

RATIO TEST

Siemens VDO Service Information

RATIO TEST FORM

In most vehicles the speedometer calibration is based on 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 custom cars are using different tires and/or transmission ratios than the ones designed by the OEM. If this is your situation, a new ratio must be established.

In general: If the tires or transmission, including the differential, has been altered from its original design, or if any other changes have been made that are not listed as original or factory specifications or approved equipment, the ratio must be adjusted.

TEST:

1. Check to see if the tire pressure is the same as recommended by the factory.
2. Measure (by making chalk marks) a distance of 52' 9½" (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 with a hairpin.
5. Push or drive the vehicle over the entire distance, counting the full and partial revolutions of the cable.
6. Always roll the car towards the first mark until you see the inner core of the speedometer cable start turning (thus eliminating the gear clearance). Before you start counting, mark the part of the vehicle that is exactly over the beginning chalk mark. Stop counting when the marked part of the vehicle is exactly over the the second (ending) chalk mark.



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

Test 1: Number of full turns _____ Number of partial turns _____.

Test 2: Number of full turns _____ Number of partial turns _____.

Test 3: Number of full turns _____ Number of partial turns _____.

Product: Speedometer	Description TROUBLESHOOTING GUIDE	Date Oct 2003
Type: Mechanical		Issue 1

General Information:

This troubleshooting guide is intended to help you with the installation of Siemens VDO Automotive instruments. Please however check the instructions provided within the package the instrument came in for more details.

Testing

American cars are geared for the speedometer cable to turn 1,000 revolutions in a mile. Changing tires or ring gears and pinion, 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 trip meter to "0". Note the reading at the end of the ten mile course. A 9.4 reading means 6% slow. A 10.4 reading means 4% 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 speedometer cable from the speedometer 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 speedometer cable core and mark the cable housing at this 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 would turn ten times if the tires and drive train were to factory standard. If the core turned 9-1/2 times, you are 5% slow. If it turned 10-3/4 times, you are 7-1/2% fast. Run test three times and average.

Once you determine the percentage of difference, you may be able to correct the difference by changing the speedometer gears. The following is a listing of gears available from G.M. dealers for turbo 350 and 400 transmissions.

G.M. Driven Gears (the gear on the end of the speedo cable) for Turbo 350 and 400:

Part Number	Number of Teeth
3987917	17
3987918	18
3987919	19
3987920	20
3987921	21
3987922	22

By installing a driven gear with more teeth than the one on the speedometer cable, the cable turns faster and increases the speed shown on the speedometer.

G.M. Drive Gears (the gear in the transmission driving the speedometer cable gear):

Turbo 350 Part #	No. of Teeth	Turbo 400 Part #	No. of Teeth
6261783	8	8629549	18
6261782	9	8629547	15
8629547	15	8440055	8

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

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

We have tried to cover most problems or situations you may encounter. If you need further assistance, please call 1-800-265-1818 for technical support

Product: Gauges	Description Fuel/ Température/ Pressure Gauges	Date Oct 2003
Type: Electrical		Issue 1

General Information:

This troubleshooting guide is intended to help you with the installation of Siemens VDO Automotive instruments. Please however check the instructions provided within the package the instrument came in for more details.

Testing Gauges

If a gauge is suspected to be faulty, the following test can be performed on VDO gauge.

1. Turn the key on:
Pressure Gauge – pointer to "0"
Fuel Gauge – pointer to amount in fuel tank
Temperature Gauge – pointer to temperature of engine water
2. With the key on, pull sender wire off the sender:
Fuel & Pressure Gauge – pointer will go to maximum right hand position
Temperature Gauge – pointer will go to maximum left hand position
3. With the key on, ground the sender wire to the engine chassis:
Fuel & Pressure Gauge – pointer will go to maximum left hand position
Temperature Gauge – pointer will go to maximum right hand position
4. All VDO electric gauge pointers peg full left hand position with the key off.

Product: Senders	Description TROUBLESHOOTING GUIDE	Date Jan 2005
Type: Electrical		Issue 1

General Information:

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TEMPERATURE & PRESSURE SENDERS

Do not use Teflon tape on the threads. It will interfere with the sender ground. Sender threads are tapered pipe threads and are self sealing. Temperature senders are most accurate when installed in the intake manifold. It is also acceptable to use the OEM engine manufacturing specified location. Do not use tee adapters or angle adapters for temperature senders since the sender tip or bulb must be immersed in the water flow.

Senders can be tested with an ohm meter that measures from 10 to 2,000 ohms. Connect the positive lead from the tester to the sender terminal and the negative lead to a good ground. The following readings will occur if the sender is operating properly.

