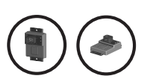
ICM200 Series
Ignition Control Module

1 INSTALLATION

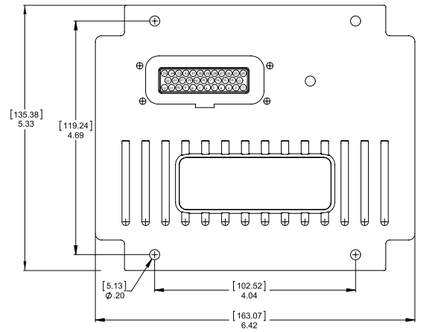
Vertical orientation allows for the draining of fluids in moist environments.



Mount in a cabinet, engine enclosure, or sealed metal box.

Avoid Extreme Heat

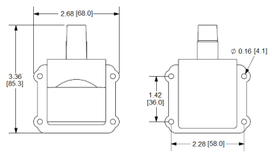
Dimensions: in [mm]



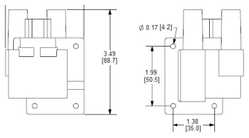
2 IGNITION COILS, WIRE, AND SPARK PLUGS

The ICM can control two different varieties of ignition coils. There is a standard for single output coil for sequential and a dual output coil for waste-spark applications. The two variations are shown below:

Ignition Coil
Sequential, Single Output



Ignition Coil
Waste-Spark, Dual Output



NOTE The ICM is not designed for coils with built-in drivers

As part of the total ignition system, GAC also supplies spark plugs for various applications. These spark plugs are designed for longevity in extreme operating conditions and varying fuel types. GAC also provides ignition wires, as shown below:

Spark Plug

Ignition Wires

Installation:

1. Disconnect the fuel and battery supply to the engine prior to installing the ignition system.
2. Clean the mounting areas from any debris prior to mounting the coils and installing the spark plugs.
3. Mount the coils to their appropriate locations using a bracket or a direct-to-bulkhead mounting scheme.
4. Install the spark plugs using a spark plug wrench.
5. Connect the spark plug wires between the ignition coils and the spark plugs.
6. Reconnect the fuel source to the engine fuel system, but do not enable.

3 ENGINE SENSOR

The camshaft / crankshaft position sensor is used to measure rotational speed as well as angular position of the engine. GAC offers a Hall Effect version of the position sensor or a Variable Reluctance version.

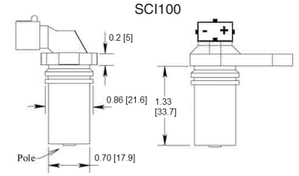
SCI100
Variable Reluctance
90 Degree

SCI101
Variable Reluctance
Straight

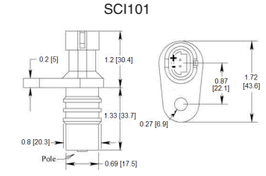
SCI102
Hall Effect
Straight

SCI103
Hall Effect
90 Degree

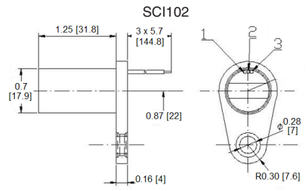
SCI100



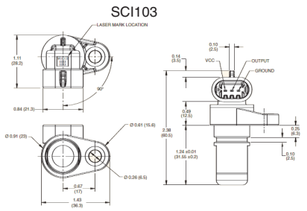
SCI101



SCI102



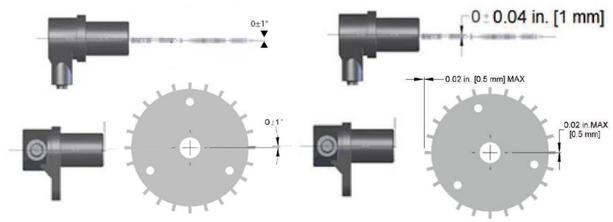
SCI103



Sensor and Camshaft Trigger Wheel:

The sensor must perpendicular to the trigger wheel within one degree. Failure to ensure this specification is a common error resulting in damaged sensors, poor starting and timing scatter. The centerline of the small trigger wheel and sensor must be within 0.04 in. [1 mm]. For large trigger wheels the sensor must be aligned within 0.02 in [0.5 mm] at a gap of 0.04 in. [1 mm]. This is shown in the following representations.

NOTE GAC offers a 24-1 camshaft trigger wheel. The trigger wheel is a multi tooth design, providing high RPM resolution for accuracy and quicker engine start. GAC does not offer large camshaft or crankshaft wheels. Contact GAC for compatible universal selection types.



Camshaft Trigger Wheel Installation:

1. Manually turn the engine to top dead center (TDC) combustion of cylinder 1
2. Install the trigger wheel (24-1 from GAC) onto the selected ½ speed shaft.
3. Place the camshaft position sensor into the bracket used to position the sensor correctly.
4. Mount and adjust the sensor / trigger wheel so that it is pointing at the 4th tooth after the gap on the trigger wheel. If the normal rotation of the trigger wheel will be clockwise, then mount the sensor at the 4th tooth, counting in the counter clockwise direction.
5. Ensure the sensor is mounted squarely and aligned correctly per the application considerations and tighten the trigger wheel bolt. If needed, shims can be used to adjust the sensor orientation.
6. Using a bolt or similar hardware gently torque the sensor down in place using the single eyelet. Take caution not to change the orientation of the sensor or over-torque the mounting tab / eyelet and cause damage to the sensor.

