FireBall™

INSTALLATION INSTRUCTIONS for HI-4TC PERFORMANCE MOTORCYCLE IGNITION

Part Number 8-3150

CAUTION: READ INSTRUCTIONS CAREFULLY BEFORE STARTING INSTALLATION

INTRODUCTION

The HI-4TC is intended only for 1999 and 2000 Harley-Davidson® carbureted models with the new Twin Cam 88™ engine. The HI-4TC mounts in place of the original equipment (OE) module and offers easy plug-in installation without requiring removal or modification of any sensors. Features include:

- **Switch selectable multi-spark mode.** Crane's exclusive *FIRE* (Fast Inductive Restrike) generates up to nine sparks at idle and three sparks up to 6,000 RPM. Reduces lean surge and plug fouling.
- **Digitally set rev limiter** adjustable from 1,500 to 9,900 RPM in 100 RPM increments via two rotary switches. Sequence type rev limiter equalizes cylinder firing at the rev limit and reduces "popping and banging."
- **Adjustable initial timing.** The new Twin Cam 88™ engine has a fixed crankshaft position sensor and lacks any mechanical means of adjusting initial timing. The HI-4TC overcomes this limitation and offers an initial timing adjustment range of -5 degrees (retard) to +4 degrees (advance) by means of a rotary switch.
- **Adjustable advance slope.** A rotary switch with ten steps allows quick fine tuning of the advance slope to accommodate applications ranging from a stock engine to full race modifications including high compression heads. Note that the HI-4TC supports a three dimensional advance surface based on RPM and manifold pressure.
- **Rear cylinder timing offset** digitally set from -5 to +4 degrees via a rotary switch. Optimizing rear cylinder timing can increase performance when dyno tuning.
- **Data link to a laptop PC RS-232 serial port.** Using a optional Crane cable that plugs into the OE data link connector and Crane software (available late 2000), sophisticated users can program custom advance tables into the HI-4TC EEPROM memory. The data link also allows logging and graphical analysis of engine data including RPM, MAP sensor output, battery voltage, and ignition timing.

Figure 1. HI-4TC Connectors

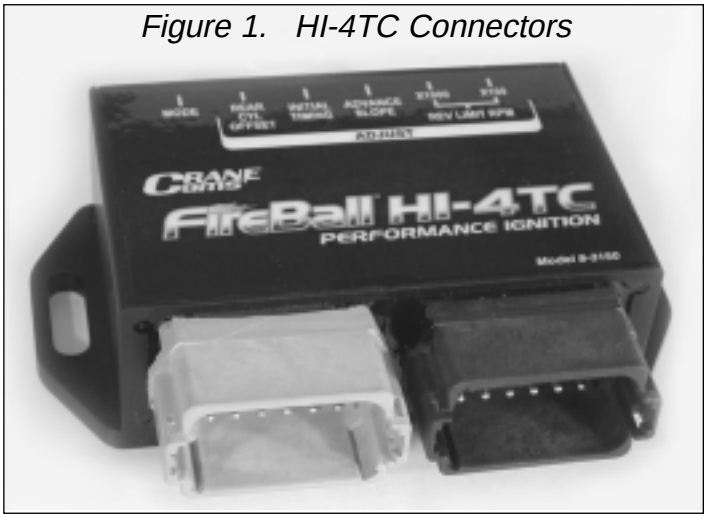
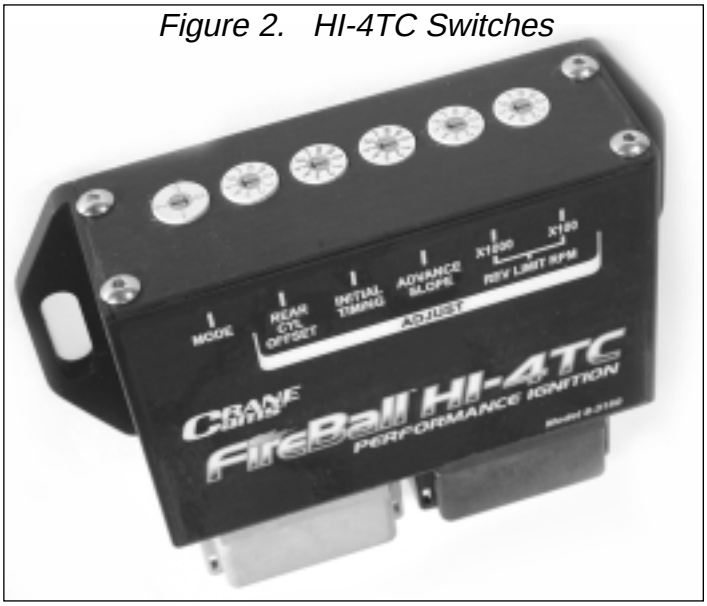


