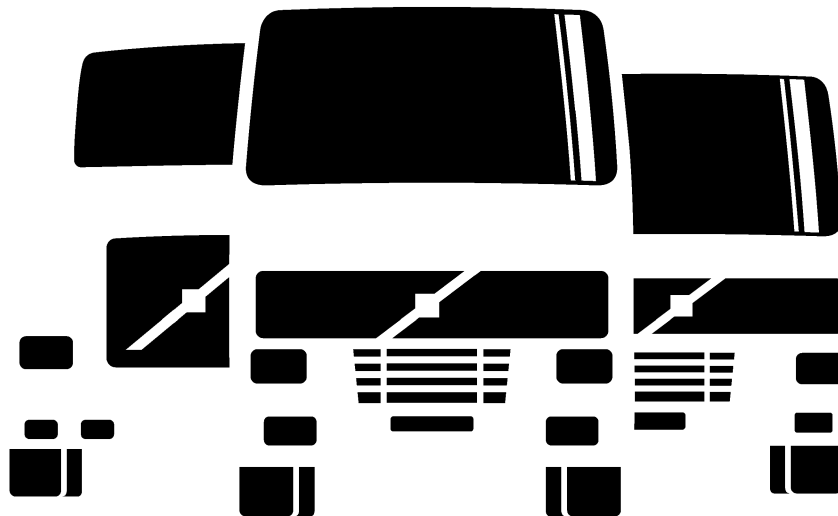


Service Manual Trucks

Group **38**

Instrument Cluster Fault Codes
MID 140
VN,VHD VERSION2



Foreword

The descriptions and service procedures contained in this manual are based on designs and methods studies carried out up to March 2003.

The products are under continuous development. Vehicles and components produced after the above date may therefore have different specifications and repair methods. When this is believed to have a significant bearing on this manual, supplementary service bulletins will be issued to cover the changes.

The new edition of this manual will update the changes.

In service procedures where the title incorporates an operation number, this is a reference to an V.S.T. (Volvo Standard Times).

Service procedures which do not include an operation number in the title are for general information and no reference is made to an V.S.T.

The following levels of observations, cautions and warnings are used in this Service Documentation:

Note: Indicates a procedure, practice, or condition that must be followed in order to have the vehicle or component function in the manner intended.

Caution: Indicates an unsafe practice where damage to the product could occur.

Warning: Indicates an unsafe practice where personal injury or severe damage to the product could occur.

Danger: Indicates an unsafe practice where serious personal injury or death could occur.

Volvo Trucks North America, Inc.
Greensboro, NC USA

Order number: PV776-TSP161704

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Specifications

Instrument Cluster, Signal Descriptions

Connector A (22-pin Green) - with breakout box connected between the instrument cluster (MID140) and cable harness

Requirements:

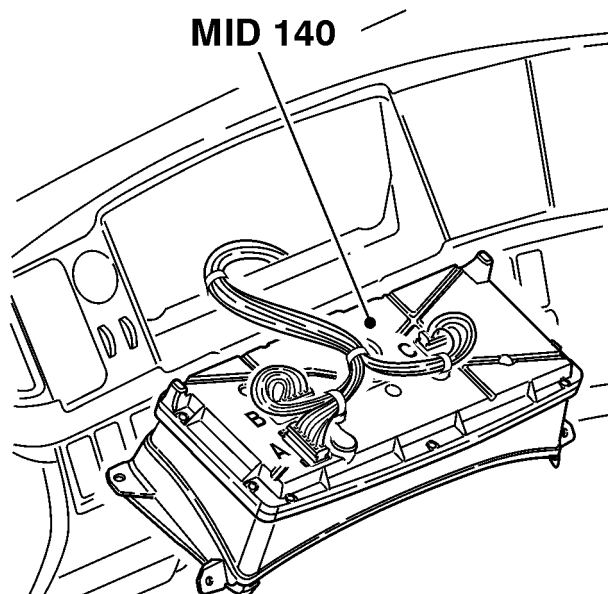
- Breakout box 9998699 connected to adapter 9998533 between the instrument cluster and cable harness. Use extension cable 9990062 if needed.
- Instrument cluster connected.
- Ignition key in the drive position.
- Engine switched off.
- Measuring voltage using the multimeter.

Notes:

V = direct current voltage (V)

V_{bat} = battery voltage

R = resistance in ohms (Ω)



W3005144

Pin	Signal type	Measurement points	Nominal value	Other
A1	Power supply (BAT+)	A1 - A2	$V \approx V_{bat}$	
A2	Ground	A2 - ground	$V \approx 0\text{ V}$	
A3	Ignition supply, (DR or key ON)	A3 - A2)	$V \approx V_{bat}$	
A4	Stalk switch, SELECT	A4 - A2	$V \approx 0\text{ V}$ $V \approx V_{bat}$ (SELECT active)	
A5	Stalk switch, ESCAPE	A5 - A2	$V \approx 0\text{ V}$ $V \approx V_{bat}$ (ESCAPE active)	
A6	Stalk switch, ARROW UP	A6 - A2	$V \approx 0\text{ V}$ $V \approx V_{bat}$ (ARROW UP active)	
A7	Stalk switch, ARROW DOWN	A7 - A2	$V \approx 0\text{ V}$ $V \approx V_{bat}$ (ARROW DOWN active)	
A8	Not used			
A9	Not used			
A10	SAE J1939-3 High	A10 - A2	$V \approx 0 - 5\text{ V}$	
A11	Not used			
A12	Ref Ground for sensor	A12 - A2	$V \approx 0\text{ V}$	
A13	Not used			

Pin	Signal type	Measurement points	Nominal value	Other
A14	Not used			
A15	J1939 CAN High	A15 - A2	$V \approx 3 - 5 \text{ V}$	
A16	J1939 CAN Low	A16 - A2	$V \approx 0 - 3 \text{ V}$	
A17	J1587/1708+	A17 - A2	$V \approx 0 - 5 \text{ V}$	
A18	J1587/1708-	A18 - A2	$V \approx 0 - 5 \text{ V}$	
A19	Not used			
A20	Not used			
A21	Audible hazard warning (signal from Lighting Control Module)	A21 - A2	$V \approx 0 \text{ V} / V_{\text{bat}}$ (Switching)	
A22	J1939-3 Low	A22 - A2	$V \approx 0 - 5 \text{ V}$	

Connector B (30-pin Green) - breakout box connected between the instrument cluster (MID140) and cable harness

Requirements:

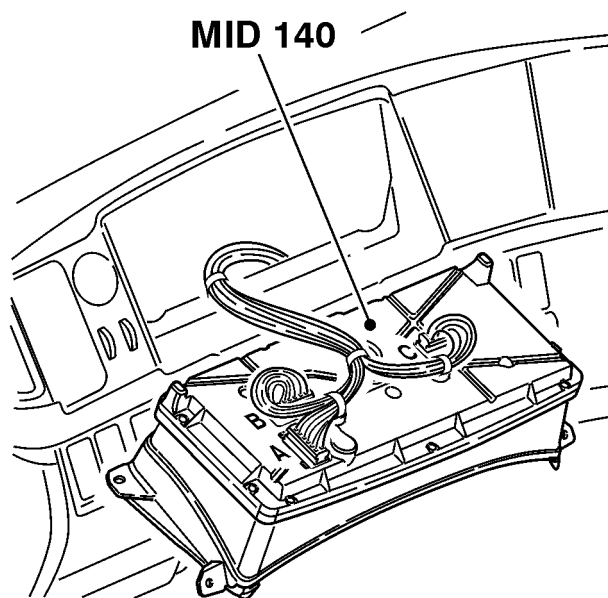
- Breakout box 9998699 and adapter 9813194 connected between the instrument cluster connector B and the cable harness. Use extension cable 9990062 if needed.
- Instrument cluster connected.
- Ignition key in the drive position.
- Engine switched off.
- Measuring voltage using the multimeter.

Notes:

V = direct current voltage (V)

V_{bat} = battery voltage

R = resistance in ohms (Ω)



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Pin	Signal type	Measurement points	Nominal value	Other
B1	Reference Ground (redundant)	B1 - ground	V $\approx$ 0 V	
B2	Application air pressure sensor, analog input	B2 - ground	V $\approx$ 0.5 - 5.0 V	
B3	Fuel level sensor, analog input	B3 - B1	V $\approx$ 0 - 5 V	
B4	Pyrometer sensor signal, negative analog input	B4 - B5	V $\approx$ 5 - 32 mV	
B5	Pyrometer sensor signal, positive analog input	B5 - B4	V $\approx$ 5 - 32 mV	
B6	Rear air suspension pressure sensor, analog input	B6 - ground	V $\approx$ 0.5 - 5.0 V	
B7	Front air suspension pressure sensor, analog input	B7 - ground	V $\approx$ 0.5 - 5.0 V	
B8	Not used			
B9	Outside temperature sensor, analog input	B9 - B1	V $\approx$ 0 - 5 V	
B10	Forward rear axle temperature sensor, analog input	B10 - ground	V $\approx$ 0 - 5 V	
B11	Rear rear axle temperature sensor, analog input	B11 - ground	V $\approx$ 0 - 5 V	
B12	Transmission oil temperature sensor, analog input	B12 - B1	V $\approx$ 0 - 5 V	
B13	Front brake air pressure gauge sensor, analog input	B13 - ground	V $\approx$ 0.5 - 5.0 V	
B14	Rear brake air pressure gauge sensor (analog input)	B14 - ground	V $\approx$ 0.5 - 5.0 V	

Pin	Signal type	Measurement points	Nominal value	Other
B15	Not used			
B16	Not used			
B17	5V supply output, rear air suspension pressure sensor	B17 - ground	$V \approx 5.0 \text{ V}$	
B18	5V supply output, application air pressure sensor	B18 - ground	$V \approx 5.0 \text{ V}$	
B19	5V supply output, front axle air pressure sensor	B19 - ground	$V \approx 5.0 \text{ V}$	
B20	5V supply output for front brake air pressure sensor	B20 - ground	$V \approx 5.0 \text{ V}$	
B21	5V supply output, rear brake air pressure sensor	B21 - ground	$V \approx 5.0 \text{ V}$	
B22	Not used			
B23	Not used			
B24	Not used			
B25	Not used			
B26	Not used			
B27	Not used			
B28	5th Wheel lock telltale sensor, digital input	B28 - ground	$V \approx V_{\text{bat}}$	
B29	Not used			
B30	Not used			

Connector C (30-pin Blue) - breakout box connected between the instrument cluster (MID140) and cable harness

Requirements:

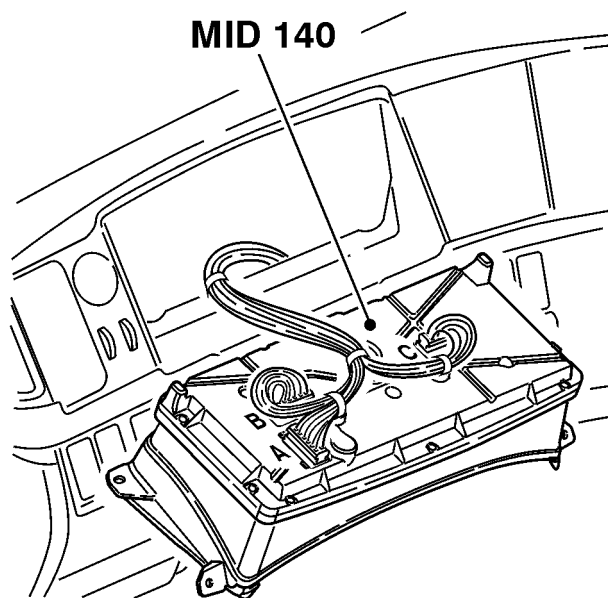
- Breakout box 9998699 and adapter 9998533 connected to connector A and C on the cable harness. Use extension cable 9990062 if needed.
- Instrument cluster connected.
- Ignition key in the drive position.
- Engine switched off.
- Measuring voltage using the multimeter.