Sensor and Crankshaft Trigger Wheel:

Make sure the sensor is perpendicular to the trigger wheel and the trigger wheel is centered on the sensor. The sensor must be 0.02 in [0.5 mm] to 0.04 in. [1 mm] away from the disk surface. Failure to ensure this specification is a common error resulting in damaged sensors, poor starting and timing scatter. For a universal trigger wheel, with the engine at TDC, the center of the signature tooth should line up with the center of the engine speed sensor.

Crankshaft Trigger Wheel Installation (OPTIONAL):

1. Manually turn the engine to top dead center (TDC) combustion of cylinder 1.
2. Remove any pulleys that are mounted to the harmonic balancer.
3. Check the surface to which the crank trigger wheel will be mounted to ensure that it is smooth and free of any excess dirt or oil. Clean the surface of the balancer, if necessary.
4. Install the crankshaft trigger wheel using appropriately selected hardware according to manufacturer's recommendations.
5. Place the engine position sensor into the bracket used to position the sensor correctly.
6. Mount and adjust the sensor / trigger wheel so that it is pointing at the signature tooth after the gap on the trigger wheel as shown on the previous figure (if universal trigger wheel used).
7. Ensure the sensor is mounted squarely, and aligned correctly per the application considerations and tighten the trigger wheel bolt(s). If needed, shims can be used to adjust the sensor orientation since it must be from 0.5 to 1.0mm away from the trigger wheel surface. Also verify that the sensor is centered longitudinally on the wheel. If it is off more than .050" or so, the block bracket must be re-shimmed appropriately
8. Using a bolt or similar hardware gently torque the sensor down in place using the single eyelet. Take caution not to change the orientation of the sensor or over-torque the mounting tab / eyelet and cause damage to the sensor.
9. Reinstall the lower crank pulley.
10. Bolt up the lower pulley. Torque to the proper specifications. The use of Loctite or lock-washers is recommended. Make sure the trigger wheel is still in the intended alignment position with the crank sensor.

4 MAP SENSOR

The Manifold Absolute Pressure sensor from GAC is available in three different pressure ranges (1 bar, 2 bar, 3 bar) supporting up to 30 psig of boost. Typically, naturally aspirated engines use the 1 bar model. All three variations have the same mounting footprint and instructions. A representation of the Manifold Absolute Pressure sensor (MAP) is shown below.

Manifold Absolute Pressure Sensor

Dimensions
xx.x - in
[xx.x]- mm

MAP Installation:

1. Lubricate the O-ring seal on the MAP sensor to ensure it is not damaged during installation.
2. Install the MAP sensor onto the appropriate location on or near the intake manifold using the 5mm thru-holes and the selected mounting hardware. Do not over torque the assembly down and ensure that the barb fitting is not damaged during installation and is free from obstruction.
3. If the sensor is remote mounted, install the barb fitting on the intake manifold which should a 6.4 mm [0.25 in.] barb fitting. Install a section of hose from the intake manifold to the MAP sensor. Ensure the vacuum hose is positioned and cut to the appropriate length to avoid kinks or low points in the line.

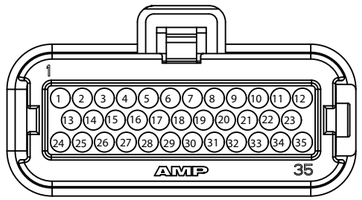
NOTE The MAP sensor is not required in the event that the multi-dimensional timing maps based on engine speed and calculated engine load are undesired. The maps can still be used to vary timing based on engine speed alone without the MAP sensor. If the MAP sensor is not used, it is good practice to tie the input signal at the ICM to sensor ground to avoid unwanted interaction.

5 SPECIFICATIONS

PERFORMANCE	
Steady State Accuracy	± 1° Crankshaft Angle
ENVIRONMENTAL	
Temperature Range	-40° to 125°C (-40 to 257°F)
Relative Humidity	up to 95%
COMPLIANCE / STANDARDS	
Agency	CE and RoHS Requirements
Communications	RS-232-C, IEEEE J1939
PHYSICAL	
Dimension	See Section 1 "Installation"
Weight	6oz
Mounting	Any position, Vertical Preferred
INPUT / OUTPUT	
Supply	12-24 VDC Battery Systems (6.5 to 33 VDC)
Polarity	Negative Ground (Case Isolated)
Power Consumption	100mA max. continuous plus ignition coil current
Reverse Power Protection	Up to 600 VDC
Engine Position Sensor Input	Hall Effect or Variable Reluctance
Igniton Coil Current	10 Amps Peak
Manifold Absolute Pressure / timing Trim Pot. Input	0 - 5 VDC
RELIABILITY	
Vibration	10G, 20-2000 Hz
Shock	20G Peak
Testing	100% Functional Testing
PARAMETERS	
Offset Angle	0 - 180°
Timing Angle	0 - 60°
Number of Cylinders	2,3,4,5,6,8 Sequential / 4,6,8,10,12 Waste-Spark
Maximum Dwell Time	1 ms
Ignition Coil Current	0 - 10 Amps
Overspeed	0-5000 RPM
Timing Trim Adjustment	-10° to 10°
Crank Trigger Wheel Setup	40-1, 60-2, others...
Cam Trigger Wheel Setup	#Cyl + 1, 24-1, others...

