DEEP SEA ELECTRONICS PLC

DSEM870 Operator Manual

Document Number: 057-246

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DSEM870 Operator Manual

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Revision History

Issue No.	Comments
1	First Release

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1 INTRODUCTION

This document details the operation and setup requirements of the DSEM870 Mobile Controller and Display, part of the DSEControl® range of products.

The manual forms part of the product and should be kept for the entire life of the product. If the product is passed or supplied to another party, ensure that this document is passed to them for reference purposes.
This is not a *controlled document.* DSE do not automatically inform on updates. Any future updates of this document are included on the DSE website at www.deepseaplc.com

Observe the operating instructions. Non-observance of the instructions, operation not in accordance with use as prescribed below, wrong installation or incorrect handling seriously affects the safety of the product, operators and machinery.

A robust metal case designed for chassis mounting houses the module. Connections are via locking plug and sockets.

The controller is supplied with no application program. The equipment manufacturer is responsible for creating and managing the application program and installing it in the controller. This is achieved using CODESYS V3.5 or C programming. Contact DSE Technical Support for further details.

1.1 CLARIFICATION OF NOTATION

Clarification of notation used within this publication.

NOTE:	**Highlights an essential element of a procedure to ensure correctness.**
CAUTION!	**Indicates a procedure or practice, which, if not strictly observed, could result in damage or destruction of equipment.**
WARNING!	**Indicates a procedure or practice, which could result in injury to personnel or loss of life if not followed correctly.**

1.2 GLOSSARY OF TERMS

Term	Description
Application	The application is the program that allows the DSEM870 to control the machine it is connected to. The Application within the DSEM870 is designed and provided by the manufacturer of the complete machine.
Bootloader	The Bootloader is the program within the DSEM870 responsible for loading the Operating System.
CAN	Control Area Network. A high-speed data transmission system used extensively within the Automotive and Off-Highway industries.
CODESYS (Previously stylised as CoDeSys)	Integrated Development Environment for programming controller applications according to the international industrial standard IEC 61131-3. DSEM870 supports CODESYS V3.5
ECU	Electronic Control Unit. For example the DSEM870 device.
Firmware	The Firmware of the DSEM870 is the Operating System of the DSEM870 that reads and executes the Application program.
FSD	Full Scale Deflection. For example 0 mA to 20 mA is the Full Scale Deflection of a current sink input.
I/O	Input / Output. For example “The I/O is taken out to an external terminal strip in the user panel”.
IDE	Integrated Development Environment. For example the CODESYS V3.5 application that runs on the host PC is an IDE.
Ixyyy	An Input, where x is the connector and yyy is the input number. For example IC003 means Input 3 on Connector C.
PLC	Programmable Logic Controller. Industrial computer used primarily for the automation of electromechanical machinery.
PWM PWMi	A digital signal is used to represent an analogue value by using Pulse Width Modulation. The mark-space ratio of a square wave changes to represent the value. Used for many control applications including proportional valves. PWM= Voltage control. PWMi = Current control.
Off-Highway	An industrial vehicle used primarily “off road”. For example construction and farm machinery. A wider interpretation includes on road access platforms, emergency vehicles and other industrial machinery, used either on the road, or off road.
Pin	A male or female pin connection in a housing (plug or socket).
Qxyyy	An Output, where x is the connector and yyy is the output number. For example QC002 means Output 2 on Connector C.

1.3 RELATED INFORMATION

This document refers to, and is referred by the following DSE publications which are obtained from the DSE website: www.deepseaplc.com or by contacting DSE technical support: support@deepseaplc.com.

1.3.1 TECHNICAL INFORMATION

DSE Part	Description
053-187	DSEM870 Installation Instructions
055-198	DSEM640 Datasheet
055-199	DSEM870 Datasheet
057-244	DSEM640 Operator Manual

1.4 SAFETY INSTRUCTIONS

1.4.1 GENERAL

- These instructions are for authorised persons according to the EMC and low-voltage directives. The device must be installed, connected and put into operation by a qualified electrician.

- It is not permissible to open the controller or to modify or repair the controller. Modification or repairs to the wiring could result in dangerous malfunctions. Repairs to the controller must be performed by DSE. Contact your original equipment supplier in the case of malfunction.

- When the device is unpowered, ensure that no connection pins are connected to a voltage source. Thus, when the supply is switched off, the supply for the electronics, the power outputs and the external sensor supply must be switched off together.

- The controller heatsink at the rear will heat up beyond normal ambient temperature during operation. To avoid danger caused by high temperatures, protect against contact.

- The customer is responsible for performing risk analysis of the mobile working machine and determining the possible safety related functions. The user is responsible for the safe function of the application programs created. If necessary, they must additionally carry out an approval test by corresponding supervisory and test organisations according to the national regulations.

- All connectors must be unplugged from the electronics during electrical welding and painting operations.

1.4.2 INSTALLATION NOTES

- Follow the instructions of the connector manufacturer, specifically with respect to preventing water from entering the device. See Section entitled *Cables, Connectors, Harnesses and Spare Parts* for details of DSE Part Numbers.

- M12 protection plugs (supplied) must be installed in both the USB and Ethernet interfaces to ensure IP67 rating when the connectors are not in use. Where IP protection is required when the interfaces are in use, suitable O-rings must be fitted.

- The heatsink must be wired to vehicle ground in order to comply with EMC guidelines. A screw connection point is provided for this purpose. A metallic screw must be used to create an electrical connection to vehicle / machine ground.

2 SPECIFICATIONS

2.1 PROCESSOR

Description	Specification
Technexion Freescale iMX6 SOLO Microcontroller	ARM A9
Speed	800 MHz

2.2 MEMORY

Description	Specification
Flash	4 Gb
RAM	512 Mb

2.3 DC SUPPLY

Description	Specification
Operating Voltage (Pin A7)	8 V to 32 V
Maximum Current (Full Backlight, no External Loads)	<1000 mA at 24 V
Maximum Current (Full Backlight & Heater, no External Loads)	<1500 mA at 24 V
Maximum Current (After Controlled Shutdown With Ignition off)	<5 mA at 24 V

2.3.1 FUSING

Description	Specification
DC Supply (Pin A7)	3 A Max
Ignition (15) (Pin A13)	1 A Max
High Current Outputs supply (Pin C1) Fuse as Required by Output Loads (Pins C2, C3, C4, C5)	10 A Max
Auxiliary Supply Output	500 mA Max

2.4 ENVIRONMENTAL

Description	Specification
Operating Temperature	-30 ºC to +85 ºC (-22 ºF to 185 ºF)
Storage Temperature	-40 ºC to +85 ºC (-40 ºF to 185 ºF)
Degrees of Protection Provided by Enclosure (With All Mating Connectors Fitted)	IP67 (NEMA 6)

2.5 USER INTERFACE

2.5.1 CONTROLS

Description	Specification
Push Buttons	9 (10 including Rotary Encoder Push)
Rotary Encoder	1 Rotary Encoder With Integral Push Button

2.5.2 DISPLAY

Description	Specification
Size (Across Diagonal)	177.8 mm (7”)
Size (W x H)	WVGA (800 x 480)
Aspect Ratio	15:9
Type	Optically Bonded LED
Lifetime	> 50,000 hours
Colour	24 bit
Splash Screen Image Type	Uncompressed Bitmap Image (BMP) 256 Colour 800 x 480

2.5.3 LED

Description	Specification
LED Type	Tricolour (Red, Amber, Green)

2.6 REAL TIME CLOCK

Description	Specification
Retention Type	Rechargeable Battery Backed For up to 800 hours

2.7 INPUTS

2.7.1 DIGITAL INPUTS

2.7.1.1 DIGITAL

Description	Specification
Applicable Pins	Pins C14, C15, C16, C17
Minimum Voltage For High Level	>6 V
Maximum Voltage For Low Level	<2 V

2.7.1.2 FREQUENCY

Description	Specification
Applicable Pins	Pins C14, C15, C16, C17
Frequency Range	5 Hz to 30 kHz
Resolution	100 Hz at Maximum Frequency
Accuracy	400 Hz at Maximum Frequency
Minimum Voltage For High Level (Mark)	>6 V
Maximum Voltage For Low Level (Space)	<2 V

2.7.2 ANALOGUE INPUTS

Description	Specification
Applicable Pins	Pins C14, C15, C16, C17
Reference Voltage Pins	C6, C18
Reference Voltage	Programmable 5 V / 10 V ±500 mV

2.7.2.1 VOLTAGE

Description	Specification
Applicable Pins	Pins C14, C15, C16, C17
Configurable Ranges	0 V to 5 V 0 V to 10 V 0 V to 32 V
Input Resistance	>=30 kΩ
Sampling Rate	500 Hz

<u>Voltage Measurement resolution and accuracy</u>

Configured Range	Resolution (12 bits)	Accuracy (±1%) FSD
0 V to 5 V	0.001 V	±0.05 V
0 V to 10 V	0.01 V	±0.1 V
0 V to 32 V	0.3 V	±0.32 V

2.7.2.2 CURRENT

Description	Specification
Applicable Pins	Pins C14, C15, C16, C17
Configurable Ranges	0 mA to 20 mA 4 mA to 20 mA
Input Type	Current sink only
Input Sink Resistance	100 Ω ± 1%
Sampling Rate	500 Hz
Resolution (12 bits)	0.005 mA
Accuracy (± 1 % Full Scale Deflection)	0.2 mA

2.7.2.3 RESISTIVE

Description	Specification
Applicable Pins	Pins C14, C15, C16, C17
Measurement Range	0 Ω to 3200 Ω
Measurement Source Voltage	12 V maximum
Measurement Source Current	1 mA
Sampling Rate	500 Hz
Resolution (12 bits)	0.78 Ω
Accuracy (± 1 % Full Scale Deflection)	32 Ω

2.7.2.4 RATIOMETRIC

Description	Specification
Applicable Pins	Pins C14, C15, C16, C17
Measurement Voltage Reference	Supply
Measurement Type	Ratio of input Pin to Supply
Measurement Source Current	1 mA
Accuracy (± 1 % Full Scale Deflection)	0.36 V (based upon maximum supply voltage of 36 V)

2.8 OUTPUTS

2.8.1 NEGATIVE SWITCHING

Description	Specification
Applicable Pins	Pins C2, C3, C4, C5
Maximum Current	2 A
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 output supply

2.8.2 POSITIVE SWITCHING

Description	Specification
Applicable Pins	Pins C2, C3, C4, C5
Maximum Current	2 A
Digital Output Active Low ‘ON’ State Maximum Voltage at Rated Current	<100 mV
Digital Output Active Low ‘OFF’ State Leakage Current	<10 µA at 24 V output supply

2.9 COMMUNICATIONS

2.9.1 CAN

NOTE: CAN connections are NOT internally terminated. A complete CAN network must have 120 Ω terminators at each end of the network.

NOTE: Screened 120 Ω impedance cable specified for use with CAN must be used for the CAN links.
DSE stock and supply Belden cable 9841 which is a high quality 120 Ω impedance cable suitable for CAN use (DSE part number 016-030).

Description	Specification
Number of CAN Interfaces	2
Supported Protocols	J1939 CAN open Raw CAN
Supported Baud Rates	50 kbit/s, 120 kbit/s, 250 kbit/s, 500 kbit/s, 800 kbit/s, 1 Mbit/s

2.9.2 ETHERNET

Description	Specification
Number Of Ethernet Ports	1
Supported Data Rates	10 Mbit/s / 100 Mbit/s, Duplex
Supported Protocols	MODBUS TCP CODESYS 3.5

M12 'D' Coded – 4 Pin Female	Pin	Description
	1	Tx+
	2	RC+
	3	TX-
	4	RC-

2.9.3 USB

Description	Specification
Number of USB Ports	1
USB Version	2
Supported Speeds	Full Speed (12 Mbit/s)
Device Class	08 (Mass Storage)
Max Size	64 Gb
Filing System	VFAT or FAT32

M12 'B' Coded – 5 Pin Female	Pin	Description
	1	5 V
	2	Data+
	3	Data-
	4	0 V
	5	Shield

2.9.4 CAMERA INPUTS

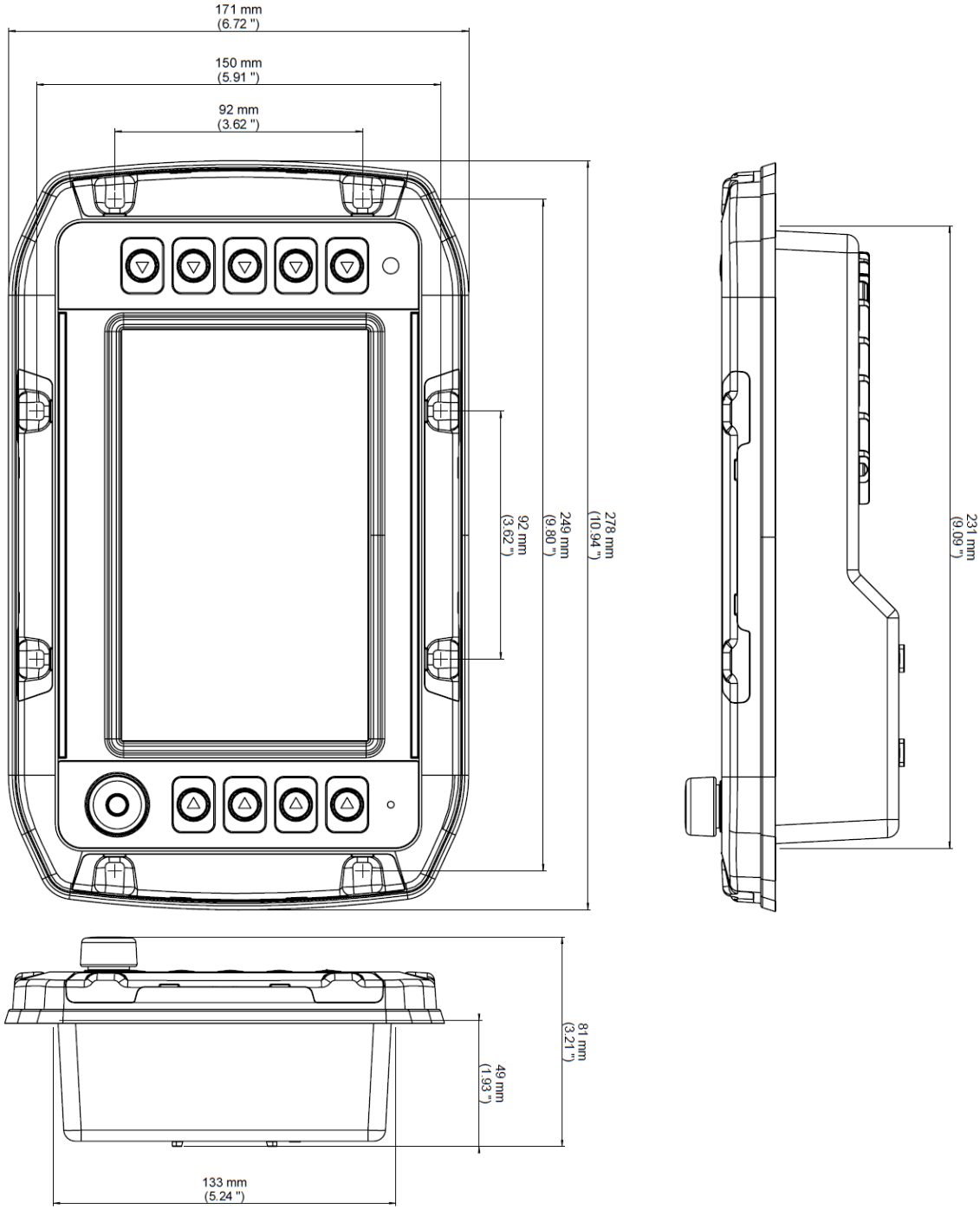
Description	Specification
Number of Camera Inputs	2
Connection Pins	A5, A11 (Camera 1) A6, A12 (Camera 2)
Camera Type	VGA
Interface Type	Analogue (Composite) Video for PAL / NTSC

