PROGRAMMABLE VEHICLE SPEEDOMETERS

Following are instructions for installing, wiring, and programming the Veethree Programmable Speedometer with Odometer.

CAUTION
READ THESE INSTRUCTIONS THOROUGHLY BEFORE PROCEEDING WITH INSTALLATION. DO NOT DEVIATE FROM WIRING INSTRUCTIONS. INCORRECT WIRING COULD CAUSE ELECTRICAL SHORT AND POSSIBLE FIRE. ALWAYS DISCONNECT BATTERY BEFORE MAKING ANY ELECTRICAL CONNECTIONS.

PREPARATION FOR INSTALLATION

1) Select a mounting location for gauge which provides easy readability from the operating position. Check behind mounting panel for sufficient installation clearance.

2) Depending on Speedometer model, cut either a 3.395” +/- .032” (86 mm) or 4.625 +/- .032” (118mm) diameter hole through the panel at the desired location.

3) Insert gauge into mounting hole and check for fit.

IMPORTANT:
BEFORE PROCEEDING WITH INSTALLATION AND FINAL WIRING, SPEEDOMETER MUST BE PROPERLY PROGRAMMED TO OPERATE WITH YOUR EQUIPMENT. REFER TO THE PROGRAMMING SECTION OF THIS BULLETIN BEFORE PROCEEDING.

4) Fit “U” bracket from hardware package over mounting studs on back of gauge (See Figure 1). Legs of bracket may be shortened if required.

INSTALLATION OF GAUGE

1) After checking fit of gauge and “U” bracket, insert gauge into panel and install bracket over mounting studs. Install a nut and washer onto each mounting stud as shown in Figure 1.

CAUTION
MAKE SURE THAT ELECTRICAL WIRING IS DRESSED AWAY FROM MOVING OR HOT ENGINE COMPONENTS.

Connect wiring to Gauge terminals using washers and nuts supplied. Use wire colors conforming to vehicle’s existing color code.

1) Using either black or white wire (to conform with previous wiring) run a lead from “GND” (ground) terminal of gauge to electrical system ground.

2) Run a lead from “LT” (light) terminal of gauge to panel light switch or “L” terminal of another Veethree gauge.

3) Run a lead from the positive “IGN” terminal of gauge to positive 12-16 V DC power source.

4) SPEEDOMETERS USING MAGNETIC PROXIMITY SENSORS: Run a wire from the “GND” (ground) terminal on back of gauge to one terminal on Proximity Sensor. Run a wire from the “SEND” terminal on back of gauge to the other terminal on Proximity Sensor.

SPEEDOMETERS USING PULSE GENERATORS:
Run a wire from the “GND” (ground) terminal on back of gauge to one terminal on Pulse Generator. Run a wire from the “SEND” terminal on back of gauge to the other terminal on Pulse Generator.

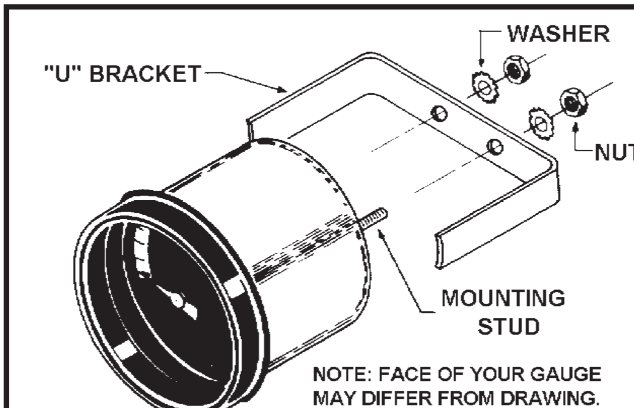


FIGURE 1

When wiring is complete, connect power. Turn key “On”. Speedometer pointer should move to “Zero”. Operate vehicle and check speedometer for proper operation.