Notes:

V = direct current voltage (V)

V_{bat} = battery voltage

R = resistance in ohms (Ω)



W3005144

Pin	Signal type	Measurement points	Nominal value	Other
C1	Not used			
C2	ABS Trailer fault, digital input	C2 - A2	V $\approx$ V _{bat} (Telltale light inactive) V $\approx$ 0 V (Telltale light active)	
C3	ABS Vehicle fault, digital input	C3 - A2	V $\approx$ V _{bat} (Telltale light inactive) V $\approx$ 0 V (Telltale light active)	
C4	Traction control system, digital input	C4 - A2	V $\approx$ V _{bat} (Telltale light inactive) V $\approx$ 0 V (Telltale light active)	
C5	Air filter restriction, digital input	C5-A2	V $\approx$ V _{bat} (Telltale light inactive) V $\approx$ 0 V (Telltale light active)	
C6	Not used			
C7	Battery charging telltale, digital input	C7 - A2	V $\approx$ 2.2 V (Ignition key in the off position) V $\approx$ V _{bat} (Alternator charging)	
C8	Air dump icon, digital input	C8 - A2	V $\approx$ V _{bat} (Suspension in dump position) V $\approx$ 0 V (Suspension in ride position)	
C9	Not used			
C10	Interaxle Differential lock telltale, digital input	C10 - A2	V $\approx$ V _{bat} (Switch active)	
C11	Interwheel Differential lock telltale, digital input	C11 - A2	V $\approx$ V _{bat} (Differential lock switch active)	
C12	Not used			

Pin	Signal type	Measurement points	Nominal value	Other
C13	Not used			
C14	Not used			
C15	Not used			
C16	Transmission oil temp telltale digital input	C16 - A2	V $\approx$ 0 V (Active signal) V $\approx$ V _{bat} (Inactive signal)	
C17	Transmission malfunction icon, digital input	C17 - A2	V $\approx$ 0 V (Active signal) V $\approx$ V _{bat} (Inactive signal)	
C18	Not used			
C19	Not used			
C20	Not used			
C21	Not used			
C22	Not used			
C23	Not used			
C24	Not used			
C25	Not used			
C26	Not used			
C27	Not used			
C28	Not used			
C29	Washer fluid level icon, digital input	C29 - A2	V $\approx$ 0V (Low level) V $\approx$ V _{bat} (Fluid level OK)	
C30	Not used			

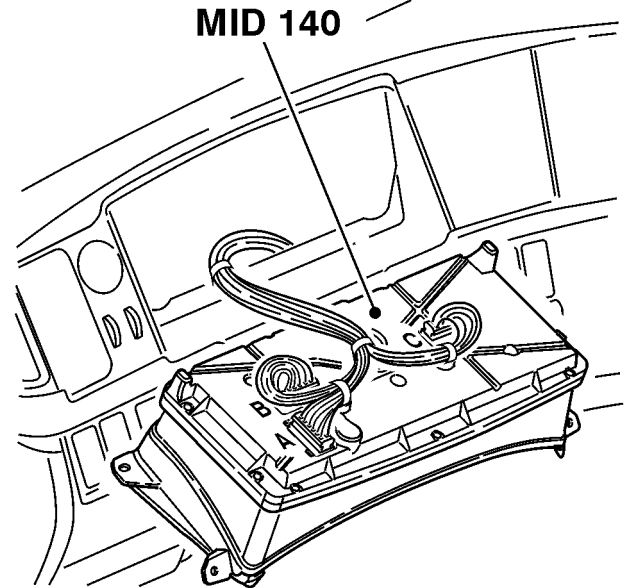
Connector A (22-pin Green) - breakout box connected to cable harness

Requirements:

- Breakout box 9998699 connected to adapter 9998533 towards the cable harness. Use extension cable 9990062 if needed.
- Instrument cluster disconnected.
- Ignition off.
- Measuring resistance using the multimeter.

Notes:

R = resistance in ohms (Ω)



W3005144

Pin	Signal type	Measurement points	Nominal value	Other
A2	Ground	A2 - ground	$R \approx 0 \Omega$	
A4	Stalk switch, SELECT	A4 - ground	$R \approx 0 \Omega$ (Active) $R \approx \infty \Omega$ (Inactive)	
A5	Stalk switch, ESCAPE	A5 - ground	$R \approx 0 \Omega$ (Active) $R \approx \infty \Omega$ (Inactive)	
A6	Stalk switch, ARROW UP	A6 - ground	$R \approx 0 \Omega$ (Active) $R \approx \infty \Omega$ (Inactive)	
A7	Stalk switch, ARROW DOWN	A7 - ground	$R \approx 0 \Omega$ (Active) $R \approx \infty \Omega$ (Inactive)	

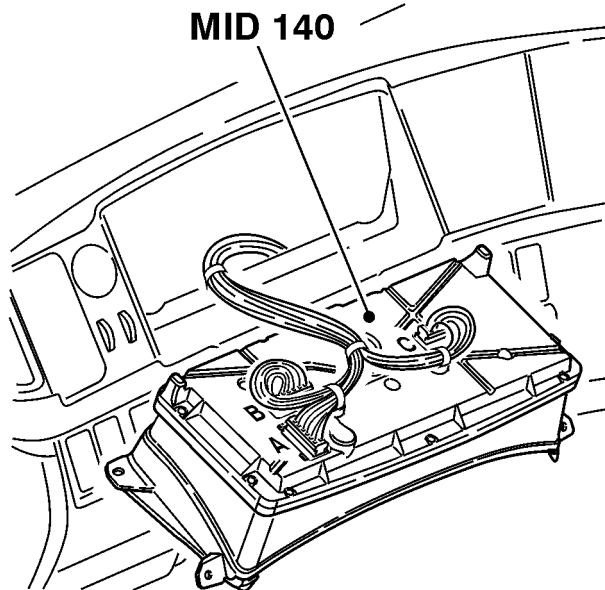
Connector B (30-pin Green) - breakout box connected to cable harness

Requirements:

- Breakout box 9998699 and adapter 9813194 connected to cable harness. Use extension cable 9990062 if needed.
- Instrument cluster disconnected.
- Ignition off.
- Measuring resistance using the multimeter.

Notes:

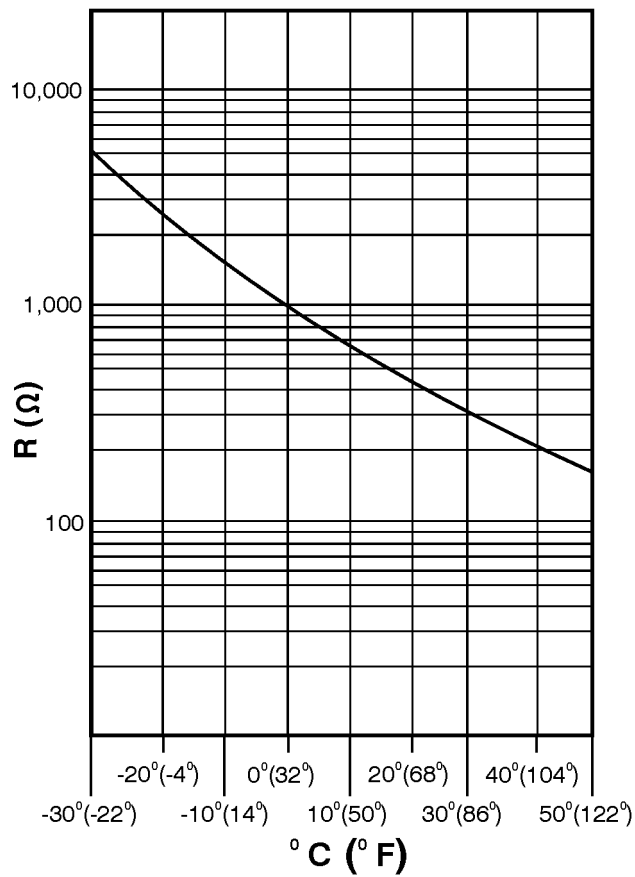
R = resistance in ohms (Ω)



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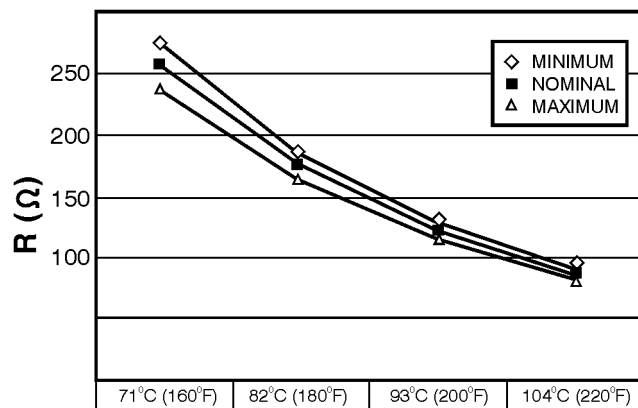
Pin	Signal type	Measurement points	Nominal value	Other
B1	Reference Ground (redundant)	B1 - ground	$R \approx 0 \Omega$	
B3	Fuel level sensor, analog input	B3 - B1	$R \approx 30 - 250 \Omega$	
B9	Outside temperature sensor, analog input	B9 - B1	See chart, page 11	
B12	Transmission oil temperature sensor, analog input	B12 - B1	See chart, page 11	

