

Electromotive Tec GT Installation Supplement for the Porsche 928





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Our ability to bring you this kit at this price relies on our customers coming to us for our knowledge and experience with these cars.

Much of this information was hard to acquire and the product of multiple trials and errors. Please do not give any section of this manual to your friends, but rather, encourage them to contact 928 Motorsports, LLC for their own kit.

Thank you for your cooperation.



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Tec GT INSTALLATION OUTLINE

FOLLOW THE INSTRUCTIONS THAT CAME WITH YOUR ELECTROMOTIVE KIT AS PRIMARY. THEY ARE ON THE ELECTROMOTVE CD PROVIDED.

THESE INSTRUCTIONS ARE MEANT ONLY AS A SUPPLEMENT TO THE IN-STRUCTIONS PROVIDED BY ELECTROMOTIVE. REFER TO THOSE INSTRUC-TIONS FIRST, THEN REFER TO THESE INSTRUCTIONS TO HELP YOU ADAPT TO YOUR LATE-MODEL PORSCHE 928.

- NOTE: all photographs are of a 1991 928. Your installation may be different depending on year and model.
- NOTE: some of the connectors in this kit are push-to-seat, and others are pull-to-seat. If you are not sure what that means, call and ask.
- NOTE: "LEFT" and "RIGHT" in this manual are always as seen from sitting in the DRIVERS SEAT.

We will be performing these tasks in this order.

This will allow for the smoothest possible installation with the least repetition.

PREPARATION FOR INSTALL

WIRE ROUTING

MOUNTING SENSORS

SPARK PLUG WIRES

WIRING SENSORS, DFU's and the ECU

WIRING OUTPUTS

ROUTING AND LOOMING

LAST ITEMS BEFORE STARTUP

STARTING THE CAR FOR THE FIRST TIME

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Preparation for Install:

Read all instructions in both the Tech GT manual and this manual to become familiar with the parts and the options you have.

DISCONNECT THE BATTERY AT THE BATTERY.

Remove the air filter box (top and bottom) and the cold air intake tubing the runs to it.

We suggest you remove the intake manifold. The throttle Position Sensor and the Idle Air Controller are underneath the intake manifold, and the knock sensor. You can try to install the new wiring harness without removing the manifold, but its easier with it lifted, and this is a good opportunity to service the oil breather and vacuum hoses. Follow the Work Shop Manual (WSM) instructions to do this.

Remove the old injector wiring harness connectors in engine bay. Start with the injector wiring harness where it exits the firewall in to the engine bay and unclip every injector and sensor that flows out of it.

Take special care not to damage the timing belt tensioner sensor and the connector for the intake resonance flap.

When the complete injector wiring harness is disconnected on the engine-side, you should be able to lay it over the fender like this:





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Preparation for Install (continued):

Remove computers and disconnect plugs from passenger compartment footwell.

A. Unplug LH-jet and EZK computers. Remove the mounting bolts that hold their common mounting bracket to the kick plate, and remove the computers and mounting bracket.





B. **DO NOT** unplug the "V" and "W" connectors in the fuse panel. Instead, cut the wires leading to those two plugs leaving about a 12" pigtail.

C. Unplug O2 sensor wiring.





D. Unplug connector that has large green and white wires.



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Preparation for Install (continued):

Remove the injector wiring harness. <u>Be sure to save the bulkhead wiring grommet.</u> Choose one of 2 methods for removing the harness:

Either cut the wiring harness for removal as shown: ...or remove the harness as detailed in the WSM.





Remove the fuel rails.

Remove intake manifold (if you have not done so already). Be sure to prevent debris from entering the engine, and stuff a clean rag in each intake port. Check fuel system for integrity while disassembling.

Remove all the spark plug wires, and remove the ignition coils as outlined in the WSM.

1985/86 Porsche 928 Only

On these years of 928 it will be necessary to remove the 100-tooth timing ring from the flywheel and replace it with a 60-tooth timing ring. A small spacer (available for 928MS) must be inserted under the crank reference sensor as the new 60-tooth timing ring is a little taller.





