




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

OVERVIEW ***software is optional

The CD-1 capacitive discharge digital ignition system is intended for professional racing applications. Both the CD-1 ignition Module P/N 102001 and CD-1 Ignition Coil P/N 102002 is included in kit part number: 102003.

- Compatible with 4-6-8 cylinder race engines that utilize a distributor type ignition. *Note: Not compatible with odd firing V6 engines.*
- Works with most popular magnetic pickup distributors, magnetic crank triggers, points, Ford TFI or ECM.
- 135 mJ spark energy output – Compatible with 16v Battery Systems – Operating Voltage 8.0v-20.0v DC
- Reverse polarity protection
- Mode switch allows you to easily adjust your ignition to match the number of cylinders in your engine 4-6-8.
- Triple RPM Limiter - Launch, Burnout, and Maximum RPM limits are adjustable in 100 RPM steps from 3,000 to 9,900 RPM (10,900 RPM for maximum RPM limit). Our RPM limiters are accurate and smooth.
- User Configurable - Up to 10 degrees of Starting Spark Retard and Multi-Spark Enable/Disable (below 3000rpm)
- Optional - Ignition advance is fully programmable – Utilize our CD-1 PC-Link Software and USB Interface to access and re-map your ignition advance. Choose from a simple RPM based advance curve to a 3D timing map with boost proportional retard.
- Built-in data logging - Stores 5 hours of data at 10 samples/sec or 30 minutes of data at 100 samples/sec.
- Dedicated input for Launch RPM Limiter and optional manifold pressure sensor (MAP).
- Optional – General Purpose Inputs(3) and Outputs(2). The Inputs and outputs are configured via the USB Interface and CD-1 PC-Link Software. The inputs can be programmed for: High Gear Timing Retard, Burnout RPM Limit, Adjustable Timing Retard, Vehicle Speed, and/or Throttle Position Sensor. Outputs can be programmed for: RPM window switch for Nitrous System Activation, and/or Multi-Gear Shift Light Functions.
- Fully encapsulated construction, waterproof 12 pin connector is utilized for external signal connections.
- Compact size. Module is 9.25”L x 3.625”W x 2.75”H. Coil is 4.4”L x 3.2”W x 3.0”H.
- Highly efficient switching power supply less than 5 amps of current draw at 12v DC and 8,000 RPM.

		<p>Optional</p> 
CD-1 Ignition - 102001	CD-1 Ignition Coil - 102002	RTD-1 Retard Control - 102005

ADDITIONAL INFO

- The parts bag supplied with the CD-1 includes a wire harness that plugs into the 12 pin connector, ring terminals for power and ignition coil connections, diodes 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.
- USB interface P/N 102004 is required to utilize our free CD-1 Configuration Software OR Data Logging Software. The configuration and datalogging software are two different programs, and available via two different self-installing downloads. A separate self-installing download is available for the USB interface driver. All of these programs are compatible with most Windows Operating Systems from XP through Windows 11. Before you run the installer on a Windows 11 or 10 machine, please disable One Drive. If One Drive is enabled during the install, a conflict occurs and the program configuration file will not be installed in the correct folder.
- To utilize driver adjustable timing retard or boost proportional retard, you must purchase, install and configure the optional RTD-1 retard control P/N 102005. To utilize boost proportional timing, use our MAP sensor harness kit P/N 102006 to connect our Delphi style MAP sensor. We offer three version of MAP sensors (1 Bar 115011, 2 Bar 115012 and 3 Bar 115013).
- If your application utilizes the optional throttle position sensor (TPS) and/or vehicle speed sensor (VSS) signal connections. **You will need to refer to the vehicle diagram for your vehicle to locate these connections.**
- POWER CYCLE the ignition **AFTER** adjusting the switches or **PRIOR** to connecting to the USB Interface. If you do not power cycle the ignition prior to connecting the USB – the software will not communicate with the ignition. After making changes to the front switch settings – power cycle the ignition so the switch changes will take effect.
- If you will be using the configuration or data log software, we recommend that you use the included single pin M/F connectors to connect the tach. When needed, the USB connects in place of the TACH. The USB connection can only functions after a power cycle – once you try to start the engine it defaults to TACH output.

WHAT IS IN THE BOX - Figure 1



CD-1 Ignition Coil – 102002

CD-1 Ignition - 102001

Instructions

Wire Harness

Power/Ground Terminals

Coil Terminals

Connectors for Tach

Diodes for connecting
INPUTS directly to solenoid
type coils (line-loc and trans-
brake – see wiring diagrams)

STATUS LED

Figure 1A



Status LED

Solid Status LED -- illuminates when powered on after a power cycle.

Blinking Status LED – engine running and it turns off – but the ignition has not been turned off -- it is normal for this to occur if the engine starts and shuts off. This can also occur if you have a bad magnetic trigger module or intermittent or poor trigger wiring [loss of trigger signal].

Blinking Status LED after power on – internal fault

MODE - Switch Settings

Figure 1B



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 -- 8 cylinder engine and boost timing retard mode with 2 bar MAP sensor
- 4 -- 6 cylinder engine and boost timing retard mode with 2 bar MAP sensor
- 5 -- 4 cylinder engine and boost timing retard mode with 2 bar MAP sensor
- 6 -- 8 cylinder engine and boost timing retard mode with 3 bar MAP sensor
- 7 -- 6 cylinder engine and boost timing retard mode with 3 bar MAP sensor
- 8 -- 4 cylinder engine and boost timing retard mode with 3 bar MAP sensor
- 9 -- Reserved (not used)

MAX RPM - Switch Settings

Figure 1C



Maximum RPM Limit - Switch Settings

The maximum RPM limit setting is offset by +1,000 RPM. This allows the two switches to set the MAX RPM value between 1,000 and 10,900 RPM

Examples: Switch Setting 10 = 2000 RPM , Switch Setting 75 = 7,600 RPM, Switch Setting 99 = 10,900 RPM

00-99 Maximum RPM limit setting X100 + 1000

Launch RPM - Switch Settings

Figure 1D



Launch RPM Limit - Switch Settings

Launch RPM Limit functions if the switches are set between 06 (600rpm) and 99 (9,900 rpm).

Settings 00 – 02 are typically used for user testing.

NOTE: These two switches can perform several functions.

00	RPM limit disabled (no RPM limit)
01	RPM limit and multi-spark disabled
02	RPM limit, multi-spark, and user defined timing functions disabled
03-05	Do Not Set (factory testing only)
06-99	Launch RPM limit setting X100 (i.e. switch setting 66 = 6,600 RPM)

GENERAL USAGE INFORMATION

- If you have a locked-out distributor (fixed timing) and wish to fire the engine at a fixed time. After installing the ignition, follow the steps listed below:
 - 1 – Use a TCD tool to Verify Top Dead Center (0) on your balancer matches your timing pointer for Cylinder 1
 - Note: when rotating the engine air will begin to blow out of CYL 1 when your on the correct cycle.
 - 2 – Remove the TDC Tool - Rotate the Engine to the desired timing on CYL1 – almost any petrol engine will start and run if you use 20 degree BTDC (Before Top Dead Center) for the initial timing.
 - 3 – Install the distributor so the rotor is pointing at the terminal for CYL 1 (Note: For high-rpm use - rotor phasing is very critical – and outside of the scope of this document).
 - 4 – Reinstall the spark plug and wire for CYL 1 – Crank the engine and adjust the total timing as desired.
- If you have a distributor with either mechanical or vacuum advance (points or magnetic) or Ford TFI Follow the above procedure with one change – the “base/initial” timing is typically set between 6-14 degrees. If your distributor has advance built into it – typically you would not build or utilize a custom timing table.
- Looking to build your own custom timing curve?

We recommend using a locked-out distributor and/or racing crank trigger and fixed timing. The CD-1 Configuration Software and USB interface allows you to build your own custom timing curve. The total timing range of the CD-1 is limited to 22 degrees to prevent possible cross-firing into the next cylinder. Example, if you set trigger timing to 32 degrees, the actual advance range is 10.0 to 32 degrees.
- Using nitrous oxide or a supercharger/turbocharger?

Utilize the USB interface and CD-1 Configuration Software to access the optional functions to setup timing retard based on nitrous activation and/or boost (Map sensor and RTD-1).
- The CD-1 ignition is setup from the factory to retard the timing 10 degrees when cranking. The timing retard is active when the ignition box is powered on and the engine RPM is less than 150 RPM. The amount of cranking retard is user adjustable via the USB interface and the CD-1 Configuration Software.

WIRING OVERVIEW

Power Connections – Heavy Gauge Power Wires

Heavy RED (12 AWG)	Battery+	Connects to battery positive terminal. Do not connect directly to the alternator (if equipped). Extend with same wire gauge.
Heavy BLACK (12 AWG)	Ground	Connects to chassis ground - battery negative terminal (-) or at the engine – a clean, secure ground connection is required

Ignition Coil Primary Connections – Note: DO NOT use a ballast resistor

Orange	Coil+	Connects to coil positive terminal – No other wires connect
Black	Coil-	Connects to coil negative terminal – No other wires connect

12 PIN Connector Signals – 18 gauge wires

Pin 1 – Red	Ignition Switch	Connects to a switched +12v ignition switch – Turns the unit on and off.
Pin 2 – Blue	Launch RPM Limit	Input Connects to Launch RPM limit circuit. Supplied 1N4007 diode must be installed if circuit includes a solenoid valve.
Pin 3 –Orange	GPI1	General purpose input 1 – User defined via software. Can also be used as the input for RTD-1 retard command signal.
Pin 4 - Grey	GPIO2	General purpose input/output 2 – User defined via software - Used for burnout RPM limit. Supplied 1N4007 diode must be installed if circuit includes a solenoid valve.
Pin 5 - Yellow	GPIO3	General purpose input/output 3 – User defined via software
Pin 6 - Violet	Magnetic Trigger+	Input - 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 7 - Green	Magnetic Trigger-	Input - 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 - Blk/White	Sensor Ground	Optional - Connects to MAP sensor and RTD-1 ground
Pin 9 Green/White	MAP Sensor	Optional - Connects to 0-5V MAP sensor signal
Pin 10 Red/White	+5V Power	Optional - Connects to MAP sensor and RTD-1 power
Pin 11 - Brown	Tach/RS-232	Output - Connects to Tach OR optional USB interface To connect the USB interface, Tach must be disconnected
Pin 12 - White	Module Trigger	Input - Connects to trigger output from points or Ford TFI or engine control module. If the module trigger input is used, the magnetic trigger inputs on pins 6 and 7 must be left open.

