



# DSEM870

## PROGRAMMABLE DISPLAY FOR USE IN VEHICLES AND OFF-HIGHWAY MACHINERY



### KEY FEATURES / SUMMARY

- Robust HMI/programmable display specifically designed for mobile applications
- Optically bonded 7" colour screen for harsh environments
- Powerful ARM Cortex A9 processor with 800 MHz clock speed
- 512 MB of DDR3 SDRAM and 2 GB of NAND mass storage
- 4 configurable inputs, digital and analogue capability
- 4 configurable digital outputs
- 2 independent CAN interfaces, J1939, CAN open and Raw CAN
- Ethernet interface for communication
- Flexible user programming via CODESYS 3.5 and QT
- IP67 protection/NEMA 6
- 2 camera inputs

### ADDITIONAL HARDWARE

- Deutsch connector A, 18 way complete with pins
- Deutsch connector C, 18 way complete with pins
- M870 connector harness
- M870 panel gasket
- Ethernet programming cable
- M12 to USB cable

### DSE PART

- 007-850
- 007-851
- 016-167
- 020-579
- 016-160
- 016-161

### OVERVIEW

#### DC SUPPLY

8 V DC to 32 V DC

#### CURRENT CONSUMPTION

**OPERATING CURRENT**  
< 1000 mA at 12 V and 24 V without external loads

< 1500 mA at 12 V and 24 V with Htr.

#### DISPLAY

800 px x 480 px  
24 bit colour  
Optically bonded

#### INPUTS/OUTPUTS (total)

4 inputs / 4 outputs

#### INPUTS

Configurable,  
Digital inputs (positive / negative)  
Analogue inputs (Voltage 0 V to 5 V, 0 V to 10 V, 0 V to 32 V, current 4 mA to 20 mA, Ratiometric, Resistive, Frequency)

#### OUTPUTS

Configurable  
Digital Output High-Sided/Low-Sided

#### INTERFACES

##### CAN 1.2

CAN Interfaces 2.0 A/B, ISO11898  
50 kbits/s... 1 Mbit/s

CAN Open, SAE J1939 or Raw CAN

##### ETHERNET

10 Mbit/s / 100 Mbit/s, Duplex

##### USB

USB Host 2.0 (12 Mbit/s)

##### DIMENSIONS

272 mm x 165 mm x 81 mm (W x H x D)

10.7" x 6.5" x 3.2" ( W x H x D)

##### WEIGHT

< 1 kg

##### STORAGE TEMPERATURE RANGE

-40 ° C to +85 ° C

-40 ° F to +185 ° F

##### OPERATING TEMPERATURE RANGE

-30 ° C to +85 ° C

-22 ° F to +185 ° F

##### PROTECTION RATING

IP67/NEMA 6 (with mating connectors)

##### MOUNTING

8 x M5 bolts / RAM arm

### RELATED MATERIALS

| TITLE                          | PART NO. |
|--------------------------------|----------|
| M870 Installation Instructions | 057-187  |
| M870 Operator Manual           | 057-246  |



## Technical Data

## DSEM870

| Supply   |                                       | Connector A        |
|--|---------------------------------------|--------------------|
| Operating voltage  | 8 V DC to 32 V DC                     | Pin 7              |
| Unit power supply maximum current consumption, full backlight (no external loads)  | < 1000 mA at 12 V and 24 V            |                    |
| Unit power supply maximum current consumption, full backlight and heater (no external loads)   | < 1500 mA at 12 V and 24 V            |                    |
| Unit power supply current consumption after controlled shutdown has occurred due to the ignition being turned off  | < 5 mA at 24 V                        |                    |
| Fusing   |                                       | Connector A        |
| Unit power supply external protection fuse rating  | 3 A                                   | Pin 7              |
| High current outputs supply input external fuse protection rating (i.e. sum of output currents from all outputs provided for by an individual supply to < external fuse rating in total) | 10 A                                  | Pin 1              |
| Housing  |                                       |                    |
| PC PBT alloy plastic resin   |                                       |                    |
| Dimensions   |                                       |                    |
| 140 mm x 230 mm x 60 mm (W x H x D) / 10.8" x 6.3" x 3.15" (W x H x D)   |                                       |                    |
| Weight   |                                       |                    |
| < 1 kg   |                                       |                    |
| Temperature  |                                       |                    |
| Operating temperature  | -30 °C to +85 °C / -22 °F to +185 °F  |                    |
| Storage temperature  | -40 °C to +85 °C / -40 °F to +185 °F  |                    |
| Protection Rating  |                                       |                    |
|  | IP67 (with mating connectors)         |                    |
| Display  |                                       |                    |
| Resolution, pixel  | 800 px x 480 px                       |                    |
| Colour   | 24 bit                                |                    |
| Format   | 7" diagonal                           |                    |
| Mounting   | Optically bonded                      |                    |
| Illumination   | LED (lifetime > 50,000 hrs)           |                    |
| Connectors   |                                       |                    |
| Connector A  | 18 pin TE connectivity DT16-18SA-K004 |                    |
| Connector C  | 18 pin TE connectivity DT16-18SC-K004 |                    |
| Ethernet   | M12, D-coded 4 pole socket            |                    |
| USB  | M12, B-coded 5 pole socket            |                    |
| Digital Inputs   |                                       | Connector C        |
| Digital inputs configured high or low  |                                       | Pin 14, 15, 16, 17 |
| High level voltage threshold   | > 6 V                                 |                    |
| Low level voltage threshold  | < 2 V                                 |                    |
| Analogue Voltage Inputs  |                                       | Connector C        |
| 0 V to 5 V programmable voltage range  | 0 V to 5 V                            | Pin 14, 15, 16, 17 |
| 0 V to 10 V programmable voltage range   | 0 V to 10 V                           |                    |
| 0 V to 32 V programmable voltage range   | 0 V to 32 V                           |                    |
| Voltage measurement resolution   | 12 bits                               |                    |
| Voltage measurement accuracy   | ± 1% FSD                              |                    |
| Voltage measurement input resistance   | ≥ 30 kΩ                               |                    |
| Voltage measurement sampling rate  | 500 Hz                                |                    |
| FSD = Full Scale Deflection  |                                       |                    |