3 INSTALLATION

3.1 DIMENSIONS AND MOUNTING

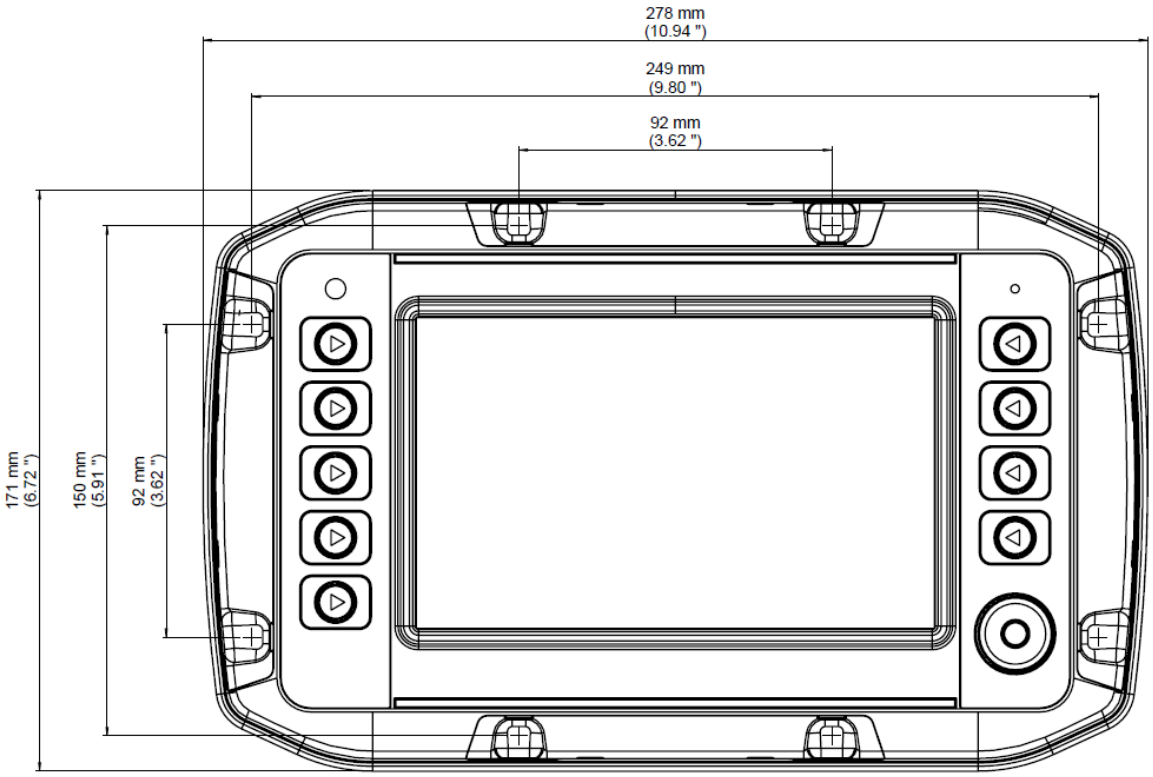
3.1.1 DIMENSIONS

Description	Specification
Overall Dimensions (Height x Width x Depth)	278 mm x 171 mm x 81 mm (10.94 ” x 6.72 ” x 3.21 ”)
Mounting Type	8 x mounting bolts or RAM mount.
Overall Weight	<1 kg (2.2 lb)



3.1.2 FASCIA MOUNTING

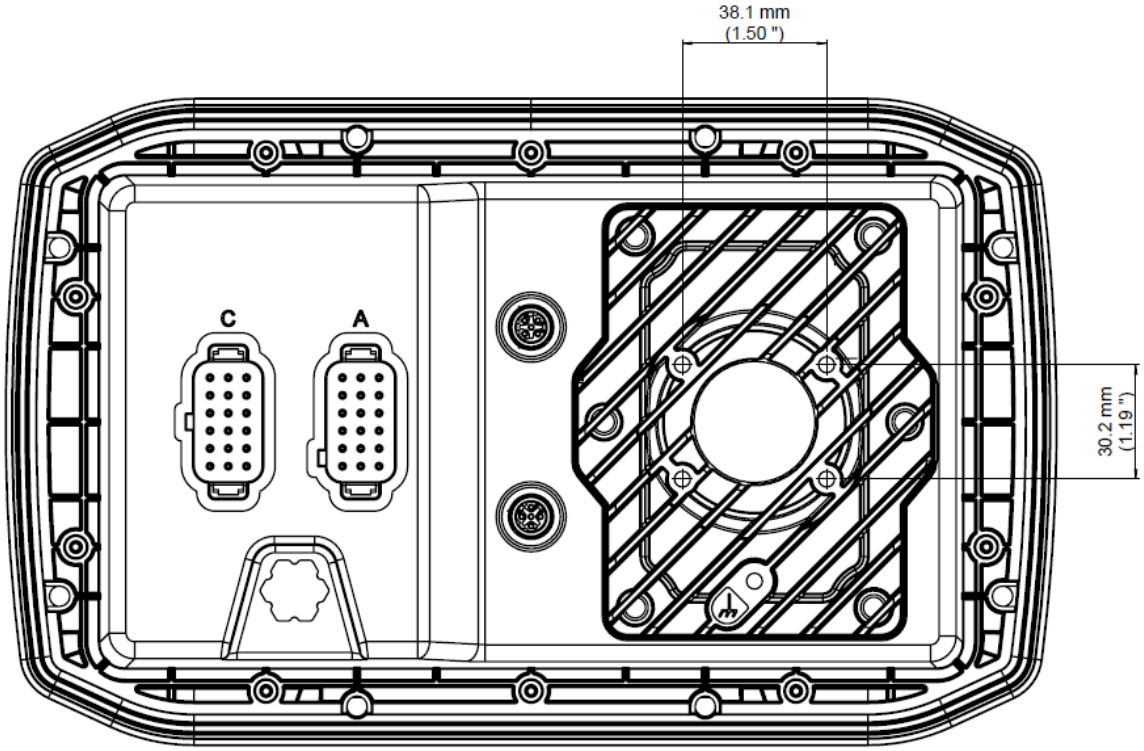
Description	Specification
Fascia Mounting Holes	Suitable for M5 bolts (0.3 “ holes)
Fascia Mounting Hole Centres	See Diagram Below
Panel Cut-Out	231 mm x 133 mm (9.09 “ x 5.24 “)
Fascia Mounting Bolt Material Recommendation	Steel or Stainless Steel
Fascia Mounting Bolt Tightening Torque to prevent distortion of the sealing gasket and subsequent seal failure / mechanical damage to the controller.	1.2 Nm Maximum (0.89 ft. lb Maximum)



3.1.3 RAM MOUNTING

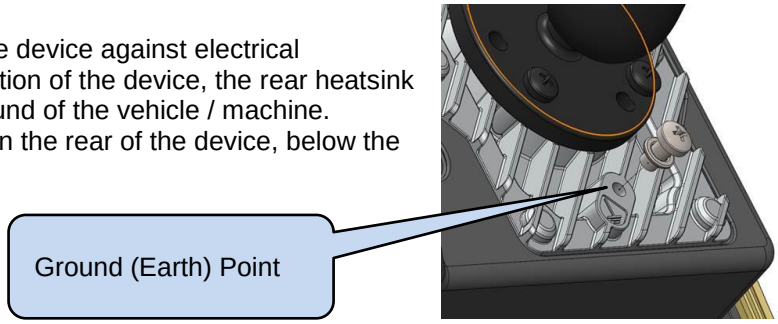
DSE870 has four holes on the rear face, suitable for fitting of a RAM type mount with the *AMPS hole pattern.* The spacing for the mounting holes is detailed in the image below.

Description	Specification
RAM Mounting Holes	Suitable for M5 bolts (0.3 “ holes)
RAM Mounting Hole Centres	31.1 mm x 30.2 mm (1.50 “ x 1.19 “)
RAM Mounting Bolt Material Recommendation	Steel or Stainless Steel
RAM Mounting Bolt Tightening Torque	4 Nm Maximum (2.95 ft. lb Maximum)



3.2 GROUNDING

To ensure the protection of the device against electrical interference and the safe function of the device, the rear heatsink must be connected to the ground of the vehicle / machine.
A suitable screw is provided on the rear of the device, below the RAM mount location.



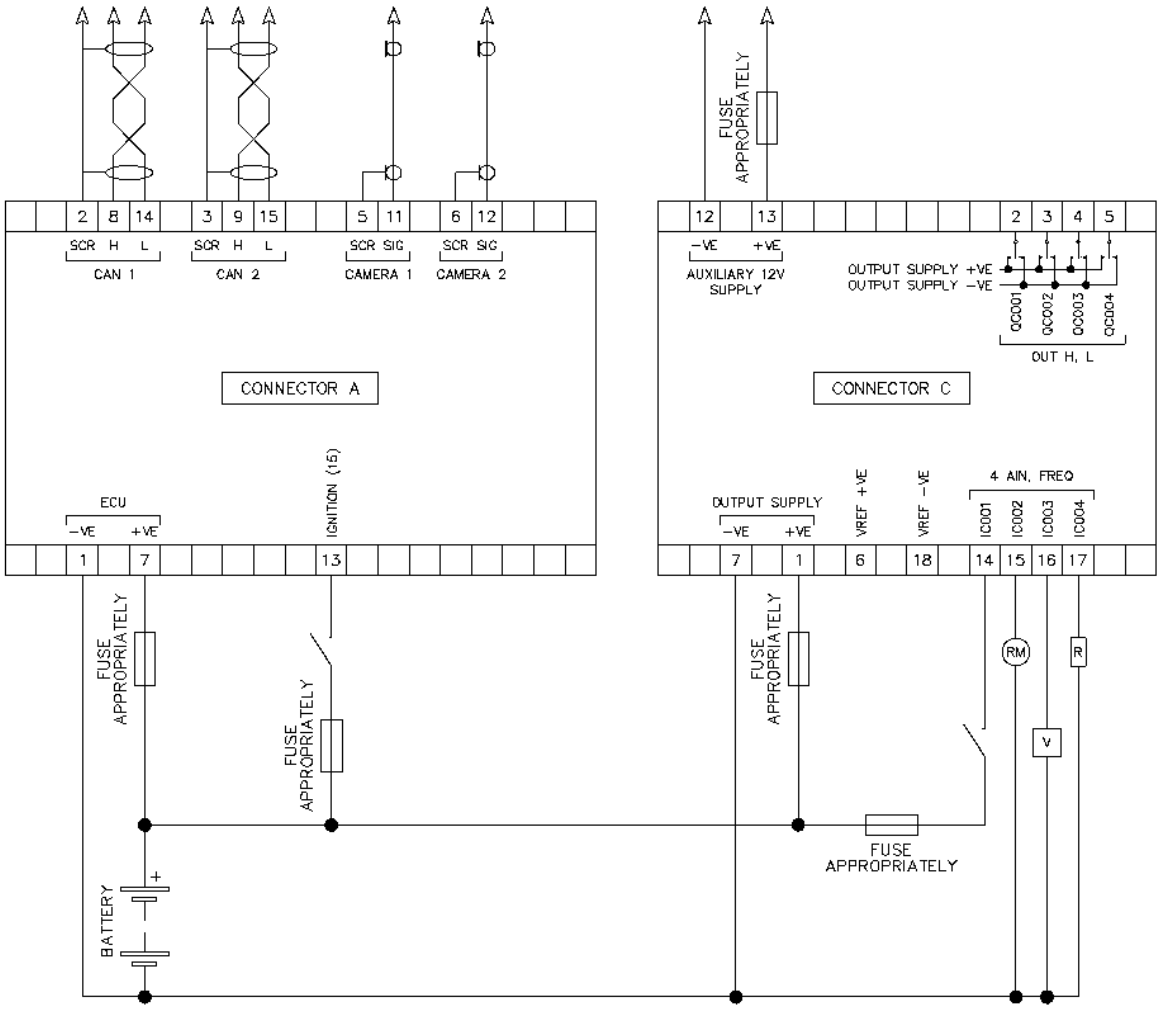
3.3 FUSING

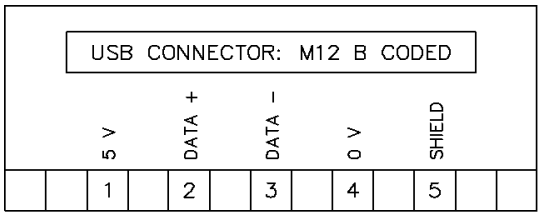
The individual electric circuits must be protected in order to protect the whole system. Select appropriate fuses to protect the outputs being supplied.

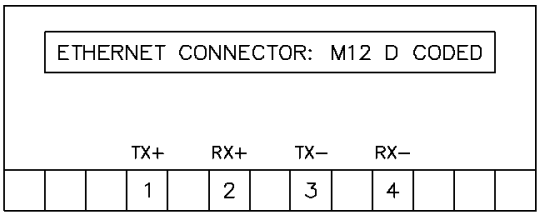
Pin	Description	Comments	Recommended Fuse Size
A7	ECU Supply	Supplies M870 CPU	3 A Max
A13	Ignition (15)		1 A Max
C1	Output Supply	Supplies Outputs QC001 (Pin C2) QC002 (Pin C3) QC003 (Pin C4) QC004 (Pin C5).	10 A Max
C13	Auxiliary Supply Output (500 mA)	Used to Supply External Devices Internally Protected From Overcurrent.	500 mA Max

3.4 TYPICAL CONNECTION DIAGRAM

Terminology	Meaning
QCxxx	Output
Ix	Input
H	Output, High when active
L	Output, Low when active
AIN, FREQ	Input configurable to accept signals as positive digital, negative digital, 0 V to 5 V, 0 V to 10 V, 0 V to 32 V, 0 mA to 20 mA, 4 mA to 20 mA, ratiometric or resistive and frequency measuring.