Temperature Sender: Cold -700
Hot (250 degrees) -22

Pressure Sender: Engine off – 10 ohms
Engine running 40psi = 105 ohms, 60psi = 152 ohms

FUEL SENDERS

Gauge manufacturers use different ohm ranges when building their fuel senders. The following are typical:

	EMPTY	FULL
VDO Lever Arm (included in instrument kit)	10 ohm	180 ohm
Stewart Warner	240 ohm	33 ohm
G.M. from '65	0 ohm	90 ohm
G.M. pre '65	0 ohm	30 ohm
Ford pre '90	73 ohm	10 ohm
VDO Tube Type	60-90 ohm	0 ohm

VDO makes compatible fuel gauges in some styles. Check the catalogue for the style and part number which matches your sender.

Note: The sender and gauge ohm ranges **must** match.

FUEL TANK SENDERS

As explained before, there are many different ohm ranges in sending units. Therefore, with an ohmmeter you can check to ascertain if unit is working properly.

VDO No. 226 001 E = 10 ohms F = 180 ohms

An empty tank will read 10 ohms. As you add gas, the ohm reading will go up until the tank is full and reads 180 ohms.

G.M.: Both 0-30 and 0-90. Empty tank will read "0" ohms. As you fill the tank, ohm reading will go up.

Stewart Warner and Ford: Empty tank will read high ohm range (S.W. 240) (Ford 73) and go down as you fill tank.

Product: Fuel Gauge	Resistance Chart	Date Oct 2004
Type: Electrical		Issue 1

MEASURING RANGE: E - F										240 - 33.5 OHMS	
RANGE	E	1/8	1/4	3/8	1/2	5/8	3/4	7/8	F		
0	240	196	153	125	103	87	67	45	33		
MOVEMENT NUMBER: 999 010 003											

REVISION 'C' (MAY '96)
DIAL NUMBER: 999 040 025
999 040 048

MEASURING RANGE: Fuel 0 - 1/1										3 - 180 OHMS	
RANGE	0	1/8	1/4	3/8	1/2	5/8	3/4	7/8	1/1		
0	3	25	45	65	85	110	138	156	180		
MOVEMENT NUMBER: 999 010 003											

REVISION 'B' (APR '95)
DIAL NUMBER: 999 040 024
999 040 047

MEASURING RANGE: Fuel E - F										16 - 168 OHMS	
RANGE	E	1/8	1/4	3/8	1/2	5/8	3/4	7/8	F		
0	13	32.2	53	73.5	94.2	115	135.7	157.4	183		
MOVEMENT NUMBER: 999 010 009											

REVISION 'D' (MAY '96)
DIAL NUMBER: 999 040 059
999 040 060

MEASURING RANGE: FUEL E - F										0 - 90 OHMS	
RANGE	E	1/8	1/4	3/8	1/2	5/8	3/4	7/8	F		
0	3	13.5	22.5	33	45	56	67.5	76.5	88		
MOVEMENT NUMBER: 999 010 001											

REVISION 'B' (MAY '96)
DIAL NUMBER: 999 040 061

MEASURING RANGE - FUEL E - F (Adjustable)										60/90 - 0.5 OHMS	
RANGE	E	1/8	1/4	3/8	1/2	5/8	3/4	7/8	F		
0	74	62	52.5	44.5	37	30	22.5	13	0.5		
MOVEMENT NUMBER: 999 010 004											

REVISION 'B' (APR '95)
DIAL NUMBER: 999 040 062
999 040 063

MEASURING RANGE: FUEL 0 - 1 (VV)										73 - 9.6 OHMS	
°C	0	1/4	1/2	3/4	1						
0	73	32.5	20.8	13.8	9.6						
MOVEMENT NUMBER: 999 010 018											

REVISION 'B' (APR '95)
DIAL NUMBER: 999 040 064
999 040 065

Product: Boost Gauge	Description RESISTOR	Date Aug 2003
Type: Electrical		Issue 1

Resistor for a Noisy Gauge

(Make your own Resistor)

Take a short piece of solid core 22 gauge copper wire. Strip insulation away pull the nylon tubing off the back of the gauge. Insert the wire into the nylon tube. About two inches from the gauge end of the nylon tube, with the wire inside, heat the tubing with a heat gun until the tubing collapse, remove the heat. When the tubing cools, pull the wire out of the tubing, re-attach the tubing to the gauge. You have just made yourself a resistor.

