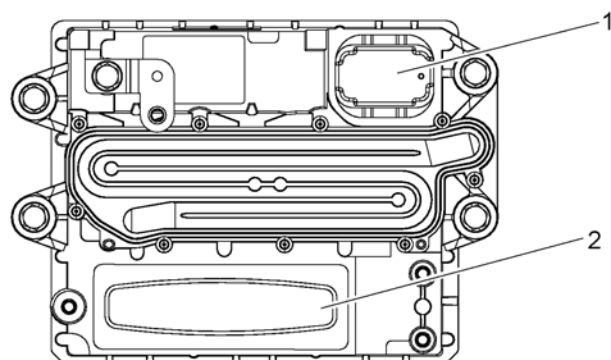


Section 3.1

Motor Control Module2

The engine mounted Motor Control Module2 (MCM2) includes control logic to provide overall engine management. See Figure "Motor Control Module2" .



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1. 21-pin Connector (OEM Responsibility) 2. 120-pin Connector (Detroit Diesel Responsibility)

Figure 1. Motor Control Module2

Note: Do NOT ground the MCM2 housing. This can result in false codes being logged.

Operating Range	
Full Functionality	$11\text{ V} \leq \text{VBatt} \leq 30\text{ V}$
Restricted Functionality	$6.5\text{ V} \leq \text{VBatt} \leq 11\text{ V}$
Operating Range for Injection	$8\text{ V} \leq \text{VBatt} \leq 32\text{ V}$
Restricted Operating Range for Injection	$6.5\text{ V} \leq \text{VBatt} \leq 8\text{ V}$
Over Voltage Shutdown	35 V
Under Voltage Shutdown of Micro Controller	4 V
Maximum DC Voltage	55 V
Reverse Battery Protection	Unlimited
Current Consumption	
Quiescent Current 2 (Current w/ign OFF)	<1 mA
Maximum Average Current (normal operation)	40 A
Typical Current Consumption (engine stalled, not actuators driven)	300 mA
Maximum Power Dissipation (normal operation)	50 W

Table 2. Electrical Limits

System Inputs	Description	Current Demand (max. Avg. DC)
Terminal 30	Voltage supply (+)	40A
Terminal 31	Voltage supply ground	40A

Terminal 15	Ignition	110mA
Terminal 50	Starter	100mA (max 4A during cranking)

Table 3. Power Supply

**All power supply lines are protected against over voltage and reverse battery.*

Description	Transmission Rate	Signal Voltage	Termination	Remarks
CAN 1	125kBaud	VBatt	None	Powertrain CAN
	500kBaud	5V	None	Powertrain CAN
CAN 2	500kBaud	5V	None	Aftertreatment / Calibration CAN
CAN 3	500kBaud	5V	60R	Actuator / Sensor CAN

Table 4. CAN-Bus

Section 3.1.1 Environmental Conditions

The Environmental Conditions for the MCM2 and ACM2 are as follows:

- The MCM2 is not water proof.
- The MCM2 has to be protected from impacts.
- The ACM2 is not water proof.
- The ACM2 requires battery power at all times.
- The ACM2 must not be wired through to disconnect switch.

Section 3.1.2 ENGINE HARNESS

The MCM2 has a 120–pin connector Engine Harness which is factory installed. It also has a 21–pin connector which is the responsibility of the OEM.

Section 3.1.2.1 MCM2 120–pin Connector for Heavy–Duty Engines

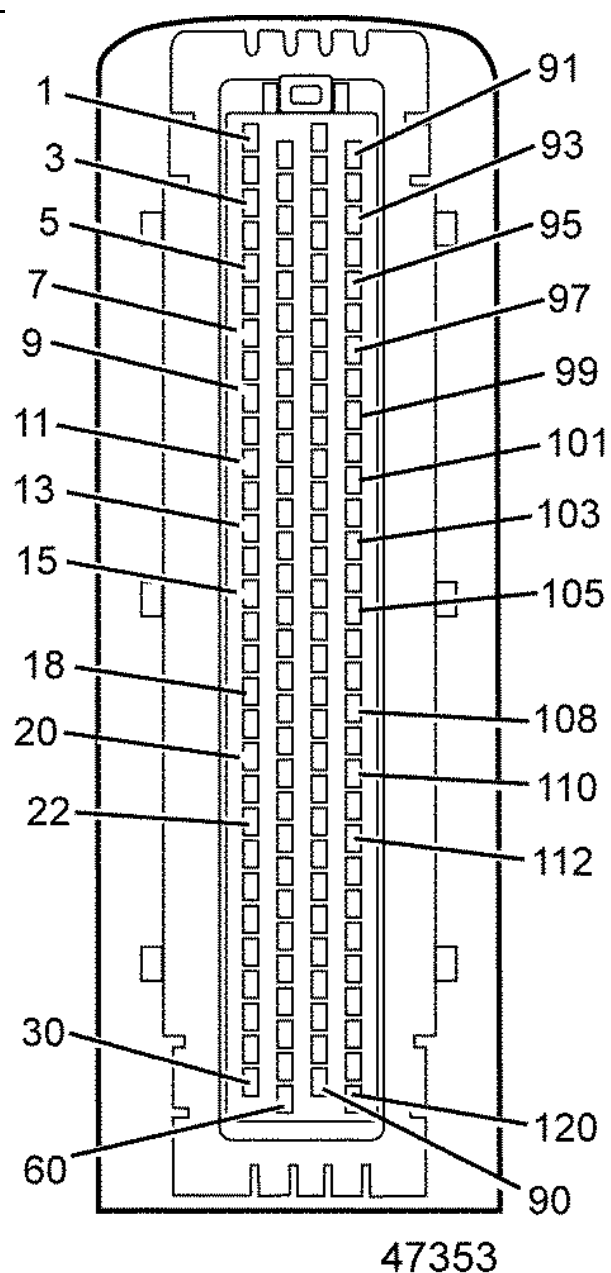
The pinouts for the MCM2 120–pin connector for the DD13, DD15, and DD16 engines are listed in the following table:

DESCRIPTION	DD13	DD15	DD16
MCM2 Pins 1 through 30	Listed in Table "MCM2 Connector – DD13 (1 of 4)"	Listed in Table "MCM2 Connector – DD15 (1 of 4)"	Listed in Table "MCM2 Connector – DD16 (1 of 4)"
MCM2 Pins 31 through 60	Listed in Table "MCM2 Connector – DD13 (2 of 4)"	Listed in Table "MCM2 Connector – DD15 (2 of 4)"	Listed in Table "MCM2 Connector – DD16 (2 of 4)"
MCM2 Pins 61 through 90	Listed in Table "MCM2 Connector – DD13 (3 of 4)"	Listed in Table "MCM2 Connector – DD15 (3 of 4)"	Listed in Table "MCM2 Connector – DD16 (3 of 4)"
MCM2 Pins 91 through 120	Listed in Table "MCM2 Connector – DD13 (4 of 4)"	Listed in Table "MCM2 Connector – DD15 (4 of 4)"	Listed in Table "MCM2 Connector – DD16 (4 of 4)"

