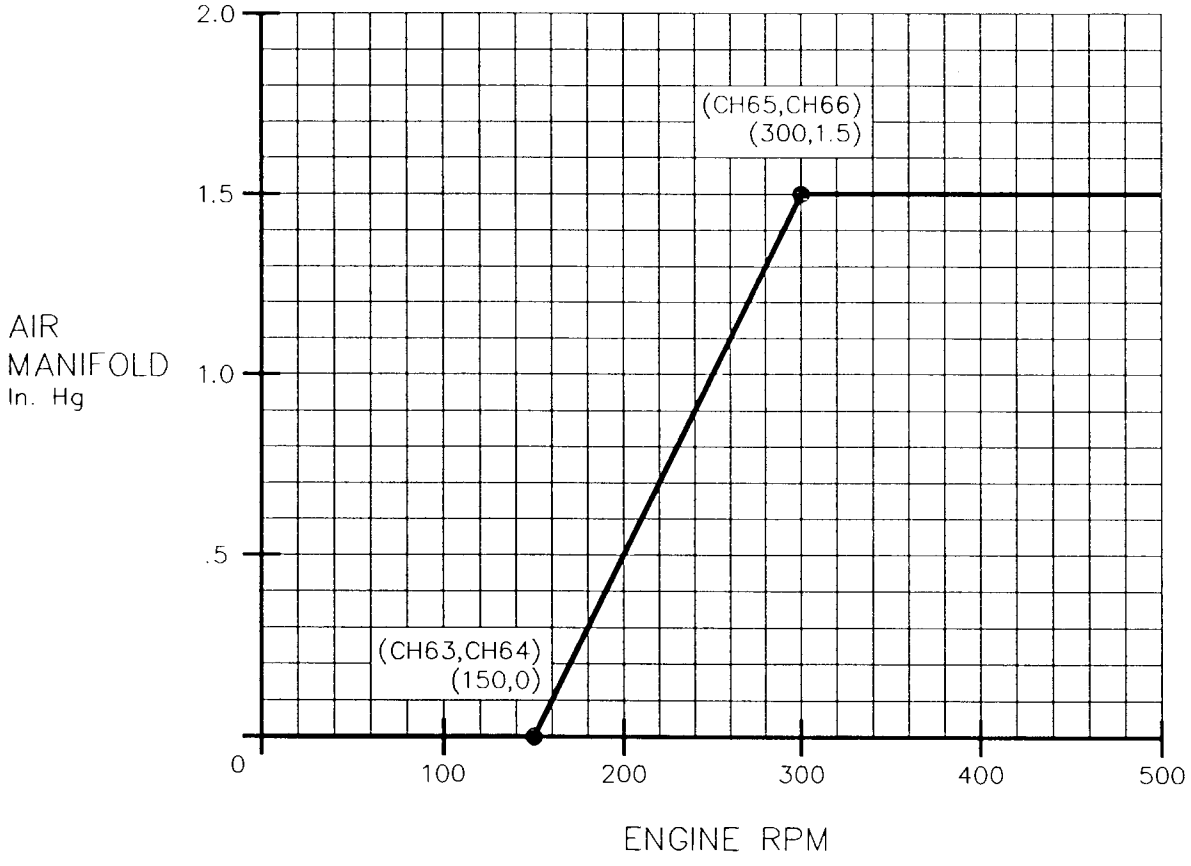


CHANNELS 63–66: CURVE COORDINATES – Y'Cs VS. RPM (s)

NOTE: It is recommended that Channels 67–72 be entered first as the Fuel Manifold Pressure will, in most cases, be the basic control variable for the Desired Air Manifold Pressure y'c.

Make a graph of the desired change in Air Manifold Pressure (y'c) vs. RPM (s). One sloped segment is available with the value of y'c remaining constant below the start and above the end of the segment. This graph should be thought of as a modifier to the basic Air Pressure vs. Fuel Pressure Curve (Channels 67–72).

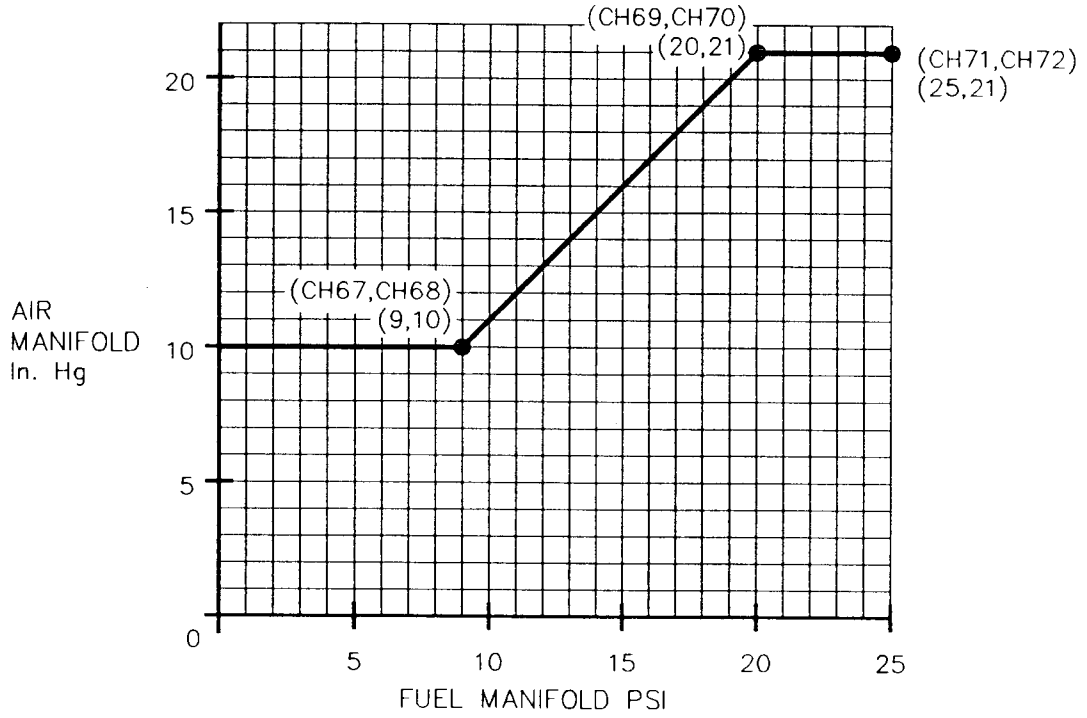
EXAMPLE 9 – Typical curve for use of Y'C vs. RPM.



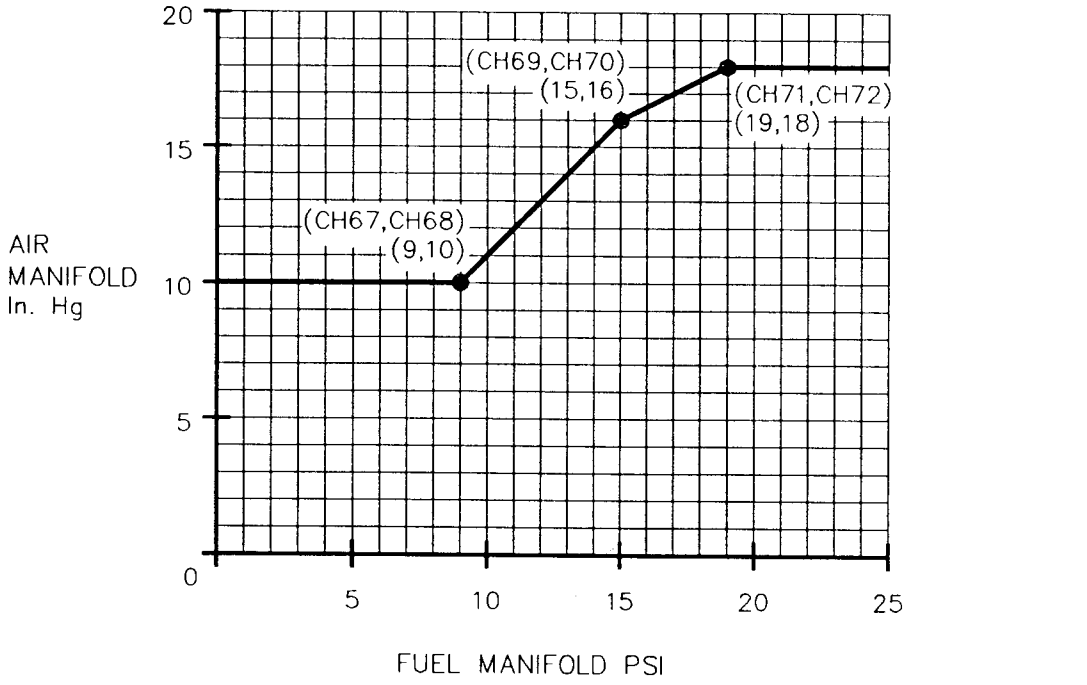
CHANNELS 67–72: CURVE COORDINATES – Y'Cx VS. FUEL MANIFOLD PRESSURE (x)

Make a graph of the desired relationship between Air Manifold Pressure (y'c) and Fuel Manifold Pressure (x). This is the primary relationship between air and fuel on the engine. Two sloped segments are available with the value of y'c remaining constant below the start of the first segment and above the end of the second segment. Two examples are shown below:

EXAMPLE 10 – Typical curve with one sloped segment.



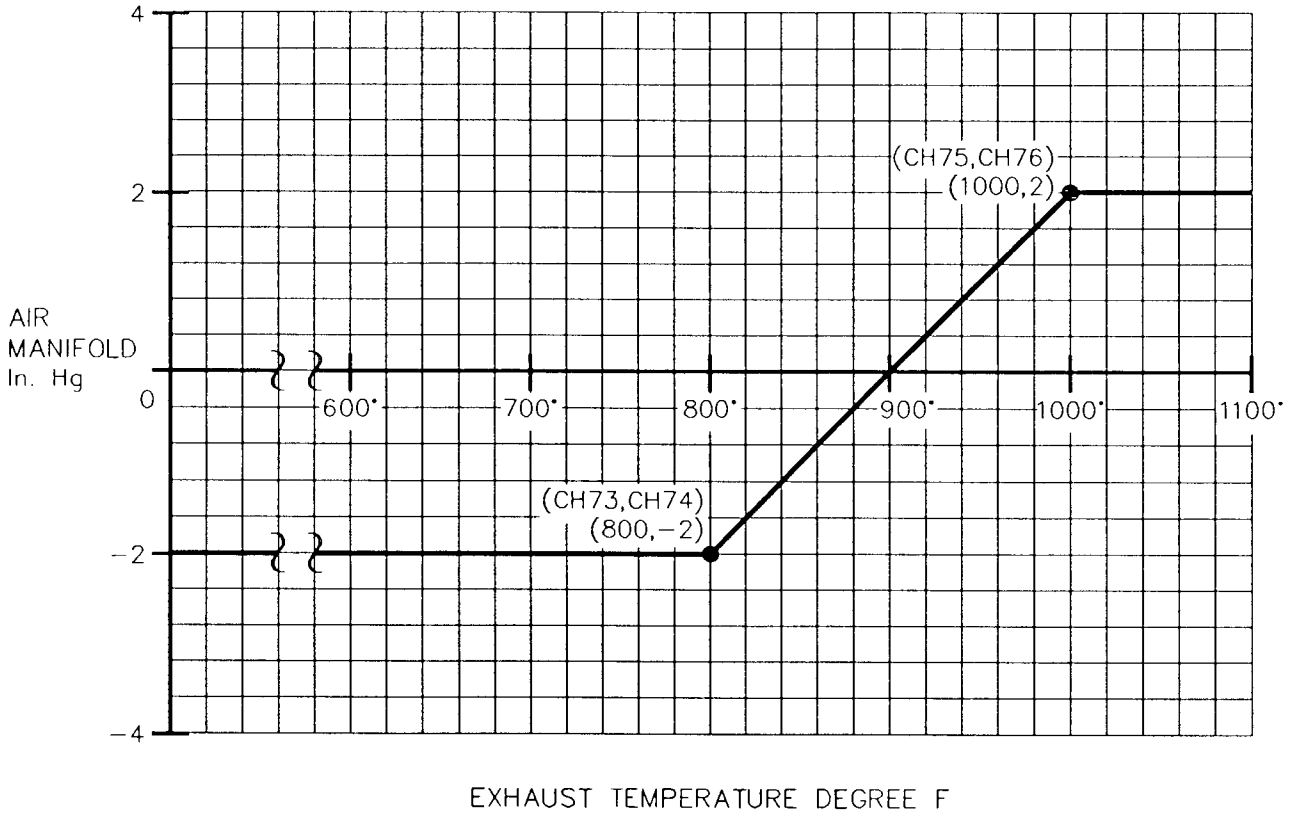
EXAMPLE 11 – Theoretical curve requiring all available segments.