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Wire Routing:

Note: wires colored in this fashion (Main color / Stripe color)

- 1. Divide wires in to 2 groups, one for in the **cabin** and one for in the **engine bay**
 - A. Engine bay wires
 - 1. DFU 1
 - 2. DFU 2
 - 3. Crank sensor (the 3 conductor black wire not labeled cam)
 - 4. Injector channels
 - a. Yellow / Black
 - b. Yellow / Blue
 - c. Yellow / Red
 - d. Yellow / Green
 - 5. TPS sensor
 - a. Gray / Red
 - b. Black / White
 - c. Dark Blue
 - 6. MAP Sensor
 - a. Gray / Red
 - b. Black / White
 - c. Dark Green
 - 7.Coolent sensor
 - a. Gray
 - b. Black / White
 - 8.MAT sensor
 - a. White
 - b. Black / White
 - 9.Knock Sensor
 - a. Orange
 - b. Black / White
 - 10. Flappy Valve
 - a. White / Black
 - b. Red wire from large +12 volt wire ran into engine bay
 - 11.IAC
- a. Dark Blue / Black
- b. Red wire from large +12 volt wire ran into engine bay
- 12. Add a 12ga red wire, we call the Engine Power Supply Wire
- 13. Add a small black wire for belt tension sensor
- 14. Optional wires to activate other things (nitrous etc):
 - a. Phased injector channels
 - 1. Light Blue / Black
 - 2. Dark Blue / Red (GP 7)
 - b. General purpose I/O's (if not used should be removed from the harness):
 - 1. GP 2 Orange / Blue (also speed input if used)
 - 2. GP 4 Dark Blue / White
 - 3. GP 5 Dark Green / Black
 - 4. GP 6 Dark Green / White
 - 5. GP 8 Orange / Black
 - 6. GP 9 White / Orange



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Wire Routing (continued):

Bundle the following wires to go under intake manifold

(Use wire loom that will tolerate oil and temps up to 220 F):

- a. TPS
- b. Flappy Valve
- c. Crank
- d. MAT
- e. IAC
- f. KNK
- 15. The following wires go around the back and to the left of the intake:
 - a. DFU 2
- 16. The following wires go to the right side of the intake:
 - a. DFU 1
 - b. Coolant temp sensor
 - c. Wire for the belt tensioner
- B. Cabin wires:
 - 1. Tach
 - a. Brown
 - 2. EGO
 - a. Tan
 - b. Purple
 - 3. Cam (not used)
 - 4. Fuel pump relay
 - a. Light Green
 - 5. Check engine light
 - a. Pink
 - 6. Any GP I/O for things like valet switch or map trim knobs
 - 7. Unused GP I/O for removal from the harness

We found that the new harness can be installed from the engine bay-in or from the cabin side-out. It doesn't matter.

Run it thru the grommet that you saved from the old wiring harness.

Route the wire bundles to their general locations on the engine.



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Mounting sensors, DFU's and the ECU

- 1. TPS
- A. Remove old Throttle Position Sensor (TPS)
- B. Mount TPS to the adaptor plate adaptor with
- hardware removed from the old TPS
- C. Mount TPS to Adaptor with supplied hardware





2. MAF and MAT

- A. Remove Mass Airflow (MAF) sensor from throttle body beneath manifold
- B. Install Mass Airflow Replacement Tube into manifold



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Mounting sensors, DFU's and the ECU (continued)

3. MAP

- A. Remove 2 bolts from coolant block-off plate at back of left head
- B. Bolt bracket with Mass Air Pressure (MAP) sensor attached to top of block-off plate







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Mounting sensors, DFU's and the ECU (continued)

4. DFU's

A. Direct-Fire Units (DFU's) are mounted in the positions formerly occupied by the coils you removed earlier. The bottom bit of sheet metal must be hammered down slightly so that the DFU with fit in that spot

B. Use the DFU as a template and carefully mark the location on the inner fender where the stand-offs need to be applied. Holes must be drilled in to the inner fender wall to mount the stand-offs in their precise location.





C. Once holes are drilled Nutserts are put in place then the standoffs for the DFU are inserted. Drill the hole just large enough that the Nutsert has to be tapped in with a hammer. Inserting a washer between the standoff and the Nutsert will help it draw up tight.

The long standoffs are for the LS FMU, and the short standoffs are for the RS FMU. The FMU's bolt down using the top two holes only, and the bottom of the FMU is supported by the former coil mount.





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Mounting sensors, DFU's and the ECU (continued)

D. Finally the DFU's are bolted to the standoffs as shown.



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Mounting sensors, DFU's and the ECU (continued)

5. TEC GT ECU Install

A. Your Tec unit is already mounted to the Porsche 928 adapter plate. All that is needed is to line up the mounting holes with the threaded inserts and install with the original hardware.

B. The power for the tech unit is supplied by a 2 wire connector, the Red wire being power and the black wire being ground.

Power is found on 1989-95 cars by removing the relay from your fuse panel in the position marked XXII. It is relay XXV on 1987 and 88 cars. This was the LH relay and by using it as a power source for your new ECU, the anti-theft security built into your 928 will continue working as designed. Insert a male spade terminal into the relay socket as shown for ECU power.







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Mounting sensors, DFU's and the ECU (continued)

Ground for the ECU is best placed in its own position away from other grounds. A good location can be found next to the right side seat under the cover that the hatch release is on (if so equipped).

