Daytona Sensors LLC
Engine Controls and Instrumentation Systems

Installation Instructions for CD-1 Pro Capacitive Discharge Ignition System

CAUTION: CAREFULLY READ INSTRUCTIONS BEFORE PROCEEDING. NOT LEGAL FOR SALE OR USE IN CALIFORNIA OR ON ANY POLLUTION CONTROLLED VEHICLES.

OVERVIEW

CD-1 Pro capacitive discharge ignition system P/N 104003 is intended for professional racing applications where data logging is not allowed. The CD-1 Pro system includes CD-1 Pro ignition module P/N 104001 and coil P/N 102002.

The term CD-1 is used throughout this document as a generic term and refers to the CD-1 Pro version unless otherwise noted.

- Compatible with 4-6-8 cylinder race engines with distributor type ignition. Not compatible with odd firing V6 engines.

- 135 mJ spark energy output.

- Digitally set launch, burnout, and maximum RPM limits with 100 RPM steps from 3,000 to 9,900 RPM (10,900 RPM for maximum RPM limit).

- PC programmable advance features ranging from a simple RPM based advance curve to a 3D timing map with boost proportional retard.

- Dedicated input terminals for launch RPM and manifold pressure.

- One general purpose input and two general purpose input/output terminals. Inputs can be programmed for high gear retard, burnout RPM limit, and throttle position sensor. Outputs can be programmed for RPM window switch, nitrous system activation, and multi-gear shift light functions.

- Fully encapsulated construction. 12 pin Deutsch connector used for signal connections.

- Compact size. Module is 7.0"L x 5.25"W x 1.9"H. Coil is 4.4"L x 3.2"W x 3.0"H.

- Highly efficient switching power supply based on US Patents 6518733 and 6636021. Less than 5 amp current draw at 8,000 RPM.

ADDITIONAL REQUIRED PARTS

To use the PC link software, you will require the optional USB interface P/N 102004. To connect a Delphi MAP sensor, you will have to fabricate a wiring harness with the appropriate mating connector or use our MAP sensor harness kit P/N 102006.

The parts bag supplied with the CD-1 includes a signal harness that plugs into the 12 terminal Deutsch connector, ring tongue terminals for power and ignition coil connections, and a set of Weather Pack connectors for tach and PC link hookup. To complete the installation, some applications may require additional wire, crimp terminals, fuses, switches, and relays. The Appendix includes a list of recommended parts and suppliers.

Some applications utilize throttle position sensor (TPS) signal connections. **You will require a vehicle wiring diagram to locate these signal connections.**

WIRING OVERVIEW

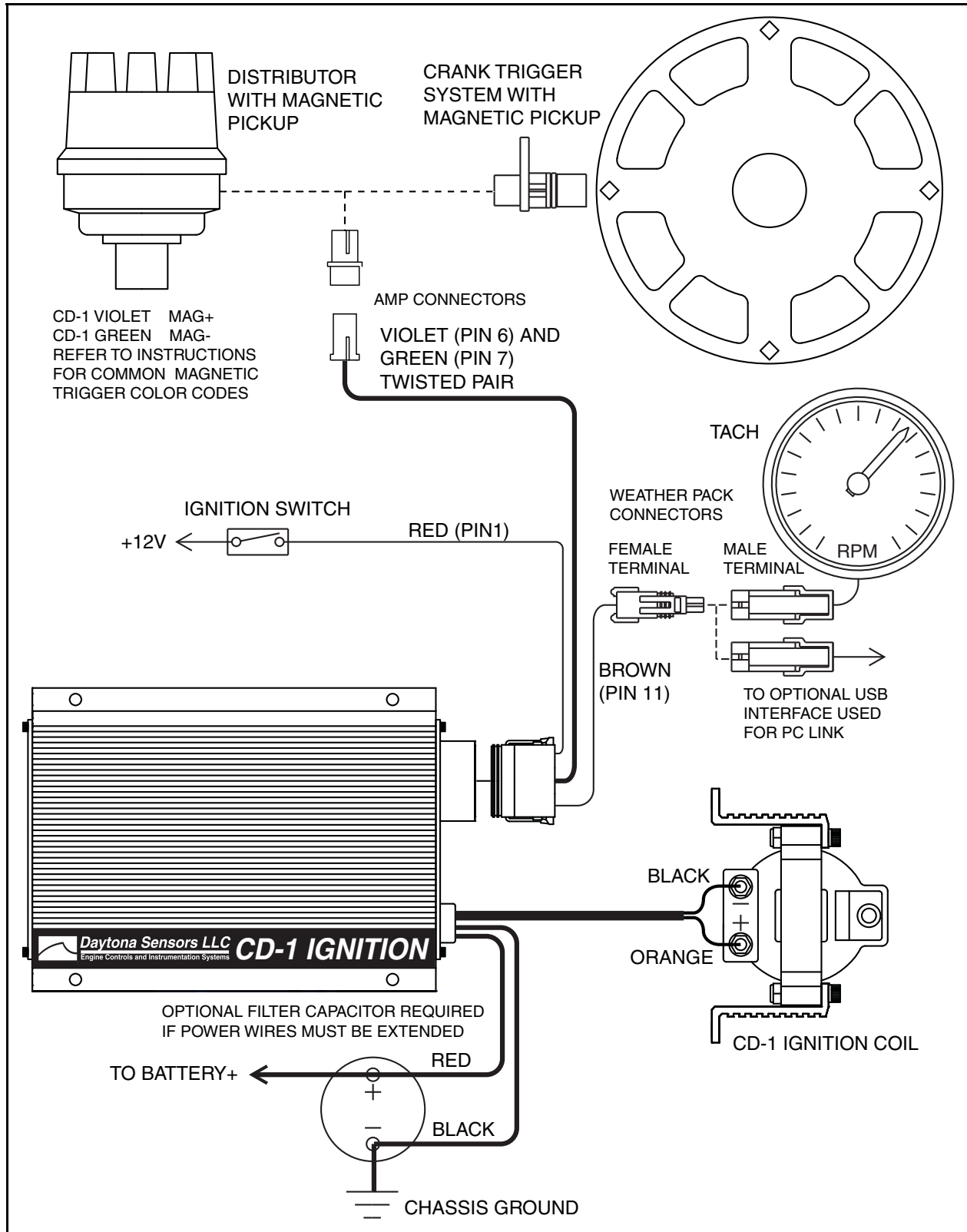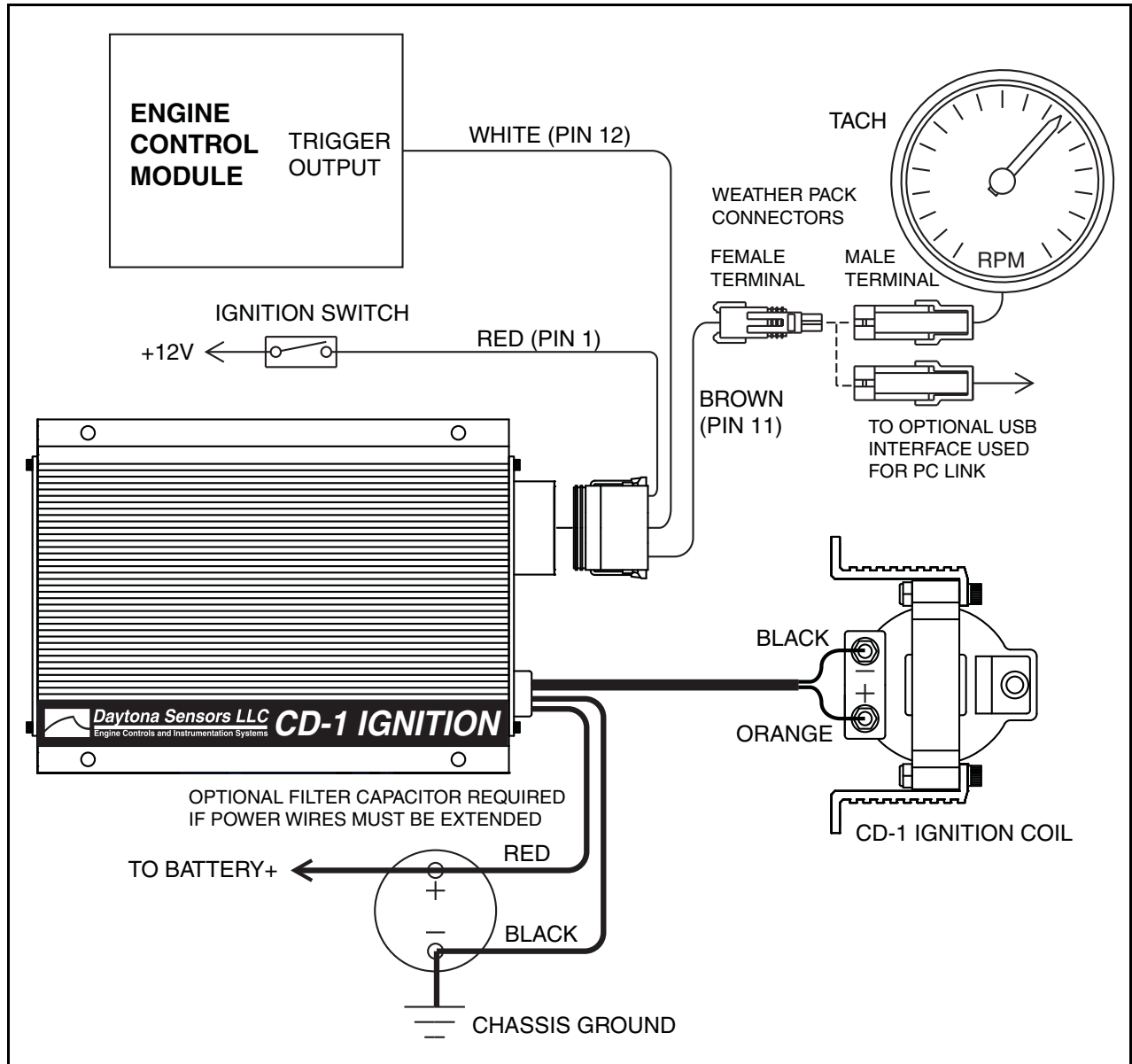| Power Connections		
Heavy (12 AWG) Red	Battery+	Connects to battery positive terminal. Do not connect to the alternator. If leads must be extended, add filter capacitor as shown in basic hookup diagrams.
Heavy (12 AWG) Black	Ground	Connects to chassis ground.
Ignition Coil Primary Connections		
Orange	Coil+	Connects to coil positive terminal
Black	Coil-	Connects to coil negative terminal
Deutsch Connector Signals		
Red (Pin 1)	Ignition Switch	Connects to ignition switch
Blue (Pin 2)	Launch RPM Limit	Connects to launch RPM limit circuit. Supplied 1N4007 diode must be installed if circuit includes a solenoid valve.
Orange (Pin 3)	GPI1	General purpose input 1
Gray (Pin 4)	GPIO2	General purpose input/output 2. Used for burnout RPM limit. Supplied 1N4007 diode must be installed if circuit includes a solenoid valve.
Yellow (Pin 5)	GPIO3	General purpose input/output 3
Violet (Pin 6)	Magnetic Trigger+	Connects to magnetic pickup distributor or crank trigger. If the magnetic trigger inputs are used, the module trigger input on pin 12 must be left open.
Green (Pin 7)	Magnetic Trigger-	Connects to magnetic pickup distributor or crank trigger. If the magnetic trigger inputs are used, the module trigger input on pin 12 must be left open.
Pin 8	Sensor Ground	Connects to MAP sensor ground
Pin 9	MAP Sensor	Connects to 0-5V MAP sensor signal
Pin 10	+5V Power	Connects to MAP sensor power
Brown (Pin 11)	Tach/RS-232	Connects to tach and optional USB interface
White (Pin 12)	Module Trigger	Connects to trigger output from engine control module. If the module trigger input is used, the magnetic trigger inputs on pins 6 and 7 must be left open.