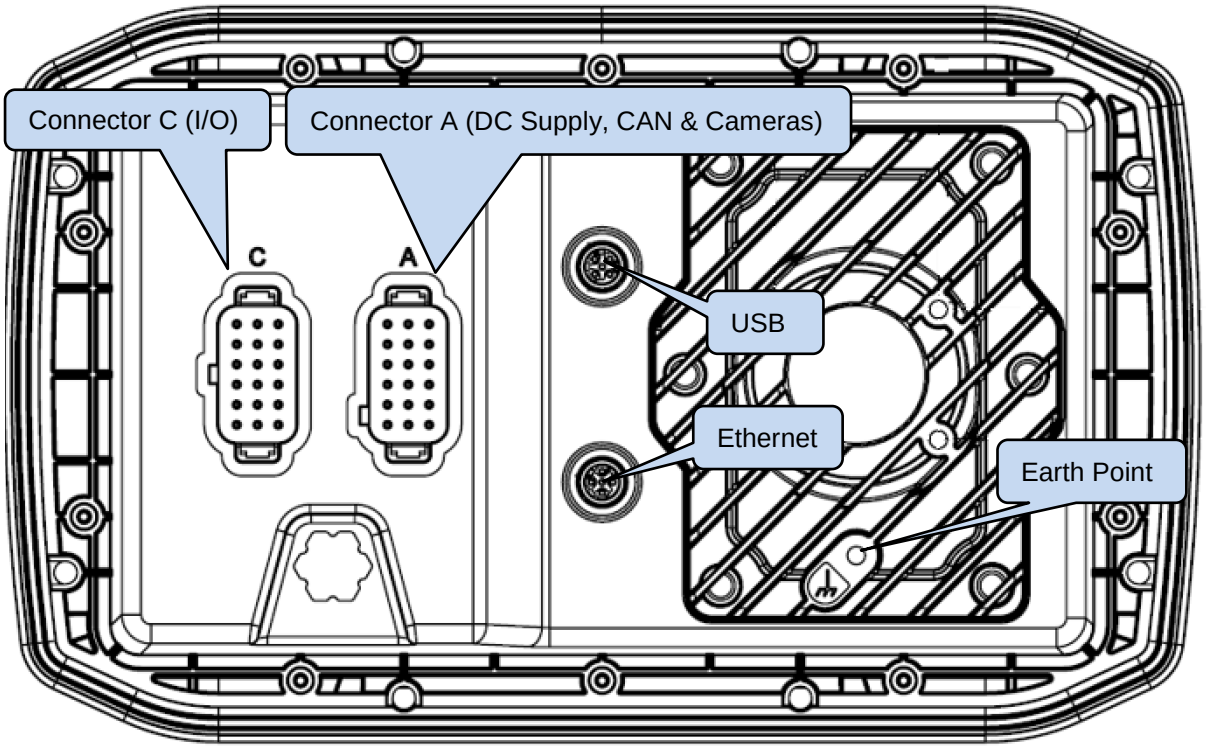


3.5 USER CONNECTIONS

NOTE: If a prewired connection cable is used, remove the cores with unused signal inputs and outputs. Unused cores, in particular core loops, lead to interference coupling that can influence the connected controller.

NOTE: Connectors A and C are coded differently. Do not try to force a connector into the wrong socket.

NOTE: USB and Ethernet connectors are coded differently. Do not try to force a connector into the wrong socket.



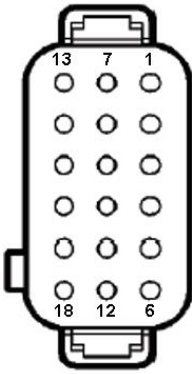
3.5.1 CONNECTOR A (DC SUPPLY, CAN AND CAMERA)

NOTE: For details of fuse requirements, refer to section entitled *Fusing* elsewhere in this document.

NOTE: Screened 120 Ω impedance cable specified for use with CAN must be used for the CAN links.
DSE stock and supply Belden cable 9841 which is a high quality 120 Ω impedance cable suitable for CAN use (DSE part number 016-030).

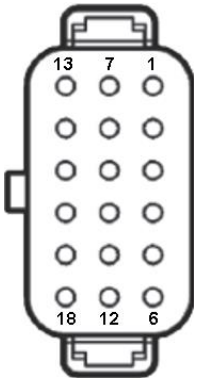
NOTE: CAN connections are NOT internally terminated. A complete CAN network must have 120 Ω terminators at each end of the network.

NOTE: Connect Camera1 and Camera2 using a single core conductor with screen (shield).

Connector A	Pin	Description	Comments
(A Coded) 	1	ECU Supply -ve	DC Supply for the M870
	2	CAN1 SCR	Screen (shield) for CAN1
	3	CAN2 SCR	Screen (shield) for CAN2
	4	No Connection	
	5	Camera 1 SCR	Screen (shield) for Camera 1
	6	Camera 2 SCR	Screen (shield) for Camera 2
	7	ECU Supply +ve	DC Supply for the M870
	8	CAN1 H	
	9	CAN2 H	
	10	No Connection	
	11	Camera 1 Signal	Analogue (Composite) video
	12	Camera 2 Signal	Analogue (Composite) video
	13	Ignition +ve (15)	Energises the ECU.
	14	CAN1 L	
	15	CAN2 L	
	16	No Connection	
	17	No Connection	
	18	No Connection	

3.5.2 CONNECTOR C (I/O)

Terminology	Meaning
QC00x	Output
IC00x	Input
H	Output, High when active.
L	Output, Low when active.
AIN, FREQ	Input configurable to accept signals as positive digital, negative digital, 0 V to 5 V, 0 V to 10 V, 0 V to 32 V, 0 mA to 20 mA, 4 mA to 20 mA, ratiometric or resistive and frequency measuring

Connector C	Pin	Description	Comments
(C Coded) 	1	Output Supply +ve	Supplies Outputs 1 to 4.
	2	QC001	OUT H, L. Supplied by C1.
	3	QC002	OUT H, L. Supplied by C1.
	4	QC003	OUT H, L. Supplied by C1.
	5	QC004	OUT H, L. Supplied by C1.
	6	Vref +	+ve Reference Output for AIN.
	7	Output Supply GND	-ve Connection for Output Supply (C1)
	8	No Connection	
	9	No Connection	
	10	No Connection	
	11	No Connection	
	12	Aux 12V -ve Output	Used to Supply External Devices
	13	Aux 12V +ve Output (Max 500 mA)	Used to Supply External Devices
	14	IC001	AIN, FREQ
	15	IC002	AIN, FREQ
	16	IC003	AIN, FREQ
	17	IC004	AIN, FREQ
	18	Vref GND	-ve Reference Output for AIN

4 OPERATION

4.1 SYSTEM PAGES

The System Information and System Settings pages are accessed by pressing and holding any two of the fascia buttons during the power up (application of DC power) of the DSEM870. Wait until *Entering Setup…* is displayed before releasing the buttons.

4.1.1 NAVIGATION

Within the System Pages, the following icons appear adjacent to the buttons to indicate their function.

Icon	Function	Description
◁	Return	Press the adjacent button to return to a previous page.
↻	Encoder	Rotate to cycle through the available options. Press to select (OK) the displayed option.

4.1.1.1 PAGE SELECTION

Use the rotary encoder to move through the pages. Press the rotary encoder to select the page.

Device Settings **Device Actions** **Device Information**

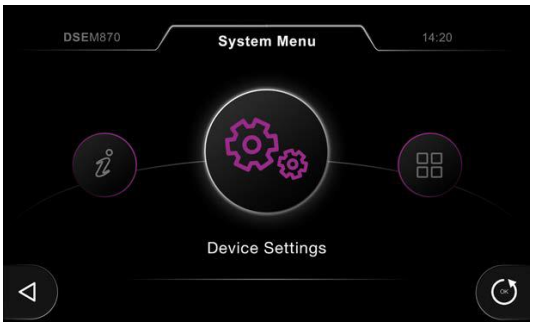
4.1.1.2 OPTION SELECTION AND EDITING

While viewing the selected page, use the rotary encoder to move through the options, Press the rotary encoder to select the option for editing.

While editing the selected parameter, use the rotary encoder to change the value, Press the rotary encoder to save the change.
Press ◄ to exit the editor.

4.1.2 DEVICE SETTINGS

This section allows access to the *Device Settings*.



4.1.2.1 SET IP ADDRESS

This section allows selection of DHCP or Static IP address.
When connecting the device to a third party network, these settings must be made after consulation with the network manager.

Turn the rotary encoder to select the item to change and press it to enter the editor.

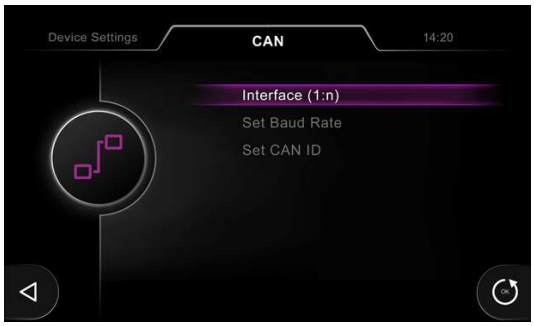
Use the rotary encoder to select the digit.
Press to accept the change and/or move to the next digit.

4.1.2.2 CAN

This section allows configuration of the CAN interface parameters.

Turn the rotary encoder to select the item to change and press it to enter the editor.

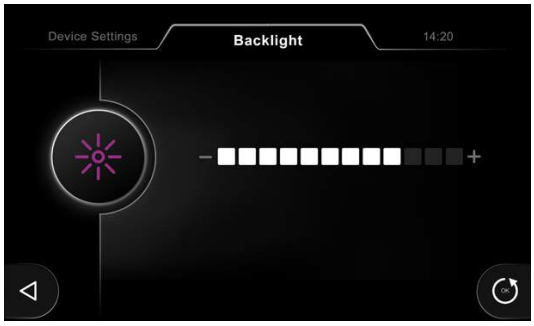
Selecting *Interface* and pressing the encoder cycles between the two CAN ports (0 & 1).



4.1.2.3 BACKLIGHT

This section allows adjustment of the LCD backlight brightness.

Use the rotary encoder to adjust the level. Press to accept the change.



4.1.2.4 REAL TIME CLOCK

Allows the setting of the Real Time Clock and Calendar.

Use the rotary encoder to select the digit. Press to accept the change and/or move to the next digit.

4.1.2.5 PASSWORD SETTINGS

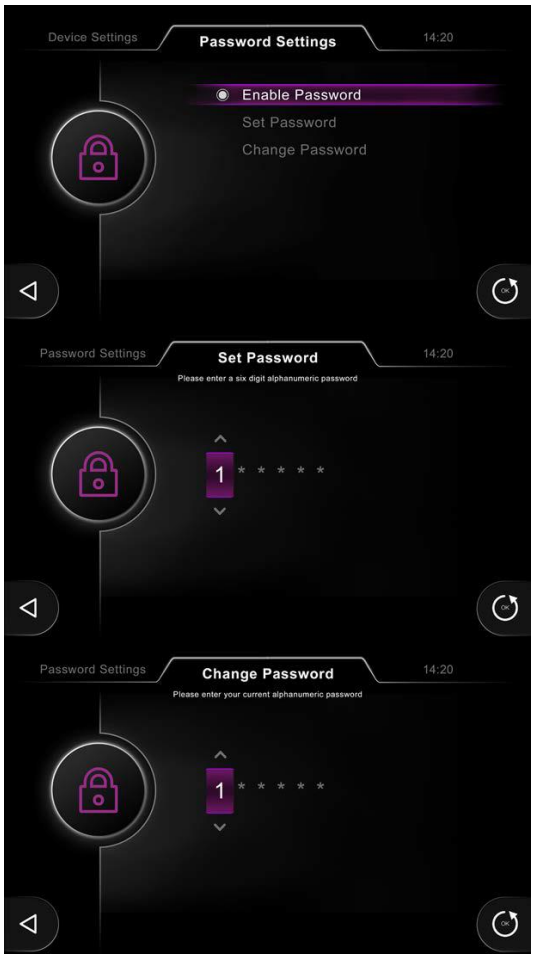
NOTE: Ensure the Password (if enabled) is not lost or forgotten!

Allows the password to be enabled and changed.

Turn the rotary encoder to select the item to change and press it to enter the editor.

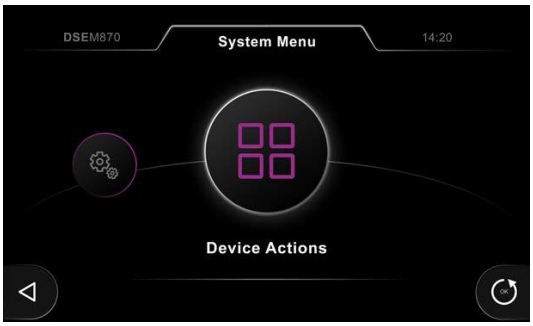
Use the rotary encoder to select the digit. Press to accept the change and move to the next digit.

Use the rotary encoder to select the digit. Press to accept the change and move to the next digit.



4.1.3 DEVICE ACTIONS

Allows selection of device actions.



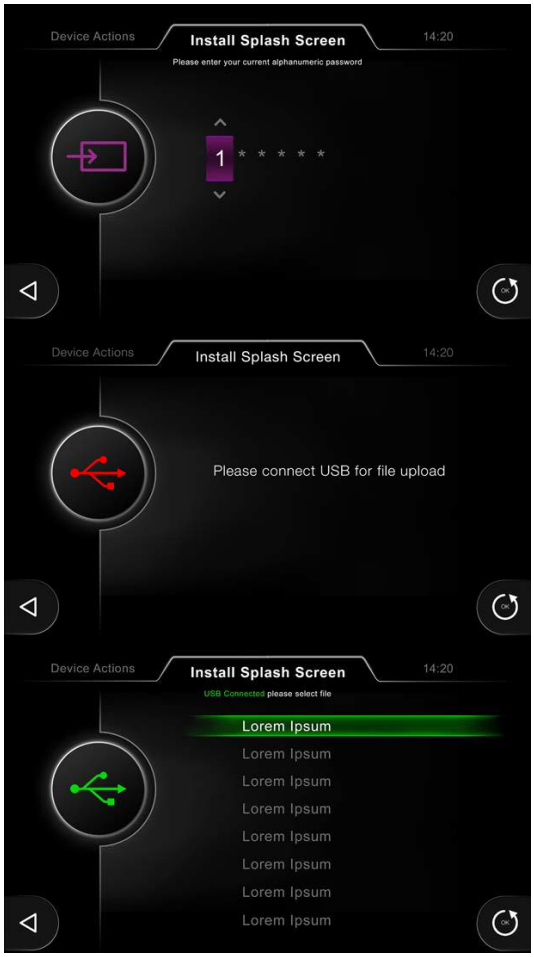
4.1.3.1 INSTALL SPLASH SCREEN

DSEM870 supports the display of a *Splash Screen* at power up of the device. This is typically used to display the OEM logo image.

The device Password is required (when enabled) to allow Splash Screen installation.

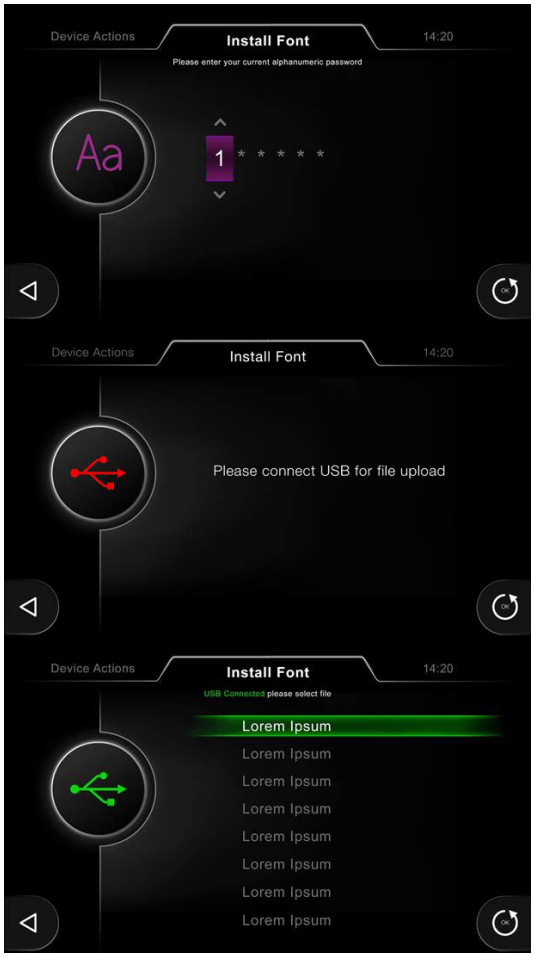
For details of the supported USB memory stick and image type, see the section entitled *Specifications* elsewhere in this document.

