

Operator Manual

ehb SMARTdisplay 840

Version 3.0



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ehb SMARTdisplay 840 Operator Manual

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1 INTRODUCTION

This document details the operation and setup requirements of the ehb SMARTdisplay 840.

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*. ehb do not automatically inform on updates. Any future updates of this document are included on the ehb website at www.ehb-electronics.de.

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 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 ehb 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 ehb SMARTdisplay 840 to control the machine it is connected to. The Application within the ehb SMARTdisplay 840 is designed and provided by the manufacturer of the complete machine.
Bootloader	The Bootloader is the program within the ehb SMARTdisplay 840 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. ehb SMARTdisplay 840 supports CODESYS V3.5
Servicetool	Software used to load packages to the ehb SMARTdisplay Series devices.
ECU	Electronic Control Unit. For example the ehb SMARTdisplay 840 device.
Firmware	The Firmware of the ehb SMARTdisplay 840 is the Operating System of the ehb SMARTdisplay 840 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 IA003 means Input 3 on Connector A.
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 QA002 means Output 2 on Connector C.

1.3 RELATED INFORMATION

This document refers to, and is referred by the following ehb publications which are obtained from the ehb website www.ehb-electronics.de or by contacting ehb technical support.

1.3.1 TECHNICAL INFORMATION

ehb Part	Description
./.	ehb SMARTdisplay 840 Datasheet
./.	ehb SMARTdisplay 840 Installation Instructions

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 ehb. 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 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 ehb Part Numbers.
- To maintain IP67 rating where a connector is completely unused, ensure the use of a suitable blanking insert as recommended by the connector manufacturer.
- To maintain IP67 rating where connectors have unused pins, ensure the use of a suitable blanking insert as recommended by the connector manufacturer.
- 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.

2 SPECIFICATIONS

2.1 PROCESSOR

Description	Specification
STM32H745 dual core	M7 & M4
Speed	M7 @ 400 MHz M4 @ 200 MHz

2.2 MEMORY

Description	Specification
Flash	32 MB Total 20 MB Available to CODESYS
RAM	64 MB Total 48 MB Available to CODESYS
Retained Data	8 kB, Data Written to Non-Volatile memory at 1 Hz rate
System Event Log	2 MB Configurable on/off


2.3 DC SUPPLY


Description	Specification
Operating Voltage (Pin A7)	8 V to 32 V Operation to 5 V for 500 ms providing supply was 5 V previously. Protection to 55 V for 200 ms
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)	<0.1 mA at 24 V

2.3.1 FUSING

Description	Specification
DC Supply (Pin A7) Supplies ehb SMARTdisplay 840 and High Current Outputs Fuse as Required by Output Loads (Pins A2, A3, A4, A5)	3 A Min (to supply SD840) 10 A Max.
Ignition (15) (Pin A13)	1 A Max

2.3.2 IGNITION (PIN A13)

 NOTE: Ignition (Pin A13) must be utilised correctly to enable / disable the application program. This ensures that <i>Persistent Variables</i> (e.g. <i>logs</i> and other changed parameters) and other files are saved correctly. Incorrect device shutdown while using the file system may result in loss of Application Program.

 NOTE: Should it be required to perform a programmatic shutdown some time after removal of <i>Ignition</i> , see section entitled <i>Manual Shutdown</i> elsewhere in this document.
--

Specifications

Pin A7 is used to give a constant DC supply to the ehb SMARTdisplay 840, with the ignition pin being used to energise and de-energise the ECU. Typically, this pin is controlled by an external ignition switch.

To stop the application, de-energise the Ignition pin. This allows the ehb SMARTdisplay 840 to store any changed parameters and logs before closing down.

Description	Specification
Ignition Pin Active	>5 V

2.4 ENVIRONMENTAL

Description	Specification
Operating Temperature	-30 °C to +70 °C
Storage Temperature	-40 °C to +80 °C
Degrees of Protection Provided by Enclosure (With All Mating Connectors Fitted)	IP67

2.5 USER INTERFACE

2.5.1 CONTROLS

Description	Specification
Push Buttons	14

2.5.2 DISPLAY

Description	Specification
Size (Across Diagonal)	109 mm
Size (W x H)	WQVGA (480 x 272)
Aspect Ratio	16:9
Type	Optically Bonded TFT
Lifetime	> 30,000 hours
Colour	24 bit
Splash Screen Image Type	Uncompressed Bitmap Image (BMP) 24 bit Colour 480 x 272 Spaces are not permitted within the image filename.

2.5.3 LED

The system LED is used to indicate operating status.

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

Colour	Operation	State	Meaning
Off	N/A	Off	Device not powered
Green	Static	Application Stopped.	Unit powered up, Application program loaded but not running
	1Hz flash	Application Running.	Unit powered up, Application program loaded and running
	5Hz flash	No Application.	Unit powered up, but no Application program loaded
Amber	Static	Bootloader Mode	Bootloader functioning normally, firmware present
		Firmware Start-up	Firmware is at Start-up.
		Application Exception	Unit Stopped due a serious fault.
	1Hz flash	Decrypting Image	Bootloader is decrypting the downloaded image
	5Hz flash	Reading Image from USB	Bootloader is reading an image from the USB
Red	Static	Fatal Error	Fatal system / hardware fault – LED may be driven directly by microcontroller error pin or firmware is in fault condition state.
	1Hz flash	Faulty Application Running	Unit running with a serious fault, see CODESYS error flags or Web Tool

2.6 REAL TIME CLOCK

Description	Specification
Retention Type	Standard RTC.
Retention Time (Approx.)	5 years

2.7 INPUTS

2.7.1 DIGITAL INPUTS

2.7.1.1 DIGITAL

Description	Specification
Applicable Pins	Pins A10, A11, A16, A17
Minimum Voltage For High Level	Configurable
Maximum Voltage For Low Level	Configurable
Active Mode	Configurable
Whetting Current	Min 1.6 mA

2.7.1.2 FREQUENCY

Description	Specification
Applicable Pins	Pins A10, A11, A16, A17
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)	>2.4 V
Maximum Voltage For Low Level (Space)	<0.9 V

2.7.2 ANALOGUE INPUTS

Description	Specification
Applicable Pins	Pins A10, A11, A16, A17
Reference Voltage Pins	A6
Reference Voltage	Programmable 0 V / 5 V / 10 V ±500 mV

2.7.2.1 VOLTAGE

Description	Specification
Applicable Pins	Pins A10, A11, A16, A17
Configurable Ranges	0 V to 5 V 0 V to 10 V 0 V to 32 V
Input Resistance	>=7.5 kΩ
Sampling Rate	500 Hz
Resolution	12 bits
Accuracy	± 1% FSD

Specifications

2.7.2.2 CURRENT

Description	Specification
Applicable Pins	Pins A10, A11, A16, A17
Configurable Ranges	0 mA to 20 mA 4 mA to 20 mA
Input Type	Current sink only
Input Sink Resistance	150 Ω \pm 1%
Sampling Rate	500 Hz
Resolution	12 bits
Accuracy (\pm 1 % Full Scale Deflection)	\pm 1% FSD

2.7.2.3 RESISTIVE

Description	Specification
Applicable Pins	Pins A10, A11, A16, A17
Measurement Range	0 Ω to 3400 Ω
Measurement Source Voltage	12 V maximum
Measurement Source Current	1 mA
Sampling Rate	500 Hz
Resolution	12 bits
Accuracy (\pm 1 % Full Scale Deflection)	\pm 1% FSD

2.7.2.4 RATIOMETRIC

Description	Specification
Applicable Pins	Pins A10, A11, A16, A17
Measurement Voltage Reference	Supply / Vref
Measurement Type	Ratio of input Pin to Reference
Resolution	12 bits
Accuracy (\pm 1 % Full Scale Deflection)	\pm 1% FSD

2.8 OUTPUTS

2.8.1 NEGATIVE SWITCHING

Description	Specification
Applicable Pins	Pins A2, A3, A4, A5
Maximum Current	1 A selectable
Digital Output Active Low 'ON' State Maximum Voltage at Rated Current	< 100 mV
Digital Output Active Low 'OFF' State Leakage Current	<120 μ A at 24 V output supply

2.8.2 POSITIVE SWITCHING

Description	Specification
Applicable Pins	Pins A2, A3, A4, A5
Maximum Current	1 A selectable
Digital Output Active Low 'ON' State Maximum Voltage at Rated Current	<100 mV
High Side Digital Output Active Low 'OFF' State Leakage Current	<10 μ A at 24 V output supply
Low Side Digital Output Active Low 'OFF' State Leakage Current	<2 mA at 24 V output supply

2.8.3 VREF

Configurable output voltage suitable for supply external circuits such as input sensors.

Description	Specification
Applicable Pins	Pin A6
Voltage	Configurable (Disabled, 5 V, 10 V)
Accuracy Under Load	1 %
Maximum Source Current	100 mA
OFF State Leakage Current	< 100 μ A

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.

Description	Specification
Number of CAN Interfaces	2
Supported Protocols	J1939 CAN open Raw CAN
Supported Baud Rates	50 kbit/s, 100 kbit/s, 125 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

2.10 CAMERA INPUTS

Description	Specification
Number of Camera Inputs	1
Connection Pins	A12 (signal), A18 (gnd).
Interface Type	Analogue (Composite) Video for PAL / NTSC

2.11 APPLICABLE STANDARDS

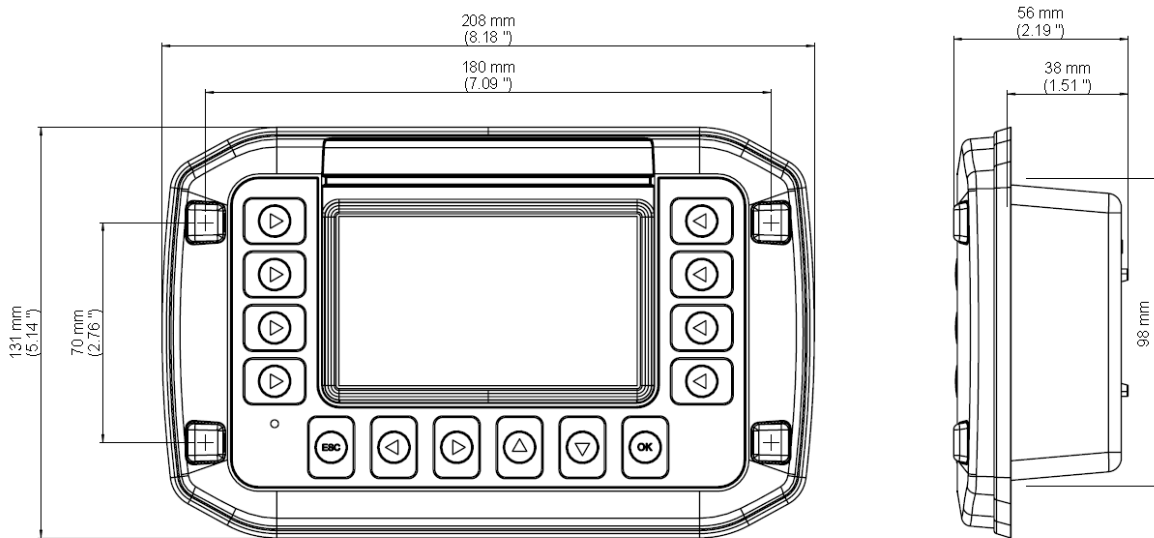
Category	Description	Standard
CE marking	Electromagnetic compatibility (EMC) noise immunity Electromagnetic compatibility (EMC) emission standard Safety of information technology equipment, general requirements	EN 61000-6-2 EN 61000-6-4
E11 PENDING	EMC requirements for vehicles Noise immunity with 100 V/m	UN/ECE-R10.05 ISO 11452-2
Climatic tests	Damp heat, cyclic upper temperature 55 °C Damp heat, steady state test temperature 40 °C / 93% RH Test duration: 21 days Salt spray test severity level 3 (vehicle)	EN 60068-2-30 EN 60068-2-78 EN 60068-2-52
Mechanical tests	Test VII; vibration, random mounting location: vehicle body. Vibration, sinusoidal 10...500 Hz; 0.73 mm / 10 g: 10 cycles / axis. bumps 30 g / 6 ms; 24,000 shocks	ISO 16750-3 EN 60068-2-6 ISO 16750-3
Load Dump (Not Applicable to DSEM840-01)	151 V (Ri 1 Ω) 202 V (Ri 8 Ω)	ISO 16750-2

