

DSEM643 – Programmable Controller (34 I/O)

Part Numbers: M643-01



Overview

The DSEM643 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, CANopen 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
- 16 configurable inputs, digital and analogue capability
- 18 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 Documentation

057-244 – DSEM640 / DSEM643 Installation and Operator Manual



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VAT No.316923457

055-236/12/25 (7)

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Specifications	
DC Supply	
Continuous Voltage Rating	8 V DC to 32 V DC continuous
Maximum Operating Current	< 300 mA at 24 V without external loads
Current Consumption	< 5 mA at 24 V after controlled shutdown
Fusing	
External Protection Fuse Rating	3 A
Maximum Total Current	16 A
Program Enable Pin	
Enable High	> 6 V
Enable Low	< 2 V
Pull-down Resistance	33 kΩ
Housing	
Material	Diecast aluminium
Connectors	
Mating Connector A	23 pin TE connectivity 1-770680-1
Connector C	35 pin TE connectivity 1-776164-1
M12 Ethernet	D-coded 4 pole socket
M12 USB	A-coded 5 pole socket
Digital Inputs	
Type	Digital - High side / low side
High Level Voltage Threshold	> 6 V
Low Level Voltage Threshold	< 2 V
Analogue Voltage Inputs	
Programmable Voltage Range	0 V to 5 V
Programmable Voltage Range	0 V to 10 V
Programmable Voltage Range	0 V to 32 V
Voltage Measurement Resolution	12 bits
Voltage Measurement Accuracy	±1 % full scale deflection
Voltage Measurement Input Resistance	> 30 kΩ
Voltage Measurement Sampling Rate	1 kHz

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Analogue Current Inputs	
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
Analogue Resistive Inputs	
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
Analogue Ratiometric Inputs	
Voltage Measurement Vref	Supply / Vref
Voltage Measurement	Ratio of input pin to supply voltage
Voltage Measurement Accuracy	±1 % full scale deflection
Frequency Inputs	
Range	5 Hz to 30 kHz
Resolution	100 Hz at maximum frequency
Accuracy	400 Hz at maximum frequency
Maximum Space Voltage	< 2 V
Minimum Mark Voltage	> 6 V
Phase Inputs	
Frequency Range	5 Hz to 30 kHz
Resolution	1 degree
Accuracy	1 degree
Maximum Space Voltage	< 2 V
Minimum Mark Voltage	> 6 V

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Specifications	
Pulse Counter Inputs	
Frequency Range	5 Hz to 30 kHz
Resolution	1 count
Maximum Count	2 ²⁴ (15777215)
Direction	Up / Down
Encoder Inputs	
Frequency Range	5 Hz to 30 kHz
Resolution	1 count
Maximum Count	2 ²⁴ (15777215)
Direction	Up / Down
Digital Outputs High Side	
Switching Current	2 A 4 A
Digital Output Active High 'On' State	< 2 V (maximum voltage at rated current)
Digital Output Active High 'Off' State	< 10 mA at 24 V (state leakage current)
Digital Outputs Low Side	
Switching Current	2 A 4 A
Digital Output Active High 'On' State	< 2 V (maximum voltage at rated current)
Digital Output Active High 'Off' State	< 10 mA at 24 V (state leakage current)
PWM / PWMi Outputs	
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	
Reference Voltage	
Reference Voltage Output	Programmable 5 V to 10 V 100 mA accuracy $\pm 5\%$
Interfaces / Communications	
CAN	CAN Interfaces: 4 50 kbit/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 Client
USB	Number of Ports: 1 Supported Version: 2 USB 2.0 host (12 Mbit/s) 08 (Mass Storage) FAT32 Filing System
Processor	
Ti Hercules™ RM Microcontroller	32 bit ARM cortex - R4FCPU 220 MHz
Memory	
Internal Flash	3 MB
External Flash	8 MB
Internal RAM	256 kB
External RAM	8 MB
FRAM	512 kB
Temperature	
Operating Temperature	-40 °C to +85 °C / -40 °F to +185 °F
Storage Temperature	-40 °C to +85 °C / -40 °F to +185 °F
Dimensions	
Overall (W x H x D)	49 mm x 240 mm x 190 mm / 1.46" x 9.45 x 7.48"
Weight	1.5 kg 3.30 lb

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Related Products	
Accessories	
DSEM040 (DSEM64X Development Kit)	M040-01
DSEM643 Connector Set	007-1020
DSEM643 Connector Harness Set	016-174
Ethernet Cable	016-160
USB Cable	016-161