Product: Temperature Gauge	Resistance Chart	Date Oct 2004
Type: Electrical		Issue 1

MEASURING RANGE: 50-150 ° C										322.4 - 18.6 OHMS	
° C	50	60	70	80	90	100	110	120	130	140	150
0	322.8	165	133	112.5	83	62.2	47.5	36.5	28.9	23.1	18.6
MOVEMENT NUMBER: 999 010 005											

REVISION 'B' (APR '95)
DIAL NUMBER: 999 040 013
999 040 036
999 040 052

MEASURING RANGE - 200 ° C								482.5 - 14.25 OHMS			
° C	60	100	120	140	160	180	200				
0	482.5	151.2	85.45	53	32.2	21.1	14.25				
MOVEMENT NUMBER: 999 010 012											

REVISION 'A' (APR '95)
DIAL NUMBER: 999 040 020

MEASURING RANGE: 100 - 220 ° F										447 - 46.5 OHMS	
° F	100	120	140	160	180	200	220	240	260	280	300
0	447	298	198.4	160	131	108	90	76	64	54	46.5
MOVEMENT NUMBER: 999 010 006											

REVISION 'B' (APR '95)
DIAL NUMBER: 999 040 014
999 040 037

MEASURING RANGE - 100 ° C								447 - 46.5 OHMS			
° C	40	50	60	70	80	90	100				
0	410	290	200	135	97	71	52.5				
MOVEMENT NUMBER:											

REVISION 'B' (APR '95)
REFERENCE

MEASURING RANGE: 100 ° C										348 - 29 OHMS	
° C	100	120	140	160	180	200	220	240			
0	348	233	155	103	70	51	38.5	29			
MOVEMENT NUMBER: 999 010 015											

DIAL NUMBER: 999 040 021
999 040 044

MEASURING RANGE - SECONDARY SCALE: 110 ° C										482.5 - 14.25 OHMS	
° C	40	50	60	70	80	90	100	110			
0	330	210	155	108	76	59	45	34			
MOVEMENT NUMBER:											

REVISION 'A' (APR '95)
REFERENCE

MEASURING RANGE: 250 ° F										287.4 - 22.7 OHMS	
° F	100	120	140	160	180	190	200	210	220	230	250
0	287.4	190	134	92	62	51.3	46	38	34	29.4	22
MOVEMENT NUMBER: 999 010 008											

REVISION 'B' (APR '95)
DIAL NUMBER: 999 040 015
999 040 038

MEASURING RANGE - SECONDARY SCALE: 120° C										287.4 - 22.7 OHMS	
° C	40	50	60	70	80	90	100	110	120		
0	260	158	134	94	67	49	37	29.4	23		
MOVEMENT NUMBER: 999 010 008											

REVISION 'B' (APR '95)
REFERENCE

MEASURING RANGE: 100 - 280 ° F										556 - 31 OHMS	
° F	100	120	140	160	180	200	220	240	260	280	
0	3	25	45	65	85	110	138	156	180		
MOVEMENT NUMBER: 999 010 003											

REVISION 'B' (APR '95)
 120 MARK ONLY ON
 DIAL NUMBER: 999 040 045
 190 MARK NOT ON
 DIAL NUMBER: 999 040 045
 999 040 022

MEASURING RANGE: SECONDARY SCALE: 140 ° C										556 - 31 OHMS	
° C	40	60	70	80	90	100	110	120	130	140	
0	475	244	180	132	96	72	53	42	34	29	
MOVEMENT NUMBER:											

REVISION 'B' (APR '96)

REFERENCE

MEASURING RANGE: 300 ° F										322.8 - 18.6 OHMS	
° F	120	160	180	200	220	240	260	280	300		
0	322.8	135	105.7	76	57	42	31	23	18.6		
MOVEMENT NUMBER: 999 010 005											

REVISION 'B' (APR '95)

DIAL NUMBER: 999 040 016
 999 040 039

MEASURING RANGE - SECONDARY SCALE: 150 ° C										322.8 - 18.6 OHMS	
° C	50	80	90	100	110	120	130	140	150		
0	322.8	135	105.7	76	57	42	31	23	18.6		
MOVEMENT NUMBER: 999 010 005											

REVISION 'B' (APR '95)

REFERENCE

MEASURING RANGE: 140 - 320 ° F										1815 - 80 OHMS	
° F	140	160	180	200	220	240	260	280	300	320	
0	1815	1130	750	490	350	237	170	128	99	80	
MOVEMENT NUMBER: 999 010 009											

REVISION 'B' (APR '95)

DIAL NUMBER: 999 040 023
 999 040 046

MEASURING RANGE - SECONDARY SCALE: 160 ° C										1815 - 80 OHMS	
BAR	60	70	80	90	100	110	120	130	140	150	160
0	1815	1160	800	550	410	290	210	155	118	90	80
MOVEMENT NUMBER:											

REVISION 'B' (APR '95)

REFERENCE

MEASURING RANGE: 400 ° F										482.5 - 14.5 OHMS	
° F	150	175	200	225	250	275	300	325	350	375	400
0	482.5	270	182	120	82	56	41	30.5	23	18	14.5
MOVEMENT NUMBER: 999 010 012											

REVISION 'A' (APR '95)