Outside Temperature Sensor, Temperature vs. Resistance



W3005183

Transmission Oil Temperature Sensor, Temperature vs. Resistance



W3005184

	71°C (160°F)	82°C (180°F)	93°C (200°F)	104°C (220°F)
Min	235 Ω	165 Ω	118 Ω	85 Ω
Nominal	255 Ω	177 Ω	125 Ω	90 Ω
Max	273 Ω	188 Ω	133 Ω	95 Ω

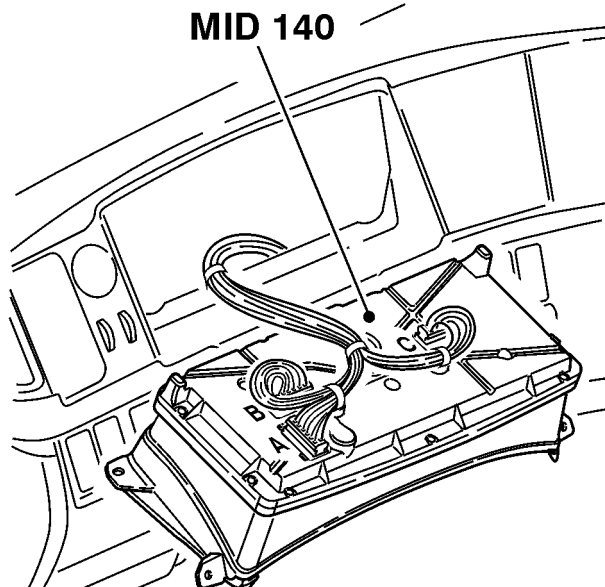
Connector C (30-pin Blue) - breakout box connected to cable harness

Requirements:

- Breakout box 9998699 and adapter 9998533 connected to connector A and C on the cable harness. Use extension cable 9990062 if needed.
- Instrument cluster disconnected.
- Ignition off.
- Measuring resistance using the multimeter.

Notes:

R = resistance in ohms (Ω)



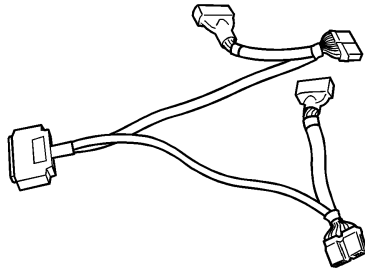
W3005144

Pin	Signal type	Measurement points	Nominal value	Other
C3	ABS Vehicle telltale, digital input	C3 - A2	$R \approx 93 \text{ k}\Omega$	
C4	Traction control system telltale, digital input	C4 - A2	$R \approx \infty \Omega$ (Inactive) $R \approx 0 \Omega$ (Active)	
C5	Air filter restriction, digital input	C5 - A2	$R \approx \infty \Omega$ (Inactive) $R \approx 0 \Omega$ (Active)	
C11	Interwheel differential lock telltale, digital input	C11 - A2	$R \approx \infty \Omega$ (Diff inactive) $R \approx 0 \Omega$ (Diff active)	

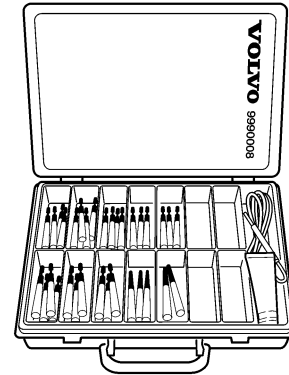
Tools

Special Tools

For special tool and special equipment ordering instructions, see tool information in group 08.

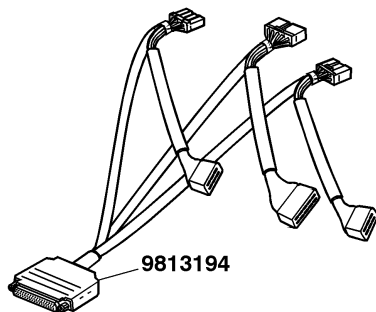


9998533 Adapter between the instrument cluster connectors A and C and breakout box 9998699



9990008

9990008 Set with test probes

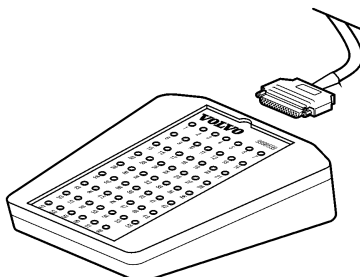


9813194 Adapter between the instrument cluster connector B and breakout box 9998699

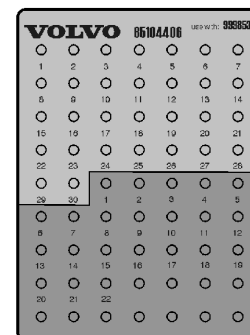
T3009536



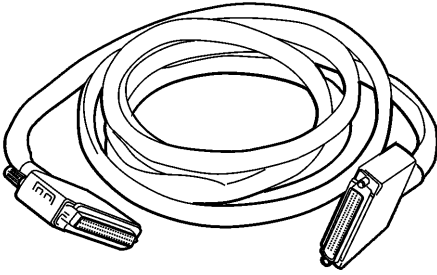
85104407 Overlay for use with breakout box 9998699 and adapter 9813194



9998699 Breakout box 62-pin



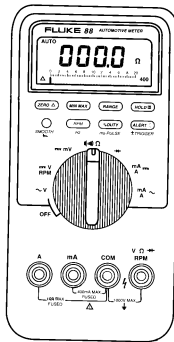
85104406 Overlay for use with breakout box 9998699 and adapter 9998533



9990062 Cable Extension for use with breakout box 9998699 and adapter 9998533

Other special equipment

For special tool and special equipment ordering instructions, see tool information in group 08.



J39200 Multimeter

Troubleshooting

MID 140 Fault Code Table

MID:

Message Identification Description (identification of control unit).

PID:

Parameter Identification Description (identification of parameter (value)).

PPID:

Proprietary Parameter Identification Description (Volvo unique identification of parameter (value)).

SID:

Subsystem Identification Description (identification of component).

PSID:

Proprietary Subsystem Identification Description (Volvo unique component identification).

FMI:

Failure Mode Identifier (identification of fault type).

Fault code	Component / function	FMI	Reference
PID 77	Forward rear axle temperature	3, 4	"MID 140 PID 77 Forward Rear Axle Temperature" page 17
PID 78	Rear rear axle temperature	3, 4	"MID 140 PID 78 Rear Rear Axle Temperature" page 20
PID 96	Fuel level	3, 4	"MID 140 PID 96 Fuel Level" page 23
PID 116	Application air pressure	5, 6	"MID 140 PID 116 Application Air Pressure" page 26
PID 117	Air brake pressure, front	5, 6	"MID 140 PID 117 Air Brake Pressure, Front" page 29
PID 118	Air brake pressure, rear	5, 6	"MID 140 PID 118 Air Brake Pressure, Rear" page 32
PID 158	Battery voltage	0	"MID 140 PID 158 Battery Voltage" page 35
PID 171	Ambient temperature	3, 4	"MID 140 PID 171 Ambient Temperature" page 37
PID 177	Transmission oil temperature	3, 4	"MID 140 PID 177 Transmission Oil Temperature" page 40
PID 178	Air suspension pressure, front	5, 6	"MID 140 PID 178 Air Suspension Pressure, Front" page 43
PID 179	Air suspension pressure, rear	5, 6	"MID 140 PID 179 Air Suspension Pressure, Rear" page 46
SID 231	SAE J1939 Data Link	2	"MID 140 SID 231 J1939 Control Link" page 49
SID 240	Program memory	2	"MID 140 SID 240 Program Memory" page 50
SID 250	SAE J1587/J1708 data link	3, 4, 9, 12	"MID 140 SID 250 J1587/1708 Information Link" page 51
SID 253	Calibration memory, EEPROM	2	"MID 140 SID 253 Calibration Memory, EEPROM" page 53
PSID 7	Internal reference resistance	3, 4	"MID 140 PSID 7 Reference Resistance" page 54
PSID 200	Open-circuit, J1939 data link, engine	9	"MID 140 PSID 200 J1939 Data Link Interruption, Engine ECU" page 55

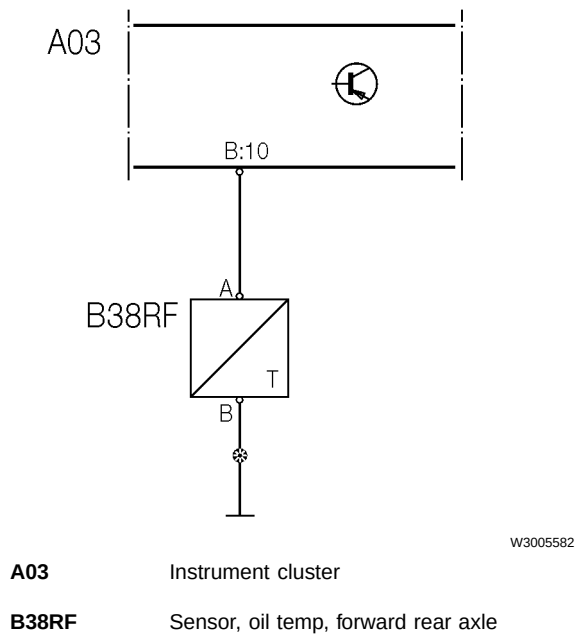
Fault code	Component / function	FMI	Reference
PSID 201	Open-circuit, J1939 data link, vehicle control unit	9	"MID 140 PSID 201 J1939 Data Link Interruption, Vehicle ECU" page 56
PSID 204	Open-circuit, J1939 data link, anti-lock brake control unit	9	"MID 140 PSID 204 J1939 Data Link Interruption, Anti-lock Brake ECU" page 57
PSID 210	Open-circuit J1939 data link, Lighting control module	9	"MID 140 PSID 210 J1939 Data Link Interruption, Lighting Control Module" page 58
PSID 232	SAE J1939-3 data link	2	"MID 140 PSID 232 J1939-3 Control Link" page 59

FMI table

SAE standard

FMI	Instrument Cluster Display text	SAE text
0	Value too high	Data applicable, but above normal operating range.
1	Value too low	Data applicable, but below normal operating range.
2	Incorrect data	Intermittent or incorrect data.
3	Electrical fault	Abnormally high voltage or short-circuit to higher voltage.
4	Electrical fault	Abnormally low voltage or short-circuit to lower voltage.
5	Electrical fault	Abnormally low current or open-circuit.
6	Electrical fault	Abnormally high current or short-circuit to ground.
7	Mechanical fault	Incorrect response from the mechanical system.
8	Mechanical or electrical fault	Abnormal frequency.
9	Communication fault	Abnormal update rate.
10	Mechanical or electrical fault	Abnormally high variations.
11	Unknown fault	Unidentifiable fault.
12	Component fault	Defective unit or component.
13	Incorrect calibration	Calibration values outside the limits.
14	Unknown fault	Special instructions.
15	Unknown fault	Reserved for future use.

