

# 1 BEGIN HERE

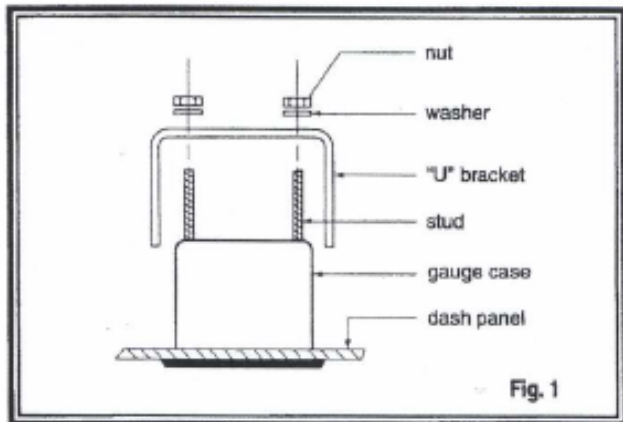


Fig. 1

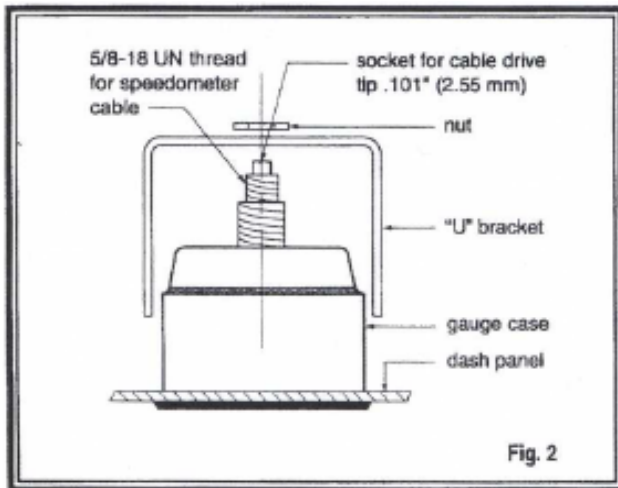


Fig. 2

**CAUTION:** Read these instructions thoroughly before installation. Do not deviate from assembly or wiring instructions. Always disconnect positive lead before making any electrical connections. If in doubt, please contact your dealer or Continental at (800)265-1818.

## Gauge Installation

1. Select mounting locations for the gauges which provide good visibility for the driver. Lay out center points for each instrument on the panel.
2. Cut 2-1/16" (52 mm) diameter holes for the smaller gauges. Check gauges into holes for fit. Open hardware package and place the proper "U" bracket over the mounting studs on the back of the gauge. (See Fig. 1) The "U" bracket is made for panels up to 1/2" (13 mm) thick. For thicker panels, trim the bracket legs as required.
3. After checking fit, insert gauges into panel and install brackets. Fasten securely into place using washers and nuts from the kit. Tighten nuts until gauge can no longer be rotated by hand in the panel.

**CAUTION:** Over-torquing may crack gauge housing or mounting panel.

## Speedometer Installation

Depending upon the kit purchased, the speedometer may have a different size housing. Check to see if you have the 3-1/8" (80 mm) or 3-3/8" (85 mm) diameter unit.

1. Cut the appropriate sized hole (3-1/8" or 3-3/8") in the panel. If necessary, enlarge the hole with a file for a close fit.
2. Remove the large nut from the speedometer center post. Position unit in hole, place "U" bracket over the center post, and determine any amount to be removed from the bracket legs for a secure fit.
3. Cut bracket as required, then re-install over the center post. (See Fig. 2) Thread on large nut and tighten, again using caution to avoid over-torquing.