DIAL NUMBER: 999 040 017
 999 040 040

MEASURING RANGE - SECONDARY SCALE: 200° C										482.5 - 14.5 OHMS	
° C	70	90	110	130	150	170	200				
0	420	185	110	66	39	27	15				
MOVEMENT NUMBER: 999 010 008											

REVISION 'B' (APR '95)

REFERENCE

Product: Pyrometer	Description GAUGE TESTING	Date Jan 03
Type: Electrical		Issue 1

1. Turn power supply to millivolts (mV)
2. Hook the red lead of the generator to the positive (+) terminal of the gauge
3. Hook the black lead of the generator to the negative (-) terminal of the gauge
4. Increase the millivolts (mV) to see the needle increase on the gauge
5. If the gauge needle does not move the gauge is defective.

Product: Pyrometer	Description SENDER TESTING	Date Jan 03
Type: Electrical		Issue 1

1. Turn voltmeter to millivolts (mV)
2. Hook the red lead of the voltmeter to the red lead of the thermocouple.
3. Take the black lead of the voltmeter to the black lead of the thermocouple.
4. Take a flame to heat up the thermocouple at the compression ring.
5. The voltmeter should start to rise - if not the thermocouple is bad.

Product: Voltmeter	Description VOLTMETER / WIRING	Date Oct 03
Type: Electrical		Issue 1

General Information:

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VOLTMETERS

- Key on-engine off-12 volts.
- Engine running without accessories or lights on-13.5-14.5 volts, (approx.)
- Engine running with accessories and lights on-13.0-14.0 volts (approx.)
- Lower readings mean a weak battery or malfunction in the alternator or voltage regulator.

WIRING

We recommend 16-gauge wiring except for the final ground wire which should be 14-gauge. Wire the gauges in a series from a (+) accessory source which is not already overloaded with other accessories such as electric fans and air conditioning. The ground is also run in series including the light socket ground. The final 14-gauge wire needs to be connected to a good ground such as the engine block ground strap or the battery ground itself.

All wiring should be of high quality stranded wire with good insulation. Take care to avoid hot engine components when running engine compartment wire. Use grommets when running wire through the fire wall. If your gauge's pointer moves noticeably when the lights, fans, or air conditioner turns on, you are experiencing a low voltage condition. This may be due to the following factors:

- You have installed the gauges to an overloaded circuit either on the positive or negative wire. Re-wire to eliminate problem.
- Voltage output of alternator during idle conditions may be too small for electrical system. Hook up voltmeter and monitor voltage. Voltage should not drop below 12.75 volts at any time.

SIEMENS VDO

A u t o m o t i v e

Technical Bulletin

No. TB-332 002

Product: Voltmeter Gauge	Description Resistance Chart	Date Oct 04
Type: Electrical		Issue 1

MEASURING RANGE: 8 - 16 Volts										8 - 16 Volts	
VOLTS	8	9	10	11	12	13	14	15	16		
0	8	9	10	11	12	13	14	15	16		
MOVEMENT NUMBER: 999 010 010											

REVISION 'B' (APR '95)

DIAL NUMBER: 999 040 018

999 040 041

999 040 054

999 040 056

MEASURING RANGE: 18 - 32 Volts										18 - 32 Volts	
PSI	18	20	22	24	26	28	30	32			
0	18	20	22	24	26	28	30	32			
MOVEMENT NUMBER: 999 010 011											

REVISION 'B' (APR '95)

DIAL NUMBER: 999 040 019

999 040 042

999 040 057

Product: Tachometer	ERRATIC OPERATION	Date Aug 03
Type: Electrical		Issue 1

To Reduce or Eliminate Erratic Operation in Tachometers

1. Purchase diode #1N4005 from your local electronics store.
2. Cut both ends of the diode so each is approx. 3/ 4" long.
3. Crimp a 1/ 4" female spade connector on the end of the diode with the silver band.
4. Crimp a butt-splice connector on the other end of the diode.
5. Crimp the opposite end of the butt-splice connector to the wire connected to ignition signal source.
6. Connect 1/ 4" female spade connector used in step # 3 above to terminal # 4 on the back of the tachometer.
7. Connect a ground (-) wire to terminal # 3.
8. Connect a switched 12-volt power wire to terminal # 2.
9. Set switches for the appropriate number of cylinders.