Figure 2. HI-4TC Switches



COIL AND SPARK PLUG CABLE CONSIDERATIONS

The HI-4TC must be used with a low primary resistance (less than 1 ohm) coil specifically intended for the Twin Cam 88™ engine. The unit is optimized for use with the OE coil.

Crane FireWire spiral core spark plug wires or equivalent suppression wires are recommended for best performance. **Do not use non-suppression solid core spark plug wires**; they may cause interference with your ignition system and accessories. Use resistor (suppression type) spark plugs. Non-resistor spark plugs will cause interference with the computer in the HI-4TC. Note that the H-D® OE plugs are resistor type.

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INSTALLATION

WARNING: Disconnect the battery ground cable before starting on the installation.

1. Turn ignition switch off and disconnect battery ground cable.
2. Locate the original equipment (OE) ignition module. The OE ignition module is usually located under the seat or under a side cover. If you have difficulty locating the OE module, you need to refer to the service manual for your model.
2. Unplug the OE module and remove the two mounting bolts. You can use a small flat screwdriver to press on the locking tabs in order to release the connectors.
3. The HI-4TC module is installed in the original location using the original mounting bolts. Depending on the location, you may not be able to access all the switches. In this case, skip ahead to the next section and make the appropriate switch settings before continuing the installation.
4. Connect the black and gray harness plugs to the HI-4TC. If you plan to do tuning or comparison tests that will require repeated removal of the unit, you may want to cut off the inner locking tabs on both connectors.
5. Check switch settings. Make sure you select reasonable values. Note that the engine will not run if you set the RPM limiter to 00 or some other value below 1,500 RPM.
6. Reinstall any hardware that you removed to access the ignition module.

SETUP AND OPERATION

1. **Mode switch**. This switch selects the advance tables and spark mode as follows:

   0 Single spark mode using primary advance tables stored in FLASH (read-only) memory

   1 Multi-spark mode using primary advance tables stored in FLASH (read-only) memory

   2 Single spark mode using alternate advance tables stored in EEPROM (user reprogrammable) memory

   3 Multi-spark mode using alternate advance tables stored in EEPROM (user reprogrammable) memory.

   As shipped from Crane, the primary advance tables stored in FLASH memory is identical to the alternate advance tables stored in EEPROM memory. Engine builders can use the optional RS-232 cable and software for programming custom advance tables that are stored in EEPROM memory. The primary tables stored in FLASH memory always remain the same as shown in Figures 3-4.

   Use multi-spark mode (switch settings 1 or 3) for optimum performance. Note that engines with very lean carburetor jetting may exhibit excessive spark knock in multi-spark mode and require selection of single spark mode. This is the result of faster flame front growth and propagation when multi-spark mode is selected.

2. **Initial timing adjustment**. Use the baseline initial timing (switch setting 0) unless you have a specific reason to change it.

3. **Advance slope**. Figure 3 shows the advance corresponding to switch setting 0 (minimum advance). Figure 4 shows the advance corresponding to switch setting 9 (maximum advance). Each figure shows the advance table represented as a three dimensional surface, where ignition advance is a function of engine RPM and manifold vacuum. Advance slope switch settings between 0 and 9 interpolate between the minimum and maximum advance tables. Higher switch settings result in a more aggressive slope above idle and more advance at high RPM. Switch setting 5 results in advance values very close to the OE module.