3 INSTALLATION

3.1 DIMENSIONS AND MOUNTING

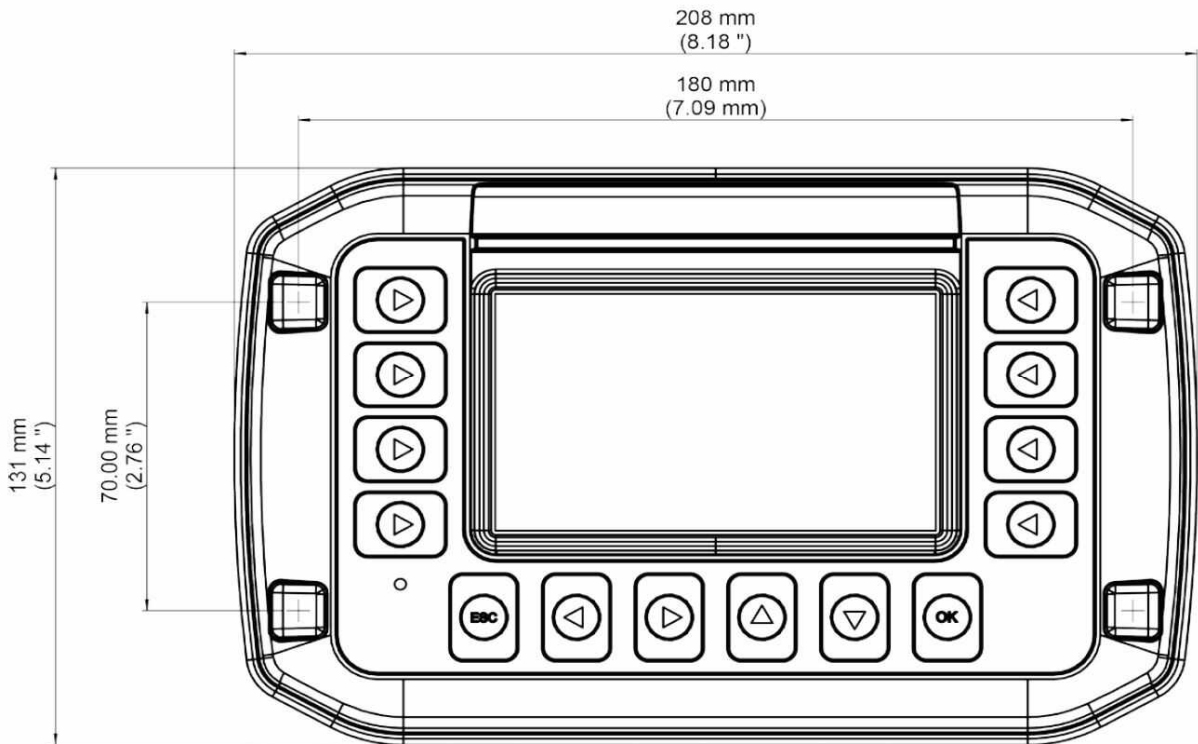
3.1.1 DIMENSIONS

Description	Specification
Overall Dimensions (Height x Width x Depth)	208 mm x 131 mm x 56 mm
Mounting Type	4 x mounting bolts or RAM mount.
Overall Weight	<1 kg



3.1.2 FASCIA MOUNTING

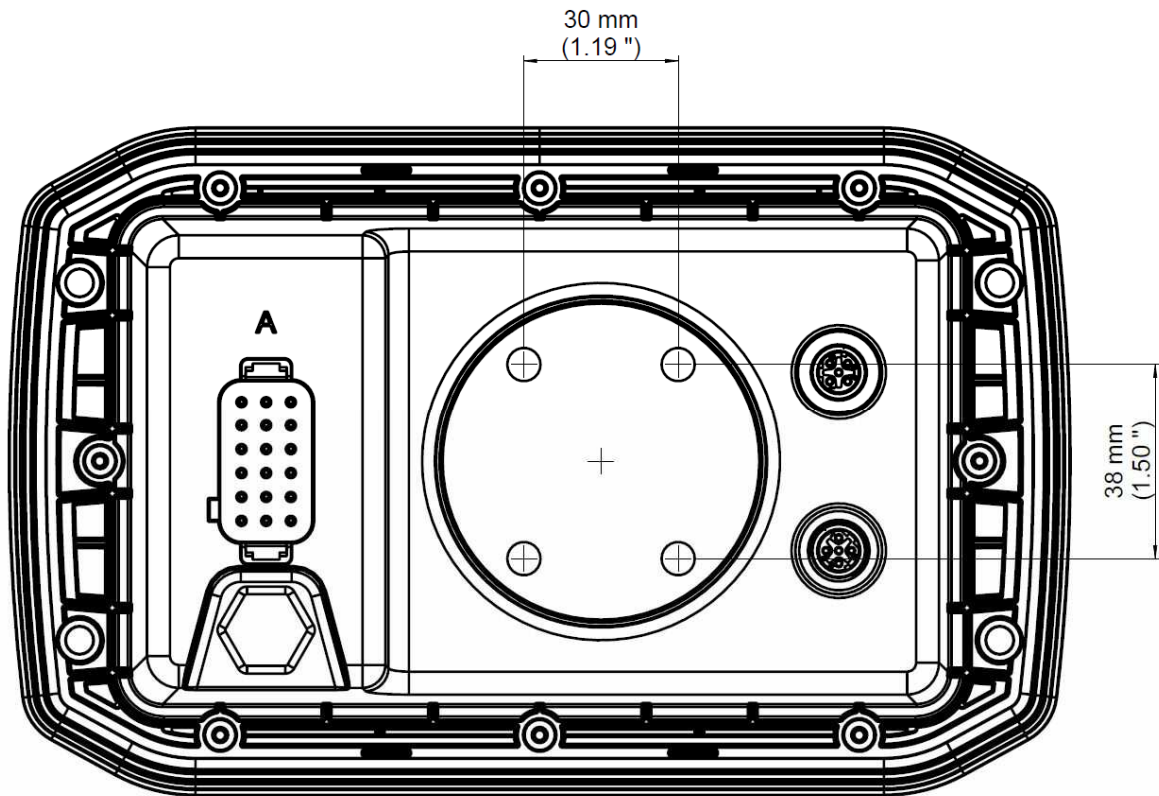
Description	Specification
Fascia Mounting Holes	Suitable for M5 bolts
Fascia Mounting Hole Centres	180 mm x 70 mm See Diagram Below
Panel Cut-Out	163 mm x 98 mm
Fascia Mounting Bolt Material Recommendation	Steel or Stainless Steel bolts fitted with M5 bonded seal washers (also known as Dowty washers).
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



3.1.3 RAM MOUNTING

ehb SMARTdisplay 840 has four holes on the rear face, suitable for fitting of a RAM type mount. The spacing for the mounting holes is detailed in the image below.

Description	Specification
RAM Mounting Holes	Suitable for M5 bolts
RAM Mounting Hole Centres	30 mm x 38 mm
RAM Mounting Bolt Material Recommendation	Steel or Stainless Steel
RAM Mounting Bolt Tightening Torque	4 Nm Maximum

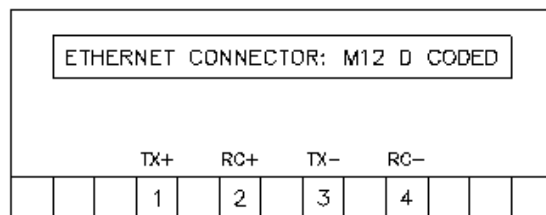
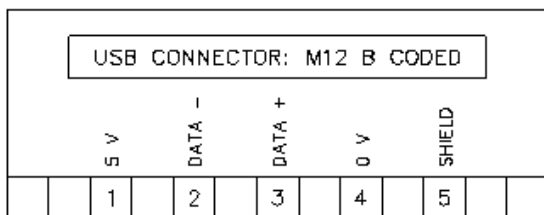
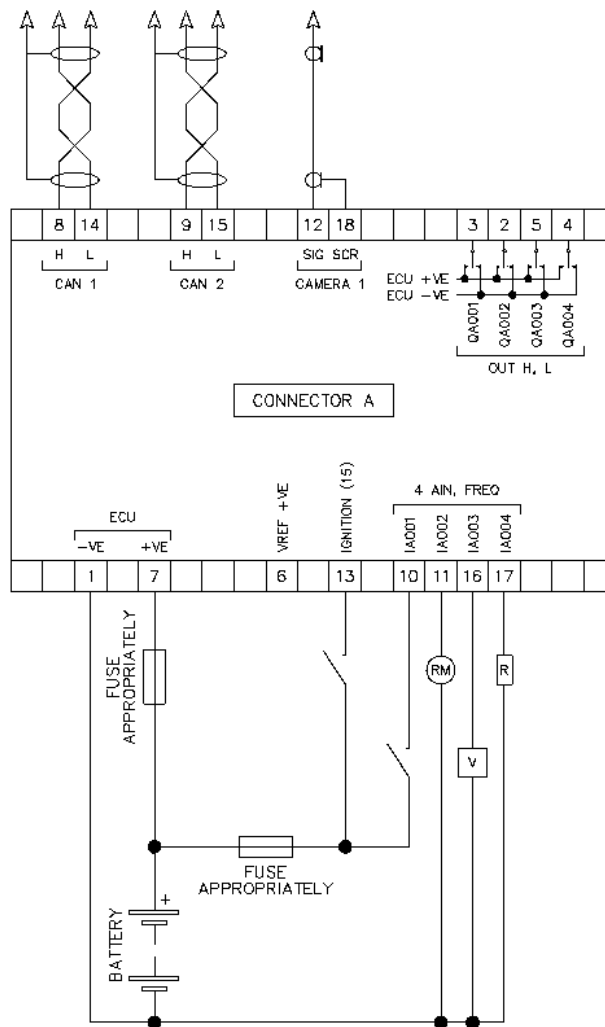


3.2 FUSING

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 ehb SMARTdisplay 840 CPU and Outputs	3 A to 10 A Max
A13	Ignition (15)		1 A Max

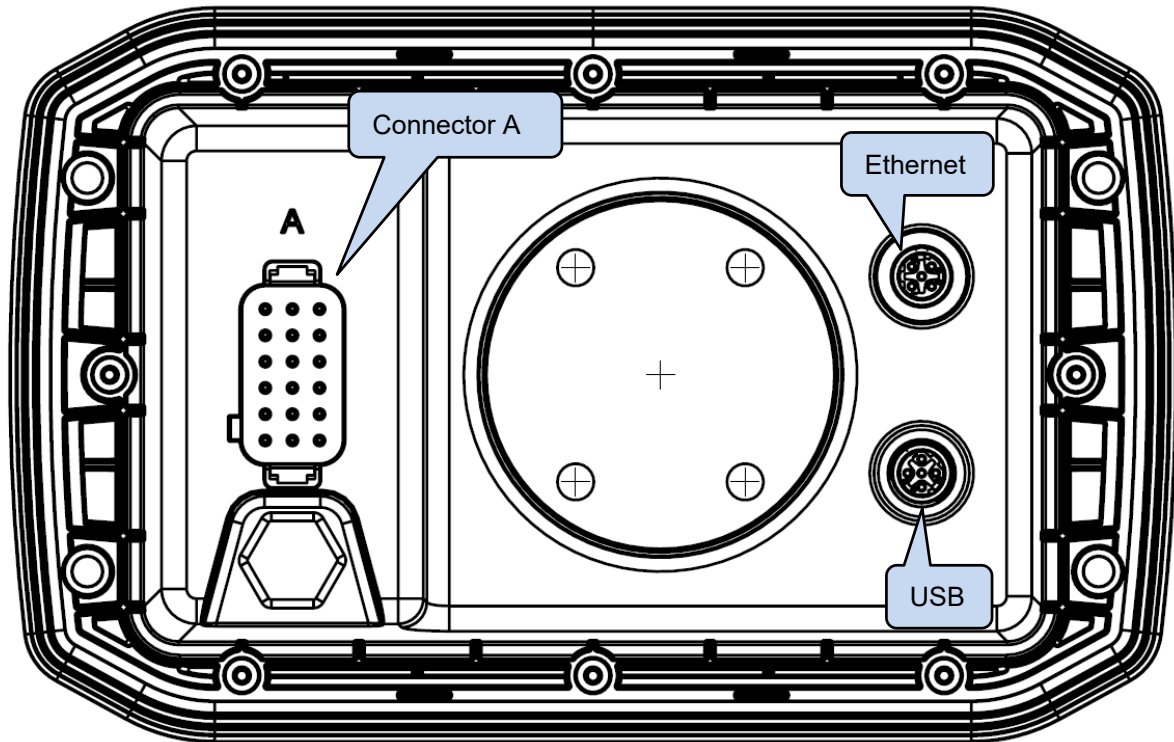
3.3 TYPICAL CONNECTION DIAGRAM



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



3.4.1 CONNECTOR A

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

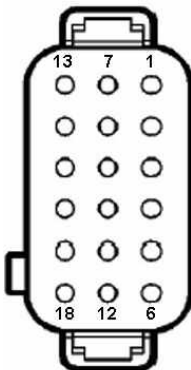
NOTE: Ignition (Pin A13) must be utilised correctly to enable / disable the application program. This ensures that logs and other changed parameters are stored when the Ignition is switched off.