6 WIRING

ICM 35 PIN MATING CONNECTOR



ICM CONNECTOR DEFINITION & WIRING TABLE			
PIN	**DESCRIPTION**	**COMMENT**	**WIRE**
1	---	Not Used	N/A
2	Ignition Coil H	Ignition Coil H Output Driver	16 AWG
3	Ignition Coil D	Ignition Coil D Output Driver	16 AWG
4	---	Not Used	N/A
5	Ignition Coil F	Ignition Coil F Output Driver	16 AWG
6	Ignition Coil B	Ignition Coil B Output Driver	16 AWG
7	---	Not Used	N/A
8	Ignition Coil G	Ignition Coil G Output Driver	16 AWG
9	Ignition Coil C	Ignition Coil C Output Driver	16 AWG
10	---	Not Used	N/A
11	Ignition Coil E	Ignition Coil E Output Driver	16 AWG
12	Ignition Coil A	Ignition Coil A Output Driver	16 AWG
13	Battery Ground	Ground for 12 or 24 VDC Power	16 AWG
14	Crank Wheel Sensor Signal	Position Signal for Ignition Firing from Crank Wheel	20 AWG Shielded / Twisted Pair
15	Crank Wheel Ground	Crankshaft Wheel Sensor Ground	20 AWG Shielded / Twisted Pair
16	Cam Wheel Sensor Signal	Position Signal for Ignition Firing from Cam Wheel	20 AWG Shielded / Twisted Pair
17	Cam Wheel Ground	Ground for the Camshaft Wheel Sensor	20 AWG Shielded / Twisted Pair
18	CAN High	CAN Communication Port	20 AWG Shielded / Twisted Pair
19	CAN Low	CAN Communication Port	20 AWG Shielded / Twisted Pair
20	RS-232 Ground	RS-232 Communication Port	20 AWG
21	RS-232 Transmit	RS-232 Communication Port	20 AWG
22	---	Not Used	N/A
23	Ignition Coil Power Output	Ignition Coil Power Relay Output (Low-Side)	18 AWG
24	Battery Positive	12 or 24 VDC Power Input	18 AWG
25	2nd Timing Map Switch	2nd Timing Map Enable Input	20 AWG
26	---	Not Used	N/A
27	Manifold Absolute Pressure	0-5 VDC Signal from MAP Sensor	20 AWG
28	Trim Pot	0-5 VDC Signal from Timing Trim Angle Pot	20 AWG
29	---	Not Used	N/A
30	Analog GND	Analog Reference Signal for Sensors	20 AWG
31	Analog GND	Analog Reference Signal for Sensors	20 AWG
32	Analog Power	5 VDC Power for Analog Sensors (MAP, Trim, etc.)	20 AWG
33	Speed Sensor Power	5 VDC Power for Cam and/or Crank Wheel Sensors	20 AWG
34	RS-232 Receive	RS-232 Communication Port	20 AWG
35	---	Not Used	N/A

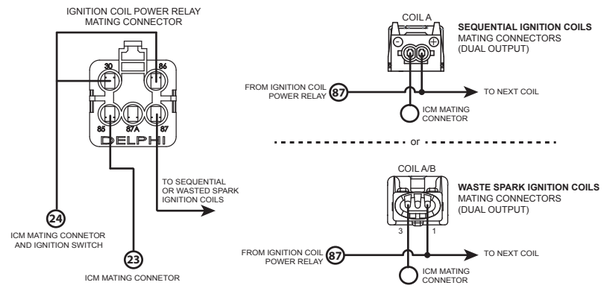
RECOMMENDATIONS

1. The ICM should be wired through a switched (On / Off Switch) DC power source of 8 to 32VDC and circuit protected with a 20 Amp fuse or circuit breaker.
2. GAC recommends shields for Crank/Cam Wheel Sensor and CANbus be terminated on one side closest to the largest block of metal (e.g., the engine).
3. Not all of the circuits will apply to your particular application

NOTE Blanks are not used.

PIN 23 — **IGNITION COIL POWER RELAY (2A-LSO)**

The ICM has a dedicated output channel (pin 23) to connect an external power relay. The output provides a ground trigger to close the relay. The ignition power relay contacts then close to provide battery voltage to the ignition coils. This relay can also be used for a fuel shutoff valve or other safety device for additional engine protection. It is capable of 2 A output, tied to ground when enabled.



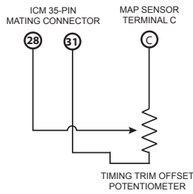
OVERSPEED

The overspeed function provides emergency shutdown by discontinuing the firing sequence and the power control relay. If the ignition coils and a gas valve are powered through the relay and the engine trips the overspeed setpoint the relay will open the contacts and shutdown the engine. When the engine is shutdown due to overspeed, the diagnostic LED will blink yellow to indicate the condition. A power cycle will be needed to clear the condition and resume normal operation.

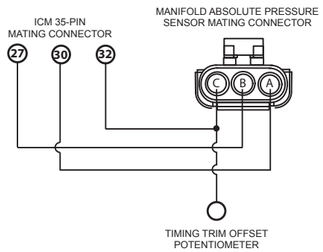
WARNING This is not a replacement for mechanical fail-safe. In the event of an overspeed shutdown, it is important to determine the root cause of the overspeed and to take corrective action to fix the problem. Also, care must be taken upon engine restart to vent trapped fuel.