Table 5. MCM2 120–pin Connectors

Pin	Signal Type	Function	Connector
1	RPU_H	IMV / FMU Highside supply metering unit (PWM)	
2	RPU_L	IMV / FMU Lowside supply metering unit (S / W)	
3	H_OUT1	Not Used	
4	MV_B5F	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
5	MV_B5	Not Used	
6	MV_B5D	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
7	MV_B5	Spill control valve / Amplifier / PLD (EUP)	
8	MV_B5B	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
9	MV_B5	Not Used	
10	MV_B4E	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
11	MV_B4	Not Used	
12	MV_B4C	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
13	MV_B4	Spill control valve / Amplifier / PLD (EUP)	
14	MV_B4A	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
15	MV_B4	Not Used	
16	MV_B2F	Needle control valve	
17	MV_B2	Not Used	
18	MV_B2D	Needle control valve	
19	MV_B2	Needle control valve	
20	MV_B2B	Needle control valve	
21	MV_B2	Not Used	
22	MV_B1E	Needle control valve	
23	MV_B1	Not Used	
24	MV_B1C	Needle control valve	
25	MV_B1	Needle control valve	
26	MV_B1A	Needle control valve	
27	MV_B1	Not Used	
28	START_B	Not Used	

29 KN1_1 Not Used



30 A01_S Not Used

Table 6. MCM2 Connector – DD13 (1 of 4)

Pin	Signal Type	Function	Connector
31	PWM_5	Not Used	
32	PWM_7	Jake brake low	
33	PWM_6	Actuator fan 2	
34	PWM_8	Not Used	
35	PWM_10	Wastegate	
36	PWM_09	Not Used	
37	PWM_11	Not Used	

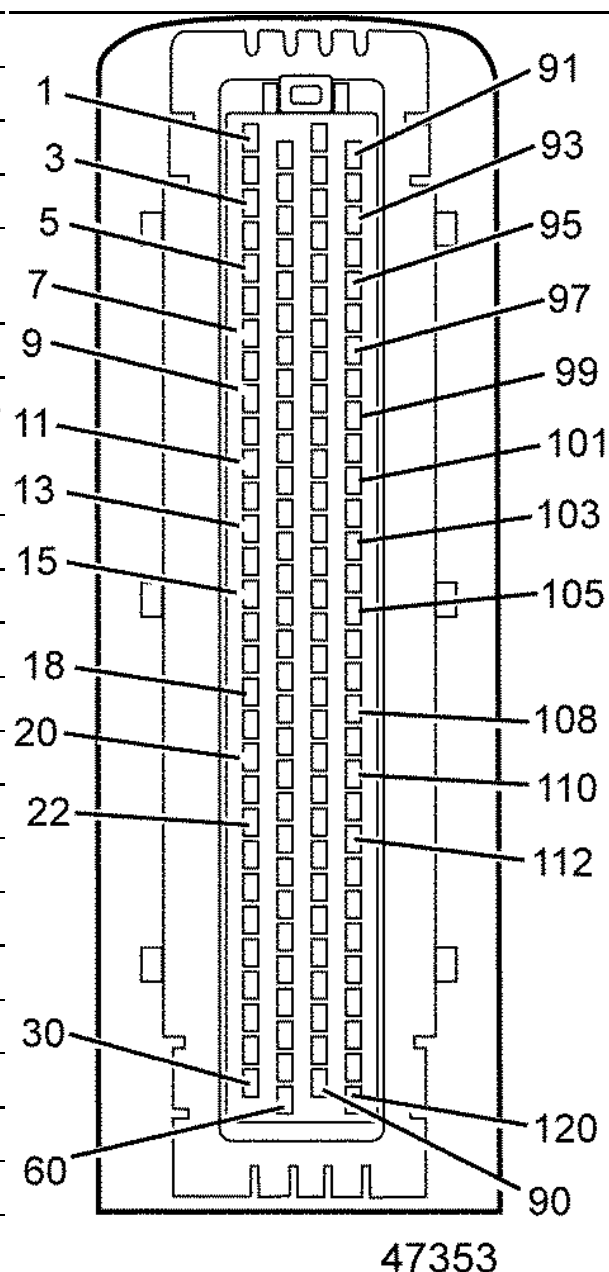
38	PV_M	Wastegate GND
39	HSW2	Not Used
40	PCV_H	Not Used
41	HSW1	Not Used
42	LSU_LS	Not Used
43	DYN3_S	Input for inductive sensor crankshaft [analysis of the falling edge from the sensor signal]
44	LSU_V	Not Used
45	DYN2_S	Input for inductive sensor camshaft (2PINs) or hall sensor (3PINs) [analysis of the falling edge from the sensor signal]
46	D3_V	EvoBus Start/Stop rear switch
47	DYN4_S	Sensor fan speed (hall sensor)
48	DYN2_M	Cam Sensor Signal ground GND
49	DYN5_S	Not Used
50	SGND	Turbo Speed GND
51	DYN1_S	Turbo Speed
52	SGND_P	Sensor ground
53	A23_S	Not Used
54	A09_S	Oil pressure switch
55	SGND_P	Sensor ground
56	KN2_2	Not Used
57	A05_S	Water level fuel filter
58	SENS1_V	Sensor Power Supply 1

59 KN1_2 Not Used

60 A02_S Not Used

Table 7. MCM2 Connector – DD13 (2 of 4)

Pin	Signal Type	Function
61	PWM_1	Not Used
62	PV_B2	SW and PWM Power Supply Output (high side)
63	H_OUT2	Not Used
		SW and PWM Power Supply Output (high side)



64	PV_B2	side)
65	PWM_12	HC dosing valve
66	PWM_13	Jake brake high
67	PV_M	Prop Valve Group Ground
68	PCV_L	Not Used
69	PWM_18	Fuel cut off valve HC Metering Unit
70	PWM_16	Not Used
71	LIN_V	12V Power supply (Vbatt-0.25V max.15V) for LIN sensors
72	LIN	Not Used
73	DYN3_M	Crank Position Signal ground GND
74	CAN3L	Actuator CAN: CAN-Low
75	CAN3H	Actuator CAN: CAN-High
76	D3_S	EvoBus Start/Stop rear switch signal in
77	A29_S	Fuel temperature
78	A15_S	Rail pressure
79	D1_S	Not Used
80	A27_S	Coolant inlet temperature
81	A13_S	Not Used
82	SENS2_V	Sensor Supply 2
83	A24_S	Not Used
84	A10_S	HC doser fuel pressure in
85	SENS2_V	Sensor Supply 2/10 way
86	A21_S	Not Used
87	A06_S	Charge air pressure [directly after intake air throttle]
88	SGND	Not Used
89	KN2_1	Not Used
90	A03_S	Position intake air throttle