Loosen the 2 thumb screws that are on the 2 sides of the cover.



Under that cover there is a black hatch release held down by 2 M6 Bolts. Remove the bolt near the rear on the car and place the ring terminal under the bolt. If for some reason your car has a lot on interference the ground may need to go directly to the battery.





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Spark Plug Wires

Because the 2 stock coils have been replaced with 4 DFU's, and because the spark voltage is so much higher than stock, you will need new spark plug wires. The requirements for the spark plug wires are published in the Tec GT manual.

You may route your spark plug wires any way you desire, so long as the connections match the TecGT manual. For this reason, the length of the spark plug wires depends a great deal on your routing.

Determine the spark plug wire layouts you desire and measure for spark plug wires now. Each of the 8 spark plug wires is unique. Some are quite long owing to the fact that they may have to go from the DFU on the left front to a cylinder on the right rear, for example.

A good way to measure spark plug wire length is to use a long vacuum line to lay in place as you would the wire, then measure the vacuum line out of the car. Repeat for each wire.

If you prefer, we know the wire lengths for the way we routed *our* spark plug wires, and if you would like to route your spark plug wires in the same location, just call us to order a set.







Cap off the exposed spark plug wire terminals on each distributor cap with the caps provided. A little Dawn dishwashing liquid on each one will make them slide on easily.





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Wiring Sensors:

- 1. General
 - A. Work on only one sensor at a time. Layout the wires first to ensure proper wire length.
 - B. Sleeve wire bundles with heat shrink prior to putting ends on. Only heat shrink the wiring after the connector is in the position you want it.
 - C. Some connectors come with boots slide boots over the wires before putting the connector on.
 - D. Note type of connectors used for each kind of install some push to seat v. pull to seat
 - E. Now is the time to evaluate the condition of the crank and knock sensors. Poor sensors and/or poor connections cause malfunctions.
- 2. MAP Sensor
 - A. Wire as indicated in Fig. G.1.1 of the Electromotive Manual

B. The vacuum line is teed from the under side of the manifold, and attaches to the MAP sensor as shown. A reducing adapter changes the ID of the vacuum tubing up or down as needed.









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Wiring Sensors (continued):

3. TPS

Wire the TPS as follows:

1. Gray / Red

2. Dark Blue

3. Black / White TIP: test the TPS connection with the elec tromotive software before re-installing your intake manifold if you can.

4. COOLANT TEMP SENSOR

Wire as show in Fig, G.3.2 of the Electromo tive manual.

5. MAT

Wire as shown in Fig. G.4.1 of the Electro

Exhaust Gas Oxygen (EGO Sensor)
 A. Cut the old EGO sensor plug from the old wiring harness leaving a 8 to 10 inch lead



motive manual.





B. Crimp a butt connector on to each wire in the EGO lead

C. Join the blue wire from the O2 sensor lead to blue wire on plug V in position 11

- D. Join the shielded black wire to the purple wire from the tech unit
- E. Join the brown wire to the tan wire from the tech unit
- F. If you have a wide band O2 installed you can use that instead. Instructions are in the Tech GT manual





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Wiring Sensors (continued):

7. Knock sensors

- A. Wire a two-into-one adapter as shown in these pictures
- B. Add the proper ends to the wires as included in the kit

C. Connect ends to the knock sensors and secure the wires into the valley such that they stay away from the moving throttle linkage and cables.







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Wiring Sensors (continued):

8. Idle Air Controller (IAC)

- A. Wire IAC as shown. Also refer to Fig 3 in the Electromotive manual. Note direction of flow indicated with the gray stripe.
- B. Soldering connections is recommended
- C. Pin placement in the connector does not matter.



9. Crank Sensor

A. Wire as shown in photo, supplied resistor is installed between red and black wire.

B. Soldering is recommended for these connections



C. Insulate the bare leads of the resistor when done, before installing the rubber boot.

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Wiring Outputs:

1. Fuel injectors

A. Wire as shown in D.2.2 of the Electromotive Manual except note The firing order is 1-3-7-2-6-5-4-8

A small + is molded into each injector so you know which is the positive side.

