M&H ELECTRIC FABRICATORS, INC.
AUTOMOTIVE WIRING SYSTEMS

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TRANSISTOR IGNITION PERFORMANCE MODULE

NEWLY REVISED PRINTED CIRCUIT BOARD DESIGN USING THE LATEST AUTOMATED ASSEMBLY AND SURFACE MOUNT COMPONENTS FOR A ROHS (RESTRICTION OF HAZARDOUS SUBSTANCES) COMPLIANT ECO-FRIENDLY MODULE. THEY ARE FULLY DESIGNED, MANUAFACTURED AND 100% CIRCUIT TESTED IN THE USA. TECHNICAL SUPPORT IS AVAILABLE DURING OUR NORMAL BUISNESS HOURS FOR HELP WITH ANY INSTALLATION QUESTIONS @ (562)-926-9552.

When originally produced by GM, there were four Transistor Ignition Pulse Amplifiers. Internally, the printed circuit board components, connections and layouts were all the same regardless of the part number. The main difference between the amplifiers was external and determined by whether the amplifier included an integral wiring harness which extended out of the housing or accepted a harness that would plug directly in to the amplifier connection mounted on the housing.

The TI Plus Performance Module is a drop-in replacement and upgrade for the electronics used in the original TI Ignition Pulse Amplifier. This easily installed Module fits completely inside the stock housing and does not require any changes to the wiring or the amplifier. The result is an ***"eco-friendly state of the art ignition technology with an absolutely stock appearance"***. Here are some of the advantages of this module:

Higher Output Voltage - Generates twice the coil primary voltage of the stock unit for up to 10% more available secondary voltage with the factory T.I. coil. Also provides satisfactory performance when used with point type coils or after market performance coils.

Output Protection - Output protection against failure caused by broken or disconnected spark plug wires. The original unit does not provide this protection which caused many to fail.

Temperature - Extended operating temperature range over 300 degrees Fahrenheit, whereas the stock unit has 160 degrees Fahrenheit limit.

Improved Triggering – Eliminates false triggering due to RF signals affecting factory TI amplifiers typically seen in the engine compartment.

Construction - Premium quality components housed in a CNC machined aluminum shell and potted with a thermally conductive epoxy for superior heat dissipation and outstanding resistance to vibration, moisture and corrosion. Circuit components are unaffected by harsh environments typically seen in the engine compartment.

ONE YEAR LIMITED WARRANTY

M&H Electric Fabricators, Inc. will repair or replace the enclosed transistor ignition module in the event of a manufacturing defect for one (1) year after the date of original purchase. Warranty service can be obtained during the warranty period by bringing or mailing your T.I. Module to us.

This warranty does not cover the postage, freight or delivery fee for sending your Transistor Ignition Module to and from our service facility. A purchase receipt or other proof of original end user purchase will be required before warranty service can be rendered. This warranty covers normal consumer use and does not cover damage which occurs in shipment or failure which results from alteration, accident, misuse, abuse, neglect, improper installation or maintenance. Under any circumstances, the liability of the manufacturer shall be limited to the original cost of the transistor ignition module paid by the end user, and the manufacturer shall not be liable for any consequential or incidental damages which occur as a result of the use of any of our transistor ignition modules. This limit on liability may vary in your state, and you may have additional rights and/or remedies depending on the state in which you live.

ATTENTION

The enclosed Transistor Ignition Performance Module is warranted to fit the specific original equipment amplifiers identified in the enclosed instructions. Do not alter or modify the unit without consulting the manufacturer. If the Transistor Ignition Performance Module is altered in any way, all the enclosed stated warranties will be voided.

INSTALLATION INSTRUCTIONS

******Read and understand the installation instructions before you begin******

It should be noted before installation that the TI Plus Performance Module, like any good aftermarket ignition system, requires clean high-quality grounds and power connections to ensure correct, enhanced performance and reliability far more than factory original TI system boards. If the wiring harnesses, battery cables and battery or posts, ignition switch or alternator and voltage regulator are past their useful life or marginal, they should be replaced in advance to ensure excellent system performance.
The TI Plus Performance Module represents a significant advance in performance and reliability from the original factory TI ignition system and should be treated as such when installing.

1. If you received a damaged part due to shipping mishandling, STOP and notify the shipping carrier immediately. Do not return the Transistor Ignition Module to us until your claim has been resolved with the carrier. If the unit arrived intact, proceed with the installation.

2. Disconnect battery ground cable before working on the system. It may be necessary to reconnect battery ground cable for certain diagnostic procedures and is left to the installer's discretion. Remove the amplifier and turn it around to the back cover. Remove the six (6) screws holding on the back cover to the Amplifier housing and carefully lift it off, exposing the internal circuit board (Figure #1). Use caution to avoid damaging the gasket on the underside of the cover.

3. Remove the three (3) screws (indicated in Figure #1 by A*, B*, C*) holding down the existing circuit board. Remove the three (3) wires and terminals from the circuit board. Remove the old circuit board from the amplifier housing and small transistor located in a recessed hole in the housing near screw hole "C" in Figure #1. Also remove the small divider plate located in the recessed hole were the transistor was removed. Make sure the inside of the Amplifier housing is clean, free of dirt, grease, or obstructions such as casting flash that interferes with the new module installation. If the internal surface of the housing is corroded, it is advisable that the inside of the housing be glass beaded.

WARNING

It is very important that the new transistor ignition module makes complete unobstructed contact with the bottom of the Amplifier housing as it is both a heat sink and an electrical ground for the module. Using dielectric or other types of grease on module terminals or in between the module and amplifier house will result in poor electrical ground.

4. Place the new module in the amplifier housing, line up the three (3) holes (indicated in Figure #1 by A*, B*, C*), and secure in place with the same three screws that held the old circuit board.