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Environmental Testing Standards	
CE Marking	
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
E Marking	
UN/ECE-R10.05	E11
ISO 11452-2	Noise immunity with 100 V/m
Salt Spray	
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
Electrical Tests	
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
Mechanical Tests	
EN 60068-2-6	Vibration Resonance Search Freq range: 10 Hz to 2 kHz Acceleration: 10 g
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
Climatic Tests	
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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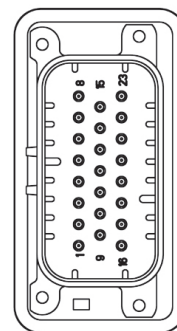
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Connector A		
Pin	Comments	Switching Current
1	Not Connected	
2	VREF Out +ve	100 mA
3	Ignition +ve (15)	
4	ECU Supply +ve	
5	ECU Supply GND	
6	Program Enable	
7	Not Connected	
8	Not Connected	
9	Output Supply 3 & 4 GND	
10	CAN1 H	
11	CAN1 H	
12	CAN1 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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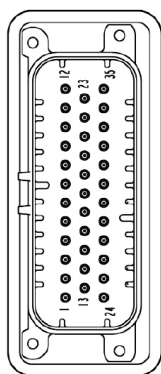
Part Numbers: M643-01

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	
7	IC001	AIN	
8	IC002	AIN	
9	IC014	DIN	
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	
15	IC011	DIN	
16	IC012	DIN	
17	IC003	AIN	

Connector C			
Pin	Description	Comments	Switching Current
18	IC004	AIN	
19	IC005	AIN	
20	IC006	AIN	
21	VREF - ve	Negative for VREF	
22	IC015	DIN	
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	
29	IC007	AIN	
30	IC008	AIN	
31	IC016	DIN	
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

Connector C



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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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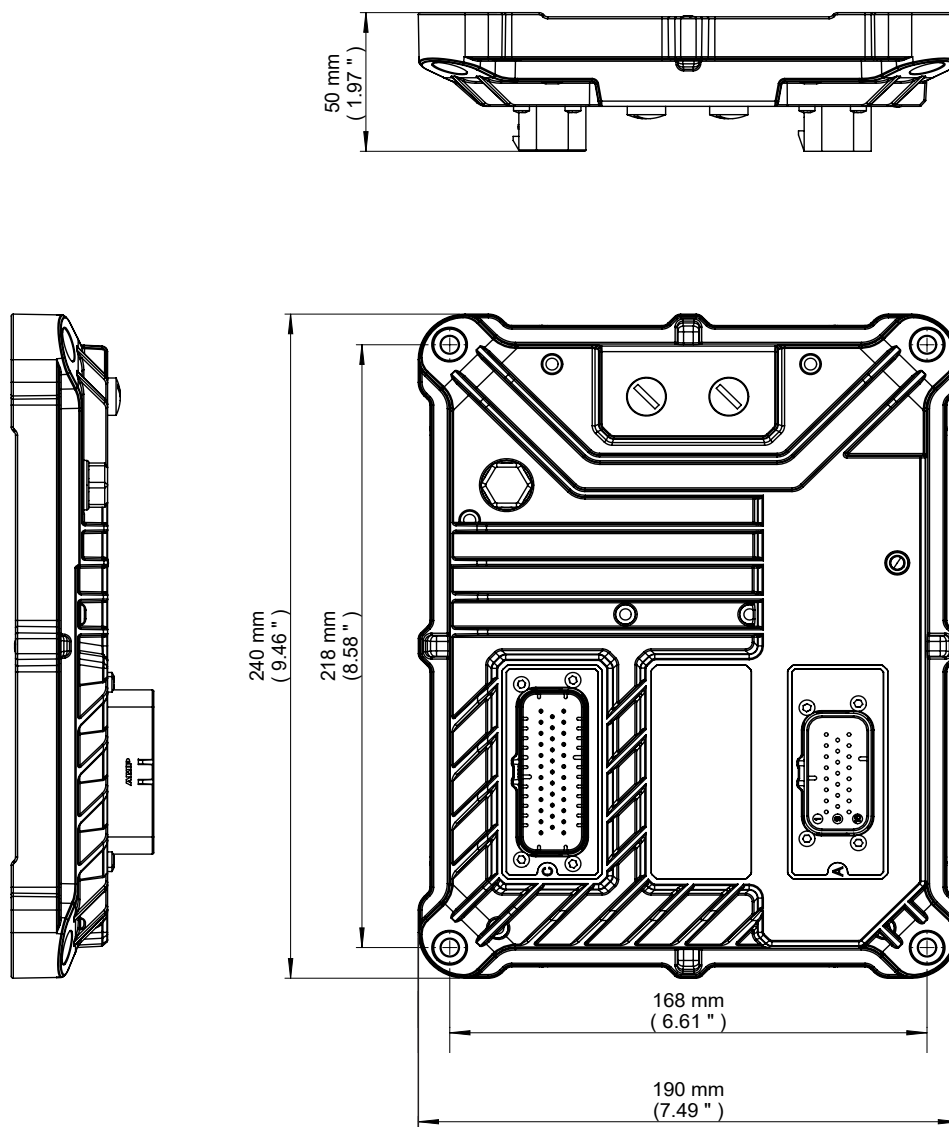
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Technical Drawing



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