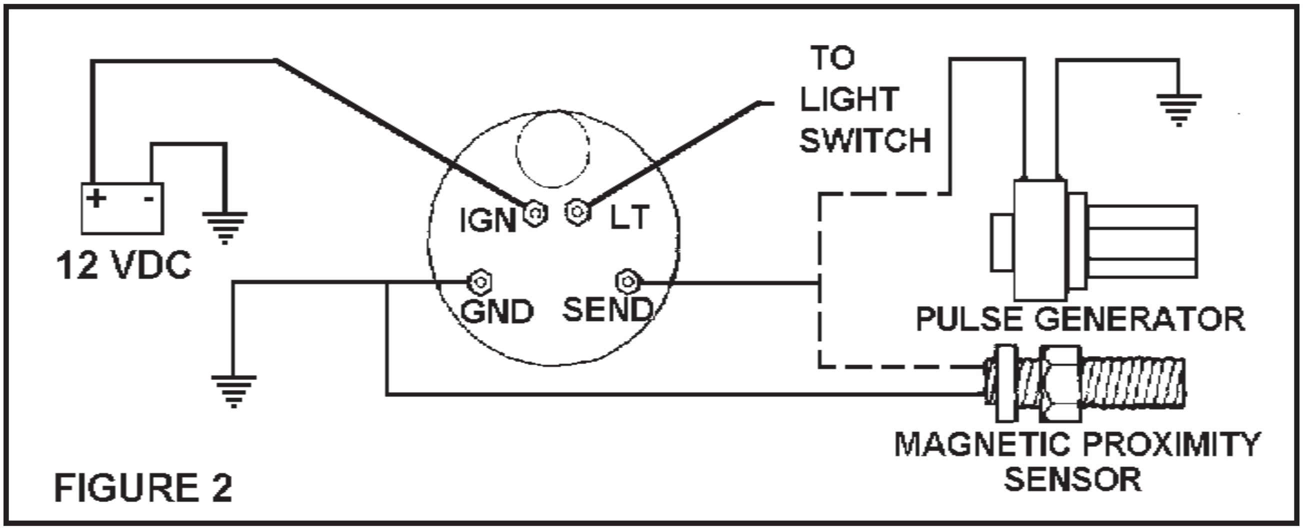
CAUTION:
BEFORE RECONNECTING BATTERY TO ELECTRICAL SYSTEM, RECHECK WIRING TO ENSURE ALL CONNECTIONS ARE PROPERLY MADE. INCORRECT CONNECTIONS OR ELECTRICAL SHORTS COULD CAUSE DAMAGE OR FIRE IN SYSTEM. ELEMENTS OF ELECTRICAL SYSTEMS SHOULD HAVE PROPER FUSES INSTALLED.

CALIBRATION - PROGRAMMING THE SPEEDOMETER

The speedometer is accurate on any system having a full scale frequency of:

30 mph models	<6,759 HZ.
50 kph models	<11,264 HZ.
85 mph models	<2,393 HZ.
120 mph models	<3,378 HZ.
140 kph models	<1,971 HZ.

Programming the speedometer is accomplished in three steps:
1. Determine the full scale frequency.
2. Calculate the divide number.
3. Program the DIP switch “Program” section.



FULL SCALE FREQUENCY CALCULATION - WHEEL MOUNTED MAGNETIC PROXIMITY SENSOR

$$\frac{\text{(Tire revolutions per mile or km)} \times \text{(no. of teeth or slots)} \times \text{full scale mph or kmh}}{3600} = \textbf{FULL SCALE FREQUENCY}$$

FULL SCALE FREQUENCY CALCULATION - TRANSMISSION MOUNTED PULSE GENERATOR

$$\frac{\text{(Tire revs/mile or km) (rear axle ratio) (\# of drive gear teeth)}}{\text{\# of driven gear teeth}} = \textbf{PULSE GENERATOR REVS/MILE OR KILOMETER}$$

$$\frac{8\text{x (Pulse Generator Revs/Mile or km)} \times \text{full scale mph or kmh}}{3600} = \textbf{FULL SCALE FREQUENCY}$$

CALCULATING THE DIVIDE NUMBER

$$\frac{\text{Full scale frequency}}{\textbf{CONSTANT}} = \textbf{DIVIDE NUMBER}$$

CONSTANTS:

30 mph models = 68.27
50 kph models = 113.78
85 mph models = 23.61
120 mph models = 34.13
140 kph models = 19.91

Example: Assume 1000 Hz full scale frequency, 85 mph model

$$\frac{1000\text{ Hz}}{24.18\text{(CONSTANT)}} = 41.36\text{, round to 41(Divide Number)}$$

The divide number **MUST BE** rounded to the nearest whole integer. In this case, the Divide number is 41.