   Stock and modified engines (mild cam, low restriction air cleaner, and aftermarket exhaust) may benefit from a more aggressive advance slope if 93 or higher octane gasoline is used. Race engines with high compression may require a less aggressive advance slope to eliminate spark knock. Note that the initial timing adjustment shifts the entire advance tables up or down. For example, if knock occurs only at low RPM, you could reduce the initial timing but maintain a relatively aggressive advance slope for maximum power at midrange and high RPM.

   Used together, the initial timing and advance slope adjustments provide a high degree a flexibility for fine tuning a particular engine setup. As a general rule of thumb, use the highest settings possible without audible spark knock.

4. **Rear cylinder timing offset.** This feature allows slight offset of rear cylinder timing for critical race applications and dyno tuning. The offset range is -5 to +4 degrees. Use zero rear cylinder offset (switch setting 0) unless you have a specific reason to change it.

5. **RPM limiter**. Two rotary switches are used to digitally set the RPM limit from 1,500 to 9,900 RPM in 100 RPM increments. Settings are X100 engine RPM (i.e. 59 = 5,900 RPM. Select a safe RPM limit that is less than the red line for your engine. Most H-D® engines with OE valvetrain parts should not be revved over 5,600 RPM.

DIAGNOSTICS

The HI-4TC does not support diagnostics via the OE data link. Scan tools intended for use with the OE module cannot be used with the HI-4TC.

The HI-4TC provides diagnostics by means of the check engine LED on the instrument cluster. When the ignition switch is turned on, the LED illuminates. The LED will remain illuminated until the engine is started. If the HI-4TC diagnostic routines detect a fault, the LED will blink a num-