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Figure 2 – Basic Magnetic Trigger Hookup

DISTRIBUTOR WITH MAGNETIC PICKUP

CRANK TRIGGER SYSTEM WITH MAGNETIC PICKUP

AMP CONNECTORS

CD-1 VIOLET   MAG+
CD-1 GREEN   MAG-
REFER TO INSTRUCTIONS FOR COMMON MAGNETIC TRIGGER COLOR CODES

VIOLET (PIN 6) AND GREEN (PIN 7) TWISTED PAIR

TACH

WEATHER PACK CONNECTORS

IGNITION SWITCH

+12V

RED (PIN1)

FEMALE TERMINAL

MALE TERMINAL

RPM

BROWN (PIN 11)

TO OPTIONAL USB INTERFACE USED FOR PC LINK

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CD-1 IGNITION

BLACK

ORANGE

CD-1 IGNITION COIL

OPTIONAL FILTER CAPACITOR REQUIRED IF POWER WIRES MUST BE EXTENDED

RED

TO BATTERY+

BLACK

CHASSIS GROUND

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Figure 3 – Basic Module Trigger Hookup

ENGINE CONTROL MODULE

TRIGGER OUTPUT

WHITE (PIN 12)

TACH

WEATHER PACK CONNECTORS

FEMALE TERMINAL

MALE TERMINAL

RPM

IGNITION SWITCH

+12V

RED (PIN 1)

BROWN (PIN 11)

TO OPTIONAL USB INTERFACE USED FOR PC LINK

Daytona Sensors LLC
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CD-1 IGNITION

BLACK

ORANGE

CD-1 IGNITION COIL

OPTIONAL FILTER CAPACITOR REQUIRED IF POWER WIRES MUST BE EXTENDED

TO BATTERY+

RED

BLACK

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INSTALLATION

1. Turn off the ignition switch and disconnect the battery ground cable before proceeding.

2. Select a convenient mounting location for the CD-1 module and coil. The CD-1 module is fully encapsulated and waterproof, but should be mounted in a dry location away from sources of heat. We recommend under dash mounting and using rubber shock mounts such as McMaster-Carr (www.mcmaster.com) P/N 9376K72. Orient the unit so that you will have easy access to the rotary switches. The CD-1 coil can be mounted in the engine compartment near the distributor.

3. Refer to Figures 2 or 3 for basic hookup.

> *WARNING: Do not cut the power or coil wires shorter than 12 inches. Doing so makes the unit impossible to test and will void the warranty.*

4. **Power connections**. Race vehicles should be equipped with a battery disconnect switch. Connect the 12 AWG red wire to the battery disconnect switch or the battery cable at the starter solenoid. If the battery is mounted in the trunk, a filter capacitor is required and minimum 12 AWG wire should be used for the connection to the disconnect switch or power block. You can use a 10000 UF 25V electrolytic capacitor such as our P/N 102007 capacitor kit or Mouser (www.mouser.com) P/N 539-CGS103U025RC3 and bracket P/N 539-VR3A. Connect the 12 AWG black wire to chassis ground near the engine, preferably where the battery ground cable is attached. Do not extend the black ground wire. Verify that the engine is properly grounded to the chassis. Separate ground straps are recommended for each cylinder head.

5. **Ignition switch connection**. Connect the red wire from Deutsch connector pin 1 to the ignition switch as shown.

6. **Trigger signal connections**. The violet/green magnetic pickup cable is supplied with an AMP connector that will mate with common MSD magnetic pickup distributors and crank trigger systems. For other magnetic pickups, cut off the connector and refer to the color code table below. For module triggered applications from engine control modules such as Haltech or Motec, the CD-1 requires a 0-12V square wave signal and fires on the rising edge. The module trigger input on pin 12 is tolerant of high voltage pulses and has an internal 150 ohm pull-up resistor to +12V.

Magnetic Trigger Color Codes		
System	Mag-	Mag+
Accel/Chrysler Distributor	Black	Orange/White
Accel Crank Trigger	Black	White
Moroso Crank Trigger	White	Black
MSD Crank Trigger	Green/Black	Violet/Orange
MSD/Ford Distributor	Violet	Orange
GM Distributor	Green	White

7. **Coil connections**. Connect the black and orange coil wires to the ignition coil as shown.

> *DANGER: High voltage is present at the coil primary and secondary terminals whenever the ignition switch is on. Do not touch or connect any test equipment to the coil terminals.*

8. **Tach connection**. Use the supplied Weather Pack connectors as shown to connect the brown wire from Deutsch connector pin 11 to the vehicle tach as shown. The tach output is also used for PC link communications before the engine is started by means of an optional USB interface P/N 102004. When the engine is running an industry standard 0-12V square wave signal appears on the tach output with one tach pulse per trigger event. The rising edge of tach pulse is synchronized with the trigger event. This tach output is compatible with all aftermarket tachometers such as Autometer and can also be used to trigger other RPM activated accessories.

9. **Application specific signal connections**. Refer to the following sections and Figures 4-10.

10. **Completing the installation**. Remove any unused wires from the Deutsch connector and install supplied terminal seals. Reconnect the battery. Set the CD-1 switches and upload any required setup program. Start engine and check timing. If timing has changed significantly, MAG+ and MAG- may be reversed.
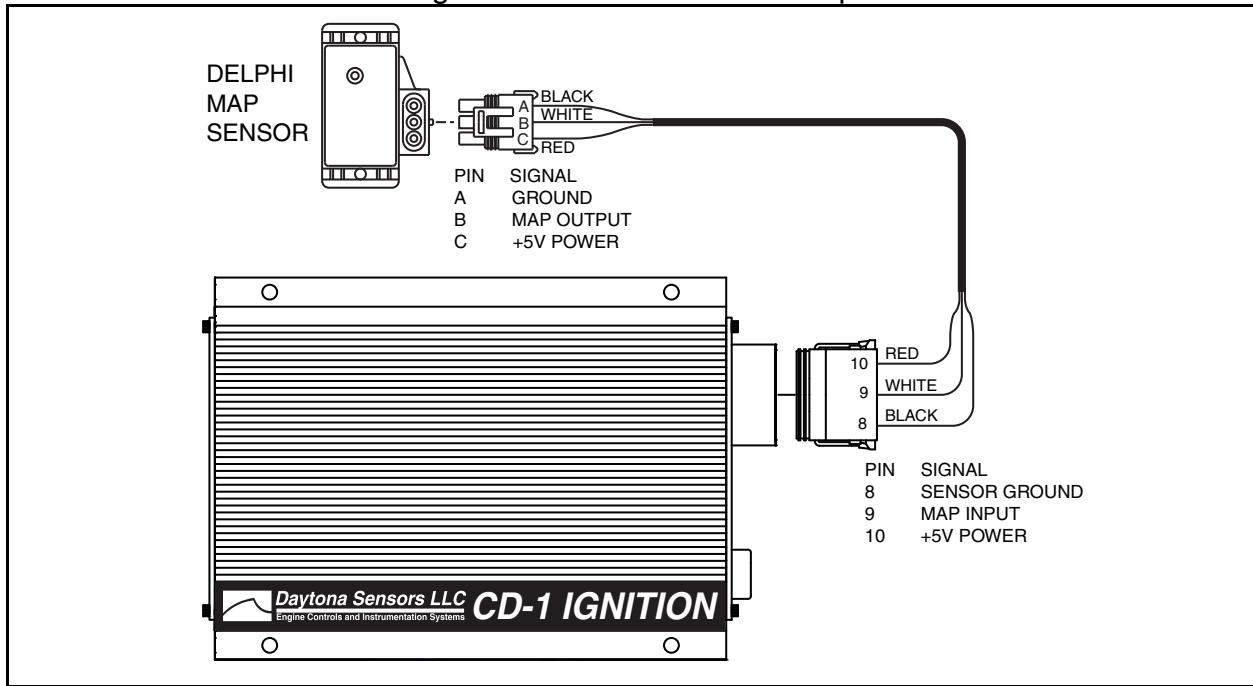
Figure 4 – MAP Sensor Hookup

DELPHI MAP SENSOR

BLACK
WHITE
RED

A
B
C

PIN   SIGNAL
A   GROUND
B   MAP OUTPUT
C   +5V POWER

10 RED
9   WHITE
8   BLACK

PIN   SIGNAL
8   SENSOR GROUND
9   MAP INPUT
10   +5V POWER

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CD-1 IGNITION

Figure 5 – Automatic Transmission RPM Limit Switch Hookup

SWITCHED +12V

LINE LOCK OR BRAKE SWITCH

SUPPLIED 1N4007 DIODE

GRAY

LINE LOCK SOLENOID VALVE

GROUND

4

2

BLUE

SWITCHED +12V

TRANS BRAKE TRIGGER SWITCH

SUPPLIED 1N4007 DIODE

TRANS BRAKE SOLENOID VALVE

GROUND

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PIN   SIGNAL
2   LAUNCH RPM LIMIT
4   GPIO2 (BURNOUT RPM LIMIT)

WARNING: FAILURE TO INSTALL DIODES WILL DAMAGE THE CD-1 AND VOID THE WARRANTY

Figure 6 – Manual Transmission RPM Limit Switch Hookup

WARNING: FAILURE TO INSTALL DIODE WILL DAMAGE THE CD-1 AND VOID THE WARRANTY

SWITCHED +12V

LINE LOCK SWITCH

SUPPLIED 1N4007 DIODE

BLUE

LINE LOCK SOLENOID VALVE

GROUND

2

4

SWITCHED +12V

CLUTCH SWITCH

30   85

87   86

12V RELAY

GROUND

GRAY

SWITCHED +12V

BURNOUT RPM LIMIT SWITCH

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PIN	SIGNAL
2	LAUNCH RPM LIMIT
4	GPIO2 (BURNOUT RPM LIMIT)
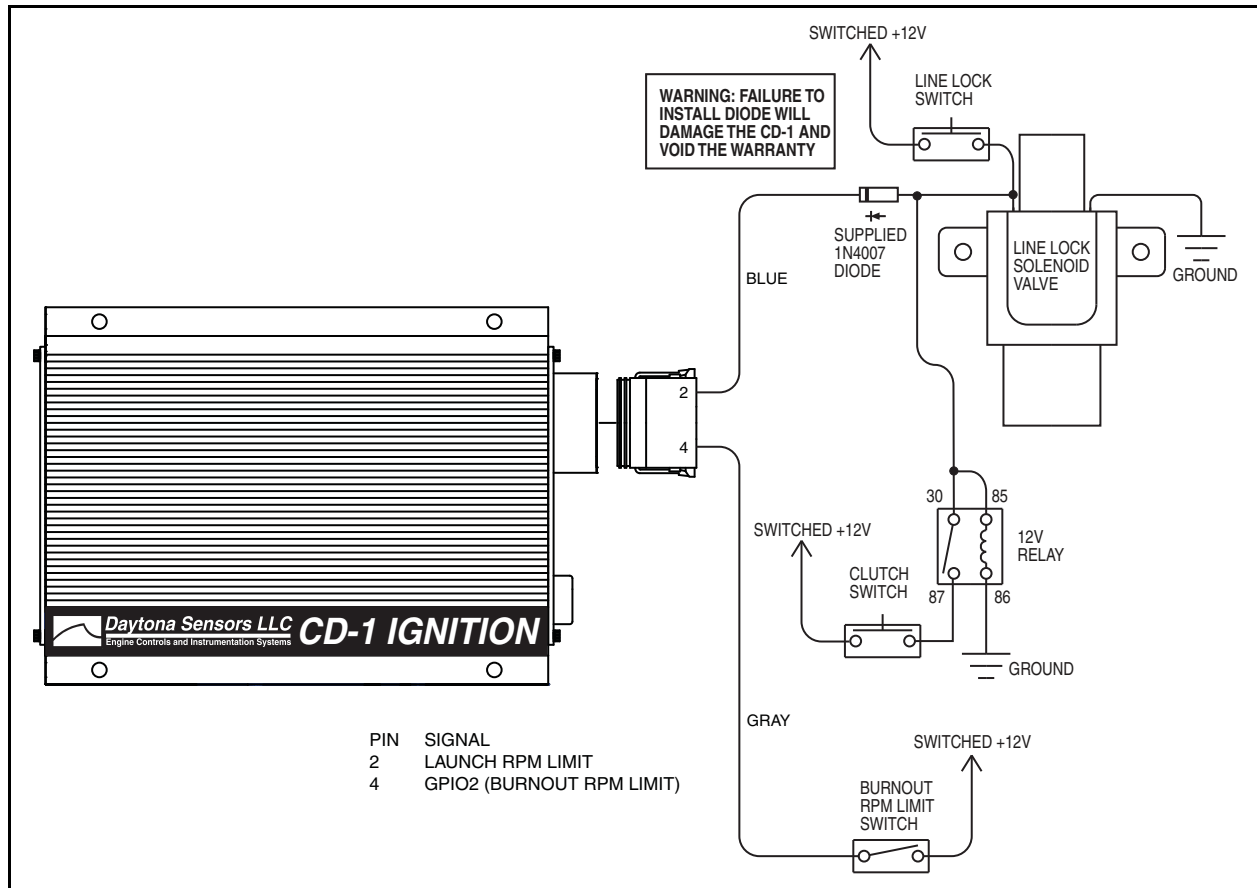
Figure 7 – Nitrous Oxide System Hookup