Turn the rotary encoder to choose the required image file and press it to select.



4.1.3.2 INSTALL FONT

The device Password is required (when enabled) to allow font installation.



Ensure the USB device containing the font(s) is connected to the controller.

Turn the rotary encoder to choose the required font and press it to select.

4.1.3.3 CLONE / RECOVER SELECTION

The device Password is required (when enabled) to allow Clone or Recover operations.

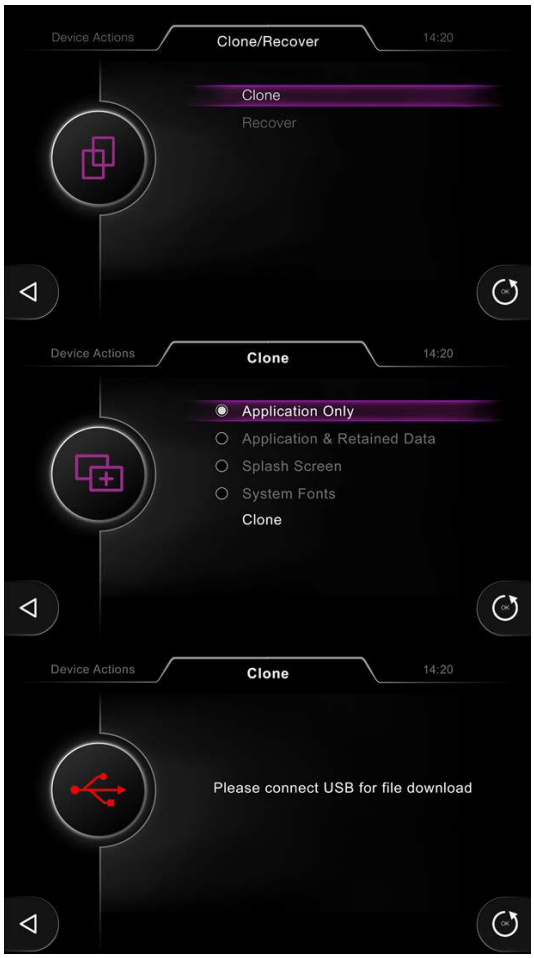
CLONE

This section is used to create a backup file of the device, selecting the elements to backup. This file may then be used to recover the device, or create *Clones*, sending the file to other devices.

Turn the rotary encoder to choose the function and press it to access the *Clone* selector.

Turn the rotary encoder to choose the function and press it to select.

Ensure the USB device used to store the Clone file(s) is connected to the controller.



Wait while the process completes….

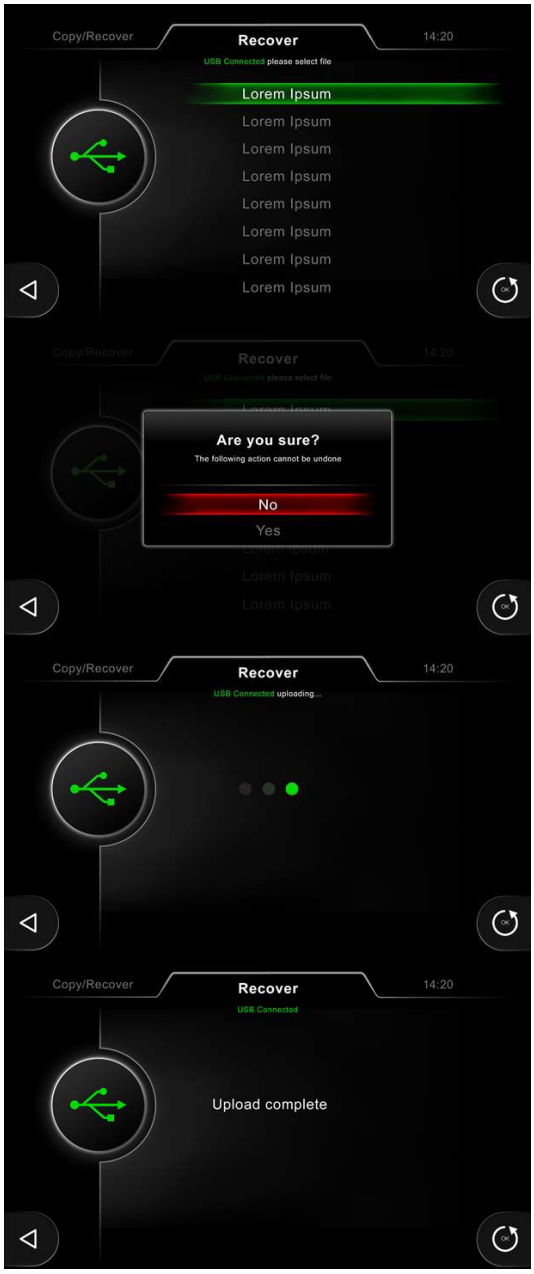
RECOVER

NOTE: The *Recover* process replaces files on the target device and may change the Application of the device.

This section is used to recover the device from a previously stored Clone (backup) file, or create copies of the device, sending the file to other devices.

Ensure the USB device containing the file(s) to Recover is connected to the controller.

Turn the rotary encoder to choose the file to restore, and press it (*click*) to select.



Confirm that you wish to proceed with this process.

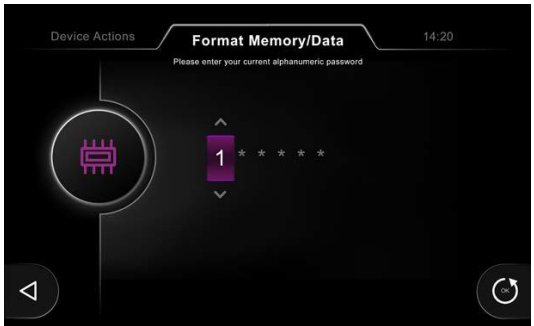
Turn the rotary encoder to choose the option, and press it to select.

Wait while the process completes….

4.1.3.4 FORMAT MEMORY / DATA

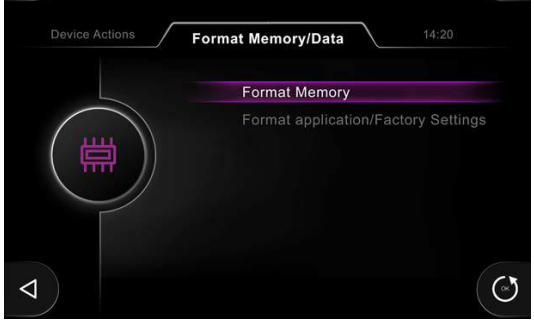
NOTE: The *Format* process deletes files on the target device and may change the operation of the device.

Enter the Password if one has been set.



Select which memory area to Format.

Turn the rotary encoder to choose the function, and press it to select.

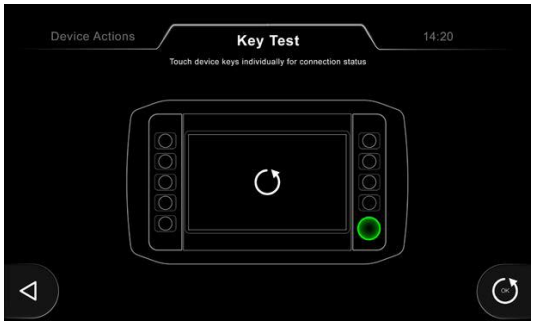


4.1.3.5 KEY TEST

This section allows the device fascia buttons and rotary encoder to be tested.

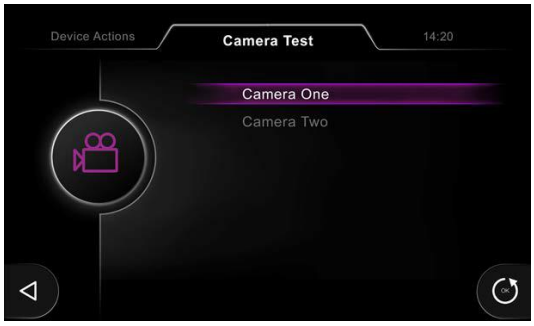
Press the keys and rotate the encoder to receive feedback of their operation.

To exit the Keytest, release all buttons for five seconds.



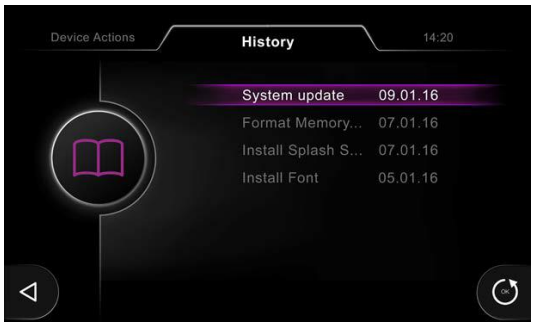
4.1.3.6 CAMERA TEST

Select the camera using the rotary encoder and press the encoder to view the selected camera.



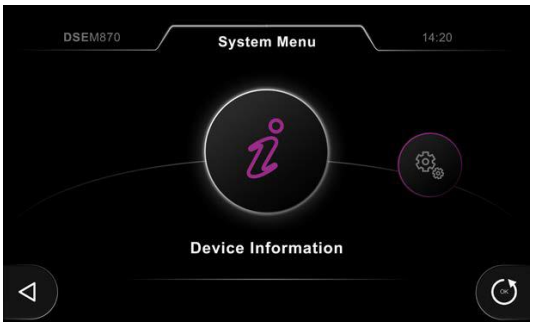
4.1.3.7 HISTORY

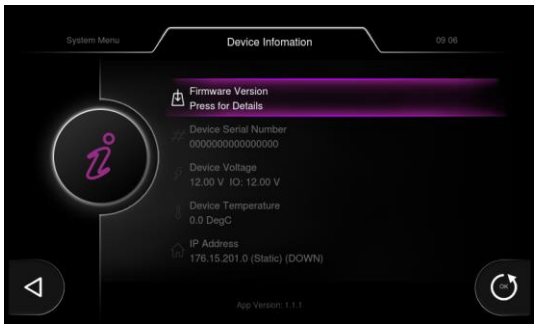
Used to display a log of the date of certain actions.



4.1.4 DEVICE INFORMATION

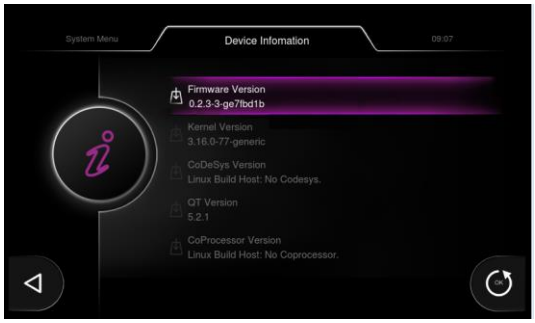
This section shows the *Device Information*.





4.1.4.1 FIRMWARE VERSION

Shows all details of the device versions.



4.2 FIRMWARE UPDATE

The Firmware Update is performed as follows:

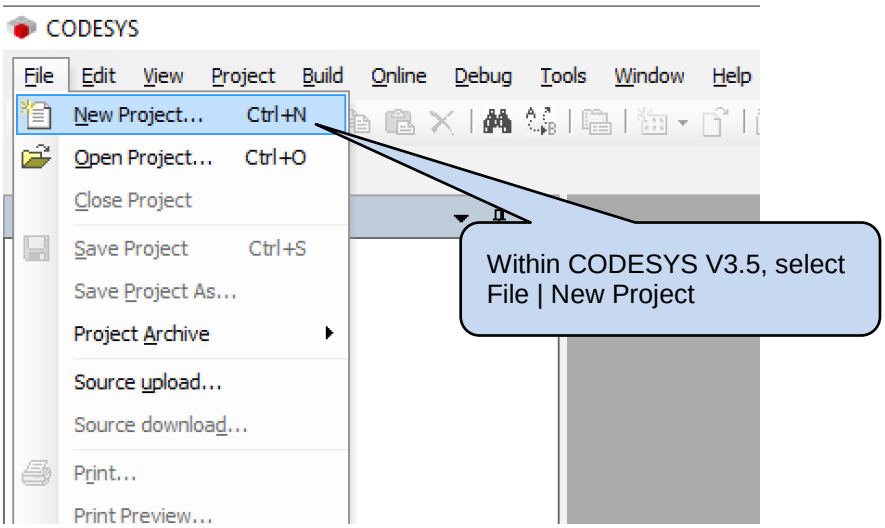
- Remove DC Supply from the DSEM870.
- Press and hold any three buttons. Reapply DC power until the DSEM870 indicates that it is *Entering Flash / Recovery.* Now release the buttons.
- When prompted, connect the USB memory stick containing the firmware update file(s). You must do this within 60 seconds. Failure to do so results in the DSEM870 restarting into normal operation mode.
- Update occurs automatically when the memory stick is inserted.
- On completion, press any button when prompted to restart the device and apply the new firmware.

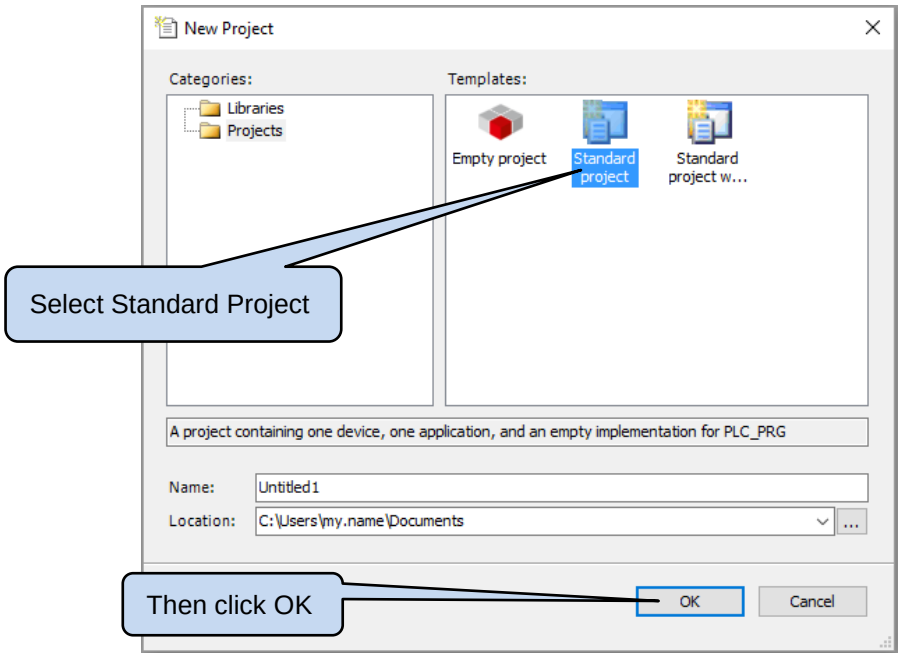
5 CONNECTING TO CODESYS

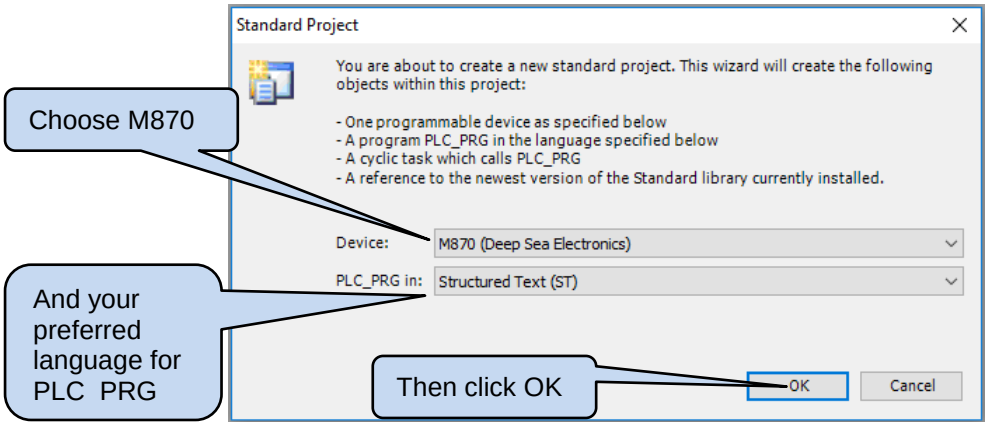
DSEM870 communicates with, and is programmed by, the CODESYS V3.5 Integrated Development Environment (IDE).