Figure 3. 3-D Graph Representing HI-4TC Minimum Advance Table

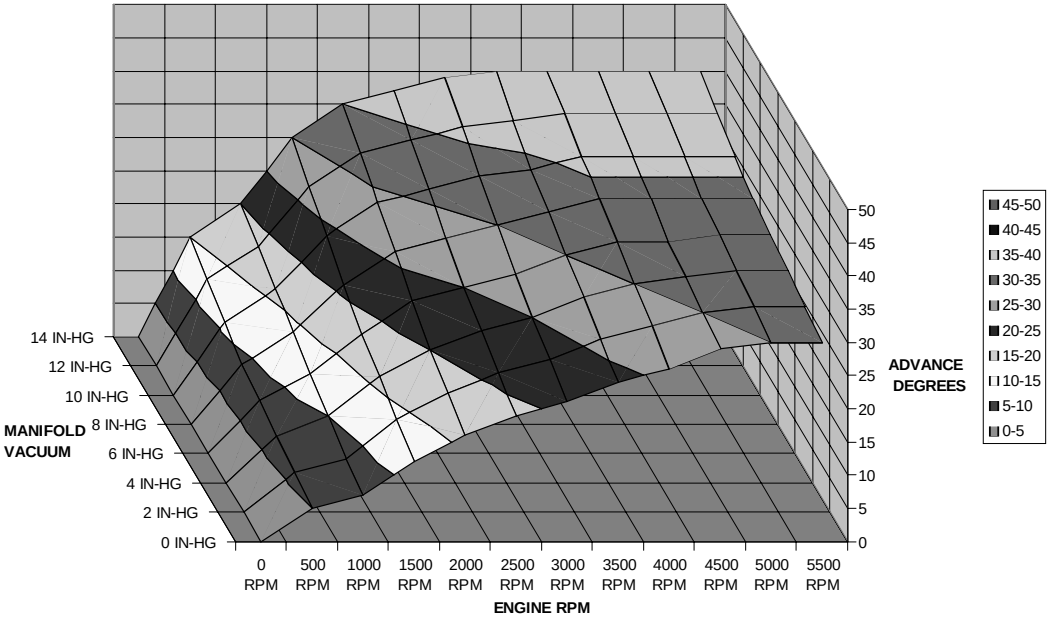

Figure 4. 3-D Graph Representing HI-4TC Maximum Advance Table

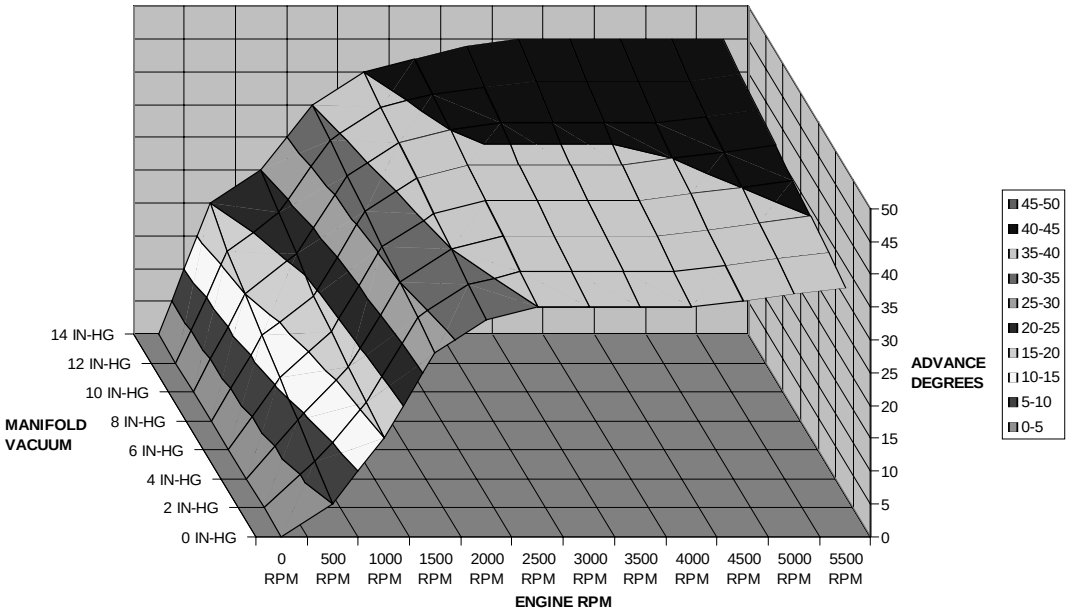

Figure 5. HI-4TC Advance Tables

MINIMUM ADVANCE TABLE (DEGREES)

	0 RPM	500 RPM	1000 RPM	1500 RPM	2000 RPM	2500 RPM	3000 RPM	3500 RPM	4000 RPM	4500 RPM	5000 RPM	5500 RPM	6000 RPM	6500 RPM	7000 RPM	7500 RPM
0 IN-HG	0	5	7	12	16	19	21	24	26	29	30	30	30	30	30	30
2 IN-HG	0	6	8	14	18	21	23	26	28	30	31	31	31	31	31	31
4 IN-HG	0	7	10	16	20	23	25	28	30	31	32	32	32	32	32	32
6 IN-HG	0	8	12	18	23	25	27	30	32	32	33	33	33	33	33	33
8 IN-HG	0	9	14	21	26	28	30	32	34	34	34	34	34	34	34	34
10 IN-HG	0	11	16	24	29	31	33	34	36	36	36	36	36	36	36	36
12 IN-HG	0	13	18	27	32	34	36	37	38	38	38	38	38	38	38	38
14 IN-HG	0	15	20	30	35	37	39	40	40	40	40	40	40	40	40	40

MAXIMUM ADVANCE TABLE (DEGREES)