Figure 7 – Nitrous Oxide System Hookup

PIN	SIGNAL
3	GPI1 (NOS ENABLE)
4	GPIO2 (NOS TRIGGER)

Figure 8 – Additional GPI1 Hookup Options

Figure 8 – Additional GPI1 Hookup Options

FOR DIGITAL RETARD, DIODE IS REQUIRED IF AN INDUCTIVE DEVICE SUCH AS A SOLENOID IS PART OF THE CIRCUIT. WARNING: FAILURE TO INSTALL REQUIRED DIODE WILL DAMAGE THE CD-1 AND VOID THE WARRANTY
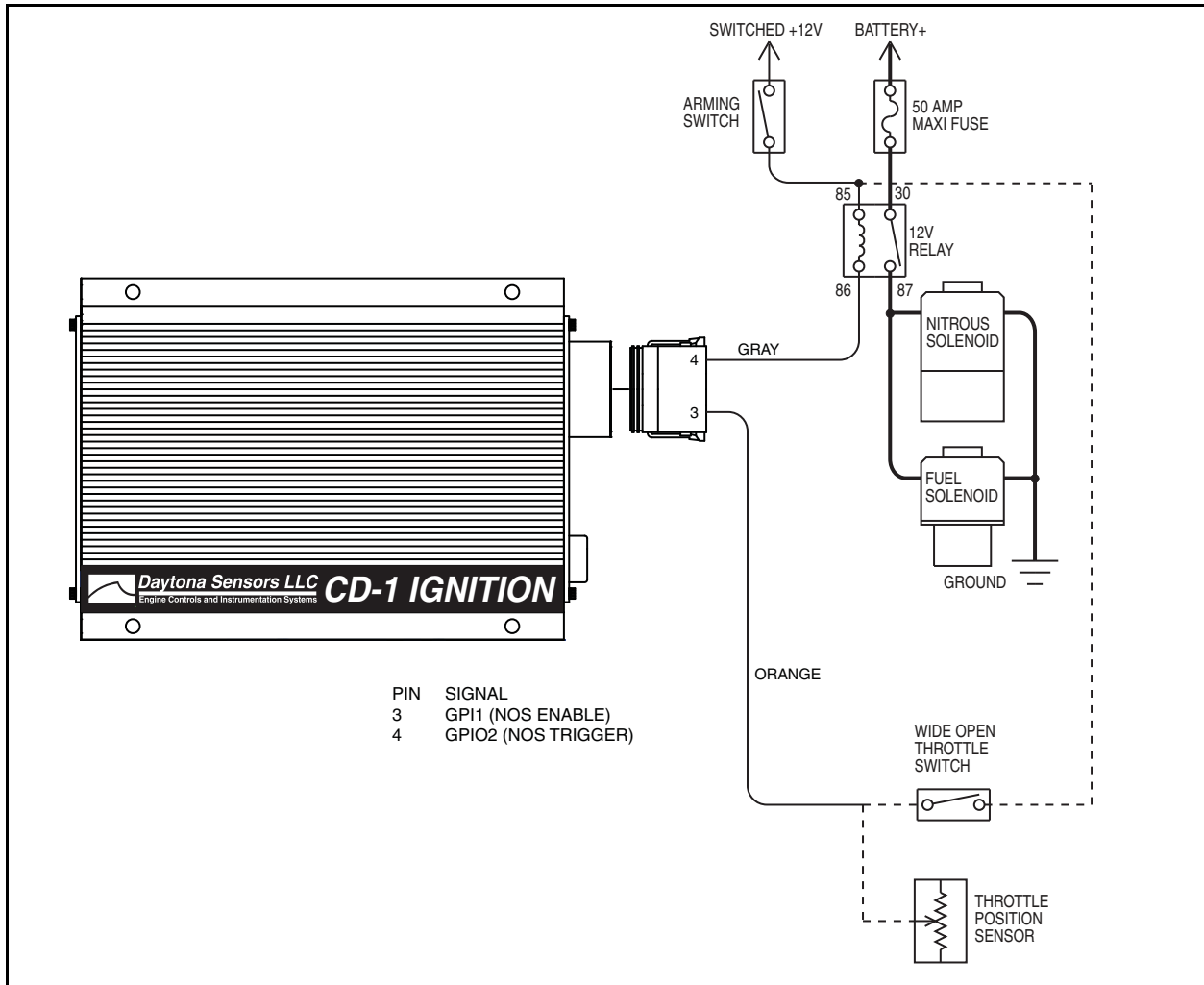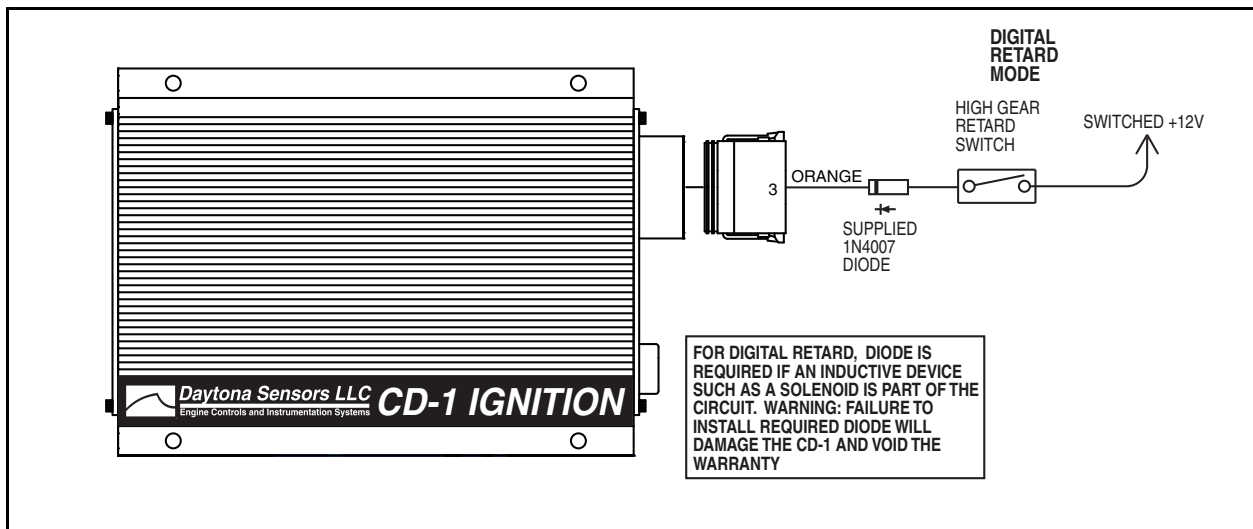
Figure 9 – Additional GPIO2 Hookup Options
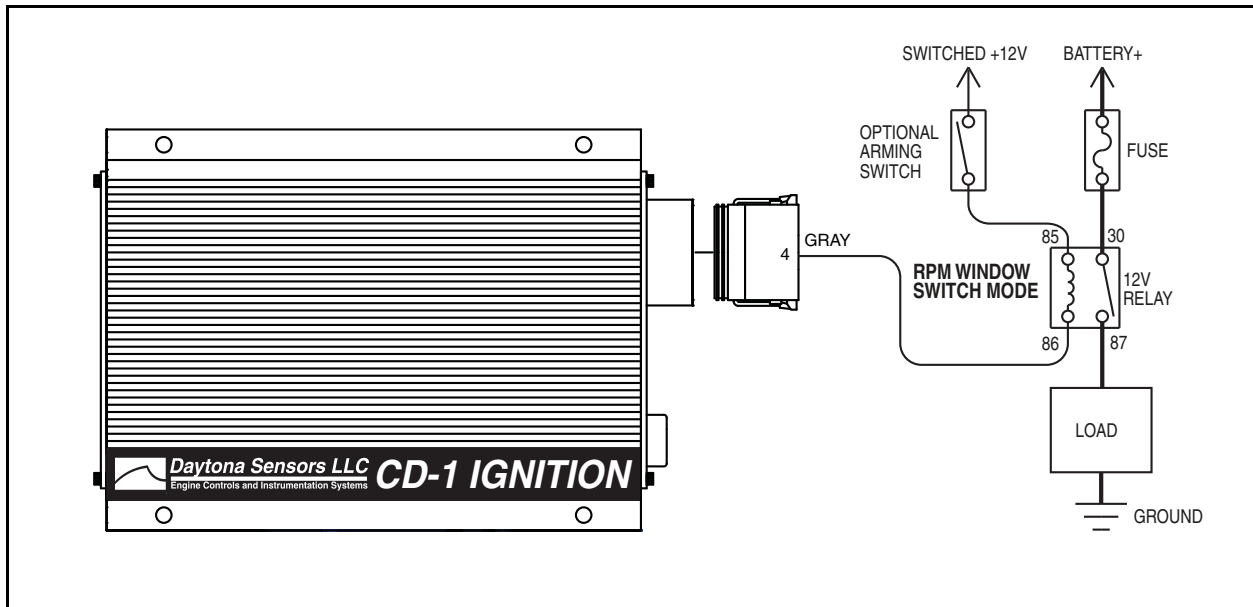
Figure 10 – GPIO3 Hookup Options

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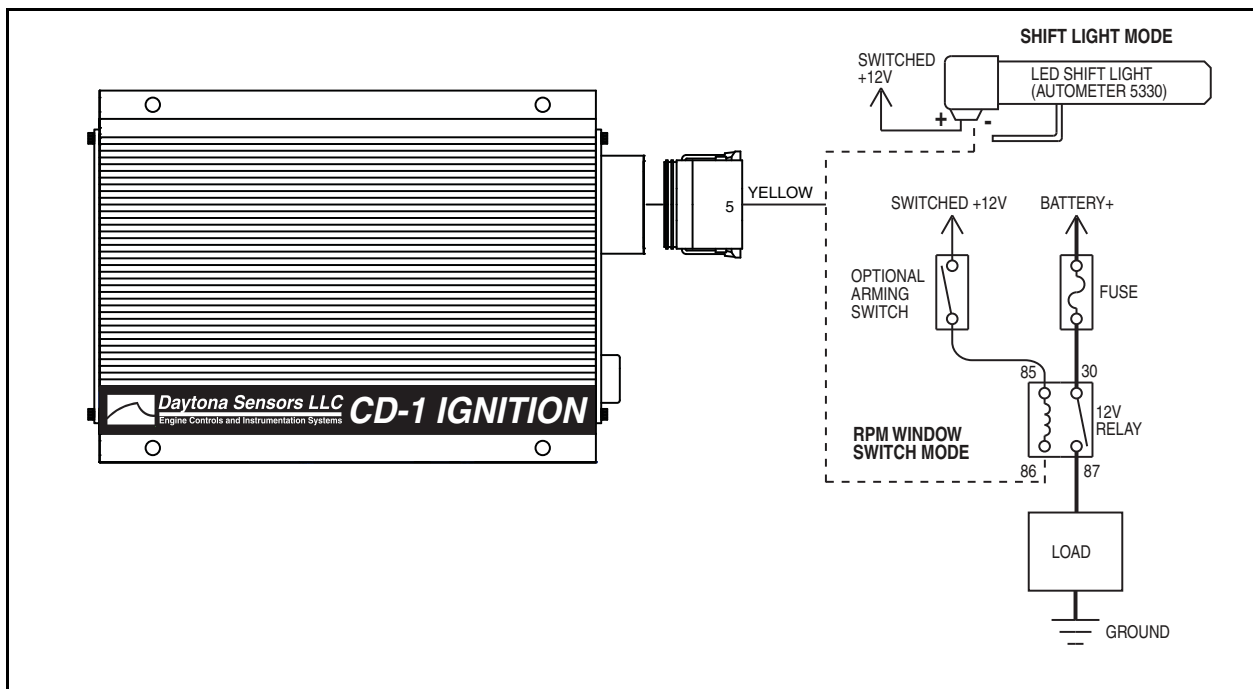
MAP Sensor Hookup

A manifold absolute pressure (MAP) sensor is required for boost timing retard mode and all applications that use a 3D timing table uploaded with the PC link.

