



## DSEM640 – Programmable Controller (68 I/O)

Part Numbers: M640-01



### Overview

The DSEM640 provides advanced programmable control options for vehicles and off-highway machinery and has been developed specifically for mobile applications. Sealed to IP67, the device incorporates a breather to allow the unit to equalise pressure and reduce condensation whilst filtering out liquids and other contaminants. The unit features Ethernet, USB, CAN and configurable I/O.

Inside the unit is a powerful 32 bit processor with a 220 MHz clock speed for outstanding operating response times. There are also 4 independent CAN interfaces, J1939, CAN Open and Raw CAN. Flexible user programming is provided via CODESYS 3.5.

### Key Features

- Controller specifically designed for mobile applications
- Powerful 32 bit processor with 220 MHz clock speed
- 4 MB application memory
- 32 configurable inputs, digital and analogue capability
- 36 configurable outputs with digital, PWM and PWMi
- 4 independent CAN interfaces, J1939, CANopen and Raw CAN
- Ethernet interface for communication
- Flexible user programming via CODESYS 3.5
- Ruggedised die cast aluminium housing for IP67 protection

### Product Approvals

- + CE
- + E11: Approval Number: E11\*10R06/02\*9491\*02

### Product Documentation

057-244 – DSEM640 / DSEM643 Installation and Operator Manual



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Specifications	
<b>DC Supply</b>	
Continuous Voltage Rating	8 V DC to 36 V DC continuous
Maximum Operating Current	< 400 mA at 24 V without external loads
Current Consumption	< 5 mA at 24 V after controlled shutdown
<b>Fusing</b>	
External Protection Fuse Rating	3 A
Maximum Total Current	16 A
<b>Program Enable Pin</b>	
Enable High	> 6 V
Enable Low	< 2 V
Pull-down Resistance	33 kΩ
<b>Housing</b>	
Material	Diecast aluminium
<b>Connectors</b>	
Mating Connector A	23 pin TE connectivity 1-770680-1
Connector B	35 pin TE connectivity 1-776164-4
Connector C	35 pin TE connectivity 1-776164-1
M12 Ethernet	D-coded 4 pole socket
M12 USB	A-coded 5 pole socket
<b>Digital Inputs</b>	
Type	Digital - High side / low side
High Level Voltage Threshold	> 6 V
Low Level Voltage Threshold	< 2 V
<b>Analogue Voltage Inputs</b>	
Measurement Ranges	0 V to 5 V 0 V to 10 V 0 V to 32 V
Measurement Resolution	12 bits
Measurement Accuracy	±1 % full scale deflection
Measurement Input Resistance	> 20 kΩ
Measurement Sampling Rate	1 kHz

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Specifications	
<b>Analogue Current Inputs</b>	
Measurement Direction	Current sink only
Measurement Ranges	0 mA to 20 mA 4 mA to 20 mA
Measurement Resolution	12 bits
Measurement Accuracy	±1 % full scale deflection
Measurement Input Sink Resistance	100 Ω ±1 %
Measurement Sampling Rate	1 kHz
<b>Analogue Resistive Inputs</b>	
Measurement Range	0 Ω to 3400 Ω
Measurement Source Voltage	12 V maximum
Measurement Current	1 mA
Measurement Resolution	12 bits
Measurement Accuracy	±1 % full scale deflection
Measurement Sampling Rate	1 kHz
<b>Analogue Ratiometric Inputs</b>	
Measurement Vref	Supply / Vref
Measurement	Ratio of input pin to supply voltage
Measurement Accuracy	±1 % full scale deflection
<b>Frequency Inputs</b>	
Measurement Range	5 Hz to 30 kHz
Measurement Resolution	100 Hz at maximum frequency
Measurement Accuracy	400 Hz at maximum frequency
Maximum Space Voltage	< 2 V
Minimum Mark Voltage	> 6 V
<b>Phase Inputs</b>	
Measurement Frequency Range	5 Hz to 30 kHz
Measurement Resolution	1 degree
Measurement Accuracy	1 degree
Maximum Space Voltage	< 2 V
Minimum Mark Voltage	> 6 V