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| Analogue Current Inputs  |  | Connector C        |
|--|--|--------------------|
| Current measurement direction  | Current sink only                                | Pin 14, 15, 16, 17 |
| Current measurement ranges   | 0 mA to 20 mA                                    |                    |
|  | 4 mA to 20 mA                                    |                    |
| Current measurement resolution   | 12 bits  |                    |
| Current measurement accuracy   | ± 1% FSD   |                    |
| Current measurement input sink resistance                                    | 100 Ω ± 1%                                       |                    |
| Current measurement sampling rate  | 500 Hz   |                    |
| <i>FSD = Full Scale Deflection</i>   |  |                    |
| Analogue Resistive Inputs  |  | Connector C        |
| Resistance measurement range   | 0 Ω to 3200 Ω                                    | Pin 14, 15, 16, 17 |
| Resistance measurement source voltage  | 12 V maximum                                     |                    |
| Resistance measurement current   | 1 mA   |                    |
| Resistance measurement resolution  | 12 bits  |                    |
| Resistance measurement accuracy  | ± 1% FSD   |                    |
| Resistance measurement sampling rate   | 500 Hz   |                    |
| <i>FSD = Full Scale Deflection</i>   |  |                    |
| Analogue Ratiometric Inputs  |  | Connector C        |
| Voltage ratiometric measurement voltage range                                |  | Pin 14, 15, 16, 17 |
| Voltage ratiometric measurement Vref   | Supply/Vref                                      |                    |
| Voltage ratiometric measurement  | Ratio of input pin to supply voltage             |                    |
| Voltage ratiometric measurement accuracy                                     | ± 1% FSD   |                    |
| <i>FSD = Full Scale Deflection</i>   |  |                    |
| Frequency Inputs   |  | Connector C        |
| Frequency range  | 5 Hz to 30 Hz                                    | Pin 14, 15, 16, 17 |
| Resolution   | 100 Hz at max. freq                              |                    |
| Accuracy   | 400 Hz at max. freq                              |                    |
| Maximum space voltage  | < 1.4 V  |                    |
| Minimum mark voltage   | > 2 V  |                    |
| Digital Outputs High Side  |  | Connector C        |
| Switching current  | 2 A  | Pin 2, 3, 4, 5     |
| Digital output active high 'ON' state internal voltage drop at rated current | < 100 mV   |                    |
| Digital output active high 'OFF' state leakage current                       | < 10 µA at 24 V                                  |                    |
| Digital Outputs Low Side   |  | Connector C        |
| Switching current  | 2 A  | Pin 2, 3, 4, 5     |
| Digital output active low 'ON' state maximum voltage at rated current        | < 100 mV   |                    |
| Digital output active low 'OFF' state leakage current                        | < 5 µA at 24 V                                   |                    |
| Reference Voltage  |  | Connector C        |
| Reference voltage output   | Programmable 5 V or 10 V,<br>500 mA accuracy ±5% | 6                  |
|  |  | VRef GND Pin 18    |
| Auxiliary Voltage  |  | Connector C        |
| 12 V auxiliary voltage   | max 100 mA                                       | Pin 13             |