PIN 28 — **TRIM POTENTIOMETER INPUT**

Ignition timing can be trimmed via a 0-5 VDC analog input. When trim is enabled, the timing can be adjusted up to ±10°, which globally offsets the current timing angle. The ICM displays the trim angle is by the blinking the diagnostic LED. The procedure is covered in greater detail in subsequent sections. For a list of LED definitions See Section 10 LED DEFINITIONS.

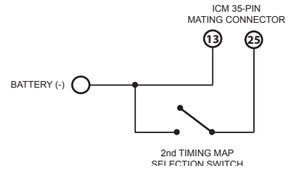


PIN: 27 30 32 — **MANIFOLD ABSOLUTE PRESSURE**

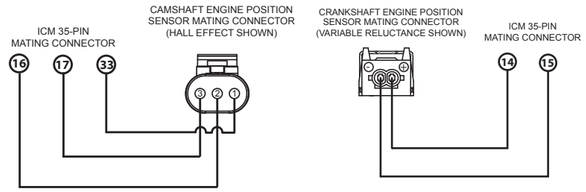


PIN 25 — **2ND TIMING MAP SELECTION INPUT**

An input is available to select between the standard timing map (map 1) and a 2nd timing map (map 2). The 2nd timing map input activates when pin 25 is connected to ground. This input is designed for dual fuel applications where separate timing maps are required for propane and natural gas for example.

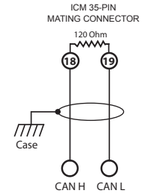


PIN: 16 17 33 — **HALL EFFECT POSITION SENSOR** or **VARIABLE RELUCTANCE POSITOIN SENSOR** — **PIN: 14 15**



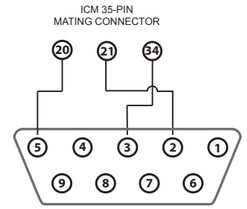
PIN: 18 19 — **CAN / J1939**

The CAN output supports J1939 protocol for individual cylinder dwell times. The ICM is not designed to be the end of line device on the CANbus. If the ICM is located at the end of the CANbus trunk ensure that a 120Ω termination resistor is placed across CAN H and CAN L (pins 18 and 19). As with all CANbus applications there needs to be a matching 120Ω resistor at the other end of the trunk for a total parallel resistance of 60Ω. There is no termination resistor internal to the ICM.



PIN: 20 21 34 — **RS-232 / MODBUS**

RS-232 / Modbus: The RS-232 inputs are used to configure the ICM using GAC's SmartVU software. A DB9-F is the standard mating connector for diagnostic information



7 TIMING TRIGGERING

Both crankshaft and camshaft triggering wheel inputs are designed to interface to most Hall Effect and variable reluctance sensors. A regulated 5 VDC output is available on pin 33 for a powered Hall Effect sensor. The signal output of the sensor is wired to the cam/crank input; the ground side is wired to ground. If the sensor is a variable reluctance magnetic pickup, then the polarity does not matter unless shared with other devices. The offset angle parameter calibrates the sensor with respect to TDC. Whenever a change is made to the crank or cam sensor, ignition timing should be re-verified. There is a direct relationship between the number of cylinders and the number of coils. If the crank trigger wheel is selected, the ICM will automatically use waste-spark and as such utilize only half the ignition channels. If a cam trigger wheel is chosen, the ICM will pair each cylinder with its own ignition output channel.

NOTE On an 8 cylinder engine with crank trigger wheel the ICM will use output channels A, B, C & D. On an 8 cylinder engine with a cam trigger wheel will use output channels A through H.

8 COILS

Each ignition coil driver channel provides up to 10 Amps to the inductive coil. The output to the coil can be configured via SmartVU for sequential or waste-spark operation. The ICM fires each channel sequentially, starting with 1 and ending at the last configured cylinder.

NOTE Care must be taken when wiring output channels to the ignition coils to insure the correct engine firing order. When running in waste-spark mode, the synchronization point is the same with respect to coil 1. Companion cylinders must be wired in series. Example, on a 4 cylinder engine where companion cylinders are 1&4, 2&3, the cylinder pairs are wired in series. The ICM will only trigger coil output channels when speed is detected by one of the two speed inputs, and after synchronization has occurred.

9 FIRING ORDER

Firing order is engine dependent; always verify the firing order before proceeding with controller wiring. Examples of 4, 6, and 8 cylinder firing orders with the coil output numbers are given in the table below:

Firing Order Examples for 4,6, and 8 Cylinder Engines

	NUMBER OF CYLINDERS					
OUTPUT CHANNEL	**4-CYL WASTE**	**4-CYL SEQ.**	**6-CYL WASTE**	**6-CYL SEQ.**	**8-CYL WASTE**	**8-CYL SEQ.**
A	1,4	1	1,6	1	1,6	1
B	3,2	3	5,2	5	5,2	5
C		4	3,4	3	4,7	4
D		2		6	3,8	3
E				2		6
F				4		2
G						7
H						8

NOTE The ICM fires the output channels in order (i.e., A, B, C, etc.) Special care needs to be taken when wiring the coils to make sure it is in the correct firing order. Cross check the firing order with the engine manufacturer. Use the table below to help in mapping the coil number to the cylinder number.