The optional MAP sensor harness includes mating connector shells for Delphi 1 bar, 2 bar, and 3 bar MAP sensors (refer to the Appendix for recommended MAP sensor part numbers). Select the connector shell with the appropriate indexing features for your MAP sensor. Connect the ground, MAP signal, and +5V power wires as shown in Figure 4.

Automatic Transmission RPM Limit Switch Hookup

Figure 5 shows typical hookup of the line lock and trans brake solenoid valves for automatic transmission vehicles.

1. **Line lock and burnout RPM limit**. Skip ahead if this feature is not used. The line lock is active during burnout and used to select the burnout RPM limit. GPIO2 must be programmed for burnout RPM limit mode by means of the PC link (refer to page 19 for details). Burnout RPM limit is selected when GPIO2 is at +12V.

2. **Trans brake and launch RPM limit**. The trans brake is active before launching and used to select the launch RPM limit set on the CD-1 switches. The launch RPM limit is selected when the launch RPM limit input is at +12V.

> **WARNING: Failure to install the diodes shown in Figure 5 will damage the CD-1 and void the warranty.**

Manual Transmission RPM Limit Switch Hookup

Figure 6 shows typical hookup of the line lock and burnout RPM limit switch for manual transmission vehicles.

1. **Burnout RPM limit**. Skip ahead if this feature is not used. A switch is used to select the burnout RPM limit. GPIO2 must be programmed for burnout RPM limit mode by means of the PC link (refer to page 19 for details). Burnout RPM limit is selected when GPIO2 is at +12V

2. **Line lock and launch RPM limit**. The line lock is active before launching and used to select the launch RPM limit set on the CD-1 switches. The hookup shown in Figure 6 uses a relay to hold the line lock on until the clutch is released. A normally open momentary pushbutton switch is used to initially set the line lock. The clutch switch is normally open and closes when the clutch pedal is down. The launch RPM limit is selected when the launch RPM limit input is at +12V.

> **WARNING: Failure to install the diode shown in Figure 6 will damage the CD-1 and void the warranty.**

Nitrous Oxide System (NOS) Hookup

Figure 7 shows typical hookup of the single stage NOS controlled by the CD-1. The NOS is triggered based on throttle position and an RPM window. When the NOS is triggered on, timing can be automatically retarded up to 10 degrees. The use this capability, GPI1 must be programmed for NOS enable mode and GPIO2 must be programmed for NOS trigger mode by means of the PC link (refer to pages 18-19 for details). Either a wide open throttle switch or throttle position sensor can be used for NOS enable.

1. **Wide open throttle switch for NOS enable**. The switch is normally open and closes at wide open throttle. This arrangement is typically used with carbureted vehicles. +12V for the wide open throttle switch is supplied by a separate NOS arming switch. +12V on GPI1 enables the NOS.

2. **Throttle position sensor (TPS) for NOS enable.** Vehicles with electronic fuel injection typically have a TPS with 0-5V signal output. Refer to the vehicle wiring diagram for details. You can check the TPS signal with a DVM. The threshold TPS voltage for enabling the NOS is programmed by means of the PC link.

3. **NOS wiring**. The arming switch should be connected to switched +12V so that the NOS cannot be armed when ignition power is off. A relay with a minimum 40 amp rating is required. If your nitrous system uses large solenoid valves, you should use the heavy duty P&B/Tyco VF7 series 70 amp relay listed in the Appendix. The use of a 50 amp fuse block such as the Littlefuse Maxi Fuse series listed in the Appendix is recommended. Power connections from the fuse block must go direct to the battery positive terminal or battery disconnect switch. The ground connection from the solenoids must go to a chassis ground stud or direct to the battery negative terminal. Use 12 or 14 AWG wire. Keep power and ground connections as short as possible.

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Additional GPI1 Hookup Options

Figure 8 shows additional hookup options for GPI1 modes that can be programmed by means of the PC link when the GPI1 input is not used by the configuration shown in Figure 7. Refer to page 18 for programming details.

Digital retard mode. This can be used as a high gear retard or retard function for a nitrous system. Connect a switch or relay contact to +12V to GPI1. Timing is retarded up to 10 degrees when GPI1 is at +12V.

> *WARNING: If GPI1 is used as a digital input and some inductive device such as a solenoid is also part of the circuit, a diode is required to protect the input from transients. Failure to install the required diode will damage the CD-1 and void the warranty.*

Additional GPIO2 Hookup Options

Figure 9 shows additional hookup options for GPIO2 modes that can be programmed by means of the PC link when the GPIO2 terminal is not used by one of the configurations shown in Figures 5-7. Refer to page 19 for programming details.

RPM window switch mode. Connect a relay as shown to control a load. You can connect an optional arming switch as shown. For direct battery power connections, you should also install a fuse. Refer to the Appendix for recommended relays and fuses.

GPIO3 Hookup Options

Figure 10 shows hookup options for GPIO3 modes that can be programmed by means of the PC link. Refer to page 19 for programming details.

1. **Shift light mode**. Connect an LED shift light such as Autometer (www.autometer.com) P/N 5330 as shown. Maximum current draw should not exceed 1 amp.

2. **RPM window switch mode.** Connect a relay as shown to control a load. You can connect an optional arming switch as shown. For direct battery power connections, you should also install a fuse. Refer to the Appendix for recommended relays and fuses.

SWITCH SETTINGS AND STATUS LED

The left end panel of the CD-1 has five rotary switches used to set RPM limits and operating modes and a status LED. The status LED will illuminate when the ignition switch is turned on. If a fault condition occurs, such as a DC/DC converter (internal high voltage power supply used to charge the capacitor) fault or loss of trigger signal, the status LED will blink.

Launch RPM Limit Switch Settings

00	RPM limit disabled
01	RPM limit and multi-spark disabled
02	RPM limit, multi-spark, and timing functions disabled
03-04	Reserved (not used)
05	Boot load mode (used by factory to reprogram CD-1 module)
06-99	Launch RPM limit setting X100 (i.e. switch setting 35 = 3,500 RPM)

Maximum RPM Limit Switch Settings

The maximum RPM limit setting is offset 1,000 RPM to allow two switches to set the value between 1,000 and 10,900 RPM

00-99	Maximum RPM limit setting X100 + 1000 (i.e. switch setting 75 = 8,500 RPM and 99 = 10,900 RPM)

Mode Switch Settings

0	8 cylinder engine and normal operation
1	6 cylinder engine and normal operation
2	4 cylinder engine and normal operation
3-9	Reserved (not used)

Mode switch settings 0-2 are used during normal operation of the CD-1 and allow full functionality of any selections made with the PC Link software.

Figure 11 – Switches and Status LED
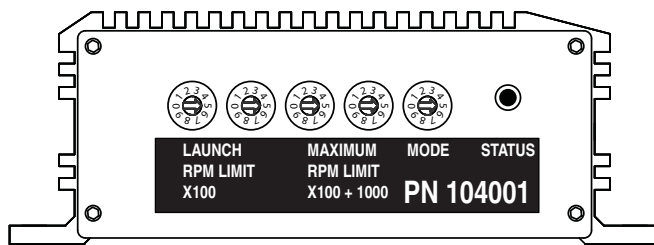
SPARK PLUGS AND WIRES

To avoid electrical noise that may interfere with the CD-1 or other onboard computer and radio equipment, resistor spark plugs are recommended and spiral core RFI/EMI suppression type spark plug wires are required. Optimum spark plug gap is .045" for normally aspirated engines. Engines with high boost levels may require a smaller spark plug gap. Do not use solid copper or high resistance carbon core spark plug wires. Optimum spark plug wire resistance is 50-500 ohms per foot, such as Taylor Vertex (www.taylorvertex.com) ThunderVolt 50 or 8.2mm spiral core.

APPLICATION ISSUES WITH VINTAGE RACE VEHICLES

Application issues may occur with vintage race vehicles, especially 1970s and earlier Ford, GM, and Mopar vehicles that have original equipment charging systems. General information is given below. For assistance with specific applications, please contact our tech support.

1. **Tach hookup**. Some original equipment tachs require a high voltage pulse and will require a commercially available tach adapter. GM vehicles, including all models with HEI coil-in-cap, have an inline tach filter. Disconnect the filter, trace the wire from the tach, and connect it to the CD-1 as shown in Figures 1 or 2.

2. **Ignition run-on**. If the engine continues to run after the ignition switch is turned off, current is leaking back into the CD-1 through the charging system indicator lamp. GM or Ford models with an external voltage regulator will require installation of a diode.

3. **Import vehicles with electronic fuel injection or a fuel pump cut-out relay**. Some systems require a tach signal with a high voltage pulse and will require a commercially available tach adapter. Some Japanese vehicles using the module trigger

hookup shown in Figure 2 will also require a tach adapter.

TROUBLESHOOTING

Did the engine run properly before installation of the CD-1? If not, remove the CD-1, reinstall the original ignition system and then find and correct the original problem. Did the CD-1 function correctly before the problem occurred? If the answer is yes, did you change anything that may have affected it? To isolate the problem, go back to the last setup that was OK. If the engine will not start, runs intermittently, or misfires, use the following check list steps:

Status LED Doesn't Illuminate

If the status LED doesn't illuminate after the ignition switch is turned on, check power and ground connections. Use a volt meter to verify +12V at the battery+ and ignition switch wires at the CD-1 with the ignition switch in both the run and start positions. The CD-1 requires a minimum of +9V when the ignition switch is first turned on. During cranking, the unit will continue to operate down to +4.5V.

Engine Will Not Start

If the status LED illuminates when the ignition switch is turned on but the engine will not start, verify that the status LED blinks while the engine is cranking. If the status LED doesn't blink during cranking, the unit is not getting a trigger signal. Verify that trigger signal wiring is not shorted together or to ground. If the status LED blinks, but engine will not start, recheck coil primary connections or replace coil.

Import vehicles: if the engine momentarily starts and then dies, a fuel pump cut-out relay may not be operating properly. Please contact our tech support.

Spark Testing

K-D Tools HEI ignition test plug P/N 2756 is recommended for spark testing. Attach the alligator clip on the test plug to chassis ground and fabricate a short section of spark plug wire to connect the test plug to the coil.

Intermittent Operation or Misfire at High RPM

1. Misfire at high RPM is usually not an electrical problem with the CD-1. Common causes include: coil failure or arcing at spark plug boots or within the distributor.

2. For vehicles without an alternator, low battery voltage may cause misfire at high RPM. Verify that

the battery is fully charged or try replacing the battery.

3. To avoid electrical noise problems, route magnetic trigger wiring away from any coil or spark plug wires. Use only spiral core spark plug wires. Do not use solid copper core or carbon core resistance wires.

4. Check for broken, loose or corroded connections. Verify correct air gap for magnetic pickup. Check distributor for loose, missing, or jammed parts in advance mechanism.

5. Verify that spark plugs are proper type, gap size, and heat range.

6. Replace spark plugs, spark plug wires, and distributor rotor and cap.

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CD-1 SOFTWARE OVERVIEW

The PC Link CD Pro software allows you to set module parameters that control overall operation of the system and override certain switch settings, program the functions of the general purpose input/output (GPIO) terminals, and program advance curves.