CHANNELS 73–76: CURVE COORDINATES – Y'Cv VS. UNSPECIFIED VARIABLE (v)

The Unspecified Variable curve is available as an additional modifier of the basic Air Manifold Pressure (y'c) vs. Fuel Pressure curve. The format is identical to that with the other input signals. A typical use is shown below.

EXAMPLE 12 – CURVE FOR Y'Cv vs. Exhaust Temperature.



CHANNELS 77–79: TEMPERATURE MODIFIER FOR DESIRED AIR MANIFOLD PRESSURE

The temperature modifier for Desired Air Manifold Pressure (y'c) is in the form of a multiplier of the value of y'c obtained by adding together the components derived from input factors x, s and v.

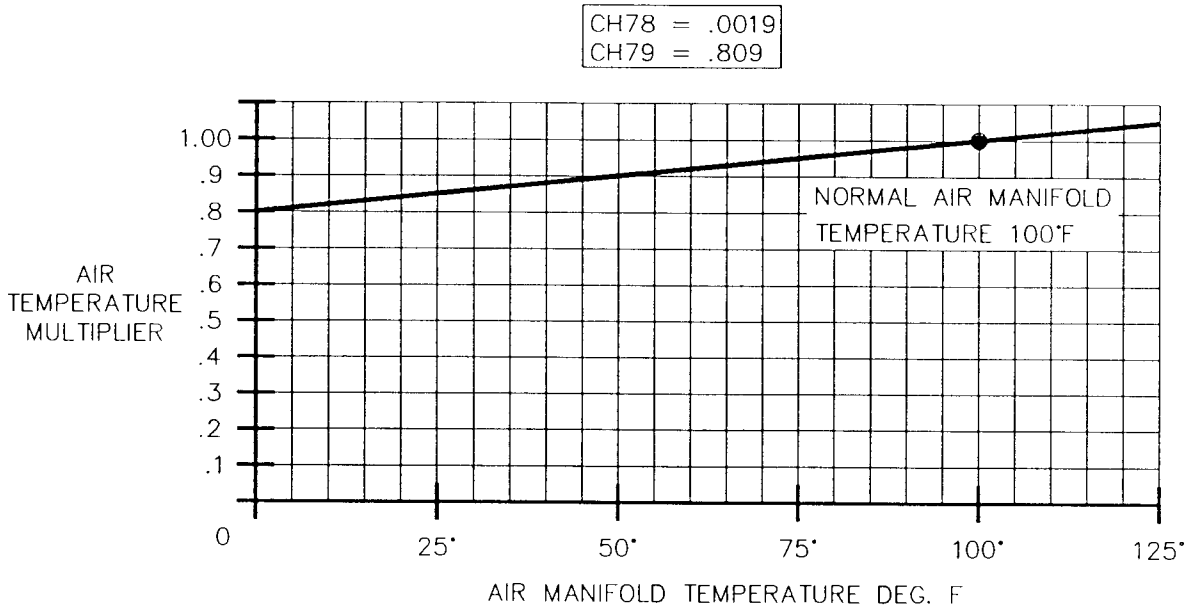
$$y'c = (77) \times (y'cs + y'cx + y'cv)$$

$$(77) = (78)z + (79)$$

The multiplier factor (Channel 77) is itself obtained from a linear equation with a slope (78) and offset value (79). The purpose of the temperature modifier is to compensate for the difference in the density of air as its temperature changes. The curve below should be used on engines which experience a significant change in air manifold temperature.

On intercooled or aftercooled engines, temperature compensation should not be necessary. If the temperature modifier is not used, zero ("0") must be entered in Channel 78 and one ("1") must be entered in Channel 79.

EXAMPLE 13 – Curve for temperature modifier.



CHANNELS 80-89: DISCRETE OUTPUTS

Channels 80-89 are listed below set-up for the common functions for a typical installation.

CHANNEL 80: (optional) ENGINE RPM TO TRIP OUTPUT O/2 - Can be used for various speed switch functions such as crank disconnect. Output O/2 is tripped when the entered RPM is reached after start-up.

CHANNEL 81: (optional) ENGINE RPM TO TRIP OUTPUT O/3 - A second speed switch similar to Channel 80 except that O/3 is tripped when the entered RPM is reached after start-up.

CHANNEL 82: (optional) TIME INTERVAL AFTER END OF START OVERRIDE SIGNAL TO TRIP O/4 Output O/4 will trip after the entered time interval (in seconds) expires following the end of the start override signal.

CHANNEL 83: (optional) TIME INTERVAL AFTER END OF START OVERRIDE SIGNAL TO TRIP O/5 Output O/5 will trip after the entered time interval (in seconds) expires following the end of the start override signal.

CHANNELS 84, 85: (optional) OVERCRANK FUNCTION, TRIPS O/6 - Output O/6 will trip if the RPM entered in Channel 85 is not reached in the time interval (in seconds) entered in Channel 84 following the end of the start override signal.

EXAMPLE: Channel 84 = 20 seconds; Channel 85 = 200 RPM
Output O/6 will trip if the engine does not exceed 200 RPM within 20 seconds after the end of the start override signal.

CHANNELS 86, 87: (optional) FLOODING FUNCTION, TRIPS O/7 - Output O/7 will trip if the RPM entered in Channel 87 is not reached before the fuel pressure entered in Channel 86 is exceeded.

EXAMPLE: Channel 86 = 5 psi; Channel 87 = 200 RPM
Output O/7 will trip if the engine does not exceed 200 RPM before the fuel pressure exceeds 5 psi.

CHANNELS 88, 89: (required) OVERSPEED AND OVERLOAD FUNCTION, TRIPS O/8 - Output O/8 will trip if either the fuel pressure entered in Channel 88 or the RPM entered in Channel 89 is exceeded.

EXAMPLE: Channel 88 = 16 psi; Channel 89 = 363 RPM
Output O/8 will trip if the fuel pressure exceeds 16 psi OR if engine RPM exceeds 363 RPM.

NOTE: To allow normal operation of the EPC Controller, the values in Channels 88 and 89 must be slightly above the maximum normal running values for fuel pressure and RPM. If either of these is exceeded, the Controller ceases normal operation and goes to the fixed default values entered in Channels 09 and 10.

CHANNELS 90, 91: DIAGNOSTICS

Channel 90 gives the current status in operation. Channel 91 locks onto the first-out fault; this is useful in the case where the EPC is used to effect an engine shutdown which can lead to subsequent fault signals. The display code for both Channels 90 and 91 is as follows:

Normal condition:	[9X 0000]
Loss of speed input:	[9X 0200]
Loss of analog input 1 (fuel pressure):	[9X 0001]
Loss of analog input 2 (air pressure):	[9X 0002]
Loss of analog input 3 (air temperature):	[9X 0010]
Loss of analog input 4 (unspecified variable):	[9X 0020]
Loss of power to all transducers:	[9X 0033]
Main board in EPC unplugged from power section:	[9X 0233]
Overspeed (speed higher than value in channel 89):	[9X 1000]
Overload (fuel psi higher than value in channel 88):	[9X 0100]

CHANNEL 92: RESPONSE RESET TIME - ITR

Channel 92 is the response reset time for the Controller to implement ignition timing changes. A longer time entered in this Channel gives a slower response to changes in input factors. Typically, this entry should be between 1 and 5 seconds. Two (2) seconds is suggested as an initial entry.

CHANNEL 93: PROPORTIONAL BAND VALUE - WGP

The proportional band value determines the magnitude of the Controller response to changes in input factors; this value is inversely proportional to the gain. For example:

Proportional Band	Gain	Controller Response
50%	2.0	Greater magnitude of initial response
100%	1.0	Nominal magnitude of initial response
125%	0.8	Lesser magnitude of initial response

A value of 60 per cent is suggested as an initial entry.

CHANNEL 94: RESPONSE RESET TIME - WGP

Channel 94 is the reset response rate for the Controller to implement changes in waste gate position. A longer time entered in this Channel gives a slower response to changes in input factors. Typically this entry should be between 10 and 40 seconds. Twenty (20) seconds is suggested as an initial entry.

CHANNEL 98: NO. OF SENSED TEETH

Enter in Channel 98 the number of teeth (or drilled holes) to be sensed by the magnetic pick-up. This number should be at least 60 and not greater than 500.

CHANNEL 99: PASSWORD/CONFIGURATION CHANNEL

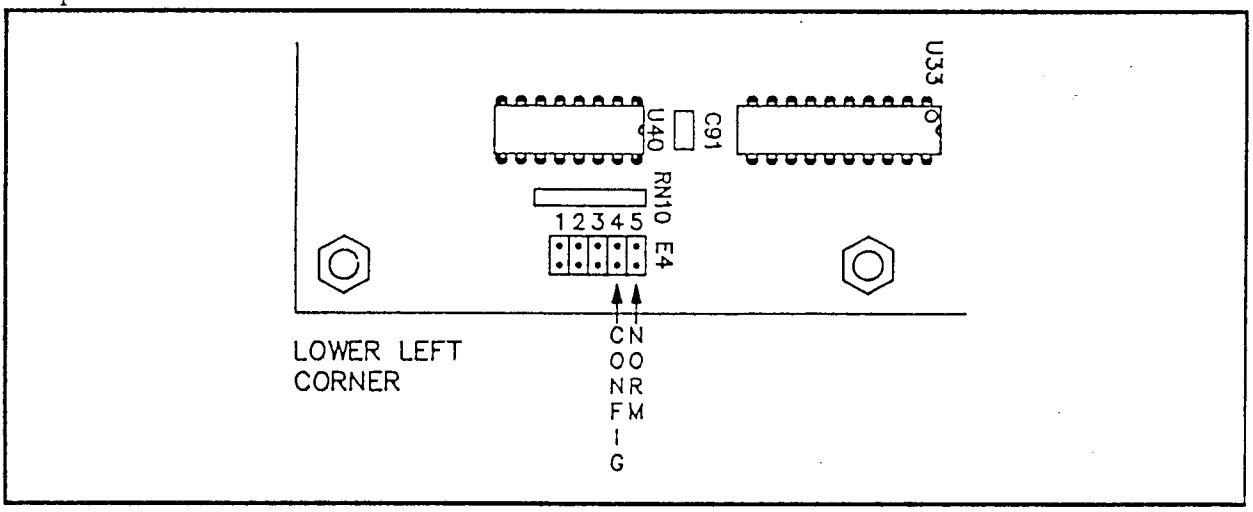
Channel 99 is the configuration channel. All data entries such as scaling factors, curve co-ordinates, etc. are password protected. Therefore, it is not possible to change these entries without first entering the password in Channel 99.

NOTE: The current entry in any channel can be read on the display without entering the configuration mode (i.e. without the use of the password). The password and configuration mode are required ONLY to change channel entries.

1. ENTERING DESIRED PASSWORD - The EPC-200C is shipped with a standard password of "9768". If a different password is preferred, proceed as follows. Move the small jumper on the main logic board (mounted to the EPC enclosure cover) to the fourth position from the left (see drawing below).

Enter 99 and press "ENTER":	[99E 0]
Enter desired password, for example "1234":	[99E 1234]
Press "ENTER":	[99 1234]

Re-position the circuit board jumper in the last (fifth) position for normal operation.



2. ENTERING THE CONFIGURATION MODE - In order to enter or change data in any of the channel entries, it is first necessary to enter the configuration mode.

Enter 99 and press "ENTER":	[99E 0]
Enter your password, for example "1234":	[99E 1234]
Press "ENTER":	[99 HELLO]

All four status indicators should be flashing indicating the EPC is now in the configuration mode. This allows any channel data entry to be changed.