******ATTENTION******

We must emphasize: poor or missing grounds will cause serious problems with the module's performance such as intermittent or missing spark and many other conditions. When installing the module, the three-original hold down screws securing the module to the amplifier housing must use serrated type lock washers that bite into the aluminum module housing to insure a solid ground. If these washers are badly flattened, corroded, or missing, install new ones from a local hardware supplier.

5. Using the original Amplifier's GM part number stamped on the bolt boss and the color coded descriptions on the enclosed diagrams, install the appropriate color wires to the new module blade terminals. Pay close attention to the female terminals crimped to the wire ends on the amplifier pigtail side to insure if the pigtail is an older or original one, the connections to the male blades are clean and strong. Keep in mind if the part number is not stamped on one of the mounting bolt bosses, it has probably been replaced with a service part at some point.

If your wires have different colors, not listed on the charts, or if you have any questions, please contact our technical support before proceeding. It is important that you connect the proper color wire to the appropriate male terminal as specified on the following page to avoid damaging the module or other ignition components and void your warranty.

On late production original equipment 1968 Corvette amplifiers with external wiring harness (stamped 1115343), you must check wire positions on the molded connector at the end of the pigtail opposite the module side of the amplifier wiring to verify that the black and pink wires occupy the same position as on the mating connector from the T.I. harness. This may require an ohm meter / continuity tester. The molded connector on this later designed harness is difficult to establish terminal index positions to wire exit position at the rear of the molded connector. Our technical support team have documented original type late production 1968 Corvettes with the black and pink wires reversed in the molded connection side of the harness. It's rare but has happened. If you have one of these cars and are not sure, please contact our technical support for help.

Do not bend the male blades on the Module when attaching the wires. If the male terminals are bent, they will snap off easily or partially fracture. In some cases, it may be necessary to loosen the external harness oval shaped metal retainer and reposition the pass thru grommet / molded connector mounted to the amplifier housing for the incoming wires to reach the male blades. See the enclosed diagrams for grommet or molded connector position references specified on GM assembly drawings to insure proper orientation to the amplifier housing. Also reference section 7 below for help with sealing of the grommet / molded connection to the amplifier.

When plugging the 3 wires with the 90-degree terminals onto the new module using the illustrations and part number cross reference listed on page 4, please make sure there are clean and tight connection between the male blades and the female terminals on the original wires. If your original terminals are corroded or damaged, they must be replaced with a commercially available 90-degree type female terminal designed to plug into a .187 wide x .020 thick male blade. If these 3 connections to the module are not tight and maintain good engagement force when reinstalled, you will experience significant voltage drops to the module causing erratic operation.

Note: It is highly recommended that the wiring harness to the module side be replaced with a new reproduction harness using the correct 90-degree type .188 series female terminals designed for .020 thick male blades especially if your amplifier harness is original or very old. This is the second most frequent technical problem reported besides poor or missing grounds.

WARNING

Do Not Attempt to Solder Wires Directly to the Male Blades on the Module if terminals are bent or cracks and creases are visible on the male blades. By soldering wires to damaged module blades,

you will heat the terminals sufficiently enough to melt the solder on the circuit board underneath the epoxy damaging or shorting the module, and potentially shorting the ignition coil, wiring harnesses or distributor pole piece assembly.

6. After you have installed the wires from your Amplifier housing into the new Module, verify that the terminals do not short against the back cover and cause damage to the module or other ignition components on your system. Note: the OEM or reproduction harnesses **WILL** clear the back cover as designed originally.

7. Re-install the back cover and gasket, applying a small amount of grease on each side of the gasket to provide a waterproof seal. We recommend a marine grade water resistant high temperature style grease be used for extremely long life of the gasket.

If the grommet / molded connection on the wiring has been separated from the amplifier housing or was replaced with a new wiring harness, apply grease to the outer surface of the grommet / molded connection to reseal against the amplifier housing. Tighten the oval flange and check that the grommet / molded connection does not rotate or allow moisture inside the housing. See correct rotation diagram for the proper alignment of wire colors inside the amplifier to insure they reach the male blades.

If the gasket on the back cover or the grommet / connection for the wiring on the amplifier housing does not seal or is compromised during removal, moisture will enter the housing. A tiny amount of moisture in an enclosed environment such as this will substantially corrode the connections, including the ground between the amplifier and the module surfaces over a very short period of time which in turn, module performance will be drastically affected.

8. Install the assembled amplifier back into the vehicle, make sure the housing is properly grounded using the ground wires from the transistor ignition harness. Also, verify other connections to the transistor ignition harness are connected (like: coil, distributor, and ignition switch per your specific application). Read the warnings listed below before starting the vehicle, then proceed to the next step.

WARNING

If you are installing the module in a Corvette, keep in mind that the engine, frame, radiator core support, and transmission are rubber mounted and insulated from chassis grounds. Typically, battery ground is connected to the engine block, cylinder head or brackets used in, or attached to, the alternator or water pump. Ensure that all the original ground straps (from the engine to the frame and the frame to radiator core support, etc.) where applicable, have their ring or spade terminals installed directly over unpainted metal.

Check the cleanliness of the surface area on the amplifier housing bolt boss where the ground wire from the harness is attached to (typically, the radiator core support).

WARNING

Verify that your Transistor Ignition wiring harness has not been altered or modified in any way. Pay close attention to the 2 white cloth-coated 12 gauge resistance wires that are present in factory original and reproduction wiring harnesses (one to the coil & the other to the pink wire from the ignition switch). Refer to the factory assembly manuals in the RPO K66 section for the correct wiring harness installation, routing and wire orientation procedures. If these 2 resistance wires have been cut, spliced or altered in any way or the harness appears to contain modifications, the voltage supply to the module may be increased beyond specifications. This may damage the final output transistor in the module or other ignition components in the system as well as void your warranty.