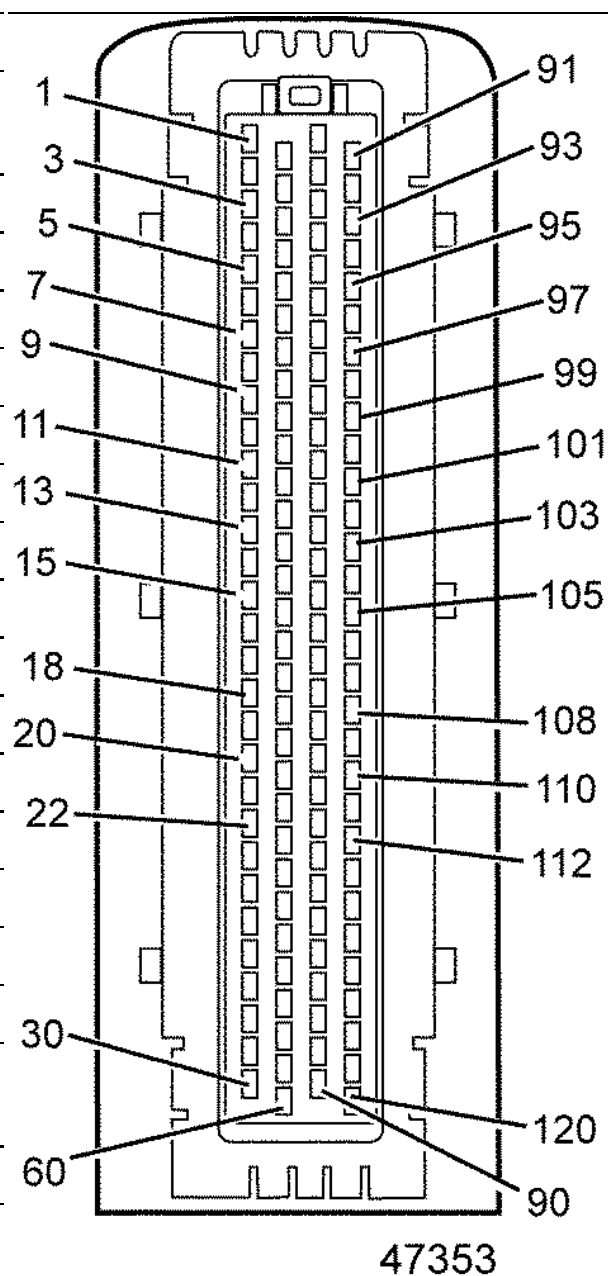
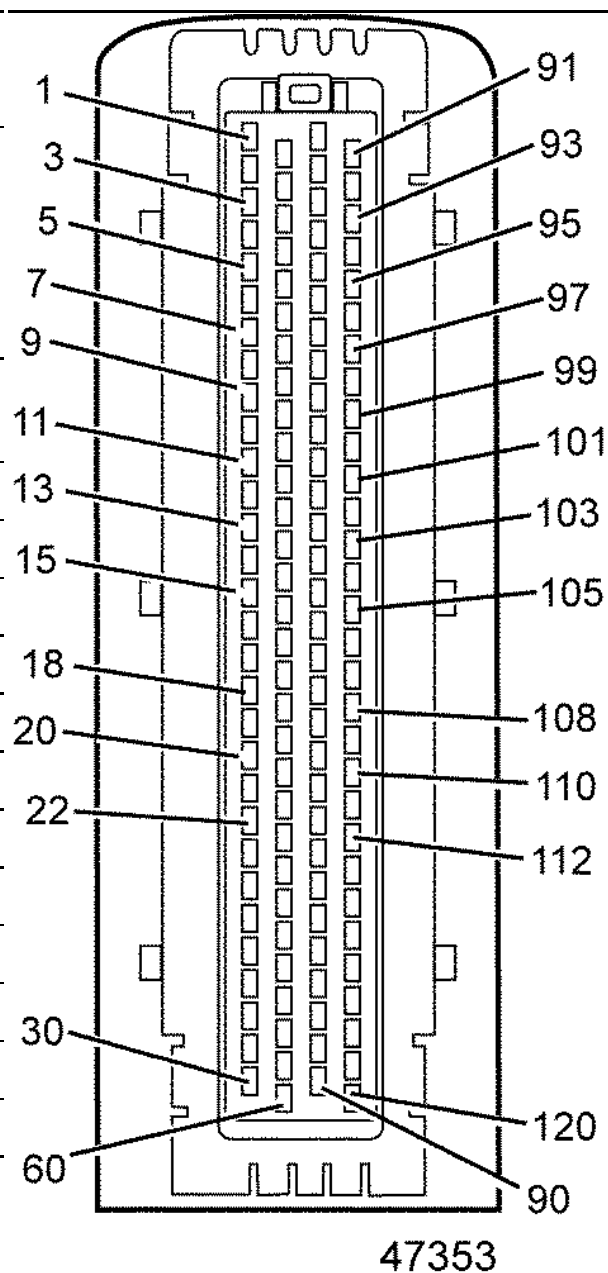


Table 8. MCM2 Connector – DD13 (3 of 4)

Pin	Signal Type	Function	Connector
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91	PV_B1	SW and PWM Power Supply Output (high side)
92	PWM_3	Not Used
93	PV_B1	Wastegate Power Supply
94	PWM_4	Not Used
95	PV_M	Not Used
96	PWM_2	Not Used
97	PWM_15	Not Used
98	PWM_14	Fan 1
99	PWM_17	Not Used
100	H_OUT1	H-bridge output for intake air throttle
101	H_OUT2	
102	SGND	Sensor ground
103	SGND	
104	SGND	
105	SGND	
106	A30_S	Intake manifold temperature [EGR and fresh air mixed]
107	D2_S	Not Used
108	A28_S	Engine oil temperature
109	A14_S	Differential pressure EGR
110	A26_S	Coolant outlet temperature
111	A12_S	HC doser fuel pressure out
112	A25_S	Not Used
113	A11_S	Not Used
114	SGND	Sensor ground
115	A22_S	Not Used
116	A08_S	Not Used
117	SENS1_V	Sensor Power Supply 1
118	A07_S	Not Used
119	A19_S	Charge air temperature [directly after intercooler]