5.1 START NEW PROJECT

To begin, start a new project as shown.



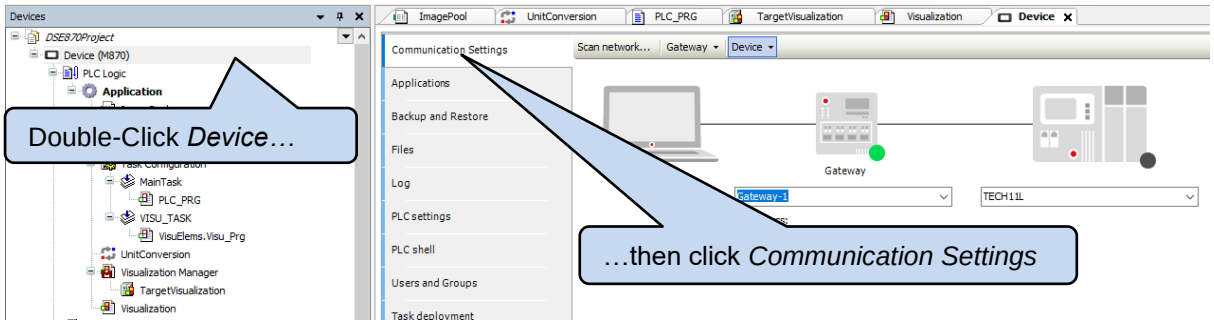


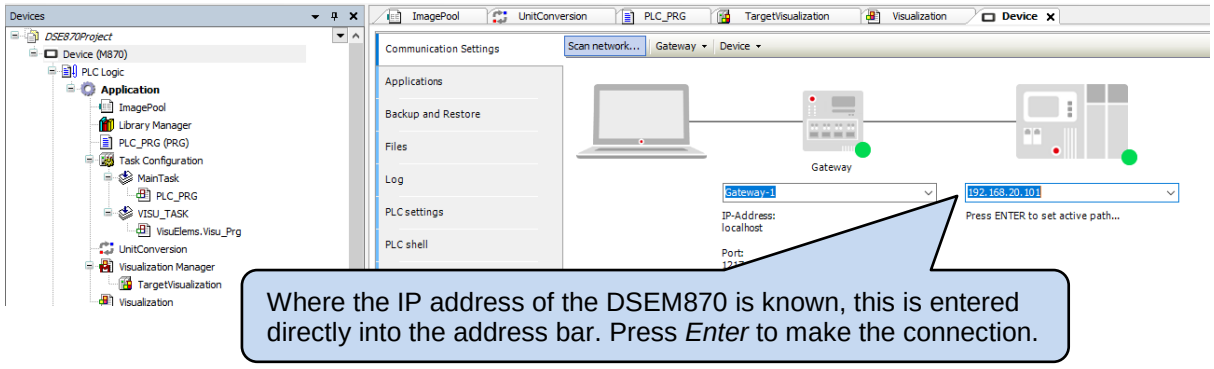


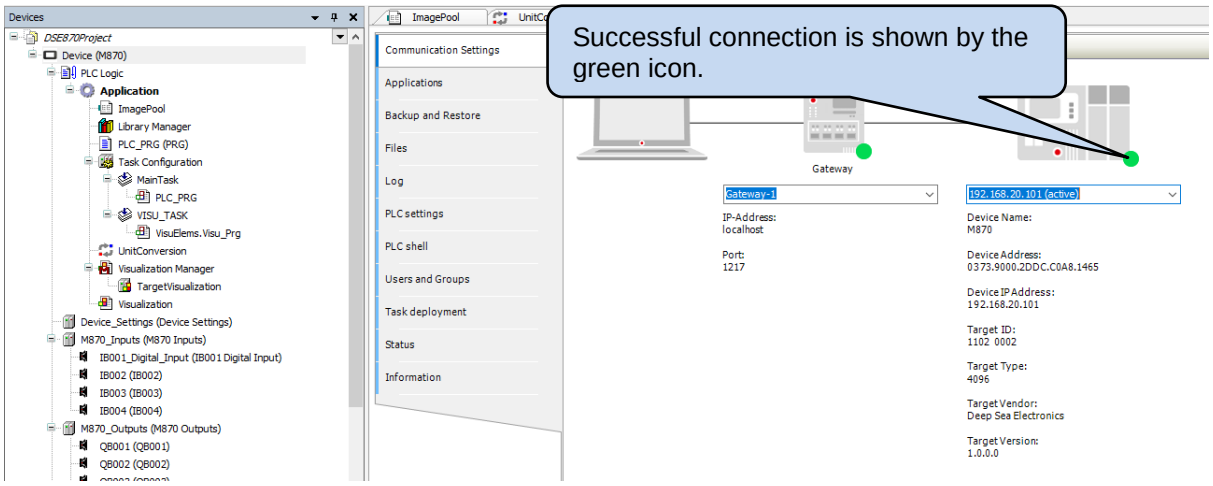
5.2 ETHERNET TCP

NOTE: If the IP address of the device is not known, see the section entitled *Ethernet UDP* elsewhere in this document.

With the DSEM870 connected to the same Ethernet network as the PC, Select *Device* | *Communication Settings* in the CODESYS V3.5 IDE.



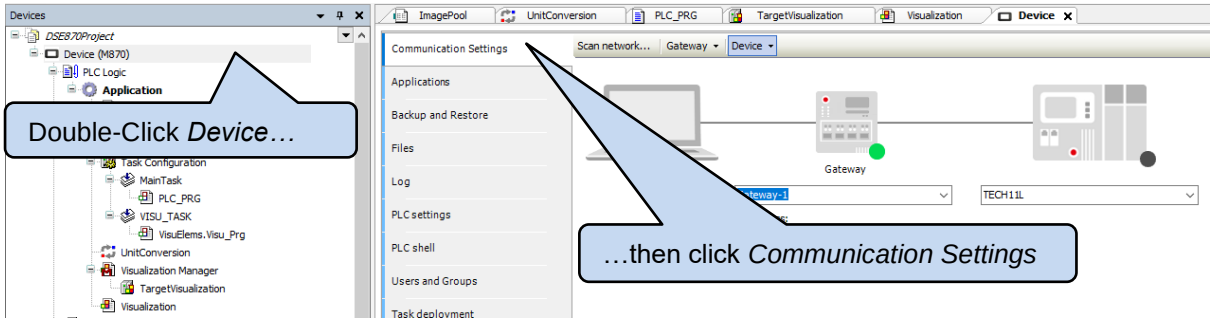


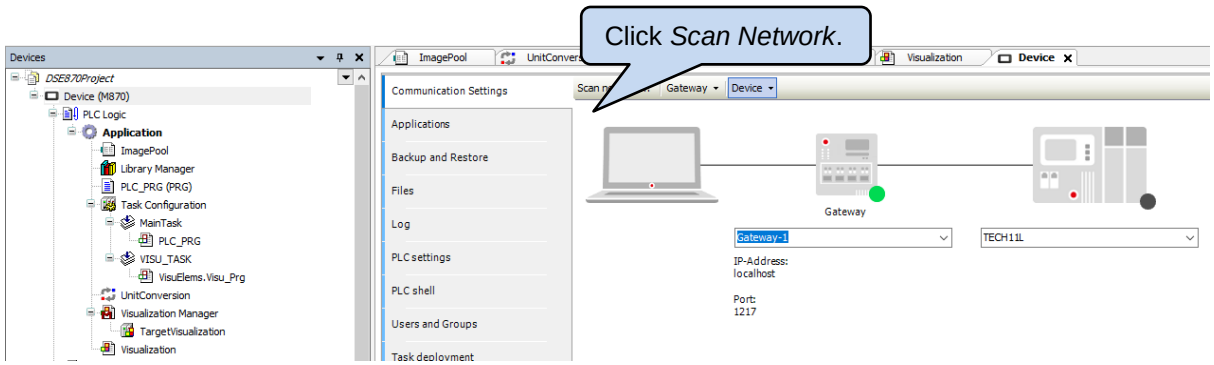


5.3 ETHERNET UDP

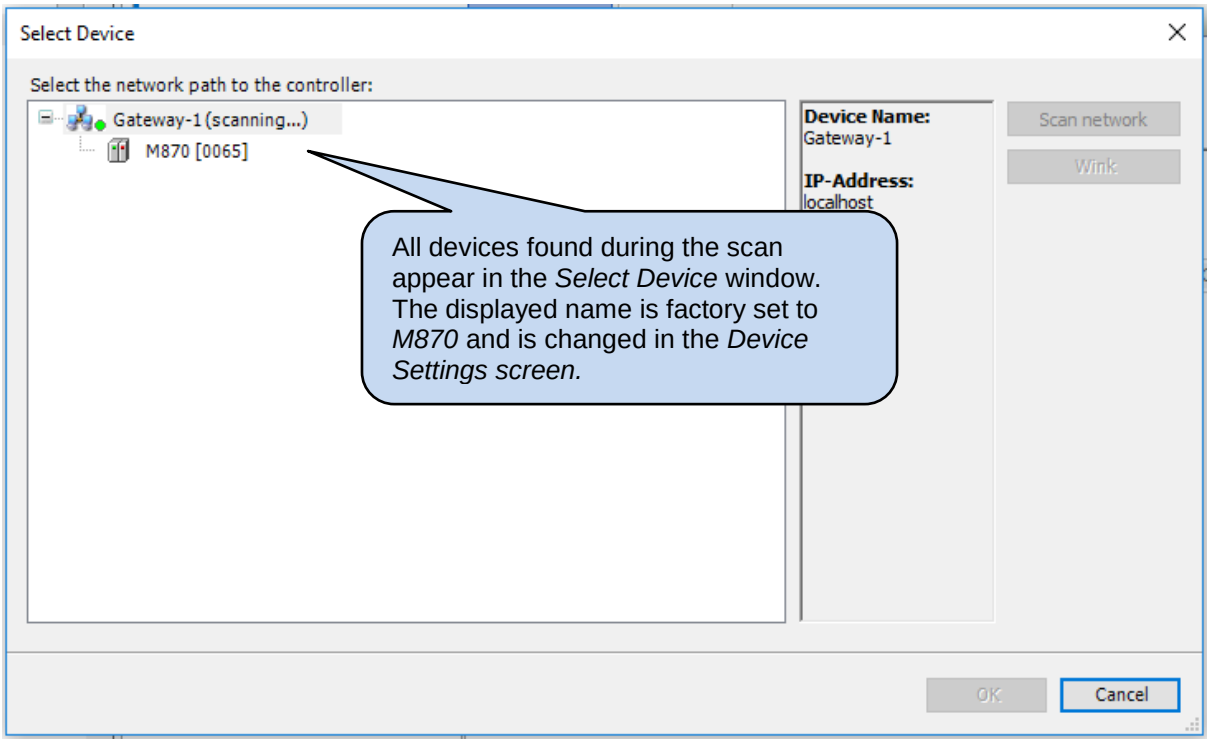
NOTE: If the IP address of the device is known, connection may also be achieved manually as detailed in the section entitled *Ethernet TCP* elsewhere in this document.

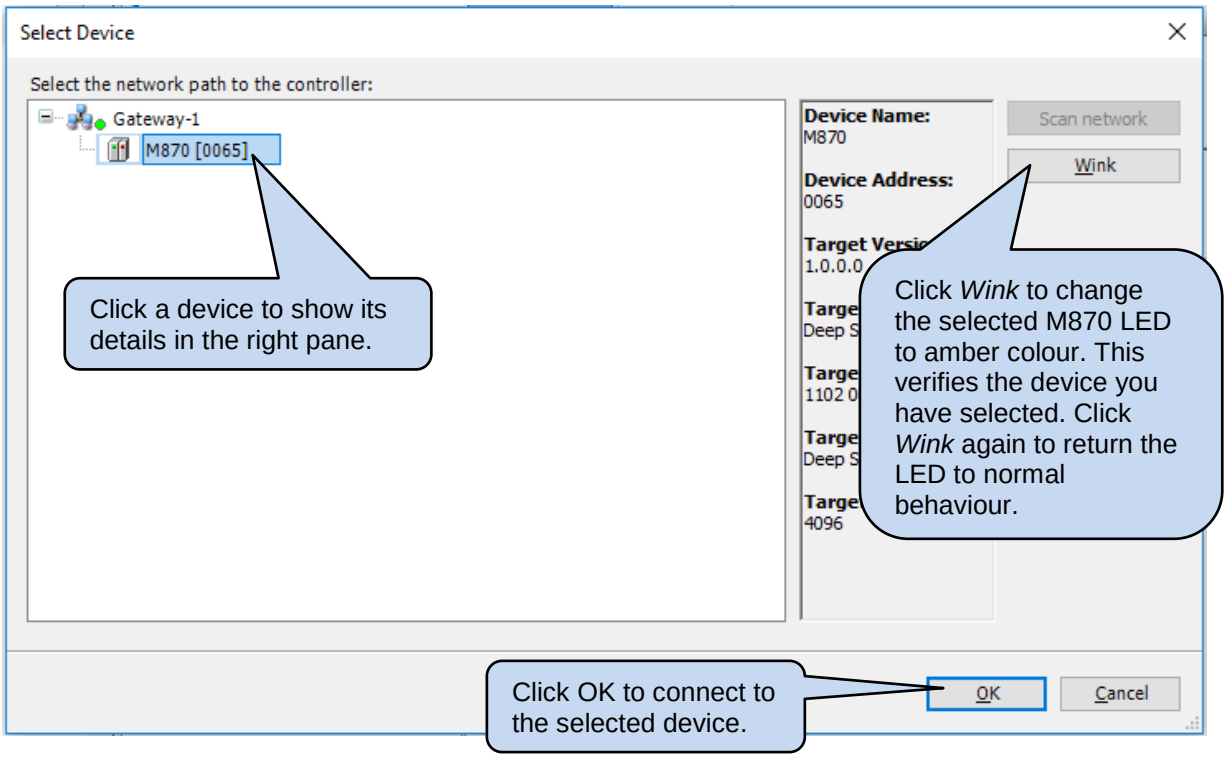
With the DSEM870 connected to the same Ethernet network as the PC, Select *Device* | *Communication Settings* in the CODESYS V3.5 IDE.