NOTE: The tire revs/mile or kilometer may be obtained from the tire manufacturer; the rear axle ratio may be obtained from the chassis manufacturer; and the number of drive and driven gear teeth may be obtained from the transmission manufacturer.

PROGRAM DIP SWITCHES

On the rear of the speedometer there is an oval shaped black plug (see Figure 3). Upon removal of the plug two six- position DIP switches will come into view. Also on the rear of the case is a blue label denoting the function of each switch position. The label is divided into two sections- Programming and Filter. Only the eight programming switches are used at this stage. The Divide number must be programmed into the speedometer in Binary Coded Decimal format. That is, the **TENS** position and the **ONES** positions must be programmed separately.

Example: Assume a divide number of 41.

41 = 40 (**TENS** divide number)
1 (**ONES** divide number)

To program "1" refer to the charts below and move position 1 to ON and switch positions 2, 3, & 4 to OFF. To program "40" refer to the chart and move switch position 7 to ON and switch position 5, 6 and 8 to OFF.

FILTER DIP SWITCHES

To minimize any extraneous electrical "noise" from interfering with the operation of the speedometer Veethree has incorporated a filter switch to fine tune the filter band to the application. The filter programming is accomplished as follows:

Find switch positions 9 through 12 on the DIP switch on the right. Refer to the following chart labeled Filter Programming. Find the range of full scale frequencies in the left hand column that covers the full scale frequency of the application. Read across to the right and set switch positions 9 through 12 as indicated.

NOTE: For 85 mph applications using a Drive Ratio adapter providing 1000 Revs at 60 MPH, the Full Scale Frequency will be 189 Hz. and the Divide number will be 8. The program DIP switches should be set with the TENS Divide numbers to the off position and the ONES Divide numbers set for 8. The Filter programming switches should be set for the 330-347 Full Scale Frequency positions.

FILTER DIP SWITCHES

To minimize any extraneous electrical “noise” from interfering with the operation of the speedometer Teleflex has incorporated a filter switch to fine tune the filter band to the application. The filter programming is accomplished as follows:

Find switch positions 9 through 12 on the DIP switch on the right. Refer to the following chart labeled Filter Programming. Find the range of full scale frequencies in the left hand column that covers the full scale frequency of the application. Read across to the right and set switch positions 9 through 12 as indicated.

NOTE: For 85 mph applications using a Drive Ratio adapter providing 1000 Revs at 60 MPH, the Full Scale Frequency will be 189 Hz. and the Divide number will be 8. The program DIP switches should be set with the TENS Divide numbers to the off position and the ONES Divide numbers set for 8. The Filter programming switches should be set for the 330-347 Full Scale Frequency positions. Replace the oval shaped black plug. The speedometer is now fully adjusted.

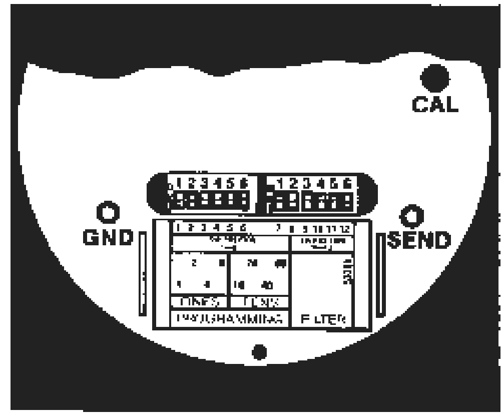


FIGURE 3

SPEEDOMETER ACCURACY

The speedometer accuracy is determined by the magnitude of the divide number and its nearness to a whole number. When the Divide number is a whole number (i.e. 42.00) the electronics error to the odometer and the vector movement is zero. This would mean the only other inherent error would be the accuracy of placing the pointer on its shaft. The worst situation would be to have a low Divide number resulting in a 0.5 fraction (i.e. 14.5). Since the program switches can only enter whole numbers the 0.5 needs to be rounded up or down. Fractional numbers closer to a whole number result in much better accuracy.