Use of the software programs is optional and not required for basic operation of the CD-1 system. If you are not planning on using the software, you can skip the rest of the material in this instruction manual.

The CD-1 Pro version cannot be used with the software for the standard CD-1 version that includes data logging capability. If you attempt to communicate with a CD-1 Pro unit using the standard PC Link CD or CD Log software, an error message will appear and communications will be aborted.

PC REQUIREMENTS

The CD-1 connects to your PC by means of an optional USB interface P/N 102004. The PC must have a free USB port. If you have an older PC without USB capability, you cannot use the CD-1 software.

We recommend a laptop PC with Pentium processor and super VGA display (SVGA with 1024 x 768 pixel resolution) running Windows XP/Vista/7. Data chart display is graphics intensive and a high speed Pentium processor is recommended. Processors slower than 300 MHz will exhibit sluggish program loading and response. The PC must have a CDROM drive for program loading.

PC Link CD Pro software includes print commands to print downloaded data. The program has been tested with Hewlett-Packard laser and inkjet printers and Epson inkjet printers. We recommend using a color inkjet printer.

USB INSTALLATION

The USB interface for the CD-1 is based on the FTDI FT232R chip and drivers that allow the unit to emulate a standard Windows RS-232 COM port. Updated Windows drivers, installation instructions and troubleshooting tips are available on the FTDI website at www.ftdichip.com. Additional information and troubleshooting tips can be found on the PC Link Tech FAQ on our website at www.daytona-sensors.com.

A new USB driver that simplifies the installation process is available. This installs as an executable file, similar to other Windows programs. The Windows Found New Hardware Wizard will then detect the USB device when it is first connected and automatically install the correct driver without the user having to browse out to the CDROM.

Before proceeding with installation, shutdown any other applications that may be running. For Windows Vista, you must disable the User Account Control (UAC) during installation. If you are not familiar with the UAC, please refer to the Vista UAC Tech Note on our website's PC Link Tech FAQ for details.
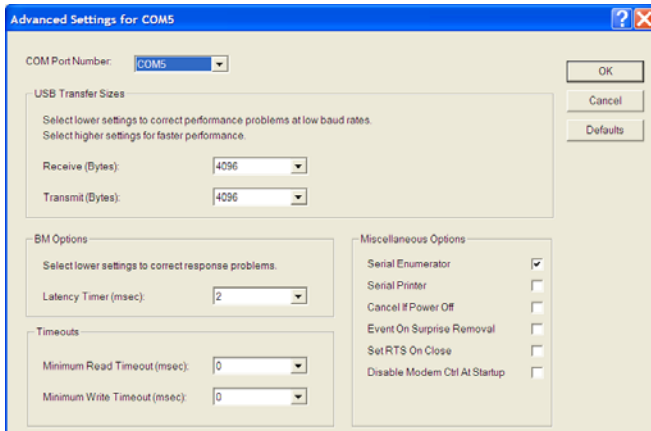
1. Make sure your USB interface is not connected to your PC. Please note that the USB interface does not need to be connected to the CD-1 during the USB installation process.

2. Insert the Daytona Sensors CDROM. When the Daytona Sensors autorun menu appears, click on Software. Scroll down and click on the USB Driver link. When the File Download dialog box appears, click on "Run this program from its current location." Ignore any security warnings and click on Yes to continue.

3. After installation of the driver is complete, connect the USB interface to the PC with the supplied USB cable. The Windows Found New Hardware Wizard will appear and complete installation of the USB interface.

COM Port Configuration

After completing the installation steps outlined above, you must configure the new COM port using Device Manager.

1. Click Start, Settings, Control Panel, System, Hardware, and then Device Manager. Scroll down to Ports (COM and LPT).

2. The new USB interface will as appear as USB Serial Port. Click on this new port.

3. Click on the Port Settings tab.

4. Click on Advanced. In most cases the wizard will have installed your new USB interface as COM5. Note the COM port number assigned for your system. For optimum performance, you should also change the BM Options Latency Timer to 2 msec as shown in the Figure 12.

5. Once you have configured a COM port number for your new unit, make sure that you use this same COM port selection in the CD-1 software by using the Port Setup command from the Communications menu.

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Figure 12 – COM Port Configuration

SOFTWARE INSTALLATION

The software is supplied on CDROM media or in the form of a compressed file downloaded from our website. The installation process uses InstallShield. This industry standard installer is based the new Microsoft Windows Installer service that greatly reduces potential problems such as version conflicts and allows for application self-repair.

Before proceeding with installation, shutdown any other applications that may be running. For Windows Vista, you must disable the User Account Control (UAC) during installation. If you are not familiar with the UAC, please refer to the Vista UAC Tech Note on our website's Tech FAQ for details.

Use the Windows Explorer or the Run command from the Windows Start Menu to launch setup.exe in the PC_Link_CD_Pro folder on the CDROM or the setup.exe file downloaded from our website. InstallShield will install the software in an appropriate folder under Program Files.

Once InstallShield has completed the installation, PC Link CD Pro will appear on the Windows Start Menu. You can then launch it just as you would any other Windows program.

The program requires the Monospace 821 BT fixed pitch printer font in order to properly align columns when printing. The Monospace 821 BT font is included in the distribution media and automatically copied to your Windows Fonts folder during installation. A backup copy is also placed in the program folder. If you accidentally delete this font, use the Install New Font command from the Fonts folder File menu. The filename associated with Monospace 821 BT is monos.ttf.

PC LINK CD PRO SOFTWARE

The brown tachometer wire (Deutsch connector pin 11) from the CD-1 is used connect to the USB interface. Mating single pin Packard Weather Pack connectors are supplied with the CD-1 to facilitate disconnecting the brown wire from the vehicle tachometer and connecting it to the USB interface as shown in Figures 1 and 2. PC communications is possible when the ignition is turned on and the engine has not yet been started. Once the engine is started, the brown wire resumes its normal function of driving the tachometer. Note that no damage occurs if the engine is inadvertently started while the USB interface is connected.

After PC Link CD Pro is launched, the main screen appears blank. You have three options for obtaining setup data for editing. You can open a previously saved setup file by using the Open Table command on the File menu. You can create a new setup file by using (as applicable) the Edit Module Parameters and Edit GPIO Parameters commands from the Edit menu and the New Timing Table command on the File menu. You can also download data from an attached CD-1 module by using the Download From EEPROM command on the Communications menu.

Note that setup files use a .tbl extension. You should create a separate folder to store these files.

If you have enabled a 2D or 3D timing table under module parameters, you can use the Edit Timing Table command from the Edit menu. You can edit the timing table data by clicking on and dragging individual points on the chart display or you can directly edit numeric data on the spreadsheet grid.

Once the appropriate parameters and timing table data have been entered, you can print the data using the Print Parameters and Timing Table command on the Print Menu. You can save the edited setup file by using the Save Table command on the File menu.

You can upload the setup data to an attached CD-1 module by using the Upload to EEPROM command on the Communications menu.

A setup file (CD1_Sample.tbl) is included in the program folder.

DOWNLOADING DATA FROM EEPROM

Connect the USB interface. An adapter harness is supplied with the USB interface. Connect the

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alligator clip on the black wire to ground and the Packard Weather Pack connector to the brown tach wire from the CD-1 wire harness. If the tach wire is not equipped with a Weather Pack connector, you can use the supplied brown jumper wire with an alligator clip to make the required connection. **Set the switch on the USB interface to the "A" position**. Turn the ignition switch on to provide power to the CD-1. Do not start the engine.

When launched for the first time, the program uses COM1 as the default port. In most cases, you will have configured the USB interface to use a different COM port, such as COM5. Use the Port Setup command on the Communications menu to select the correct COM port. The program will remember the new port setup.

Download data by using the Download From EEPROM command on the Communications menu.

If the download process is successful, the module parameters are displayed. You can then edit setup data as explained in subsequent sections.

CD-1 units are shipped from the factory with default parameters and timing tables loaded into EEPROM memory. If you have never uploaded any custom setup file to EEPROM memory, these defaults are what you will see.

MODULE PARAMETERS

Module parameters are displayed in a dialog box by using the Edit Module Parameters command on the Edit menu. Module parameters control the overall operation of the CD-1 unit.

When PC Link CD Pro is first started, default module parameters are loaded. Module parameters are updated whenever you download data from a CD-1 unit or open a setup file. Module parameters are saved along with the GPIO parameters and timing table data when you save a setup file. **Always check the module parameters before uploading data to the CD-1**.

Figure 13 – Module Parameters
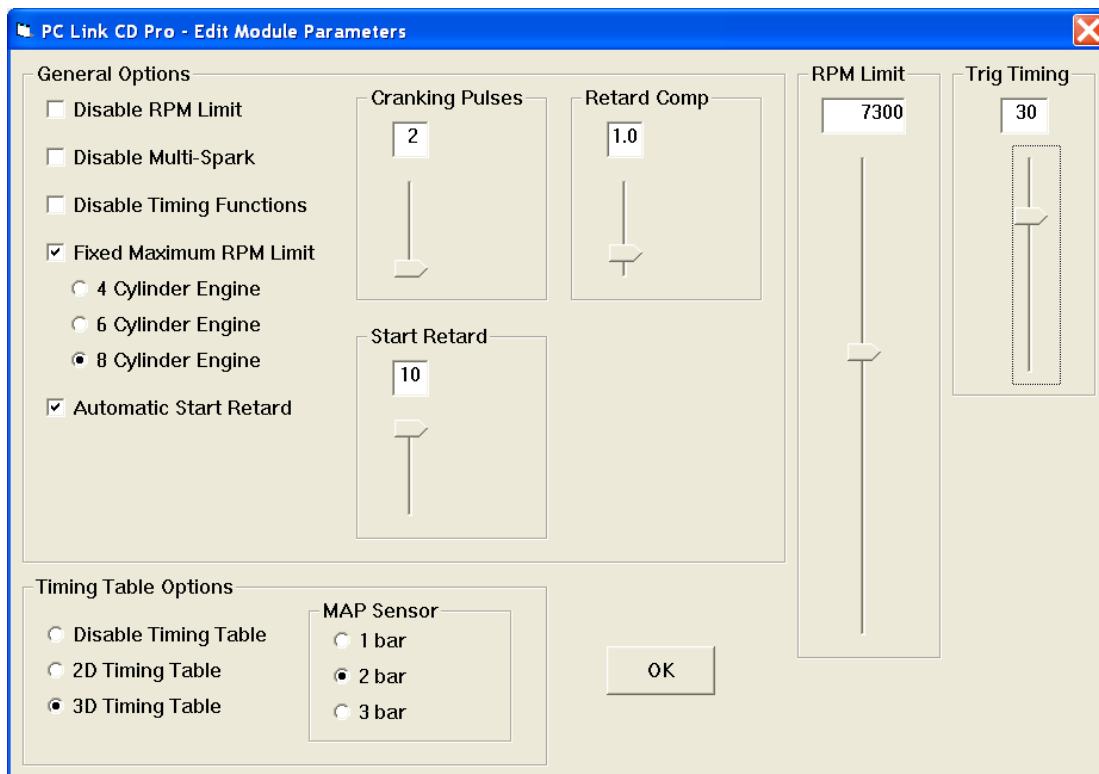
General Options

Disable RPM Limit - all RPM limit functions are disabled (including any fixed maximum RPM limit selection).

Disable Multi-Spark - multi-spark is disabled. Multi-spark should always be disabled when an external engine control that generates the trigger signal for the CD-1 also limits RPM. Missing trigger pulses could cause false multi-spark and result in cross-firing within the distributor.

Disable Timing Functions - all timing functions including the automatic start retard and any timing table are disabled.

Fixed Maximum RPM Limit - selecting this option overrides all other RPM limit values set on the switches and the RPM limit slider and cylinder number select options are displayed. However a lower launch or burnout RPM limit can still be selected.

4, 6, or 8 Cylinder Engine - sets the engine type. 8 cylinder engine is the default. You must select the correct engine type for proper scaling of RPM limit and timing control functions. Note that when the fixed maximum RPM limit is not enabled, cylinder number selection is by means of the Mode switch on the CD-1.