3. LEAVING THE CONFIGURATION MODE - To leave the configuration mode and return to normal operation with protected entries, proceed as follows:

Enter 99 and press "ENTER":	[99E 0]
Enter 0:	[99E 0]
Press "ENTER":	[99 -----]

The EPC is now in the normal operating mode.

SECTION 4

DATA ENTRY

4.0 DATA ENTRY

4.1 APPLICATION CHARTS - On the following three pages are Application Charts for the data entry EPC Channels. It is recommended that the user keep a log of Channel entries on these pages for reference purposes.

A. Application Chart A has the Overriding Constants and Scaling Factors. The user should, in particular, carefully consider the values of channels (09) and (10) since the Controller will default to these values should any input be lost, or if fuel pressure or engine RPM exceed the preset limits. Output O/8 is also tripped under default conditions, and it is strongly recommended that O/8 be connected to effect an engine shutdown.

B. Application Chart B has the Coordinates of the controlling graphs. Based on the examples of section 3, translate the data for the particular engine to be controlled into similar graphs. The entries must follow the (x,y) coordinate format given in section 2.7 and 2.8 as illustrated in the samples in section 3. The following rules should be followed when entering coordinate data:
   - Assign all the Channels in categories being used - see the examples in section 3.
   - Zero ("0") should be left in the Channels of unused categories EXCEPT for Channel 79. If the temperature modifier is not required for air/fuel ratio control, enter zero ("0") in Channel 78 and one ("1") in Channel 79.

C. Application Chart C has the Discrete Outputs, the PI response entries and the Set-up and Password Channels. For the Discrete Output Channels 80-89, zero ("0") should be left in channels of functions that will not be used EXCEPT for Channels 88 and 89. Values slightly outside the normal running range MUST be entered in Channels 88 and 89 to prevent the Controller from going into the default mode in the normal operating range of the engine.

4.2 DATA ENTRY - Following the Application Charts is a step-by-step procedure for configuring (entering data into) the EPC-200C Controller from graphs and/or other sources. All channels requiring data entry are covered. If the channel in question is not to be used in the application, "0" should be the entry (except for Channel 79). Refer to section 3 for a more complete description of the channel functions.

APPLICATION CHART A

CHANNEL NO.	ITEM	ENTRY	UNITS
OVERRIDING CONSTANTS			
09	Default value - ITR	_____	degs.
10	Default value - WGP	_____	%
11	Full advance timing point	_____	BTDC
12	Maximum limit of ITR	_____	degs.
13	Time delay before O/8 is active	_____	secs.
14	ITR during start override	_____	degs.
15	ITR limit in air/fuel override	_____	degs.
16	Time between retard steps, AFO	_____	secs.
17	Time between advance steps, AFO	_____	secs.
SCALING FACTORS			
18	Scaling of ITR for 4-20 ma output	_____	degs.
19	Min. voltage for analog input no. 1	_____	volts
20	Engr. units at min. voltage - analog input 1	_____	_____
21	Engr. units at 5V. input - analog input 1	_____	_____
22	Min. voltage for analog input no. 2	_____	volts
23	Engr. units at min. voltage - analog input 2	_____	_____
24	Engr. units at 5V. input - analog input 2	_____	_____
25	Min. voltage for analog input no. 3	_____	volts
26	Engr. units at min. voltage - analog input 3	_____	_____
27	Engr. units at 5V. input - analog input 3	_____	_____
28	Min. voltage for analog input no. 4	_____	volts
29	Engr. units at min. voltage - analog input 4	_____	_____
30	Engr. units at 5V. input - analog input 4	_____	_____

APPLICATION CHART B

ITR COORDINATES	CHANNEL	INPUT	UNITS	CHANNEL	ITR	UNITS
CHANNELS 31-38: ITR vs. RPM	31	_____	RPM	32	_____	degs.
	33	_____	RPM	34	_____	degs.
	35	_____	RPM	36	_____	degs.
	37	_____	RPM	38	_____	degs.
CHANNELS 39-44: ITR vs. Fuel Manifold Pressure	39	_____	_____	40	_____	degs.
	41	_____	_____	42	_____	degs.
	43	_____	_____	44	_____	degs.
CHANNELS 45-50: ITR vs. Air Manifold Pressure	45	_____	_____	46	_____	degs.
	47	_____	_____	48	_____	degs.
	49	_____	_____	50	_____	degs.
CHANNELS 51-56: ITR vs. Air Manifold Temperature	51	_____	_____	52	_____	degs.
	53	_____	_____	54	_____	degs.
	55	_____	_____	56	_____	degs.
CHANNELS 57-62: ITR vs. Unspecified Variable _____	57	_____	_____	58	_____	degs.
	59	_____	_____	60	_____	degs.
	61	_____	_____	62	_____	degs.

Y'C COORDINATES	CHANNEL	INPUT	UNITS	CHANNEL	Y'C	UNITS
CHANNELS 63-66: y'c vs. RPM	63	_____	RPM	64	_____	_____
	65	_____	RPM	66	_____	_____
CHANNELS 67-72: y'c vs. Fuel Manifold Pressure	67	_____	_____	68	_____	_____
	69	_____	_____	70	_____	_____
	71	_____	_____	72	_____	_____
CHANNELS 73-76: y'c vs. Unspecified Variable _____	73	_____	_____	74	_____	_____
	75	_____	_____	76	_____	_____
CHANNELS 78-79: Temperature Modifier	78	_____	slope	79	_____	offset

NOTE: If not used, enter "0" in (78) and "1" in (79).

APPLICATION CHART C

CHANNEL NO.	ITEM	ENTRY	UNITS
DISCRETE OUTPUTS			
80	RPM limit to trip output O/2	_____	RPM
81	RPM limit to trip output O/3	_____	RPM
82	Time limit to trip output O/4	_____	secs.
83	Time limit to trip output O/5	_____	secs.
84	Time limit to reach RPM (85) before O/6 trips	_____	secs.
85	RPM to be reached within time (84)	_____	RPM
86	Fuel pressure to reach before RPM (87) before O/7 trips	_____	_____
87	RPM to be reached prior to fuel pressure (86)	_____	RPM
88	Fuel pressure to trip output O/8 (overload)	_____	_____
89	RPM to trip output O/8 (overspeed value)	_____	RPM
PI RESPONSE FACTORS			
92	Reset response rate for ITR	_____	secs.
93	Proportional band value for WGP	_____	%
94	Reset response rate for WGP	_____	secs.
SET-UP CHANNELS			
98	No. of sensed teeth or holes	_____	
99	Password	_____	

DATA ENTRY

	DISPLAY
A. ENTERING THE CONFIGURATION MODE	
- Enter 99 (press "9" twice), then press "ENTER":	[99E 0]
- Enter your password, for example "9768":	[99E 9768]
- Press "ENTER":	[99 HELLO]
All status indicators flashing; the EPC is now in the configuration mode.	
B. ENTERING MAGNETIC PICK-UP DATA	
- Enter 98, then press "ENTER":	[98E 0]
- Enter the number of gear teeth or holes: NOTE: Maximum number is 500.	[98E XXX]
- Press "ENTER":	[98 XXX]
C. ENTERING ANALOG INPUT SCALING FACTORS	
IGNITION TIMING DEGREE SPAN	
- Enter 18, then press "ENTER":	[18E 0]
- Enter the total ignition degree span to be represented by the 4-20ma control signal: For Altronic II-CPU, Memory Code xxxxxx.DA, enter 48.0. For Altronic II-CPU, Memory Code xxxxxx.DB, enter 36.0. For Altronic II-CPU, Memory Code xxxxxx.DC, enter 24.0. For Altronic III-CPU, Memory xxxxxx.CD, enter 16.0 or 8.0. For Altronic CPU-90, Memory xxxxxx.EE, enter 24.0 or 16.0.	[18E XX.X]
- Press "ENTER":	[18 XX.X]
FUEL PRESSURE	
- Enter 19, then press "ENTER":	[19E 0]
- Enter the voltage input to the EPC representing the minimum fuel pressure of Channel 20 (1.00 typical):	[19E X.XX]
- Press "ENTER":	[19 X.XX]
- Enter 20, then press "ENTER":	[20E 0]
- Enter the minimum fuel pressure in the desired engineering units represented by the voltage of Channel 20:	[20E X.X]
- Press "ENTER":	[20 X.X]
- Enter 21, then press "ENTER":	[21E 0]
- Enter the fuel pressure value representing 5 volts input to the EPC:	[21E XX.X]
- Press "ENTER":	[21 XX.X]

DATA ENTRY	DISPLAY
AIR MANIFOLD PRESSURE	
- Enter 22, then press "ENTER":	[22E 0]
- Enter the voltage input to the EPC representing the minimum air pressure of Channel 23 (1.00 typical):	[22E X.XX]
- Press "ENTER":	[22 X.XX]
- Enter 23, then press "ENTER":	[23E 0]
- Enter the minimum air pressure in the desired engineering units represented by the voltage of Channel 22:	[23E X.X]
- Press "ENTER":	[23 X.X]
- Enter 24, then press "ENTER":	[24E 0]
- Enter the air manifold pressure value representing 5 volts input to the EPC:	[24E XX.X]
- Press "ENTER":	[24 XX.X]
AIR TEMPERATURE	
- Enter 25, then press "ENTER":	[25E 0]
- Enter the voltage input to the EPC representing the minimum air temperature of Channel 26 (1.00 typical):	[25E X.XX]
- Press "ENTER":	[25 X.XX]
- Enter 26, then press "ENTER":	[26E 0]
- Enter the minimum air temp. in the desired engineering units representing the voltage of Channel 25: NOTE: Must enter one digit after the decimal point.	[26E XXX.X]
- Press "ENTER":	[26 XXX.X]
- Enter 27, and press "ENTER":	[27E 0]
- Enter the air temperature value representing 5 volts input to the EPC:	[27E XXX.X]
- Press "ENTER":	[27 XXX.X]
UNSPECIFIED ANALOG INPUT (If Used)	
- Enter 28, and press "ENTER":	[28E 0]
- Enter the voltage input to the EPC representing the minimum input value of Channel 29 (1.00 typical):	[28E X.XX]
- Press "ENTER":	[28 X.XX]
- Enter 29, and press "ENTER":	[29E 0]
- Enter the the minimum input value in the desired engineering units representing the voltage of Channel 28: NOTE: Must enter one digit after the decimal point.	[29E XXX.X]
- Press "ENTER":	[29 XXX.X]
- Enter 30, and press "ENTER":	[30E 0]
- Enter the input value representing 5 volts input to the EPC:	[30E XXX.X]
- Press "ENTER":	[30 XXX.X]

DATA ENTRY	DISPLAY
D. ENTERING OVERRIDING CONSTANTS:	
- Enter 09, and press "ENTER":	[09E 0]
- Enter the desired ignition retard under fault conditions:	[09E XX.X]
- Press "ENTER":	[09 XX.X]
- Enter 10, and press "ENTER":	[10E 0]
- Enter the desired waste gate position (per cent open) under fault conditions (100% typical):	[10E XXX]
- Press "ENTER":	[10 XXX]
- Enter 11, and press "ENTER":	[11E 0]
- Enter the engine ignition timing value in degrees BTDC corresponding to zero retard (max. advance):	[11E XX.X]
- Press "ENTER":	[11 XX.X]
- Enter 12, and press "ENTER":	[12E 0]
- Enter the maximum value of ignition timing retard to be allowed by the EPC output:	[12E XX.X]
- Press "ENTER":	[12 XX.X]
- Enter 13, and press "ENTER":	[13E 0]
- Enter the time after the start-override signal until some speed signal must be observed (10 seconds min.):	[13E XX]
- Press "ENTER":	[13 XX]
- Enter 14, and press "ENTER":	[14E 0]
- Enter the ignition timing retard value for starting:	[14E XX.X]
- Press "ENTER":	[14 XX.X]
- Enter 15, and press "ENTER":	[15E 0]
- Enter the maximum ignition retard increment to be allowed during air/fuel override: (2 degrees typ.)	[15E XX.X]
- Press "ENTER":	[15 XX.X]
- Enter 16, and press "ENTER":	[16E 0]
- Enter the time delay between retard steps during air/fuel override (180 seconds typical):	[16E XX]
- Press "ENTER":	[16 XX]
- Enter 17, and press "ENTER":	[17E 0]
- Enter the time delay between advance steps during air/fuel override (5 seconds typical):	[17E XX]
Press "ENTER":	[17 XX]