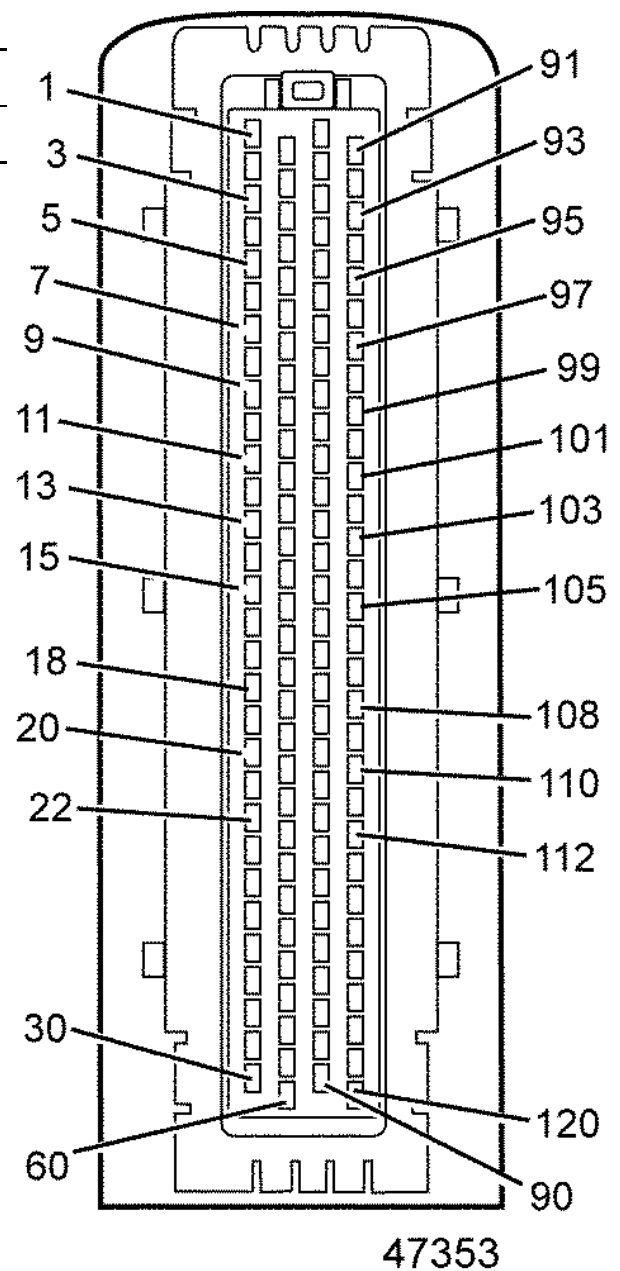
120 A04_S Not Used

Table 9. MCM2 Connector – DD13 (4 of 4)

Pin	Signal Type	Function	Connector
1	RPU_H	IMV / FMU Highside supply metering unit (PWM)	
2	RPU_L	IMV / FMU Lowside supply metering unit (S / W)	
3	H_OUT1	Not Used	
4	MV_B5F	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
5	MV_B5	Not Used	
6	MV_B5D	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
7	MV_B5	Spill control valve / Amplifier / PLD (EUP)	
8	MV_B5B	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
9	MV_B5	Not Used	
10	MV_B4E	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
11	MV_B4	Not Used	
12	MV_B4C	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
13	MV_B4	Spill control valve / Amplifier / PLD (EUP)	
14	MV_B4A	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
15	MV_B4	Not Used	
16	MV_B2F	Needle control valve	
17	MV_B2	Not Used	
18	MV_B2D	Needle control valve	
19	MV_B2	Needle control valve	
20	MV_B2B	Needle control valve	
21	MV_B2	Not Used	
22	MV_B1E	Needle control valve	
23	MV_B1	Not Used	
24	MV_B1C	Needle control valve	
25	MV_B1	Needle control valve	

26	MV_B1A	Needle control valve
27	MV_B1	Not Used
28	START_B	Not Used

29 KN1_1 Not Used

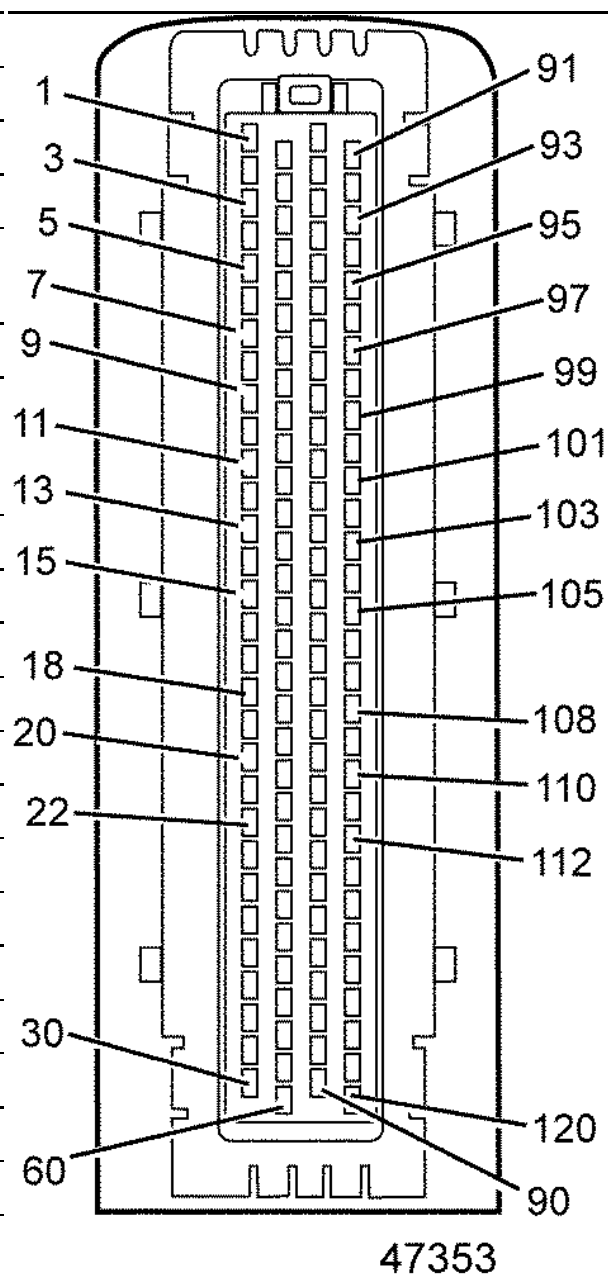


30	A01_S	Not Used
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Table 10. MCM2 Connector – DD15 (1 of 4)

Pin	Signal Type	Function	Connector
31	PWM_5	Not Used	
32	PWM_7	Jake brake low	
33	PWM_6	Actuator fan 2	
34	PWM_8	Not Used	
35	PWM_10	Not Used	
36	PWM_09	Not Used	
37	PWM_11	Not Used	

38	PV_M	Not Used
39	HSW2	Not Used
40	PCV_H	Not Used
41	HSW1	Not Used
42	LSU_LS	Not Used
43	DYN3_S	Input for inductive sensor crankshaft [analysis of the falling edge from the sensor signal]
44	LSU_V	Not Used
45	DYN2_S	Input for inductive sensor camshaft (2PINs) or hall sensor (3PINs) [analysis of the falling edge from the sensor signal]
46	D3_V	Not Used
47	DYN4_S	Sensor fan speed (hall sensor)
48	DYN2_M	Cam Sensor Signal ground GND
49	DYN5_S	Electrostatic Oil Separator Speed
50	SGND	Not Used
51	DYN1_S	Not Used
52	SGND_P	Sensor ground
53	A23_S	Not Used
54	A09_S	Oil pressure switch
55	SGND_P	Sensor ground
56	KN2_2	Not Used
57	A05_S	Water level fuel filter
58	SENS1_V	Sensor Power Supply 1



59 KN1_2 Not Used

60 A02_S Not Used

Table 11. MCM2 Connector – DD15 (2 of 4)

Pin	Signal Type	Function	Connector
61	PWM_1	Not Used	
62	PV_B2	SW and PWM Power Supply Output (high side)	
63	H_OUT2	Not Used	
		SW and PWM Power Supply Output (high side)	