Product: Tachometer	Description FORMULA CALCULATION	Date Aug 03
Type: Electrical		Issue 1

Formula for determining number of pulses to set on the Tachometer (with engine hour-meter) fitted with Alternator

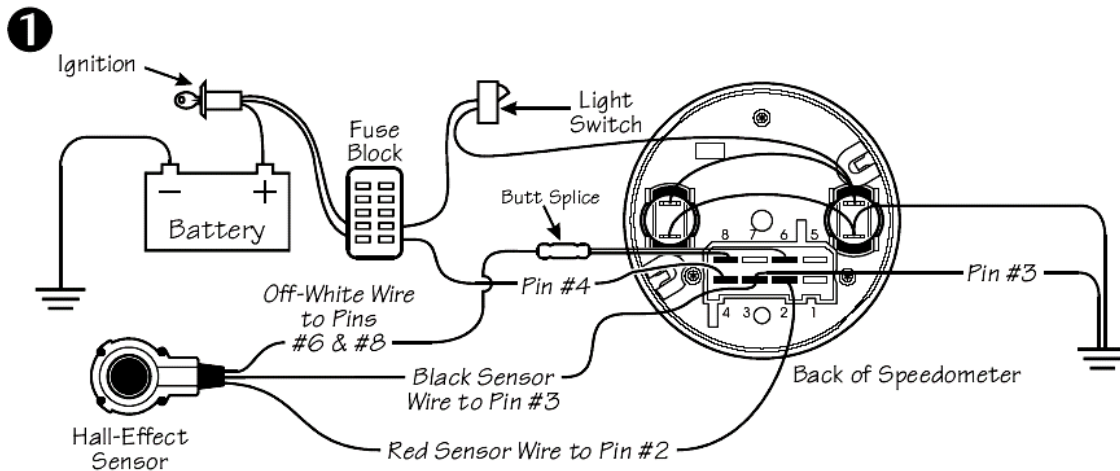
Divide the **diameter of the Crankshaft Pulley** by the **diameter of the Alternator Pulley**. Multiply this number times **one-half the number of poles on the alternator**. (14 pole alternators = 7, 12 pole alternators = 6, etc.)

This total gives you the number of pulses per revolutions.

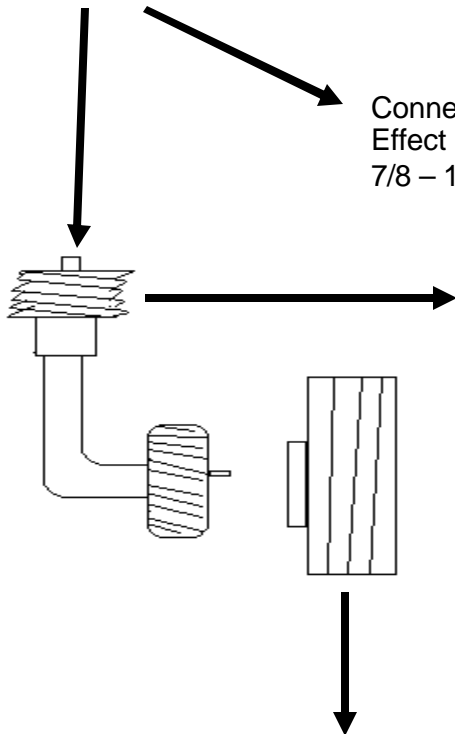
Use this number to determine dip switch settings as shown in the table on Page 2 of the instruction sheet.

Product: Speedometer	Description Hall Effect Sensor for VW	Date Dec 2004
Type: Electrical		1

Part Number: 340-011



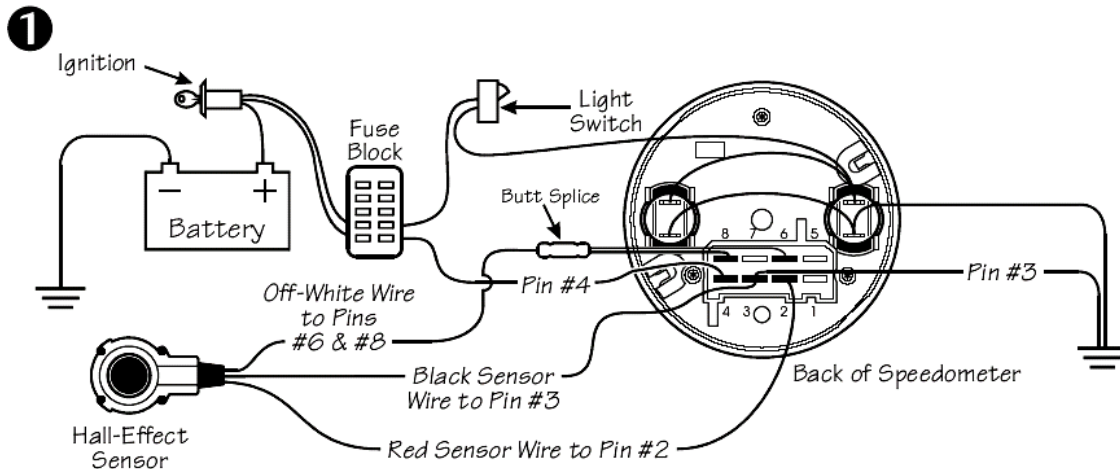
Connection from Siemens VDO – Hall Effect Speed Sensor – Female connector 7/8 – 18 thread.