Table 1

Example Cross-Reference Chart for Coil # vs. Firing Order

ICM COIL FIRING SEQUENCE	CABLE COLOR OR NUMBER	ENGINE FIRING ORDER
A		1
B		
C		
D		
E		
F		
G		
H		

10 LED DEFINITIONS

LED STATE	DEFINITION
OFF	ICM200 is powered down.
Solid GREEN	Normal operation; trim potentiometer is currently disabled, or set to zero degrees.
Blinking RED	Normal operation; trim pot is enabled - the LED flashes once for each degree of trim retarded. The blink rate is ¾ of a second on then off. The angle is repeated every 10 seconds.
Blinking GREEN	Normal operation; trim pot is enabled - the LED flashes once for each degree of trim advanced. The blink rate is ¾ of a second on then off. The angle is repeated every 10 seconds.
Blinking YELLOW	An overspeed or an E-STOP condition has occurred; power must be cycled to clear this condition.

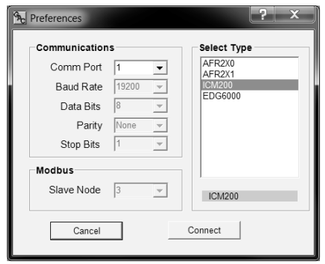
NOTE For the Trim Potentiometer Input pinout see Section 6 WIRING

11 SMARTVU

The ICM is programmed using GAC's SmartVU software. Download SmartVU and the SmartVU instruction manual at: **http://www.governors-america.com/Downloads/SmartVU**. Once SmartVU has been installed, start SmartVU with the RS232 Communications port properly connected to the computer and ICM200.

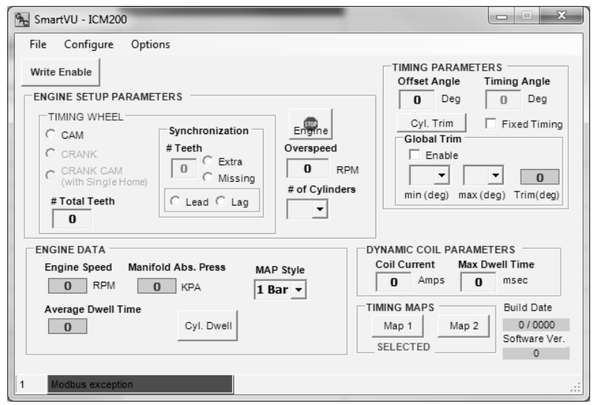
Setup Connection Menu:

After the ICM200 has been properly selected from the Setup Connection Sub menu (found under the "Configure" pull-down menu). You will see this screen at startup, or go to Configure -> Setup Connection on the top menu bar and select ICM 200.



NOTE The SmartVU software requires a serial port (or USB to serial adapter) and a pass-through DB9 F/M cable.

Main Menu

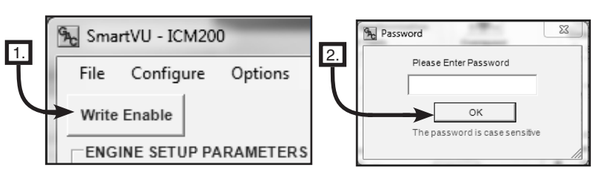


12 EDITING PARAMETERS

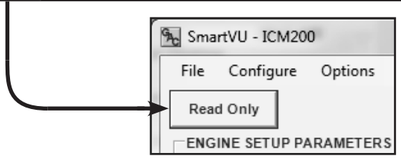
SmartVU has a Write Enabled mode and a Read Only mode. When SmartVU is first started, it defaults to the Read Only mode where parameters can not be changed. To edit paremeters, SmartVU must be placed into Write Enabled mode.

Switching to Write Enabled mode:

1. Select the Write Enable button at the top left of the Main Menu window.
2. Hit the "OK" button when the Password window appears. (Do not enter a password unless you were supplied one from the OEM). You can now edit SmartVU parameters.



NOTE While in Write Enabled mode, you will see a "Read Only" button at the top left of the Main Menu Window. To switch to Read Only mode, select the "Read Only" button. When promted, hit the "OK" button on the Password Menu. You are now in Read Only mode.



13 PRE-START

The following parameters must be set before starting the engine. For more details on these parameters, refer to Section 14 Main Menu Parameters

Engine Setup Parameters	Overspeed
	# of Cylinders
	Timing Wheel
	Synchronization
Engine Data	MAP Style

Timing Parameters	Offset Angle
	Timing Angle
	Fixed Timing
Dynamic Coil Parameters	Coil Current
	Max Dwell Time

NOTE Cycling the ICM's power is required for the stored changes to take effect.