In the event that there is damage to any of the Transistor Ignition Harnesses or ground straps, M&H Electric Fabricators, Inc. manufactures and stocks a complete inventory of replacement Transistor Ignition wiring Harnesses, ground strap kits, battery cables, various switches and electrical assemblies for your classic car. Contact us for further information concerning replacement harnesses or for an authorized dealer near you.

9. Before attempting to crank the engine, check that the battery is connected properly and is fully charged as battery condition and voltage affects the performance of the TI module. Start the car with your new TI performance module installed, you should be prepared to check or reset ignition timing and check distributor advance (timing light with advance capability would be required) as needed. Ignition timing and distributor advance should be set to factory model specifications and the spark plug gap will also remain the same. Replacing an original TI system circuit board with the TI performance module should not alter any existing timing, distributor advance, etc. However, as previously stated should be checked for best possible performance.

When replacing any other TI system ignition components such as spark plugs and wires, distributor cap and rotor, ignition coils, etc. continue to use all factory specified components for the TI system or equivalent.

If ignition timing will be checked, connect your timing light prior to attempting to start the car. With the light connected, crank the engine. If the engine cranks and starts normal, check timing and advance as needed.

If the distributor was removed for any repairs at the same time the TI performance module was installed, proper rotor alignment to cylinder number 1 compression stroke during the distributor reinstallation process must be completed successfully then the ignition timing reset to factory specifications. Your installation should now be complete. Test drive the car thoroughly throughout the RPM range of the engine to verify reinstallation of your TI ignition system.

IDENTIFYING THE GM PART NUMBER ON ORIGINAL EQUIPMENT MODULES

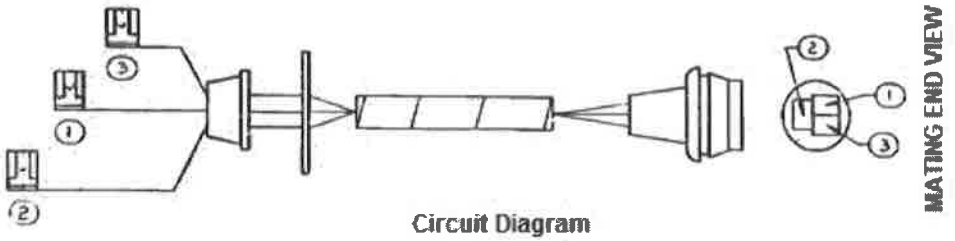
Inspect the bolt boss areas on the amplifier housing for the GM part number. It is stamped (original equipment type) on the bolt mounting boss. Some later service replacement amplifiers had no identification part numbers whatsoever on them.

Listed below are the original GM part numbers along with descriptions and wire color codes necessary for installation of the new transistor ignition performance module into your specific TI amplifier housing. If your amplifier has the GM part number stamped, look for that specific part number and wiring detail cross reference below. The colors should match the list provided. If, however, no GM part numbers are visible on the amplifier housing, it will be necessary to use the wire color x-ref charts below to match the amplifier wiring detail instead of the GM part number. If colors on your original wiring do not match any of the diagrams listed below, contact our technical support for help.

There are three (3) wires located inside your T.I. Pulse Amplifier

GM Part# 1115343, Late Production 1968 & UP Chevrolet, All (with external pigtail & molded-on connector)

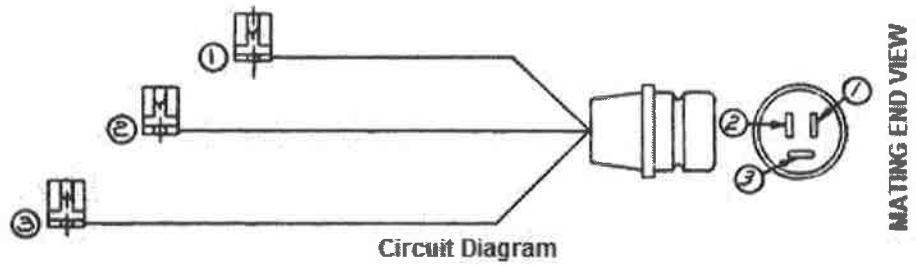
Circuit #1 - PINK (resistor) = connect to Terminal 1 on Replacement Module
Circuit #3 - GRAY (distributor) = connect to Terminal 2 on Replacement Module
Circuit #2 - BLACK ("+" ignition coil) = connect to Terminal 3 on Replacement Module



Circuit Diagram

GM Part# 1115005, 1964 to Early 1968 Chevrolet & 1964 Pontiac (with connector on top of box & no external wires)

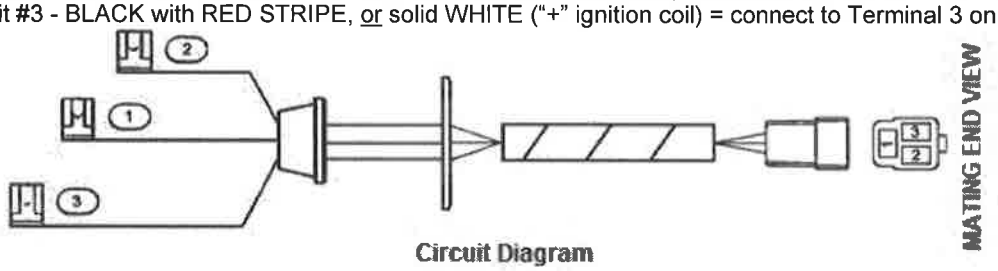
Circuit #2 - BROWN (resistor) = connect to Terminal 1 on Replacement Module
Circuit #1 - WHITE with GREEN STRIPE, or solid GRAY (distributor) = connect to Terminal 2 on Replacement Module
Circuit #3 - BLACK ("+" ignition coil) = connect to Terminal 3 on Replacement Module