Have a speedometer machine shop remove (end) and shorten cable to the length you need (to mount it per your needs). Then have them install a male connection 7/8 – 18 thread end on your cable which will then screw into the Hall Effect Speed Sensor Part number 340-011.

Drive at wheel hub

Product: Speedometer	Description Hall Effect Sensor Wiring and Testing	Date Jan 2005
Type: Electrical		1



Wiring of Sender to Speedo:

- Red on sender to terminal #2 on speedo
- Black on sender to terminal #3 and ground (important)
- Off-white on sender to terminals #6 and #8
- Keyed Power of 12volts to term #4

Testing Hall Effect Sender and Wiring:

- Turn ignition key "ON". Put red lead of a voltmeter to term #2 of the speedometer and black lead to term #3. You should have approx. 5volts dc.
- With the key "ON", leave the black lead of the voltmeter on term #3 and put the red lead on term #8. Remove the sender from the transmission with the square drive key in place in the sender. Rotate the square drive shaft key in either direction very slowly with your fingers. You should see the voltmeter pulse from 0-4 volts dc (0-4-0-4-0). If it pulses, the sender is working properly.
- If the voltmeter stays a constant 5 volts dc, the sender is defective.

Programming the Speedo:

- Mark a measured mile with another vehicle by spraying a paint line on the side of the road, drive 1 mile and spray another paint line on the side of the road.
- Hold the black button "in" on front of speedometer while starting the vehicle. Once the vehicle is started release the button.
- Now using the button on the front of the speedometer, push and scroll until it says "AUtOCl". Then wait a few seconds and the word "bUttOn" will appear on the display.
- Drive to your first mile marker at this point. Your speedo will not work in this mode. At your first mile marker, press the button on the front of the speedo. The word "StArt" will appear. Start driving until you reach your next mile marker, press the button. You are finished and the speed as well as odometer will be calibrated.
- If you change gearing or tire sizes in the vehicle at any time repeat the process for re-calibration of the speedometer.

Product: Pressure Gauge	Description Resistance Chart	Date Oct 04
Type: Electrical		Issue 1

MEASURING RANGE: 80 PSI										10 - 192 OHMS	
PSI	0	10	20	30	40	50	60	70	80		
0	10	36	61	84	108	132	156	179	192		
MOVEMENT NUMBER: 999 010 009											

REVISION 'B' (APR '95)
DIAL 999 040 007
999 040 030

MEASURING RANGE - SECONDARY SCALE: 5 BAR							10 - 192 OHMS				
BAR	0	1	2	3	4	5					
0	10	48	82	116	151	184					
MOVEMENT NUMBER:											

REVISION 'B' (APR '95)

REFERENCE

MEASURING RANGE: 80 PSI										240 - 33.5 OHMS	
PSI	0	10	20	30	40	50	60	70	80		
0	240	196	153	125	103	87	67	50	33.5		
MOVEMENT NUMBER: 999 010 003											

REVISION 'B' (APR '95)
DIAL 999 040 006
999 040 028

MEASURING RANGE - SECONDARY SCALE: 5 BAR							240 - 33.5 OHMS				
BAR	0	1	2	3	4	5					
0	240	175	128	97	71	46					
MOVEMENT NUMBER:											

REVISION 'B' (APR '95)

REFERENCE

MEASURING RANGE: 5 BAR										10 - 180 OHMS	
BAR	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
0	10	30	48	65	82	99	116	134	151	168	184
MOVEMENT NUMBER: 999 010 009											

REVISION 'B' (APR '95)
DIAL 999 040 003
999 040 026

MEASURING RANGE: 100 PSI										10 - 180 OHMS	
PSI	0	10	20	30	40	50	60	70	80	90	100
0	10	34	52	69	84	97	108	121	137	155	180
MOVEMENT NUMBER: 999 010 009											

REVISION 'B' (APR '95)
DIAL 999 040 008
999 040 031

MEASURING RANGE - SECONDARY SCALE: 7 BAR							10 - 180 OHMS				
BAR	0	1	2	3	4	5	6	7			
0	10	42	67	88	105	124	149	181			
MOVEMENT NUMBER: 999 010 008											

REVISION 'B' (APR '95)

REFERENCE

MEASURING RANGE: 100 PSI										240 - 33.5 OHMS	
PSI	0	10	20	30	40	50	60	70	80	90	100
0	240	188	160	138	121	103	92	76	60	46	33.5
MOVEMENT NUMBER: 999 010 003											

REVISION 'B' (APR '95)
DIAL 999 040 029
999 040 050

MEASURING RANGE - SECONDARY SCALE: 7 BAR							240 - 33.5 OHMS				
BAR	0	1	2	3	4	5	6	7			
0	240	173	140	118	96	73	52	33			
MOVEMENT NUMBER: 999 010 003											