14 MAIN MENU PARAMETERS

ENGINE SETUP PARAMETERS			
Name	**Definition**	**Range**	**Default**
Overspeed	RPM at which to automatically shut off the ignition	0 - 6000	3000
# of Cylinders	# of clylinders on the engine	2 -12	xx
Timing Wheel	Trigger wheel is either mounted to the camshaft or the crankshaft.	Cam, Crank	Cam
# Total Teeth	Total number of teeth for the trigger wheel being used	0 - 60	24
# Teeth	Number of missing or extra teeth	0-2	1
Extra / Missing	Defines the signature teeth as either extra teeth or missing teeth	Extra, Missing	Missing
Lead / Lag	Defines the extra (signature) teeth as leading or lagging	Lead, Lag	Lag
TIMING PARAMETERS			
Name	**Definition**	**Range**	**Default**
Offset Angle	Number of degrees after the sensor detects the synchronizing gap to TDC	0° - 180°	80°
Timing Angle	Angle to fire before TDC	0° - 60°	20°
Cyl. Trim	Propmts the Cylinder Trim window allowing for individual cylinder timing offset angles to be changed	-10 to 10	0
Fixed Timing	Select for fixed timing or uncheck for variable timing maps	Yes / No	Yes
Enable	Enables Global Trim to offset engine timing.	Yes / No	No
min (deg)	Sets the lower limit for adjusting trim	-10 to 10	-10
max (deg)	Sets the upper limit for adjusting trim	-10 to 10	+10
Trim (deg)	Display current commanded trim angle	Read Only	
ENGINE DATA PARAMETERS			
Name	**Definition**	**Range**	**Default**
Engine Speed	Engine speed as read from the cam or crank trigger wheel (RPM)		---
Manifold Abs. Press	Absolute pressure reading from the intake manifold (kPa)		---
Average Dwell Time	Average of all cylinders for the most recent, complete, combustion cycle.		---
MAP Style	The type of MAP sensor installed (Bar)	1, 2, 3	1
	NOTE Click the down arrow, select MAP Style, and press the ENTER key to ensure it saves.		
Cyl. Dwell	Reveals the Cylinder Dwell Time window which displays the individual dwell time for each coil.		---
ENGINE DATA PARAMETERS			
Name	**Definition**	**Range**	**Default**
Coil Current	Energy setting for coils	0 - 10	5
Max Dwell Time	Max time allowed to charge each coil for safety (msec)	0 - 100	3
TIMING MAPS PARAMETERS			
Name	**Definition**	**Range**	**Default**
Map 1	Displays the System Tuning window where Timing Map 1 may be edited and selected		---
Map 2	Displays the System Tuning window where Timing Map 2 may be edited and selected		---

15 TIMING PARAMETERS

This section on the display is specific to the fixed timing parameters. The fixed timing is accomplished using a set timing angle and offset angle regardless of engine speed. For variable timing based on engine speed and load refer to the Section 17 TIMING MAPS.

Editing Procedure:

1. Enable the Fixed Timing option by pressing the appropriate check box.
2. Ensure the Global Trim enable option is unchecked.
3. Set the desired Timing Angle required before TDC at which the spark is to occur.
4. Set the "Offset Angle" to the same rough angular offset between the reference tooth on the trigger wheel and TDC. Offset Angle is the number of degrees after the sensor detects the synchronizing gap (or tooth) to TDC. This value must be calibrated such that the actual angle of the ignition event occurs at the requested timing angle. This angle is based on how the trigger wheel is mechanically mounted to the engine. Larger angles before TDC allow greater control for accurate timing. 80° is the default value
5. Crank the engine, with the fuel still disconnected and observe the position of the ignition timing for cylinder 1 with a timing light.
6. If the timing is off from the desired timing, by +/-3°, adjust the Offset Angle parameter. For example, if the specified "Timing Angle" is 10 degrees before TDC and the observed timing angle is 6°, decrease the offset angle by 4°.
7. Enable the fuel supply and start the engine.
8. Allow the engine to ramp up to the desired speed. If the engine does not start refer to the SYSTEM TROUBLESHOOTING Section 18.
9. Once the engine is at rated speed, verify proper ignition timing angle is within ±1° and adjust the offset accordingly

16 INDIVIDUAL CYLINDER TIMING TRIM

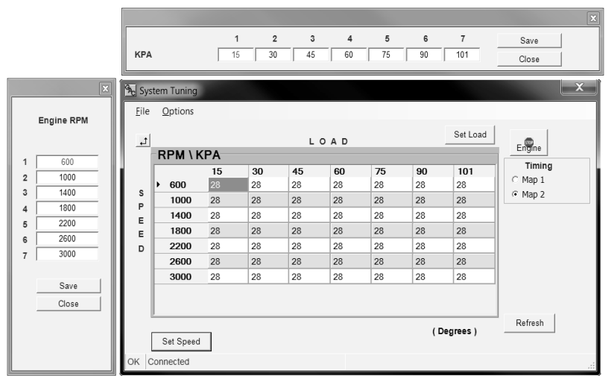
In some cases the individual cylinders may need a small timing offset to account for mechanical variations in the engine design, triggering arrangement, or other factors which result in firing inconsistencies. The ICM has the ability to offset the individual cylinder timing by a maximum of +/- 10 crank degrees. This adjustment is performed after the fixed timing procedure and startup is completed.

Editing Procedure:

1. Select the Cyl. Trim button under the TIMING PARAMETERS sections or go to Options > Cylinder Trim on the top menu bar. The window above will appear:
2. Adjust the angles as necessary and check the individual coil timing angles with a timing light until the desired result is attained.
3. Close the window once complete using the 'X' button in the upper right hand corner.

17 TIMING MAPS

The timing maps are used to adjust timing based on real-time engine speed and load. There are two maps available within the ICM typically used for dual-fuel or for a global timing retard/advance.



