PC Software Manual

ehb SMARTdisplay 050 Configuration Suite

Version 1.2

ISSUE: 1.2

ehb SMARTdisplay 050 Configuration Suite PC Software Manual

Typeface: The typeface used in this document is *Arial*. Care must be taken not to mistake the upper case letter I with the numeral 1. The numeral 1 has a top serif to avoid this confusion.

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Section **Page**

1 INTRODUCTION

This document details the use of *ehb Configuration Suite PC Software* with the ehb SMARTdisplay 050 module.

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

ehb Configuration Suite PC Software allows the ehb SMARTdisplay 050 module to be connected to a PC via USB to CAN interface. Once connected, the software allows easy, controlled access to various operating parameters within the module which can then be viewed and edited as required.

ehb Configuration Suite PC Software must only be used by competent, qualified personnel, as changes to the operation of the module may have safety implications on the engine to which it is fitted.

The information contained in this manual must be read in conjunction with the information contained in the appropriate module documentation. This manual only details which settings are available and how they may be used. Separate manuals deal with the operation of the individual module and its ancillaries, refer to section entitled *Bibliography* elsewhere in this document for further information.

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
29-bit ID	29-bit Identifier used in the Extended J1939 header used by the ehb SMARTdisplay 050 device.
CAN	Controller Area Network Vehicle standard to allow digital devices to communicate to one another.
DEF	Diesel Exhaust Fluid A liquid used as a consumable in the SCR process to lower nitric oxide and nitrogen dioxide concentration in engine exhaust emissions.
DM1	Diagnostic Message 1 A DTC that is currently active on the engine ECU.
DM2	Diagnostic Message 2 A DTC that was previously active on the engine ECU and has been stored in the ECU's internal memory.
DPF	Diesel Particulate Filter A filter fitted to the exhaust of an engine to remove diesel particulate matter or soot from the exhaust gas.
DPTC	Diesel Particulate Temperature Controlled Filter A filter fitted to the exhaust of an engine to remove diesel particulate matter or soot from the exhaust gas which is temperature controlled.
DTC	Diagnostic Trouble Code The name for the entire fault code sent by an engine ECU.
ECU/ECM	Engine Control Unit/Management An electronic device that monitors engine parameters and regulates the fuelling.
FMI	Failure Mode Identifier A part of DTC that indicates the type of failure, e.g. high, low, open circuit etc.
HEST	High Exhaust System Temperature. Initiates when DPF filter is full in conjunction with an extra fuel injector in the exhaust system to burn off accumulated diesel particulate matter or soot.
HMI	Human Machine Interface A device that provides a control and visualisation interface between a human and a process or machine.
J1939	Refers to standard J1939 by the Society of Automotive Engineers.
OC	Occurrence Count A part of DTC that indicates the number of times that failure has occurred.
PGN	Parameter Group Number A CANbus address for a set of parameters that relate to the same topic and share the same transmission rate.
SCR	Selective Catalytic Reduction A process that uses DEF with the aid of a catalyst to convert nitric oxide and nitrogen dioxide into nitrogen and water to reduce engine exhaust emission.

Term	Description
SPN	Suspect Parameter Number A part of DTC that indicates what the failure is, e.g. oil pressure, coolant temperature, turbo pressure etc.

1.3 BIBLIOGRAPHY

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: info@ehb-electronics.de

1.3.1 INSTALLATION INSTRUCTIONS

Installation instructions are supplied with the product in the box and are intended as a 'quick start' guide only.

	Description
	ehb SMARTdisplay 050 Installation Instructions

1.3.2 MANUALS

Product manuals are obtained from the ehb website: www.ehb-electronics.de or by contacting ehb technical support: info@ehb-electronics.de

	Description
	ehb SMARTdisplay 050 Operator Manual

2 INSTALLATION AND USING EHB CONFIGURATION SUITE SOFTWARE

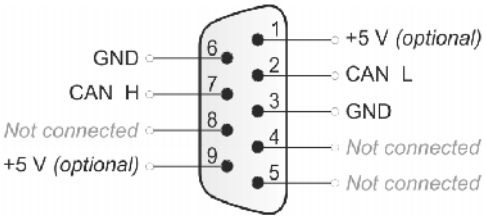
2.1.1 USB-CAN INTERFACE

To convert PC USB to CAN Interface, use one of the following devices. Both devices offer the same basic functionality, with the *Opto-Isolated* variant providing enhanced protection should there be a potential difference (up to 500 V) between the Earth points of the CAN device and the PC.
The device driver is supplied with the interface and is further available at the website listed in the table below.