MID 140 PID 77 Forward Rear Axle Temperature



Fault code

FMI 3

Abnormally high voltage or short-circuit to higher voltage.

Conditions for fault code:

- If the instrument cluster registers a voltage greater than 4.5 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Signal cable short-circuited to higher voltage.
- Faulty sensor.
- Contact resistance and oxidation.

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 77 Forward Rear Axle Temperature, Check" page 18.

FMI 4

Abnormally low voltage or short-circuit to lower voltage.

Conditions for fault code:

- If the instrument cluster registers a voltage of less than 0.5 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.

Reaction from the instrument cluster:

- fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 77 Forward Rear Axle Temperature, Check" page 18.

3811-21-02-10 MID 140 PID 77 Forward Rear Axle Temperature, Check

Special tools: 9998699, 9813194

Other special equipment: J39200, 9990008

NOTE!

- Read off other fault codes for the instrument cluster.
- Turn the ignition OFF before disconnecting the connector.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Tests in VCADS Pro

The following tests are useful for a closer examination of the component function:

- "3810-08-02-01 Instrument cluster test".
- "3810-08-02-02 Gauge checks, instrument cluster".

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

Ground cable

1

Requirements:

J39200
9990008

- The connector for the sensor disconnected.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster. (See page 17 for measurement points.)

Measuring points	Nominal value
B - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, disconnect the voltage from the battery.

Signal cable

2

Requirements:

J39200
9990008

- The connector to the sensor is disconnected.
- Measuring voltage using the multimeter.
- Instrument cluster connected.
- Ignition key in the drive position.
- Measurement to the instrument cluster. (See page 17 for measurement points.)

Measuring points	Nominal value
A - ground	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

Cable harness

3

For checking the cable harness, see service information under function group 371.

Checking component

Note: Faults in the component may be caused by faults in the cable harness to the control unit. Check the cable harness before connecting a new component.

Sensor

1

Requirements: J39200

- The connector for the sensor disconnected.
- Measuring resistance using a multimeter.
- Ignition off.
- Measurement to sensor. (See page 17 for measurement points.)

Measuring points	Nominal value
A - B	$R \approx 90 \Omega$ @ (220 °F)
	$R \approx 255 \Omega$ @ (160 °F)
	$R \approx 1 \text{ k}\Omega$ @ (77 °F)

Checking sub-systems

Ground cable

1

Requirements: 9813194
9998699
J39200

- Breakout box with adapter connected between instrument cluster connector B and cable harness.
- Measuring resistance using a multimeter.
- Ignition off.
- Instrument cluster connected.

Measuring points	Nominal value
Pin B1- ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Signal cable

2

Requirements: 9813194
9998699
J39200

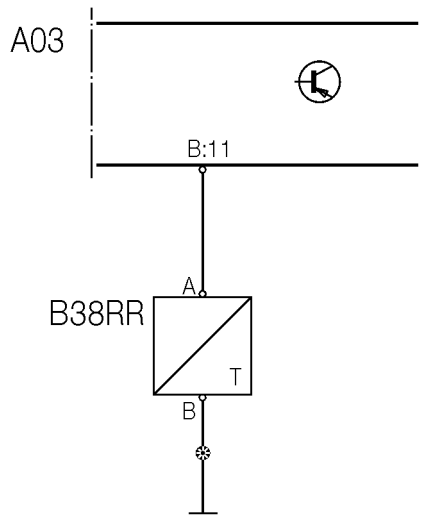
- Breakout box with adapter connected between instrument cluster connector B and cable harness.
- Measuring voltage using the multimeter.
- Ignition key in the drive position.
- Instrument cluster connected.

Measuring points	Nominal value
Pins B1 - B3	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

Verification

Check that the fault has been repaired using the tests in VCADS Pro (See "Tests in VCADS Pro" page 18).

MID 140 PID 78 Rear Rear Axle Temperature



W3005583

A03 Instrument cluster

B38RR Sensor, oil temp, rear rear axle

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 78 Rear Rear Axle Temperature, Check" page 21.

FMI 4

Abnormally low voltage or short-circuit to lower voltage.

Conditions for fault code:

- If the instrument cluster registers a voltage of less than 0.5 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.

Reaction from the instrument cluster:

- fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 78 Rear Rear Axle Temperature, Check" page 21.

Fault code

FMI 3

Abnormally high voltage or short-circuit to higher voltage.

Conditions for fault code:

- If the instrument cluster registers a voltage greater than 4.5 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Signal cable short-circuited to higher voltage.
- Faulty sensor.
- Contact resistance and oxidation.

3811-21-02-01 MID 140 PID 78 Rear Rear Axle Temperature, Check

Special tools: 9998699, 9813194

Other special equipment: J39200, 9990008

NOTE!

- Read other fault codes for the instrument cluster.
- Turn the ignition OFF before disconnecting the connector.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Tests in VCADS Pro

The following tests are useful for a closer examination of the component function:

- "3810-08-02-01 Instrument cluster test".
- "3810-08-02-02 Gauge checks, instrument cluster".

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

Ground cable

1

Requirements:

J39200
9990008

- The connector for the sensor disconnected.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster. (See page 20 for measurement points.)

Measuring points	Nominal value
B - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, disconnect the voltage from the battery.

Signal cable

2

Requirements:

J39200
9990008

- The connector to the sensor is disconnected.
- Measuring voltage using the multimeter.
- Instrument cluster connected.
- Ignition key in the drive position.
- Measurement to the instrument cluster. (See page 20 for measurement points.)

Measuring points	Nominal value
A - ground	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

Cable harness

3

For checking the cable harness, see service information under function group 371.

Checking component

Note: Faults in the component may be caused by faults in the cable harness to the control unit. Check the cable harness before connecting a new component.

Sensor

1

Requirements: J39200

- The connector for the sensor disconnected.
- Measuring resistance using a multimeter.
- Ignition off.
- Measurement to sensor. (See page 20 for measurement points.)

Measuring points	Nominal value
A - B	$R \approx 90 \Omega @ (220^\circ\text{F})$
	$R \approx 255 \Omega @ (160^\circ\text{F})$
	$R \approx 1 \text{ k}\Omega @ (77^\circ\text{F})$

Checking sub-systems

Ground cable

1

Requirements: 9813194
9998699
J39200

- Breakout box with adapter connected between instrument cluster connector B and cable harness.
- Measuring resistance using a multimeter.
- Ignition off.
- Instrument cluster connected.

Measuring points	Nominal value
Pin B1- ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Signal cable

2

Requirements: 9813194
9998699
J39200

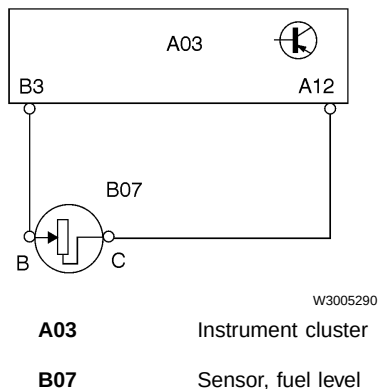
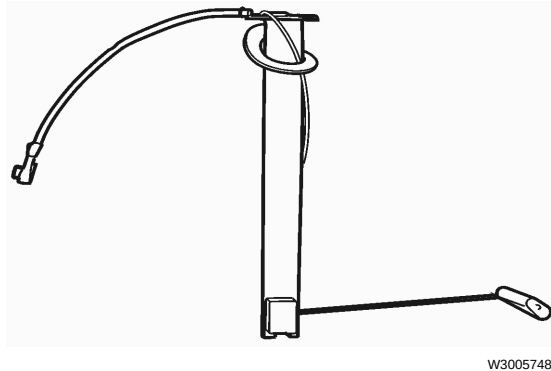
- Breakout box with adapter connected between instrument cluster connector B and cable harness.
- Measuring voltage using the multimeter.
- Ignition key in the drive position.
- Instrument cluster connected.

Measuring points	Nominal value
Pins B1 - B3	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

Verification

Check that the fault has been repaired using the tests in VCADS Pro (See "Tests in VCADS Pro" page 21).

MID 140 PID 96 Fuel Level



Fault code

FMI 3

Abnormally high voltage or short-circuit to higher voltage.

Conditions for fault code:

- If the instrument cluster registers a resistance greater than 250 Ω the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Signal cable short-circuited to higher unladen voltage.
- Faulty sensor.

- Contact resistance and oxidation.

Reaction from the instrument cluster:

- fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The fuel level gauge remains permanently at the MIN position.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 96 Fuel Level, Check" page 24.

FMI 4

Abnormally low voltage or short-circuit to lower voltage.

Conditions for fault code:

- If the instrument cluster registers a resistance of less than 20 Ω the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.

Reaction from the instrument cluster:

- fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The fuel gauge remains in the MAX position.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 96 Fuel Level, Check" page 24.

3811-21-02-02**MID 140 PID 96 Fuel Level, Check***Special tools: 9998699, 9813194**Other special equipment: J39200***NOTE!**

- Read off other fault codes for the instrument cluster.
- Turn the ignition OFF before disconnecting the connector.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Tests in VCADS Pro

The following tests are useful for a closer examination of the component function:

- "3810-08-02-01 Instrument cluster test".
- "3810-08-02-02 Gauge checks, instrument cluster".

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

*Ground cable***1****Requirements:** J39200

- The connector for the fuel level sensor (B07) disconnected.
- Adapter connected to the instrument cluster.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B07, pin C - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, cut the voltage from the battery.

*Signal cable***2****Requirements:**

J39200

- The connector to the fuel level sensor (B07) is disconnected.
- Adapter connected to the instrument cluster.
- Measuring voltage using the multimeter.
- Instrument cluster connected.
- Ignition key in the drive position.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B07, pin B - ground	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

*Cable harness***3**

For checking the cable harness, see service information under function group 371.

Checking component

Note: Faults in the component may be caused by faults in the cable harness to the control unit. Check the cable harness before connecting a new component.

Sensor, fuel level

1

Requirements: J39200

- The connector for the fuel level sensor (B07) disconnected.
- Adapter connected to sensor for fuel level.
- Measuring resistance using a multimeter.
- Ignition off.
- Measurement to sensor for fuel level.