NOTE: Screened 120 Ω impedance cable specified for use with CAN must be used for the CAN links.

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

NOTE: Connect Camera using a single core conductor with screen (shield).

Terminology	Meaning
QA00x	Output
IA00x	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 A	Pin	Description	Comments
<p>(A Coded)</p> 	1	ECU Supply -ve	DC Supply negative for the DSEM840
	2	QA002	OUT H,L
	3	QA001	OUT H,L
	4	QA004	OUT H,L
	5	QA003	OUT H,L
	6	VREF +	VREF output for AIN
	7	ECU Supply +ve	DC Supply positive for the DSEM840
	8	CAN1 H	
	9	CAN2 H	
	10	IA001	AIN, FREQ
	11	IA002	AIN, FREQ
	12	Camera Signal	Analogue (Composite) video
	13	Ignition +ve (15)	Energises the ECU.
	14	CAN1 L	
	15	CAN2 L	
	16	IA003	AIN, FREQ
	17	IA004	AIN, FREQ
	18	Camera GND	Screen/GND for Camera

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 Ignition input with DC power supplied) of the ehb SMARTdisplay 840 . 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
ESC	Return	Return to a previous page.
◀▶▲▼	Navigate	Navigate through the available selections.
OK	OK / Accept	Accept/Edit the current selection, Save the value being edited.

4.1.1.1 PAGE SELECTION

Use the ◀ / ▶ buttons to move through the pages. Press **OK** to select the page. Press **ESC** to exit the editor and return to the main application.



4.1.1.2 OPTION SELECTION AND EDITING

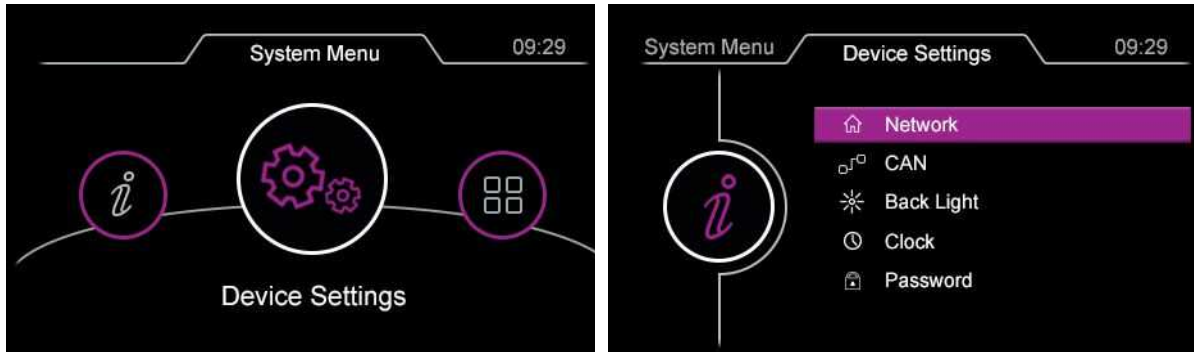
While viewing the selected page, use the ◀ / ▶ buttons to move through the options, Press **OK** to select the option for editing.

While editing the selected parameter, use the ▲ / ▼ buttons to change the value, Press **OK** to save the change.

Press **ESC** to exit the editor.

4.1.2 DEVICE SETTINGS

This section allows access to the *Device Settings*.



4.1.2.1 NETWORK

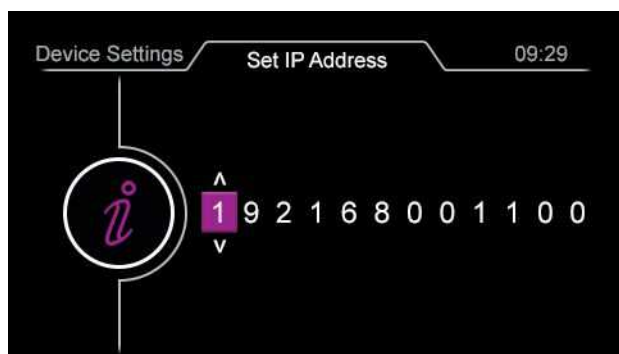
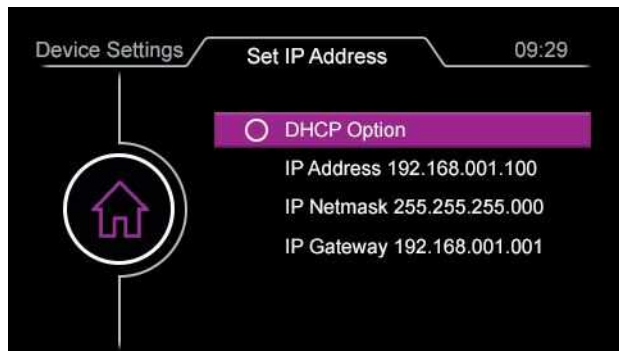
This section allows selection of DHCP or Static IP address.
When connecting the device to a third party network, these settings must be made after consultation with the network manager.

Press **OK** to enable / disable *DHCP Option*.

Selecting *DHCP Option* instructs the device to obtain the network settings automatically from a DHCP server on the connected network. When unselected, the network options are user configured.

Press the **▲** / **▼** buttons to move through the options, Press **OK** to select the option for editing.
Press **ESC** to exit the editor.

While editing the parameter, use **◀** / **▶** buttons to move through the digits, use **▲** / **▼** buttons to change the value of the selected digit. Press **OK** to save the change.
Press **ESC** to exit the editor.

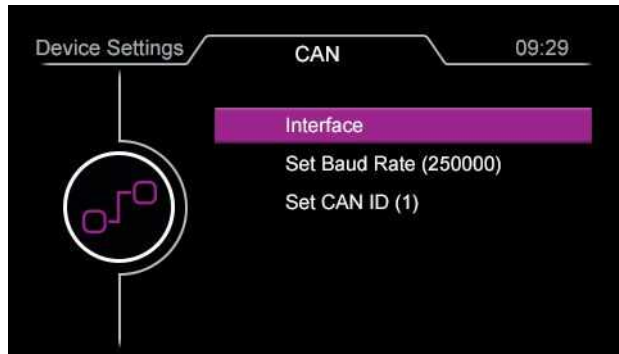


4.1.2.2 CAN

This section allows configuration of the CAN interface parameters.

Press the ▲ / ▼ buttons to move through the options, Press **OK** to select the option for editing.

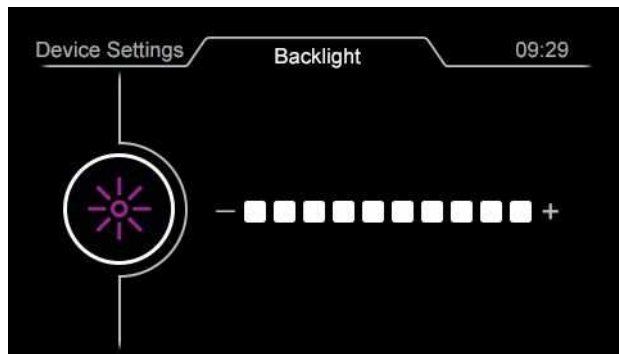
Selecting *Interface* and pressing **OK** cycles between the two CAN ports (0 & 1).



4.1.2.3 BACKLIGHT

This section allows adjustment of the LCD backlight brightness.

Use the ◀ / ▶ buttons to change the brightness, Press **OK** to save the change. Press **ESC** to exit the editor.



4.1.2.4 REAL TIME CLOCK

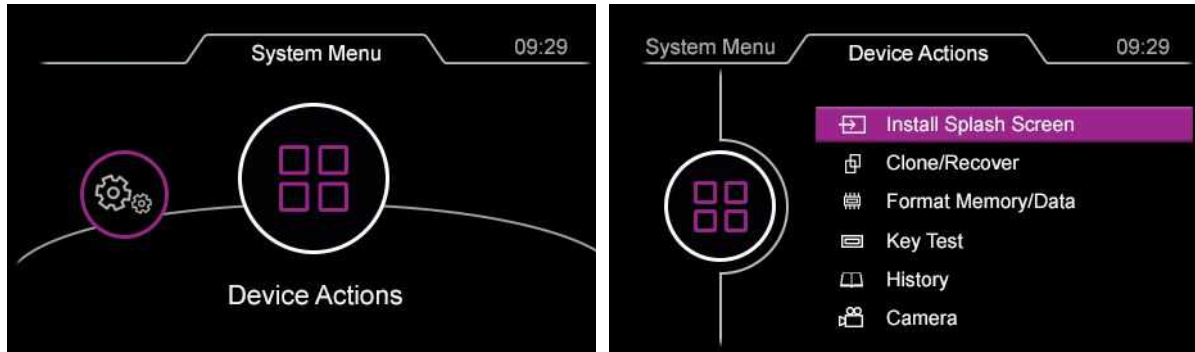
Allows the setting of the Real Time Clock and Calendar.

While editing the parameter, use the ◀ / ▶ buttons to change between fields and ▲ / ▼ buttons to change the highlighted value. Press **OK** to save the change. Press **ESC** to exit the section.



4.1.3 DEVICE ACTIONS

Allows selection of device actions.



4.1.3.1 INSTALL SPLASH SCREEN

ehb SMARTdisplay 840 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.

Supported Splash Screen Image Type:
 Uncompressed Bitmap Image (BMP)
 24-bit Colour
 480 x 272
 Spaces are not permitted within the image filename.



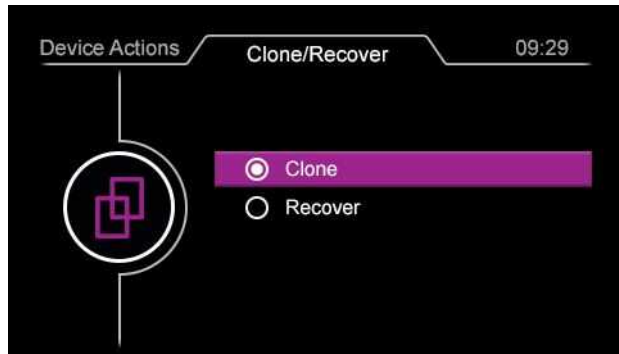
Press **ESC** to exit the section.

Press the ▲ / ▼ buttons to select the required file, Press **OK** to apply it

4.1.3.2 CLONE / RECOVER SELECTION

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

Press the ▲ / ▼ buttons to select the required function, Press **OK** to access it. Press **ESC** to exit the section.



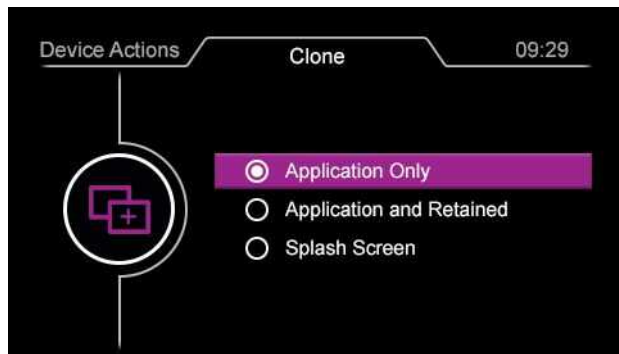
CLONE

NOTE: Max 8 GB USB Memory Device is supported for Clone function.

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.

Press the ▲ / ▼ buttons to select the required section to Clone, Press **OK** to action it.

Ensure the USB device (FAT / FAT32 formatted, Max 8 GB) used to store the Clone file(s) is connected to the controller. Press **ESC** to exit the section.



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.

Ensure the USB device containing the file(s) to Recover is connected to the controller. All applicable files are listed.

Press the ▲ / ▼ buttons to select the required file, Press **OK** to apply it. Press **ESC** to exit the section.



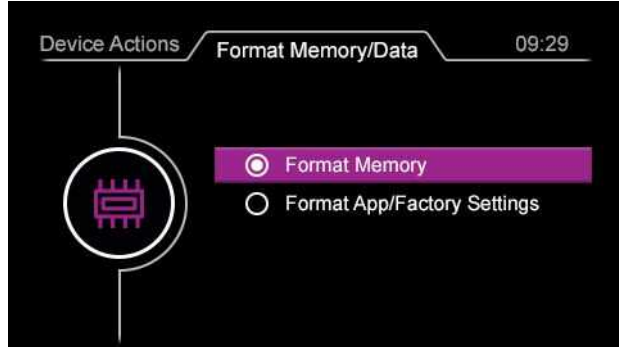
Operation

4.1.3.3 FORMAT MEMORY / DATA

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

Select which memory area to Format.