REVISION 'B' (APR '95)

REFERENCE

MEASURING RANGE: 150 PSI												10-189.5 OHMS				
PSI	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
0	10	26	40	53	67	78	90.5	103	115	127	138	149	160	169	178	189.5
MOVEMENT NUMBER: 999 010 009																

REVISION 'B' (APR '95)

DIAL NUMBER: 999 040 009
999 040 032

MEASURING RANGE - 10 BAR										10-189.5 OHMS						
BAR	0	2	4	6	8	10										
0	10	52	88	124	155	184										
MOVEMENT NUMBER:																

REVISION 'B' (APR '95)

REFERENCE

MEASURING RANGE: 150 PSI												240 - 33.5 OHMS				
PSI	0	15	30	45	60	75	90	105	120	135	150					
0	240	188	160	138	121	103	92	76	60	46	33.5					
MOVEMENT NUMBER: 999 010 003																

REVISION 'B' (APR '95)

DIAL 999 040 043
999 040 053

MEASURING RANGE - SECONDARY SCALE: 10 BAR										240 - 33.5 OHMS						
BAR	0	2	4	6	8	10										
0	240	162	125	96	67	37										
MOVEMENT NUMBER: 999 010 003																

REFERENCE

MEASURING RANGE - 10 BAR												10 - 180 OHMS				
BAR	0	1	2	3	4	5	6	7	8	9	10					
0	10	31	52	71	88	106	124	140	155	170	184					
MOVEMENT NUMBER: 999 010 009																

REVISION 'B' (APR '95)

DIAL 999 040 004
999 040 027
999 040 049

MEASURING RANGE: SECONDARY SCALE: 150 PSI												10 - 180 OHMS				
PSI	0	30	60	90	120	150										
0	10	55	90	127	162	189										
MOVEMENT NUMBER:																

999 040 058

REVISION 'B' (APR '95)

REFERENCE

MEASURING RANGE: 25 BAR												10 - 180 OHMS				
BAR	0	2.5	5	7.5	10	12.5	15	17.5	20	22.5	25					
0	10	32	53	73	92	101	125	143	155	169	184					
MOVEMENT NUMBER: 999 010 009																

REVISION 'D' (APR '95)

DIAL 999 040 005

MEASURING RANGE: 400 PSI												10 - 184 OHMS				
PSI	0	50	100	150	200	250	300	350	400							
0	10	36	66	82	103	125	141	161	184							
MOVEMENT NUMBER: 999 010 009																

REVISION 'B' (APR '95)

DIAL 999 040 010
999 040 033

MEASURING RANGE - SECONDARY SCALE: 25 BAR										10 - 184 OHMS						
BAR	0	5	10	15	20	25										
0	10	50	69	110	136	169										
MOVEMENT NUMBER: 999 010 008																

REVISION 'B' (APR '95)

REFERENCE

Product: Programmable Speedometer	Calibration Guide	Date Oct 04
Type: Electrical		Issue 1

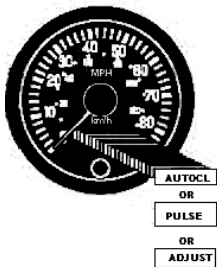
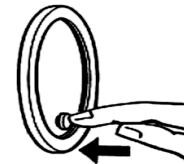
Calibration of the **VDO Programmable Speedometer** is a relatively simple procedure. To Calibration:

1. Your vehicle must be driven over a 1 mile markers or between a 1 mile course – either between highway mile makers or between a 1 mile stretch that you mark off with your family car.



1 Mile

2. Bring your vehicle to the beginning of the 1 mile course and shut off your ignition.
3. Hold in the odometer trip button and while holding it in, restart your engine.



4. The odometer window should say "AUTOCL". If it doesn't it will read "PULSE" or "ADJUST", as shown at left. If it reads "PULSE" or "ADJUST", hold in the button until "AUTOCL" appears in the window and then release the button.

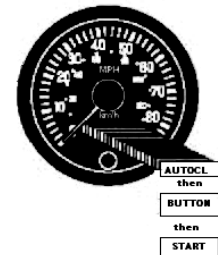
5. In about 3 seconds, the word "AUTOCL" disappears and the word "BUTTON" appears.

6. Push the button again.

7. The word "BUTTON" disappears and the word "START" appears and flashes
8. Start driving toward the next mile or the end of your marked course. You may drive at any speed you like. The word "START" will continue to flash and the pointer will stay on "0".
9. At the next mile marker or the end of the mile course, stop your vehicle.

DO NOT SHUT OFF YOUR ENGINE!