Circuit Diagram

GM Part# 1115007, 1965-66 Pontiac (OEM version installed in car during production). Approximately 50.0" long

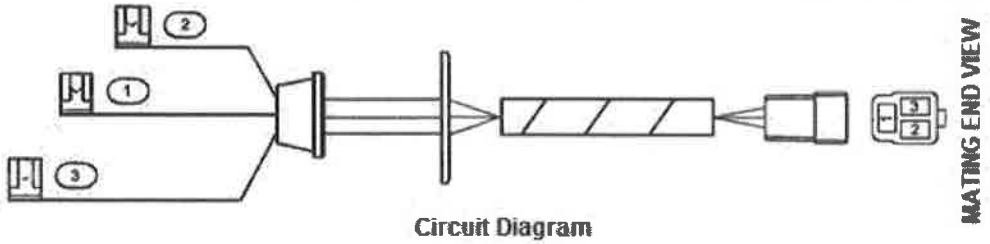
Circuit #1 - BLACK with PINK STRIPE, or solid PINK (resistor) = connect to Terminal 1 on Replacement Module
Circuit #2 - BLACK with WHITE STRIPE, or solid BLACK (distributor) = connect to Terminal 2 on Replacement Module
Circuit #3 - BLACK with RED STRIPE, or solid WHITE ("+" ignition coil) = connect to Terminal 3 on Replacement Module



Circuit Diagram

GM Part# 1115008, 1965-66 Pontiac (service part originally sold to replace Part# 1115007). Approximately 100.0" long

Circuit #1 - BLACK with PINK STRIPE, or solid PINK (resistor) = connect to Terminal 1 on Replacement Module
Circuit #2 - BLACK with WHITE STRIPE, or solid BLACK (distributor) = connect to Terminal 2 on Replacement Module
Circuit #3 - BLACK with RED STRIPE, or solid WHITE ("+" ignition coil) = connect to Terminal 3 on Replacement Module



Circuit Diagram

TROUBLE SHOOTING & DIAGNOSTICS

Do not apply these diagnostic tests to an original amplifier with an original circuit board, factory amplifiers, NOS service amplifiers which may still contain factory circuit boards, used or any other TI system replacements encountered whereby an exposed circuit board is present inside the amplifier housing.

These TI systems are unprotected against reversed polarity, short circuits and very high transient voltages generated during tests discussed on these instructions. When the energy is not dissipated from the ignition coil thru the NON-HEI test plug to a chassis ground, these circuit designs are easily damaged and can have negative effects on other ignition components. The tests and instructions listed on this document are designed only for the TI Plus Performance Module.

Some tests require diagnostic equipment not common or easily available. In some instances, there may be other options. We list the most common here. Please consult with our technical support team for more specific help or other options if needed.

1. Digital Multimeter / VOM (to measure voltage and resistance)
2. 12 Volt test light (test for power present)
3. NON-HEI Test Spark Plug with ground clamp (visually test for spark)
4. Set of alligator clip jumper wire test leads. Usually minimum of four jumpers 12" or longer (to jump circuits as needed for testing)
5. Automotive timing light (verify and reset engine timing as needed)
6. 10 feet minimum of 18-gauge automotive primary wire, any color (test amplifier ground)
7. Spare Distributor Cap, Rotor, Spark Plugs and 7mm Spark Plug Wire set (cheap universal set for V/8 engine to use for tests only)
8. Replacement TI coil (Spare TI coil used as backup)

Using a NON-HEI Test Plug to determine condition of spark

IMPORTANT

Use only a standard ignition test plug that has been calibrated for standard ignition systems (NON-HEI). Example: KD Tools 2757. Note: an electrode that is recessed from the ceramic indicates you have an HEI test plug, conversely, a NON-HEI plug has the electrode protruding from the ceramic, and typically flushed with the end of the test plug.

WARNING

Determine if fuel vapors or combustible materials are present before cranking engine with exposed spark on NON-HEI test plugs. High voltage is present on any ignition system, electrical shocks from ignition coil and other related components may cause severe personal injury or death, do not expose yourself to potential areas that may shock you!

Install the NON-HEI test plug alligator clip on a good ground source and plug it in the coil wire from the center of the distributor cap. Crank the engine while closely observing the NON-HEI test plug. You should see a steady and strong spark while the engine is cranking. If spark is erratic, intermittent or unstable, proceed to next step.

Grounds

Poor or missing ground connections are the most common cause for equipment failure. Mostly due to the age of the wiring (especially If original harnesses are still used) and related system components. As previously discussed during the installation, secure grounding of the TI module and amplifier housing are critical for proper operation. Because of the number of "links" in this ground chain from battery cables to ground straps and many other potential weak points, the probability of a poor or missing ground affecting performance is high.

The simplest way to confirm poor or missing grounds is to run an 18-gauge wire directly from the battery "-" terminal to one of the mounting screws on the amplifier housing or to one of the module mounting screws (if the cover was previously removed for further testing).

If resolved, remove the temporary ground wire and begin checking all ground paths starting with the negative battery cable and ending with the specific location the amplifier is mounted on (usually the radiator core support). Be sure to check items like ground straps from the engine to the frame, radiator core support to frame, etc.

If there are signs of minimal spark improvement on the NON-HEI test plug, reconnect the coil wire to the distributor and check engine performance with the temporary ground connected, and continue with the next step.

Changing or replacing the TI Ignition Coil

Change ignition coils temporarily to check the old coil. Ignition coils can have high voltage breakdown that occurs only when firing a gap or microscopic fractures in the Alkyd tower material. The fractures in the tower act like channels to guide the high-voltage to the closest ground or even the oils left behind from your hands during handling.