Editing Procedure:

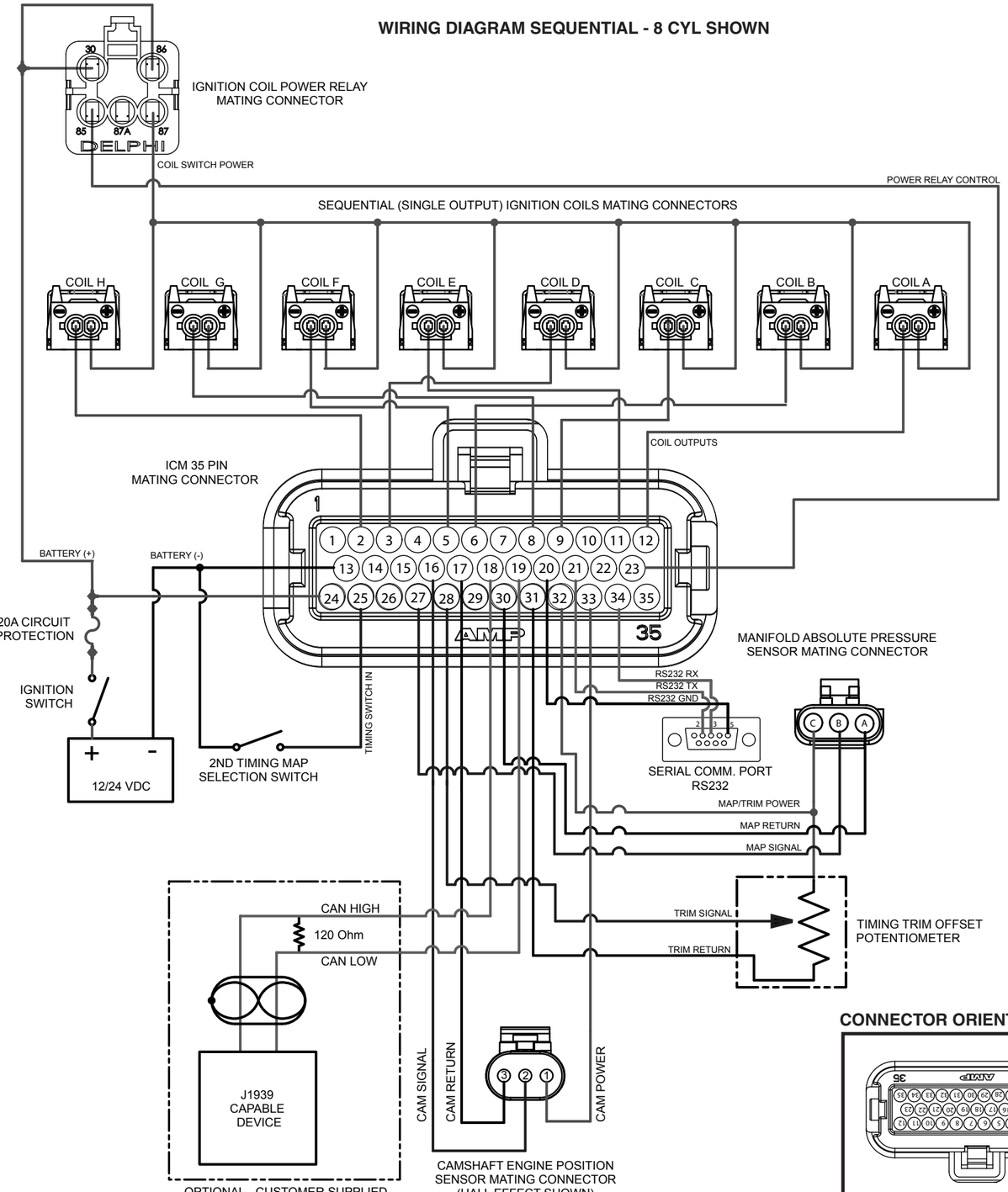
1. Ensure the Fixed Timing box is NOT checked under the TIMING PARAMETERS section
2. Locate the Map 1 and 2 buttons under the TIMING MAPS section and select Map 1 (default selection). Alternatively, you can go to Options > System Tuning > Timing Map1 or Press F2. The screen will appear similar to that shown above
3. Adjust the speed and load scales by selecting the "Set Load" or "Set Speed" buttons and entering the required values. Ensure the values are linear so that the transition between cells is gradual for smooth engine response. Press Save and then Close when complete.
4. Edit each of the cells needed with respect to the number of degrees before TDC for each speed vs. load value. Note that this can be done in real-time with the engine running
5. If both timing maps are going to be used:
   a. Switch over to Map 2 using the timing map select switch.
   b. Select the radio button for Map 2 under the Timing section on the right side of the System Tuning window.
   c. Edit the map in a similar manner to that for Map 1.

   NOTE If a global timing offset condition is needed you can use the same values from Map 1 but minus/plus the degrees of retardation/advancement required. If dual fuel operation is required; set up the primary fuel in Map 1 and the secondary in Map 2
6. To get back to the main screen, close the window by clicking on the 'X' in the upper right-hand corner, press Ctrl + B, or select Options > Back to Main Screen from the top menu bar.