DATA ENTRY	DISPLAY
E. ENTERING THE IGNITION TIMING RETARD AND AIR/FUEL RATIO PERFORMANCE CURVE DATA	
IGNITION TIMING RETARD VS. RPM CURVE COORDINATES:	
- Enter 31, and press "ENTER":	[31E 0]
- Enter the first RPM control point (s1) for the ignition timing retard curves:	[31E XXXX]
- Press "ENTER":	[31 XXXX]
- Enter 32, and press "ENTER":	[32E 0]
- Enter the value of ignition timing retard (ITR-s1) for RPM less than the value of Channel 31:	[32E XX.X]
- Press "ENTER":	[32 XX.X]
- Enter 33, and press "ENTER":	[33E 0]
- Enter the second RPM control point (s2) for the ignition timing retard curves:	[33E XXXX]
- Press "ENTER":	[33 XXXX]
- Enter 34, and press "ENTER":	[34E 0]
- Enter the value of ignition timing retard (ITR-s2) at the RPM value of Channel 33:	[34E XX.X]
- Press "ENTER":	[34 XX.X]
- Enter 35, and press "ENTER":	[35E 0]
- Enter the third RPM control point (s3) for the ignition timing retard curves:	[35E XXXX]
- Press "ENTER":	[35 XXXX]
- Enter 36, and press "ENTER":	[36E 0]
- Enter the value of ignition timing retard (ITR-s3) at the RPM value of Channel 35:	[36E XX.X]
- Press "ENTER":	[36 XX.X]
- Enter 37, and press "ENTER":	[37E 0]
- Enter the fourth RPM control point (s4) for the ignition timing retard curves:	[37E XXXX]
- Press "ENTER":	[37 XXXX]
- Enter 38, and press "ENTER":	[38E 0]
- Enter the value of ignition timing retard (ITR-s4) at the RPM value of Channel 37:	[38E XX.X]
- Press "ENTER":	[38 XX.X]

DATA ENTRY	DISPLAY
IGNITION TIMING RETARD VS. FUEL PRESSURE CURVE COORDINATES:	
- Enter 39, and press "ENTER":	[39E 0]
- Enter the first fuel pressure control point (x1) for the ignition timing retard curves:	[39E XX.XX]
- Press "ENTER":	[39 XX.XX]
- Enter 40, and press "ENTER":	[40E 0]
- Enter the value of ignition timing retard (ITR-x1) below the fuel pressure value of Channel 39:	[40E XX.X]
- Press "ENTER":	[40 XX.X]
- Enter 41, and press "ENTER":	[41E 0]
- Enter the second fuel pressure control point (x2) for the ignition timing retard curves:	[41E XX.XX]
- Press "ENTER":	[41 XX.XX]
- Enter 42, and press "ENTER":	[42E 0]
- Enter the value of ignition timing retard (ITR-x2) at the fuel pressure value of Channel 41:	[42E XX.X]
- Press "ENTER":	[42 XX.X]
- Enter 43, and press "ENTER":	[43E 0]
- Enter the third fuel pressure control point (x3) for the ignition timing retard curves:	[43E XX.XX]
- Press "ENTER":	[43 XX.XX]
- Enter 44, and press "ENTER":	[44E 0]
- Enter the value of ignition timing retard (ITR-x3) at the fuel pressure value of Channel 43:	[44E XX.X]
- Press "ENTER":	[44 XX.X]
IGNITION TIMING RETARD VS. AIR PRESSURE CURVE COORDINATES:	
- Enter 45, and press "ENTER":	[45E 0]
- Enter the first air pressure control point (y1) for the ignition timing retard curves:	[45E XX.XX]
- Press "ENTER":	[45 XX.XX]
- Enter 46, and press "ENTER":	[46E 0]
- Enter the value of ignition timing retard (ITR-y1) below the air pressure value of Channel 45:	[46E XX.X]
- Press "ENTER":	[46 XX.X]
- Enter 47, and press "ENTER":	[47E 0]
- Enter the second air pressure control point (y2) for the ignition timing retard curves:	[47E XX.XX]
- Press "ENTER":	[47 XX.XX]

DATA ENTRY	DISPLAY
- Enter 48, and press "ENTER":	[48E 0]
- Enter the value of ignition timing retard (ITR-y2) for the air pressure value of Channel 47:	[48E XX.X]
- Press "ENTER":	[48 XX.X]
- Enter 49, and press "ENTER":	[49E 0]
- Enter the third air pressure control point (y3) for the ignition timing retard curves:	[49E XX.XX]
- Press "ENTER":	[49 XX.XX]
- Enter 50, and press "ENTER":	[50E 0]
- Enter the value of ignition timing retard (ITR-y3) at the fuel pressure value of Channel 49:	[50E XX.X]
- Press "ENTER":	[50 XX.X]

IGNITION TIMING RETARD VS. AIR TEMPERATURE CURVE COORDINATES:

- Enter 51, and press "ENTER":	[51E 0]
- Enter the first air temperature control point (z1) for the ignition timing retard curves:	[51E XXX]
Press "ENTER":	[51 XXX]
- Enter 52, and press "ENTER":	[52E 0]
- Enter the value of ignition timing retard (ITR-z1) below the air temperature value of Channel 51:	[52E XX.X]
- Press "ENTER":	[52 XX.X]
- Enter 53, and press "ENTER":	[53E 0]
- Enter the second air temperature control point (z2) for the ignition timing retard curves:	[53E XXX]
- Press "ENTER":	[53 XXX]
- Enter 54, and press "ENTER":	[54E 0]
- Enter the value of ignition timing retard (ITR-z2) at the air temperture value of Channel 53:	[54E XX.X]
- Press "ENTER":	[54 XX.X]
- Enter 55, and press "ENTER":	[55E 0]
- Enter the third air temperature control point (z3) for the ignition timing retard curves:	[55E XXX]
- Press "ENTER":	[55 XXX]
- Enter 56, and press "ENTER":	[56E 0]
- Enter the value of ignition timing retard (ITR-z3) at the air temperature value of Channel 56:	[56E XX.X]
- Press "ENTER":	[56 XX.X]

DATA ENTRY

	DISPLAY	
IGNITION TIMING RETARD VS. UNSPECIFIED INPUT CURVE COORDINATES:		
- Enter 57, and press "ENTER":	[57E	0]
- Enter the first unspecified input control point (v1) for the ignition timing retard curves:	[57E	XXX]
- Press "ENTER":	[57	XXX]
- Enter 58, and press "ENTER":	[58E	XX.X]
- Enter the value of ignition timing retard (ITR-v1) below the unspecified input value of Channel 57:	[58E	XX.X]
- Press "ENTER":	[58	XX.X]
- Enter 59, and press "ENTER":	[59E	0]
- Enter the second unspecified input control point (v2) for the ignition timing retard curves:	[59E	XXX]
- Press "ENTER":	[59	XXX]
- Enter 60, and press "ENTER":	[60E	0]
- Enter the value of ignition timing retard (ITR-v2) at the unspecified variable value of Channel 59:	[60E	XX.X]
- Press "ENTER":	[60	XX.X]
- Enter 61, and press "ENTER":	[61E	0]
- Enter the third unspecified input control point (v3) for the ignition timing retard curves:	[61E	XXX]
- Press "ENTER":	[61	XXX]
- Enter 62, and press "ENTER":	[62E	0]
- Enter the value of ignition timing retard (ITR-v3) at the unspecified variable value of Channel 61:	[62E	XX.X]
- Press "ENTER":	[62	XX.X]
AIR MANIFOLD PRESSURE VS. RPM CURVE COORDINATES:		
- Enter 63, and press "ENTER":	[63E	0]
- Enter the first RPM control point (s1') for the air manifold pressure curves:	[63E	XXXX]
Press "ENTER":	[63	XXXX]
- Enter 64, and press "ENTER":	[64E	0]
- Enter the value of air manifold pressure (y'c-s1') below the RPM value of Channel 63:	[64E	XX.XX]
- Press "ENTER":	[64	XX.XX]
- Enter 65, and press "ENTER":	[65E	0]
- Enter the second RPM control point (s2') for the air manifold pressure curves:	[65E	XXXX]
- Press "ENTER":	[65	XXXX]
- Enter 66, and press "ENTER":	[66E	0]
- Enter the value of air manifold pressure (y'c-s2') at the RPM value of Channel 65:	[66E	XX.XX]
- Press "ENTER":	[66	XX.XX]

DATA ENTRY	DISPLAY
AIR MANIFOLD PRESSURE VS. FUEL PRESSURE CURVE COORDINATES:	
- Enter 67, and press "ENTER":	[67E 0]
- Enter the first fuel pressure control point (x1') for the air manifold pressure curves:	[67E XX.XX]
- Press "ENTER":	[67 XX.XX]
- Enter 68, and press "ENTER":	[68E 0]
- Enter the value of desired air manifold pressure (y'c-x1') at the fuel pressure value of Channel 67:	[68E XX.XX]
- Press "ENTER":	[68 XX.XX]
- Enter 69, and press "ENTER":	[69E 0]
- Enter the second fuel pressure control point (x2') for the air manifold pressure curves:	[69E XX.XX]
- Press "ENTER":	[69 XX.XX]
- Enter 70, and press "ENTER":	[70E 0]
- Enter the value of desired air manifold pressure (y'c-x2') at the fuel pressure value of Channel 69:	[70E XX.XX]
- Press "ENTER":	[70 XX.XX]
- Enter 71, and press "ENTER":	[71E 0]
- Enter the third fuel pressure control point (x3') for the air manifold pressure curves:	[71E XX.XX]
Press "ENTER":	[71 XX.XX]
- Enter 72, and press "ENTER":	[72E 0]
- Enter the value of desired air manifold pressure (y'c-x3') at the fuel pressure value of Channel 71:	[72E XX.XX]
- Press "ENTER"	[72 XX.XX]
AIR MANIFOLD PRESSURE VS. UNSPECIFIED INPUT CURVE COORDINATES:	
- Enter 73, and press "ENTER":	[73E 0]
- Enter the first unspecified input control point (v1') for the air manifold pressure curves:	[73E XX.XX]
- Press "ENTER":	[73 XX.XX]
- Enter 74, and press "ENTER":	[74E 0]
- Enter the value of desired air manifold pressure (y'c-v1') below the unspecified input value of Channel 73:	[74E XX.XX]
- Press "ENTER":	[74 XX.XX]
- Enter 75, and press "ENTER":	[75E 0]
- Enter the second unspecified input control point (v2') for the air manifold pressure curves:	[75E XX.XX]
- Press "ENTER":	[75 XX.XX]
- Enter 76, and press "ENTER":	[76E 0]
- Enter the value of desired air manifold pressure (y'c-v2') at the unspecified input value of Channel 75:	[76E XX.XX]
- Press "ENTER":	[76 XX.XX]

DATA ENTRY	DISPLAY
AIR MANIFOLD PRESSURE - TEMPERATURE CORRECTION FACTOR:	
- Enter 78, and press "ENTER":	[78E 0]
- Enter the slope of the temperature offset multiplier for air manifold pressure:	[78E 0.XXX]
- Press "ENTER":	[78 0.XXX]
- Enter 79, and press "ENTER":	[79E 0]
- Enter the offset value of the temperature offset multiplier for air manifold pressure:	[79E XX.XX]
- Press "ENTER":	[79 XX.XX]
NOTE: If temperature correction is not used, - enter "0" in Channel 78 - enter "1" in Channel 79	
F. PID RESPONSE VALUES	
- Enter 92, and press "ENTER":	[92E 0]
- Enter the Controller response reset time value for ignition timing control (2 sec. suggested):	[92E X]
- Press "ENTER":	[92 X]
- Enter 93, and press "ENTER":	[93E 0]
- Enter the Controller proportional band value for waste gate control (60 suggested):	[93E XX]
- Press "ENTER":	[93 XX]
- Enter 94, and press "ENTER":	[94E 0]
- Enter the Controller response reset time value for waste gate control (20 sec. suggested initially):	[94E XX]
- Press "ENTER":	[94 XX]