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Specifications	
<b>Pulse Counter Inputs</b>	
Measurement Frequency Range	5 Hz to 30 kHz
Measurement Resolution	1 count
Maximum Count	2 <sup>24</sup> (15777215)
Direction	Up / Down
<b>Encoder Inputs</b>	
Measurement Frequency Range	5 Hz to 30 kHz
Measurement Resolution	1 count
Maximum Count	2 <sup>24</sup> (15777215)
Direction	Up / Down
<b>Digital Outputs High Side</b>	
Switching Current	2 A 4 A
Digital Output Active High 'On' State	> 2 V
Digital Output Active High 'Off' State	< 10 mA at 24 V
<b>Digital Outputs Low Side</b>	
Switching Current	2 A 4 A
Digital Output Active High 'On' State	< 2 V
Digital Output Active High 'Off' State	< 10 mA at 24 V
<b>PWM / PWMi Outputs</b>	
Peak Current Rating	5 A (software will stop output if > rating detected)
Minimum PWM Frequency	20 Hz
Maximum PWM Frequency	250 Hz
PWM Frequency Resolution	0.1 Hz steps
PWM Minimum Pulse Ratio	0 Hz
PWM Maximum Pulse Ratio	100%
PWM Pulse Resolution	1%
Current Measurement Resolution (0 A to 2 A Range)	1 mA
Current Measurement Resolution (0 A to 4 A Range)	2 mA
Current Measurement Accuracy	±1 % full scale deflection
Minimum Load Impedance (12 V Supply Voltage to 4 A Output)	3 Ω
Minimum Load Impedance (24 V Supply Voltage to 4 A Output)	6 Ω

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Specifications	
<b>Reference Voltage</b>	
Reference Voltage Output	Programmable 5 V to 10 V 100 mA accuracy ±5 %
<b>Interfaces / Communications</b>	
CAN	CAN Interfaces: 4 50 kbits/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 800 kbit/s, 1 Mbit/s CANopen, SAE J1939 or Raw CAN
Ethernet	Number of Ports: 1 10 Mbit/s / 100 Mbit/s Duplex CODESYS MODBUS TCP Server
USB	Usage: For Device Updates, CODESYS File Operations not Supported Number of Ports: 1 Supported Version: 2 USB 2.0 host (12 Mbit/s) 08 (Mass Storage) FAT32 Filing System
<b>Processor</b>	
Ti Hercules™ RM Microcontroller	32 bit ARM cortex - R4FCPU 220 MHz
<b>Memory</b>	
Internal Flash	3 MB
External Flash	8 MB
Internal RAM	256 kB
External RAM	8 MB
FRAM	512 kB
<b>Temperature</b>	
Operating Temperature	-40 °C to +85 °C / -40 °F to + 185 °F
Storage Temperature	-40 °C to +85 °C / -40 °F to +185 °F
<b>Dimensions</b>	
Overall (W x H x D)	240 mm x 190 mm x 50 mm / 9.46 " x 7.49 " x 1.97 "
Weight	1.5 kg 3.30 lb

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Related Products	
Accessories	
DSEM040 (DSEM64X Development Kit)	M040-01
DSEM640 Connector Set	007-035
DSEM640 Connector Harness Set	007-036
Ethernet Cable	016-160
USB Cable	016-161

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Environmental Testing Standards	
<b>CE Marking</b>	
EN 61000-6-2	Electromagnetic compatibility (EMC) noise immunity
EN 61000-6-4	Electromagnetic compatibility (EMC) emission standard
BS EN 60950-1: 2006 + A2:2013	Safety of information technology equipment, general requirements
<b>E Marking</b>	
UN/ECE-R10.06	E11
ISO 11452-2	Noise immunity with 100 V/m
<b>Salt Spray</b>	
BS EN 60068-2-52	Test Kb - Salt Mist Cyclic (Sodium Chloride Solution) Severity 3 One test cycle consisting of: Salt mist temperature: +15 °C to +35 °C Spray period: 2 hours. Followed by humidity storage period: 20 hours to 22 hours at 93 + 2 % to 3 % rh and +40 °C ± 2 °C Four test cycles (as above) to be applied followed by a Storage Period: 3 days @ 45 % to 55 % rh and +23 °C ± 2 °C
<b>Electrical Tests</b>	
ISO 7637-2 (2004)	Pulse 1 - Severity Level III - Function State C Pulse 2a - Severity Level III - Function State A Pulse 2b - Severity Level III - Function State C Pulse 3a - Severity Level III - Function State A Pulse 3b - Severity Level III - Function State A Pulse 4 - Severity Level III - Function State A Pulse 5a - Severity Level III - Function State C
<b>Mechanical Tests</b>	
EN 60068-2-6	Vibration Resonance Search. Freq range: 10 Hz to 2 kHz Acceleration: 10 g
EN 60068-2-27	Mechanical shock Shock pulse shape: Half sine Amplitude: 15 g Duration: 11 ms Number of shocks: 3 in each direction of each axis (9 in total of each duration)
ISO 16750-3	Test VII; Commercial vehicle, sprung masses. Random vibration. Mounting location; vehicle body
ISO 16750-3	Bumps. Amplitude: 30 g Duration: 6 ms; 24,000 shocks
<b>Climatic Tests</b>	
EN 60068-2-30	Damp heat, cyclic upper temperature 55 °C
EN 60068-2-78	Damp heat, steady state test temperature 40 °C/93% RH (21 Day Duration)
EN 60068-2-52	Salt spray test severity level 3 (vehicle)