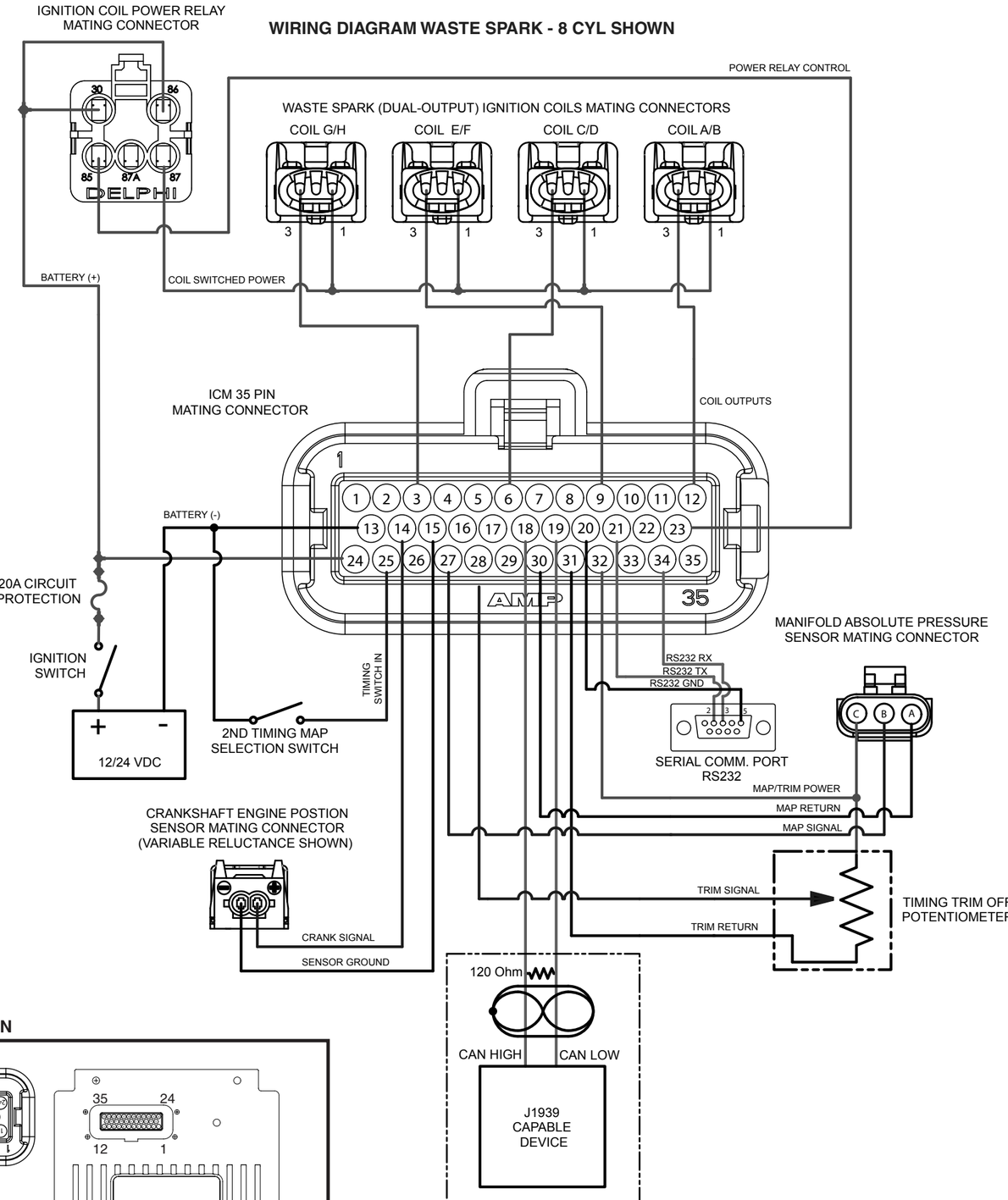
18 SYSTEM TROUBLESHOOTING

SYMPTOM	PROBABLE CAUSE OF ABNORMAL READING
Engine does not start (during cranking)	1. Verify that the LED on the ICM200 is not blinking yellow. 2. Recheck all trigger wheel Parameters, Coil Current, Offset Angle, Overspeed, and Timing Angle/Map Settings. 3. Verify that the fuel controller and/or fuel are on and is being supplied to the engine. 4. Verify the main power relay is wired correctly and is being enabled at power on. Also, make sure the correct relay voltage (12 / 24) is selected.
Engine does not start well (after cranking)	1. If engine does not sound smooth, or if a back-fire occurs, then shut down immediately and check the following: a. Verify that the Coils are wired in the correct sequence. Coil #1 must be wired to the cylinder fired after the "Cylinder 1" reference tooth, with all other coils wired sequentially after. b. Incorrect Offset Angle values can create an extreme retard or advance condition; verify the angles as recommended by the engine manufacturer. c. Verify mounting of trigger wheel. 2. Using a timing light, check the engine timing on cylinder 1 to make sure it is within an acceptable range to start the engine. 3. Battery Voltage may be too low. If the voltage is below 8 volts while cranking, recharge the battery. 4. Make sure the fuel system is actively delivering fuel to the system and is tuned.
Engine is not running at the correct timing.	1. Adjust the Offset Angle with a timing light until desired timing is reached. 2. Make sure that all the ignition coils are connected.

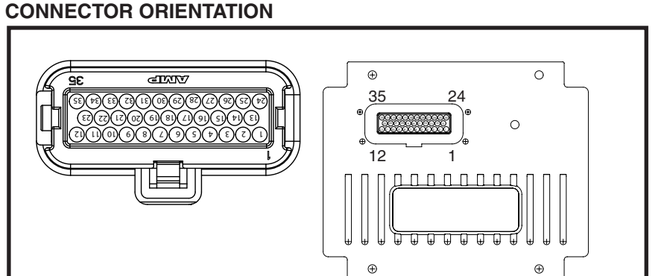
WIRING DIAGRAM SEQUENTIAL - 8 CYL SHOWN



WIRING DIAGRAM WASTE SPARK - 8 CYL SHOWN



CONNECTOR ORIENTATION



NOTE The connector on the ICM unit is orientated with the connector clip at the bottom. Terminal 1 starts at the bottom right of the connector.