Try to use a TI type replacement coil or other good known ignition coil if possible, however, the TI Plus Performance Module will work with a standard point type coil, but at a reduced output / performance. TI coils use different windings than point coils and improve performance significantly when using the TI Performance Module. If a DMM or VOM is available, check coil resistance of both the old and new TI coil to compare before replacement. Resistance is outlined below:

Primary resistance at 75°F (measured between "+" and "-" terminals)

Typical TI coil: .46 ohms ± .05

Typical Point coil: 1.3 ohms ± .05

Note: when checking low resistance as indicated above, readings are more accurate if the coil and DMM are allowed to acclimate at 75°F for a short period prior before taking measurements.

Set your DMM to the lowest scale, unless the meter has auto range. Hold the leads steady together until the meter readings stabilize, write down your measurement as this is the resistance of your test leads and DMM internal circuit (typical test lead resistance readings measure around .3 to .5 ohms). You will

subtract this number from the final primary resistance measurement.

Secondary resistance at 75° F (measured between "+" terminal and high-voltage output terminal)

Typical TI coil: 13,500 ohms ± 10%

Typical Point coil: 7000 ohms ± 10%

Run the spark test again using the NON-HEI test plug as indicated in the section above. If the spark condition has improved, reconnect the coil wire and check if the engine runs better or the problem is resolved. If changing the coil did not improve the condition and resistance tests are within tolerance, continue to the next step.

Distributor output voltage and stationary pole piece assembly resistance test

Unplug the connector at the distributor from the TI harness. Connect the test leads from the DMM to the two leads coming out of the distributor and set the meter to a resistance scale just above 600 ohms such as 1K, etc. If the DMM is auto ranging proceed with the test. Measure the pickup resistance (no polarity is necessary). Resistance should be between 550 to 630 ohms at 70° F. The most common failures are an open circuit.

Keep in mind sometimes the resistance readings are within tolerance, however failure only occurs after the engine is hot from internal shorts in the windings. Thermal expansion / contraction of the magnet wire and the plastic bobbin during engine operation, aggravated by high ambient temperatures make this part very difficult to diagnose without a known good spare stationary pole piece to swap in. Even in controlled environmental tests, shorts may not show up until reinstalled and the car is driven, fooling the technician into believing the stationary pole piece assembly is not the problem.

Inspections of many past failed windings inside the stationary pole piece assembly sometimes show poor quality solder joints which broke loose from low temperature solder used originally between the 2-conductor ripcord white and white with green stripe to the copper magnet wire in the winding. The splice joints between the ripcord and the copper magnet wire are so small they are extremely difficult to repair or re-solder. If repairs to these joints are attempted, be sure to review original documentation in factory service manuals and online web resources. Also use the highest possible temperature solder such as a lead-free type.

If the resistance tests are within tolerance, switch the DMM to AC Volts (lowest possible scale unless the meter is auto ranging). Keep in mind the resistance test above related to the temperature as mentioned. Reconnect test leads. Polarity is not required. Crank the engine. Readings of at least 1.1 volts AC are required at the distributor terminals to ultimately trigger the TI system when fully installed. Note that many DMM's are not capable of reading this low of scale AC voltage or may not show accurate readings. An analog type VOM or higher-quality DMM may be required.

If resistance and voltage readings are within tolerance and visual inspections of the distributor stationary pole piece assembly seems to be okay, proceed with the next step. Be sure to check the pole piece assembly alignment by cranking the engine and watching the pole piece assembly gaps while spinning. Also inspect the centrifugal advance and vacuum advance systems as needed. Inspect the distributor cap and rotor for any damage or signs of excessive arcing on the brass terminal contacts or other noticeable damage. If any of these are suspect including the stationary pole piece assembly, replace the faulty items and retest for spark.

Finally, review the position of the wire colors on the 2-conductor ripcord coming out of the distributor housing at the harness side of the connection. The two-way plastic connector on the end of the two wires must be properly indexed with the right wire colors.

The colors of the wires should be solid white and white with a light green stripe. The included schematic diagram shows the mating end view of the two-way connector for the distributor and the proper indexing position of both wires. If the wire colors are reversed in the connection, the system will still function however, the performance is significantly degraded. The wire positions must be corrected. The included schematic diagram contains directions for properly removing the male blades from the connector housing without damaging the terminals.

Note that if the distributor pole piece assembly needs to be removed for repairing or replacing, both male terminals must be removed from the connector housing first to push them through the small hole in the distributor housing.

After correcting any connector miss-indexing of wires and tests outlined above are within tolerance, continue with the next step.

Continued erratic, intermittent, weak or missing spark

1. If you have completed previous sections and spark is still poor or weak, then the most likely possibility is cumulative voltage drops.

This is especially evident on 1115005, many times, we find that the female terminals in the molded connection combined with the female terminals inside the amplifier are loose or have weak engagement force causing cumulative voltage drops. Regardless of which pigtail is used, marginal or poor connections with fatigued terminals will cause erratic or weak spark.

After all the wiring connections on the TI harnesses and amplifier are verified, repaired or replaced, plug all connections back together and check spark using the NON-HEI test plug again. If a good spark condition is now visible, reconnect your coil wire to the distributor and start the engine.

If there are no improvements in previous conditions, continue to the next step.

2. If no visible signs of spark are seen when cranking or only a single spark output is generated when the ignition switch is first activated, then the minimum input voltage required for the TI Plus Performance Module to work is not being deliver. Input voltages are provided below for reference purposes only.

*Original TI system circuit boards require a minimum input voltage of **.5** Volts ± 10% to trigger.*

*The TI Plus Performance Module requires a minimum input voltage of **.7** Volts ± 10% to trigger.*

By increasing the trigger point to .7 volts and filtering the input signal, the TI Plus Performance Module eliminated the false triggering.