Manufacturer	Part Number	ehb Part Number	Description
PEAK-System Technik GmbH https://www.peak-system.com/	IPEH-002021	./.	PCAN-USB
	IPEH-002022	./.	PCAN-USB Opto-Isolated

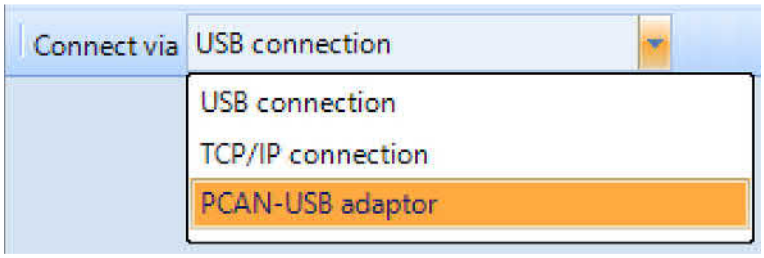
2.1.1.1 PCAN-USB CONNECTION DETAILS

Connect PCAN-USB to ehb SMARTdisplay 050 using connections for CAN H, CAN L and GND. For suitable connection looms from ehb, see ehb Publication *ehb SMARTdisplay 050 Operator Manual.*



2.1.1.2 USE WITH EHB CONFIGURATION SUITE PC SOFTWARE

Once installed, the device is selected within ehb Configuration Suite PC Software as follows:

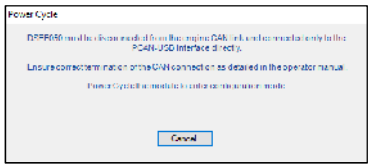


2.1.2 READ CONFIGURATION

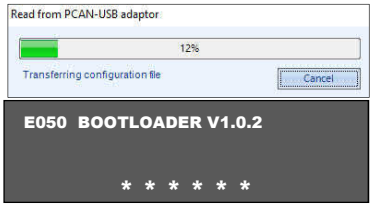
NOTE: During *Configuration Read* and *Configuration Write* operations, ehb SMARTdisplay 050 must be disconnected from the engine CAN link and connected only to PCAN-USB interface directly.

To read the existing configuration from the device:

- Connect via the CAN-USB interface as described in the section entitled *USB-CAN Interface.*
- Click  in the toolbar or select *File* | *Read from Module* or press *F5* on the computer keyboard.
- ehb Configuration Suite prompts to *Power Cycle* the module.
- Remove DC Power from the device.
- Wait a few seconds….
- Then reapply DC Power.



- Wait while the configuration is transferred. This takes a couple of minutes.



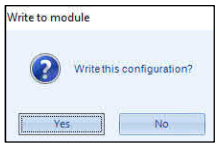
- During this time ehb SMARTdisplay 050 shows the *Bootloader* version number and an animation to show continuing progress.
- After *Validation*, ehb Configuration Suite confirms completion of the file transfer.
- Remove DC Power from the device.
- Wait a few seconds….
- Then reapply DC Power to apply the new configuration.

2.1.3 WRITE CONFIGURATION

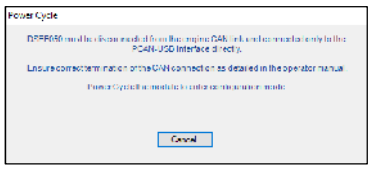
NOTE: During *Configuration Read* and *Configuration Write* operations, ehb SMARTdisplay 050 must be disconnected from the engine CAN link and connected only to PCAN-USB interface directly.

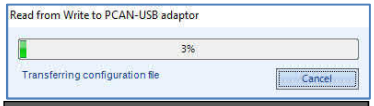
To write the configuration to the device:

- Connect via the CAN-USB interface as described in the section entitled *USB-CAN Interface.*
- Click  in the toolbar or select *File* | *Write to Module* or press *F8* on the computer keyboard.
- Confirm to Write to the Module.



- ehb Configuration Suite prompts to *Power Cycle* the Module.
- Remove DC Power from the device.
- Wait a few seconds….
- Then reapply DC Power.
- Wait while the configuration is transferred. This takes a couple of minutes.





- During this time ehb SMARTdisplay 050 shows the *Bootloader* version number and an animation to show continuing progress.