Press the ▲ / ▼ buttons to select the required function, Press **OK** to access it. Press **ESC** to exit the section.

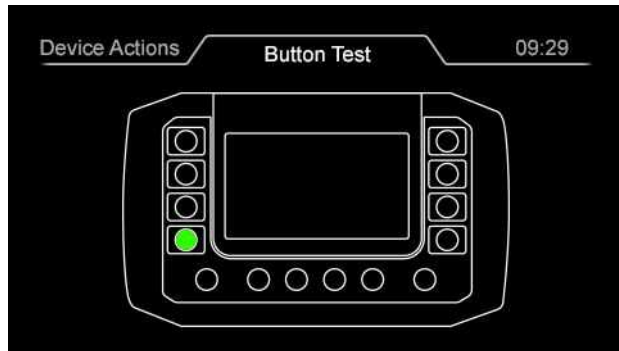


4.1.3.4 KEYTEST

This section allows the device fascia buttons 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.



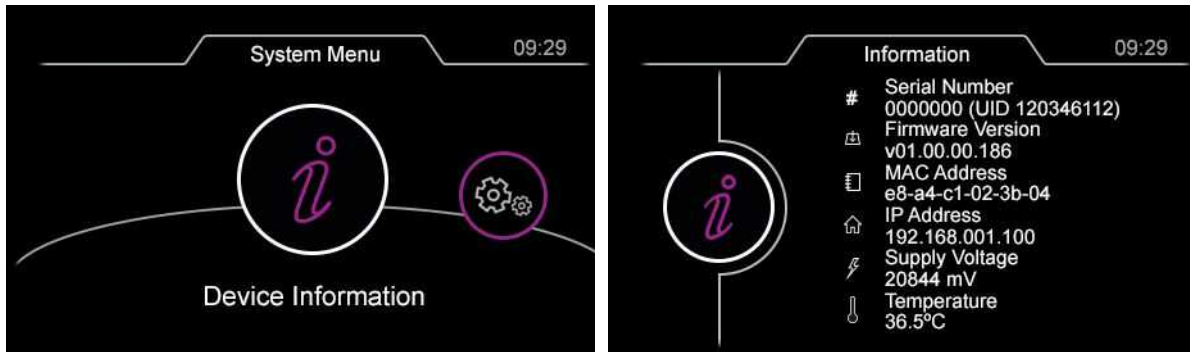
4.1.3.5 HISTORY

Used to display a log of the date of certain actions.
Press **ESC** to exit the section.



4.1.4 DEVICE INFORMATION

This section shows the *Device Information*.



4.2 FIRMWARE UPDATE AND FILE SYSTEM OPERATIONS

▲ NOTE: *Load from USB* process deletes files on the target device and may change the operation of the device.

This section allows new files and firmware to be installed.

- Remove Ignition from the ehb SMARTdisplay 840.
- Press and hold any three buttons. Reapply Ignition until the Boot Menu is displayed. Now release the buttons to enter the Boot Menu.

Press ◀ / ▶ / ▲ / ▼ buttons to select the required option.
Press **OK** to access the selected function.
Press **ESC** to exit the section.

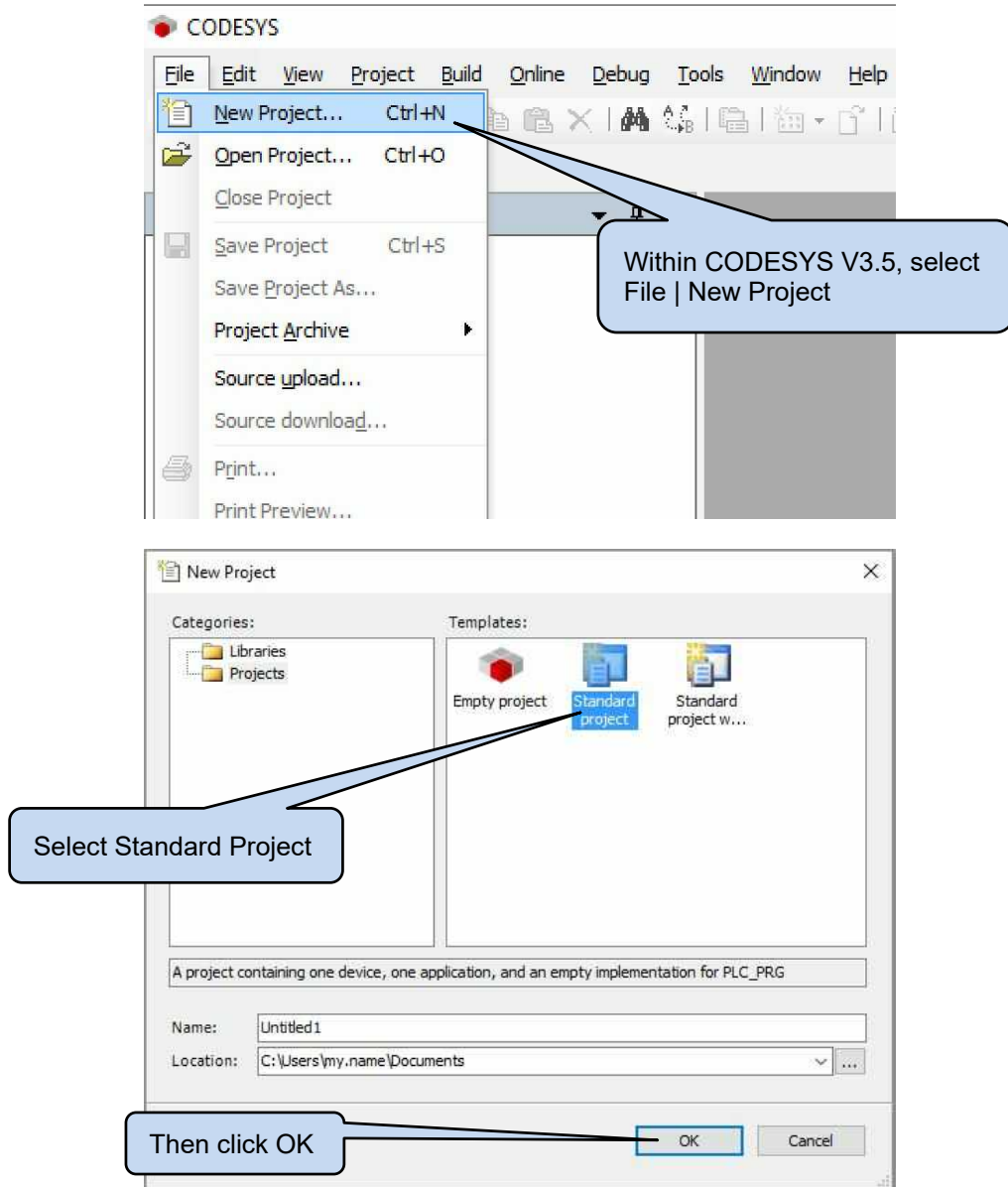


5 CONNECTING TO CODESYS

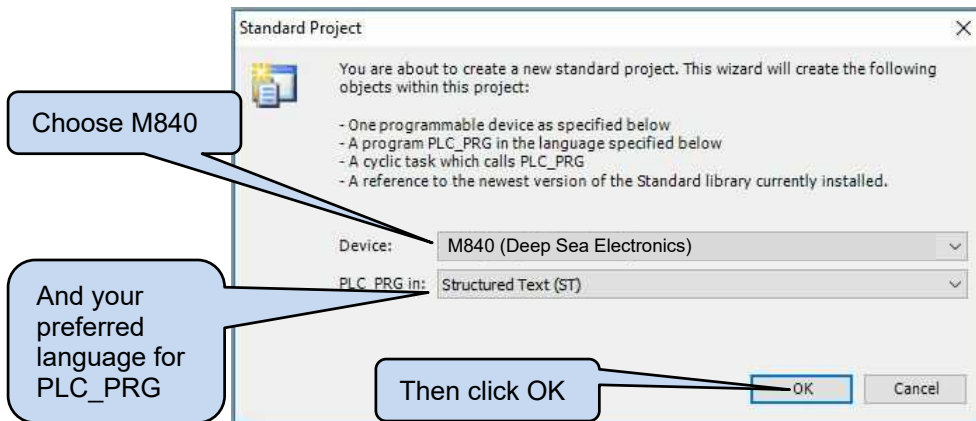
ehb SMARTdisplay 840 communicates with, and is programmed by, the CODESYS V3.5 Integrated Development Environment (IDE) version 3.5.12.0.

5.1 START NEW PROJECT

To begin, start a new project as shown.



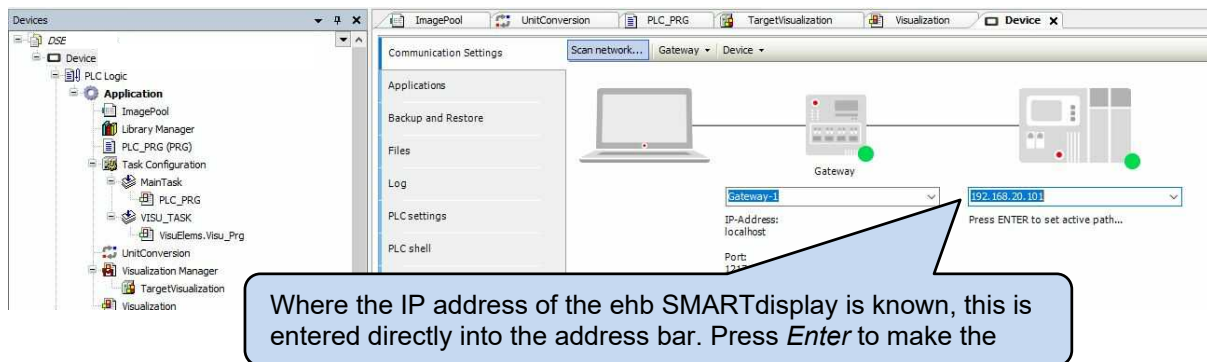
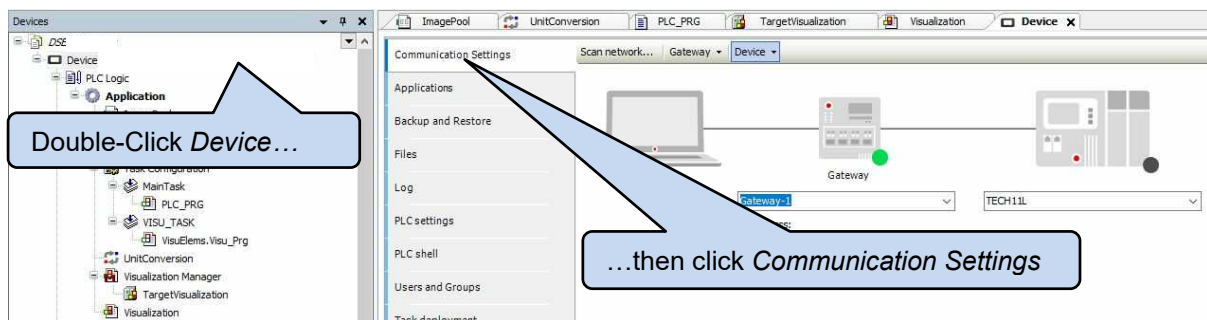
Connecting to CODESYS



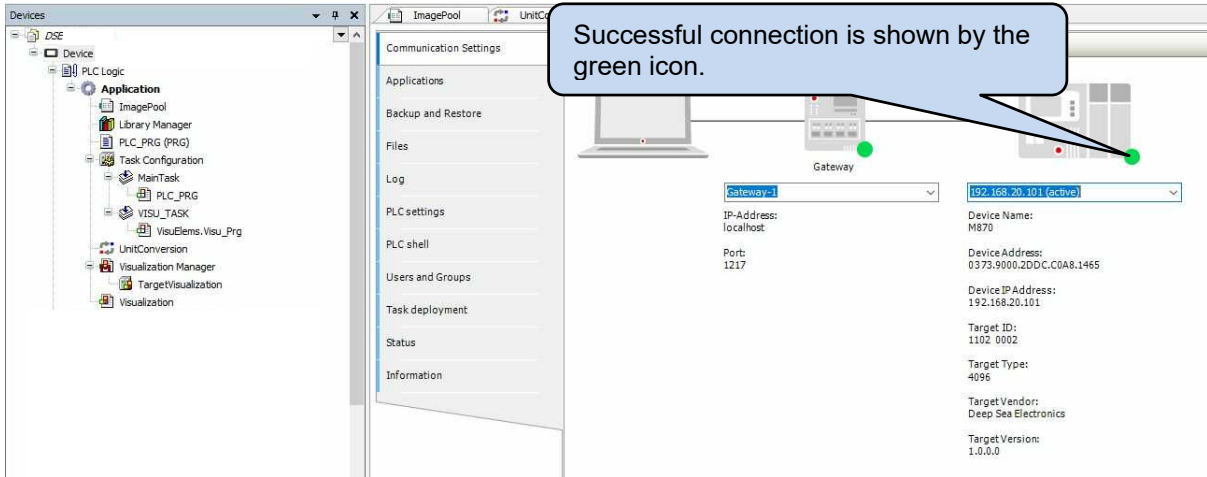
5.2 ETHERNET TCP

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

With the ehb SMARTdisplay 840 connected to the same Ethernet network as the PC, Select *Device | Communication Settings* in the CODESYS V3.5 IDE.