Measuring points	Nominal value
B07, pins B - C	$R \approx 30 - 35 \Omega$ (100%)
	$R \approx 45 - 65 \Omega$ (75%)
	$R \approx 85 - 115 \Omega$ (50%)
	$R \approx 145 - 170 \Omega$ (25%)
	$R \approx 230 - 250 \Omega$ (0%)

Note: The amount of fuel is measured as a percentage of the possible volume of fuel.

Checking sub-systems

Ground cable

1

Requirements: 9813194
9998699
J39200

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring resistance using a multimeter.
- Ignition off.
- Instrument cluster connected.

Measuring points	Nominal value
Pin B1- ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Signal cable

2

Requirements: 9813194
9998699
J39200

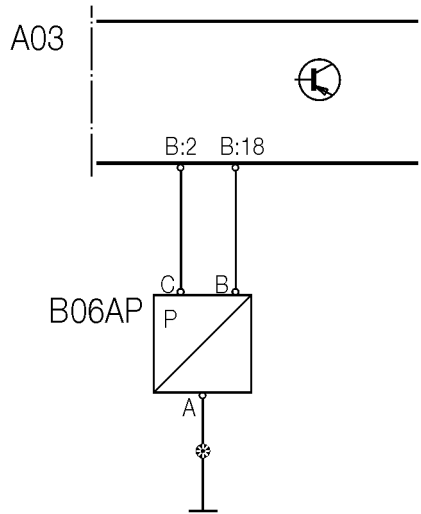
- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using the multimeter.
- Ignition key in the drive position.
- Instrument cluster connected.

Measuring points	Nominal value
Pins B1 - B3	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

Verification

Check that the fault has been repaired using the tests in VCADS Pro (See "Tests in VCADS Pro" page 24).

MID 140 PID 116 Application Air Pressure



A03 Instrument cluster
B06AP Sensor, application air

W3005584

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 116 Application Air Pressure, Check" page 27.

FMI 6

Abnormally high current or short-circuit to ground.

Conditions for fault code:

- If the instrument cluster registers a voltage more than 4.7 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 116 Application Air Pressure, Check" page 27.

Fault code

FMI 5

Abnormally low current or open-circuit.

Conditions for fault code:

- If the instrument cluster registers a voltage value less than 0.3 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Faulty sensor.
- Contact resistance and oxidation.

Reaction from the instrument cluster:

3811-21-02-13 MID 140 PID 116 Application Air Pressure, Check

Special tools: 9998699, 9813194

Other special equipment: J39200

NOTE!

- Read off other fault codes for the instrument cluster.
- Turn the ignition OFF before disconnecting the connector.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Tests in VCADS Pro

The following tests are useful for a closer examination of the component function:

- "3810-08-02-01 Instrument cluster test".
- "3810-08-02-02 Gauge checks, instrument cluster".

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

Ground cable

1

Requirements:

J39200

- The connector for the application air pressure sensor (B06AP) disconnected.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B06AP, pin A - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Supply cable

2

Requirements:

J39200

- The connector to the sensor (B06AP) is disconnected.
- Measuring voltage using the multimeter.
- Instrument cluster connected.
- Ignition key in the drive position.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B06AP, pin B - ground	$V \approx 5 V$

Cable harness

3

For checking the cable harness, see service information under function group 371.

Checking sub-systems

Supply cable

1

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using a multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

9813194
9998699
J39200

Measuring points	Nominal value
Pin B18 - B1	V ≈ 5 V

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Signal cable

2

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using the multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

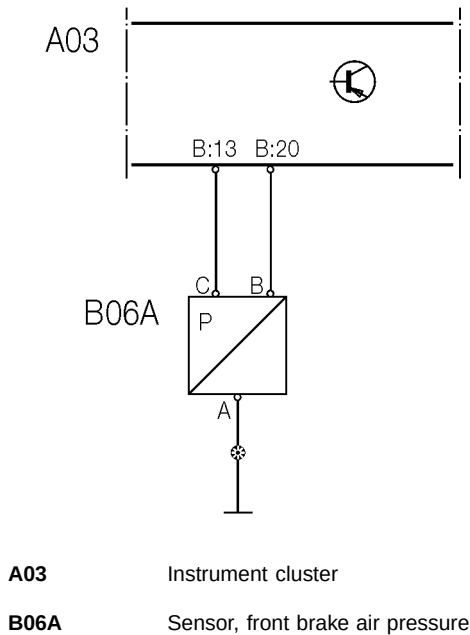
9813194
9998699
J39200

Measuring points	Nominal value
Pins B2 - B1	V ≈ 0.5 V- 5 V

Verification

Check that the fault has been repaired using the tests in VCADS Pro (See "Tests in VCADS Pro" page 27).

MID 140 PID 117 Air Brake Pressure, Front



W3005585

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 117 Air Brake Pressure, Front, Check" page 30.

FMI 6

Abnormally high current or short-circuit to ground.

Conditions for fault code:

- If the instrument cluster registers a voltage more than 4.7 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 117 Air Brake Pressure, Front, Check" page 30.

Fault code

FMI 5

Abnormally low current or open-circuit.

Conditions for fault code:

- If the instrument cluster registers a voltage value less than 0.3 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Faulty sensor.
- Contact resistance and oxidation.

Reaction from the instrument cluster:

3811-21-02-14

MID 140 PID 117 Air Brake Pressure, Front, Check

Special tools: 9998699, 9813194

Other special equipment: J39200

NOTE!

- Read off other fault codes for the instrument cluster.
- Ignition off.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Tests in VCADS Pro

The following tests are useful for a closer examination of the component function:

- "3810-08-02-01 Instrument cluster test".
- "3810-08-02-02 Gauge checks, instrument cluster".

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

Ground cable

1

Requirements:

J39200

- The connector for the front brake air pressure sensor (B06A) disconnected.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B06A, pin A - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Supply cable

2

Requirements:

J39200

- The connector to the front brake pressure sensor (B06A) is disconnected.
- Measuring voltage using the multi-meter.
- Instrument cluster connected.
- Ignition key in the drive position.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B06A, pin B - ground	$V \approx 5 V$

Cable harness

3

For checking the cable harness, see service information under function group 371.

Checking sub-systems

Supply cable

1

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using a multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

9813194
9998699
J39200

Measuring points	Nominal value
Pin B20 - B1	V ≈ 5 V

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Signal cable

2

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using the multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

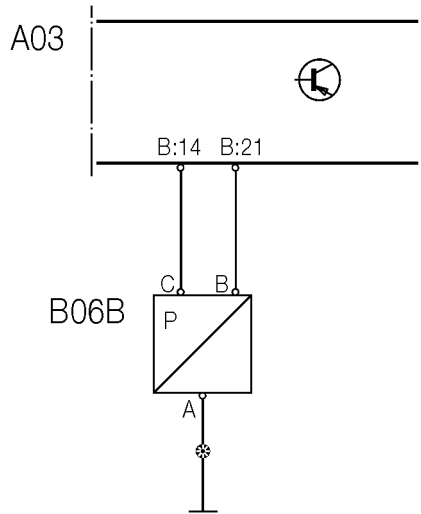
9813194
9998699
J39200

Measuring points	Nominal value
Pins B13 - B1	V ≈ 0.5 V- 5 V

Verification

Check that the fault has been repaired using the tests in VCADS Pro (See "Tests in VCADS Pro" page 30).

MID 140 PID 118 Air Brake Pressure, Rear



A03 Instrument cluster

B06B Sensor, rear brake air pressure

W3005586

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 118 Air Brake Pressure, Rear, Check" page 33.

FMI 6

Abnormally high current or short-circuit to ground.

Conditions for fault code:

- If the instrument cluster registers a voltage more than 4.7 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 118 Air Brake Pressure, Rear, Check" page 33.

Fault code

FMI 5

Abnormally low current or open-circuit.

Conditions for fault code:

- If the instrument cluster registers a voltage value less than 0.3 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Faulty sensor.
- Contact resistance and oxidation.

Reaction from the instrument cluster:

3811-21-02-15 MID 140 PID 118 Air Brake Pressure, Rear, Check

Special tools: 9998699, 9813194

Other special equipment: J39200

NOTE!

- Read off other fault codes for the instrument cluster.
- Turn the ignition OFF before disconnecting the connector.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Tests in VCADS Pro

The following tests are useful for a closer examination of the component function:

- "3810-08-02-01 Instrument cluster test".
- "3810-08-02-02 Gauge checks, instrument cluster".

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

Ground cable

1

Requirements: J39200

- The connector for the rear brake pressure sensor (B06B) disconnected.
- Adapter connected to the instrument cluster.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B06B, pin A - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, remove the voltage from the battery and remeasure the circuit.

Supply cable

2

Requirements: J39200

- The connector to the rear brake pressure sensor (B06B) is disconnected.
- Measuring voltage using the multimeter.
- Instrument cluster connected.
- Ignition key in the drive position.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B06B, pin B - ground	$V \approx 5 V$

Cable harness

3

For checking the cable harness, see service information under function group 371.

Checking sub-systems

Supply cable

1

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using a multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

9813194
9998699
J39200

Measuring points	Nominal value
Pin B21 - B1	V ≈ 5 V

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Signal cable

2

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using the multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

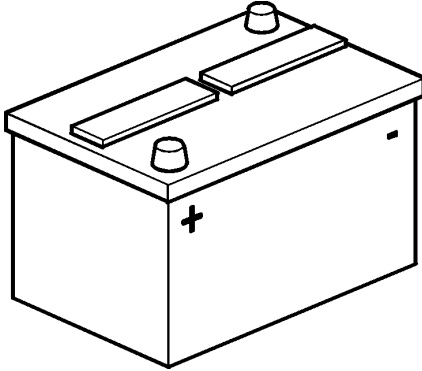
9813194
9998699
J39200

Measuring points	Nominal value
Pins B14 - B1	V ≈ 0.5 - 5.0 V

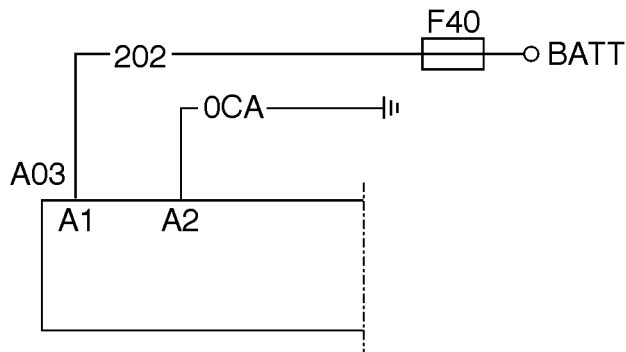
Verification

Check that the fault has been repaired using the tests in VCADS Pro (See "Tests in VCADS Pro" page 33).