	DISPLAY
G. ENTER I/O SEQUENCING FACTORS	
- Enter 80, and press "ENTER":	[80E 0]
- Enter the RPM trip point for output channel 0/2:	[80E XXXX]
- Press "ENTER":	[80 XXXX]
- Enter 81, and press "ENTER":	[81E 0]
- Enter the RPM trip point for output channel 0/3:	[81E XXXX]
- Press "ENTER":	[81 XXXX]
- Enter 82, and press "ENTER":	[82E 0]
- Enter the time delay from the end of start-override until output 0/4 trips:	[82E XX]
- Press "ENTER":	[82 XX]
- Enter 83, and press "ENTER":	[83E 0]
- Enter the time delay from the end of start-override until output 0/5 trips:	[83E XX]
- Press "ENTER":	[83 XX]
- Enter 84, and press "ENTER":	[84E 0]
- Enter the time from the end of start-override to allow RPM to reach the value of channel 85 (see output 0/6):	[84E XX]
- Press "ENTER":	[84 XX]
- Enter 85, and press "ENTER":	[85E 0]
- Enter the RPM that must be reached within the time value of Channel 84 after the end of the start-override signal (see output 0/6):	[85E XXX]
- Press "ENTER":	[85 XXX]
- Enter 86, and press "ENTER":	[86E 0]
- Enter the maximum fuel pressure limit at the starting speed of Channel 87 (see output 0/7):	[86E XX.XX]
- Press "ENTER":	[86 XX.XX]
- Enter 87, and press "ENTER":	[87E 0]
- Enter the RPM that must be reached before fuel pressure exceeds the value of Channel 86 (see output 0/7):	[87E XXX]
- Press "ENTER":	[87 XXX]
- Enter 88, and press "ENTER":	[88E 0]
- Enter the maximum fuel manifold pressure allowed (see output 0/8):	[88E XX.XX]
- Press "ENTER":	[88 XX.XX]
- Enter 89, and press "ENTER":	[89E 0]
- Enter the overspeed RPM (see output 0/8):	[89E XXXX]
- Press "ENTER":	[89 XXXX]

DATA ENTRY

DISPLAY

H. LEAVING THE CONFIGURATION MODE

- Enter 99:	[99 HELLO]
- Press "ENTER", then 0:	[99E 0]
- Press "ENTER":	[99 -----]

The EPC is now in the normal operating mode. Before attempting full operation on an engine:

1. Momentarily interrupt the power and then reconfirm that the data entries have been retained in the EPC.
2. The control function should be simulated either off the engine or on the engine with no load to be sure the output values are what are desired.

SECTION 5

OPERATION

5.0 OPERATION

5.1 START OVERRIDE / RESET BUTTON - A start override signal is required on every start-up to start the operating programs in the EPC at the beginning of the engine start-up cycle. This can be accomplished either manually or automatically:

A. MANUAL - Depress (one time) the RESET button on the EPC keyboard.

B. AUTOMATIC - A 12-24 VDC signal must be sent to the input I/1 in the EPC. This could be achieved, for example, by a pressure switch activated by starting air.

5.2 FINE TUNING ENGINE PERFORMANCE - Once an EPC is programmed and controlling an engine, it may be desirable to fine tune the control program in an effort to attain optimum fuel efficiency, emissions and/or performance. Usually this will be accomplished by a small advance in ignition timing or slight adjustment to the air/fuel ratio through adjusting the value of desired air manifold pressure (y'c).

Study the operating curves (graphs). To change timing, for example, you may want to change just one coordinate point by one or two degrees. To offset the curve a fixed amount over its entire length may require changing the "y" value of two or more points. The EPC will link together your entered coordinate points with straight lines.

It is possible to change a coordinate value "on the fly" and the EPC will immediately process the new information and adjust to the new curves. We suggest, however, that you make use of the manual override channels to lock the outputs to known, stable values before changing coordinates. This allows you to check the results of changes before they are actually implemented. In this way, if an entering error is made, it can be caught and corrected before upsetting the operation of the engine.

5.3 CHANGING IGNITION TIMING CURVES (ITR) WITH ENGINE RUNNING / ITR BUTTON:

A. With the engine at a STABLE operating point, write down the value of ITR shown on channel 05; then proceed as follows:

- Press ITR Manual Override Button: [P5 XX]

This locks the EPC onto the then current (displayed) value of ITR. If a different "locked" value is desired:

- Press "ENTER" and enter desired value: [P5E YY]
- Press "ENTER": [P5 YY]

The EPC now locks onto the entered override value of timing retard (ITR). Status indicator no. 2 blinking indicates the Controller is in the Manual Override Mode on at least one of the output functions.

B. Refer to your ITR curves (graphs) and determine which coordinate(s) must be changed to effect the timing change you desire. In the graph labeled EXAMPLE 2, to advance the timing one degree between 200 and 300 RPM would require changing the entries of channels 34 and 36 from "12" to "11". This requires entering the configuration mode by first entering the password in channel 99. Refer to section 4.4 for the specific steps to enter new data.

NOTE: Depending on the complexity of the curve, more than one coordinate point may have to be changed; remember, the EPC will link together your new coordinate points with straight lines. You can also effect a change by moving the RPM at which the timing starts to advance either left or right (coordinate values 33 and/or 35 in EXAMPLE 2).

C. After the new data is entered, check channel 05 to see if the desired result (1 less degree of ITR in our example) has indeed been achieved. At this point the value in channel 05 is the calculated output that will be implemented once the Controller is put back on automatic operation. The actual output remains at the value entered through the manual override button.

D. To resume automatic control:
   - Press ITR Manual Override Button and "ENTER": [P5E 0]
   - Enter "999": [P5E 999]
   - Press "ENTER": [05 ZZ]

   The Controller will now resume automatic control of the ITR output value using the new coordinate values that have been entered.

5.4 CHANGING AIR/FUEL RATIO (Y'C) WITH THE ENGINE RUNNING / WGP BUTTON:

A. With the engine at a STABLE operating point, write down the values shown on channels 06 and 07; then proceed as follows:
   - Press WGP Manual Override Button: [P6 XX]

   This locks the EPC onto the then current (displayed) value of Waste Gate Position (WGP). If a different "locked" value is desired:
   - Press "ENTER" and enter desired value of WGP: [P6E YY]
   - Press "ENTER": [P6 YY]

   The EPC now locks onto the entered override value of WGP; that is the waste gate will stay at the %-open value that was entered (for example, 05%). Status indicator no. 2 blinking indicates the Controller is in the Manual Override Mode on at least one of the output functions.

B. Refer to your air pressure (y'c) curves (graphs) and determine which coordinate(s) must be changed to effect the air/fuel ratio change you desire.

   NOTE: To lean the mixture, increase the value of y'c.
   To richen the mixture, decrease the value of y'c.

   In the graph labeled EXAMPLE 10, to slightly lean the mixture would require increasing the slope of the curve; for example, change channel 70 from 21 to 22. This requires entering the configuration mode by first entering the password in channel 99. Refer to section 4.4 for the specific steps to enter new data.

   NOTE: Depending on the complexity of the curve, more than one coordinate point may have to be changed; remember, the EPC will link your new coordinate points together with straight lines.

C. After the new data is entered, check channel 07 to see if the desired result (slightly higher air pressure in our example) has indeed been achieved. Then check channel 06 to see if the WGP position has slightly changed (in our example, the %-open should decrease slightly). The values in channels 06 and 07 are the calculated output that will be implemented once the Controller is put back on automatic operation. The actual waste gate position remains at the value entered through the manual override button.

D. To resume automatic control:
   - Press WGP Manual Override Button and "ENTER": [P6E 0]
   - Enter "999": [P6E 999]
   - Press "ENTER": [06 ZZ]

   The Controller will now resume automatic control of the WGP output value using the new coordinate values that have been entered.

5.5 **CLEAR BUTTON** - The CLEAR button is used to cancel an entry (an erroneous number, for example) prior to pushing the ENTER button. The display will revert to the previous data.

5.6 **DISPLAY STATUS INDICATORS** - There are four display status indicators at the lower edge of the display. These are indicated on the front of the EPC and, from left to right, indicate the following when active:

- No. 1: Normal operation
- No. 2: Manual Override active
- No. 3: Controller at limit for ITR or WGP or one of the seven discrete outputs O/2 - O/8 has tripped
- No. 4: Fault output O/8 has tripped; Controller outputs will go to default values (Channels 09 and 10)

5.7 **DIAGNOSTICS** - The EPC senses various fault conditions such as overspeed, high fuel pressure, etc. Channels 80 through 89 must be programmed to avoid undesired faults. The fault output (Qutput O/8) in the EPC should be connected to the engine safety shutdown system.

NOTE: If the fault output O/8 is not used, be sure to program values into channels 88 and 89 that will not cause the EPC to go to the fault mode in normal operation. In the fault mode, the EPC will implement the output values entered into channels 09 and 10 and will stay in this mode until the start-override signal is received.

The EPC will annunciate codes on the display for various status and fault conditions as follows:

	DISPLAY
Call Channel 90 for Present Status	[90 XXXX]
Normal Condition:	[90 0000]
Loss of speed input:	[90 0200]
Loss of analog input 1 (fuel pressure):	[90 0001]
Loss of analog input 2 (air pressure):	[90 0002]
Loss of analog input 3 (air temperature):	[90 0010]
Loss of analog input 4 (unspecified variable):	[90 0020]
Loss of power to all transducers:	[90 0033]
Main board in EPC unplugged from power section:	[90 0233]
Overspeed (speed higher than value in channel 89):	[90 1000]
Overload (fuel psi higher than value in channel 88):	[90 0100]
Call Channel 91 for First-Out Fault	[91 XXXX]
Normal Condition:	[91 0000]
All conditions shown above under Channel 90:	[91 same as above]

SECTION 6

INSTALLATION

6.0 INSTALLATION

6.1 GENERAL INSTALLATION LAYOUT - Refer to figure 3 for the general layout of wiring in and out of the EPC-200C Controller.

6.2 MOUNTING THE EPC - The EPC is preferably panel-mounted off the engine in such a manner as to minimize exposure to vibration. Refer to figure 4 for physical mounting details.

6.3 OPERATING ENVIRONMENT - Operating temperature range is 32° to 158° F. / 0° to 70° C. Humidity specification is 0 - 95%, non-condensing.

6.4 PART NO. DESIGNATION - The electrical rating of various parts of the EPC controller is designated in the full device Part No. which is found on the inside of the enclosure.

EXAMPLE: EPC - 200Cm - xy

m = Letter designating the required Power Source:
A = 110 VAC, D = 24 VDC

x = Number designating Input Module type:
1 = IDC5 module: 10-32 VDC - white case
2 = IAC5 module: 90-140 VAC/DC - yellow case

y = Number designating Output Module type:
4 = ODC5 module: 60VDC, 2A. - red case
5 = OAC5A module: 24-280 VAC, 2A. - black case
6 = ODC5A module: 5-200 VDC, 0.67A. - red case

6.5 ELECTRICAL HOOK-UP - GENERAL

A. The power connections to the EPC-200C must be in accordance with the National Electrical Code. The EPC-200C is suitable for installation in Class I, Division 2 locations. The external power is connected to the EPC plus (+) and minus (-) connections (see figure 5); the Ground terminal in the EPC must be connected to earth ground which may be the same as the power negative (-). The input power has a 3-amp protective fuse. The EPC can be powered in one of the following ways:

1. 24 VDC POWERED MODELS:
   - 24 volt battery with trickle charger (2 amp min. capability);
   - DC power supply capable of furnishing 18-36 VDC, 5 amps.
2. 110 VAC POWERED MODELS:
   - A source of "instrument quality" 110-120 VAC free from line spikes such as caused by the turning-on of electric motors, etc.

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

B. A separate 24 VDC Instrument Supply is available in the EPC as a power source for the analog input transducers. This output is protected with a 0.5-amp fuse.