Caution: Do not attempt to measure voltages at the module with or without the engine running. The rapidly fluctuating voltages

seen at the module means that any measurement with a voltmeter or typical DMM is meaningless. The only accurate way to measure voltage on the TI Plus Performance Module is with an oscilloscope.

3. Starter bypass circuit is not properly connected or functioning.

The starter solenoid contains a small threaded stud marked "R" for "resistor bypass". This stud is energized with battery voltage during engine cranking until the engine starts and (or) the ignition switch is released.

Note: The presence of the starter bypass circuit (partly in the engine compartment wiring and partly the TI system wiring) in the harnesses is mandatory for the TI system to function. Also, if the TI system is installed using a high torque mini type starter motor, the resistor bypass stud will not be on the starter solenoid.

The next 3 steps will help determine if the starter bypass circuit has a poor connection

a. The engine won't start until the ignition switch is released during cranking. This condition sounds like the engine fires (or wants to fire) as soon as the ignition switch is released when cranking. When the starter motor is de-energized, the battery voltage increases significantly just before the engine stops rotating. Sometimes the momentary voltage increase is enough for the TI module to fire 1 or 2 cylinders just as rotation stops. The engine may or may not successfully start depending on several factors. This condition is best described as a cold-blooded engine start.

The starter solenoid contact (located internally) that energizes the resistor bypass stud (marked "R"), should be reviewed for damage, loose connections, excessive wear, and erosion. Depending on the level of wear, the voltage available during cranking may be substantially less than expected.

Disassemble the starter solenoid contactor assembly containing the threaded studs and electrical connections. Inspect the internal spring-loaded washer and contacts for excessive wear, arching, or damage that may be causing poor contacts. Some older or original starter solenoids allow rotation of the contactor washer to a clean, unused area not damaged. Some only allow 180-degree rotation and others are not reparable. Repair or replace as needed and retest engine starting.

b. No spark is visible using the NON-HEI test plug while cranking the engine, however, once the ignition switch is released, a momentary spark is noticed at the NON-HEI test plug. Voltage drops from degraded connection points is most likely causing the problem.

c. The connection between the bypass wire in the engine harness at the starter solenoid and the TI harness connection side of the circuit contain poor contacts or are not modified properly as described in the factory assembly instruction manual under the RPO K66 sheet. These connections are critical to proper operations during cranking and should be verified against assembly manual instructions where available or reviewed with our technical support team as needed.

Note: Most TI system applications require modifications to the factory dash/engine harnesses to properly install the TI system in the vehicle. These modifications are found in the K66 section of the factory assembly instruction manuals specific to the year and model.

Standard factory harnesses were not produced with alterations for integrating TI systems, therefore, it had to be altered at the assembly plant or as a dealer installed option kit. When the wiring is replaced with reproduction ones, they must be modified as well.

Continue with section 4 below If the starter bypass circuit is functioning correctly and no visible spark is present at the NON-HEI test plug still.

4. Checking primary ignition switch feed circuit to the TI harness and running spark tests manually triggering the TI Module.

a. Ignition switch "+" feed (IGN #1 on switch) circuit bypass test to determine any voltage drops.

Find the feed circuit coming from the ignition switch on "IGN 1" terminal. This circuit is used to feed the TI harness with +12 volts when the ignition switch is rotated to the "RUN" position. Typically, the feed wire should be pink (some applications may be black with pink stripe) and plugs into one of the resistance wires covered with white fiberglass braiding on the TI harnesses.

Note: The white braided resistance wire may not be visible outside of the TI harness covering, instead the connection is either pink on both sides (or black with pink stripe).

Once the circuit has been identified, disconnect the ignition switch feed side from the TI harness temporarily and keep the TI harness (white braided resistance wire in most cases) side in your hand. Attach the alligator clip to the rear of the terminal inside the connector back side. The other side of the jumper wire will be connected to a constant battery source such as the battery stud on the rear of the alternator or battery "+" terminal ***when ready to test.*** Except for this jumper wire, and the feed connection previously unplugged, make sure the rest of the TI system is re-connected and the spark plug wire from the ignition coil to the NON-HEI test plug is properly grounded.

Keep these 2 items in mind before proceeding to connect the jumper wire:

- By connecting the TI harness feed circuit directly to a battery source, the engine may start unexpectedly.
- You must remove the alligator clip jumper wire at the battery "+" connection in order for the engine to stop running.

Connect the jumper wire to the battery "+" terminal such as the stud on the alternator. The TI system is now energized thru the jumper wire. Attempt to crank the engine by rotating the ignition switch to the crank position as normal. Does the NON-HEI test plug show normal spark or does the engine fire if the NON-HEI test plug was not used in this test?

If yes, then the primary harnesses and ignition switch feed side of the wiring should be inspected to determine bad connections (or a series of bad connections) causing voltage drops to the TI harness input feed circuit.

If no improvements were noticed, reconnect the TI harness feed circuit to the ignition switch feed side to continue with the next step.

b. Spark test using the NON-HEI test plug only and manually exciting the TI Plus Performance module on Terminal 2.

The purpose of this test is to verify the output of the module is working to confirm that good grounds, feed circuits, connections on the TI harness and the coil are working properly by manually triggering the TI system. The test isolates the module inputs from outputs. There are 4 pre-conditions to prepare for the test, please read this section carefully before beginning:

- The NON-HEI test plug must be used to check for spark. Use the spark plug wire from the coil connected to the NON-HEI test plug only.
- The TI amplifier rear cover must be removed to expose the installed TI Module terminals.
- The amplifier housing must be properly grounded without being mounted. Either use the factory design harness grounds (depending on specific year / model and TI harness) or a separate 18-gauge (or larger) ground wire connected directly to the negative battery cable.
- Pre-attach and alligator clip jumper wire to a known good ground. The other end of the jumper should reach the module terminals.