MID 140 PID 158 Battery Voltage



T3009517



A03

Instrument cluster

W3005291

Fault code

FMI 0

Data applicable, but above normal operating range.

Conditions for fault code:

- The battery voltage exceeds 15 V for one minute.

Possible cause:

- Fault in alternator.
- Fast charger connected.

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow light and symbol lights up.

Appropriate check:

- "MID 140 PID 158 Battery Voltage, Check" page 36.

3811-21-02-08**MID 140 PID 158 Battery Voltage, Check***Special tools: 9998699, 9998533**Other special equipment: J39200***NOTE!**

- Read off other fault codes for the instrument cluster.
- Ignition off.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

*Ground cable***1****Requirements:**

9998699
9998533
J39200

- Connector A disconnected from the rear of the cluster and connected to adapter and breakout box.
- Measuring resistance using a multimeter.
- Ignition off.

Measuring points	Nominal value
Pins A2 - ground	$R \approx 0 \Omega$

*Supply cable***2****Requirements:**

9998699
9998533
J39200

- Connector A disconnected from the rear of the cluster and connected to adapter and breakout box.
- Measuring voltage using the multimeter.
- Ignition key in the drive position.

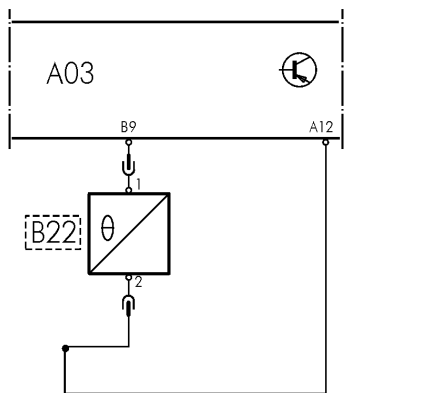
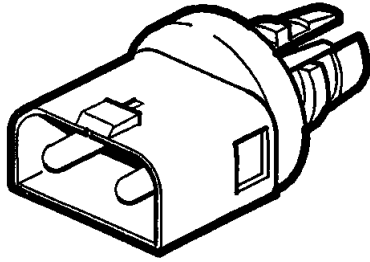
Measuring points	Nominal value
Pins A1 - A2	$V \approx V_{\text{bat}}$

Checking sub-systems*Power supply instrument cluster***1****Requirements:**

J39200

- Check if any other control units have stored fault codes for the power supply.
- Perform a charging test on the vehicle to check if the alternator is overcharging. A defective alternator will cause damage to the vehicle's electrical system and should be replaced as soon as possible.

MID 140 PID 171 Ambient Temperature



A03 Instrument cluster
B22 Sensor, ambient temperature

Fault code

FMI 3

Abnormally high voltage or short-circuit to higher voltage.

Conditions for fault code:

- If the instrument cluster registers a resistance greater than 19.5 K Ω the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Faulty sensor.
- Contact resistance and oxidation.
- Extreme cold (Colder than -40°C [-40°F]).

Reaction from the instrument cluster:

- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 171 Ambient Temperature, Check" page 38.

FMI 4

Abnormally low voltage or short-circuit to lower voltage.

Conditions for fault code:

- If the instrument cluster registers a resistance of less than 47 Ω the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.
- Extreme heat (Hotter than 90°C [194°F]).

Reaction from the instrument cluster:

- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 171 Ambient Temperature, Check" page 38.

3811-21-02-04**MID 140 PID 171 Ambient Temperature, Check**

Special tools: 9998699, 9990008, 9813194

Other special equipment: J39200

NOTE!

- Read off other fault codes for the instrument cluster.
- Turn the ignition OFF before disconnecting the connector.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

*Ground cable***1****Requirements:**

9990008
J39200

- The connector for the ambient temperature sensor disconnected.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster. (See page 37 for measurement points.)

Measuring points	Nominal values
2 - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, cut the voltage from the battery.

*Signal cable***2****Requirements:**

9990008
J39200

- The connector for the ambient temperature sensor disconnected.
- Measuring voltage using the multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster. (See page 37 for measurement points.)

Measuring points	Nominal value
1 - ground	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

*Cable harness***3**

For checking the cable harness, see service information under function group 371.

Checking component

Note: Faults in the component may be caused by faults in the cable harness to the instrument cluster. Check the cable harness before connecting a new component.

Ambient temperature sensor

1

Requirements:

9990008
J32900

- The connector for the ambient temperature sensor disconnected.
- Measuring resistance using a multimeter.
- Ignition off.
- Measurement at ambient temperature sensor. (See page 37 for measurement points.)

Measuring points	Nominal value
1 - 2	$R \approx 2.9 - 4.4 \text{ k}\Omega$ (-20 °C [-4 °F])
	$R \approx 1.8 - 2.7 \text{ k}\Omega$ (-10 °C [14 °F])
	$R \approx 1.3 - 2.0 \text{ k}\Omega$ (-4 °C [25 °F])
	$R \approx 1.1 - 1.7 \text{ k}\Omega$ (0 °C [32 °F])
	$R \approx 0.9 - 1.4 \text{ k}\Omega$ (+4 °C [39 °F])
	$R \approx 0.7 - 1.1 \text{ k}\Omega$ (+10 °C [50 °F])
	$R \approx 0.5 - 0.7 \text{ k}\Omega$ (+20 °C [68 °F])
	$R \approx 0.4 - 0.6 \text{ k}\Omega$ (+25 °C [77 °F])
	$R \approx 200 - 400 \text{ }\Omega$ (+40 °C [104 °F])
	$R \approx 100 - 200 \text{ }\Omega$ (+60 °C [140 °F])

Checking sub-systems

Ground lead

1

Requirements:

9813194
9998699
J39200

- Breakout box with adapter connected between instrument cluster connector B and cable harness.
- Measuring resistance using a multimeter.
- Ignition off.
- Instrument cluster connected.

Measuring points	Nominal value
Pin B1 - ground	$R \approx 0 \text{ }\Omega$

Note: If the correct value is not achieved, remove the voltage from the batteries and measure again.

Signal cable

2

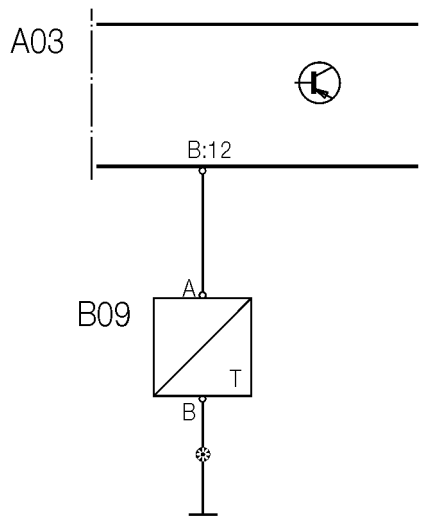
Requirements:

9998699
9813194
J39200

- Breakout box with adapter connected between instrument cluster connector B and cable harness.
- Measuring voltage using the multimeter.
- Ignition key in the drive position.
- Instrument cluster connected.

Measuring points	Nominal value
Pins B1 - B9	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

MID 140 PID 177 Transmission Oil Temperature



W3005588

A03	Instrument cluster
B09	Sensor, transmission oil temperature

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 177 Transmission Oil Temperature, Check" page 41.

FMI 4

Abnormally low voltage or short-circuit to lower voltage.

Conditions for fault code:

- If the instrument cluster registers a voltage of less than 0.5 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.

Reaction from the instrument cluster:

- fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 177 Transmission Oil Temperature, Check" page 41.

Fault code

FMI 3

Abnormally high voltage or short-circuit to higher voltage.

Conditions for fault code:

- If the instrument cluster registers a voltage greater than 4.5 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Signal cable short-circuited to higher voltage.
- Faulty sensor.
- Contact resistance and oxidation.

3811-21-02-05 MID 140 PID 177 Transmission Oil Temperature, Check

Special tools: 9998699, 9813194

Other special equipment: J39200, 9990008

NOTE!

- Read other fault codes for the instrument cluster.
- Turn the ignition OFF before disconnecting the connector.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Tests in VCADS Pro

The following tests are useful for a closer examination of the component function:

- "3810-08-02-01 Instrument cluster test".
- "3810-08-02-02 Gauge checks, instrument cluster".

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

Ground cable

1

Requirements:

J39200
9990008

- The connector for the sensor disconnected.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster. (See page 40 for measurement points.)

Measuring points	Nominal value
B - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, disconnect the voltage from the battery.

Signal cable

2

Requirements:

J39200
9990008

- The connector to the sensor is disconnected.
- Measuring voltage using the multimeter.
- Instrument cluster connected.
- Ignition key in the drive position.
- Measurement to the instrument cluster. (See page 40 for measurement points.)

Measuring points	Nominal value
A - ground	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

Cable harness

3

For checking the cable harness, see service information under function group 371.

Checking component

Note: Faults in the component may be caused by faults in the cable harness to the control unit. Check the cable harness before connecting a new component.

Sensor

1

Requirements:

J39200

- The connector for the sensor disconnected.
- Measuring resistance using a multimeter.
- Ignition off.
- Measurement to sensor.

Measuring points	Nominal value
Pins B12 - B1	See chart, page 11, for sensor values.

Checking sub-systems

Ground cable

1

Requirements:

9813194
9998699
J39200

- Breakout box with adapter connected between instrument cluster connector B and cable harness.
- Measuring resistance using a multimeter.
- Ignition off.
- Instrument cluster connected.

Measuring points	Nominal value
Pin B1- ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Signal cable

2

Requirements:

9813194
9998699
J39200

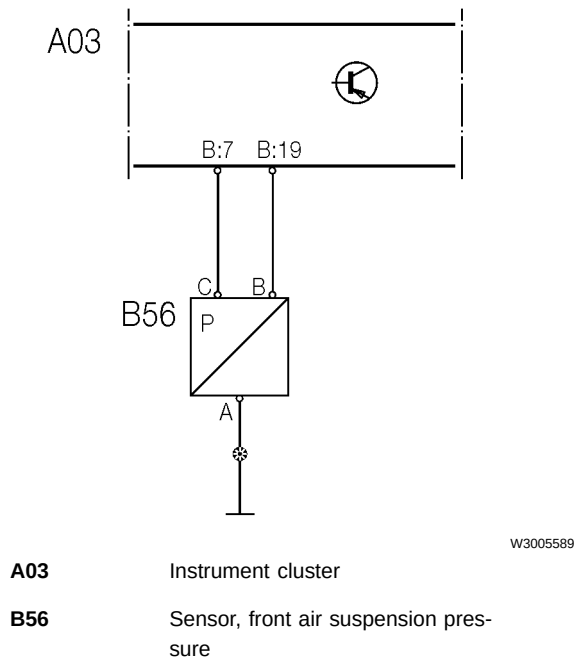
- Breakout box with adapter connected between instrument cluster connector B and cable harness.
- Measuring voltage using the multimeter.
- Ignition key in the drive position.
- Instrument cluster connected.