	0 RPM	500 RPM	1000 RPM	1500 RPM	2000 RPM	2500 RPM	3000 RPM	3500 RPM	4000 RPM	4500 RPM	5000 RPM	5500 RPM	6000 RPM	6500 RPM	7000 RPM	7500 RPM
0 IN-HG	0	5	15	28	33	35	35	35	35	36	37	38	38	38	38	38
2 IN-HG	0	7	16	29	34	36	36	36	36	37	38	39	39	39	39	39
4 IN-HG	0	9	17	30	35	37	37	37	37	38	39	40	40	40	40	40
6 IN-HG	0	11	18	31	36	38	38	38	38	39	40	41	41	41	41	41
8 IN-HG	0	13	19	32	37	39	39	39	39	40	41	42	42	42	42	42
10 IN-HG	0	15	21	33	38	40	41	41	41	41	42	43	43	43	43	43
12 IN-HG	0	17	23	34	39	41	42	43	43	43	43	44	44	44	44	44
14 IN-HG	0	20	25	35	40	42	44	45	45	45	45	45	45	45	45	45

ber of times followed by a 2 second pause. The number of blinks indicates the fault condition.

1 Blink: Crankshaft position sensor (CKP) signal lost. This indicates failure of the CKP sensor or a faulty connection in the wire harness to the sensor.

2 Blinks: Camshaft position sensor (CMP) signal lost. This indicates failure of the CMP sensor or a faulty connection in the wire harness to the sensor.

3 Blinks: Manifold pressure sensor (MAP) signal out of range. This indicates failure of the MAP sensor or a faulty connection in the wire harness to the sensor. A vacuum leak or loose sensor will also cause this fault.

4 Blinks: Low battery voltage. This condition may be caused by an alternator, regulator, or battery failure or an excessive electrical load (too many lights or accessories). If this fault occurs immediately after cranking, the battery may be discharged.

5 Blinks: High battery voltage. This condition may be caused by a regulator or battery failure or loose connections in the wiring harness to the battery.

6 Blinks: Bank sensor tipped. The bank sensor is indicating a 'tipped over" condition. This may be caused by a loose bank sensor or bank sensor failure.

7 Blinks: EEPROM checksum failure. Data stored in EEPROM has been corrupted. This condition may be caused by a failure within the HI-4TC or improper programming via the data link.

TROUBLESHOOTING

Did the engine run properly before installation of the HI-4TC? If not, remove the HI-4TC, reinstall the OE ignition or another known good unit and then find and correct the original problem. Did the HI-4TC function correctly before the problem occurred? If the answer is yes, did you change anything that may have affected it? Try going back to the last setup that worked OK to help isolate the problem.

If the engine will not start, or runs rough or intermittently, use the following checklist steps:

ENGINE WILL NOT START

Verify that the check engine LED on the instrument cluster lights up when the ignition key is first turned on. If not, check battery voltage and 30 amp circuit breaker. Low voltage may result from a faulty or marginal charging system or battery.

The check engine LED should go out while the engine is cranking. If the LED stays on, the crankshaft position sensor (CKP) may be defective.

If the check engine light goes out while the engine is cranking, but the engine will not start, the ignition coil or coil harness may be defective.

Check switch settings. Make sure you select reasonable values. Note that the engine will not run if you set the RPM limiter to 00 or some other value below 1,500 RPM.

CHECKING FOR SPARK

To crank the engine and check for spark, use a KD Tools test plug or H-D tool HD-26792. These test plugs come with an alligator clip that must be attached to frame or engine ground. Use a length of spark plug wire to connect the test plug to the coil.

MISFIRE OR INTERMITTENT OPERATION

Field experience has shown that popping back through the carburetor, misfiring, and intermittent failure (especially after the engine gets hot) are usually not caused by electrical problems with the ignition module. Carburetor problems, fouled spark plugs, coil failure, and loose wire harness connections are the most common culprits. Verify use of spiral core or suppression type spark plug wires and resistor spark plugs.

TACH INOPERATIVE

The tach signal is generated by the ignition module on all Twin Cam 88™ equipped motorcycles (unlike older models where the tach signal was taken from the Coil- terminal). The HI-4TC generates a 12 volt square wave tach signal identical to the OE module. If the OE tach is inoperative, consult the service manual. If you plan to install an aftermarket tach, make sure that it is specifically intended for Twin Cam 88™ applications.