Automatic Start Retard - selecting this option enables the automatic start retard and the start retard slider is displayed. You can set a start retard value from zero to 10 degrees. The automatic start retard is active for 10 engine revolutions after engine start while the engine is running below 450 RPM.

Cranking Pulses - the slider sets the number of trigger pulses (events) before the CD-1 fires the first spark. For a V8 engine, there are 4 trigger pulses per revolution. To prevent spurious firing when the ignition key is turned on, you should always use a value of 2 or higher.

Retard Comp - the slider allows fine tuning the timing to eliminate the effects of spark firing delay and the intrinsic delay of some magnetic pickup systems. A typical value is 1.5 degrees. Check the timing with a timing light. If a noticeable retard is observed between 2,000 RPM and the upper RPM range of the engine, use a higher value for retard compensation.

Timing Table Options

Disable Timing Table - no timing table is active.

2D Timing Table - enables a 2D timing table with timing based on engine RPM.

3D Timing Table - enables a 3D timing table with timing based on engine RPM and manifold absolute pressure (MAP). The MAP sensor option box appears. You can select a 1 bar, 2 bar, or 3 bar MAP sensor. To use the 3D timing table, a MAP sensor must be connected. Refer to Figure 4 and page 10 for details.

Trigger Timing

The CD-1 and similar competitive products require a trigger signal (magnetic pickup or 12V module output) with a single pulse per firing event. The rising edge of the trigger pulse is the most advanced timing (earliest spark firing) that the unit can generate. All timing curves and other timing functions are based on delaying the spark firing referenced to the trigger pulse. Refer to page 23 for additional information on trigger timing.

Set the Trig (Trigger) Timing slider value to correspond to the actual advanced timing point (degrees BTDC) of your trigger signal. The trigger timing value represents the most advanced timing that the CD-1 can generate. The default value is 30 degrees BTDC, but you must enter the actual value for your engine (or adjust your trigger system so that it generates a trigger signal at 30 degrees BTDC).

Timing table data "tracks" the trigger timing value. The table values always represent the actual engine timing that will result if the trigger system generates a pulse corresponding to the trigger timing value.

GENERAL PURPOSE INPUT/OUTPUT PARAMETERS

General purpose input/output (GPIO) parameters are displayed in a dialog box by using the Edit GPIO Parameters command on the Edit menu. GPIO parameters control the function of the GPI1, GPIO2, and GPIO3 terminals on the CD-1 unit.

When PC Link CD Pro is first started, default GPIO parameters are loaded. GPIO parameters are updated whenever you download data from a CD-1 unit or open a setup file. GPIO parameters are saved along with the module parameters and timing table data when you save a setup file. **Always check the GPIO parameters before uploading data to the CD-1**.

Figure 14 – GPIO Parameters
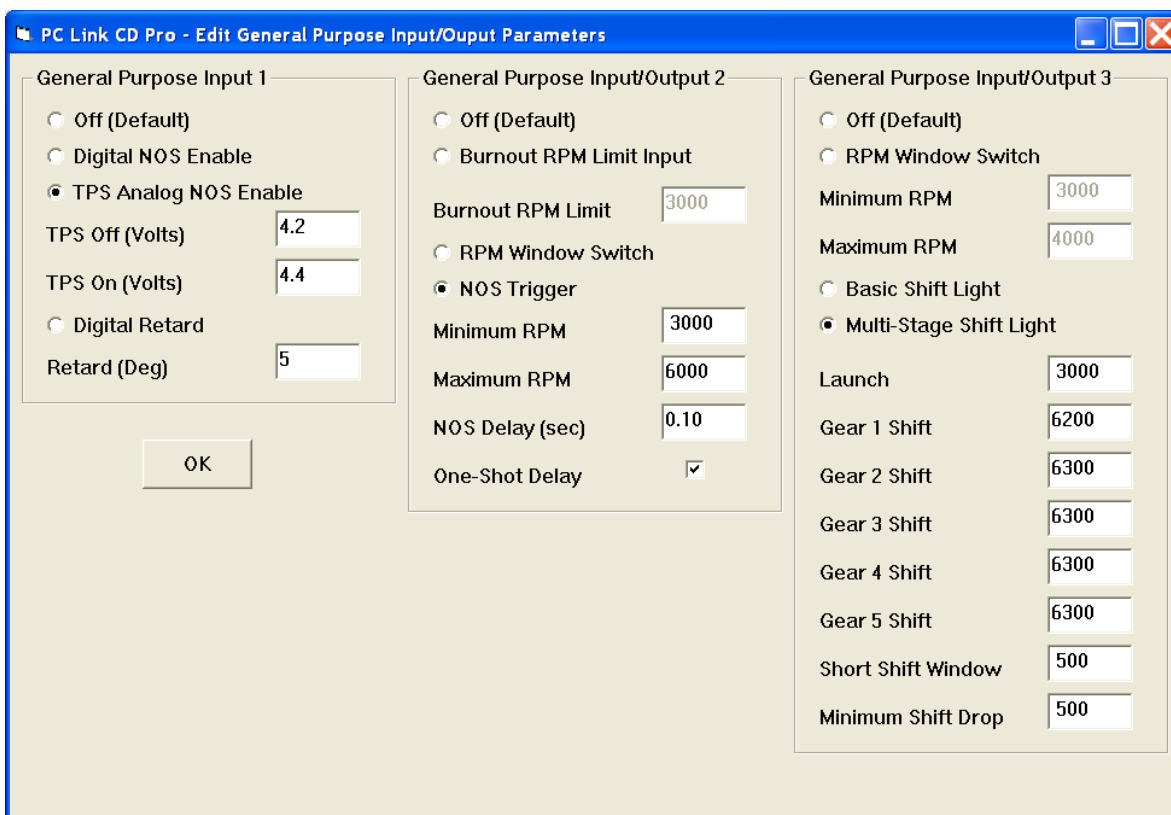
General Purpose Input 1 (GPI1)

GPI1 is on the Deustch connector pin 3. GPI1 has five modes:

Off (Default) - the GPI1 input is ignored.

Digital NOS Enable - this mode is used in combination with the NOS trigger mode on GPIO2. When GPIO2 is configured for NOS trigger mode, the NOS system will be triggered on when a +12V level is detected on GPI1 and all the trigger conditions set for GPIO2 are satisfied. You can enter a retard value from zero to 10 degrees. The retard will be active whenever the NOS system is triggered.

TPS Analog NOS Enable - this mode is used in combination with the NOS trigger mode on GPIO2. A zero to +5V throttle position sensor (TPS) is connected to GPI1. When GPIO2 is configured for NOS trigger mode, the NOS system will be triggered on when a GPI1 detects a TPS signal greater than the TPS on level. If the TPS signal drops below the TPS off level, the NOS system will be turned off. This allows some hysteresis to prevent cycling the NOS system when the throttle position is near the on level. You can enter a retard value from zero to 10 degrees. The retard will be active whenever the NOS system is triggered.

Digital Retard - you can enter a retard value from zero to 10 degrees. The retard will be active whenever a +12V signal level is detected on GPI1. This mode can be used as high gear retard.

General Purpose Input/Output 2 (GPIO2)

GPIO2 is on the Deustch connector pin 4. When configured as an output, GPIO2 can switch a 2 amp load to ground. A relay must be used to control larger loads, such as solenoid valves. GPIO2 has four modes:

Off (Default) - the GPIO2 terminal is inactive.

Burnout RPM Limit Input - the burnout RPM limit will be active and override any launch RPM limit setting or higher maximum RPM limit setting whenever a +12V signal is detected on GPIO2.

RPM Window Switch - the GPIO2 output will be active (switched to ground) whenever engine RPM is within the minimum and maximum values.

NOS Trigger - the GPIO2 output will be active (switched to ground) whenever all the NOS trigger conditions are satisfied. NOS trigger conditions include any NOS enable mode configured on GPI1, engine RPM within the minimum and maximum values, and the NOS delay elapsed. If the one-shot delay option is not selected, the NOS delay will occur each time the NOS system is triggered on. If the one-shot-delay option is selected, the NOS delay will only occur the first time the NOS system is triggered on after the launch input is released. In most drag race applications, a one-shot delay is appropriate.

General Purpose Input/Output 3 (GPIO3)

GPIO3 is on the Deustch connector pin 5. When configured as an output, GPIO3 can switch a 2 amp load to ground. A relay must be used to control larger loads, such as solenoid valves. GPIO3 has four modes:

Off (Default) - the GPIO3 terminal is inactive.

RPM Window Switch - the GPIO3 output will be active (switched to ground) whenever engine RPM is within the minimum and maximum values.

Basic Shift Light - the GPIO3 output can directly drive a LED type shift light. Refer to Figure 10 and page 11 for details. The GPIO3 output active will be active (switched to ground) and the shift light will come on whenever engine RPM exceeds the gear 1 shift RPM value.

Multi-Stage Shift Light - the GPIO3 output can directly drive a LED type shift light. Refer to Figure 10 and page 11 for details. The GPIO3 output active will be active (switched to ground) and the shift light will come on whenever engine RPM exceeds the selected RPM value. Gear detection is based on a signal from a line lock solenoid connected to the launch input and

sensing RPM drop between gears. This mode of operation is only suitable for drag racing. The launch RPM value is active while the line lock solenoid is energized and +12V is applied to the launch input. The shift light will illuminate at the launch RPM and start rapidly blinking 100 RPM higher. Energizing the line lock solenoid also resets the gear counter. When the line lock solenoid is released, the launch function is disabled and the multi-stage shift light function becomes active. You can set individual shift RPM values for up to five gears. If your transmission has less than six gears, just set the unused shift points to the same value as used for your upper gear. The Short Shift Window value provides protection in case you shift before the shift point is reached. For the sample data shown, the unit would correctly sense a short shift from 1st into 2nd gear as low as 5,700 RPM. The Minimum Shift Drop value is the minimum RPM drop that must occur between gears for the unit to sense a shift.

CREATING A NEW TIMING TABLE

If you are creating a new setup file, you must first select the 2D or 3D timing table option under module parameters as explained in the Module Parameters section. You can then use the New Timing Table command on the File menu. A dialog box appears as shown in Figure 15 or 16 depending on the type of timing table you selected.

Figure 15 – New 2D Timing Table Dialog
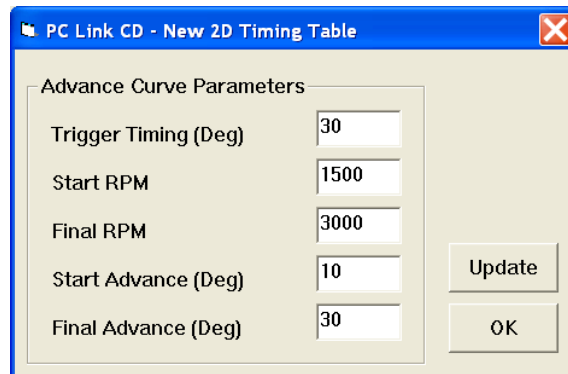
New 2D Timing Table

For a new 2D timing table, you can enter the trigger timing, start and final RPM, and start and final advance. A new value of trigger timing overrides and updates whatever value you may have previously entered under module parameters. Set the trigger timing value to correspond to the actual advanced timing point (degrees BTDC) of your trigger signal. The trigger timing value represents the most advanced timing that the CD-1 can generate. The default value is

30 degrees BTDC, but you must enter the actual value for your engine (or adjust your trigger system so that it generates a trigger signal at 30 degrees BTDC). Trigger timing is shown on the graph as a straight blue line. The actual timing advance curve is shown in red. Since trigger timing represents the most advanced timing, the red timing curve can never go above the blue trigger timing line. The total timing range of the CD-1 is limited to 22 degrees to prevent possible crossfiring into the next cylinder. For example, if you set trigger timing to 30 degrees, the actual advance range is 8.0 to 30 degrees. The program will not allow you to enter values outside this range.

Each time you click on Update, the corresponding timing advance table is displayed. You will find the New Timing Table command useful for generating a timing advance table that will serve as a starting point for further edits. When you are ready to proceed with editing, click on OK.