- After *Validation*, ehb Configuration Suite confirms completion of the file transfer.
- Remove DC Power from the device.
- Wait a few seconds….
- Then reapply DC Power to apply the new configuration.

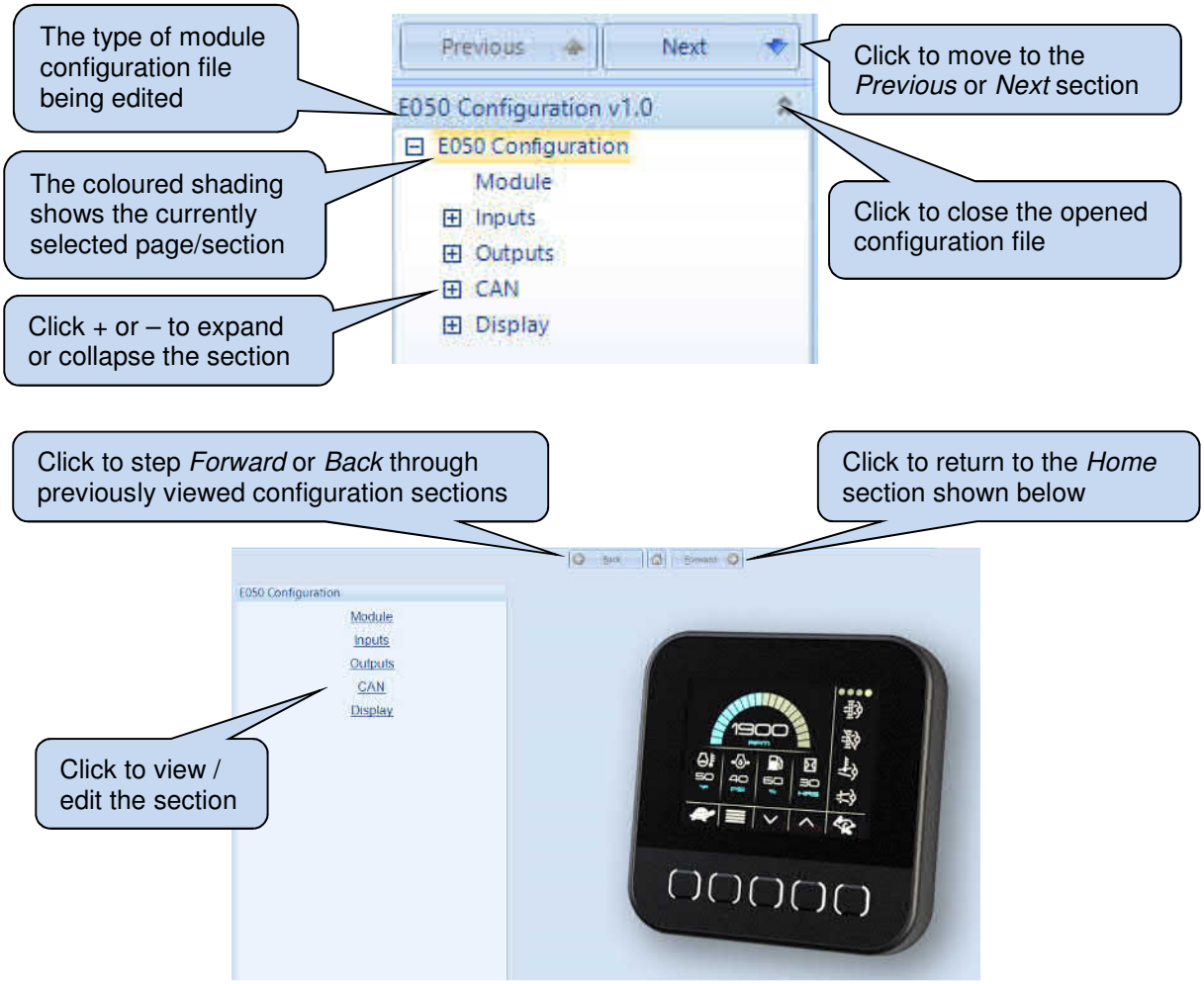
2.1.4 TROUBLESHOOTING CONFIGURATION READ/WRITE ISSUES

Issue	Possible Solution
PCAN-USB adaptor is not available in the *Connect Via…* dropdown list box.	Try the following possible solutions in the order listed: • Ensure PCAN-USB is connected to a functioning USB Port on the PC. • Disconnect and reconnect PCAN-USB device. Wait a few seconds, then try again to select *PCAN-USB adaptor*. • Close, ehb Configuration Suite PC Software. Ensure PCAN-USB Driver is correctly installed (use Windows Device Manager to check). Restart ehb Configuration Suite PC Software.
Please Connect and/or Select a Module is displayed when attempting to read/write.	• Ensure *PCAN-USB adaptor* is selected in the *Connect via* dropdown select box. • Ensure the cable between PCAN-USB and the ehb SMARTdisplay 050 is correctly connected. • Ensure the E050 is not additionally connected to the engine ECU.
Transfer does not begin after power cycle of the ehb SMARTdisplay 050.	• When requested to 'Toggle module power', remove DC Supply from ehb SMARTdisplay 050, ensure PCAN-USB is correctly connected to the ehb SMARTdisplay 050, then reapply ehb power to the ehb SMARTdisplay 50. • Ensure the E050 is not additionally connected to the engine ECU.