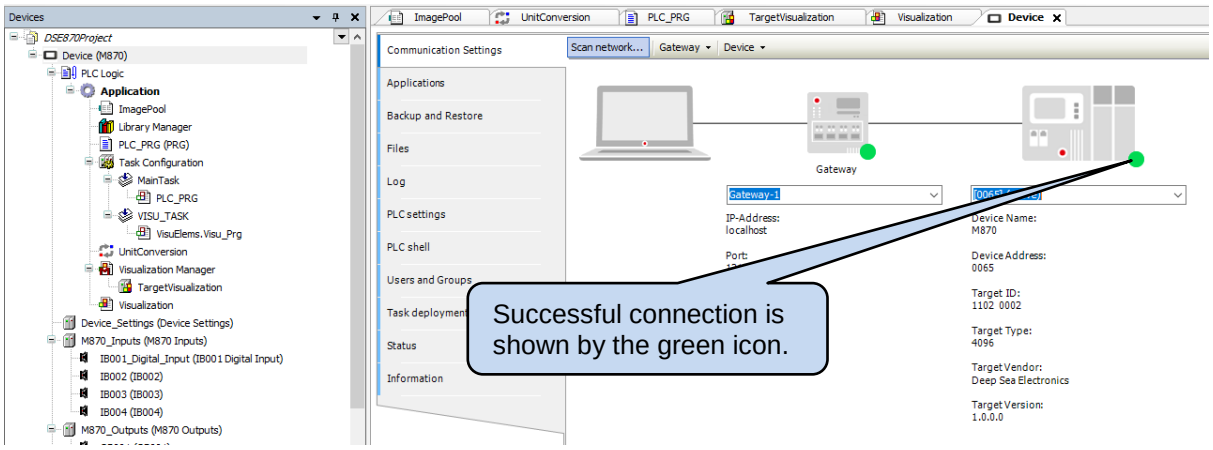




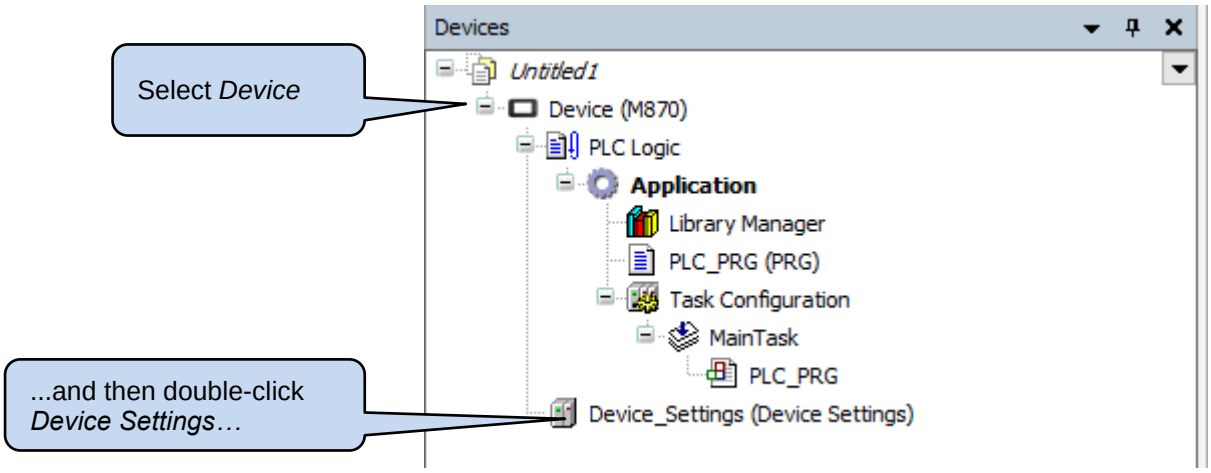
NOTE: A device in *Setup* mode is not discoverable by the Scan.







5.4 CONFIGURE SETTINGS AND MONITOR THE DEVICE



See the following subsections for details of the Device Settings pages.

5.4.1 DEVICE SETTINGS PARAMETERS

...and then select *Device Settings Parameters…*

...and then expand *Ethernet Parameters* by clicking the + symbol.

Device_Settings

Device Settings Parameters
Device Settings I/O Mapping
Status
Information

Parameter	Type	Value	Def...	Unit	Description
Ethernet Parameters					
Voltage Reference	Enumeration of USINT	Disa...	Disa...		Voltage Reference Configuration
Battery Voltage	Enumeration of USINT	12V	12V		Battery Voltage
Screen Rotation	Enumeration of USINT	0 Deg	0 Deg		Screen Rotation
Persistance Settings					Data Persistance Settings
System Information					Low level System Information
Shutdown Delay	UDINT	500	500	ms	Delay before shutdown initiated

Device_Settings

Device Settings Parameters
Device Settings I/O Mapping
Status
Information

Example of how to set the IP Address to 192.168.1.100

Parameter	Type	Value	Def...	Unit	Desc
Ethernet Parameters					
Save Config	Enumeration of USINT	No	No		Save
IP Mode	Enumeration of UINT	DHCP	DHCP		IP Mo
WebConfig Port	UDINT	8080	8080		WebC
IP Address					Static IP A
[0]	USINT	192	192		
[1]	USINT	168	168		
[2]	USINT	1	1		
[3]	USINT	100	100		
Subnet Mask					Subnet Mask for Static Mode
[0]	USINT	255	255		
[1]	USINT	255	255		
[2]	USINT	255	255		
[3]	USINT	0	0		
Gateway Address					Gateway Address for Static Mode
[0]	USINT	192	192		
[1]	USINT	168	168		
[2]	USINT	1	1		
[3]	USINT	1	1		
DNS Address					DNS for Static Mode
[0]	USINT	192	192		
[1]	USINT	168	168		
[2]	USINT	1	1		
[3]	USINT	1	1		
Hostname	STRING	'M870'	'M640'		Hostname
Voltage Reference	Enumeration of USINT	Disa...	Disa...		Voltage Reference Configuration
Battery Voltage	Enumeration of USINT	12V	12V		Battery Voltage
Screen Rotation	Enumeration of USINT	0 Deg	0 Deg		Screen Rotation
Persistance Settings					Data Persistance Settings
System Information					Low level System Information
Shutdown Delay	UDINT	500	500	ms	Delay before shutdown initiated

Parameter	Type	Value	Default Value	Unit	Description
Debug Mode	Enumeration of USINT	Keep Current	Keep Current		
Ethernet Parameters					
Save Config	Enumeration of USINT	No			
IP Mode	Enumeration of UINT	No			
WebConfig Port	UDINT	Yes			
IP Address					
[0]	USINT	192			
[1]	USINT	168			
[2]	USINT	1			
[3]	USINT	100	100		

After making changes, choose *Yes* in the *Save Config* section to save the changes made when the project is downloaded to the DSEM870 device.

5.4.2 DEVICE SETTINGS I/O MAPPING

This page is used to monitor the device, and if required, to map the monitored values to program variables.

Error Code is a bit field, detailed in the section entitled *M870 CODESYS Error Codes* elsewhere in this document.

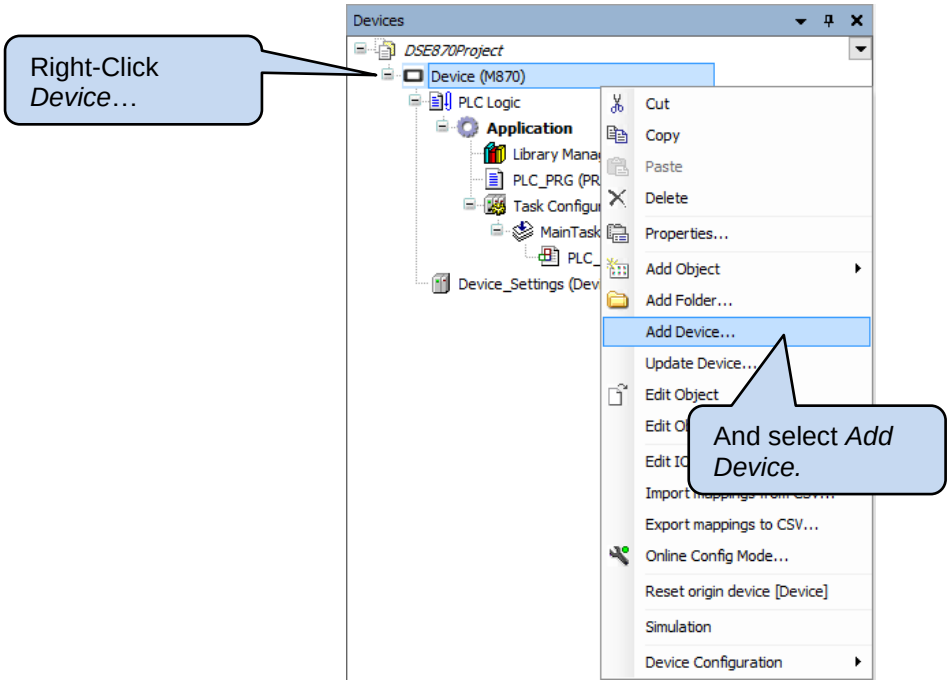
Device_Settings

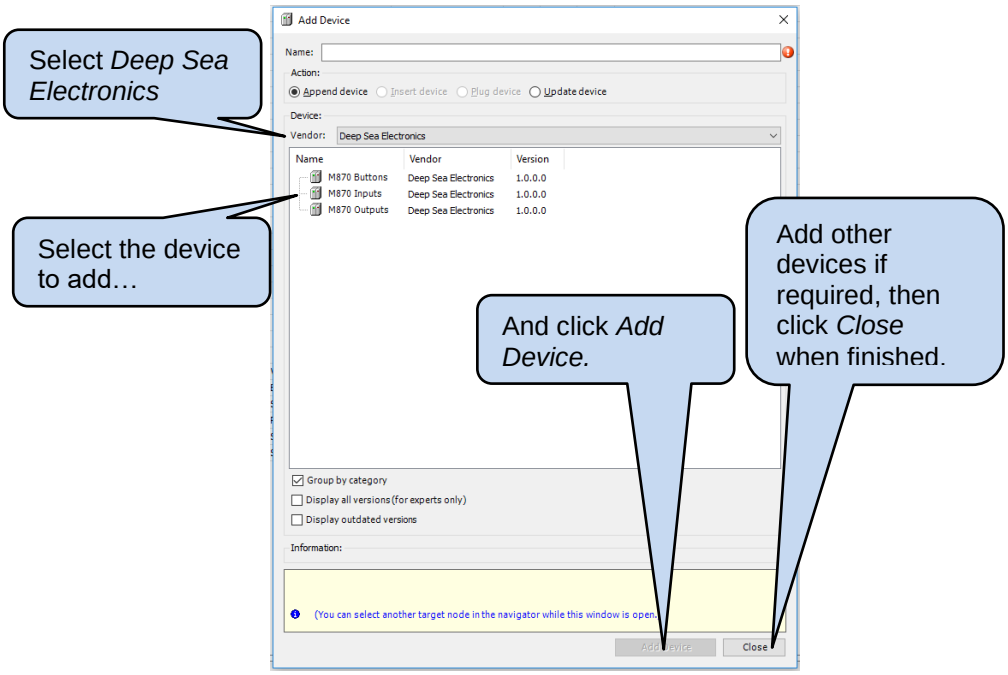
Device Settings Parameters
Device Settings I/O Mapping
Status
Information

Channels

Variable	Mapping	Channel	Address	Type	Unit	Description
		Device Error Code	%IW0	UINT		Error Code: Check Manual for more information
		Device Temperature	%ID1	REAL	°C	Value of the Device Temperature
		Battery Voltage	%IW4	INT	mV	Battery Voltage
		Supply Voltage 1	%IW5	INT	mV	Supply Voltage 1
		Ignition Switch	%IX12.0	BIT		Ignition Switch
		Voltage Reference	%IW7	INT	mV	Voltage Reference
		LightSensor	%IW8	UINT	%	LightSensor
		Backlight	%QW0	UINT		Backlight Level
		Keyboard Backlight	%QW1	UINT		Keyboard Backlight Level
		LED	%QB4			LED Configuration
		LED Colour	%QB4	Enum...		Colour of the LED when Blinking
		LED Frequency	%QB5	Enum...		LED blinking Frequency
		M870 Camera	%QD3			Camera Settings
		Input Channel	%QB12	USINT		0 or 1 to select between Channels
		Contrast Setting	%QB13	USINT		0 to 255
		Brightness Setting	%QB14	USINT		0 to 255
		Hue Setting	%QB15	USINT		0 to 255
		Internal Mode	%QB16	USINT		0 for Overlay, 1 for Background (Overlay mode ...
		Screen Rotation	%QB17	Enum...		Screen Rotation
		Overlay x position	%QW9	UINT		Left hand position of Overlay Image
		Overlay y position	%QW10	UINT		Top position of Overlay Image
		Overlay Width	%QW11	UINT		Width of Overlay Image
		Overlay Height	%QW12	UINT		Height of Overlay Image
		Transparency Colour	%QD7	UDINT		Colour in non-transparency image to make tran...
		Enable Overlay	%QB32	Enum...		Display Overlay Image
		Overlay Filename	%QB33	STRING		Overlay Image Filename (png, jpg, bmp)

5.5 ADD INPUTS, OUTPUTS AND BUTTONS TO THE PROJECT





5.5.1 BUTTONS AND ROTARY ENCODER

NOTE: F10 is not fitted to DSEM870. In its place is fitted the Encoder Button (F11) and Rotary Encoder (F12).

5.5.1.1 BUTTON LOCATION

5.5.1.2 BUTTON POSITION ON THE VISUALISATION

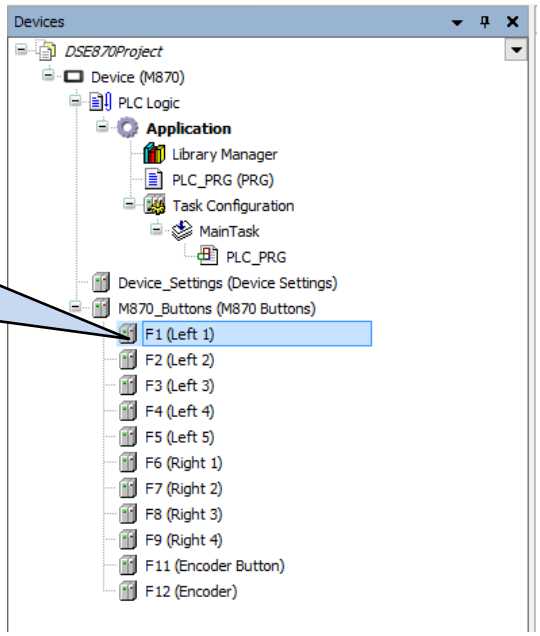
To aid positioning of icons on the visualisation, the vertical position of the centre of each button is as follows.

Button	Pixel Position From Top of Display
F1 & F6 (centre)	30
F2 & F7 (centre)	130
F3 & F8 (centre)	230
F4 & F9 (centre)	330
F5 (centre)	430
F11 & F12 (top)	430

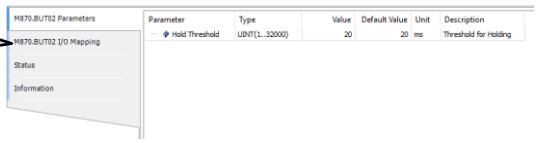
5.5.1.3 BUTTON SETTINGS (F1 TO F11)

NOTE: F10 is not fitted to DSEM870. In its place is fitted the Encoder Button (F11) and Rotary Encoder (F12).

Double-Click the Button to configure the *Hold Time* and variable mappings.

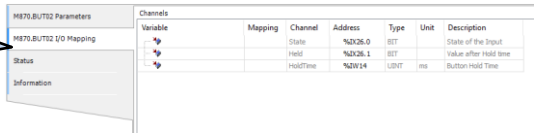


Click *Parameters* to edit the *Hold Threshold*



Parameter	Description
Hold Threshold	Amount of time (in milliseconds) that the button must be pressed before it is considered 'held down'.

Click *Mapping* to view and edit the variable mapping.