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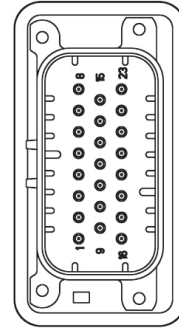
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Connector A		
Pin	Comments	Switching Current
1	Output Supply 1 +ve	
2	VREF +ve	100 mA
3	Ignition +ve (15)	
4	ECU Supply +ve	
5	ECU Supply GND	
6	Program Enable	
7	Output Supply 1 & 2 GND	
8	Output Supply 2	
9	Output Supply 3 & 4 GND	
10	CAN1 H	
11	CAN1 H	
12	CAN1 L	
13	CAN1 L	
14	CAN4 H	
15	CAN4 L	
16	Output Supply 3 +ve	
17	CAN2 H	
18	CAN2 H	
19	CAN2 L	
20	CAN2 L	
21	CAN3 H	
22	CAN3 L	
23	Output Supply 4 +ve	

### Connector Diagram

Connector A



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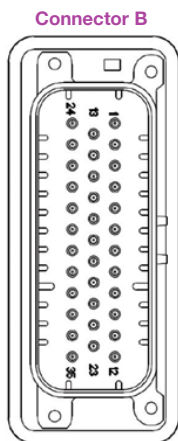
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Part Numbers: M640-01

Connector B			
Pin	Description	Comments	Switching Current
1	QB005	OUT H, L, PWM	2 A
2	QB001	OUT H, PWM	2 A / 4 A
3	QB007	OUT H, PWM	2 A
4	QB010	OUT H	4 A
5	QB014	OUT H	2 A
6	IB009	DIN H, L, FREQ	
7	IB001	AIN	
8	IB002	AIN	
9	IB014	DIN H, L, FREQ	
10	QB011	OUT H	4 A
11	QB015	OUT H	2 A
12	QB004	OUT H, L, PWM	2 A / 4 A
13	QB003	OUT H, L, PWM	2 A / 4 A
14	IB010	DIN H, L, FREQ	
15	IB011	DIN H, L, FREQ	
16	IB012	DIN H, L, FREQ	
17	IB003	AIN	

Connector B			
Pin	Description	Comments	Switching Current
18	IB004	AIN	
19	IB005	AIN	
20	IBC006	AIN	
21	VREF	Negative for VREF	
22	IB015	DIN H, L, FREQ	
23	QB006	OUT H, L, PWM	2 A
24	QB018	OUT H, L	2 A
25	QB017	OUT H, L	4 A
26	QB013	OUT H	2 A
27	QB009	OUT H	4 A
28	IB013	DIN H, L, FREQ	
29	IB007	AIN	
30	IB008	AIN	
31	IB016	DIN	
32	QB016	OUT H	2 A
33	QB012	OUT H	4 A
34	QB008	OUT H, PWM	2 A
35	QB002	OUT H, PWM	2 A / 4 A

### Connector Diagram



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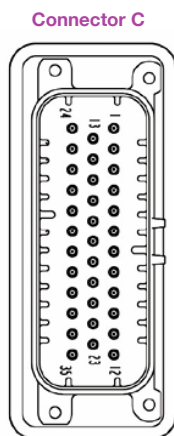
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Connector C			
Pin	Description	Comments	Switching Current
1	QC005	OUT H, L, PWM	2 A
2	QC001	OUT H, PWM	2 A / 4 A
3	QC007	OUT H, PWM	2 A
4	QC010	OUT H	4 A
5	QC014	OUT H	2 A
6	IC009	DIN H, L, FREQ	
7	IC001	AIN	
8	IC002	AIN	
9	IC014	DIN H, L, FREQ	
10	QC011	OUT H	4 A
11	QC015	OUT H	2 A
12	QC004	OUT H, L, PWM	2 A / 4 A
13	QC003	OUT H, L, PWM	2 A / 4 A
14	IC010	DIN H, L, FREQ	
15	IC011	DIN H, L, FREQ	
16	IC012	DIN H, L, FREQ	
17	IC003	AIN	