## Parts List

Item	Description	Quantity
1.	Speedometer (3-1/8" or 3-3/8" body)	1
2.	Voltmeter (2-1/16" body)	1
3.	Fuel Gauge (2-1/16" body)	1
4.	Pressure Gauge (2-1/16" body)	1
5.	Temperature Gauge (2-1/16" body)	1
6.	Pressure Sender (1/8-27 NPT)	1
7.	Temperature Sender (1/2-14 NPT)	1
8.	Fuel Level Sender	1
9.	Float Arm	1
10.	Clamp and Hardware Kit	1

## Limited Warranty

Continental warrants all merchandise against defects in factory workmanship and materials for a period of 24 months after purchase. This warranty applies to the first retail purchaser and covers only those products exposed to normal use or service. Provisions of this warranty shall not apply to a VDO product used for a purpose for which it is not designed, or which has been altered in any way that would be detrimental to the performance or life of the product, or misapplication, misuse, negligence or accident. On any part or product found to be defective after examination by Continental, Continental will only repair or replace the merchandise through the original selling dealer. Continental assumes no responsibility for diagnosis, removal and/or installation labor, loss of vehicle use, loss of time, inconvenience or any other consequential expenses. The warranties herein are in lieu of any other expressed or implied warranties, including any implied warranty of merchantability of fitness, and any other obligation on the part of Continental, or selling dealer.

(NOTE: This is a "Limited Warranty" as defined by the Magnuson-Moss Warranty Act of 1975.)

## Additional Material Required To Complete Installation:

- 16 gauge stranded insulated wire
- 14 gauge stranded insulated wire
- Insulated quick-disconnect female wire terminals
- Speedometer cable
- Fuel sender installation kit (optional)



Instrument Kit  
Installation Instructions  
Instruction Sheet #0 515 010 152  
Rev. 01/08

THE INSTRUCTIONS FOR INSTALLATION AND ELECTRICAL WIRING ARE CONTAINED HEREIN. USE IS RESTRICTED TO 12-VOLT NEGATIVE GROUND ELECTRICAL SYSTEMS.

USE FOR COCKPIT, COCKPIT ROYALE, SERIES 1, NIGHT DESIGN, HERITAGE GOLD, & INDUSTRIAL STYLES.

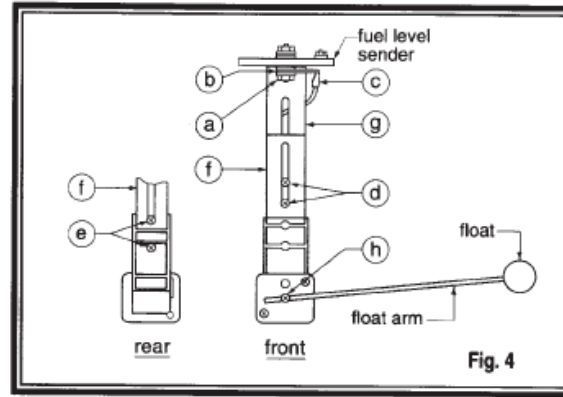
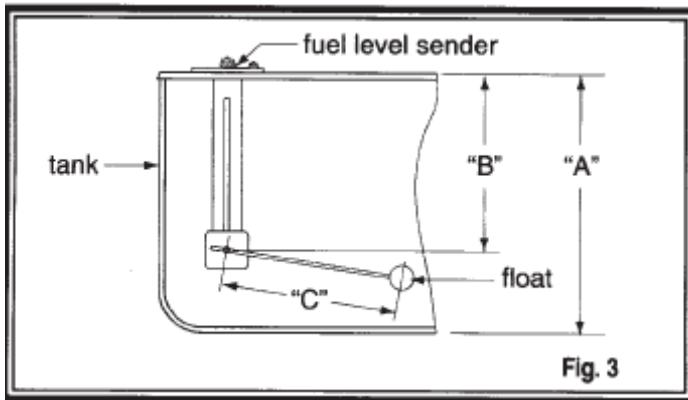
## Fuel Level Sender Installation

The Fuel Level Sender in this kit is designed to work with the VDO fuel gauge enclosed and has a resistance rating of 10 ohms when the tank is empty and 180 ohms when full. The unit can be adjusted to read accurately in tanks from 6" to 23" deep. For sender adjustment, refer to Table 1 and Fig. 3.