## DSEM870

| RTC  |   |  |                            |
|--|---|--|----------------------------|
| Real time clock  |   | Standard RTC, powered by Super Cap, backup time ~800 hours |                            |
| Camera   |   |  | Connector A                |
| Analogue video input (supported video standards: PAL & NTSC) | 2   |  | 5, 6, 11, 12               |
| CAN Interfaces   |   |  | Connector A                |
| Number of CAN ports  | 2   |  | Pin 2, 3, 8, 9, 14, 15     |
| Supported protocols  | J1939   |  |                            |
|  | CAN open  |  |                            |
|  | Raw CAN   |  |                            |
| Supported programmable baud rates                            | 50 kbit/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 800 Mbit/s, 1 Mbit/s   |  |                            |
| Ethernet Interface   |   |  | M12, 4 pole                |
| Number of Ethernet ports                                     | 1   |  | D-coded 4 pole socket      |
| Supported data rates   | 10/100 Mbit/s   |  |                            |
| Supported protocols  | Modbus TCP  |  |                            |
|  | CODESYS 3.5   |  |                            |
| USB Interface  |   |  | M12, 5 pole                |
| Number of USB host ports                                     | 1   |  | B-coded, 5 pole socket     |
| Supported USB version  | 2   |  |                            |
| Speeds supported   | Full speed (12 Mbit/s)  |  |                            |
| Device class supported                                       | 08 (Mass Storage)   |  |                            |
| Supported filing system                                      | FAT32   |  |                            |
| Processor  |   |  |                            |
| Technexion Freescale iMX6-SOLO Microcontroller               | ARM A9  |  |                            |
|  | 800 MHz   |  |                            |
| Memory   |   |  |                            |
| Flash  | 2 GB  |  |                            |
| RAM  | 512 MB  |  |                            |
| LED Status   |   |  |                            |
| Colour   | Description   | Operation  | State                      |
| None   | Device not powered  | N/A  | Off                        |
| Green  | Unit powered up, application program loaded but not running   | Static   | Application stopped        |
|  | Unit powered up, application program loaded and running   | 1 Hz flash   | Application running        |
|  | Unit powered up, but no application program loaded  | 5 Hz flash   | No application             |
| Amber  | Bootloader functioning normally, firmware present   | Static   | Bootloader mode            |
|  | Firmware is at start-up   | Static   | Firmware start-up          |
|  | Unit stopped due to a serious fault   | Static   | Application exception      |
|  | Bootloader is decrypting the downloaded image   | 1 Hz flash   | Decrypting image           |
|  | Bootloader is reading an image from the USB   | 5 Hz flash   | Reading image from USB     |
| Red  | Fatal system/hardware fault - LED may be driven directly by microcontroller error pin or firmware is in a fault condition | Static   | Fatal error                |
|  | Unit running with a fault, see CODESYS error flags or web tool.   | 1 Hz flash   | Faulty application running |



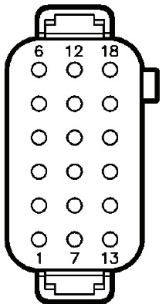
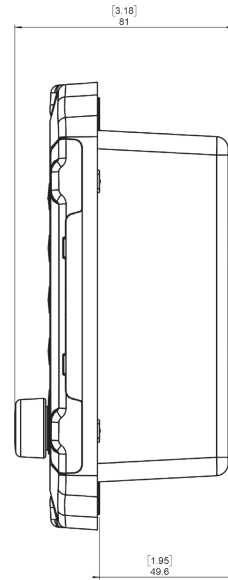
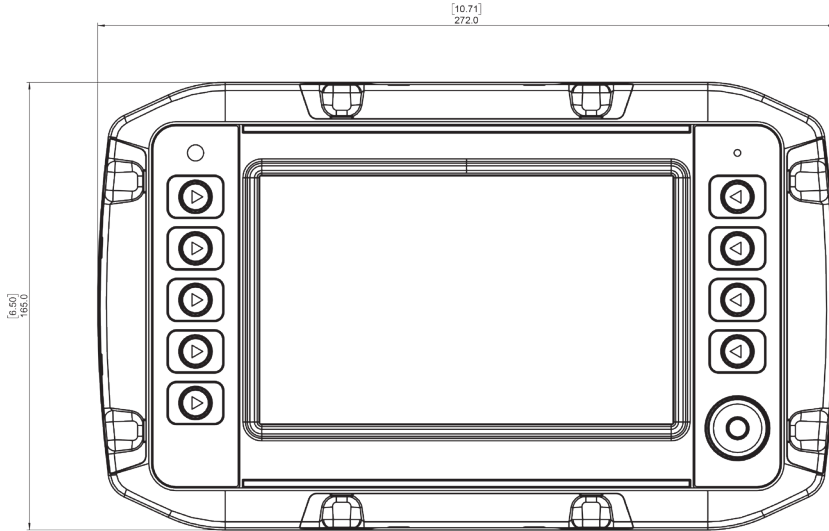
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| Environmental and Testing |   |   |
|---------------------------|---|---|
| CE marking                | Electromagnetic compatibility (EMC) noise immunity<br>Electromagnetic compatibility (EMC) emission standard   | EN 13309<br>EN 13766                            |
| E11 marking               | Emission standard noise immunity with 100 V/m   | UN/ECE-R10                                      |
| Electrical tests          | Pulse 1, severity level: IV; function state C<br>Pulse 2a, severity level: IV; function state B<br>Pulse 2b, severity level: IV; function state C<br>Pulse 3a, severity level: IV; function state A<br>Pulse 3b, severity level: IV; function state A<br>Pulse 4, severity level: IV; function state B<br>Pulse 5a, severity level: III; function state C | ISO 7637-2                                      |
| Climatic tests            | Damp heat, cyclic upper temperature 55 °C, number<br>Damp heat, steady state test temperature 40 °C / 93% RH<br>Test duration: 21 days<br>Salt spray test severity level 3 (vehicle)  | EN 60068-2-30<br>EN 60068-2-78<br>EN 60068-2-53 |
| Mechanical tests          | Test VII; vibration, random mounting location: vehicle body<br>Vibration, sinusoidal<br>2000 Hz: 0.73 mm / 10g; 10 cycles/axis<br>Bumps 30 g / 6 ms; 24,000 shocks  | ISO 16750-3<br>EN 60068-2-6<br>ISO 16750-3      |