Begin by disconnecting the wire from Terminal 2 on the TI module. Temporarily insulate the terminal that was just removed to avoid any shorting or undesired connections affecting the test. All the remaining terminals and TI system are to remain fully connected and ready.

Turn the ignition switch to the "RUN" position to energize the TI system, but *do not crank the engine*. Take the unconnected side of the alligator clip jumper wire (attached to a known good ground) and tap the alligator clip to the Terminal 2 blade on the TI module.

Every time the Terminal 2 module side of the blade is momentarily grounded, the TI module will generate a nice healthy strong spark across the plug gap on the NON-HEI test plug. ***DO NOT*** hold the ground wire on the Terminal 2 blade of the module especially if you do not generate spark on the NON-HEI test plug while taping it. Avoid taping the Terminal 2 blade more than a few times as the Ignition coil (and other components) may overheat.

If spark is visible and strong as described previously, the output and all related components in the system are working properly however, this points to low voltage conditions on the input as previously described. Check harnesses and other components or call our technical support team for further help.

If spark was not generated on the NON-HEI test plug, first go back and double check all connections including the primary feed wire to the TI harness. Also check that the ignition switch is in the run position and that power is present on IGN1 terminal of the switch, grounds of the housing and module to the chassis are good and finally, the coil connections are connected to their appropriate terminal (check the polarity on coil connections) and nuts on the coil studs are tight. If all connections check ok, try another coil. If changing the coil does not improve the condition, please contact our technical support team for further help.

5. Intermittent engine miss or erratic spark condition that appears to be spark plug or spark plug wire related:

If the engine sounds like it's misfiring after installation of the module and the condition is not caused by other items already discussed, there are 2 potential causes if it appears to be a high voltage side engine miss. We are ruling out the ignition coil in this discussion as that subject was already addressed in an earlier section.

a. Spark plugs are either damaged or worn electrodes are past their useful life. Change the entire set of 8 plugs and be sure to check that the plug gaps are maintained on all 8 to factory gap dimensions. Keep in mind that gaps are factory set however when pulled from the containers and checked prior to installation, an average of 2 are different out of every set of 8.

b. Common misfires from spark jumping from or thru the insulation to ground are mostly due to degraded wire core or Hypalon insulation that has been compromised beyond its useful life. Sometimes from the heat of the exhaust or rubbing against engine components during engine operation. Sometimes just old age.

Spark plug wires with braided shielding over the outside of the 7mm Hypalon insulation that are aged are more difficult to detect from the shielding covering up compromised insulation. The increased output of the TI Plus Performance Module may cause older wire sets to jump spark regardless even if the original TI system board did not have the problem. While rare, it should be considered during diagnostic if the engine spark is missing as described.

Sometimes waiting until the evening when dark outside, and assuming the spark jumping thru the spark plug wires are significant enough, they can be seen and heard in the dark with the engine running and the hood opened. Note that the darker the better especially with shielding on the wires.

Having an inexpensive set of 7 mm universal spark plug wires to fit your car (from a local auto parts store) are the best way to test for bad spark plug wires. This method allows temporary replacement one cylinder at a time in case there are more than one bad wire.

When the spark plug wires are replaced with new or reproduction type or aftermarket cut to fit style, we suggest measuring the resistance with a DMM and log the measurements on each wire including the coil wire before final installation. Original resistance amounts measured when they are new is the best method to compare future measurements if suspect or to determine age and life cycle.

In closing, when further diagnostic or trouble shooting is needed, please notify our technical support team with details of tests and results already completed along with your contact information. It may be necessary to send us components from your TI system however, rest assured that more advanced diagnostic procedures using our test lab will determine any faulty components in the TI system quickly.

