

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	Description 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: 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.

Product: Voltmeter Gauge	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	Description 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: Pressure Gauge	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: 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.