I. Measure depth of the fuel tank. Locate this dimension in Column "A" of table. Column "B" then shows the length from the underside of the sender flange to the center of the float pivot. Column "C" shows the distance from the center of the float pivot to the center of the float ball. For example, a tank 12" deep would need a measurement of 6" from the flange to the pivot, and 7.8" from the pivot to the float.

II. For tank depths up to 15-1/2" it will be necessary to eliminate a part of the assembly. (See Fig. 4) Proceed as follows:

1. Remove nut "a", washer "b", and ring terminal "c" from the underside of the mounting flange.
2. Remove two screws "d" and discard.
3. Remove two screws "e" from the plastic housing and reserve for later use.
4. Carefully remove bracket "f" from the plastic housing and discard. Replace with bracket "g" in the housing and loosely re-install two screws "e" into housing.



**CAUTION:** When installing the float arm into the sender body, make sure the float ball is to the right side when you face the unit, as shown in Fig. 4. If installed to the left, the fuel gauge will read "full" when the tank is empty.

5. Slide housing up or down until the proper dimension from Table 1 is reached, then tighten screws securely.
6. Replace ring terminal and hardware.

**CAUTION:** Do not overtighten hardware to avoid damage to the threads.

III. For tank depths of 16" to 23", no disassembly of the sender bracket is necessary.

1. Remove ring terminal as instructed in Section II, above.
2. Loosen two screws "d" and adjust the plastic housing up or down until the proper dimension from Table 1 is obtained, then retighten screws securely.
3. Re-install ring terminal and hardware, and tighten all hardware securely, avoiding overtightening.

IV. To install the float assembly, loosen screw "h", remove the short piece of rod, and discard. Insert the float rod until the proper length "c" from Table 1 is met, then tighten the screw securely. Carefully cut off any excess rod with a bolt cutter or similar tool, taking care not to damage the assembly.

**NOTE:** Make sure the float is installed as shown in Fig. 4. If installed backwards, the fuel gauge will indicate "full" when the tank is empty, and "empty" when the tank is full.

VDO North America recommends that the fuel sender and the fuel gauge be wired together and checked for compatibility prior to installing fuel sender into tank.

V. Refer to Fig. 5 for installation of the fuel sender assembly into the tank. The sender flange is designed to fit a standard SAE hole pattern.

**SAFETY PRECAUTION:** When making modifications to fuel tanks, it is essential that the tank be removed from the vehicle, and that it is empty, clean, and dry. After drilling, make sure all chips and other foreign matter have been removed from the tank.

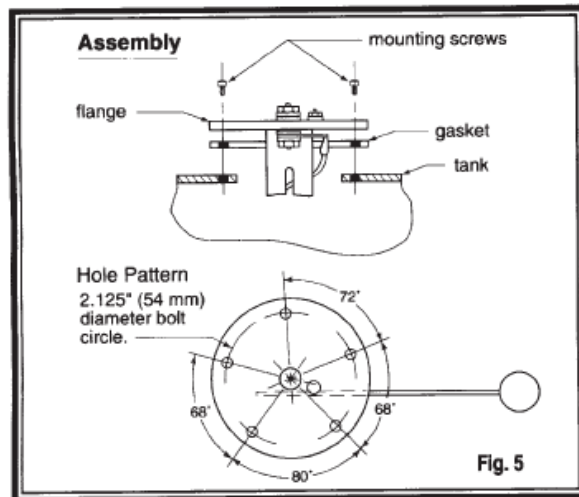
TABLE I (dimensions in inches)

A	B	C	A	B	C	A	B	C
6.0	3.0	3.5	12.0	6.0	7.8	18.0	9.0	12.0
6.5	3.25	3.8	12.5	6.25	8.1	18.5	9.25	12.3
7.0	3.5	4.2	13.0	6.5	8.5	19.0	9.5	12.6
7.5	3.75	4.5	13.5	6.75	8.9	19.5	9.75	12.9
8.0	4.0	4.9	14.0	7.0	9.3	20.0	10.0	13.4
8.5	4.25	5.3	14.5	7.25	9.6	20.5	10.25	13.8
9.0	4.5	5.6	15.0	7.5	10.0	21.0	10.5	14.2
9.5	4.75	6.0	15.5	7.75	10.4	21.5	10.75	14.6
10.0	5.0	6.4	16.0	8.0	10.7	22.0	11.0	15.0
10.5	5.25	6.7	16.5	8.25	11.0	22.5	11.25	15.4
11.0	5.5	7.1	17.0	8.5	11.4	23.0	11.5	15.7
11.5	5.75	7.4	17.5	8.75	11.8			

**CAUTION:** Before drilling any holes into tank, place the sender assembly on top of the tank to judge proper hole placement allowing float arm clearance inside of tank.