Measuring points	Nominal value
Pins B12 - B1	$V_{\max} \approx 5 \text{ V}$ $V_{\min} \approx 0 \text{ V}$

Verification

Check that the fault has been repaired using the tests in VCADS Pro (See "Tests in VCADS Pro" page 41).

MID 140 PID 178 Air Suspension Pressure, Front



Fault code

FMI 5

Abnormally low current or open-circuit.

Conditions for fault code:

- If the instrument cluster registers a voltage value less than 0.3 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Faulty sensor.
- Contact resistance and oxidation.

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 178 Air Suspension Pressure, Front, Check" page 44.

FMI 6

Abnormally high current or short-circuit to ground.

Conditions for fault code:

- If the instrument cluster registers a voltage more than 4.7 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 178 Air Suspension Pressure, Front, Check" page 44.

3811-21-02-16**MID 140 PID 178 Air Suspension Pressure, Front, Check***Special tools: 9998699, 9813194**Other special equipment: J39200***NOTE!**

- Read off other fault codes for the instrument cluster.
- Ignition off.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Tests in VCADS Pro

The following tests are useful for a closer examination of the component function:

- "3810-08-02-01 Instrument cluster test".
- "3810-08-02-02 Gauge checks, instrument cluster".

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

*Ground cable***1****Requirements:**

J39200

- The connector for the air suspension pressure sensor (B56) disconnected.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B56, pin A - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

*Supply cable***2****Requirements:**

J39200

- The connector to the sensor (B56) is disconnected.
- Measuring voltage using the multi-meter.
- Instrument cluster connected.
- Ignition key in the drive position.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B56, pin B - ground	$V \approx 5 V$

*Cable harness***3**

For checking the cable harness, see service information under function group 371.

Checking sub-systems

Supply cable

1

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using a multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

9813194
9998699
J39200

Measuring points	Nominal value
Pin B19 - B1	V $\approx$ 5.0 V

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Signal cable

2

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using the multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

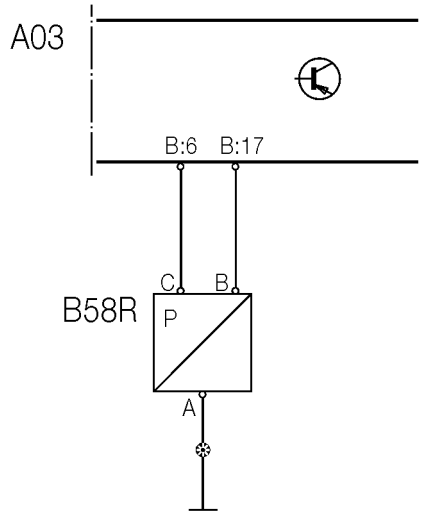
9813194
9998699
J39200

Measuring points	Nominal value
Pins B7 - B1	V _{max} $\approx$ 5 V V _{min} $\approx$ 0 V

Verification

Check that the fault has been repaired using the tests in VCADS Pro (See "Tests in VCADS Pro" page 44).

MID 140 PID 179 Air Suspension Pressure, Rear



A03	Instrument cluster
B58R	Sensor, rear air suspension pressure

W3005590

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 179 Air Suspension Pressure, Rear, Check" page 47.

FMI 6

Abnormally high current or short-circuit to ground.

Conditions for fault code:

- If the instrument cluster registers a voltage more than 4.7 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Signal cable short-circuited to ground.
- Faulty sensor.

Reaction from the instrument cluster:

- Fault code is stored.
- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows an icon and the text "NO DATA".

Appropriate check:

- "MID 140 PID 179 Air Suspension Pressure, Rear, Check" page 47.

Fault code

FMI 5

Abnormally low current or open-circuit.

Conditions for fault code:

- If the instrument cluster registers a voltage value less than 0.3 V the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Open-circuit in the ground lead.
- Open-circuit in the signal cable.
- Faulty sensor.
- Contact resistance and oxidation.

Reaction from the instrument cluster:

3811-21-02-17 MID 140 PID 179 Air Suspension Pressure, Rear, Check

Special tools: 9998699, 9813194

Other special equipment: J39200

NOTE!

- Read off other fault codes for the instrument cluster.
- Ignition off.
- Check all the relevant connectors. Check for loose connections, contact resistance and oxidation. For a detailed description of electrical fault tracing, see separate service information under function group 371.

Tests in VCADS Pro

The following tests are useful for a closer examination of the component function:

- "3810-08-02-01 Instrument cluster test".
- "3810-08-02-02 Gauge checks, instrument cluster".

Measurement at the component's connector to the instrument cluster

Note: Faults in the instrument cluster cable harness can damage the component. Check the component if any of the readings is outside its permitted range.

Ground cable

1

Requirements: J39200

- The connector for the rear air suspension pressure sensor (B58R) disconnected.
- Measuring resistance using a multimeter.
- Instrument cluster connected.
- Ignition off.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B58R, pin A - ground	$R \approx 0 \Omega$

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Supply cable

2

Requirements: J39200

- The connector for the rear air suspension pressure sensor (B58R) disconnected.
- Measuring voltage using the multimeter.
- Instrument cluster connected.
- Ignition key in the drive position.
- Measurement to the instrument cluster.

Measuring points	Nominal value
B58R, pin B - ground	$V \approx 5 V$

Cable harness

3

For checking the cable harness, see service information under function group 371.

Checking sub-systems

Supply cable

1

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using a multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

9813194
9998699
J39200

Measuring points	Nominal value
Pin B17- B1	V ≈ 5 V

Note: If the correct value is not achieved, remove the voltage from the battery and measure again.

Signal cable

2

Requirements:

- Breakout box with adapter connected between instrument cluster (A03) connector B and cable harness.
- Measuring voltage using the multi-meter.
- Ignition key in the drive position.
- Instrument cluster connected.

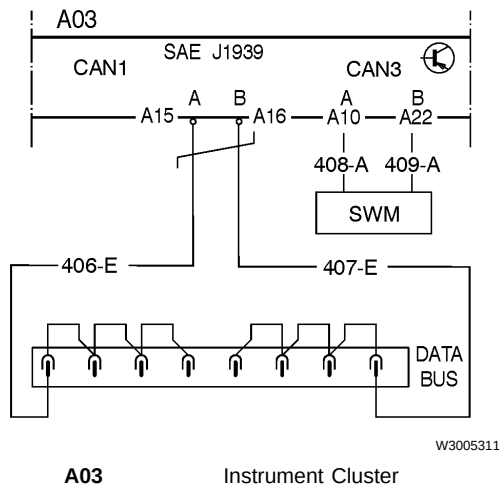
9813194
9998699
J39200

Measuring points	Nominal value
Pins B6 - B1	V ≈ 0.5 - 5 V

Verification

Check that the fault has been repaired using the tests in VCADS Pro (See "Tests in VCADS Pro" page 47).

MID 140 SID 231 J1939 Control Link



Fault code

FMI 2

Intermittent or incorrect data.

Conditions for fault code:

- If the instrument cluster cannot communicate via the J1939 Control data link the instrument cluster interprets this as a fault, and a fault code is stored.

Possible cause:

- Open-circuit in the data link cable between the instrument cluster and other control units.
- Short-circuit to ground in the data link cable between the instrument cluster and other control units.
- Short-circuit to voltage in the data link cable between the instrument cluster and other control units.

Reaction from the instrument cluster:

- Fault code is stored.

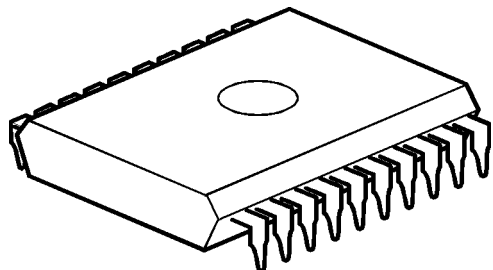
Noticeable external symptoms:

- Lighting functions disappear from the instrument cluster.
- J1939 data link functions cease to operate.

Appropriate action:

- Fault-trace the J1939 data link, see service information group 371 "Data links, fault-tracing".

MID 140 SID 240 Program Memory



T2012704

General information

At start-up a checksum is calculated for the software in the flash memory for the instrument cluster. This is compared with a previously stored checksum to check that the software is correct.

Component: A03 instrument cluster

Fault code

FMI 2

Intermittent or incorrect data.

Conditions for fault code:

- If the checksum calculated at start-up does not agree with the previously saved checksum, the instrument cluster interprets this as a fault and a fault code is set.

Note: If a fault code is set, reprogram the instrument cluster.

Possible cause:

- Software fault.
- Faulty memory circuit.

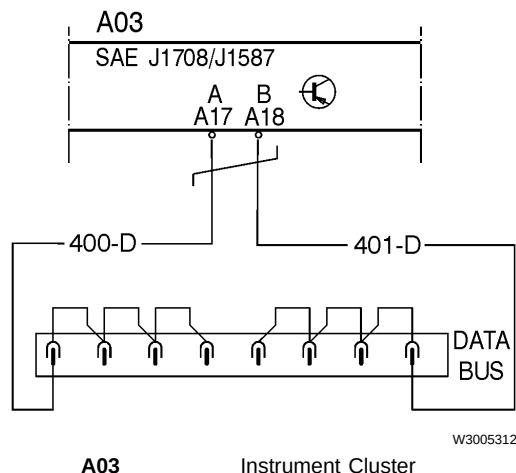
Reaction from the instrument cluster:

- "Boot mode" requested.

Noticeable external symptoms:

- "Boot mode" shown on the display.

MID 140 SID 250 J1587/1708 Information Link



Fault code

FMI 3

Abnormally high voltage or short-circuit to higher voltage.

Conditions for fault code:

- If the instrument cluster does not receive any contact with the information link (no echo available) the fault codes is set.

Possible cause:

- Open circuit in the data link.
- Fault in the instrument cluster communication circuits.