Figure 16 – New 3D Timing Table Dialog
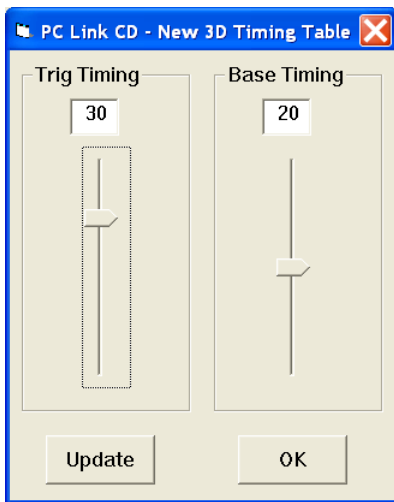
New 3D Timing Table

For a new 3D timing table, you can enter the trigger timing and a base timing value. The base timing value is used to generate a flat timing table. A new value of trigger timing overrides and updates whatever value you may have previously entered under module parameters. Set the trigger timing slider to correspond to the actual advanced timing point (degrees BTDC) of your trigger signal. The trigger timing value represents the most advanced timing that the CD-1 can generate. The default value is 30 degrees BTDC, but you must enter the actual value for your engine (or adjust your trigger system so that it generates a trigger signal at 30 degrees BTDC). Since trigger timing represents the most advanced timing, the 3D timing table values can

never exceed the trigger timing. The total timing range of the CD-1 is limited to 22 degrees to prevent possible crossfiring into the next cylinder. For example, if you set trigger timing to 30 degrees, the actual advance range is 8.0 to 30 degrees. The program will not allow you to enter values outside this range.

Each time you click on Update, the corresponding timing advance table is displayed. You will find the New Timing Table command useful for generating a timing advance table that will serve as a starting point for further edits. When you are ready to proceed with editing, click on OK.

EDITING TIMING TABLE DATA

Once you have timing advance table data, you can edit the data by clicking on and dragging individual points on the chart display or you can directly edit numeric data on the spreadsheet grid.
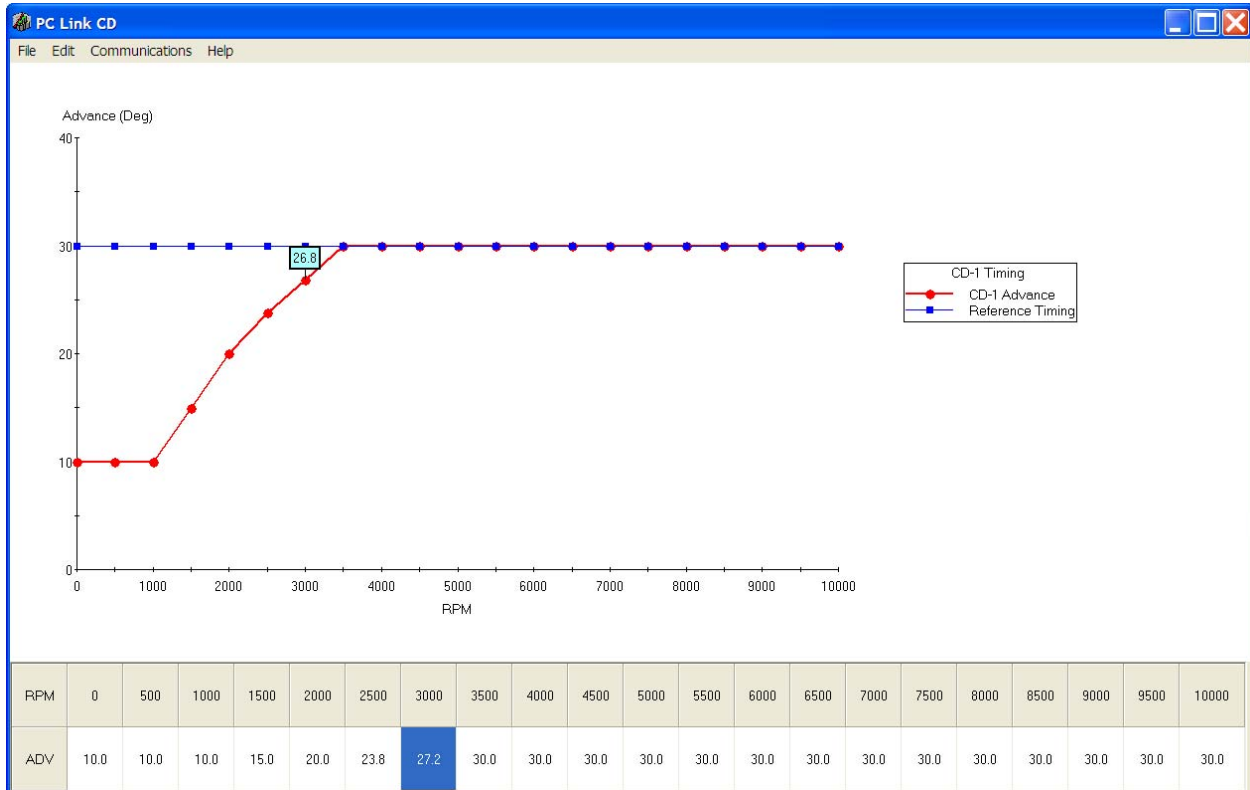
2D Timing Table

The table consists of 21 columns corresponding to 500 RPM increments from zero to 10,000 RPM. The 10,000 RPM timing value is used at all higher RPM levels.

The trigger timing value represents the most advanced timing that the CD-1 can generate. The default value is 30 degrees BTDC, but you must use the actual value for your engine (or adjust your trigger system so that it generates a trigger signal at 30 degrees BTDC). If you need to change the trigger timing value, go back to module parameters. Trigger timing is shown on the graph as a straight blue line. The actual timing advance curve is shown in red. Since trigger timing represents the most advanced timing, the red timing curve can never go above the blue trigger timing line. The total timing range of the CD-1 is limited to 22 degrees to prevent possible crossfiring into the next cylinder. For example, if you set trigger timing to 30 degrees, the actual advance range is 8.0 to 30 degrees. The program will not allow you to enter values outside this range.

There is a slight signal delay within the CD-1 unit. This affects the maximum advance that can be generated at high RPM. You should leave about 1 degree headroom between the maximum advance value on your table and the reference (trigger) timing value. For example, if your reference timing is 30 degrees, you should not use timing table values exceeding 29 degrees above 3,000 RPM.

Figure 17 – 2D Timing Table

RPM	0	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	9500	10000
ADV	10.0	10.0	10.0	15.0	20.0	23.8	27.2	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0

PC Link CD Pro is intended to be an open system and uses the Component One Chart 7.0 2D charting control. The adventurous user can experiment with the chart property pages by right clicking on the chart. Almost any chart property can be changed. Click on the Help button for more information. If you corrupt the chart, exit and restart PC Link CD Pro.
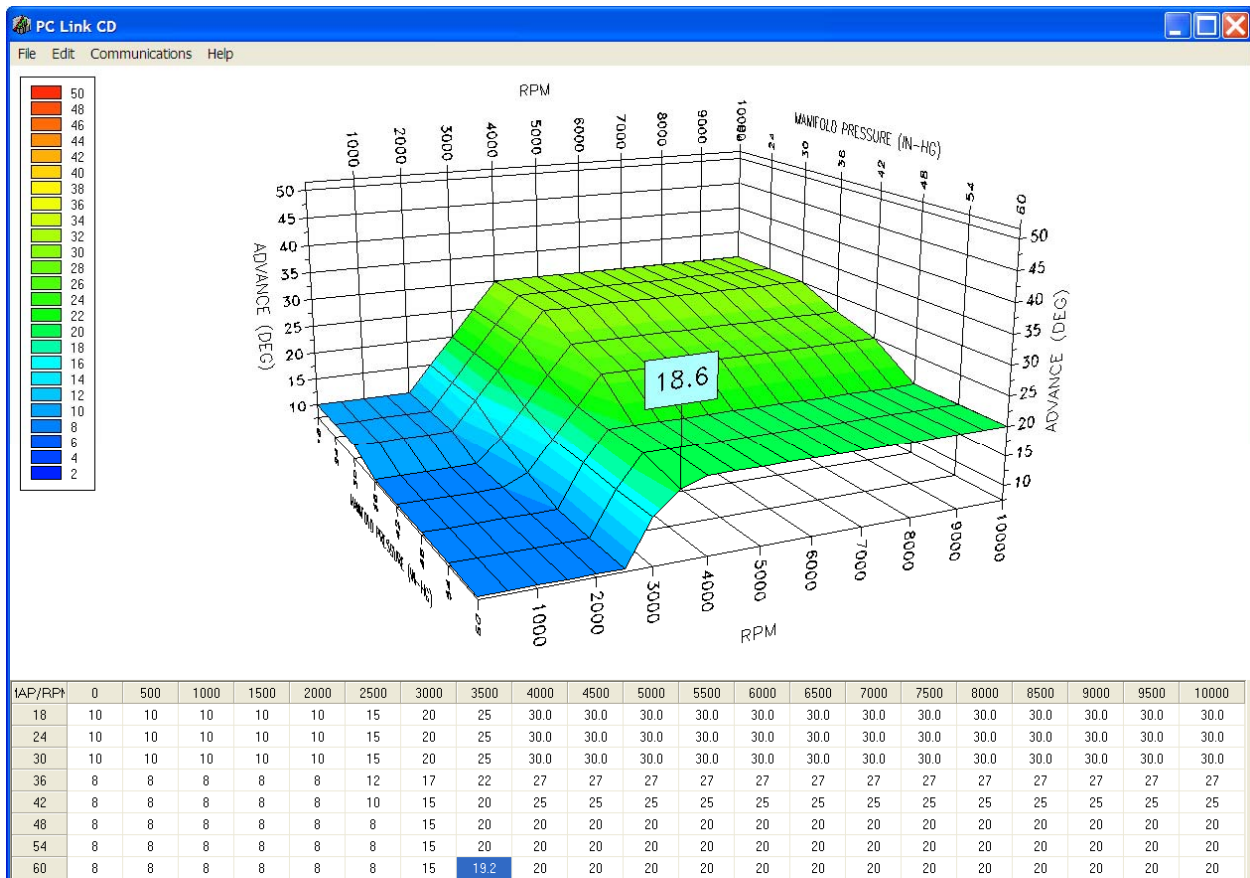
3D Timing Table

The 3D timing advance table consists of 21 columns corresponding to 500 RPM increments from zero to 10,000 RPM and 8 manifold pressure (MAP) rows. The MAP range depends on the type of MAP sensor selected under module parameters. The timing value at 10,000 RPM is used at all higher RPM levels and the timing value in the lowest MAP row is used at all lower MAP levels. Note that 30 In-Hg corresponds to atmospheric pressure (zero boost). Normally aspirated engines will not exceed 30 In-Hg and not all supercharged engines will reach the maximum MAP level for 2 bar or 3 bar MAP sensors. You can use the CD Log software to check the actual MAP values when the engine is running under various load and throttle settings.

The trigger timing value represents the most advanced timing that the CD-1 can generate. The default value is 30 degrees BTDC, but you must use the actual value for your engine (or adjust your trigger system so that it generates a trigger signal at 30 degrees BTDC). If you need to change the trigger timing value, go back to module parameters. Since trigger timing represents the most advanced timing, the 3D timing table values can never go exceed the trigger timing. The total timing range of the CD-1 is limited to 22 degrees to prevent possible crossfiring into the next cylinder. For example, if you set trigger timing to 30 degrees, the actual advance range is 8.0 to 30 degrees. The program will not allow you to enter values outside this range.

There is a slight signal delay within the CD-1 unit. This affects the maximum advance that can be generated at high RPM. You should leave about 1 degree headroom between the maximum advance value on your table and the reference (trigger) timing value. For example, if your reference timing is 30 degrees, you should not use timing table values exceeding 29 degrees above 3,000 RPM.