Figure 2 – Basic Magnetic Trigger Hookup – NOTE: Trigger input must not be used in this config

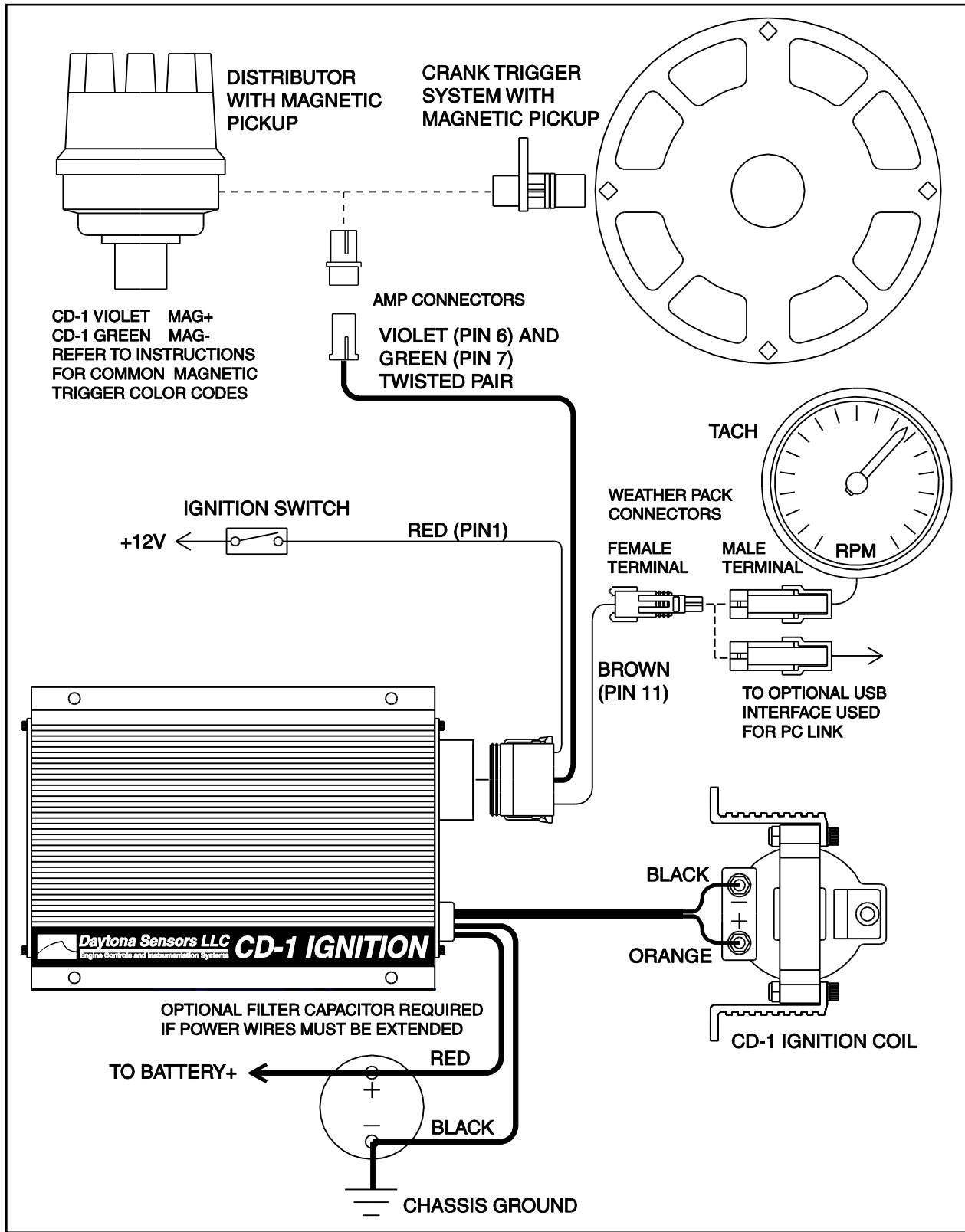
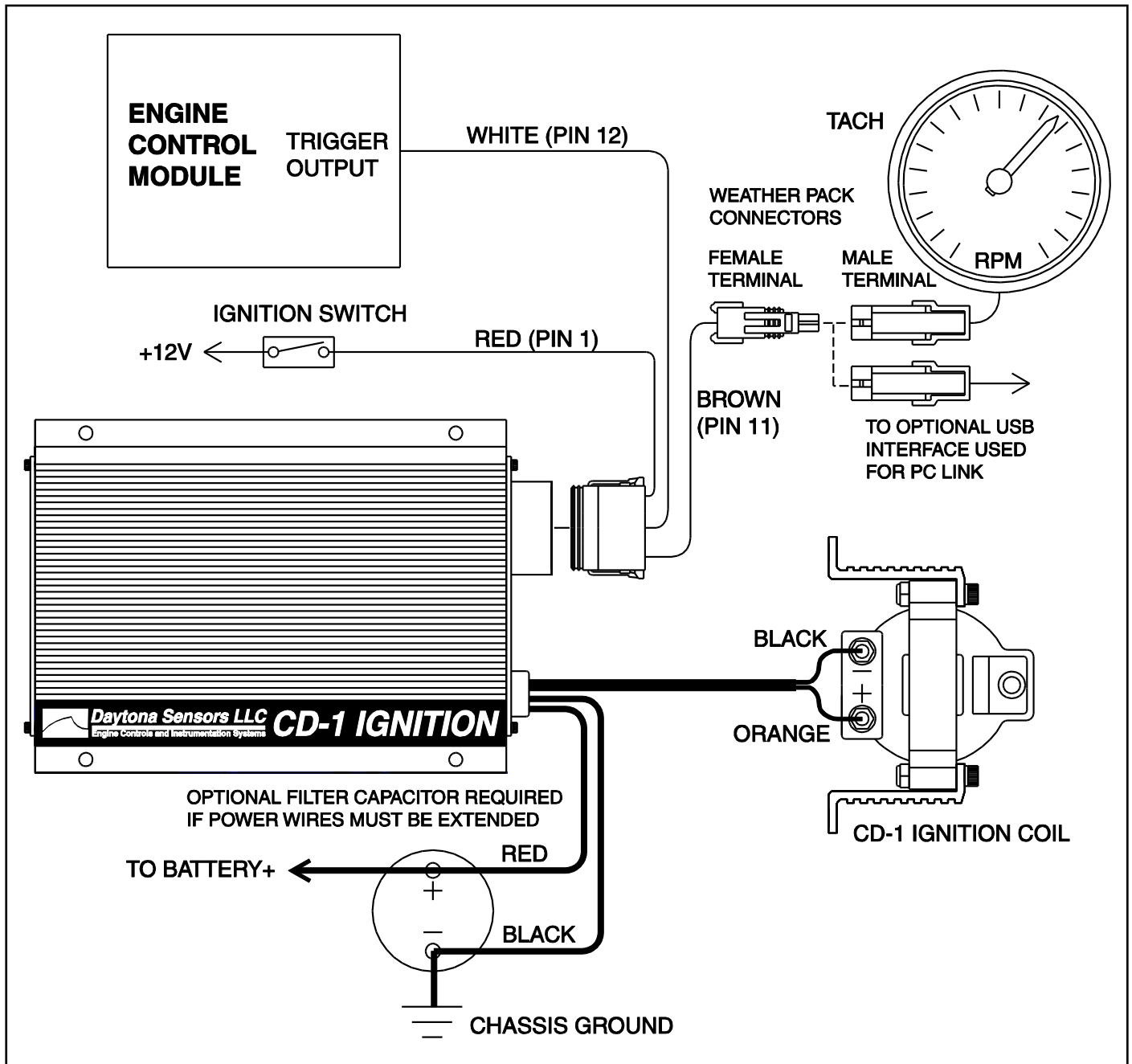


Figure 3 – Basic Module Trigger Hookup – NOTE: Mag Trigger must not be used in this config



CD-1 – BASIC -- 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 it should be mounted in a dry location away from sources of heat. 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.
4. **Power connections.**

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

+12v - Connect the HEAVY Gauge RED 12 AWG wire directly to the +12v battery terminal or to a battery disconnect switch or to the battery feed terminal of the remote starter solenoid. If the battery is mounted in the trunk, we recommend a min 12 AWG wire be used from the ignition to the power source.

Ground - Connect the HEAVY Gauge BLACK 12 AWG wire directly to the negative battery terminal or chassis ground near the engine, preferably where the battery ground cable is attached. Verify that the engine is properly grounded to the chassis. Separate grounds are recommended for each cylinder head.

In the rare case that the +12v wire is an extreme distance from the ignition OR you are having issues with ignition noise - 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 as shown in figure 2/3.

5. **Ignition switch connection.** Connect the thin red wire from the 12-pin connector (pin 1) to the ignition switch or +12v power switch as shown in figure 2/3. The ignition powers ON when +12v is applied to the thin red wire - pin 1.
6. **Ignition Trigger Signal connection.**

Choose either Magnetic Pickup or Module Trigger. Note: Only one input type can be used at a time – be sure to tape up the unused input.

Magnetic Pickup - The violet/green magnetic pickup cable is supplied with an AMP connector that will mate with many common magnetic pickup distributors and crank trigger systems (Msd). For other magnetic pickups, cut off the connector and refer to the color code table below.

Module Trigger – Input is usually connected to: Points or Points Replacement module, Ford TFI or engine control modules such as Haltech or Motec. The module trigger input 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.

Typical - 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 in figure 2/3.

Orange – Coil + terminal **Black** – Coil - terminal

DANGER

High voltage is present at the ignition coil – ORANGE / BLACK Wires and terminal when the ignition switch is on.

- Tachometer connection.** Use the supplied M/F Weather Pack connectors as shown in Figures 2-3 to connect the brown wire from 12 pin connector pin 11 to the vehicle tachometer as shown. When the engine is running the industry standard 0-12V square wave signal appears on the tach output with one tachometer pulse per trigger event. The rising edge of tach pulse is synchronized with the trigger event. Our tach output is compatible with all aftermarket tachometers, and can be used to trigger other RPM activated accessories.

Optional - The tachometer output wire is also used by the USB interface P/N 102004 to communicate with configuration and data log software. To use the USB interface, connect the USB interface, power the ignition on and DO NOT start the engine and connect to the ignition.