C. Power wiring and signal (transducer) wiring must be in separate conduits and conduit entries into the EPC to avoid undesired electrical interaction. Separate as follows (see figure 3):

1. RS422 Communications Wiring.
2. Signal Wiring: magnetic pick-up, analog inputs, 4-20 ma analog outputs, +/- 24VDC instrument power.
   NOTE: Use #24 AWG, .032" insulated hook-up wire (U.L. style 1015 or Altronic part no. 603 102 or 603 103) for the signal connections between the EPC and engine mounted transducers.
3. Power Wiring: input power, input module I/1, output modules O/2 -O/8.

D. The analog inputs of the EPC operate with various types of transducers outputting 4-20 ma (1-5 V.). Figures 7, 8 and 9 show wiring diagrams using typical types of input transducers and output connections to an Altronic II-CPU or III-CPU ignition system and to the pressure transducer for the waste-gate.

NOTE: All input commons are to be referenced to terminal #40. Do NOT use terminal #20 (+24V.) to power any external devices except as shown in figure 7, 8 or 9.

E. The Input Module I/1 (master reset) is protected with a 3-amp fuse. It is necessary to impose a voltage within the rating of the particular module used (see section 6.4 above) to effect a reset condition. The keyboard RESET button also provides the same function.

F. The solid state DC output modules (O/2 and O/8) have the following associated with each device (see section 6.4 for electrical ratings):

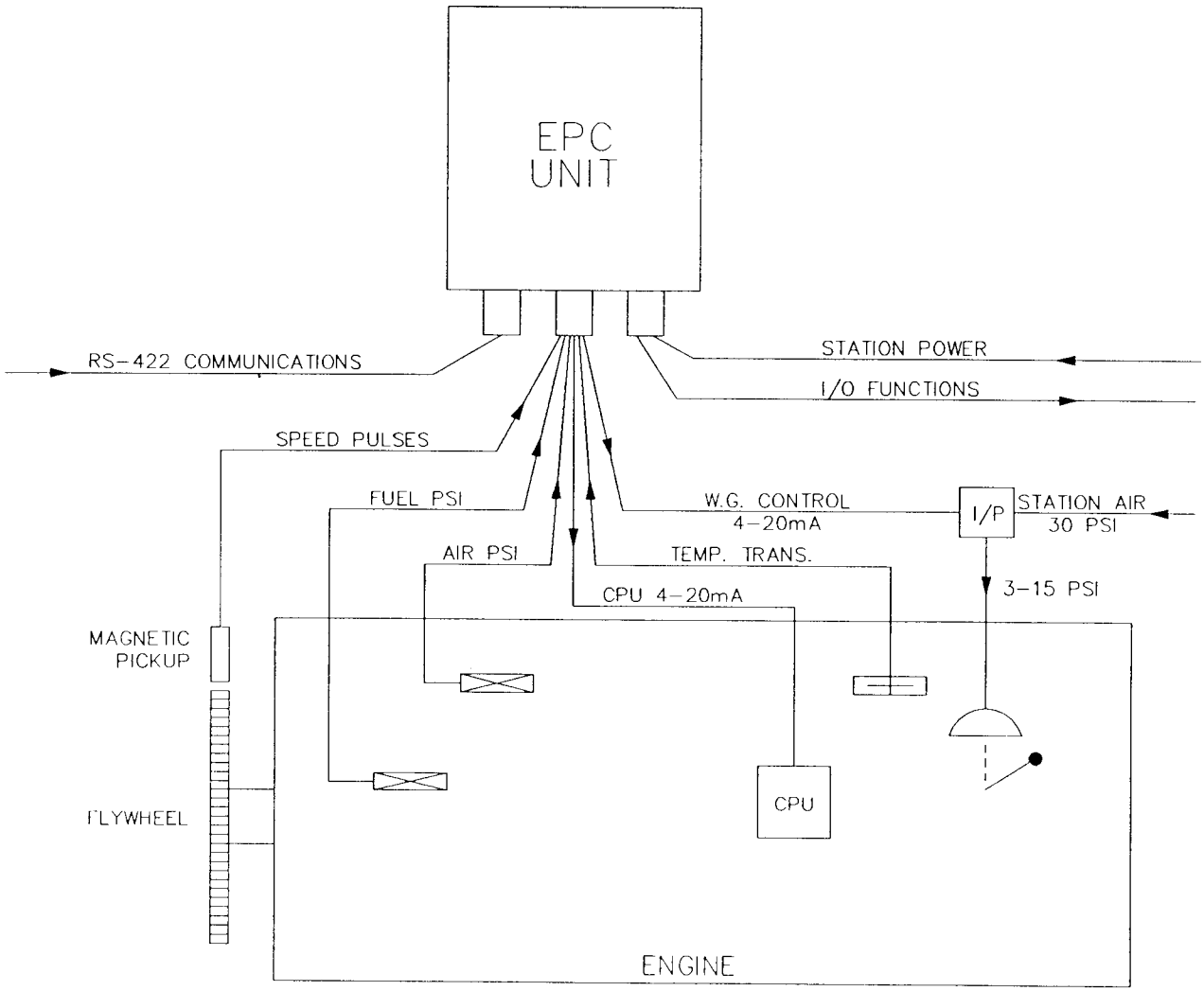
- an LED indicator mounted directly above its associated solid state relay; the output switch is in the closed position when the LED is on.
- a 3-amp fuse in the output leg mounted on the circuit board directly below its associated solid state relay.

A typical automatic start hook-up using all seven output modules is shown in figure 6.

G. All terminations to the EPC are to plug-in type terminal strips; these require only that the wire insulation be stripped back approximately 1/4". A small screwdriver is used to secure the conductor to the plug-in connector. The plug-in connectors must be lifted away from the bottom of the box for removal.

FIG.3

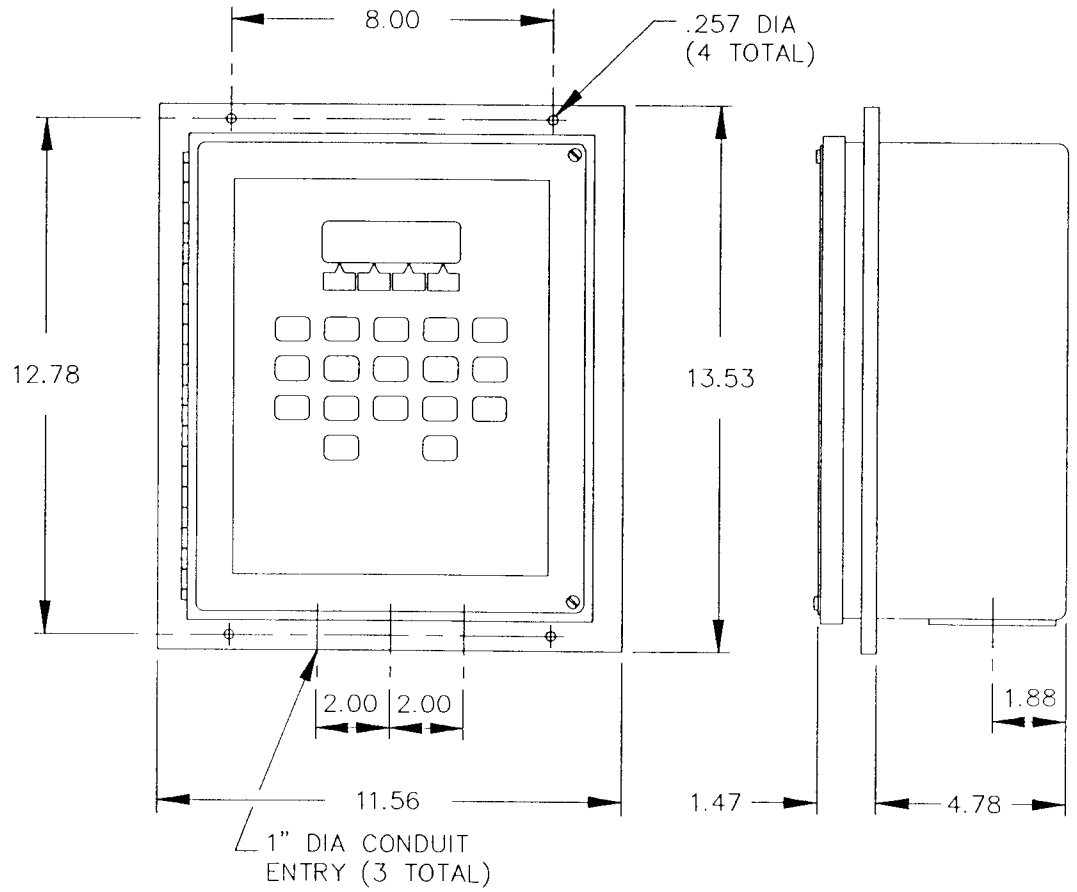
GENERAL INSTALLATION LAYOUT



FUNCTION	EPC TERMINAL NO.
MAGNETIC PICKUP	1(+) & 2(-)
FUEL PRESSURE TRANSDUCER	8 & 9
AIR PRESSURE TRANSDUCER	10 & 11
CPU CONTROL SIGNAL	16(-) & 17(+)
TEMPERATURE TRANSMITTER	12 & 13 (SEE WIRING DIAGRAM)
I/P CONVERTER SIGNAL	18 & 19
MANUAL/REMOTE START SWITCH	20 & 25
I/O FUNCTIONS	26 THRU 39
INSTRUMENT (+24V)	20
COMMON	40
STATION POWER +	⊕
STATION POWER -	⊖

FIG.4

EPC MOUNTING DIMENSIONS



NOTE: PANEL CUT-OUT IS 10.12 X 12.12
ALL DIMENSIONS IN INCHES

6.5 TERMINAL STRIP DESIGNATION (See figure 5)

TERMINAL NO.	FUNCTION
1	Magnetic Pick-up
2	Magnetic Pick-up
3	Shield - Mag. Pick-up
4	RS-422 - XMA
5	RS-422 - XMB
6	RS-422 - REC. A
7	RS-422 - REC. B
8	Analog input 1 (x) - negative (-)
9	Analog input 1 (x) - positive (+)
10	Analog input 2 (y) - negative (-)
11	Analog input 2 (y) - positive (+)
12	Analog input 3 (z) - negative (-)
13	Analog input 3 (z) - positive (+)
14	Analog input 4 (v) - negative (-)
15	Analog input 4 (v) - positive (+)
16	Ignition timing output - negative (-)
17	Ignition timing output - positive (+)
18	Air/fuel ratio output - negative (-)
19	Air/fuel ratio output - positive (+)
20	Instrument 24VDC power - positive (+)
40	Instrument 24VDC power - negative (-)
21	Not used
22	Not used
23	Not used
24	Digital input 1 - negative (-)
25	Digital input 1 - positive (+)
26	Digital output 2 - negative (-)
27	Digital output 2 - positive (+)
28	Digital output 3 - negative (-)
29	Digital output 3 - positive (+)
30	Digital output 4 - negative (-)
31	Digital output 4 - positive (+)
32	Digital output 5 - negative (-)
33	Digital output 5 - positive (+)
34	Digital output 6 - negative (-)
35	Digital output 6 - positive (+)
36	Digital output 7 - negative (-)
37	Digital output 7 - positive (+)
38	Digital output 8 - negative (-)
39	Digital output 8 - positive (+)
+	Input power - positive (+) for DC models
-	Input power - negative (-) for DC models
Ground symbol	Ground