Connector C			
Pin	Description	Comments	Switching Current
18	IC004	AIN	
19	IC005	AIN	
20	IC006	AIN	
21	VREF GND	Negative for VREF	
22	IC015	DIN H, L, FREQ	
23	QC006	OUT H, L, PWM	2 A
24	QC018	OUT H, L	2 A
25	QC017	OUT H, L	4 A
26	QC013	OUT H	2 A
27	QC009	OUT H	4 A
28	IC013	DIN H, L, FREQ	
29	IC007	AIN	
30	IC008	AIN	
31	IC016	DIN H, L, FREQ	
32	QC016	OUT H	2 A
33	QC012	OUT H	4 A
34	QC008	OUT H, PWM	2 A
35	QC002	OUT H, PWM	2 A / 4 A

### Connector Diagram



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Ethernet - M12 'D' Coded	
Pin	Description
1	Tx+
2	Rx+
3	Tx-
4	Rx-
USB Host	
Pin	Description
1	+5 V DC
2	Data -
3	Data +
4	ID
5	GND

### Connector Diagrams

Ethernet



USB Host



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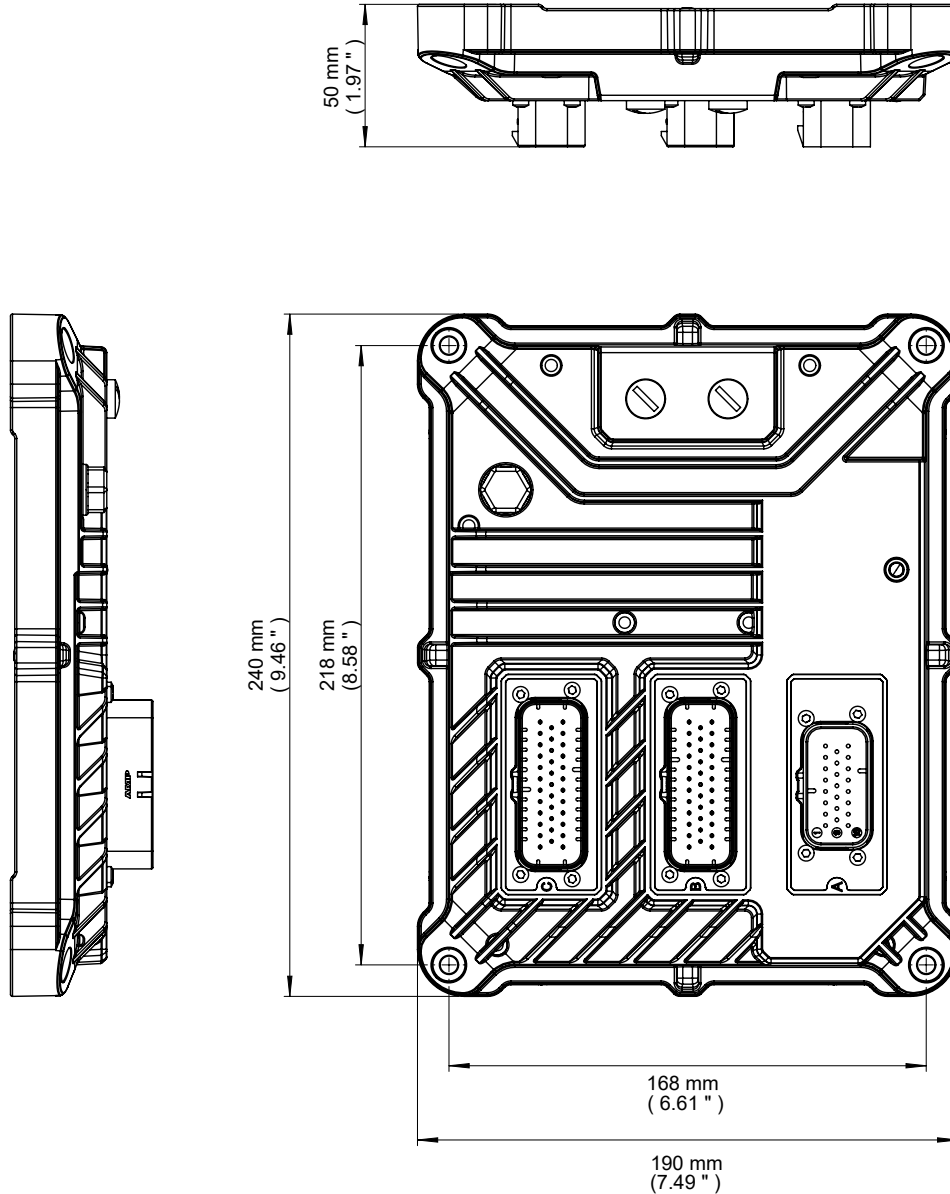
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### DSEM640 – Programmable Controller (68 I/O)

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#### Technical Drawing



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