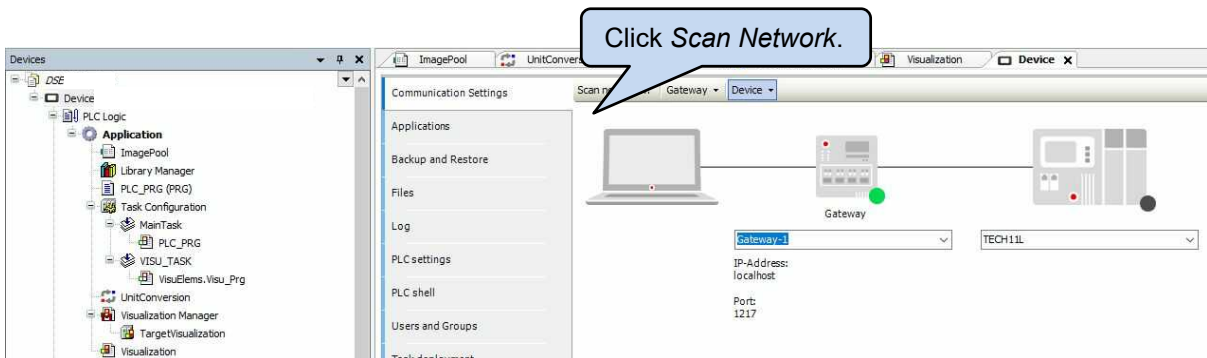
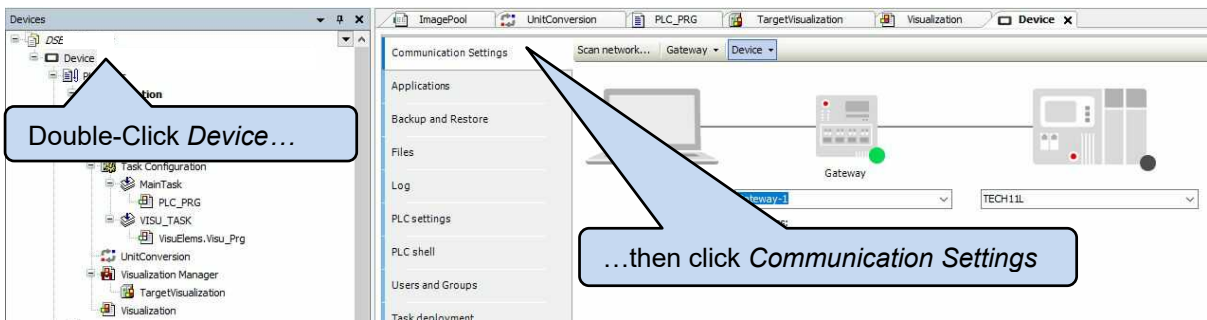
Connecting to CODESYS



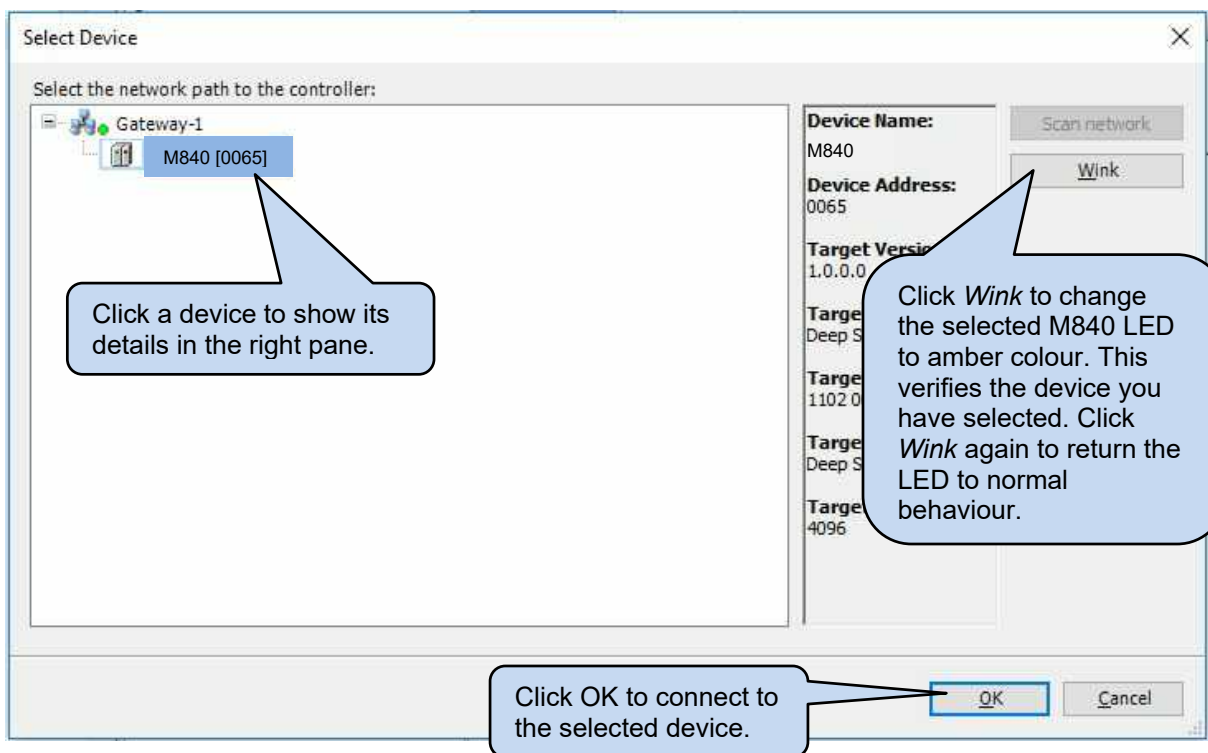
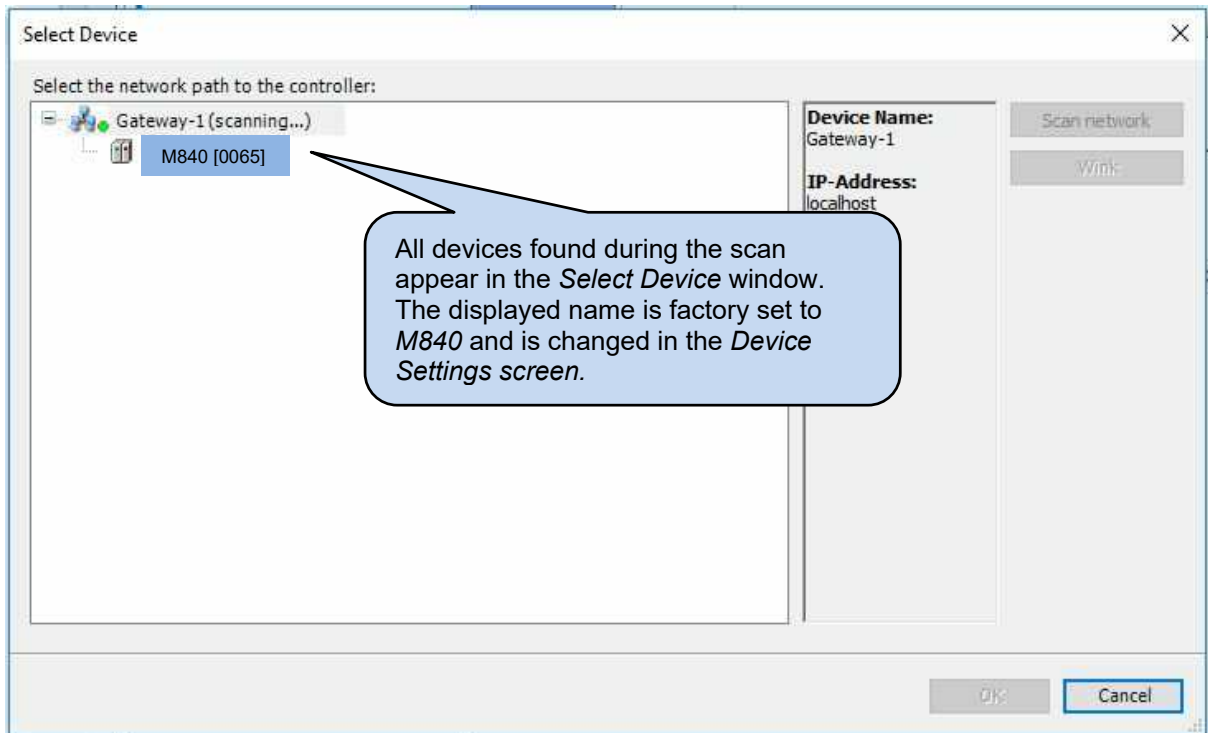
5.3 ETHERNET UDP

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.

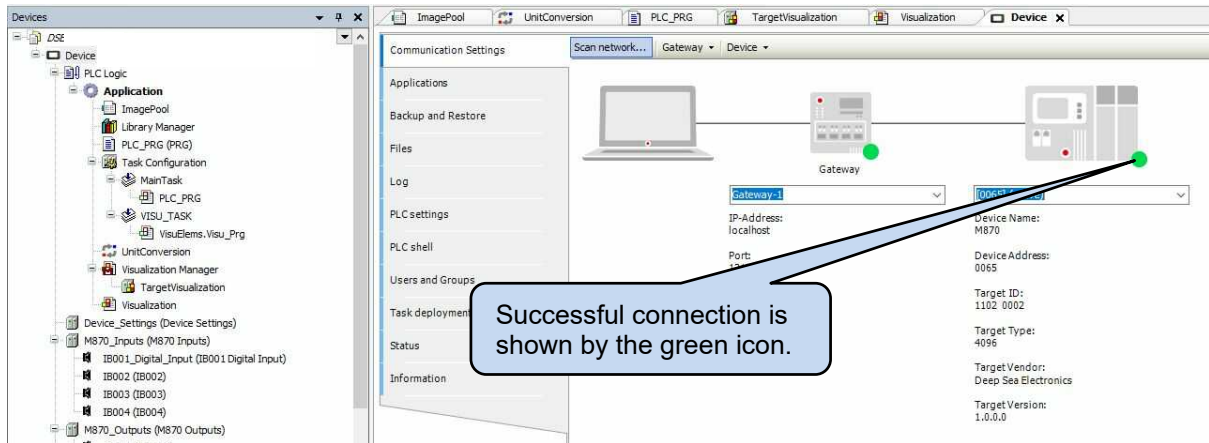
With the ehb SMARTdisplay 840 connected to the same Ethernet network as the PC, Select *Device | Communication Settings* in the CODESYS V3.5 IDE.



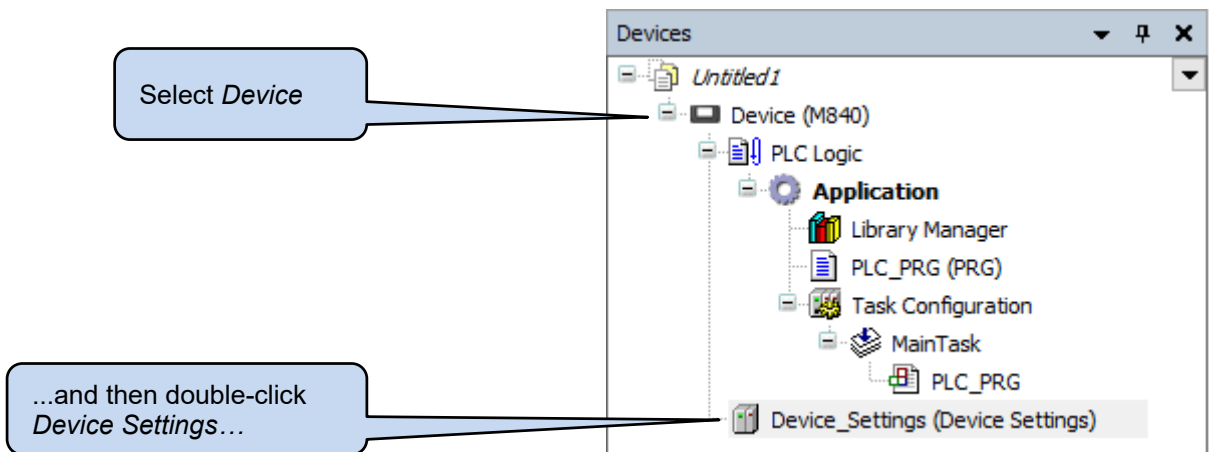
NOTE: A device in Setup mode is not discoverable by the Scan.