If no holes exist in the fuel tank (see CAUTION above):

1. Cut a 1.697" (43mm) hole in the top of the tank.
2. With the gasket in place below the flange, carefully feed the float arm and sender body into the 1.697" (43mm) hole in the tank. Make certain the float arm has free motion within the tank. Using the sender flange as a template, locate the positions of the five mounting holes. Depending on the thickness of the tank, either self-tapping screws or #8-32 machine screws may be used, drilling and tapping accordingly. If threaded holes already exist, check the thread size and use the appropriate hardware.
3. Insert fuel sender assembly into tank, align holes and thread in 1/2" mounting screws, through holes in sender flange and tank. Check that all screws are secure to complete assembly. **AVOID OVERTIGHTENING.**



### Temperature and Pressure Senders

Check the OEM engine manual for the correct location for these senders. Temperature senders are most accurate when installed in an "aftermarket" intake manifold. Installing the sender into the cylinder head can cause high readings due to exhaust manifold heat.

### Electrical Wiring

Refer to the wiring diagram. (See Fig. 6) Wire gauges in series from a positive (+) accessory to a source which is not already overloaded with fans, air conditioning, and such. The ground (-) is also run in series, including light socket ground. The final ground run, using 14 gauge wire, should be connected to a good ground such as the engine block ground strap or directly to the battery negative post.

**NOTE:** Speedo cable provides ground for Speedo light circuit.

### System Testing

When installation and wiring has been completed, the following tests should be performed to ensure that all systems are functioning properly.

I. Turn dash light switch on, and check to see if all gauges light up. If not, check wiring, ground, and bulb, and reconnect or replace as necessary.

II. Turn ignition key on. Gauges should read:

Pressure: needle to "O"  
 Fuel: needle to amount of fuel in tank  
 Temperature: needle to temperature of engine water

- a. With key on, pull sender wire off sender.  
 Fuel and pressure gauges: needle to the right-hand position.  
 Temperature gauge: needle to the left-hand position
- b. With key on, ground sender wire to the engine block.  
 Fuel and pressure gauges: needle to the left-hand position.  
 Temperature gauge: needle to the right-hand position.

**NOTE:** All VDO North America electrical gauge pointers will peg full left-hand position when the key is off.

III. Senders can be tested with an ohm meter that measures from 10 to 2000 ohms. Connect the positive (+) lead from the tester to the sender terminal, and the negative (-) lead to a good ground. The following readings should occur if the sender is operating properly.

Temperature sender 250°:		
	engine cold	700 ohms
	engine approximately 180°	68 ohms
Pressure sender:	engine off	10 ohms
	engine running 40 psi	105 ohms
	engine running 60 psi	152 ohms

IV. Volt Meter gauge:

Volts:

key on and engine off	12
engine running, no accessories or lights	13.7-14.3
engine running with accessories, lights	13.0-14.0

**NOTE:** These readings are approximate, depending on the regulator system and engine speed. Lower readings indicate a bad battery, regulator, or alternator, or incorrect wiring.

V. With VDO North America fuel tank senders (p/n 226 001), an empty tank will read 10 ohms. As fuel is added, the resistance reading will rise until the tank is full, when it reads 180 ohms.

**NOTE:** If you already have a fuel level sender in your tank, check the resistance readings. If they do not match the readings above, VDO North America manufactures a number of fuel gauges which may match these units. Sender and gauge ohm ranges *must match*.

## JUST IN CASE!

DON'T attempt to open case, as this voids the warranty.