64	PV_B2	side)
65	PWM_12	HC dosing valve
66	PWM_13	Jake brake high
67	PV_M	Prop Valve Group Ground
68	PCV_L	Not Used
69		Fuel cut off valve HC Metering Unit
70	PWM_18	Not Used
71	LIN_V	12V Power supply (Vbatt-0.25V max.15V) for LIN sensors
72	LIN	Not Used
73	DYN3_M	Signal ground GND
74	CAN3L	Actuator CAN: CAN-Low
75	CAN3H	Actuator CAN: CAN-High
76	D3_S	Not Used
77	A29_S	Fuel temperature
78	A15_S	Rail pressure
79	D1_S	Not Used
80	A27_S	Coolant inlet temperature
81	A13_S	Not Used
82	SENS2_V	Sensor Supply 2
83	A24_S	Not Used
84	A10_S	HC doser fuel pressure in
85	SENS2_V	Sensor Supply 2/10 way
86	A21_S	Not Used
87	A06_S	Charge air pressure [directly after intake air throttle]
88	SGND	Not Used
89	KN2_1	Not Used
90	A03_S	Position intake air throttle

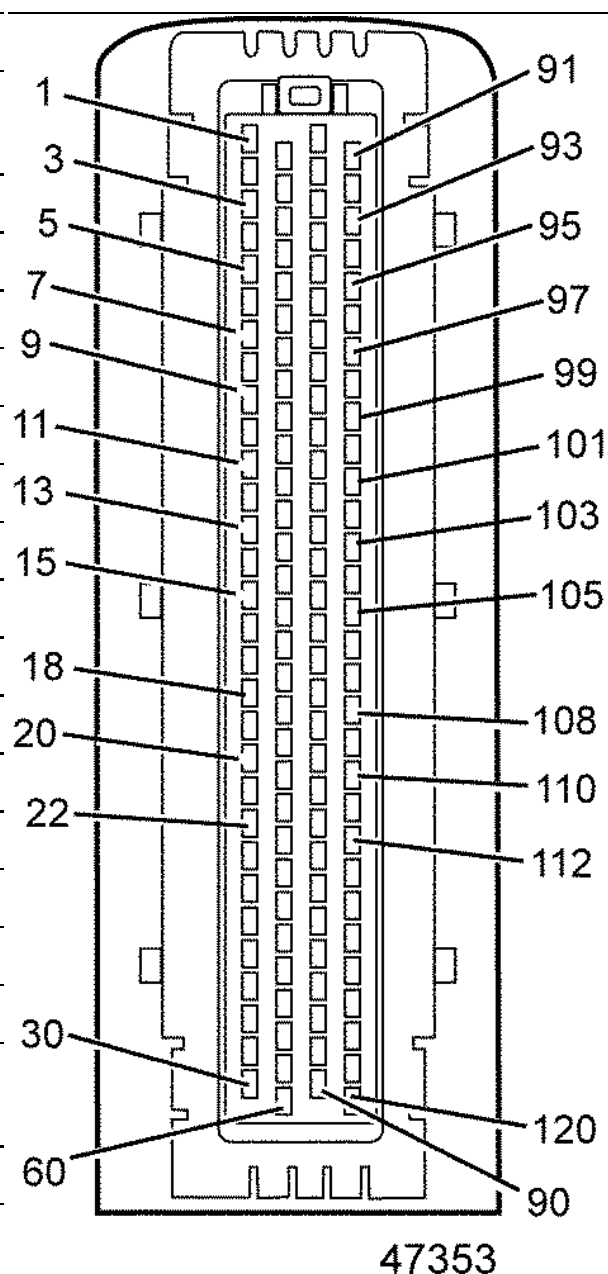


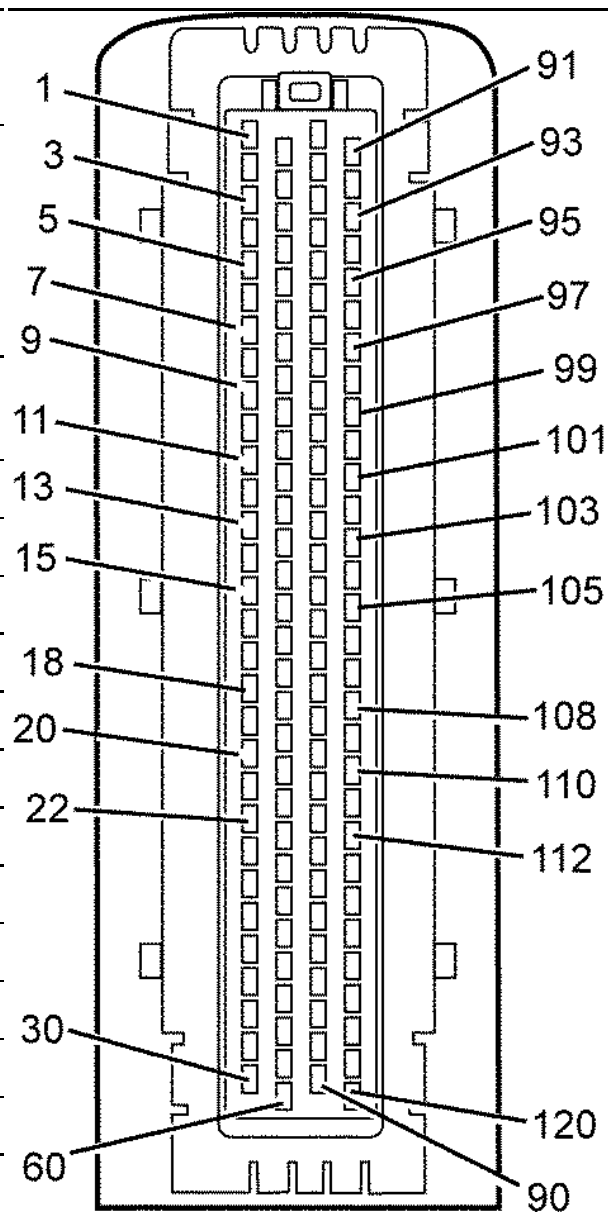
Table 12. MCM2 Connector – DD15 (3 of 4)

Pin	Signal Type	Function	Connector
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91	PV_B1	SW and PWM Power Supply Output (high side)
92	PWM_3	Not Used
93	PV_B1	Not Used
94	PWM_4	Not Used
95	PV_M	Not Used
96	PWM_2	Not Used
97	PWM_15	Not Used
98	PWM_14	Fan 1
99	PWM_17	Not Used

100	H_OUT1	H-bridge output for intake air throttle
101	H_OUT2	
102	SGND	Sensor ground
103	SGND	
104	SGND	
105	SGND	
106	A30_S	Intake manifold temperature [EGR and fresh air mixed]
107	D2_S	Not Used
108	A28_S	Engine oil temperature
109	A14_S	Differential pressure EGR
110	A26_S	Coolant outlet temperature
111	A12_S	HC doser fuel pressure out
112	A25_S	Not Used
113	A11_S	Not Used
114	SGND	Sensor ground
115	A22_S	Not Used
116	A08_S	Not Used
117	SENS1_V	Sensor Power Supply 1
118	A07_S	Not Used