Connecting to CODESYS



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 *New Ethernet Configuration* by clicking the + symbol.

Enables the VREF auxiliary voltage output.

Enables *Manual Shutdown*.

Parameter	Type	Value	Default Value
Voltage Reference	Enumeration of USINT	Disabled	Disabled
Battery Voltage	Enumeration of USINT	12V	12V
Manual Shutdown	BOOL	TRUE	0

5.4.1.1 ETHERNET SETTINGS

Example of how set the IP Address to 192.168.1.100

Parameter	Type	Value	Default Value	Unit
Save Config	Enumeration of USINT	No	No	
IP Mode	Enumeration of UINT	DHCP	DHCP	
WebConfig Port	UDINT	8080	8080	
IP Address [0]	USINT	192	192	
IP Address [1]	USINT	168	168	
IP Address [2]	USINT	1	1	
IP Address [3]	USINT	100	100	
Subnet Mask [0]	USINT	255	255	
Subnet Mask [1]	USINT	255	255	
Subnet Mask [2]	USINT	255	255	
Subnet Mask [3]	USINT	0	0	
Gateway Address [0]	USINT	192	192	
Gateway Address [1]	USINT	168	168	
Gateway Address [2]	USINT	1	1	
Gateway Address [3]	USINT	1	1	
DNS Address [0]	USINT	192	192	
DNS Address [1]	USINT	168	168	
DNS Address [2]	USINT	1	1	
DNS Address [3]	USINT	1	1	
Hostname	STRING	'M840'	'M840-01'	Hostname
Voltage Reference	Enumeration of USINT	Disabled	Disabled	
Battery Voltage	Enumeration of USINT	12V	12V	
Manual Shutdown	BOOL	TRUE	0	Overrides automatic shutdown on ignition power loss

SAVE CONFIG

After making changes, choose *Yes* in the *Save Config* section to save the changes made when the project is downloaded to the ehb SMARTdisplay 840 device.

Parameter	Type	Value
Save Config	Enumeration of USINT	No
IP Mode	Enumeration of UINT	No
WebConfig Port	UDINT	Yes

5.4.2 MANUAL SHUTDOWN

NOTE: Calling *DSE.SystemShutdown* when *Ignition* pin remains active, results in ehb SMARTdisplay 840 shutting down and restarting (ie similar to a power cycle).

Manual Shutdown parameter is controlled by either mapping a BOOL variable within *Device Settings I/O Mapping*:

Application.PLC_PRG.bIgnitionSwitch	Ignition Switch	%IX126.0	BIT	Ignition Switch
-------------------------------------	-----------------	----------	-----	-----------------

or by utilising the function:

```
DSE.SystemSetManualShutdown(TRUE); or DSE.SystemSetManualShutdown(FALSE);
```

When Manual Shutdown is set to *TRUE*, removal of the *Ignition* pin does not begin the shutdown process. Instead, the application can monitor the *Ignition* pin, performing a graceful machine shutdown, before programmatically instructing ehb SMARTdisplay 840 to shutdown using the function:

```
DSE.SystemShutdown();
```

Ignition pin may be monitored either by mapping Ignition Switch within the *Device Settings I/O Mapping* page, or by using:

```
DSE.SystemGetIgnition(Ignition => bIgnitionState);
```

Where *bIgnitionState* is a BOOL variable used to store the state of the system *Ignition* pin.

To restart the ehb SMARTdisplay 840 application, reapply *Ignition* pin.

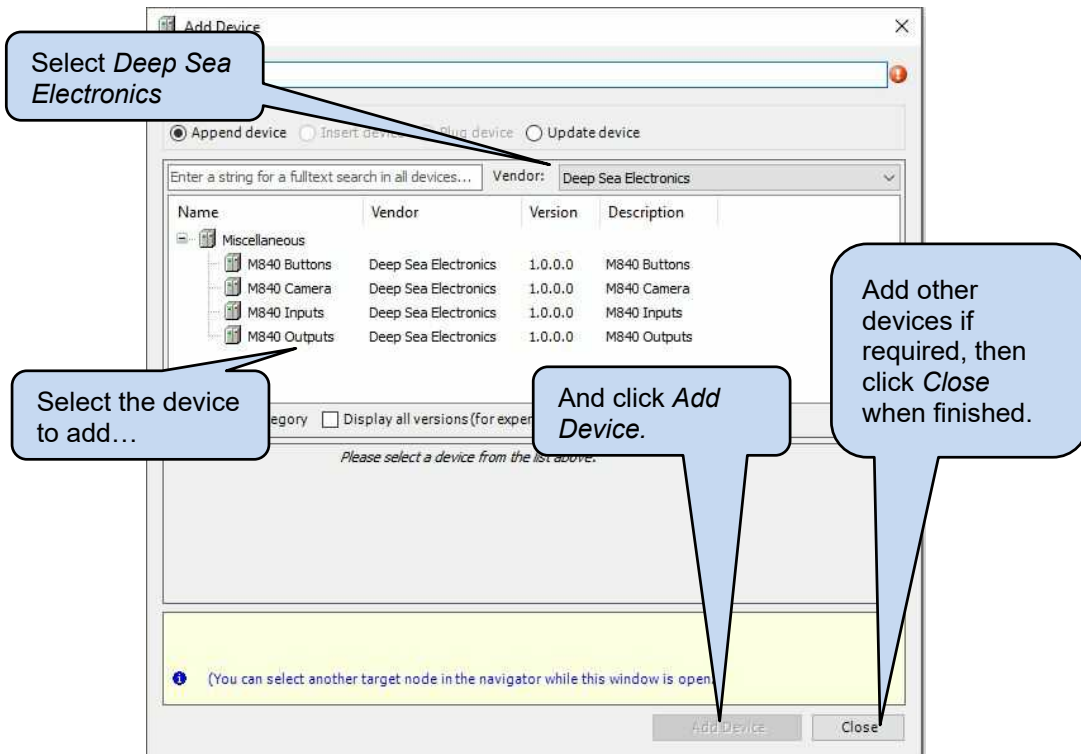
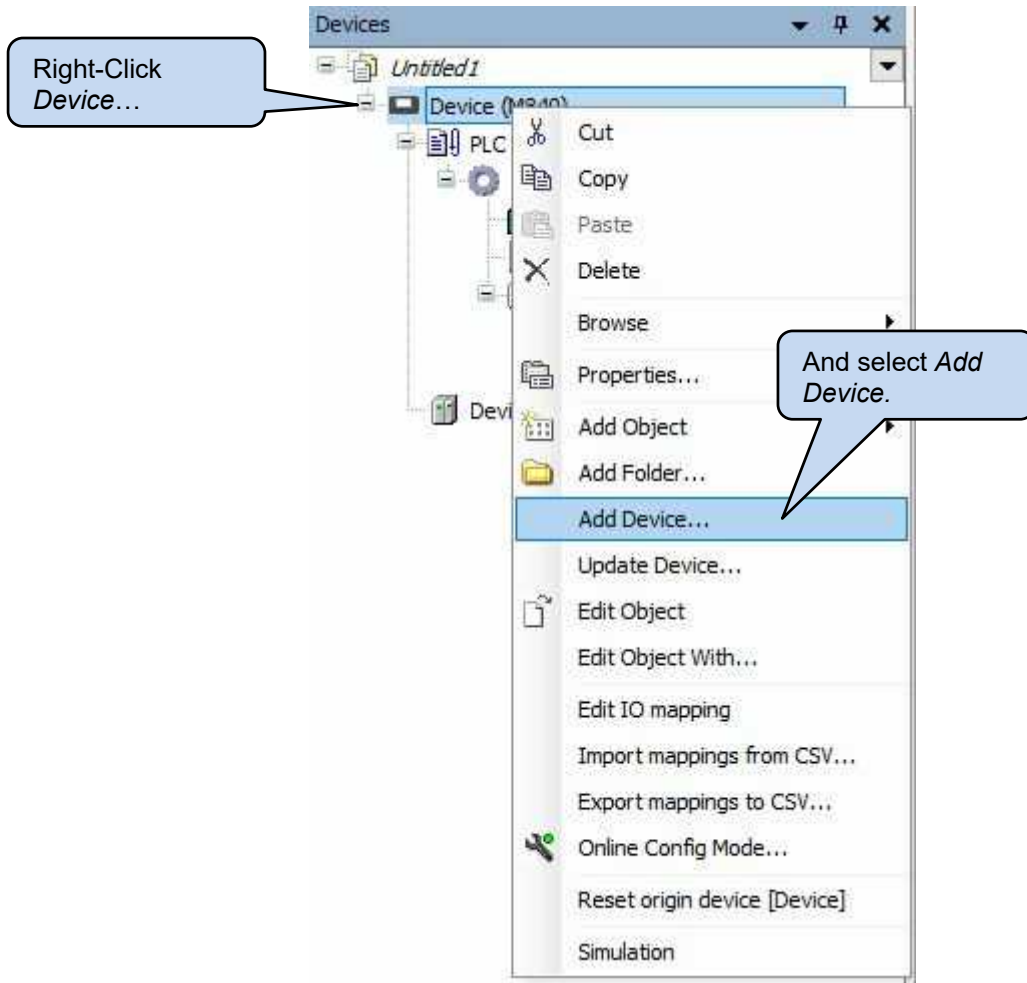
5.4.3 DEVICE SETTINGS I/O MAPPING

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 ehb SMARTdisplay 840 CODESYS Error Codes elsewhere in this

Variable	Mapping	Channel	Address	Type	Unit	Description
		Error Code	%IW0	UINT		Error Code: Check Manual for more information
		Device Temperature	%ID4	REAL	0.01°	Value of the Device Temperature
		Battery Voltage	%IW8	UINT	mV	Battery Voltage
		Ignition Switch	%IX10.0	BIT		Ignition Switch
		Voltage Reference	%IW12	UINT		Voltage Reference Configuration
		Backlight	%QW0	UINT		Backlight Level
		Keyboard Backlight	%QW2	UINT		Keyboard Backlight Level

5.5 ADD INPUTS, OUTPUTS AND BUTTONS TO THE PROJECT



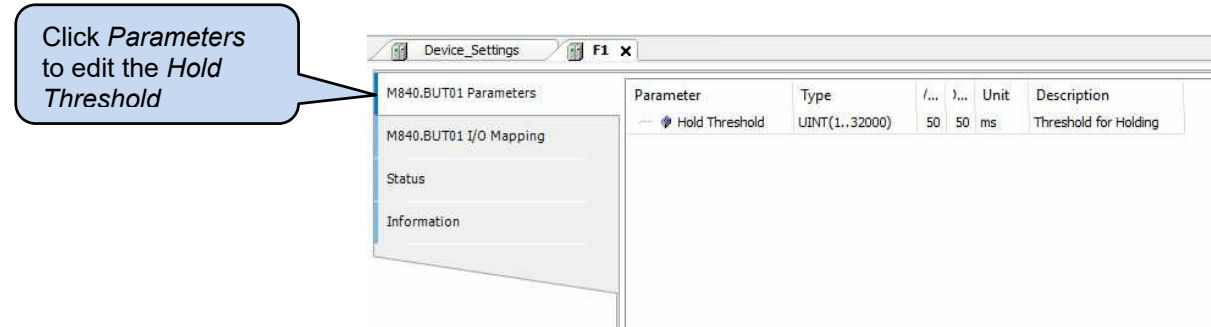
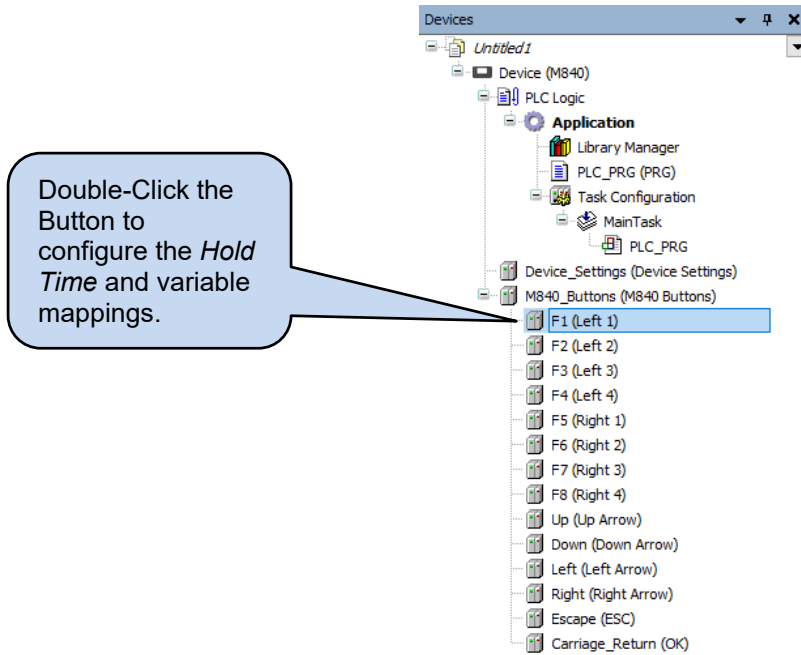
5.5.1 BUTTONS