CHECK all wiring, especially for proper ground.

REMEMBER, temperature and pressure senders are standard ground type, which means that the engine or transmission must be grounded to the same point as the gauges, battery, and chassis. Also, remember not to use teflon tape on sender threads.

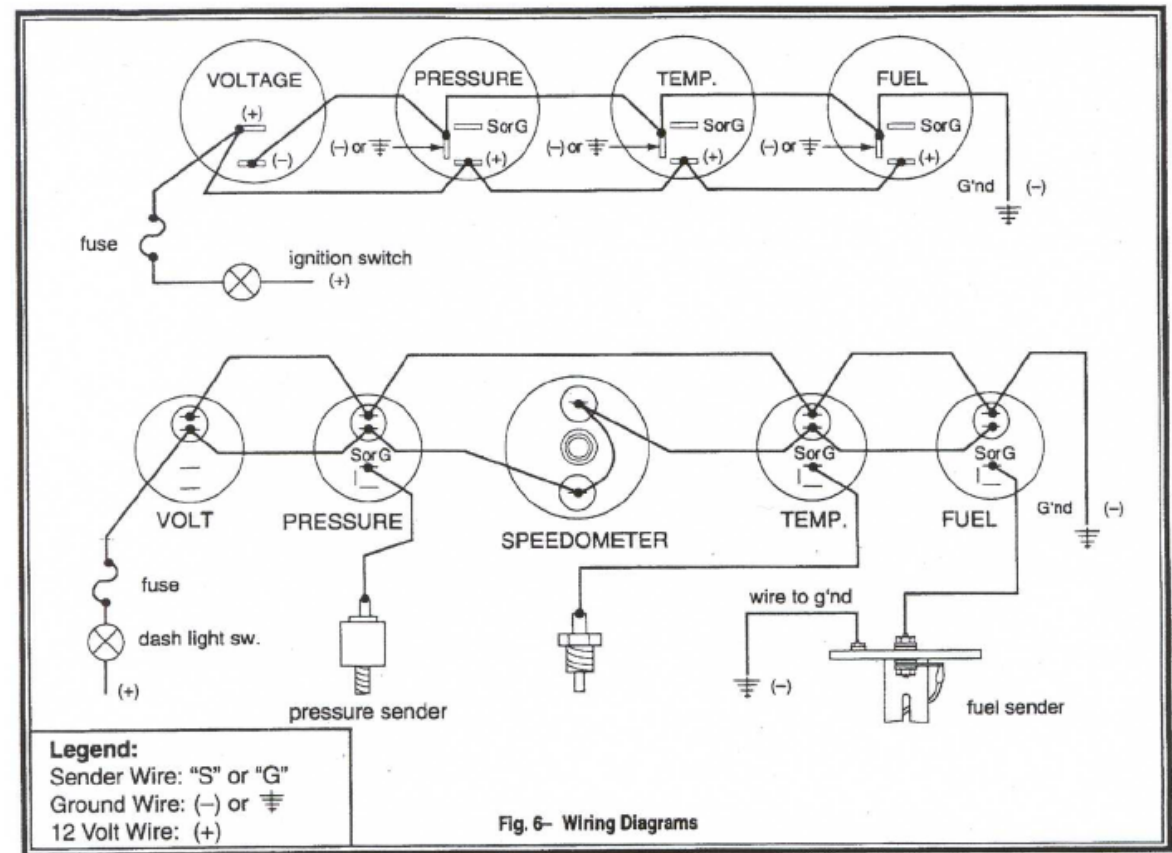
If you want an estimate on repair costs, please state this and you will be notified by phone call or in writing before any repair work begins.

Be sure to include a description of the problem, your address, and your telephone number with your package.