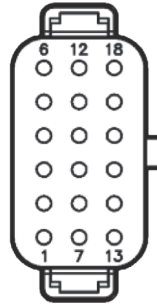
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### Connector A

| PIN | DESCRIPTION       |
|-----|-------------------|
| 1   | EGU Supply GND    |
| 2   | CAN1 GND          |
| 3   | CAN2 GND          |
| 4   | No connection     |
| 5   | Camera 1 GND      |
| 6   | Camera 2 GND      |
| 7   | ECU Supply +VE    |
| 8   | CAN1 H            |
| 9   | CAN 2 H           |
| 10  | No connection     |
| 11  | Camera 1 signal   |
| 12  | Camera 2 signal   |
| 13  | Ignition +VE (15) |
| 14  | CAN1 L            |
| 15  | CAN2 L            |
| 16  | No connection     |
| 17  | No connection     |
| 18  | No connection     |



### Connector C

| PIN | DESCRIPTION         | REF   |
|-----|---------------------|-------|
| 1   | Output supply +VE   |       |
| 2   | OUT H, L            | QC001 |
| 3   | OUT H, L            | QC002 |
| 4   | OUT H, L            | QC003 |
| 5   | OUT H, L            | QC004 |
| 6   | VREF +              |       |
| 7   | Output supply GND   |       |
| 8   | No connection       |       |
| 9   | No connection       |       |
| 10  | No connection       |       |
| 11  | No connection       |       |
| 12  | Output supply GND   |       |
| 13  | Aux 12 +VE Output   |       |
| 14  | AIN, DIN H, L, FREQ | IC001 |
| 15  | AIN, DIN H, L, FREQ | IC002 |
| 16  | AIN, DIN H, L, FREQ | IC003 |
| 17  | AIN, DIN H, L, FREQ | IC004 |
| 18  | VREF GND            |       |



### Ethernet

M12 'D' coded - 4 pin female

|          |     |
|----------|-----|
| Pin - 01 | TX+ |
| Pin - 02 | RC+ |
| Pin - 03 | TX- |
| Pin - 04 | RC- |



### USB Host

M12 'B' coded - 5 pin female

|          |        |
|----------|--------|
| Pin - 01 | 5 V    |
| Pin - 02 | Data+  |
| Pin - 03 | Data-  |
| Pin - 04 | 0 V    |
| Pin - 05 | Shield |

Abbreviations  
 OUT PWM, H, L  
 OUT H  
 OUT H, L  
 AIN  
 DIN, H, L, FREQ  
 A GND

Output can be configured as a PWM, PWMi, digital high-side or digital low-side  
 Output is digital high  
 Output can be configured as a digital high-side or digital low side  
 Input can be configured to accept signals from positive digital, negative digital, 0 V to 10 V, 4 mA to 20 mA, ratiometric or resistive  
 Input can be configured to accept signals from positive digital, negative digital or frequency  
 Ground connection for the analogue input channels