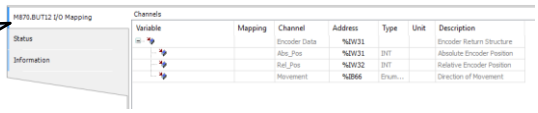


Parameter	Description
State	Indicates if the button is pressed (1) or not pressed (0).
Held	Indicates if the button has been held for longer than the duration of the *Hold Threshold* (1) or not (0).
Hold Time	The amount of time (in milliseconds) that the button has been pressed for (zero if not currently pressed).

5.5.1.4 ROTARY ENCODER (F12)

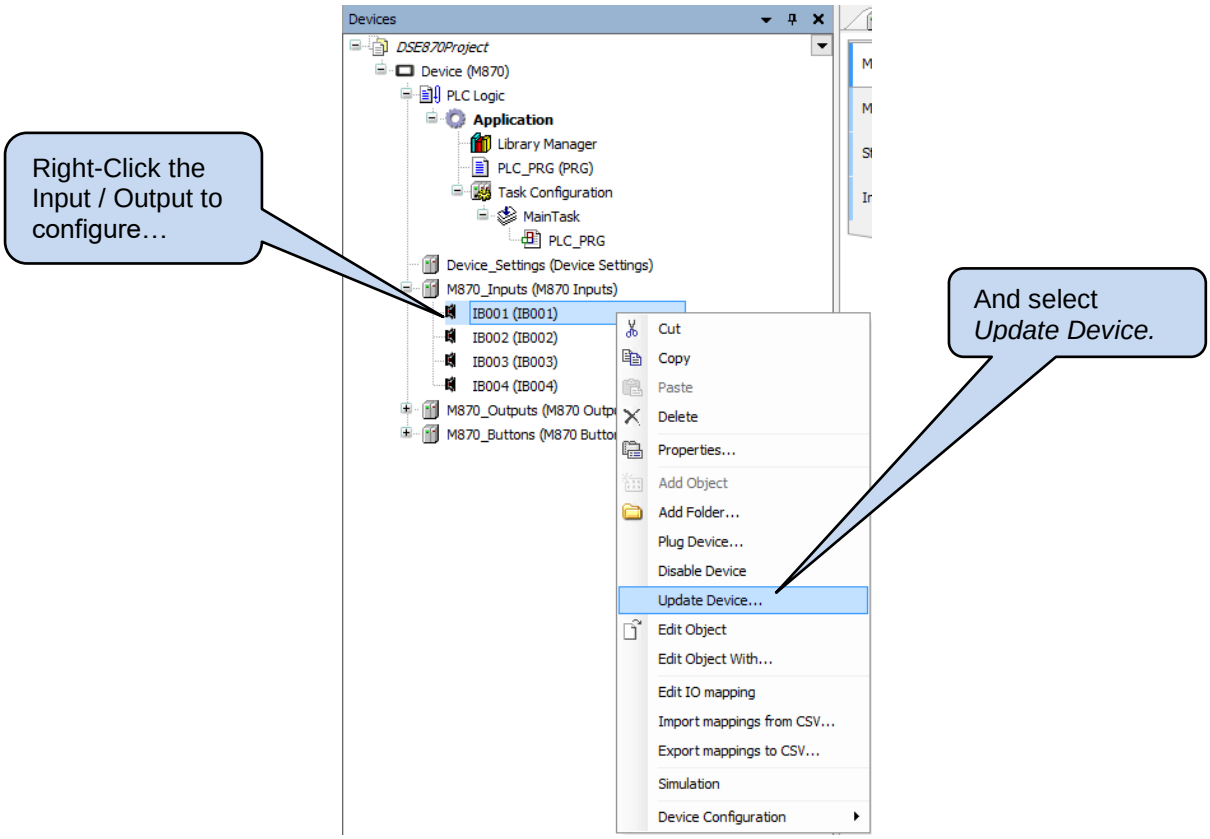
The rotary encoder may be turned to make selections and adjust values.

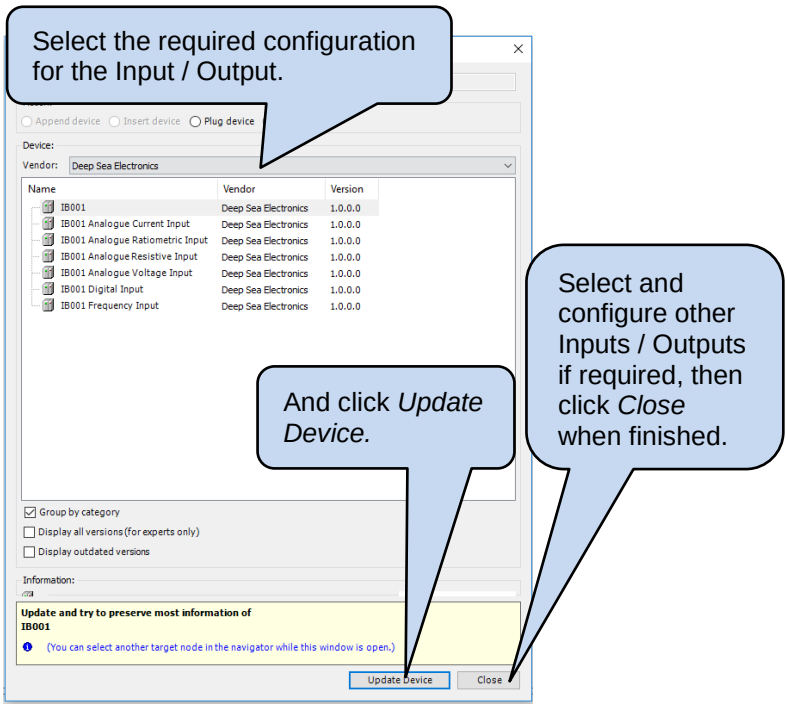
Click *Mapping* to view and edit the variable mapping.



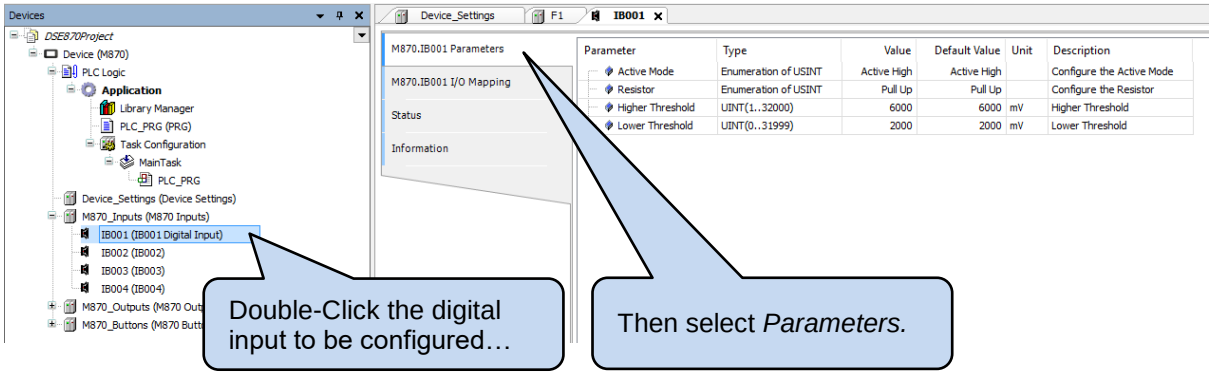
Parameter	Description
Abs_Pos	The absolute position of the encoder. Increases with Clockwise rotation, Decreases with Anti-Clockwise rotation.
Rel_Pos	The relative position of the encoder. Increases with Clockwise rotation, Decreases with Anti-Clockwise rotation.
Movement	***0:*** Indicates that the rotary encoder is not being rotated. ***1:*** Indicates that the rotary encoder is being rotated Clockwise. ***2:*** Indicates that the rotary encoder is being rotated Anti-Clockwise.

5.5.2 INPUTS AND OUTPUTS





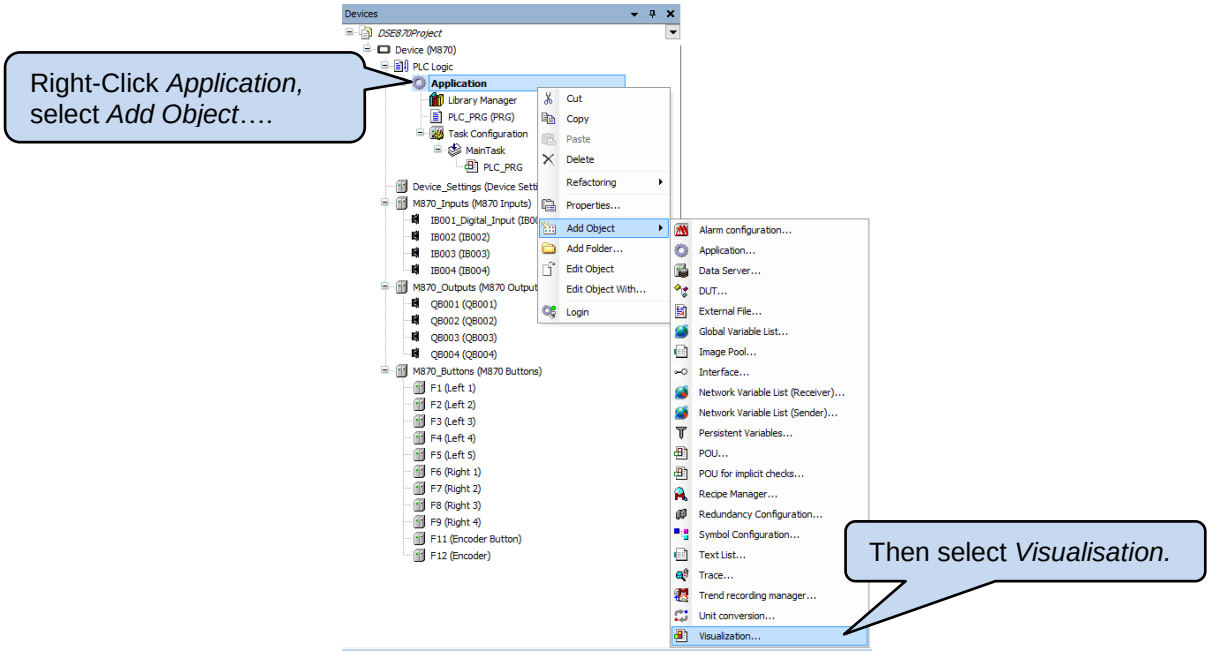
5.5.3 DIGITAL INPUT PARAMETER CONFIGURATION

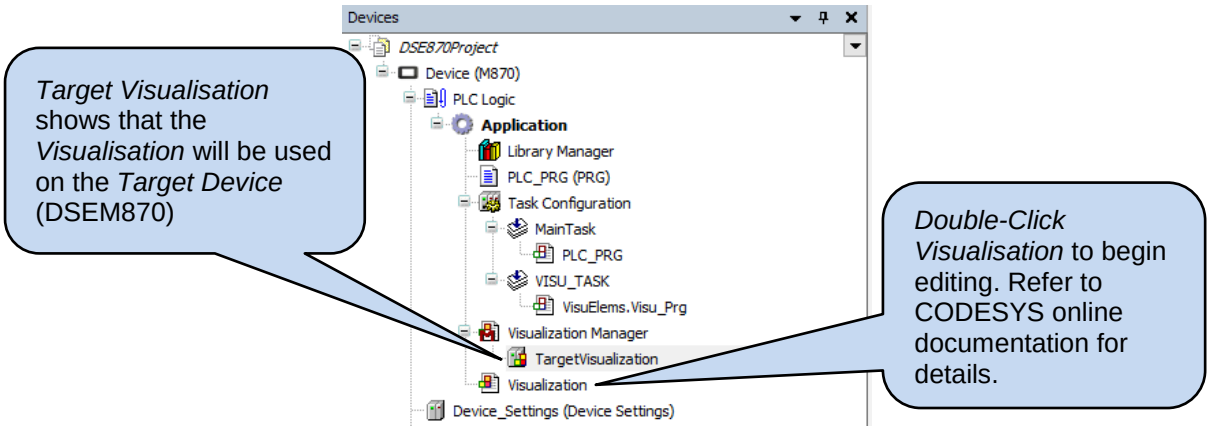


Parameter	Description
Active Mode	***Active High***: The input connects to the positive supply rail when activated. ***Active Low***: The input connects to the negative supply rail when activated.
Resistor	***Float***: The input is floating when no connection is made. Commonly used with PNP (Sourcing) type switched sensors. ***Pull Up***: An internal pull up resistor biases the input to the positive supply rail when no connection is made. Commonly used with NPN (Sinking) type switched sensors and volt-free contacts. ***Pull Down***: An internal pull down resistor biases the input to the negative supply rail when no connection is made. Commonly used with volt-free contacts.
Higher Threshold	For *Active High* inputs, the input is detected as being active when above this threshold with respect to the negative supply rail.
Lower Threshold	For *Active Low* inputs, the input is detected as being active when below this threshold with respect to the negative supply rail.

5.6 USING THE DISPLAY IN THE PROJECT

CODESYS 3.5 includes the facility to design and manipulate the LCD of the device. While the operation of the CODESYS environment is detailed within the CODESYS online document, this section provides a quick-start guide to using the *Visualisation* component of CODESYS 3.5.

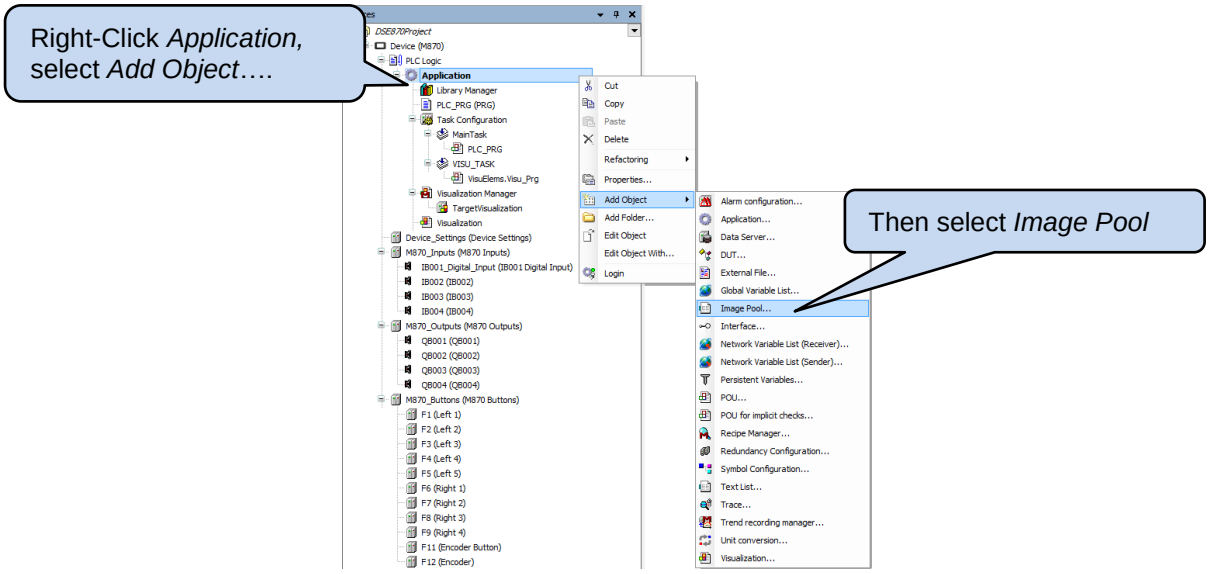




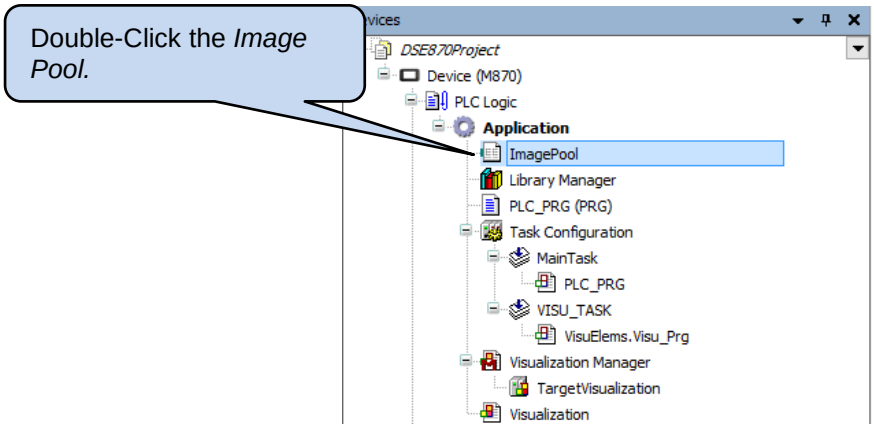
5.6.1 USING CUSTOM IMAGES ON THE DISPLAY

Many applications require custom images to be placed on the M870 display. This is controlled using an *Image Pool* within CODESYS. The Image Pool acts as a container for the images, which are then selected for display.