### Mechanical Speedometers

American cars are geared for the Speedo cable to turn 1000 revolutions in a mile. Changing tires or ring gears and pinions changes the revolutions by a percentage at all speeds. This percentage can be determined as follows:

1. Drive a measured 10 mile course after setting the tripodometer to "0". Note the reading at the end of the 10 mile course. A 9.4 reading indicates six percent slow. A 10.4 reading would indicate four percent fast.
2. Mark a 52 foot, 9-1/2 inch course on a driveway or parking lot with tape. Place a piece of tape on the rocker panel under the driver's door. Disconnect the Speedo cable from the Speedo head. Push the car up to the starting point, aligning the tape on the car with the tape on the ground. Place a paper clip on the Speedo cable core and mark the cable housing at the end of the clip for a starting point.



Push the car along the marked course, counting the cable revolutions as you go until you reach the tape marking the end of the course. The core will have turned ten times if the drive train and tires are factory standard. If the core turned 9-1/2 times, you are five percent slow. If it turned 10-3/4 times, you are 7-1/2 percent fast. Run the test three times and average out. A Ratio Test Form is provided for your convenience.

Once you determine the percentage of difference, you may be able to correct it by changing the Speedo gears. Following is a listing of gears available from GM dealers for turbo 350 and 400 transmissions. By installing a driven gear with more teeth than the one on the Speedo cable, the cable will turn slower and decrease the speed shown on the speedometer.

I. GM driven gears (the gear at the end of the Speedo cable) for Turbo 350 and 400:

<u>Part Number</u>	<u>Number of teeth</u>
3987917	17
3987918	18
3987919	19
3987920	20
3987921	21
3987922	22

II. GM drive gears (the gear in the transmission which drives the Speedo cable gear):

<u>Turbo 350 Part Number</u>	<u>Number of teeth</u>
6261783	8
6261782	9
8629547	15

<u>Turbo 400 Part Number</u>	<u>Number of teeth</u>
8629549	18
9629547	15
8440055	8

If the drive gear is changed to one with more teeth, the Speedo will show a decrease in speed. Fewer teeth will show an increase in speed. The percentage of change depends on how many more or fewer teeth are on the gears compared to the gears which you are replacing.

## VDO Service Information

### Ratio Test Form

In most vehicles, the speedometer calibration is based on a certain tire and transmission ratio. These factors were used by the speedometer manufacturer to establish the proper combination of gears and worms inside the speedometer head to obtain accurate speed readings.

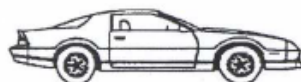
Some car manufacturers and individuals building customized cars are using different tires and/or transmission ratios rather than OEM equipped. If this is the case on your automobile, the ratio has to be established.

In general, if the tires or transmission, including the differential of your car, has been or will be altered, or if any other changes have been made that are not listed as original or factory approved equipment, the ratio has to be established.

### Tests

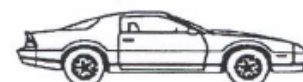
To determine the new ratio, please follow the test outlined below:

1. Check to see if the tire pressure is the same as advised by the factory.
2. Measure, by making chalk marks, a distance of 52 feet, 9-1/2 inches or 16.09 meters.
3. Unscrew the speedometer cable at the speedometer head.
4. Mark the inner core with a paper flag, paper clip, or preferably a hairpin.
5. Push or drive the vehicle over the entire distance, counting the full and partial revolutions of the cable.
6. Roll car toward the first mark until the inner core starts turning, to eliminate the gear clearance. Before beginning to count, mark the part of the vehicle which is directly over the chalk line. When this portion of the vehicle passes over the end of the line, stop counting revolutions.



A

52'-9 1/2"



B

7. Repeat this procedure three times and jot down results.

1. Test \_\_\_\_\_ full \_\_\_\_\_ partial turns.
2. Test \_\_\_\_\_ full \_\_\_\_\_ partial turns.
3. Test \_\_\_\_\_ full \_\_\_\_\_ partial turns.

If you cannot correct the Speedo reading sufficiently with gear changes, most speedometer repair shops can make a ratio adapter which will make the necessary correction. VDO also manufactures programmable speedometers which can be adjusted in the field by the owner to virtually any ratio. Check with your VDO dealer.

This manual attempts to cover most problems or situations you may encounter. However, if you need more assistance, call our corporate headquarters at **1-800-265-1818**