- Optional - Application specific signal connections (Inputs and Outputs)** Launch, GPI1 and GPIO2/3, MAP and 5v power – be sure to tape off or utilize heat shrink on unused connections. Refer to Figures 4-10.
- Completing the installation.** Set the CD-1 switches and upload or change software configuration options (optional).

Reconnect the battery.

Start engine and check timing. If the engine was already running prior to installation and the timing has changed significantly, MAG+ and MAG- may be reversed (if connected). When connected correctly the timing will be at the most retarded – if connected incorrectly (timing will be more advanced than normal).

Figure 4 – Optional -- RTD-1 Retard Control and MAP Sensor Hookup

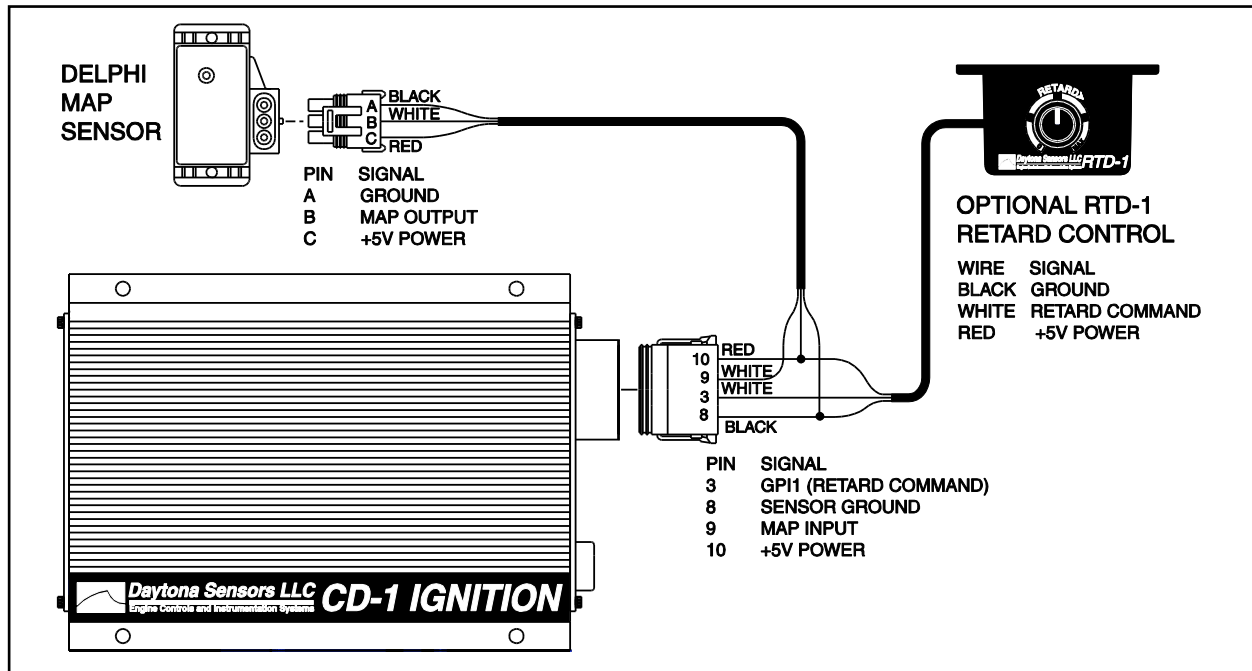


Figure 5 – Optional -- Automatic Transmission RPM Limit Switch Hookup (Launch / Burnout)

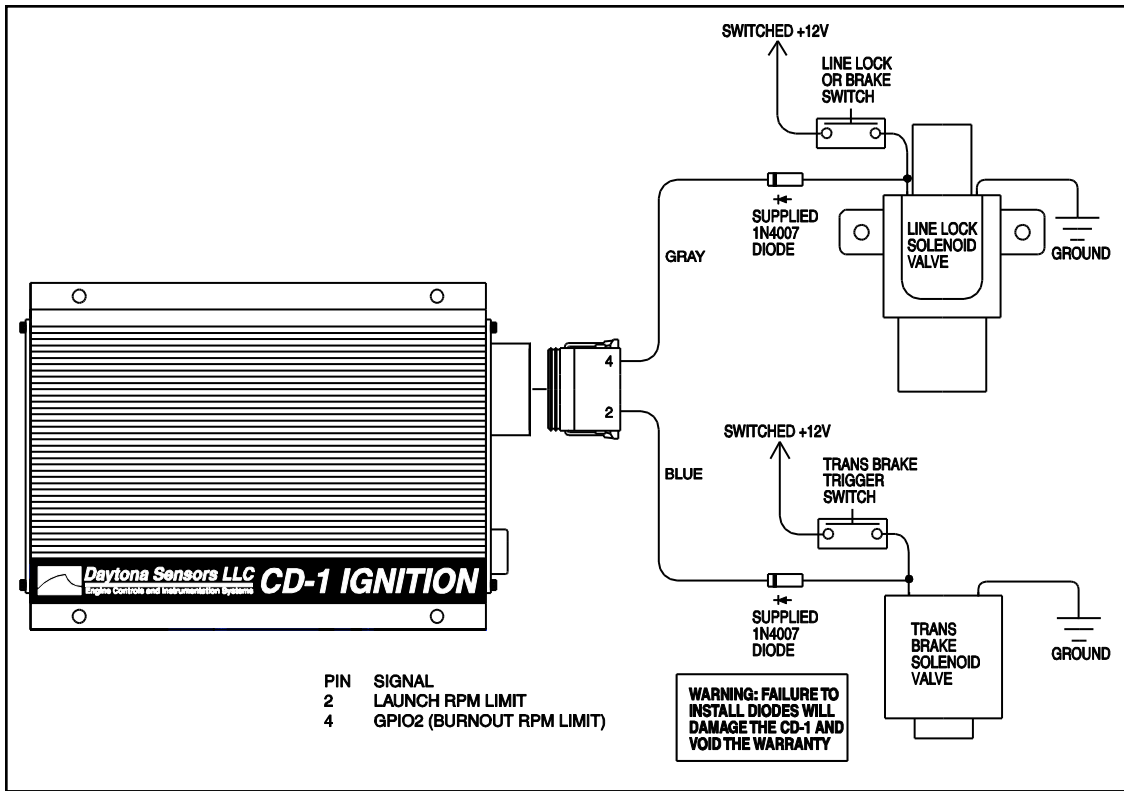


Figure 6 – Optional - Manual Transmission RPM Limit Switch Hookup (Launch / Burnout)