Communications Timeout occurs during transfer.	• Ensure the cable between PCAN-USB and the is correctly connected. • Ensure the ehb SMARTcontroll 050 is not additionally connected to the engine ECU.

3 EDITING THE CONFIGURATION

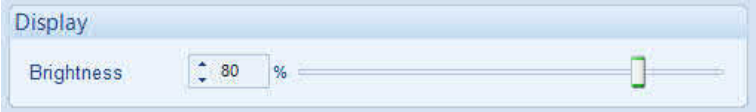
The software is broken down into separate sections to provide simple navigation while editing the module's configuration to suit an application.

3.1 SCREEN LAYOUT



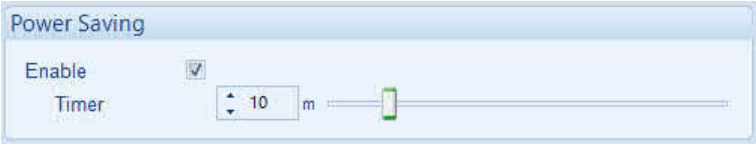
3.2 MODULE

3.2.1 DISPLAY



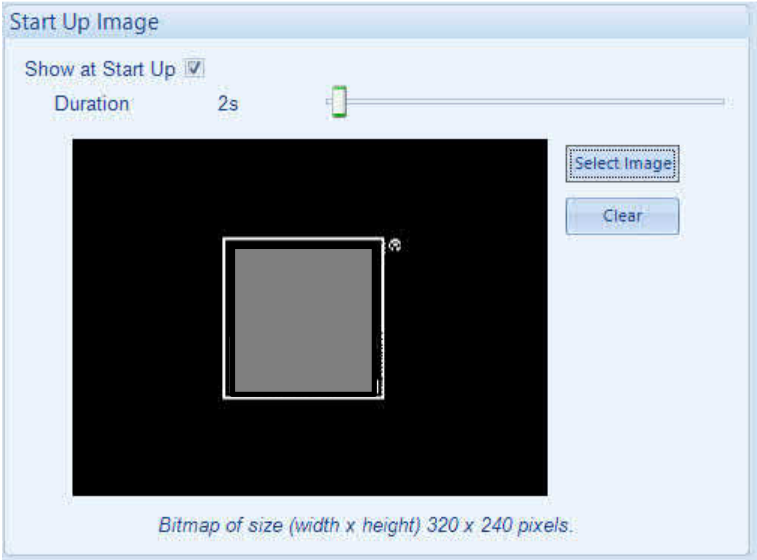
Parameter	Description
Brightness	**NOTE: *Display Brightness* is also adjustable from the device fascia.** Select the required brightness for the display backlight. Higher values allow the device to be viewed in bright ambient conditions, however this make it too bright if viewed at night time or in a darkened room.

3.2.2 POWER SAVING



Parameter	Description
Enable	☑: Power Saving is enabled. Upon extended period of CAN data inactivity, the device enters *Power Saving.* The device awakens when CAN data is received or when a device fascia button is pressed. This is useful for both power saving and to prevent attention being drawn to the device when the engine is no longer operating. ☐: No Power Saving takes place.
Timer	Set the timer as required. After this period of user inactivity, the device enters *Power Saving* mode, reducing the DC power used and automatically disabling the screen when the engine stops, and CAN traffic is no longer received.