Example#l 14.5 round to 15 - - .5/15 = 3.33%error
Example#2 14.94 round to 15 - - .06/15 = O.4%error
The higher the divide number the more accurate the speedometer becomes.
Example #3 88.5 round to 89 .5/89 = .56% error
Example #4 88.13 round to 88.13/89 = .147% error

When designing an application using a magnetic proximity sensor it is very important to try to keep the Divide number as close to a whole number as possible. This will keep the system error to an absolute minimum. Whole number Divide numbers have no digital error.

If road testing through a measured mile shows incorrect speed indication, the error can be compensated as follows:

$$\frac{\text{INCORRECT READING (MPH OR KMH) x PROG.DIVIDE NO.}}{\text{ACTUAL SPEED}} = \text{CORRECT DIVIDE NO.}$$

Example: If an 85 mph speedometer reads 45 mph @ 55 mph actual speed, and the switches are set for program divide number 65 - -

$\frac{45 \times 65}{55}$ = 53.18 Round off to 53 (New Divide Number)

In this case, the switch configuration changes from Program Divide Number of 65 (101001100101) to 53 (110010101111).
0= Off, 1= On. Changing the Program Divide Number may require re-setting the Filter Program Switches as well. Once the correct Program Divide Number is achieved, the Full Scale Frequency is calculated as follows:
Program Divide No. x Constant = Full Scale Frequency
Using the scenario above, 53 (Program Divide No.) x 24.18 (Constant for 85 mph model) = 1282 HZ (Full Scale Frequency). Filter Program Switches (#9 through 12) should be set to “ On”.

PROGRAM CHART

Ones Divide Number	Switch Positions 1	2	3	4	Tens Divide Number	Switch Positions 5	6	7	8
0	OFF	OFF	OFF	OFF	<10	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	10	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	20	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF	30	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF	40	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF	50	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF	60	OFF	ON	ON	OFF
7	ON	ON	ON	OFF	70	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON	80	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON	90	ON	OFF	OFF	ON

FILTER PROGRAMMING

. Frequency full scale	Switch Positions 9	10	11	12
<347	ON	OFF	OFF	OFF
347-388	ON	OFF	OFF	ON
388-546	ON	OFF	ON	ON
546-695	OFF	OFF	OFF	OFF
695-748	OFF	OFF	OFF	ON
748-808	OFF	OFF	ON	OFF
808-905	OFF	OFF	ON	ON
905-1072	ON	ON	ON	OFF
1072-1286	ON	ON	ON	ON
1286-1497	OFF	ON	OFF	OFF
1497-1771	OFF	ON	OFF	ON
1771-2145	OFF	ON	ON	OFF
>2145	OFF	ON	ON	ON

SPECIFICATIONS

Scale Range	**Frequency**
0-30 mph	< 6,759 Hz
0-50 kmh	<11,624 Hz
0-85 mph	< 2,393 Hz
0-120 mph	< 3,378 Hz
0-140 kmh	< 1,971 Hz

Operating temperatures	-40º to 185º F	
Voltage Range	12 - 16 VDC	
Shock	per SAE J 1226	
Vibration	per SAE J 1226	
Transient Voltage	per SAE J 1226	
Accuracy @ 70º F (85 mph model shown, is typical)	18.9 - 22.4 mph 39.5 - 43 mph 55-58.4 mph	SAE J 1226*
Accuracy @ -40º and 185º F	within +/- 2% of readings at 70º F	
Current Draw	50 mA	
Panel cutout	3.395 +/- .032 in.(86mm) or 4.625 in.(118mm) diameter	
Program positions	99	
Odometer range	999999.99	
Odometer accuracy	Per SAE J 1226*	
Illumination	2 candlepower bulb and socket.	

*Conformance based on whole number Divide Number programming.

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