FIG.5

TERMINAL LAY-OUT

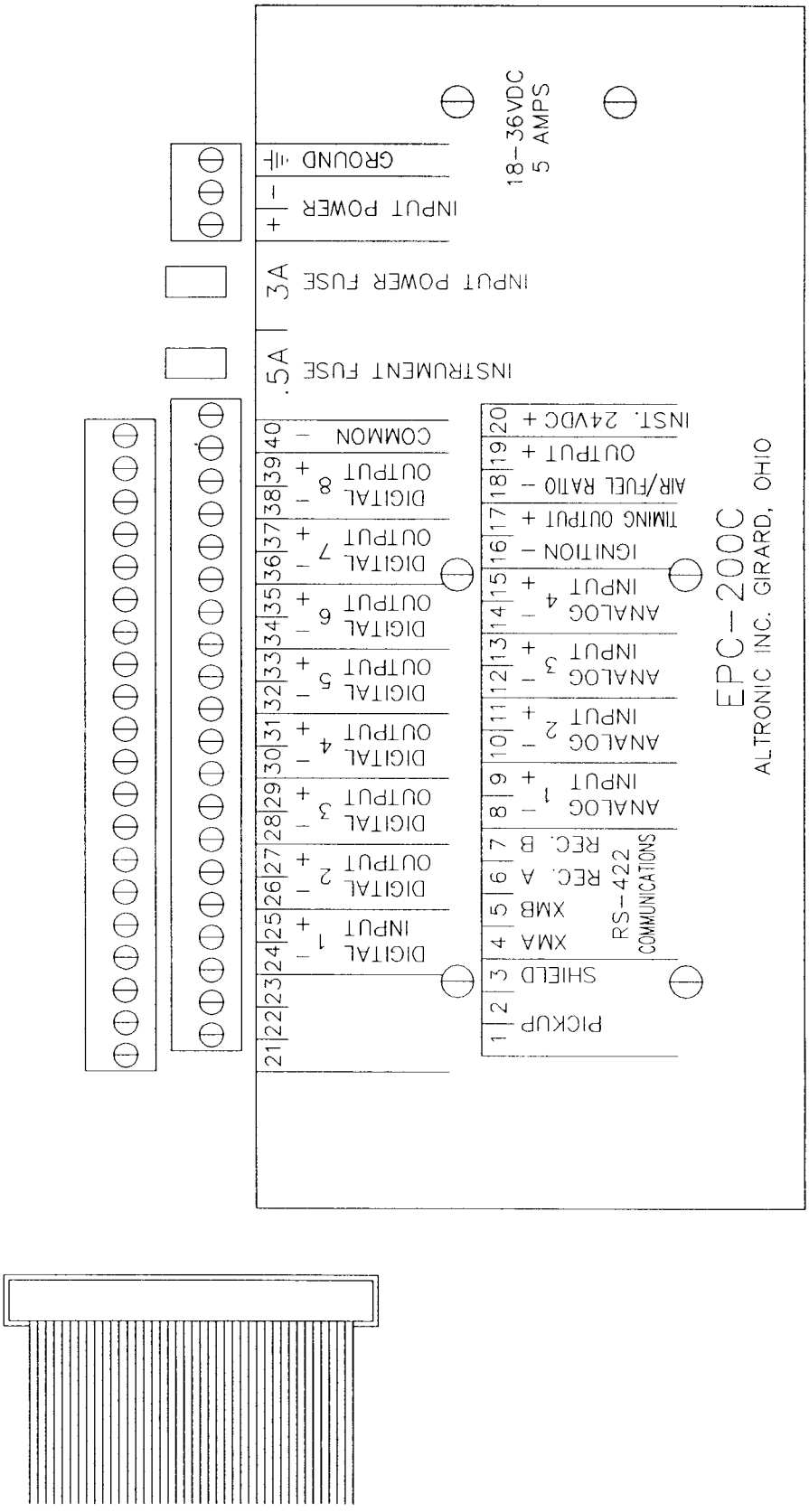
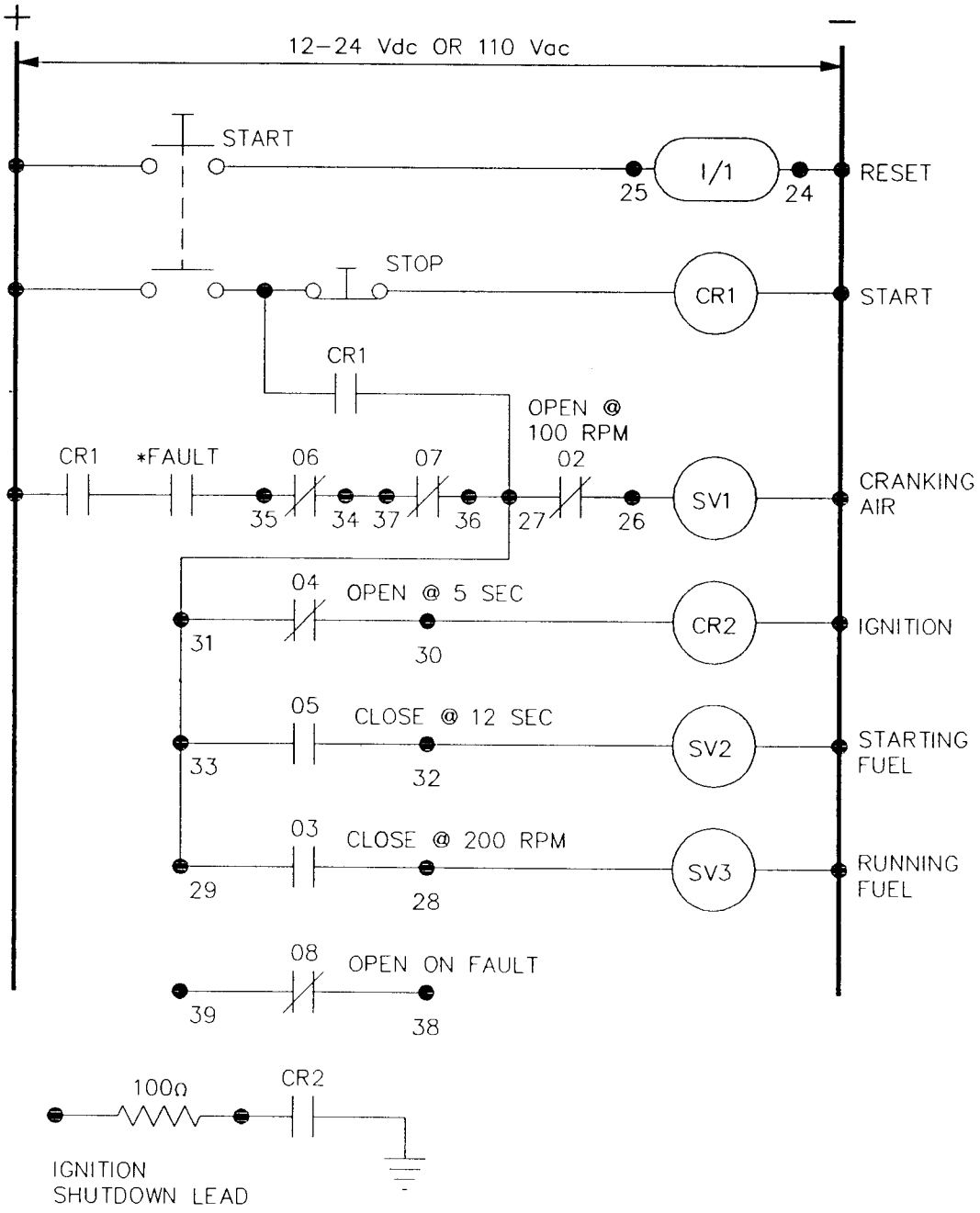


FIG.6



NOTE:

1. *FAULT CONTACT FROM CUSTOMER SAFETY SHUTDOWN SYSTEM.
2. CR1 AND CR2 ALTRONIC P/N 610 064−24 FOR 24vDC SYSTEM.
3. TIME AND SPEED SETTINGS ARE PROGRAMMABLE FROM THE KEY PAD ON THE FRONT PANEL.
4. CONTACTS 06 AND 07 ARE TYPICALLY USED FOR OVERCRANK AND FLOODED ON START UP.