5.5.1.1 BUTTON LOCATION

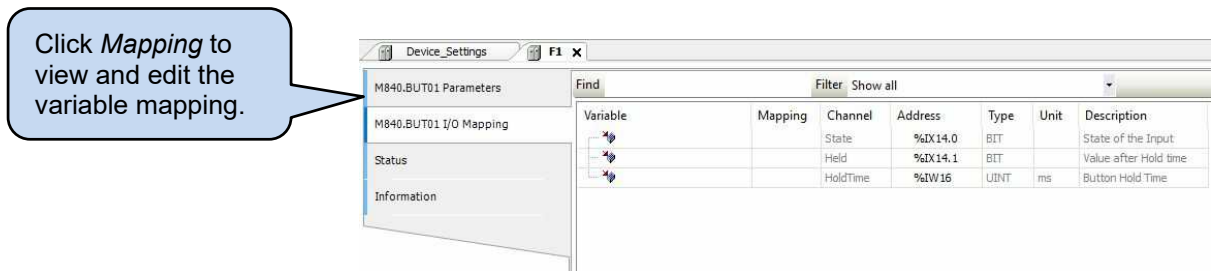
The below image shows the location of the buttons along with their default names within the CODESYS environment.



5.5.1.2 BUTTON SETTINGS

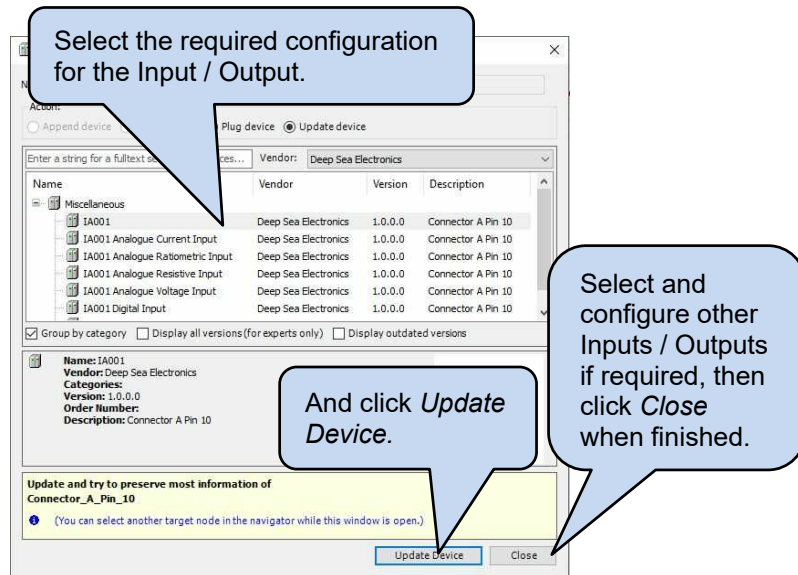
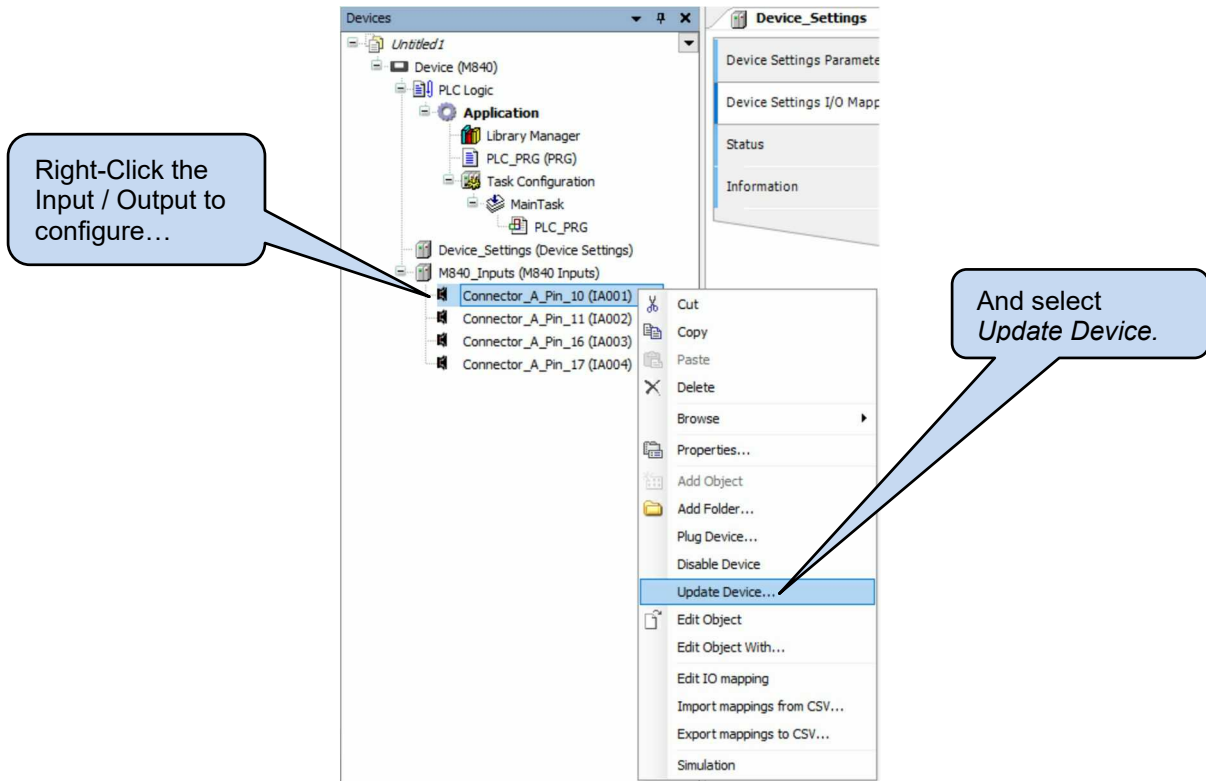


Parameter	Description
Hold Threshold	Amount of time (in milliseconds) that the button must be pressed before it is considered 'held down'.

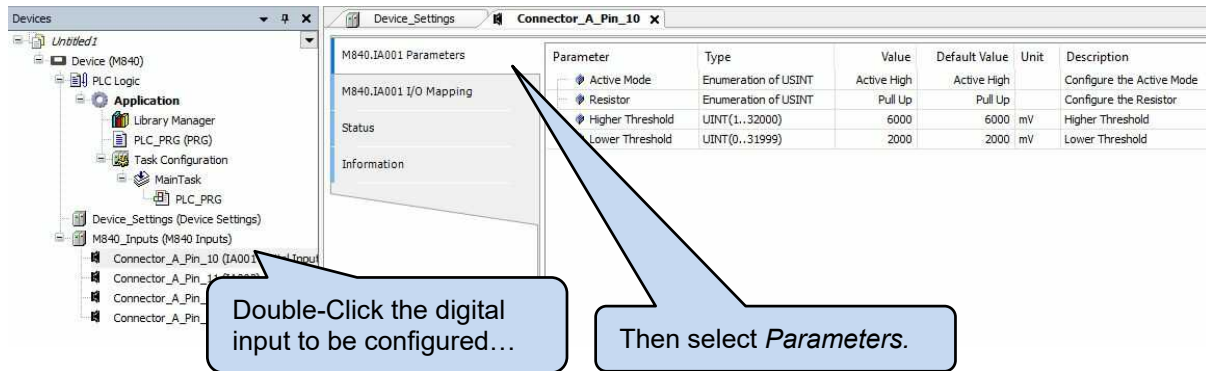


Parameter	Description
State	Indicates if the button is pressed (1) or not pressed (0).
Held	Indicates if the button has been held for longer than the duration of the <i>Hold Threshold</i> (1) or not (0).
Hold Time	The amount of time (in milliseconds) that the button has been pressed for (zero if not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

5.5.2 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. Used where the external sensor (NPN Sinking or PNP Sourcing type) has an integrated pull-up or pull down resistor. 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 PNP (Sourcing) type switched sensors and 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

NOTE: Ensure Visualisation elements do not fall outside the boundary of the visible screen area.

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.

The image consists of two screenshots from the CODESYS 3.5 software interface. The top screenshot shows the 'Devices' window with a right-click context menu open over the 'Application' folder. A callout bubble points to the 'Add Object...' option in the menu. The bottom screenshot shows the same 'Devices' window with the project tree expanded to show the 'Visualisation' components. Two callout bubbles provide instructions: one pointing to 'TargetVisu' and another pointing to the 'Visualisation' folder.

Right-Click *Application*, select *Add Object...*

Then select *Visualisation*.

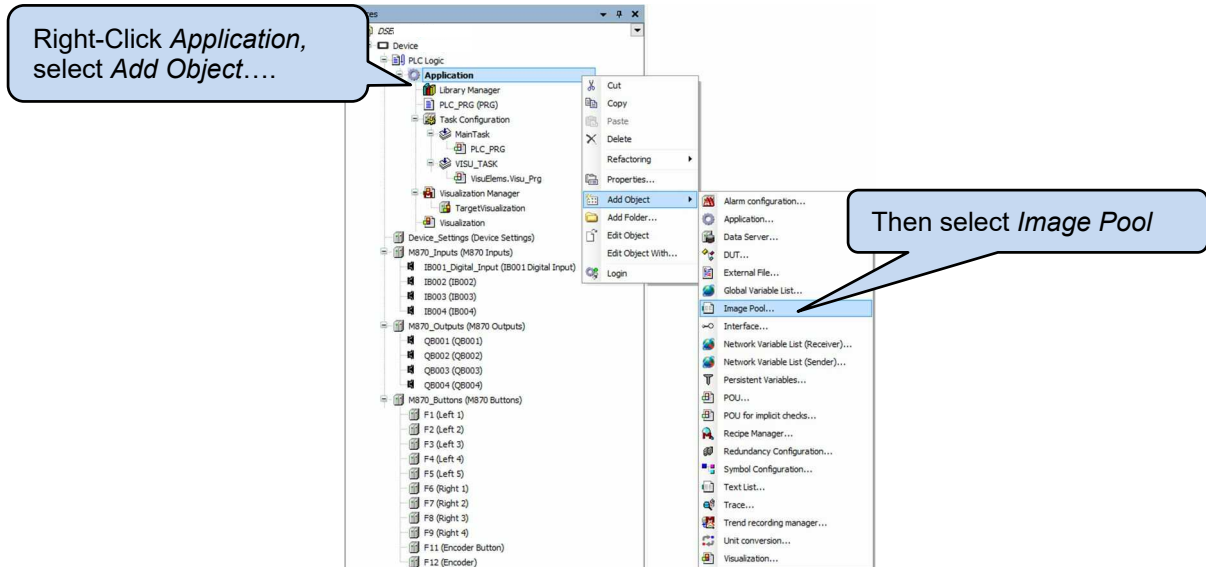
Double-Click *TargetVisu* to view/change the settings for the *Visualisation* on the *Target Device* (ehb SMARTdisplay 840)

Double-Click *Visualisation* to begin editing. Refer to CODESYS online documentation for details.