10. Push the button again.
11. The odometer window will show "P" with numbers after it. These are the pulses the sender produced over the mile you just drove.
12. The window will then switch to either the odometer reading or the trip odometer reading. You are finished calibrating your VDO Programmable speedometer.
13. To switch between the odometer and trip odometer, simply push the button.
14. To zero out the trip reading, hold the button for about 2 or 3 seconds.



Product: Speedometer	Description CALIBRATION PROGRAM	Date Aug 03
Type: Electrical		Issue 1

CALIBRATION PROGRAM FOR HALL EFFECT SENDER

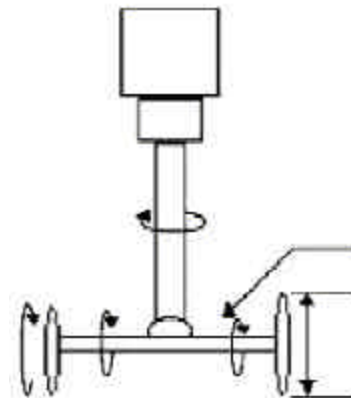
In Parameters Are The Following:

- Tire Diameter X 3.14159 = Tire Circumference
- Tire Circumference / 12 = Tire Circumference in feet
- 5280' / Tire Circumference in feet = Tire Revolutions per Mile
- Tire Revolutions per Mile X Rear End Ratio (411 rear enter as 4.11) Pulse
- Pulse X (Drive Gear or Driven Gear) X 16 Pulse per Revolution Sender = Pulse per Mile

Computation Results:

Computed Driven Gear is 39776 Ratio of Driven over Drive Gear is 2486.0

Engine	No. of pulses per mile
Transmission	<i>Known:</i> 16 pulse/rev. Tire Diameter Rear End Ratio
Rear	1 mile = 5280 feet
X= Tire Diameter	



Example:

Tire circumference = 2π R R = Diameter / 2 = 28.88 / 14.44
 = 2 x π x 14.44 = 90.73 inches / 12 inches = 7.56 feet
 So ... 1 tire revolution = 7.56 feet of travel ...

How many revolutions (tire) to go 1 mile ? 5280 feet / 7.56 feet = 698 revolution Rear end ratio = 3:55:1

3:55 ? 1
 2479 ? 698
 2479 = revolution at transmission
 2479 revolutions x 16 pulses (Teeth) / revolution = 39669 pulses.

Product: Temperature Gauge	Description Testing Cylinder Head Temperature	Date Jan 04
Type: Electrical		Issue 1

Gauge Testing

- 1) Turn power supply to millivolts (mV)
- 2) Hook the red lead of the generator to the positive (+) terminal of the gauge.
- 3) Hook the black lead of the generator to the negative (-) terminal of the gauge
- 4) Increase the millivolts (mV) to see the needle increase on the gauge
- 5) If the gauge needle does not move, the gauge is defective

Product: Sender	Description CYLINDER HEAD TEMPERATURE	Date Jan 04
Type: Electrical		Issue 1

Sender Testing

- 1) Turn voltmeter to millivolts (mV)
- 2) Hook the red lead of the voltmeter to the black lead of the thermocouple.
- 3) Take the black lead of the voltmeter to the red lead of the thermocouple.
- 4) Take a flame to heat up the thermocouple at the compression ring.
- 5) The voltmeter should start to rise. If not the thermocouple is bad.

Product: Tachometer	Description GENERATOR SENDER TESTING	Date Sept 03
Type: Electrical		Issue 1

Resistance Testing Generator Sender

- Unplug sender wires from the back of the tachometer.
- Using an ohm meter, check the resistance of the sender by connecting across the two wires.
 1. The sender should produce a resistance of 50 ohms. If not, re-test at the sender terminals.
 2. If reading is 50 ohms at the sender, the fault is in the vehicles wiring.
 3. If reading is less than or greater than 50 ohms, replace the sender. Continue on with function test.

Function Testing Generator Sender

- Unplug sender wires from the back of the tachometer. Start the vehicle and run at 1000 rpm. Measure output AC voltage across sender wires.
 1. A nominal voltage of 10 volts RMS should be obtained. If not, remove the sender terminals.
 2. If reading is 10 volts RMS at the sender, the fault is in the vehicles wiring.
 3. If reading is OK, fault is in the vehicles wiring.
 4. If reading is below 10 volts RMS, replace the sender.

NOTE: WHEN FUNCTION TESTING, BEAWARE THAT THIS IS ASSUMED TO BE ON AN APPLICATION OF 1:1 RATIO OF ENGINE GRANKSHAFT SPEED. SENDERS RUNNING OFF THE CAM SHAFT MUST BE TESTED AT 2000 RPM. ALSO INCREASE OR LOWER ENGINE SPEED ACCORDINGLY IF USED IN CONJUNCTION WITH SPEED REDUCERS OR RATIO ADAPTERS.