FIG.7

TERMINAL LAY-OUT

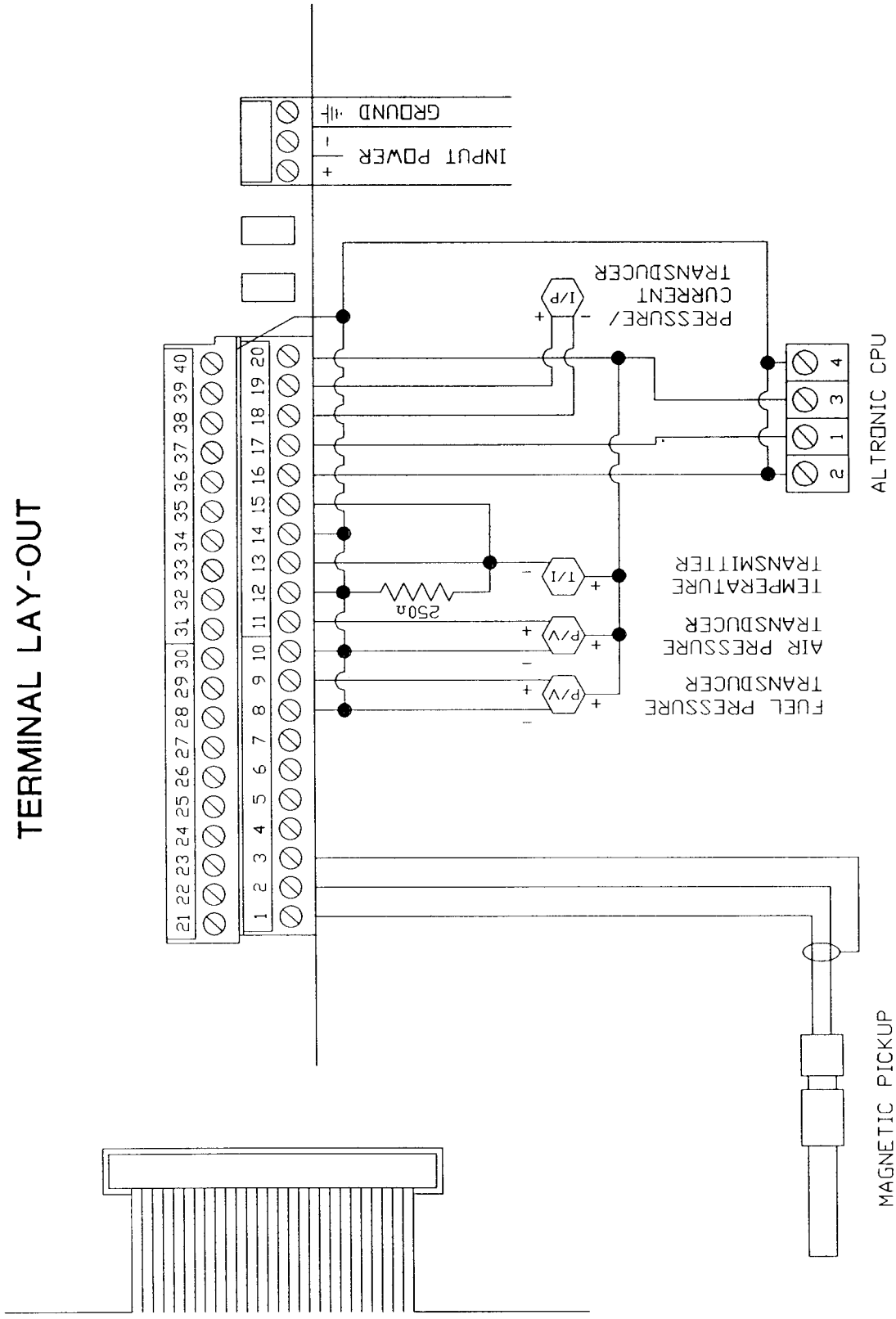


FIG.8

TERMINAL LAY-OUT

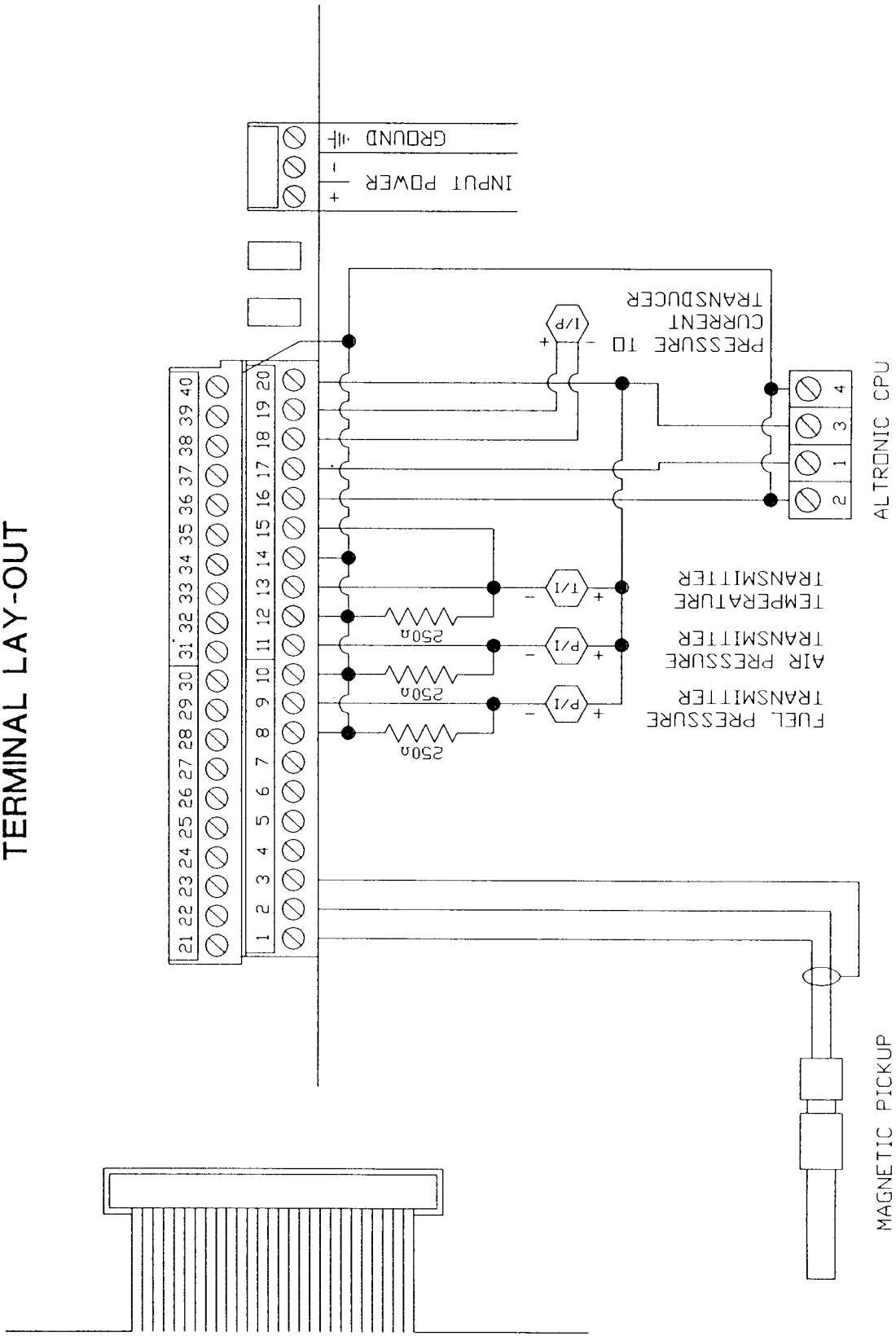
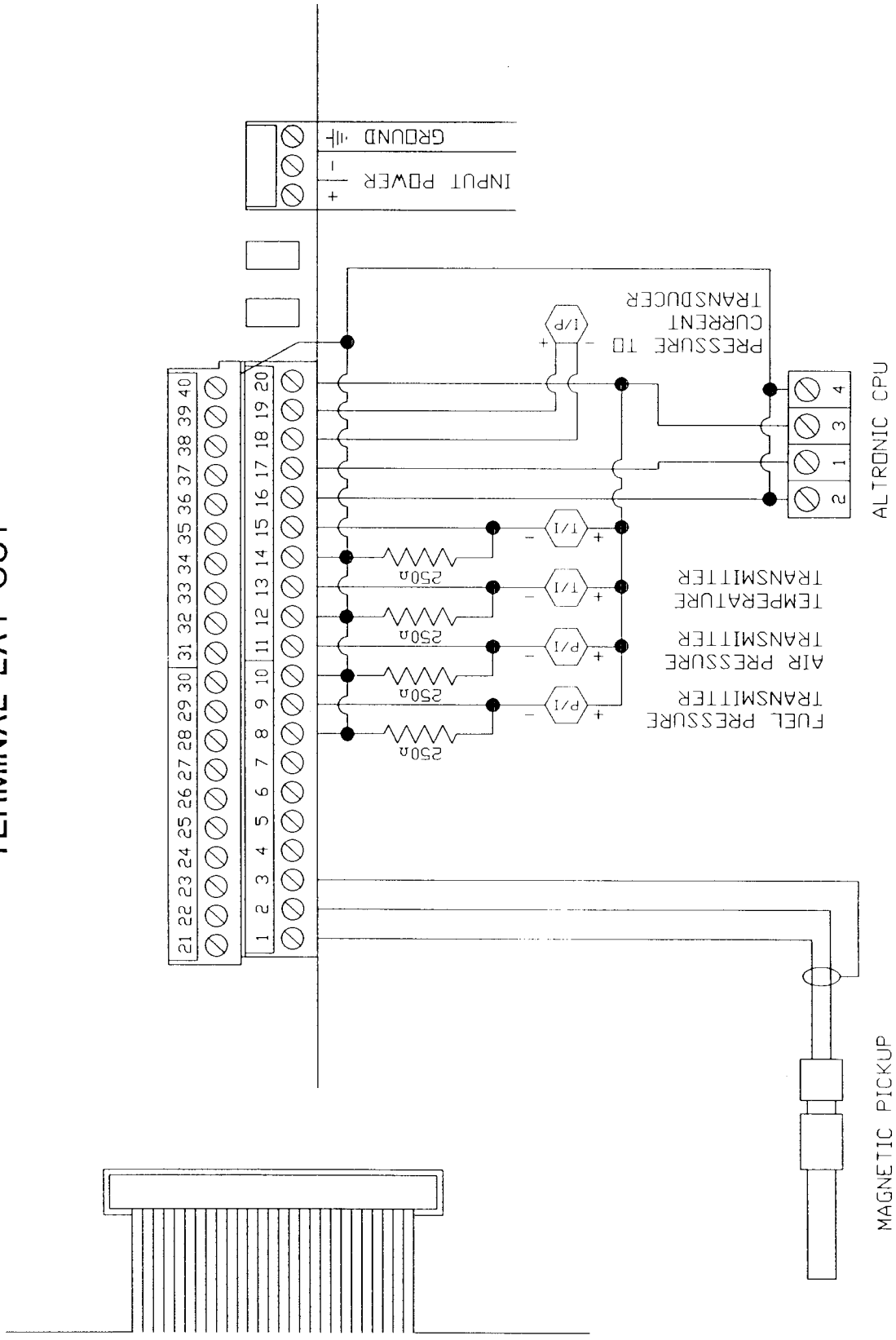


FIG.9

TERMINAL LAY-OUT

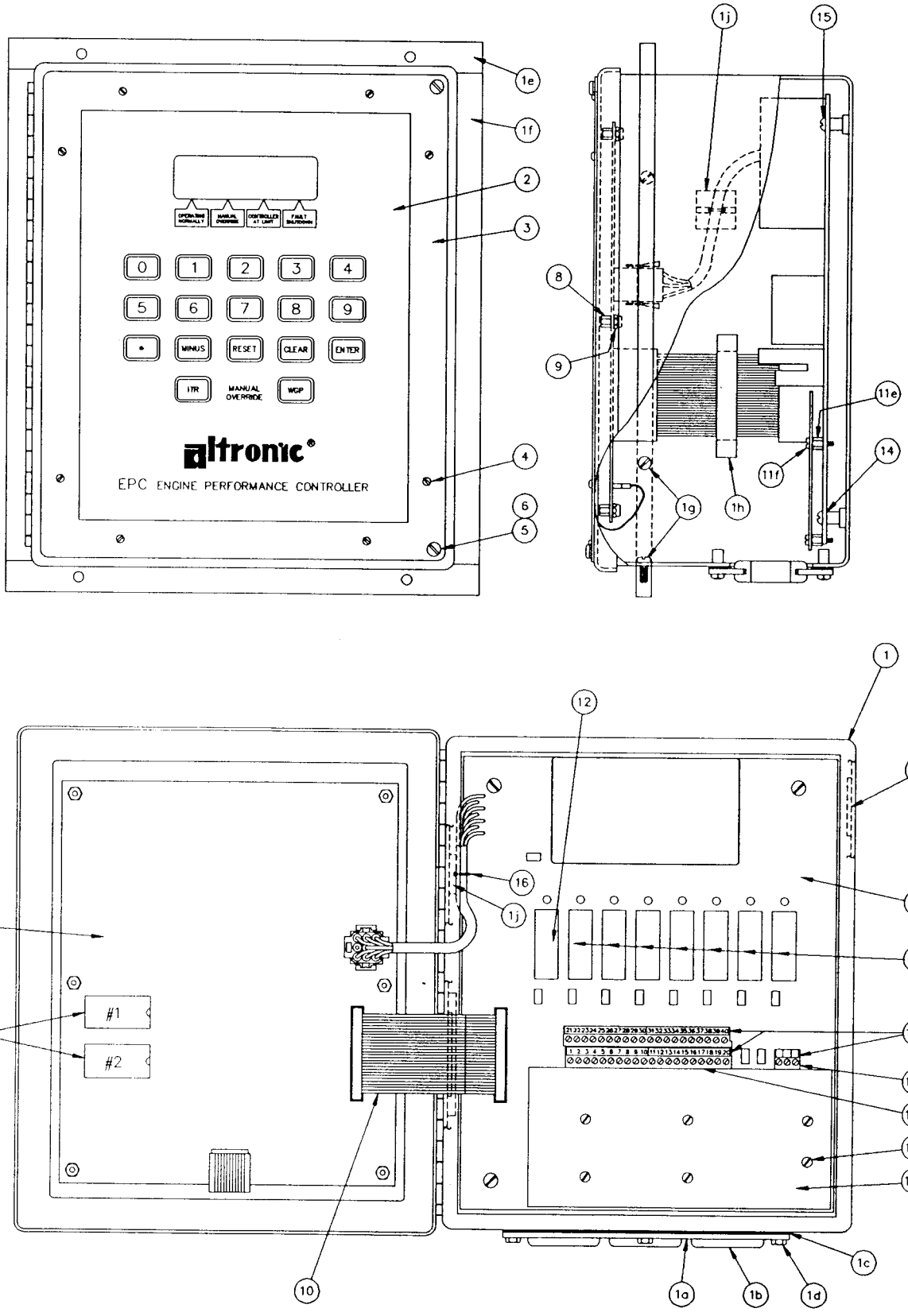


SECTION 7

PARTS LIST

PARTS IDENTIFICATION

FIG.10



7.0 PARTS LIST - EPC-200C

FIGURE & REF. NO.	PART NO.	DESCRIPTION
10-1	610 230	Enclosure
-1a	610 221	Plate, entry
-1b	610 256	Grommet
-1c	210 625	Gasket
-1d	902 599	Screw 10-24 nyloc
-1e	610 219	Mounting bar - horizontal
-1f	610 220	Mounting bar - vertical
-1g	902 439	Screw 10-32
-1h	610 257	Cable clamp, ribbon cable
-1j	610 166	Tie anchor
-1k	602 300	Label - S/N
-2	610 216	Keypad
-3	602 283-1	Frame
-4	902 578	Screw 4-40
-5	902 611	Screw 10-32
-6	610 443	O-ring
-7	672 081-EPC	Logic board assembly
-7a	601 471-EPC	Memory chip
-8	610 227	Standoff, aluminum
-9	902 459	Lock-nut 6-32
-10	610 209	Jumper cable
-11	681 033-1	I/O board assembly, EPC-200CF, 12VDC
	681 033-2	I/O board assembly, EPC-200CD, 24VDC
	681 033-3	I/O board assembly, EPC-200CA, 115VAC
-11a	610 243	Receptacle plug, 20-position
-11b	610 241	Receptacle plug, 3-position
-11c	602 372	Label - plug terminal
-11d	602 294	Label, EPC-200CF, 12VDC
	602 297	Label, EPC-200CD, 24VDC
	602 303	Label, EPC-200CA, 115VAC
-11e	610 228	Standoff, aluminum
-11f	902 598	Screw 6-32
-12	691 057	Input module IDC5
	691 064	Input module IAC5
-13	691 056	Output module ODC5
	691 065	Output module OAC5A
	691 066	Output module ODC5A
-14	610 254	Standoff 10-32 (EPC-200CA only)
-15	902 439	Screw 10-32
-16	610 145	Cable tie