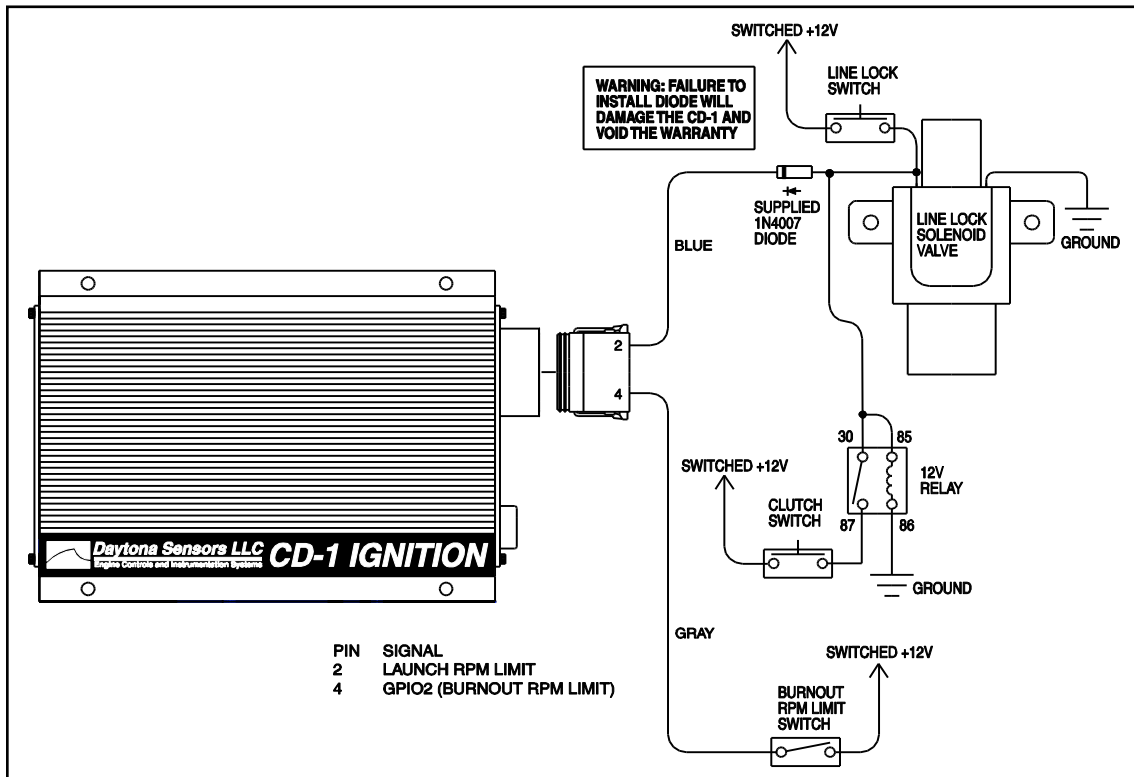


Figure 7 – Optional - Nitrous Oxide System Hookup

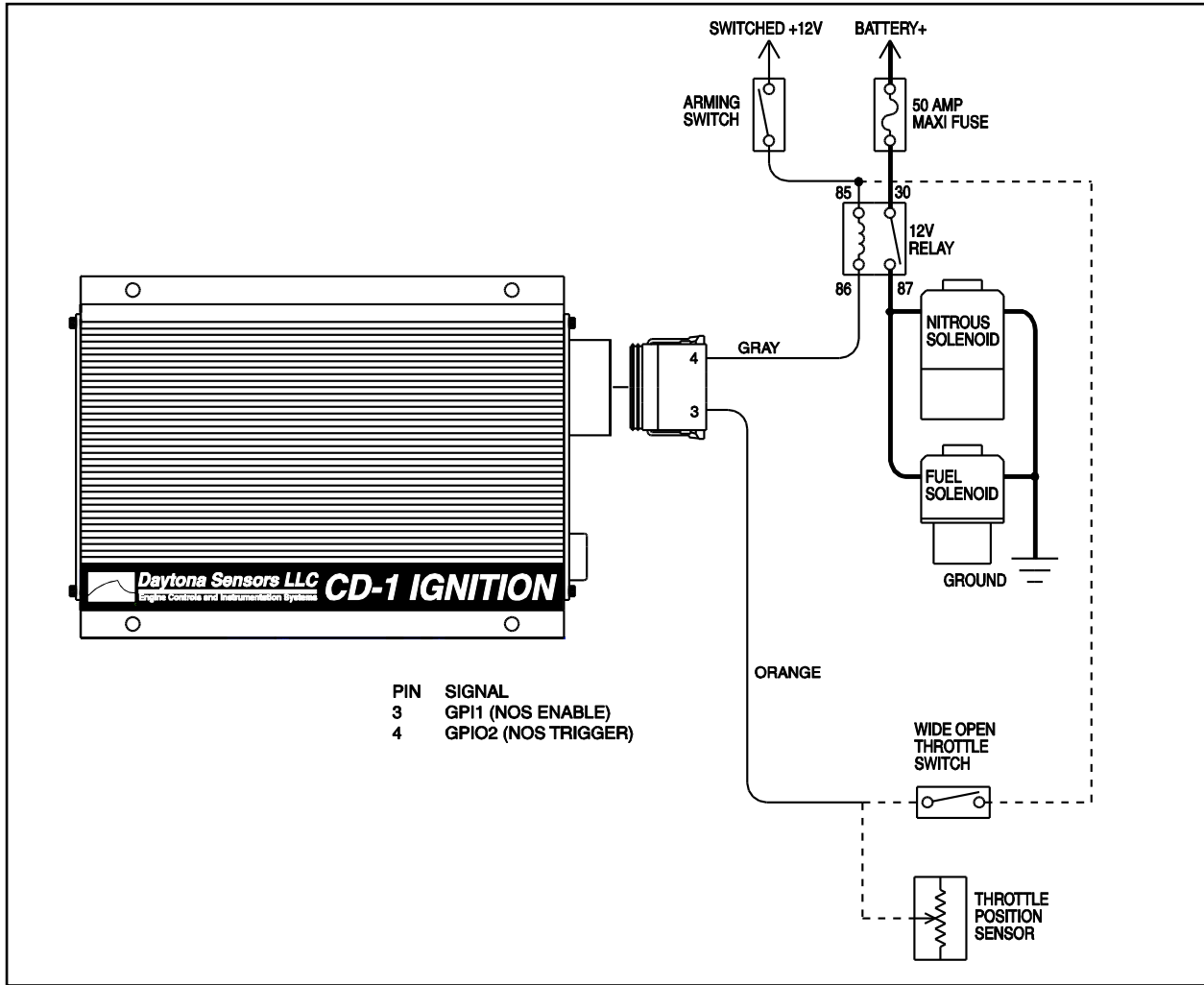


Figure 8 – Optional - Additional GPI1 Hookup Options

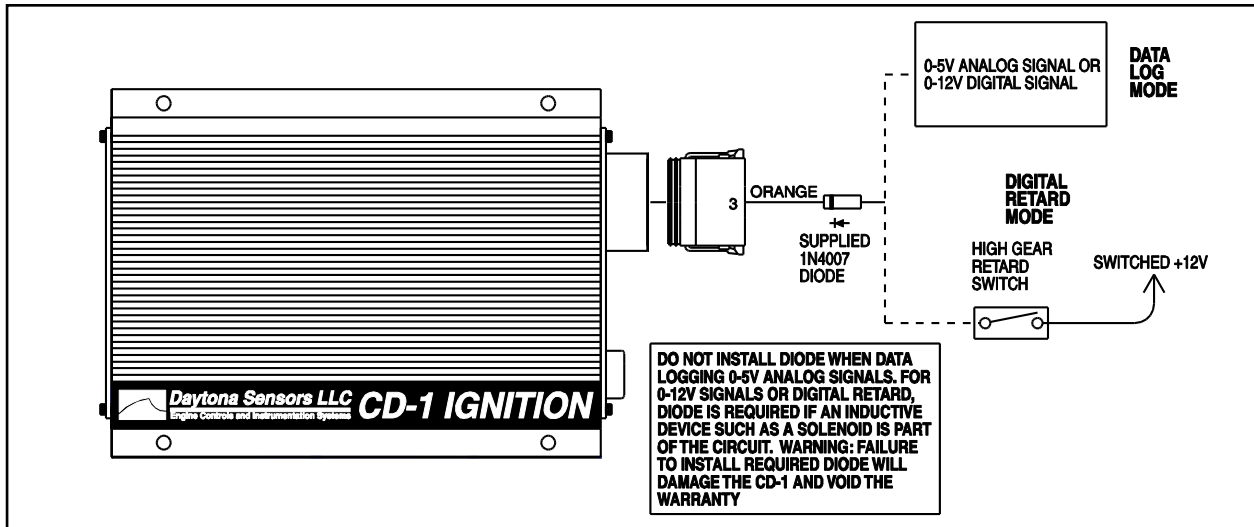


Figure 9 – Optional - Additional GPIO2 Hookup Options

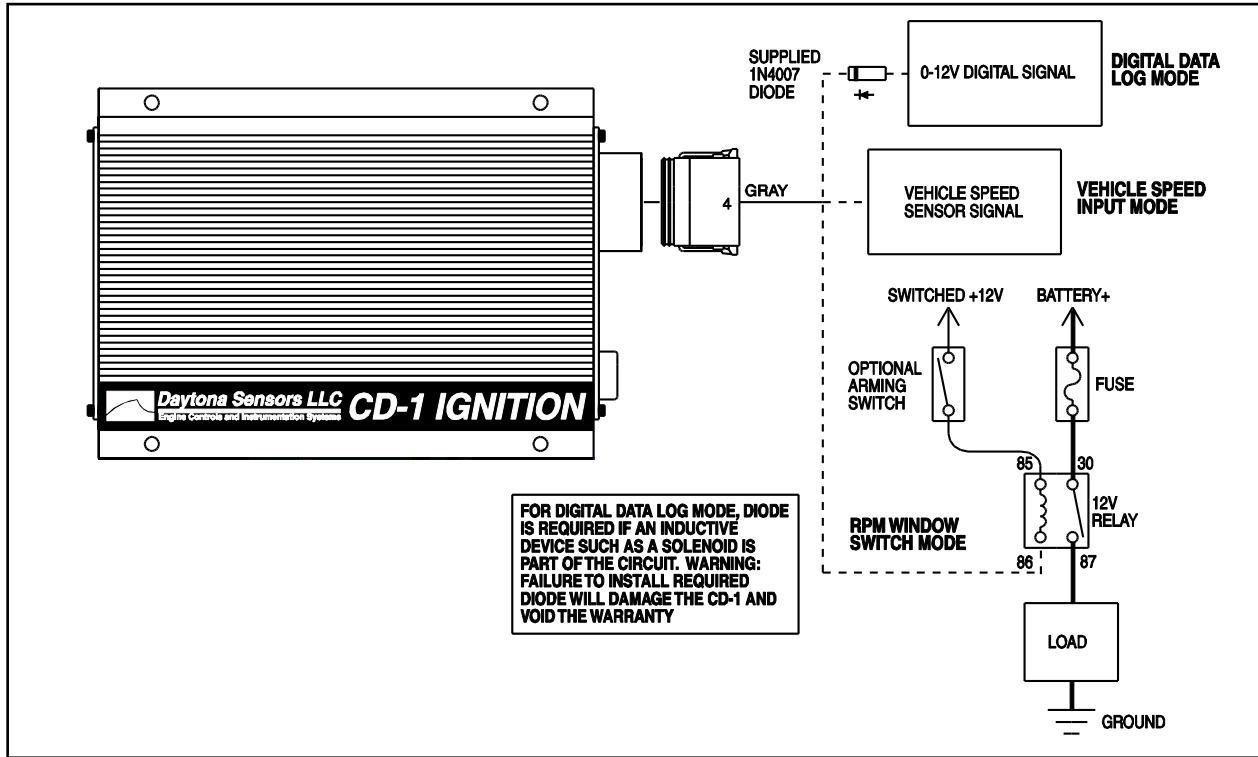
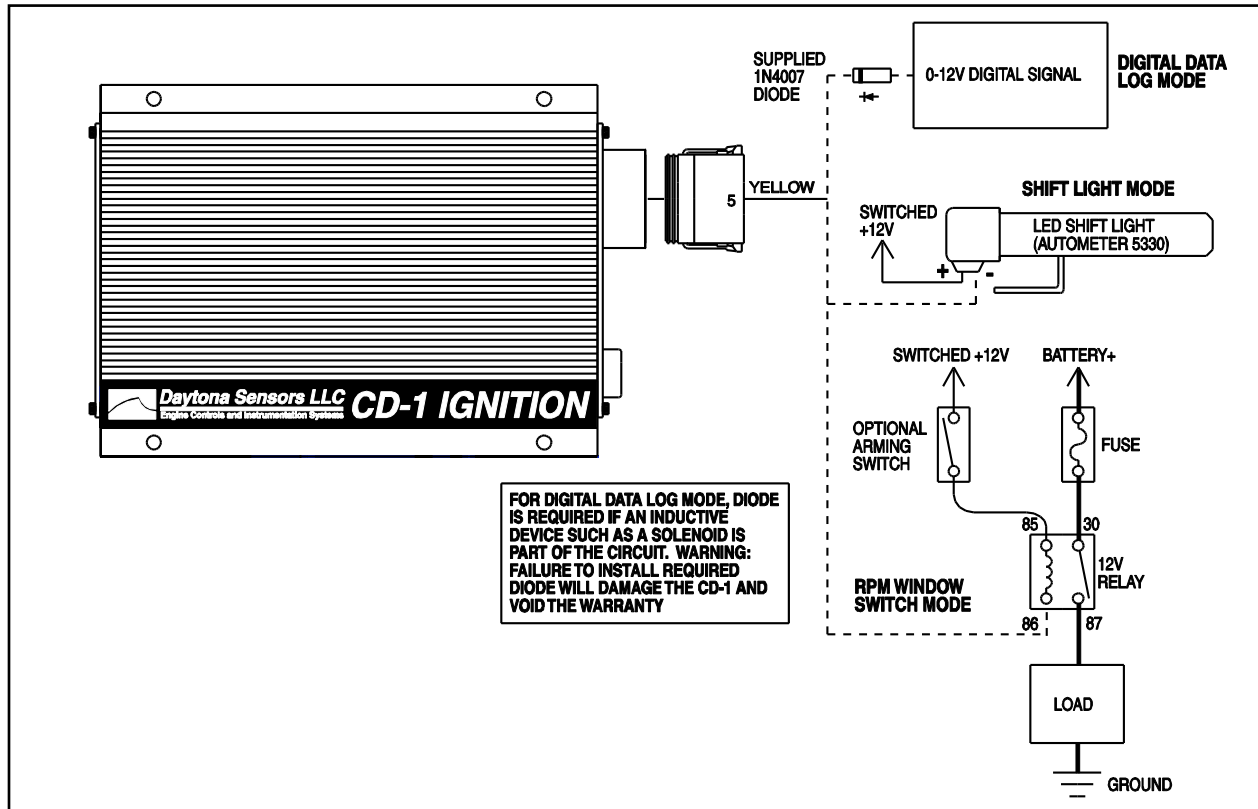


Figure 10 – Optional - GPIO3 Hookup Options



Optional – Boost Retard - MAP Sensor and RTD-1 Retard Control Hookup

Installation of a 2 or 3 bar MAP sensor AND the RTD-1 timing retard control is required for boost timing retard (Figure 4).