119	A19_S	Charge air temperature [directly after intercooler]
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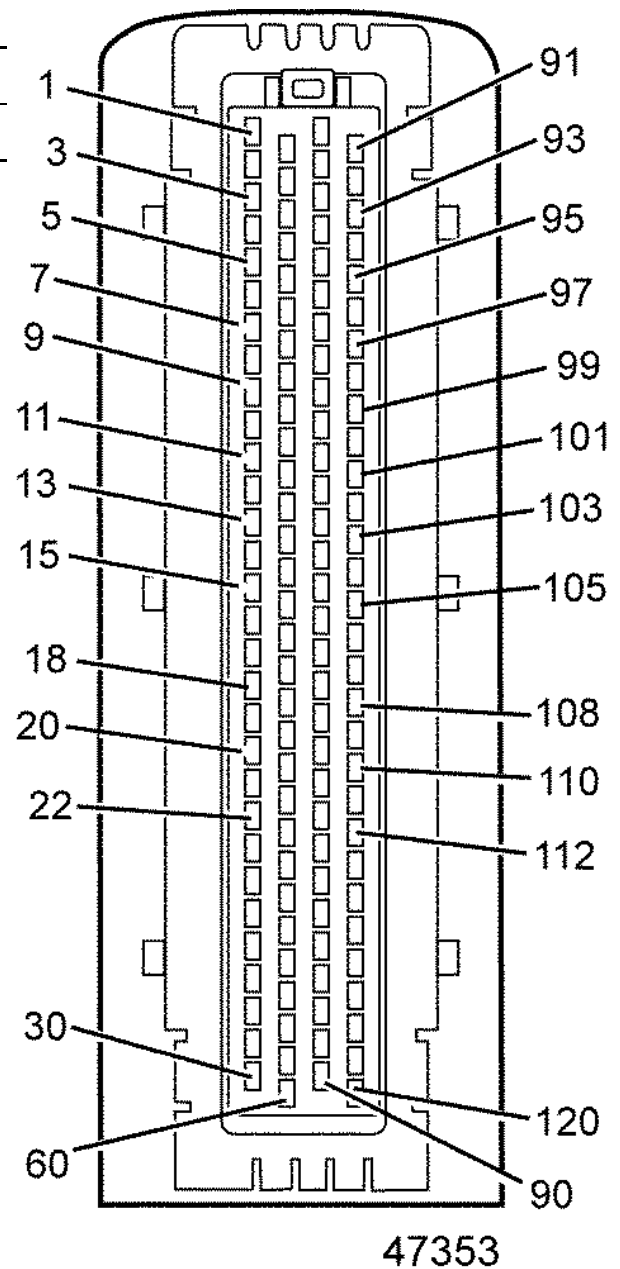
120 A04_S Not Used

Table 13. MCM2 Connector – DD15 (4 of 4)

Pin	Signal Type	Function	Connector
1	RPU_H	IMV / FMU Highside supply metering unit (PWM)	
2	RPU_L	IMV / FMU Lowside supply metering unit (S / W)	
3	H_OUT1	Not Used	
4	MV_B5F	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
5	MV_B5	Not Used	
6	MV_B5D	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
7	MV_B5	Spill control valve / Amplifier / PLD (EUP)	
8	MV_B5B	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
9	MV_B5	Not Used	
10	MV_B4E	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
11	MV_B4	Not Used	
12	MV_B4C	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
13	MV_B4	Spill control valve / Amplifier / PLD (EUP)	
14	MV_B4A	APCRS: Amplifier; Bosch PLD; E3: Spill valve	
15	MV_B4	Not Used	
16	MV_B2F	Needle control valve	
17	MV_B2	Not Used	
18	MV_B2D	Needle control valve	
19	MV_B2	Needle control valve	
20	MV_B2B	Needle control valve	
21	MV_B2	Not Used	
22	MV_B1E	Needle control valve	
23	MV_B1	Not Used	
24	MV_B1C	Needle control valve	
25	MV_B1	Needle control valve	

26	MV_B1A	Needle control valve
27	MV_B1	Not Used
28	START_B	Not Used

29 KN1_1 Not Used

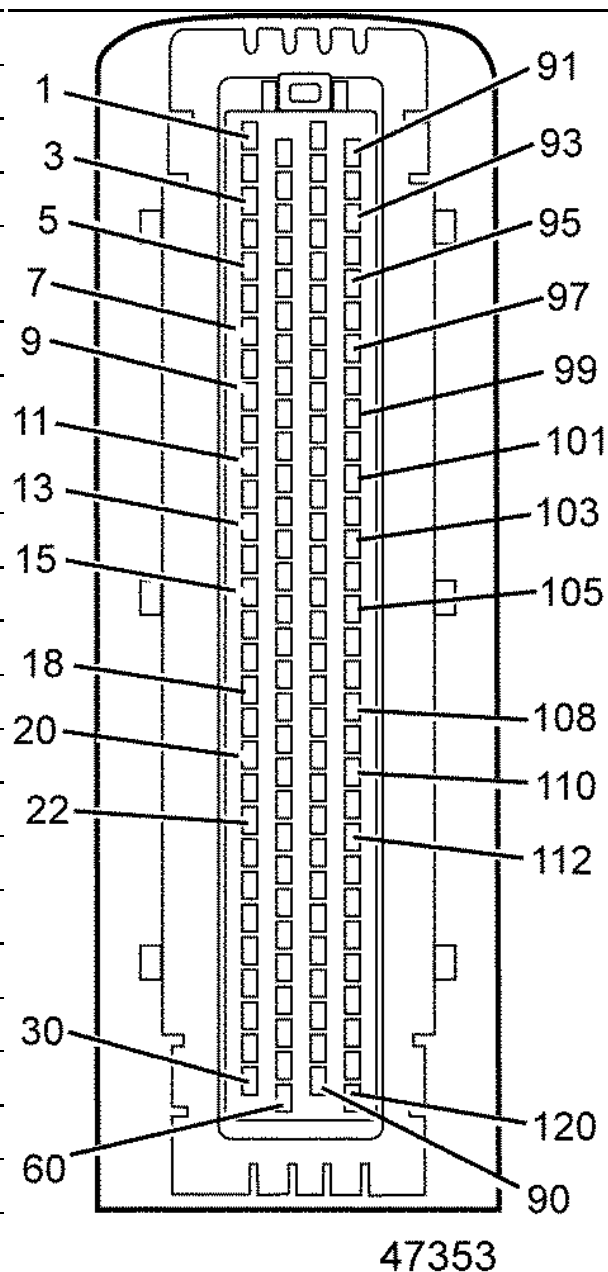


30	A01_S	Not Used
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Table 14. MCM2 Connector – DD16 (1 of 4)

Pin	Signal Type	Function	Connector
31	PWM_5	Not Used	
32	PWM_7	Jake brake low	
33	PWM_6	Actuator fan 2	
34	PWM_8	Not Used	
35	PWM_10	Not Used	
36	PWM_09	Not Used	
37	PWM_11	Not Used	

38	PV_M	Not Used
39	HSW2	Not Used
40	PCV_H	Not Used
41	HSW1	Not Used
42	LSU_LS	Not Used
43	DYN3_S	Input for inductive sensor crankshaft [analysis of the falling edge from the sensor signal]
44	LSU_V	Not Used
45	DYN2_S	Input for inductive sensor camshaft (2PINs) or hall sensor (3PINs) [analysis of the falling edge from the sensor signal]
46	D3_V	Not Used
47	DYN4_S	Sensor fan speed (hall sensor)
48	DYN2_M	Cam Sensor Signal ground GND
49	DYN5_S	Not Used
50	SGND	Not Used
51	DYN1_S	Not Used
52	SGND_P	Sensor ground
53	A23_S	Not Used
54	A09_S	Oil pressure switch
55	SGND_P	Sensor ground
56	KN2_2	Not Used
57	A05_S	Water level fuel filter
58	SENS1_V	Sensor Power Supply 1