Figure 18 – 3D Timing Table

| 1AP/RP	0	500	1000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	6500	7000	7500	8000	8500	9000	9500	10000
18	10	10	10	10	10	15	20	25	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
24	10	10	10	10	10	15	20	25	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
30	10	10	10	10	10	15	20	25	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
36	8	8	8	8	8	12	17	22	27	27	27	27	27	27	27	27	27	27	27	27	27
42	8	8	8	8	8	10	15	20	25	25	25	25	25	25	25	25	25	25	25	25	25
48	8	8	8	8	8	8	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20
54	8	8	8	8	8	8	15	20	20	20	20	20	20	20	20	20	20	20	20	20	20
60	8	8	8	8	8	8	15	19.2	20	20	20	20	20	20	20	20	20	20	20	20	20

You can rotate the 3D chart display for a better view of a particular region by dragging the mouse while holding both mouse buttons down. PC Link CD Pro is intended to be an open system and uses the Component One Chart 7.0 3D charting control. The adventurous user can experiment with the chart property pages by right clicking on the chart. Almost any chart property can be changed. Click on the Help button for more information. If you corrupt the chart, exit and restart PC Link CD Pro.

Editing Spreadsheet Table Data

You can edit table data using standard Windows copy and paste operations by selecting cells and then clicking the right mouse button to pop-up the edit menu. You can select cells by dragging the mouse with the left button down. You can also use the Modify command on the pop-up menu. When you enter a value, the presence of optional sign (+ or -) or percent (%) characters affects the outcome of the Modify command.

Figure 19 – Modify Command
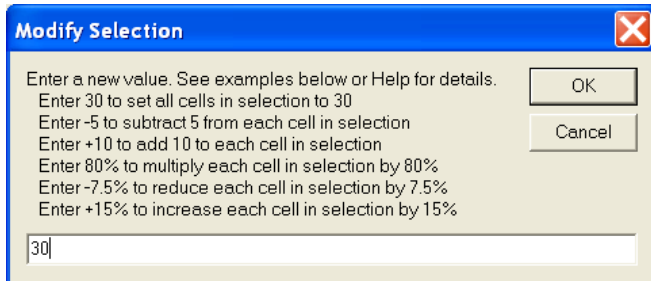
Data Export and Import by Means of Copy and Paste

You might want to export or import table data to or from another application such as Microsoft Excel and other programs with tables that support copy and paste operations. You can directly copy and paste data to and from the PC Link CD Pro program. In the PC Link CD Pro program, you can select a range of cells with the mouse and right click to bring up a copy and paste menu. When you paste data into the PC Link CD Pro program, the data is automatically checked and any out-of-range data corrected.

UPLOADING DATA TO EEPROM

Refer to the Downloading Data from EEPROM section on page 15 for details about USB interface cable hookup and COM port setup. Before uploading, make sure the parameters and timing tables are correct.

Upload data by using the Upload To EEPROM command on the Communications menu. A status message is displayed when the upload process has been successfully completed.

TRIGGER TIMING CONSIDERATIONS

Refer to Figure 20. The trigger timing value set under module parameters must correspond to the actual timing point (degrees BTDC) of your trigger signal. The trigger signal can come from a magnetic pickup crankshaft position sensor, magnetic distributor pickup, or 12V module trigger signal from another system such as an electronic engine control module (ECM). The trigger timing value represents the most advanced timing that the CD-1 can generate. The default value is 30 degrees BTDC, but you must enter the actual value for your engine (or adjust your trigger system so that it generates a trigger signal at 30 degrees BTDC). Since trigger timing represents the most advanced timing, the timing table values can never exceed the trigger timing. The total timing range of the CD-1 is limited to 22 degrees to prevent possible cross firing into the next cylinder. For example, if you set trigger timing to 30 degrees, the actual advance range is 8.0 to 30 degrees (shaded area in Figure 20).

Figure 20 – Trigger Timing
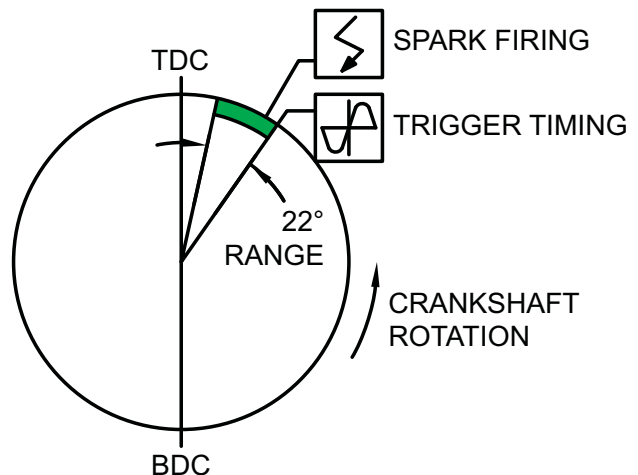
Magnetic Pickup Crankshaft Position (CKP) Sensor

You can accurately establish the position of the CKP sensor by temporarily disabling multi-spark and any timing table in module parameters (remember to upload to CD-1). Use a timing light to check the timing and adjust the position of the CKP sensor as required so that your observed engine timing is the same as the trigger timing value. For best accuracy, we suggest that you set the timing at 1,500-2,000 RPM. While you are conducting this test, you should also check the distributor phasing. Use a spare distributor cap and drill or mill a large hole on the top or side so that you can observe the rotor tip position at cylinder 1 with the timing light. If you are using a dial-back timing light, set the dial-back to zero while observing rotor tip position. The leading edge of the rotor should just touch the cap terminal.

Magnetic Pickup Distributor without Advance Mechanism

You can accurately establish the position of the distributor by temporarily disabling multi-spark and any timing table in module parameters (remember to upload to CD-1). Use a timing light to check the timing and adjust the position of the distributor as required so that your observed engine timing is the same as the trigger timing value. For best accuracy, we suggest that you set the timing at 1,500-2,000 RPM.

Magnetic Pickup Distributor with Advance Mechanism

In this case, you will not be using a timing table, but you might still want to use the retard features. Set the trigger timing value to correspond to the maximum distributor advance at high RPM.

Module Trigger from an ECM

In this case, you will not be using a timing table, but you might still want to use the retard features. Set the trigger timing value to correspond to the maximum advance generated by the ECM at high RPM.

APPENDIX – RECOMMENDED PARTS AND SUPPLIERS

MAP SENSORS

To connect a Delphi MAP sensor for boost timing retard mode or for implementing a 3D timing table, you will have to fabricate a wiring harness with the appropriate mating connector or use our MAP sensor harness kit P/N 102006. Recommended Delphi MAP sensors, and equivalent aftermarket parts are listed in the table below. Note that Wells is stocked by Autozone (www.autozone.com) and SMP (Standard Motor Products) is stocked by RockAuto (www.rockauto.com).

Range	Delphi P/N	Aftermarket P/Ns
1 bar (normally aspirated engines)	12219927, 16254719, 16175339, 12247561	Wells SU105 SMP AS165
2 bar (0-15 psi boost)	16009886	Wells SU129 SMP AS4
3 bar (0-30 psi boost)	12223861	Wells SU504 SMP AS210

WIRE

Wire supplied with most automotive accessories is usually un-tinned copper with a low number of strands. The unprotected copper in this inexpensive wire quickly oxidizes, especially when in contact with dissimilar metals on terminals. The low number of strands limits life in applications where flexing occurs. We recommend the use of high quality industrial grade wire with tinned copper strands and a high strand count.

18-20 AWG sizes can be used for all signal and low current applications. 16-18 AWG is adequate for line lock and trans brake solenoid wiring. 14 AWG should be used for high current fuel and nitrous solenoid wiring. Carol UL grade 1007/1015 wire is available from Digi-Key.

P/N	Description
C2040X-100	20 AWG wire (100 foot spool)
C2064X-100	18 AWG wire (100 foot spool)
C2104X-100	16 AWG wire (100 foot spool)
C2105X-100	14 AWG wire (100 foot spool)

Note: replace X with color code B=Black, W=White, R=Red, G=Green, A=Orange, Y=Yellow, L=Blue, N=Brown, S=Gray, V=Violet

CRIMP TERMINALS

High quality crimp terminals and a proper crimping tool are required to make reliable electrical connections. Crimp terminals commonly sold in automotive and hardware stores have brittle vinyl insulation that easily cracks. We recommend the use of high quality industrial grade nylon insulated crimp terminals. The following parts are available from Digi-Key.

P/N	Description
A27241	16-20 AWG #10 ring tongue terminal
A27246	16-20 AWG 1/4" ring tongue terminal
A27248	16-20 AWG 3/8" ring tongue terminal
A27262	14-16 AWG 1/4" ring tongue terminal
A27264	14-16 AWG 3/8" ring tongue terminal
A27288	10-12 AWG 1/4" ring tongue terminal
A27291	10-12 AWG 3/8" ring tongue terminal
A0911	18-22 AWG .110" female quick disconnect terminal
MNU18-187DFIK	18-22 AWG .187" female quick disconnect terminal
MNU18-250DFIK	18-22 AWG 1/4" female quick disconnect terminal
MNU14-250DFIK	14-16 AWG 1/4" female quick disconnect terminal
A1069	16-22 AWG butt splice
A1080	14-16 AWG butt splice
A1086	10-12 AWG butt splice

RELAYS

The typical import brand 30-40 amp relays leave little safety margin. When used to switch heavy inductive solenoid loads, arcing can result in the contacts welding together – a potentially catastrophic failure mode. We recommend using Tyco/P&B automotive OE grade relays available from Newark Electronics and Digi-Key. Use the 40 amp version for most applications and the 70 amp version for fuel/nitrous solenoid activation. We recommend that you use the relay sockets and crimp terminals listed along with the relays.

P/N	Description
1432791-1	40 amp VF4 series relay
VCF4-1001	Socket for VF4 series relay

60249-1	12-16 AWG terminal for VF4
VF7-41F11	70 amp VF7 series relay
VCF7-1000	Socket for VF7 series relay
42281-1	14-18 AWG terminal for VF4 coil connections (2 required)
280756-4	10-14 AWG terminal for VF7 contact connections (2 required)

FUSES AND FUSE TAPS

ATC series fuses and fuse holders commonly used for automotive applications are only available in 40 amp and lower ratings. For high current applications, we recommend the heavy duty 50 amp Littlefuse Maxi Fuse series available from Digi-Key.

| P/N | Description |
| F1085 | Maxi fuse block |
| F1038 | 50 amp Maxi fuse |

SWITCHES

All switches used in performance applications should be sealed. Representative sealed toggle and rocker style switches available from Digi-Key are listed below.

P/N	Description
480-2191	Honeywell SPDT toggle switch
360-2278	NKK SPDT rocker switch

RELIABLE CONNECTIONS TO EXISTING SIGNALS

For some applications, you may have to tap into existing signal wires on the vehicle. We caution against using any of the so called "vampire clips" that make an insulation displacement connection. These have proven very unreliable in racing applications. They may even cause the original wire to fray and break. We suggest soldering any connections to existing signals. Use a stripping tool to cut through and push back about 1/4" of insulation at the spot on the original wire where you plan to make the connection. Wrap several turns of the new wire around, solder, insulate with self vulcanizing electrical tape, and use two cable ties to secure the splice as shown. Regular electrical tape will tend to unravel. Self vulcanizing electrical tape is available from Digi-Key as their P/N W213.
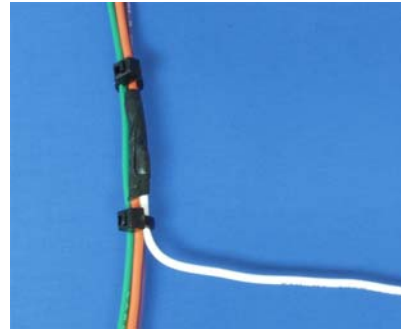
SUPPLIERS

Suppliers referenced in the Appendix are listed in the table below. Additional suppliers for connectors, electronic tools, mechanical hardware, and test equipment are listed on our website at www.daytona-sensors.com/tech_tools.htm.

Supplier	Phone	Website
Digi-Key	1-800-344-4539	www.digi-key.com
Mouser	1-800-346-6873	www.mouser.com
Newark	1-800-463-9275	www.newarkinone.com
State Wire & Terminal	1-800-922-6527	www.statewire.com