Configure the “Mode Switch” on the front panel to match your engine/map setup (Figure 1B).

After installing the MAP sensor and RTD-1 utilize your PC and PC Link CD-1 Configuration software to connect via the USB interface to the ignition, setup the feature and create a boost timing retard table.

1. **RTD-1 retard control.** The RTD-1 unit is not waterproof and is intended for under dash mounting only. Connect the ground, retard command, and +5V power wires as shown in Figure 4.
2. **MAP sensor.** 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. If you are using the RTD-1 and MAP sensor together, splice the ground and +5V power wires from the MAP sensor to the same wires from the RTD-1 near the CD-1.

Optional - Automatic Transmission RPM Limit Switch Hookup (Launch / Burnout)

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

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

1. **Trans brake and Launch RPM Limit - Figure 5 -**
The trans brake input is active before launching and is used to select the launch RPM Limit set on the CD-1 front panel switches (Figure 1D). The Launch RPM Limit is selected when +12V is applied to Pin 2 (Blue).
2. **Line lock and Burnout RPM Limit -** Skip ahead if this feature is not used. The line lock is active during burnout and selects the Burnout RPM Limit. **IMPORTANT** - GPIO2 must be programmed for Burnout RPM Limit Mode. Utilize the USB interface and PC Link CD-1 Configuration software to enable this feature and setup the RPM. Burnout RPM Limit is selected when +12v is applied to Pin 4 (GPIO2) and the feature is setup.

Optional - Manual Transmission RPM Limit Switch Hookup (Launch / Burnout)

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

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

3. **Line lock and Launch RPM Limit - Figure 6 -** The line lock is active before launching and used to select the launch RPM limit set on the CD-1 front panel switches (Figure 1D). 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 +12V is applied to Pin 2 (Blue). **Alternatively** – this can be wired without the Line Lock.
1. **Burnout RPM Limit.** Skip ahead if this feature is not used. A user provided external switch is used to select the burnout RPM limit. GPIO2 must be configured for burnout RPM limit mode, utilize the USB interface and PC Link CD-1 Configuration software to enable this feature and setup the RPM. Burnout RPM Limit is selected when +12v is applied to Pin 4 – Grey (GPIO2) and the feature is setup

Optional - Nitrous Oxide System (NOS) Hookup

Figure 7 shows typical hookup of the single stage NOS kit that is 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.

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 one of the configurations shown in Figures 4 or 7. Refer to page 18 for programming details.

1. **Data log mode.** This is the default for GPI1 if no other mode is programmed. Both 0-5V analog signal levels and 0-12V digital off/on values are simultaneously logged by the CD-1. The on threshold voltage for digital signals is approximately 2.5V and the input is tolerant of voltage levels up to 30V. Many automotive sensors have 0-5V signals levels and can be connected to GPI1. A +5V reference for sensor power (up to 50 ma current) is available at pin 10. To avoid errors caused by voltage drop between the CD-1 and chassis ground, pin 8 can be used as the sensor ground. A switch or relay contact to +12V can be connected to GPI1 and logged as a digital signal.
2. **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, GPIO2, or GPIO3 are 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.

1. **Digital data log mode.** This is the default for GPIO2 if no other mode is programmed. 0-12V digital off/on values are logged by the CD-1. The on threshold voltage for digital signals is approximately 2.5V and the input is tolerant of voltage levels up to 30V. A switch or relay contact to +12V can be connected to GPIO2 and logged as a digital signal.
2. **Vehicle speed input mode.** In this mode, the CD-1 will log speed data from a Hall Effect type vehicle speed sensor (VSS) with 0-5V signal levels. Many newer vehicles already have an appropriate VSS signal that can be directly connected to GPIO2. Most vehicles manufactured since 1981 will have a VSS. Older vehicles will require installation of a driveshaft sensor (refer to the CD-1 Tech FAQ on our website for 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.

- Digital data log mode.** This is the default for GPIO3 if no other mode is programmed. 0-12V digital off/on values are logged by the CD-1. The on threshold voltage for digital signals is approximately 2.5V and the input is tolerant of voltage levels up to 30V. A switch or relay contact to +12V can be connected to GPIO3 and logged as a digital signal.
- 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.
- 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) |
|--------------|--|

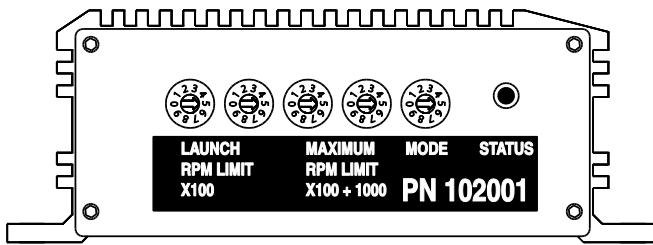
Mode Switch Settings

- | | |
|----------|--|
| 0 | 8 cylinder engine and normal operation |
| 1 | 6 cylinder engine and normal operation |
| 2 | 4 cylinder engine and normal operation |
| 3 | 8 cylinder engine and boost timing retard mode with 2 bar MAP sensor |
| 4 | 6 cylinder engine and boost timing retard mode with 2 bar MAP sensor |
| 5 | 4 cylinder engine and boost timing retard mode with 2 bar MAP sensor |
| 6 | 8 cylinder engine and boost timing retard mode with 3 bar MAP sensor |
| 7 | 6 cylinder engine and boost timing retard mode with 3 bar MAP sensor |
| 8 | 4 cylinder engine and boost timing retard mode with 3 bar MAP sensor |
| 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.

Boost timing retard (BTR) mode requires connection of a 2 bar or 3 bar MAP sensor and connection of the optional RTD-1 retard control to the GPI1 input (refer to Figure 4 and details on page 10). BTR mode allows easy setup of boost proportional retard without the use of the PC Link software to create a 3D timing table. The RTD-1 allows the user to dial in 0-3 degrees/psi boost retard with a 2 bar MAP sensor or 0-1.5 degrees/psi boost retard with a 3 bar MAP sensor. Mode switch settings 3-8 for BTR mode override and disable any 2D or 3D timing table settings made with the PC Link software. When BTR mode is selected, the automatic start retard feature (if enabled) remains operational. BTR mode also overrides any selection made in the PC Link software for GPI1. The RTD-1 generates a zero to +5V analog signal on GPI1. This analog data is logged by the CD-1 and available for display with the CD Log software. Zero volts corresponds to zero boost retard and +5V corresponds to full scale boost retard.

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.

CD-1 SOFTWARE OVERVIEW

The Windows software suite for the CD-1 system consists of the PC Link CD and CD Log programs. PC Link CD 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. CD Log software allows you to download data from the CD-1 module, open and save files to disk, display data on a chart, and print chart graphics. Chart display for downloaded data allows you to monitor vehicle operation on the track.

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.

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.

PC Link CD and CD Log software include print commands to print downloaded data. The programs have 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.

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.

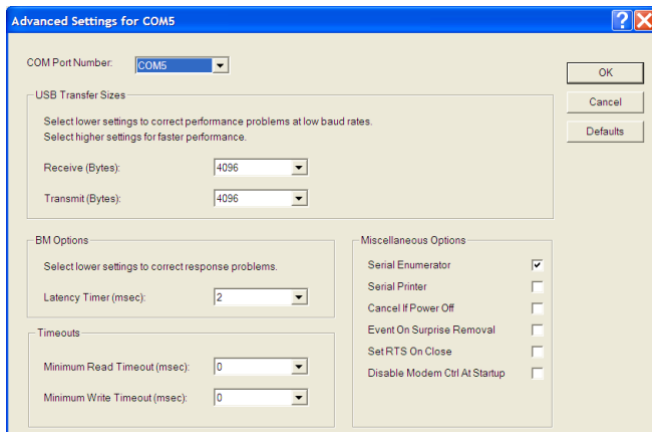
1. Make sure your USB interface is not connected to your PC. Please note that the USB interface does not need to be connected to the CD-1 during the USB installation process.
2. From the Daytona Sensors website go to the software download library located under the Tech Center tab. Scroll down and click 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. **Windows XP:** click Start, Settings, Control Panel, System, Hardware, and then Device Manager. **Windows Vista:** click Start, Control Panel, System and Maintenance, and then Device Manager. **Windows 7:** Click Start, Control Panel, System and Security, and then Device Manager. For more information, visit www.pcsupport.about.com.
2. Scroll down to Ports (COM and LPT). The new USB interface will appear as a USB Serial Port. Click on this new port. Click on the Port Settings tab.
3. 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.
4. 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.

Figure 12 – COM Port Configuration



SOFTWARE INSTALLATION

The software is supplied 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.

There are two programs to install: PC Link CD and CD Log. Start by installing PC Link CD. If you are downloading software from the web, only download and install one program at a time. 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 the setup.exe file downloaded from our website. InstallShield will install the software in an appropriate folder under Program Files.

Repeat the installation process for CD Log. Use the Windows Explorer or the Run command from the Windows Start Menu to launch 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 and CD Log will appear on the Windows Start Menu. You can then launch them just as you would any other Windows program.