59 KN1_2 Not Used

60 A02_S Not Used

Table 15. MCM2 Connector – DD16 (2 of 4)

Pin	Signal Type	Function	Connector
61	PWM_1	Not Used	
62	PV_B2	SW and PWM Power Supply Output (high side)	
63	H_OUT2	Not Used	
		SW and PWM Power Supply Output (high side)	

64	PV_B2	side)
65	PWM_12	HC dosing valve
66	PWM_13	Jake brake high
67	PV_M	Prop Valve Group Ground
68	PCV_L	Not Used
69		Fuel cut off valve HC Metering Unit
70	PWM_18	Not Used
71	LIN_V	12V Power supply (Vbatt-0.25V max.15V) for LIN sensors
72	LIN	Not Used
73	DYN3_M	Signal ground GND
74	CAN3L	Actuator CAN: CAN-Low
75	CAN3H	Actuator CAN: CAN-High
76	D3_S	Not Used
77	A29_S	Fuel temperature
78	A15_S	Rail pressure
79	D1_S	Not Used
80	A27_S	Coolant inlet temperature
81	A13_S	Not Used
82	SENS2_V	Sensor Supply 2
83	A24_S	Not Used
84	A10_S	HC doser fuel pressure in
85	SENS2_V	Sensor Supply 2/10 way
86	A21_S	Not Used
87	A06_S	Charge air pressure [directly after intake air throttle]
88	SGND	Not Used
89	KN2_1	Not Used
90	A03_S	Position intake air throttle

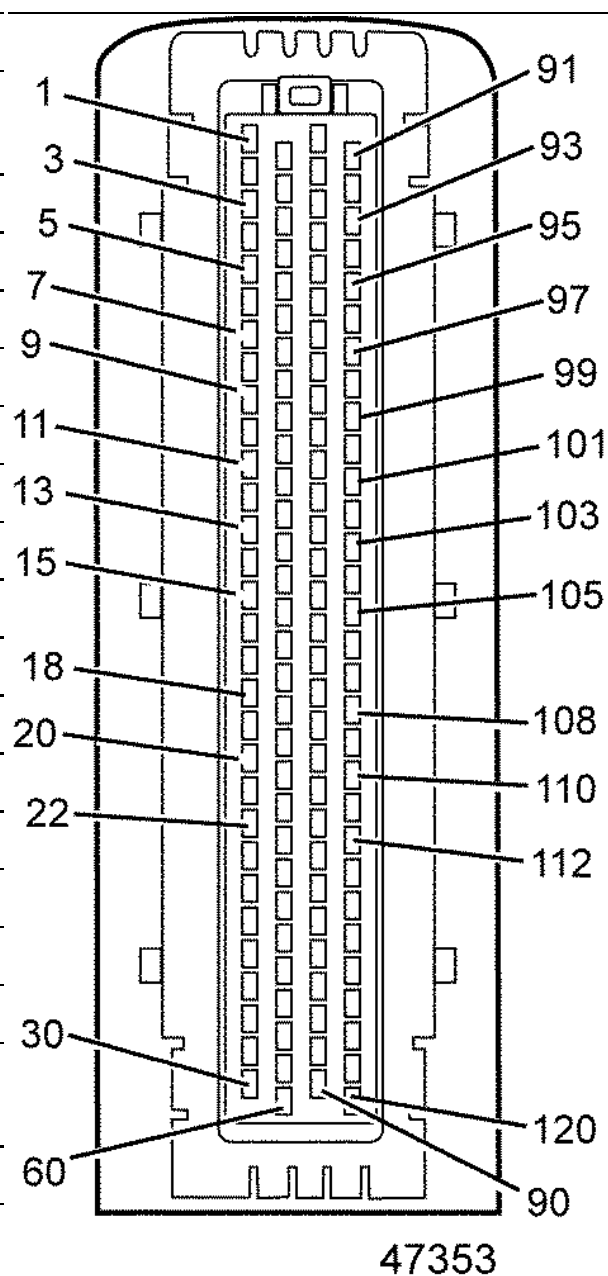


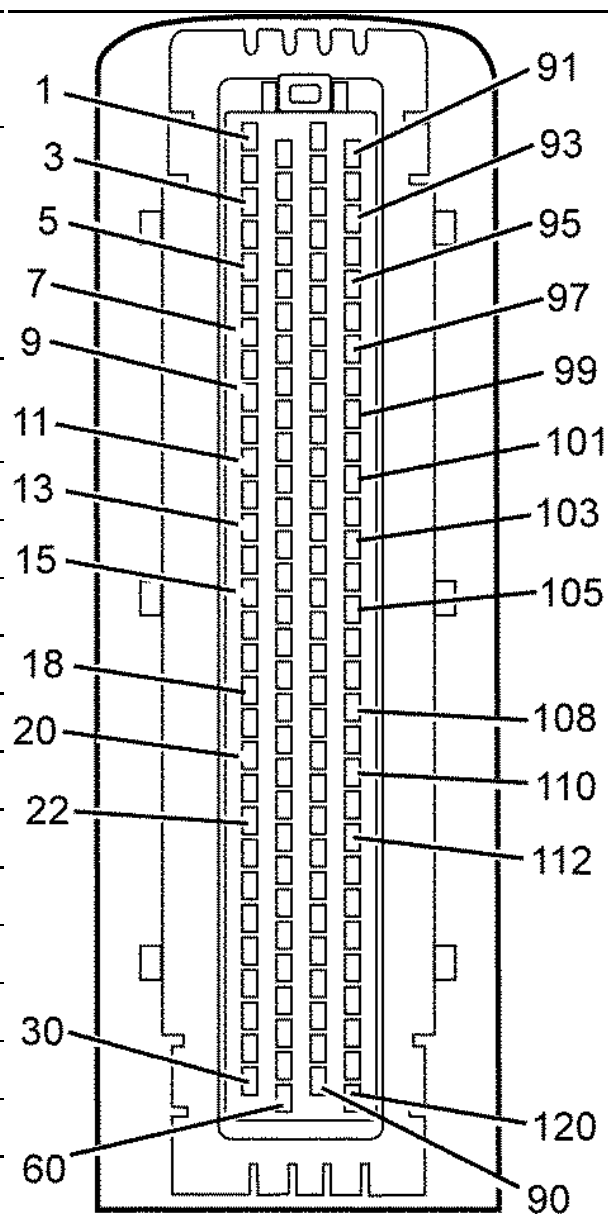
Table 16. MCM2 Connector – DD16 (3 of 4)

Pin	Signal Type	Function	Connector
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91	PV_B1	SW and PWM Power Supply Output (high side)
92	PWM_3	Not Used
93	PV_B1	Not Used
94	PWM_4	Not Used
95	PV_M	Not Used
96	PWM_2	Not Used
97	PWM_15	Not Used
98	PWM_14	Fan 1
99	PWM_17	Not Used