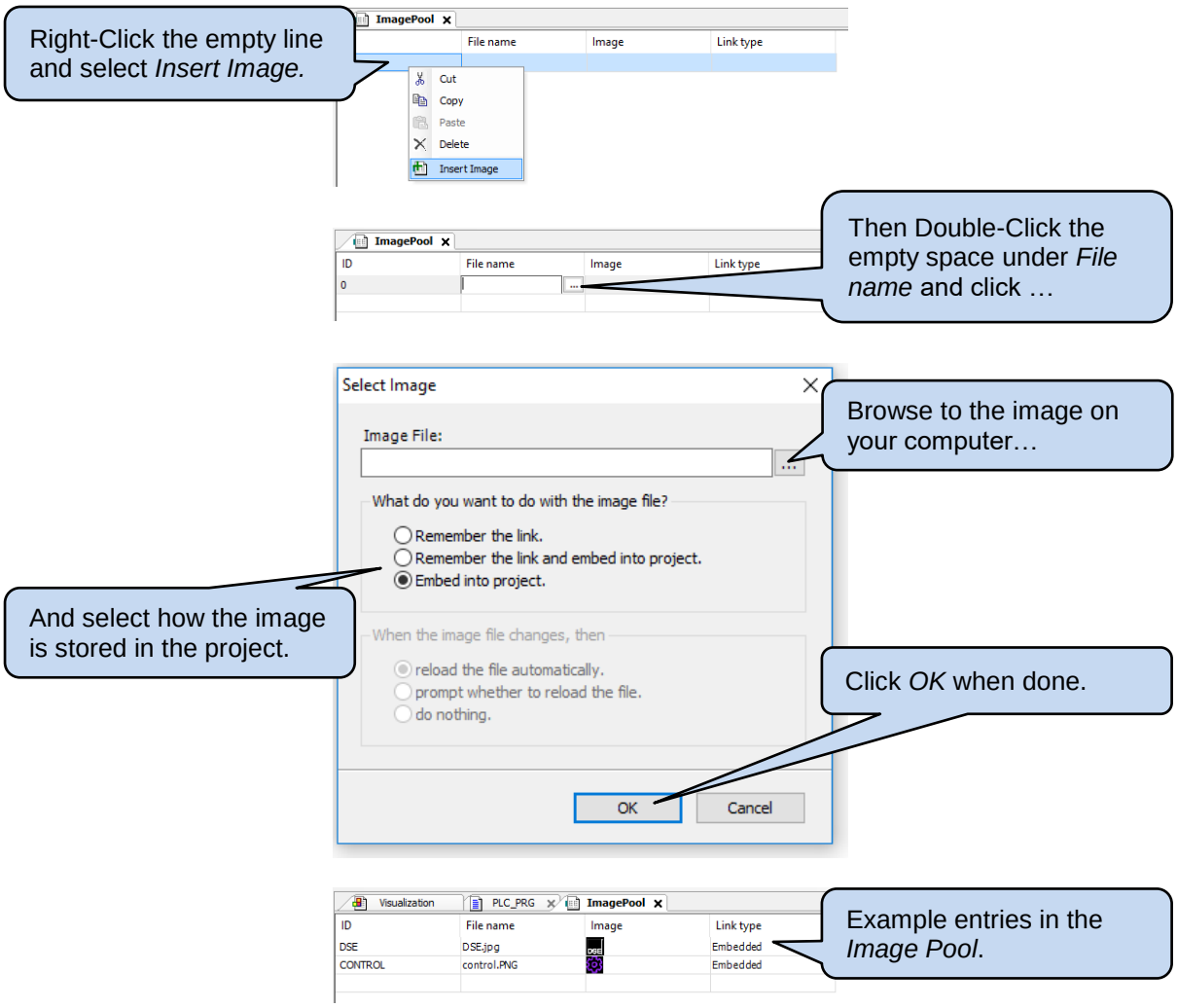
5.6.1.1 ADDING AN IMAGE POOL



5.6.1.2 ADDING IMAGES TO THE IMAGE POOL

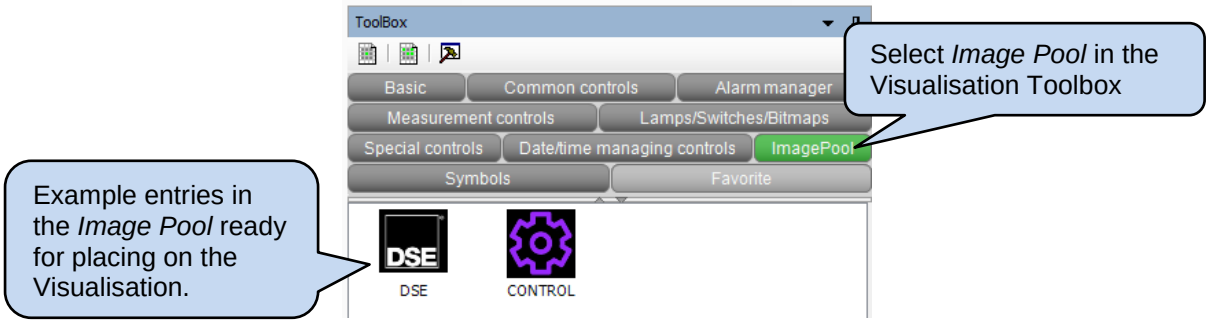


Continued overleaf…



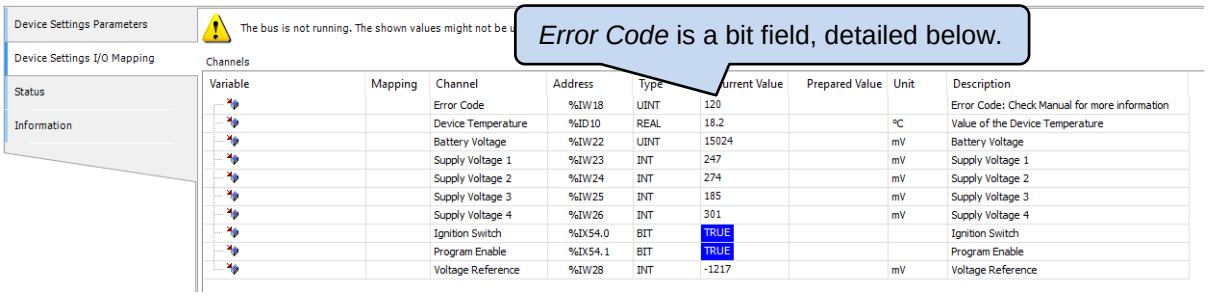
5.6.1.3 USING THE IMAGE POOL ON THE DISPLAY

Entries within the Image Pool are automatically detected by the CODESYS Visualisation Toolbox and are available for placing on the Visualisation.



6 M870 CODESYS ERROR CODES

DSEM870 returns error codes to CODESYS when appropriate. Individual bits are set within the returned value to indicate one or more error conditions. This can be mapped to a variable if required and is available to view within CODESYS under the *Device Settings I/O Mapping* as shown below.



Variable	Mapping	Channel	Address	Type	Current Value	Prepared Value	Unit	Description
		Error Code	%IW18	UINT	120			Error Code: Check Manual for more information
		Device Temperature	%ID10	REAL	18.2		°C	Value of the Device Temperature
		Battery Voltage	%IW22	UINT	15024		mV	Battery Voltage
		Supply Voltage 1	%IW23	INT	247		mV	Supply Voltage 1
		Supply Voltage 2	%IW24	INT	274		mV	Supply Voltage 2
		Supply Voltage 3	%IW25	INT	185		mV	Supply Voltage 3
		Supply Voltage 4	%IW26	INT	301		mV	Supply Voltage 4
		Ignition Switch	%IX54.0	BIT	TRUE			Ignition Switch
		Program Enable	%IX54.1	BIT	TRUE			Program Enable
		Voltage Reference	%IW28	INT	-1217		mV	Voltage Reference

Examples:

A *Device* error value of 120 (01111000 in binary) indicates that all four *Output Supplies* are *Under Voltage.*

A *Device* error value of 2 (00000010 in binary) indicates *Over Temperature.*

6.1 DEVICE

MSB 8	7	6	5	Bit 4	3	2	LSB 1
Output Reference Outside Limits	Under Voltage Output Supply 4	Under Voltage Output Supply 3	Under Voltage Output Supply 2	Under Voltage Output Supply 1	Under Voltage Supply	Over Temperature	Error

6.2 ANALOGUE INPUTS

Input Configuration	MSB 8	7	6	Bit 5	4	3	2	LSB 1
Digital	Invalid Parameter	Reserved	Reserved	Invalid Threshold	Reserved	Reserved	Reserved	Error
Voltage	Invalid Parameter	Reserved	Reserved	Reserved	Reserved	Over Range	Inverted Input (<10 mV)	Error
Current	Invalid Parameter	Reserved	Reserved	Reserved	Reserved	Over Range	Wire Break (<4 mA)	Error
Resistance	Invalid Parameter	Reserved	Reserved	Reserved	Reserved	Over Range	Reserved	Error
Ratiometric	Invalid Parameter	Reserved	Invalid Reference	Reserved	Reserved	Over Range	Reserved	Error

6.3 DIGITAL INPUTS

Input Configuration	MSB 8	7	6	5	4	3	2	LSB 1
	Bit							
Digital	Invalid Parameter	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Error
Frequency	Invalid Parameter	Reserved	Reserved	Reserved	Reserved	Freq Over Range	Reserved	Error

6.4 DIGITAL OUTPUTS

Output Configuration	MSB 8	7	6	5	4	3	2	LSB 1
	Bit							
Digital	Invalid Parameter	Reserved	Reserved	Reserved	Reserved	Over Current	Wire Break (Config)	Error

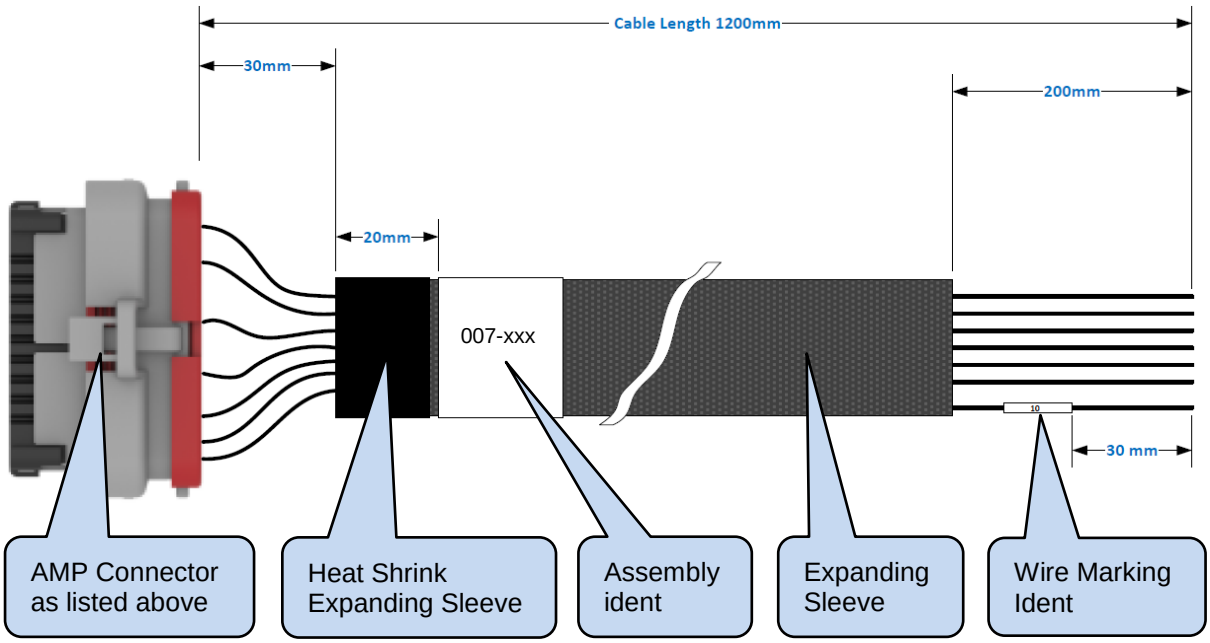
7 CABLES, CONNECTORS, HARNESSES AND SPARE PARTS

Description	DSE Part	Manufacturer Part	Manufacturer
M870 Connector Kit (Set of 2)	007-850	DT16-18SA-K004 DT16-18SC-K004	TE / Deutsch
Connector Pin Crimp (0.5 mm² to 1.0 mm²)	N/A	0462-201-16	TE
Connector Pin Crimp (2 mm²)		0462-209-16	TE
M870 Connector Harness Kit (Set of 2)	016-167	N/A	DSE
M12 to Ethernet Cable	016-160	VS-M12MS-IP20-93R-L1/2	Phoenix
M12 to USB Cable	016-161	N/A	DSE
Belden 9841 (CAN Cable)	016-030	9841	Belden
Panel Mounting Sealing Gasket	020-579	N/A	DSE

7.1 M870 CONNECTOR HARNESS KIT (016-167)

DSE Part 016-167 consists of two cables as listed below. Connectors are fitted at one end, with cable marking to identify the wires at the other end.

	Connector A	Connector B
Assembly Ident	007-850	007-851
AMP Connector	DT16-18SA-K004	DT16-18SC-K004
No of Connections	18	18
Wire size	0.5 mm² (AWG 20)	0.5 mm² (AWG 20)
Wire Colour	Black	Black
Wire Idents	1 to 18	1 to 18
Connector Pin Crimp (0.5 mm² to 1.0 mm²)	0462-201-16	0462-201-16
Connector Pin Crimp (2 mm²)	0462-209-16	0462-209-16



8 MAINTENANCE AND WARRANTY

The device is *Fit and Forget*. As such, there are no user serviceable parts within the controller.
In the case of malfunction, you should contact your original equipment manufacturer (OEM).

DSE Provides limited warranty to the equipment purchaser at the point of sale. For full details of any applicable warranty, refer to the original equipment supplier (OEM).

9 DISPOSAL

9.1 WEEE (WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT)

If you use electrical and electronic equipment you must store, collect, treat, recycle and dispose of WEEE separately from your other waste

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