The programs require 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 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 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 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.

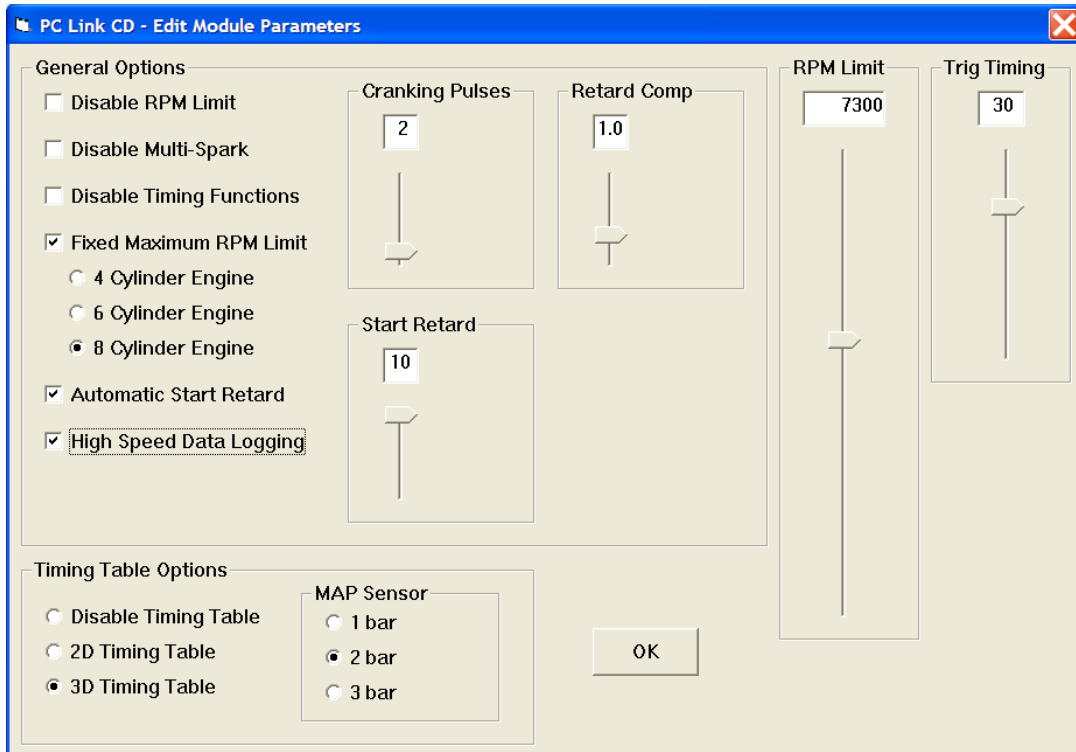
CD-1 units are shipped from the factory with default parameters and timing tables loaded into EEPROM memory. If you have never uploaded any custom setup file to EEPROM memory, these defaults are what you will see.

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 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.

High Speed Data Logging - selecting this option enables high speed data logging at 100 samples/second. High speed data logging is recommended for all drag race applications. If high speed data logging is not enabled, the default data logging rate is 10 samples/second.

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.

Note: mode switch settings 3-8 for boost timing retard (BTR) mode override and disable any 2D or 3D timing table selections (refer to the Module Switch Setting section on page 12 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).

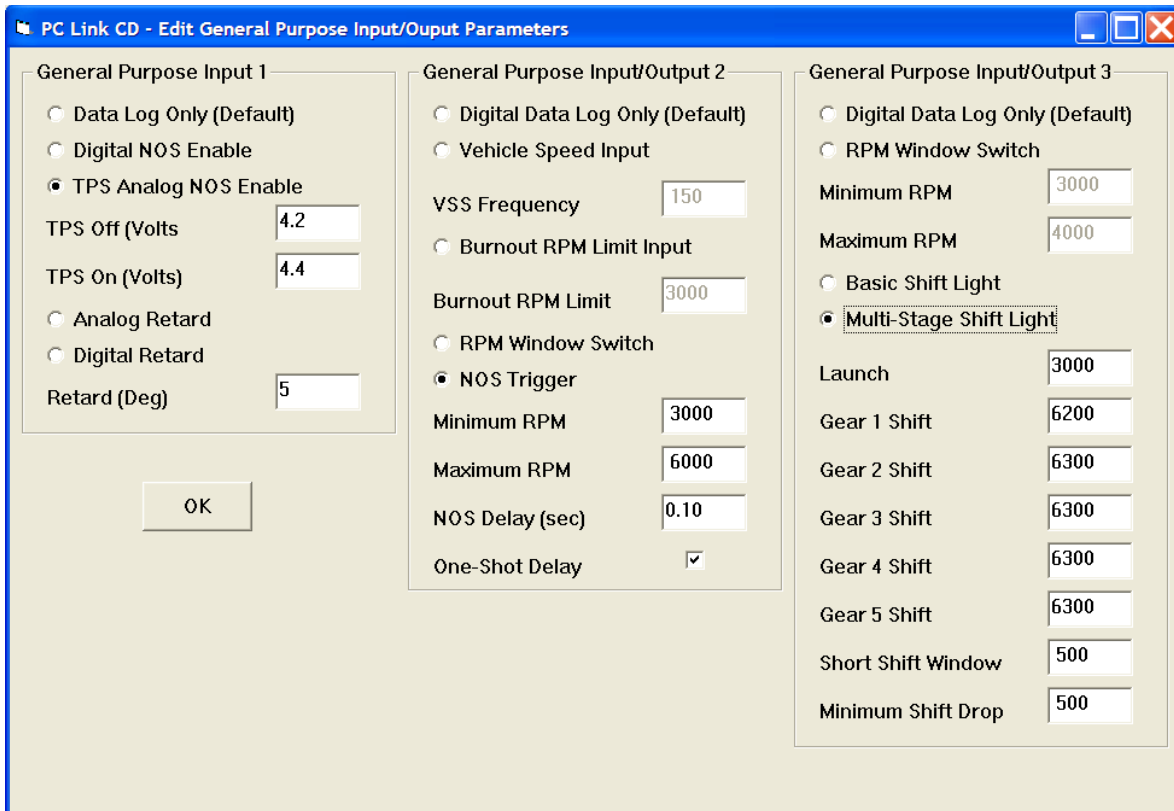
Timing table data "tracks" the trigger timing value. The table values always represent the actual engine timing that will result if the trigger system generates a pulse corresponding to the trigger timing value.

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 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 Deutsch connector pin 3. GPI1 has five modes:

Data Log Only - the system will log data on GPI1. You can log an analog signal from zero to +5V or a digital signal with zero and +12V levels.

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.

Analog Retard - refer to Figure 4 and page 10 for details. The optional RTD-1 retard control is connected to GPI1, the +5V reference supply on the Deutsch connector pin 10, and signal ground on the Deutsch

connector pin 9. The RTD-1 can be used to dial in a zero to 10 degree retard. Zero volts on GPI1 corresponds to zero retard and +5V corresponds to 10 degrees retard. This mode can be used as a driver adjustable timing function.

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.

Note: mode switch settings 3-8 for boost timing retard (BTR) mode override any selection for GPI1. In BTR mode, the GPI1 is used as an analog input for the optional RTD-1 retard control (refer to the Switch Setting section on page 12 for details).

General Purpose Input/Output 2 (GPIO2)

GPIO2 is on the Deutsch 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 five modes:

Data Log Only - the system will log data on GPIO2. You can log a digital signal with zero and +12V levels.

Vehicle Speed Input - refer to Figure 9 and page 11 for details. A Hall Effect type vehicle speed sensor (VSS) with 0-5V signal levels is connected to GPIO2. Many newer vehicles already have an appropriate VSS signal that can be directly connected to GPIO2. For correct data logging, the VSS frequency at 60 MPH must also be entered.

Establishing the correct VSS scale factor will require some trial and error. Start with the default setting. Log speed data while operating the vehicle at a known speed. Use CD Log software and download data to read the logged speed data. Use the following formula to calculate the correct scale factor:

$$\text{New VSS Freq} = \frac{\text{Original VSS Freq} \times \text{Speed Reading}}{\text{Actual Vehicle Speed}}$$

For example, if the original VSS frequency parameter was 145 Hz, the speed reading is 40 MPH and the actual vehicle speed is 50 MPH, then the new VSS frequency parameter should be:

$$116 \text{ Hz} = \frac{145 \text{ Hz} \times 40 \text{ MPH}}{50 \text{ MPH}}$$

You may have repeat this process several times for maximum accuracy.

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 Deutsch 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:

Data Log Only - the system will log data on GPIO3. You can log a digital signal with zero and +12V levels.

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.

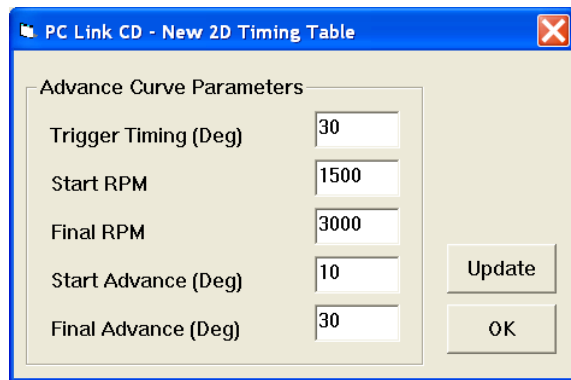
Multi-Stage Shift Light - the GPIO3 output can directly drive a LED type shift light. Refer to Figure 10 and page 11 for details. The GPIO3 output active will be active (switched to ground) and the shift light will come on whenever engine RPM exceeds the selected RPM value. Gear detection is based on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