100	H_OUT1	H-bridge output for intake air throttle
101	H_OUT2	
102	SGND	Sensor ground
103	SGND	
104	SGND	
105	SGND	
106	A30_S	Intake manifold temperature [EGR and fresh air mixed]
107	D2_S	Not Used
108	A28_S	Engine oil temperature
109	A14_S	Differential pressure EGR
110	A26_S	Coolant outlet temperature
111	A12_S	HC doser fuel pressure out
112	A25_S	Not Used
113	A11_S	Not Used
114	SGND	Sensor ground
115	A22_S	Not Used
116	A08_S	Not Used
117	SENS1_V	Sensor Power Supply 1
118	A07_S	Not Used

119	A19_S	Charge air temperature [directly after intercooler]
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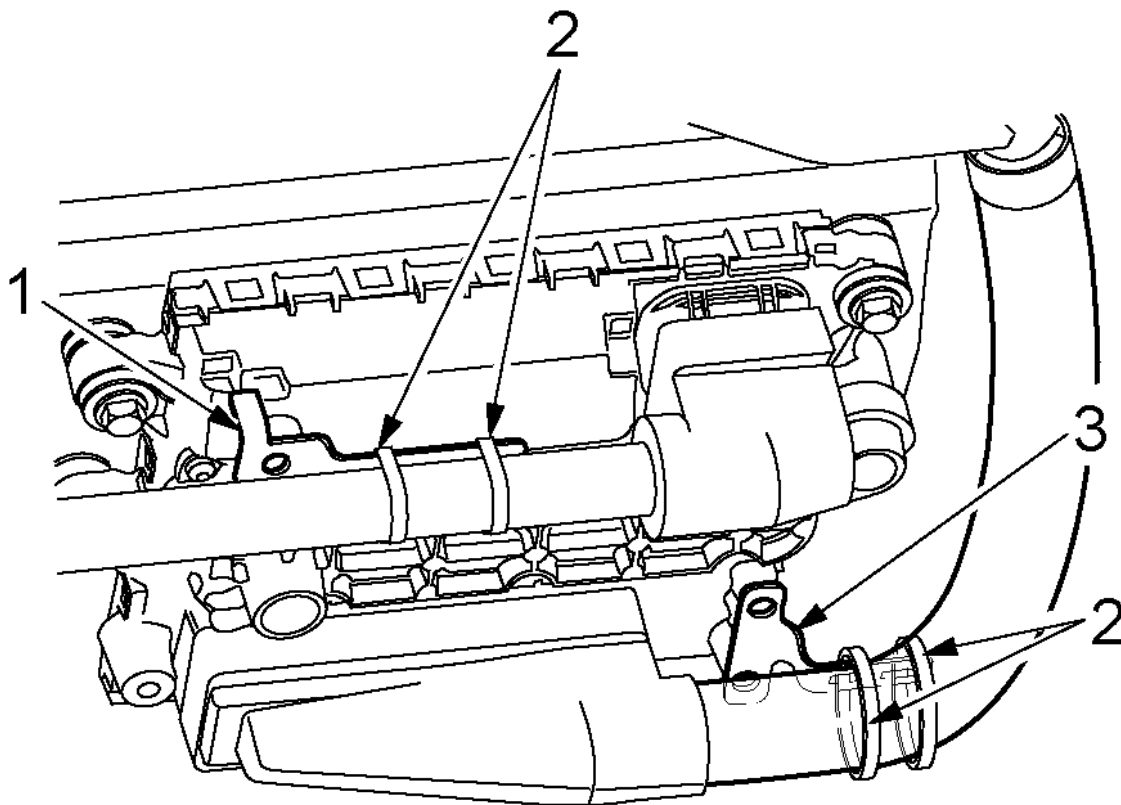
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120 A04_S

Not Used

*Table 17. MCM2 Connector – DD16 (4 of 4)***Section 3.1.2.2****Connector Brackets**

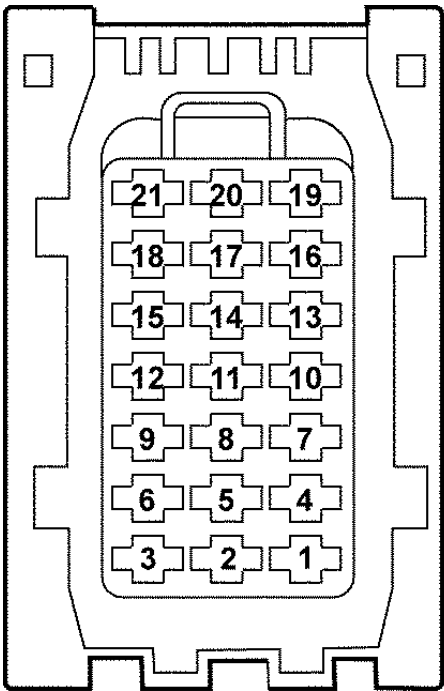
The harnesses on MCM2 must be bracketed and held secure. The bracket design will change for different engines as the routing is different. The 120-pin connector and the 21-pin connector must be tie-wrapped to the brackets as shown in the following drawing (see Figure "120-pin Connector and 21-pin Connector Tie-wrapped to Brackets").



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Figure 2. 120-pin Connector and 21-pin Connector Tie-wrapped to Brackets**Section 3.1.2.3****MCM2 21-pin Connector**

The wiring for the VIH 21-pin to the MCM2 listed in the following tables. The side of the connector shown is looking into the pins.

Pin	Signal Type	Function	Connector
21/1	CAN2L	NOT USED	
21/2	CAN2GND	NOT USED	
21/3	CAN2H	NOT USED	
21/4	CAN2GND	NOT USED	
21/5	KL31	Battery (-) (current demand 40A)	
21/6	KL31	Battery (-) (current demand 40A)	
21/7	KL15	IGN	
21/8	KL31	Battery (-) (current demand 40A)	
21/9	KL31	Battery (-) (current demand 40A)	
21/10	CAN1GND	IES Motor CAN HF Ground	
21/11	KL30	Battery (+) (current demand 40A)	
21/12	KL30	Battery (+) (current demand 40A)	
21/13	CAN1H	Powertrain CAN High	
21/14	KL30	Battery (+) (current demand 40A)	
21/15	KL30	Battery (+) (current demand 40A)	
21/16	CAN1GND	Powertrain CAN Ground	
21/17		Not Used	
21/18	KDiag_S	Not Used	
21/19	CAN1L	Powertrain CAN Low	
21/20	KL50	Crank Start Input	

45801

Front

21/21 START_B Start Enable Output Looking into the Pins on the Harness

Table 18. MCM2 21-Pin Connector — DD13, DD15, DD16

Part	DDC Part Number
Connector	1-1355222-8
1.0 – 2.5 mm Contact (single)	014 545 82 26
0.5 – 1.0 mm Contact (single)	014 545 83 26
Seal (2.2 – 3.0 mm ² insulation diameter)	000 545 29 39
Seal (1.2 – 2.1 mm ² insulation diameter)	000 545 28 39
Backshell	13940501
Cavity Plug	000 545 62 80

Table 19. 21-Pin Connector to the MCM2 Part Numbers

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