3.2.3 START UP IMAGE

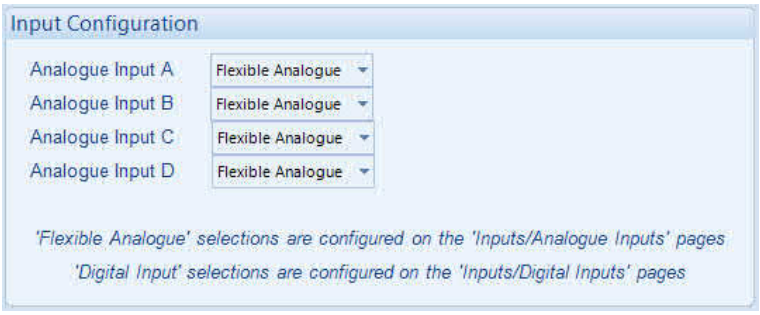


Parameter	Description
Show at Start Up	☑: Image is shown at device power up. ☐: No image is shown.
Duration	Set the duration as required. At power up, the image is displayed for the configured duration.
Select Image	Click to browse the PC to select the required image. This image must be 320 pixels wide, 240 pixels high.

3.3 INPUTS

3.3.1 ANALOGUE INPUT CONFIGURATION

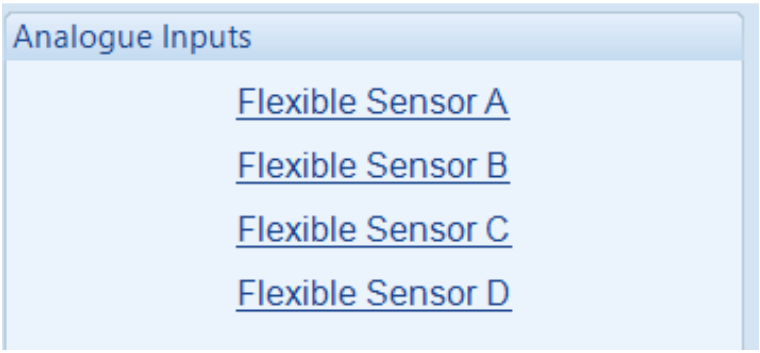
This page is used to select the operation of the inputs. After selection, configuration is available on *Inputs* | *Analogue Inputs* or *Inputs* | *Digital Inputs*.



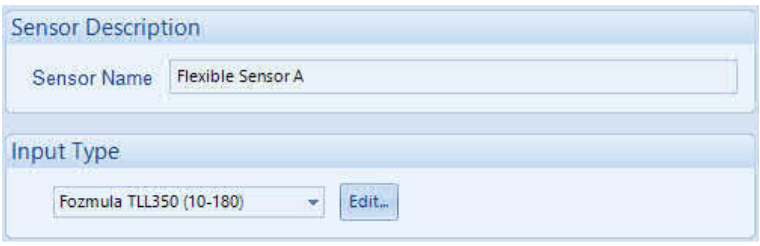
Parameter	Description
Analogue Input A, B, C, D	***Not Used:*** The selected input is not used. ***Flexible Analogue:*** The selected input is used as an analogue input. For example, this could be used to measure fuel level for inclusion on the device display. ***Digital:*** The selected input is a digital input. For example, this input could be used to detect low fuel level from a switch located in the fuel tank.

3.3.2 ANALOGUE INPUTS

Inputs configured as *Flexible Analogue* are further configured here. Select the input to configure.



3.3.2.1 FLEXIBLE SENSOR A, B, C, D



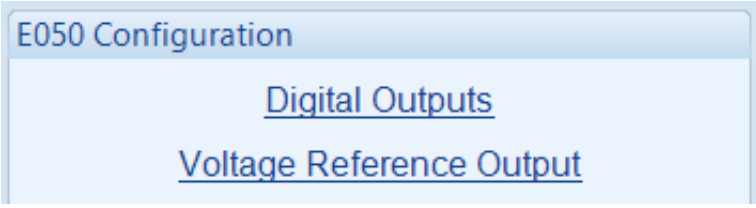
3.3.3 DIGITAL INPUTS

Inputs configured as *Digital* are further configured here.

Parameter	Description
Close Configuration	***Close to Supply Negative:*** Connect the input pin to Supply Negative to activate. ***Close to Supply Positive:*** Connect the input pin to Supply Positive to activate.
Polarity	***Close to Activate:*** To activate the input, connect the input to the configured supply. ***Open to Activate:*** To activate the input, disconnect the input from the configured supply (open circuit).