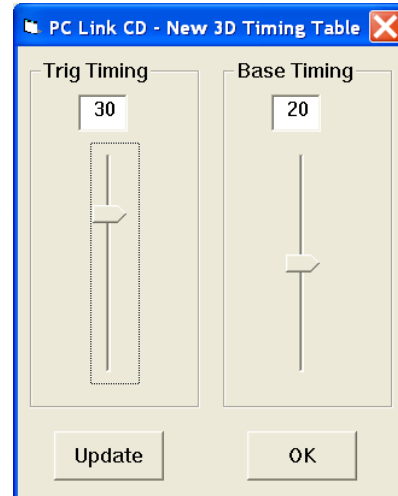
New 2D Timing Table

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

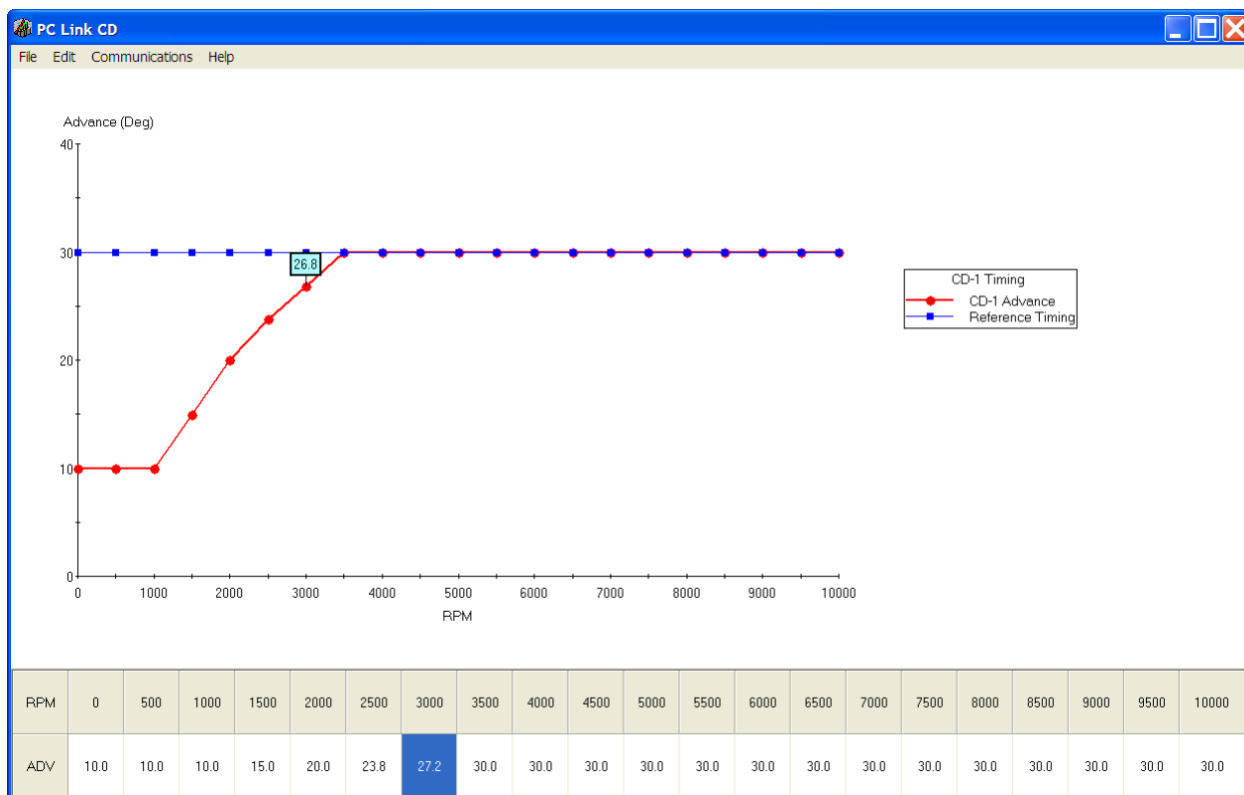
The table consists of 21 columns corresponding to 500 RPM increments from zero to 10,000 RPM. The 10,000 RPM timing value is used at all higher RPM levels.

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



PC Link CD 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.

3D Timing Table

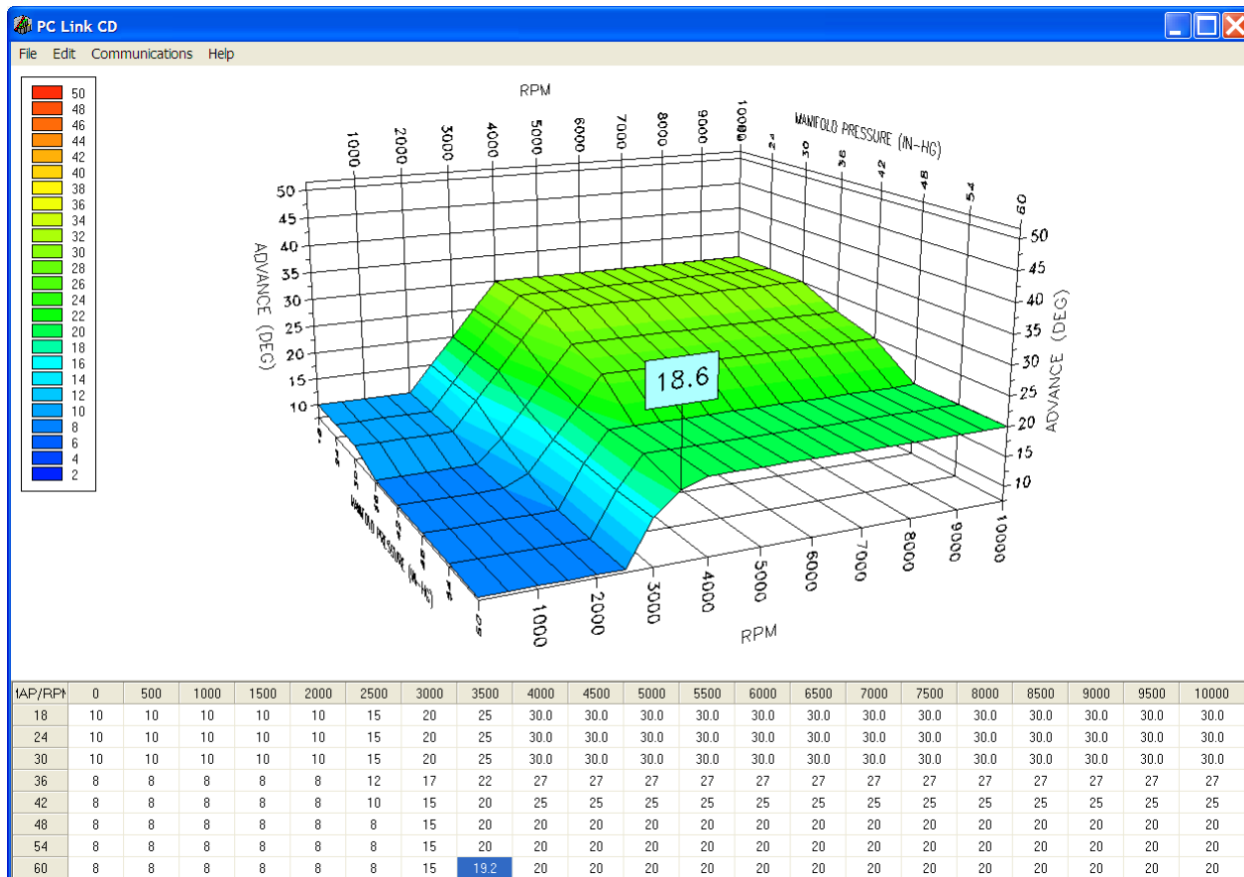
The 3D timing advance table consists of 21 columns corresponding to 500 RPM increments from zero to 10,000 RPM and 8 manifold pressure (MAP) rows. The MAP range depends on the type of MAP sensor selected under module parameters. The timing value at 10,000 RPM is used at all higher RPM levels and the 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

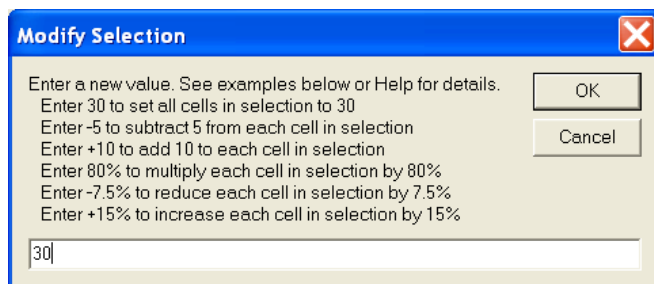


You can rotate the 3D chart display for a better view of a particular region by dragging the mouse while holding both mouse buttons down. PC Link CD is intended to be an open system and uses the Component One Chart 7.0 3D charting control. The adventurous user can experiment with the chart property pages 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.

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 program. In the PC Link CD 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 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 16 for details about USB interface cable hookup and COM port setup. Before uploading, make sure the parameters and timing tables are correct.

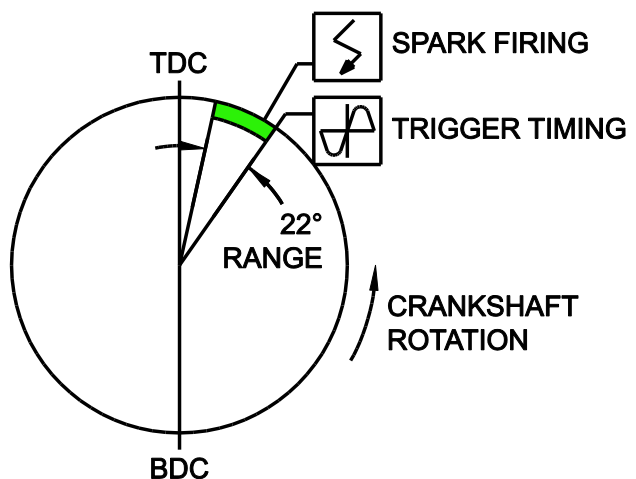
Upload data by using the Upload To EEPROM command on the Communications menu. A status message is displayed when the upload process has been successfully completed.

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).

The trigger timing value is also used by the CD Log data logging software to allow correct display of timing advance.

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 and data logging. 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 and data logging. Set the trigger timing value to correspond to the maximum advance generated by the ECM at high RPM.

CD LOG 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.

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.

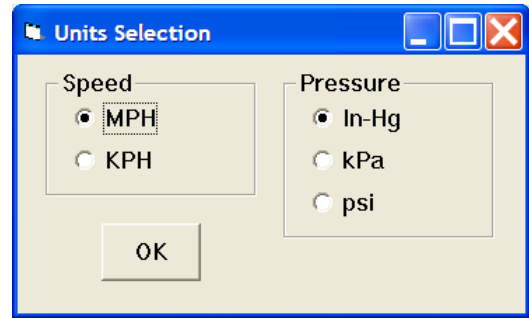
After CD Log is launched, the screen initially appears blank. You can use the Units Selection command from the Edit menu to select speed and pressure units if your CD-1 is configured to log this data, i.e. vehicle speed sensor and/or manifold absolute pressure (MAP) sensor connected. The program will remember your selections. You can display data logged by the unit on a chart recorder type screen. Data logged by the unit must be downloaded before it can be displayed, by using the Download Data command on the Communications menu. Once data has been downloaded, it is automatically displayed on a chart recorder type screen. You can save downloaded data by using the Save File command from the File menu. You can display a previously saved data file by first using the Open File command on the File menu and then using the View Chart command on the View menu.