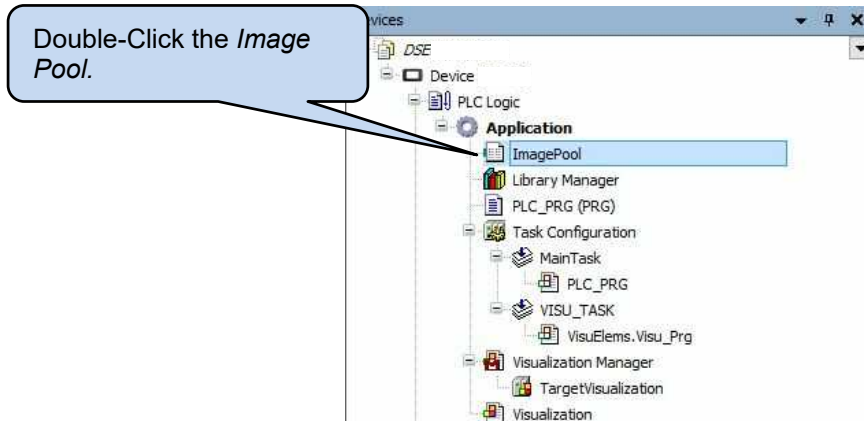
5.6.1 USING CUSTOM IMAGES ON THE DISPLAY

Many applications require custom images to be placed on the DSEM840 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...

Connecting to CODESYS

Right-Click the empty line and select *Insert Image*.

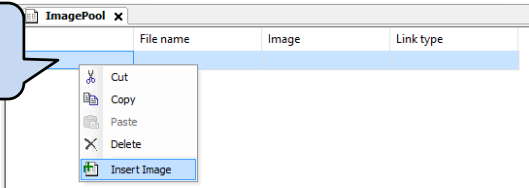
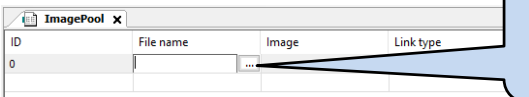
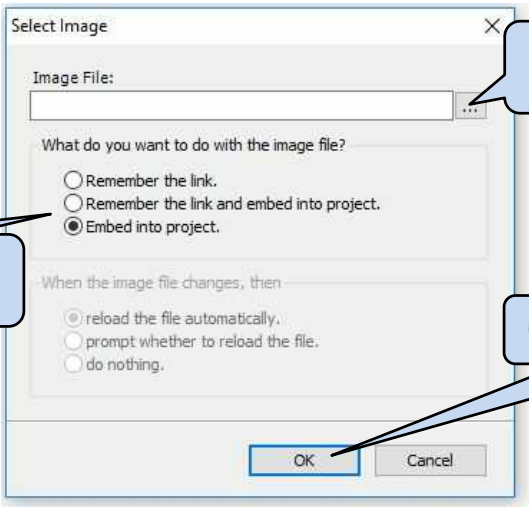
Then Double-Click the empty space under *File name* and click ...



Browse to the image on your computer...

And select how the image is stored in the project.

Click OK when done.

Example entries in the *Image Pool*.


ID	File name	Image	Link type
DSE	DSE.jpg		Embedded
CONTROL	control.PNG		Embedded

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.

Select *Image Pool* in the Visualisation Toolbox

Example entries in the *Image Pool* ready for placing on the Visualisation.



5.7 APPLICATION UPDATE

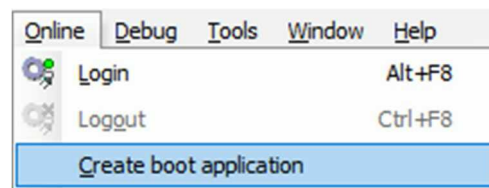
While a live CODESYS connection to the device by Ethernet is the most common method to load the application, alternatives exist as detailed below. Both options require the creation of a 'Boot Application' and the use of *Servicetool PC Software*. First, we must connect by Ethernet to a device to create the .pkg file.

5.7.1 CREATION OF THE BOOT APPLICATION AND PKG FILE

NOTE: For further details using *Servicetool PC Software*, *Servicetool PC Software Manual*.

NOTE: The boot application includes the folder *PicLogic*. This contains all images, text files and associated visualisation files.

Within CODESYS select *Online | Create boot application*



Browse to select the location to store the files. It is convenient to put the file (application.app) into an empty folder.

Within *Servicetool PC Software* scan for and select the M840 device, then select the file *Application.app* and transfer it to the ehb SMARTdisplay 840.

The process of transfer creates *Application.pkg* and stores it along with the *Application.app* file.

With the .pkg file now created, this can be used to update other devices by USB if required.

5.7.2 APPLICATION UPDATE USING USB

NOTE: A .pkg (package) file of the application must be pre-prepared as described in the section entitled *Creation of the Boot Application and pkg file* elsewhere in this document.

NOTE: The .pkg file is a compressed folder, containing all images, text files and associated visualisation files.

- Store the .pkg file on a USB memory stick.
- Remove ECU Power from the device.
- Press and hold any THREE buttons.
- Apply ECU Power.
- Wait until the display enters the Boot Menu and release the three buttons.
- Connect the memory stick to the device USB connection using the M12 to USB-A adaptor.
- Use ◀▶▲▼ and **OK** to navigate the USB device file structure and select the .pkg file to apply.
- Press **OK** to install the file.
- After confirmation, remove DC Supply from the device.
- Remove the USB memory stick.
- The update is complete.

6 EHB SMARTDISPLAY 840 CODESYS ERROR CODES

ehb SMARTdisplay 840 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.

The screenshot shows the 'Device Settings I/O Mapping' window in CODESYS. A table lists various channels with columns for Variable, Mapping, Channel, Address, Type, Current Value, Prepared Value, Unit, and Description. A callout box highlights the 'Error Code' channel, stating 'Error Code is a bit field, detailed below.' The 'Error Code' channel has an address of %IW18, type UINT, and a current value of 120. Other channels include Device Temperature, Battery Voltage, Supply Voltage 1-4, Ignition Switch, Program Enable, and Voltage Reference.

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

6.2 ANALOGUE INPUTS

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

7 FIRMWARE UPDATE

 **NOTE:** Firmware update is also possible using Servicetool PC Software. For further details, see *Servicetool PC Software Manual*.

- Store the update .pkg file on a USB memory stick.
- Remove ECU Power from the device.
- Press and hold any THREE buttons.
- Apply ECU Power.
- Wait until the display enters the Boot Menu and release the three buttons.
- Connect the memory stick to the device USB connection using the M12 to USB-A adaptor.
- Use ◀▶▲▼ and **OK** to navigate the USB device file structure and select the .pkg file to apply.
- Press **OK** to install the file.
- After confirmation, remove DC Supply from the device.
- Remove the USB memory stick.
- The update is complete

8 CABLES, CONNECTORS AND HARNESSSES

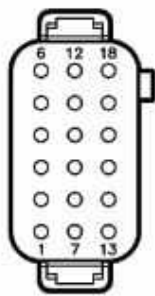
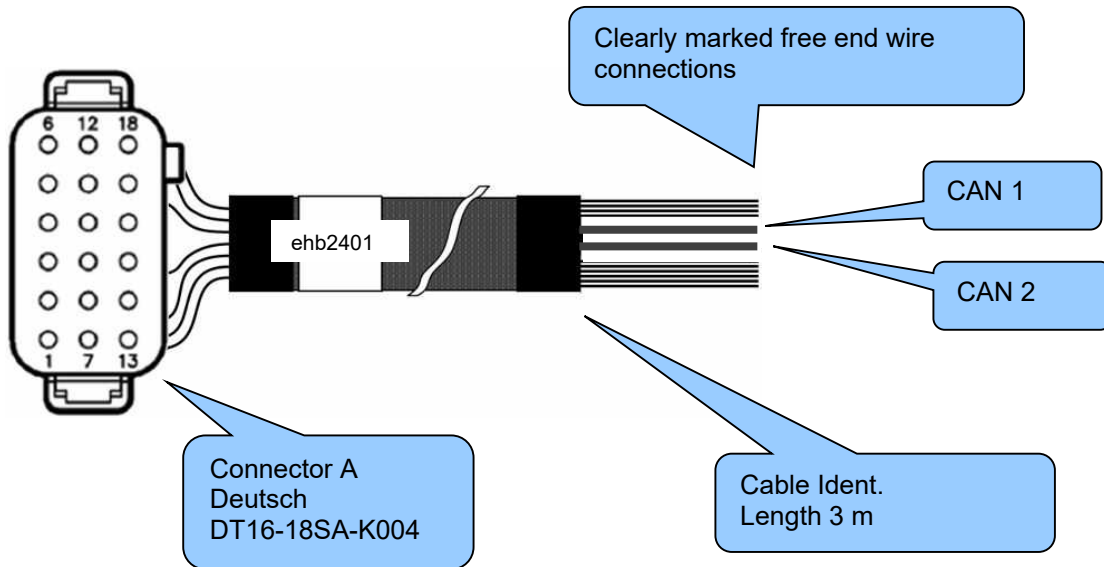
Description	ehb Part	Manufacturer Part
ehb SMARTdisplay 840 Connector Harness Kit	ehb2401	N/A
M12 to Ethernet Cable	M11350	N/A
M12 to USB Cable	M11351	N/A

8.1 ehb SMARTdisplay 840 CONNECTOR HARNESS KIT (ehb2401)

ehb Part ehb2401 consists of a cable with connector fitted at one end, with cable marking to identify the wires at the other end.

Connector A	
Assembly Ident	ehb2401
DEUTSCH Connector	DT16-18SA-K004
No of Connections	18
Wire size	0.5 mm ² (AWG 20)
Wire Colour	Black
Wire Idents	1 to 18

Connector Pin Crimp (0.5 mm² to 1.0 mm²) Connector Pin Crimp (2 mm²)	0462-201-16
	0462-209-16
Description	ehb Part Manufacturer Part
Deutsch Connector A, 18-pin complete with pins / Plug set for self-assembly	ZUB0004 DT16-18SA-K004 0462-201-16 (17x) 0462-209-16 (1x)



PIN ASSIGNMENT CONNECTOR A

PIN	DESCRIPTION	COLOR
1	ECU Supply GND	Blue
2	DOUT 2	Green
3	DOUT 1	Pink
4	DOUT 4	Orange
5	DOUT 3	Violet
6	VREF OUT	Red
7	Battery	Brown
8	CAN1 H	White
9	CAN2 H	White
10	AIN 1	White/red
11	AIN 2	Yellow/blue
12	Camera 1	Grey/red
13	Ignition	Yellow
14	CAN1 L	Brown
15	CAN2 L	Brown
16	AIN 3	Yellow/red
17	AIN 4	Grey
18	Camera 1 GND	Black

9 IMPORTANT NOTES FOR USE

How to use

The device must only be operated with the supplies provided.
Use a mild cleaning agent to clean the device.
Do not insert any objects that are not designed for the specific purpose into the openings of the unit, as this may cause problems in the electrical components.
When operating the device, always observe general accident prevention regulations.

Safety

Do not operate the ehb SMARTdisplay 840 device within range of strong electromagnetic fields. Observe the temperature specifications.

Storage

ehb SMARTdisplay 840 devices that are not being used must be stored as described in the operating specifications.

Installation

During the installation of the device follow the directions of the manufacturers of plugs and wire harnesses.

Shipping

When shipping, equipment must always be shipped in the original packaging or in correspondingly sturdy packaging.
Use of unsuitable packaging constitutes negligence, hence rendering null and void any claim to repairs under warranty.

Maintenance

The ehb SMARTdisplay 840 requires no maintenance throughout its entire service life and requires no special care.

Opening the device

The ehb SMARTdisplay 840 contains no parts that can be serviced, replaced or repaired by customers or third-party maintenance personnel.
The ehb SMARTdisplay 840 is sealed to protect against any unauthorised opening. Please note that unauthorised opening will destroy the device.



CAUTION

Do not use high-pressure cleaning equipment to clean the device. Service personnel are to be fully instructed that high-pressure cleaners will damage the device and void the warranty.

Display



There is no warranty in case of improper operation (e.g. use of knife or screw driver on Display).

A broken display is under no circumstances covered by warranty.

10 REPAIR OF DEVICES

If a repair does become necessary, please ship the device to:

ehb electronics gmbh
Hans-Böckler-Str. 20
30851 Langenhagen, Germany

Please always be sure to include a written description of the problem. This will considerably simplify troubleshooting for ehb electronics gmbh service department and allow the **device** to be returned more quickly.

Or use our online service for returning the unit: www.ehbservice.de

11 DISPOSAL

11.1 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



12 DOCUMENT INFORMATION, HISTORY

Project:	ehb SMARTdisplay 840
Document type:	Technical documentation
Version:	ISSUE 1
Created on:	2017-03-17
Author:	Tony

Version:	Editing:	on:	by:
Issue 1	Initial release of document	2017-03-17	Tony
Issue 2	Added Manual Shutdown feature	xxxx.xx.xx	Tony
Issue 2	Adaptation Copyedit	2020-11-11 2020-11-11	Ger, Kra Hag
Issue 3	Added SD840-02 Copyedit	2021-02-01 2021-02-01	Kra Hag

13 IMPRINT



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