- 1. Channel 1 is cylinders 1 and 6
- 2. Channel 2 is cylinders 3 and 5
- 3. Channel 3 is cylinders 7 and 4
- 4. Channel 4 is cylinders 2 and 8



B. Power needs to be supplied from the 12 volt positive lead in the engine bay. This wire was installed earlier (Item number 12 on Page 7)

- 2. Direct Fire Units (DFU)
 - A. DFU 1 is the one mounted on the right inner fender wall
 - 1. The gray DFU bundle with 3 wires should be run along the right side of the manifold
 - 2. The wires are positioned as such
 - A. White
 - B. Red
 - C. No Connection
 - D. +12 volt power from 12 volt main line running thru firewall
 - B. DFU 2 is the one mounted on the left inner fender wall
 - 1. The gray DFU bundle with 2 wire should be run around the back and then to the left of the intake manifold
 - 2. The wires are positioned as such
 - A. Black

B. Red C. No Connection D +12 Volt power from 12

volt main line running thru firewall

IMPORTANT: run a separate ground from each DFU to the engine block as shown. The easy way is to use the small wire screwed to the DFU and attach the wire to the timing belt cover bolts.





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Wiring Outputs (continued):

3. Tach

Connect Brown wire from TEC unit to the to the Blue / White wire from plug W in position 5 (bottom) of the left side as shown here >



4. Fuel Pump and Engine Power Supply Wire

A. The light green wire from the tech GT unit gets spliced with a diode as shown and connected to the Brown / Red wire in position 15 on plug W. The light green wire ALSO gets connected to the Brown / White wire from position 21 on plug W.



When complete, wrap all exposed wires. The diode, and connectors with insulation or loom or both.





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Wiring Outputs (continued):

5. Check engine

The pink wire from the tech GT unit gets spliced to any one of the Yellow / Green wires from plugs V. The other may be trimmed back.

6. Cam Belt Tensioner/Sensor

The loose black wire from line 13, Page 7 gets routed along the right fuel rail and connected to the cam belt sensor connector. The end in the cabin gets spliced to the Brown / White wire on plug W in position 25.



7. Engine Power Supply Wire

The 12 ga red wire (Item 12, Page 7) is connected to the large Red wire coming from plug W in position 22.

On the engine bay side this is the time to made a multi wire split for all the +12 volt apparatus under your hood. Example as shown in pictures, the number of sources you need may vary.

8. Flappy Valve

The Flappy Valve can be operated from a GP/IO if desired.





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Routing and Looming:

1. Any wire loom may be used. In these photos we used split-type loom. The loom you select should be chemically-resistant to oil and able to withstand 200 degrees.

2. Routing is largely up to you depending on how you want your engine bay to look. You may decide to hide almost all the wires, or run the wires so that they may be easily serviced.



5. One easy way to route the wiring is to largely follow the route of the of the old harness.



3. Wires should be kept away from large heat sources and moving parts (e.g. exhaust headers, fans etc)

4. Supplied shrink tubing should have been used on exposed wires just prior to the connectors.





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Last Items Before Startup:

1. Starter

The Black / Violet wire in position 14 on plug V need to be grounded. There is a ground point just above the fuse panel that can be used for this. Extend the black/violet wire by splicing on a length of wire and add a ring terminal on the end. Place it under the ground bolt.

2. Throttle

Take a moment and ensure the throttle is opening and closing all the way. You probably have had the intake manifold on and off by now, and we have removed the MAF sensor too. This is a good time to check it.



3. Make sure all connectors are plugged in firmly and all wiring is secured properly.

4. Hook laptop up to the Tec GT ECU and load starting map (read and follow the instructions in TEC manual)

Recommended initial Tec GT settings for Late-Model 928's

(These settings for a naturally-aspirated motor with stock injectors)

Tec GT Advanced Parameters

Tach Pulse set to 2. Can Bus Off Cam Sensor Type set to MAG Crank Sensor Type set to MAG TDC Change DFU-a Trigger Wheel TDC set to 11 Change DFU-B Trigger Wheel will be 11 Mechanical Offset set to 0

General Purpose Outputs

Control flappy valve by setting GPIO1 to "Intake Runner Control" if desired. Set GPIO3 to IAC output.

Idle Speed Idle Speed Controller Activation should be OFF for initial start.

Idle Min/Max Duty Cycle

Min value of duty cycle set to 117 Max value of duty cycle set to 170



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Starting the Car for the First Time:

- 1. Make sure car is ready to start (fuel, coolant, oil etc)
- 2. Make sure you can see the TEC GT unit from the Drivers seat (Carpeted covers off)
- 3. Crank the engine over and observe the two LED lights on the ECU. If receiving a proper crank trigger signal, one light will be steady green and the other will alternate between green and red. If not, go back and make sure that the crank sensor is properly wired.
- 4. If your having a no start or hard start situation refer to the section M Troubleshooting in the Tec GT manual
- 5. Depending on mods made to the engine the TOG, IOT and MOT may need to be tuned.
- 6. A base-tune can be worked out on country roads pretty easily. Have your assistant drive the car while you adjust the Tec GT map with the laptop on your lap. Save your changes.

We recommend taking the car to a chassis dyno and have the final map tuned there.