A sample data file (CD1_Sample.log) is included in the program folder.

UNITS SELECTION

You can use the Units Selection command from the Edit menu to select speed and pressure units if your CD-1 is configured to log this data, i.e. vehicle speed sensor and/or manifold absolute pressure (MAP) sensor connected. The program will remember your selections. When you save downloaded data to a file, the units settings are saved along with the data. If you later open the file, the same units settings will remain in effect.

Figure 21 – Units Selection Dialog Box



DOWNLOADING DATA

Connect the USB interface. An adapter harness is supplied with the USB interface. Connect the 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 Data command on the Communications menu.

DATA LOGGING CHART DISPLAY

You can display data logged by the unit on a chart recorder type screen. Data logged by the unit must be downloaded before it can be displayed, by using the Download Data command on the Communications menu. Once data has been downloaded, it is automatically displayed. **The last data logged will appear at the right end of the chart.** You can save the data by using the Save File command from the File menu after closing the chart display (data is not lost by closing the chart display). You can display a previously saved data file by first using the Open File command on the File menu and then using the View Chart command on the View menu.

The data logging memory within the CD-1 stores the **last** 18000 data points at 10 samples/second (default sample rate) or 100 samples/second (if the

high speed data logging mode is selected by means of the PC Link CD software). This corresponds to 5 hours of data at 10 samples/second or 30 minutes of data at 100 samples/sec. When you use the Download Data command on the Communications menu, one of the popup menus shown below will appear based on the sampling rate you have configured. You can select the length of the data set that will be downloaded.

Figure 22 – Download Options Dialog Box (CD-1 Configured for 10 Samples/Second)

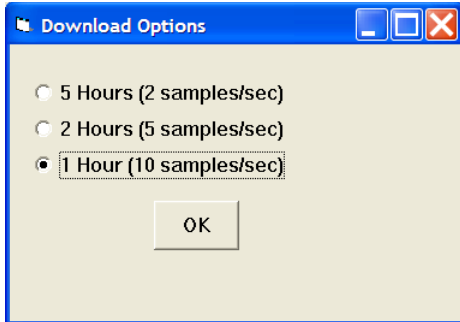
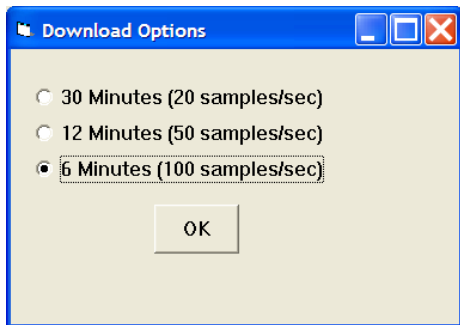


Figure 23 – Download Options Dialog Box (CD-1 Configured for 100 Samples/Second)



Note that CD-1 data files use a .log extension. You should create a separate folder to store these files. A sample data file (Sample.log) is included in the program folder.

You have a range of capabilities for analyzing downloaded data displayed in the chart recorder format.

You can select two parameters for display. Trace 1 is displayed in red with its Y axis legends on the left side of the chart. Trace 2 is displayed in green with its Y axis legends on the right side of the chart. The X axis is always elapsed time. You can zoom in, zoom out, or zoom all (displays entire data file). At the maximum zoom in level, approximately 100 data samples will be displayed on the chart. You can use the scroll bar to move the chart display window in

terms of elapsed time. If you hold the left mouse button down within the chart area, a cursor line appears. The exact values of the parameters displayed on trace 1 and trace 2 and the elapsed time appear in windows above the chart. When you zoom in or zoom out, the displayed data will always be centered about the cursor line. This allows you to quickly select and closely examine an area of interest. If you want to analyze the elapsed time between two events (for example the time required to accelerate from 0 to 60 MPH), you can move the cursor to the first event and then click on the Reset Time Display button. You can print the displayed chart to any Windows printer by clicking on the Print button (a color inkjet printer is recommended for best results). Data parameters include:

RPM – engine crankshaft RPM

TIMING – ignition advance in degrees BTDC

MAP – manifold pressure in In-Hg, kilopascals (kPa), or psi (29.92 In-Hg, 101.3 kPa, or 14.696 psi corresponds to sea level atmospheric pressure). If a MAP sensor is not connected, the MAP value corresponding to zero sensor volts will be displayed. The CD-1 supports standard Delphi 1 bar, 2 bar, and 3 bar MAP sensor as configured with the PC Link CD software.

VSS – vehicle speed in MPH or KPH. If a vehicle speed sensor is not connected, a zero value will be displayed.

BAT – battery voltage

GPI1 ANALOG – zero to +5V analog input voltage on the GPI1 input (Deutsch connector pin 3)

LAUNCH – input level on Deutsch connector pin 2 displayed as a digital (on/off) signal

GPI1 DIGITAL – input level on the GPI1 terminal displayed as a digital (on/off) signal. On means that the GPIO is terminal is at +12V

GPIO2, GPIO3 – these terminals (GPIO2 on Deutsch connector pin 4 and GPIO3 on pin 5) can be configured as inputs or outputs for various functions with the PC Link CD software. When configured as an input, the level is displayed as a digital (on/off) signal. On means that the GPIO terminal is at +12V. When configured as output, the status is also displayed as a digital (on/off) signal. On means that the GPIO terminal is switched to ground. This is referred to as an active low output

The maximum RPM and VSS values displayed on the chart can be set by means of commands on the Chart Display Edit Menu. **Caution: If these maximum values are set lower than the actual logged data, the chart cursor function will not update the display correctly.**

Additional data is displayed at the lower right side of the screen. This data includes:

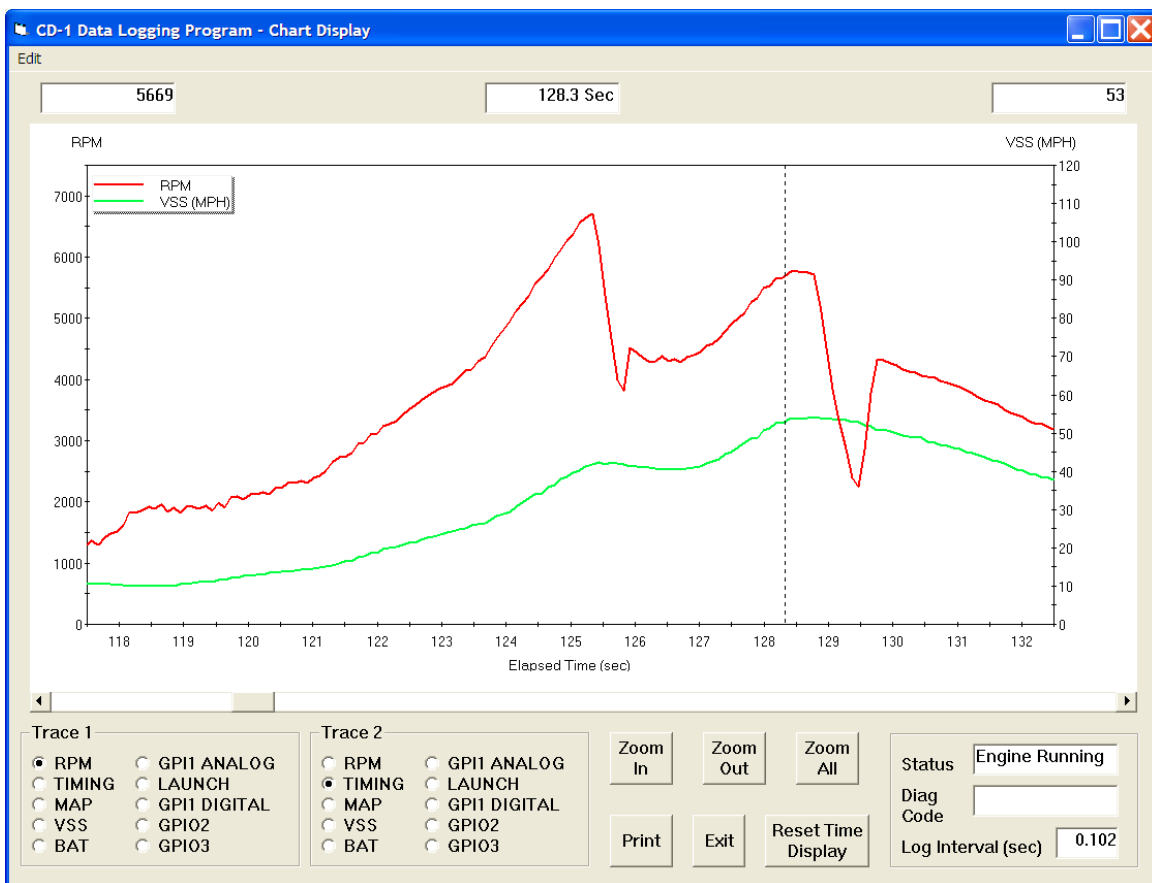
Status - displays CD-1 status

Diagnostic Code – normally blank unless a diagnostic code is set.

Log Interval – the actual data logging interval in seconds

You can clear the data within the unit by using the Clear CD-1 Data Buffer command from the Communications menu. If you change the data logging mode with the PC Link CD software, you should also clear the data buffer within the unit.

Figure 24 – Data Logging Chart Display



IMPORTING DATA INTO EXCEL

Data files saved from CD Log are in comma delimited ASCII format. Note that VSS data is scaled in MPH units and MAP data is scaled in In-Hg units. You can easily import a data file into other programs such as Microsoft Excel for further analysis. You can also view data files with a text editor such as Windows WordPad. To import a data file into Excel:

1. Start Excel. In the File Open dialog box, select Files of type: All Files (*.*). Then browse for the data file.
2. The Text Import Wizard appears. For step 1, select delimited file type. For step 2, select comma delimiter. For step 3, select general column data format. Then click on Finish.
3. You can then format the data and save the spreadsheet as an Excel file.

APPENDIX – RECOMMENDED PARTS AND SUPPLIERS

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

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)

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