BACK VIEW OF T.I. AMPLIFIER
WITH BACK COVER REMOVED

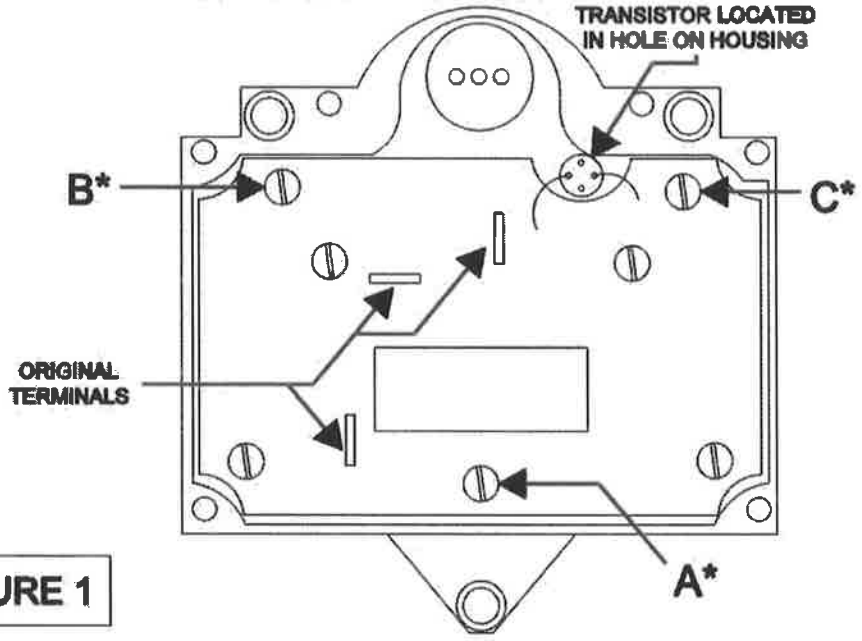


FIGURE 1

FRONT VIEW OF T.I. AMPLIFIER

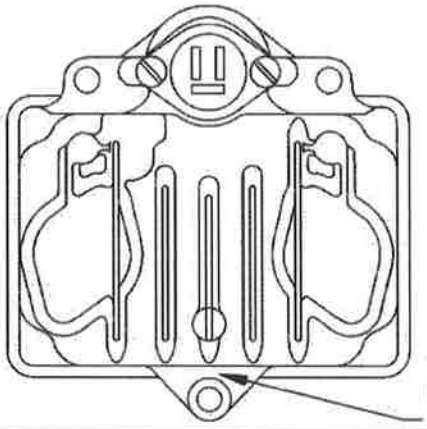
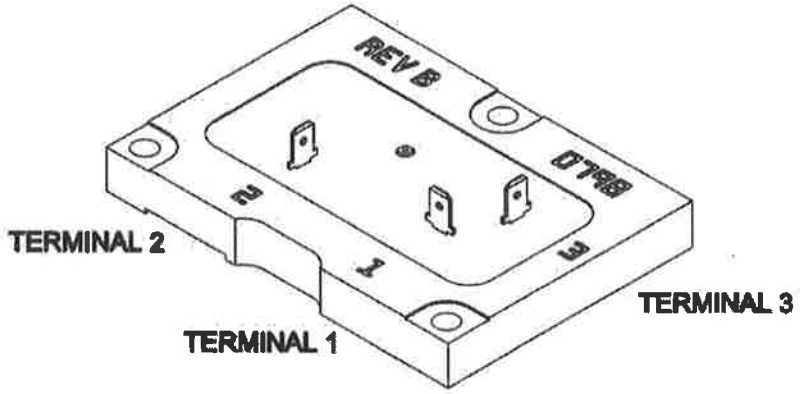


FIGURE 2



TOP VIEW OF NEW TRANSISTOR IGNITION MODULE REV. B

FIGURE 3

Terminal 1 = POWER (RESISTOR) Ignition Switch
Terminal 2 = DISTRIBUTOR
Terminal 3 = COIL (Positive +)

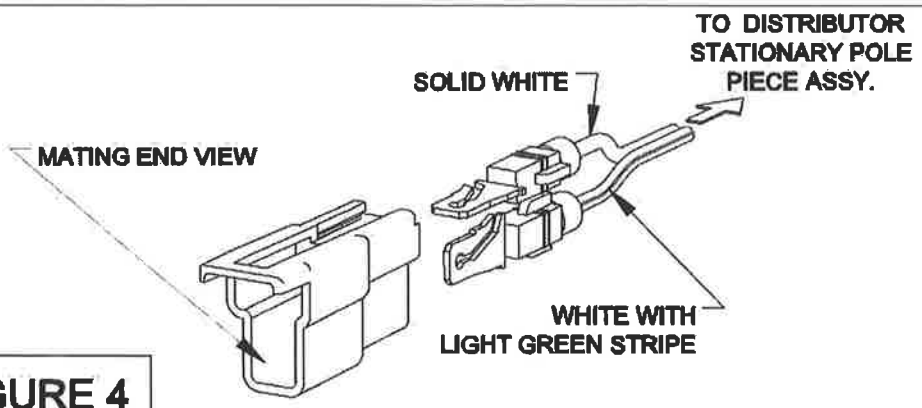


FIGURE 4

MATING END OF TWO-WAY CONNECTOR AND WIRE INDEXING

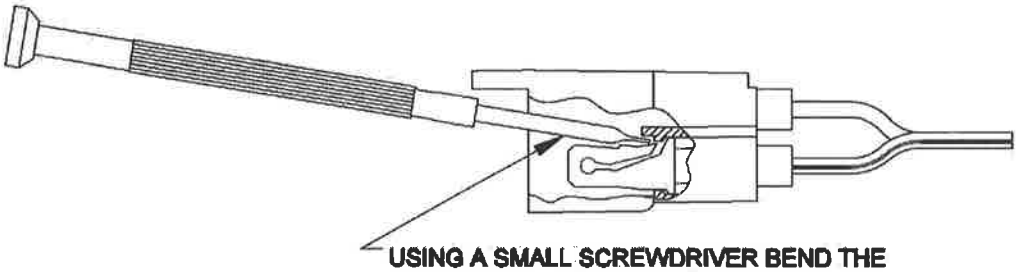
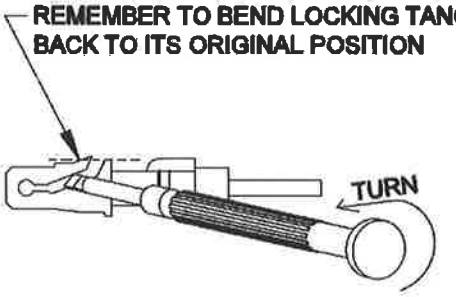


FIGURE 5

REMOVING TERMINALS FROM THE TWO-WAY CONNECTOR



PROPER BENDING OF TERMINAL LOCKING TANG

NOTE: EXCESSIVE BENDING WILL CAUSE STRAIN ON TERMINAL TANG CREATING MATING PROBLEMS AND INCREASING THE NORMAL AMOUNT OF VOLTAGE DROP ACROSS CONNECTION.

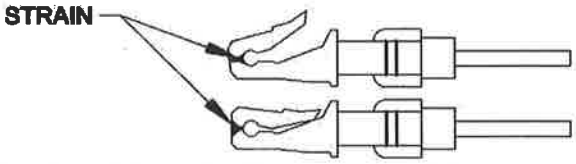


FIGURE 6

OVER BENDING OF TERMINAL LOCKING TANG