Reaction from the instrument cluster:

- Yellow lamp requested.
- Fault code is stored.

Noticeable external symptoms:

- Yellow lamp lights up and the display shows which control unit should to be checked.
- ABS vehicle telltale may be illuminated, but this does not indicate an ABS fault.
- The display shows the text "CHECK DATA LINK".

Appropriate check:

- Fault-trace the J1587/1708 information link, see service information "Data links, fault-tracing" function group 371.
- Isolate/disconnect the instrument cluster from the data link by disconnecting the harness connections at the rear. Check for active SID250 fault codes in other control units. If no other active faults are reported, it is likely the instrument cluster has an internal problem. Replace the instrument cluster. If other control units do report an active SID250 fault, the problem is likely in the data link wiring or another control unit.

FMI 4

Abnormally low voltage or short-circuit to lower voltage.

Conditions for fault code:

- If the instrument cluster does not receive any contact with the information link (no echo available) the fault codes is set.

Possible cause:

- Open circuit in the data link.
- Fault in the instrument cluster communication circuits.

Reaction from the instrument cluster:

- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up and the display shows which control unit should to be checked.
- ABS vehicle telltale may be illuminated, but this does not indicate an ABS fault.

Appropriate check:

- Fault-trace the J1587/1708 information link, see service information "Data links, fault-tracing" function group 371.

FMI 9

Abnormal update rate.

Conditions for fault code:

- If a control unit does **not** transmit PID 44 to the instrument cluster the control unit interprets this as a fault and a fault code is stored.

Possible cause:

- The particular control unit is in the process of being programmed and therefore does not transmit any signals on the information link.

Reaction from the instrument cluster:

- Yellow lamp requested.

Noticeable external symptoms:

- Yellow lamp lights up and the display shows which control unit should to be checked.
- ABS vehicle telltale may be illuminated, but this does not indicate an ABS fault.

Appropriate check:

- Fault-trace the J1587/1708 information link, see service information on "Data links, fault-tracing" function group 371.

FMI 12

Defective unit or component.

Conditions for fault code:

- If the control units do **not** send PID 44 to the instrument cluster, but the instrument cluster still has contact with the link (echo is available), the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- One of the control units is being programmed and has sent a command to the other control units not to transmit signals on the information link in the meantime.

Reaction from the instrument cluster:

- Yellow lamp requested.

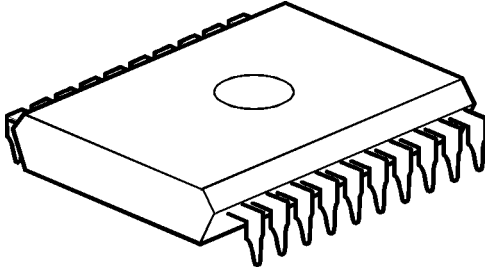
Noticeable external symptoms:

- Yellow lamp lights up.
- The display shows the text "CHECK DATA LINK".
- ABS vehicle telltale may be illuminated, but this does not indicate an ABS fault.

Appropriate check:

- Fault-trace the J1587/1708 information link, see service information on "Data links, fault tracing" function group 371.

MID 140 SID 253 Calibration Memory, EEPROM



T2012704

General information

At start-up a check sum is calculated for the data set in the instrument cluster's EEPROM memory. This is compared with a previously stored check sum to check that the data set is correct.

Component: A03 Instrument cluster

Fault code

FMI 2

Intermittent or incorrect data.

Conditions for fault code:

- If the content of the memory circuit is faulty the instrument cluster interprets this as a fault and a fault code is set.

Possible cause:

- Error when programming.
- Fault in the memory circuit.

Reaction from the instrument cluster:

- Undetermined.

Noticeable external symptoms:

- Undetermined.

MID 140 PSID 7 Reference Resistance

General information

Component: A 03 Instrument cluster

Fault code

FMI 3

Abnormally high voltage or short-circuit to higher voltage.

Conditions for fault code:

If the instrument cluster registers a resistance of less than 22.5 Ω the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Hardware fault in the instrument cluster.
- Fault in the fuel level sensor.
- Fault in the ambient temperature sensor.

Reaction from the instrument cluster:

- Fault code is stored.

Noticeable external symptoms:

- No reading on the gauges from the directly connected sensors (ambient temperature and fuel level).

Appropriate check:

- Check all the wiring directly connected to the instrument cluster.

FMI 4

Abnormally low voltage or short-circuit to lower voltage.

Conditions for fault code:

If the instrument cluster registers a resistance of less than 22.5 Ω the instrument cluster interprets this as a fault and a fault code is stored.

Possible cause:

- Hardware fault in the instrument cluster.
- Fault in the fuel level sensor.
- Fault in the ambient temperature sensor.

Reaction from the instrument cluster:

- Fault code is stored.

Noticeable external symptoms:

- No reading on the gauges from the directly connected sensors (ambient temperature and fuel level).

Appropriate check:

- Check all the wiring directly connected to the instrument cluster.

MID 140 PSID 200 J1939 Data Link Interruption, Engine ECU

General information

The control units share important messages via the SAE J1939 Control data link. If one control unit is missing information from another control unit, this fault code is used to indicate which control unit is expected to transmit the message via the J1939 data link.

Fault code

FMI 9

Abnormal update rate.

Conditions for fault code:

- If the instrument cluster does not receive the message from the engine control unit via the J1939 control data link within a specific time period, the instrument cluster interprets this as a communication fault from the engine control unit and a fault code is stored.

Possible cause:

- Fault in the J1939 data link between the instrument cluster and the engine control unit.

Reaction from the instrument cluster:

- Fault code is stored.
-

Noticeable external symptoms:

-
- Warning light lights up.

Appropriate check:

- Fault-trace the J1939 data link, see service information group 371 "Data links, fault-tracing".

MID 140 PSID 201 J1939 Data Link Interruption, Vehicle ECU

General information

The control units share important messages via the SAE J1939 Control data link. If one control unit is missing information from another control unit, this fault code is used to indicate which control unit is expected to transmit the message via the J1939 data link.

Fault code

FMI 9

Abnormal update rate.

Conditions for fault code:

- If the instrument does not receive the message from the vehicle control unit via the J1939 control data link within a specific time period, the instrument cluster interprets this as a communication fault from the vehicle control unit and a fault code is stored.

Possible cause:

- Fault in the J1939 data link between the instrument cluster and the vehicle control unit.

Reaction from the instrument cluster:

- Fault code is stored.
- Brake lights requested.

Noticeable external symptoms:

- Speed signal missing.
- Warning light lights up.

Appropriate check:

- Fault-trace the J1939 data link, see service information group 371 "Data links, fault-tracing".

MID 140 PSID 204 J1939 Data Link Interruption, Anti-lock Brake ECU

General information

The control units share important messages via the SAE J1939 Control data link. If one control unit is missing information from another control unit, this fault code is used to indicate which control unit is expected to transmit the message via the J1939 data link.

Fault code

FMI 9

Abnormal update rate.

Conditions for fault code:

- If the instrument cluster does not receive the message from the Anti-lock brake (ABS) control unit via the J1939 control data link within a specific time period, the instrument cluster interprets this as a communication fault from the engine control unit and a fault code is stored.

Possible cause:

- Fault in the J1939 data link between the instrument cluster and the ABS control unit.

Reaction from the instrument cluster:

- Fault code is stored.
-

Noticeable external symptoms:

-
- Warning light lights up.

Appropriate check:

- Fault-trace the J1939 data link, see service information group 371 "Data links, fault-tracing".

MID 140 PSID 210 J1939 Data Link Interruption, Lighting Control Module

General information

The control units share important messages via J1939 control data link. If one control unit is missing information from another control unit, this fault code is used to indicate which control unit is expected to transmit the message via the J1939 data link.

Fault code

FMI 9

Abnormal update rate.

Conditions for fault code:

- If the instrument cluster does not receive the message, from the external lighting control unit via the J1939 control data link, within a specific time period, the instrument cluster interprets this as a communication fault from the external lighting control unit and a fault code is stored.

Possible cause:

- Fault in the external lighting control unit.

Reaction from the instrument cluster:

- Fault code is stored.
- Brake lights requested.

Noticeable external symptoms:

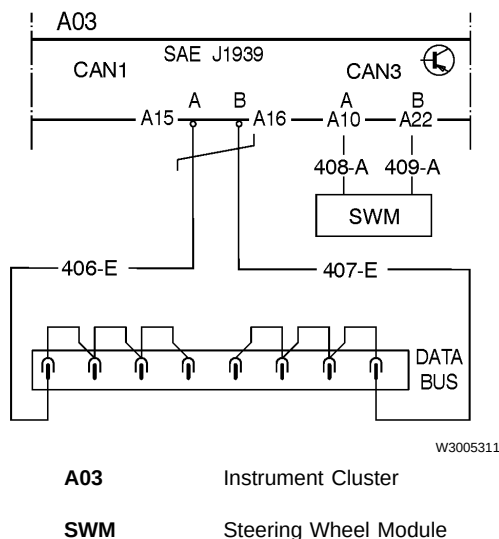
- Lighting functions missing.
- Warning light lights up.

Appropriate check:

- Fault-trace the J1939 data link, see service information group 371 "Data links, fault-tracing".

MID 140 PSID 232 J1939-3 Control Link

(Link to Steering Wheel Module [SWM])



Fault code

FMI 2

Intermittent or incorrect data.

Conditions for fault code:

- If the control unit cannot communicate via the J1939 control data link the instrument cluster interprets this as a fault, and a fault code is stored.

Possible cause:

- Open-circuit in the data link cable between the instrument cluster and other control unit (SWM).
- Short-circuit to ground in the data link cable between the instrument cluster and other control unit (SWM).
- Short-circuit to voltage in the data link cable between the instrument cluster and other control unit (SWM).

Reaction from the instrument cluster:

- Fault code is stored.

Noticeable external symptoms:

- Radio functions are not shown in the instrument cluster display.
- Lights cannot be controlled by steering wheel switches.

Appropriate check:

- Fault-trace the J1939 data link, see service information group 371 "Data links, fault-tracing".

Feedback

One of our objectives is that workshop personnel should have access to correct and appropriate service manuals where it concerns fault tracing, repairs and maintenance of Volvo trucks.
In order to maintain the high standards of our literature, your opinions and experience when using this manual would be greatly appreciated.
If you have any comments or suggestions, make a copy of this page, write down your comments and send them to us, either via telefax or mailing directly to the address listed below.

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From

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Comments/proposals

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Concerns Service Manual:

Operation Numbers

3811-21-02-01	MID 140 PID 78 Rear Rear Axle Temperature, Check	21
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