3.4 OUTPUTS

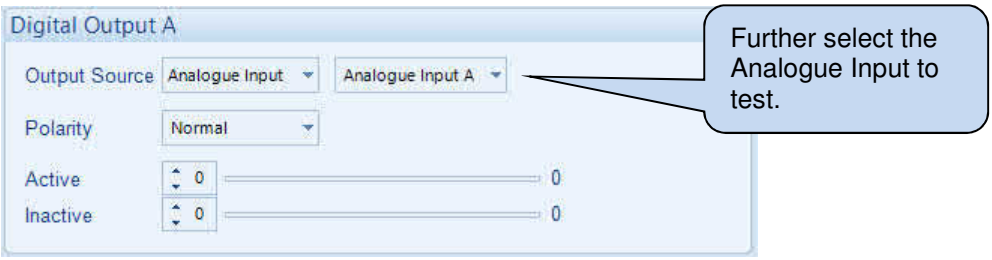
This section is further divided into subsections.



3.4.1 DIGITAL OUTPUTS

3.4.1.1 ANALOGUE INPUT

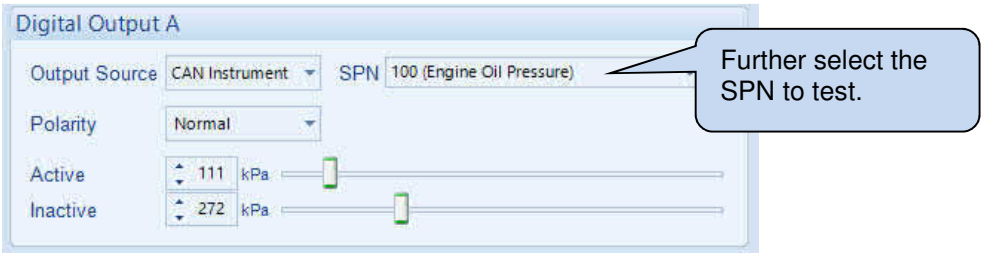
Configures the output to operate upon the condition of a selected *Analogue Input*.



Parameter	Description
Polarity	***Normal:*** The output becomes active when the input measurement is above the *Active* setting and remains active until the input measurement falls below the *Inactive* setting. ***Inverted:*** The output becomes inactive when the input measurement is above the *Active* setting and remains inactive until the input measurement falls below the *Inactive* setting.
Active	**NOTE: Best practice is to include a small amount of *Hysteresis* (a gap between *Active* and *Inactive*) to prevent the output pulsating if the input value is *hovering* around the set point.** Adjusts the value for the *Active* setting.
Inactive	**NOTE: Best practice is to include a small amount of *Hysteresis* (a gap between *Active* and *Inactive*) to prevent the output pulsating if the input value is *hovering* around the set point.** Adjusts the value for the *Inactive* setting.

3.4.1.2 CAN INSTRUMENT

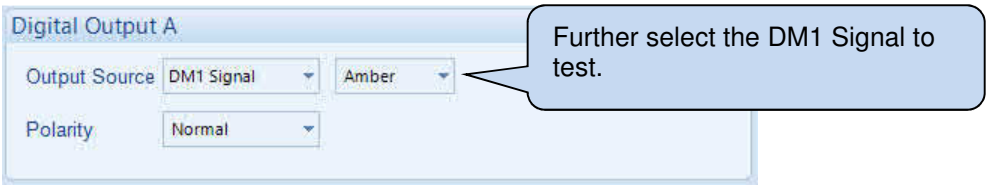
Configures the output to operate upon the condition of a selected *CAN Instrument*.



Parameter	Description
Polarity	***Normal:*** The output becomes active when the SPN value is above the *Active* setting and remains active until the SPN value falls below the *Inactive* setting. ***Inverted:*** The output becomes inactive when the SPN value is above the *Active* setting and remains inactive until the SPN value falls below the *Inactive* setting.
Active	**NOTE: Best practice is to include a small amount of *Hysteresis* (a gap between *Active* and *Inactive*) to prevent the output pulsating if the SPN value is *hovering* around the set point.** Adjusts the value for the *Active* setting.
Inactive	**NOTE: Best practice is to include a small amount of *Hysteresis* (a gap between *Active* and *Inactive*) to prevent the output pulsating if the SPN value is *hovering* around the set point.** Adjusts the value for the *Inactive* setting.

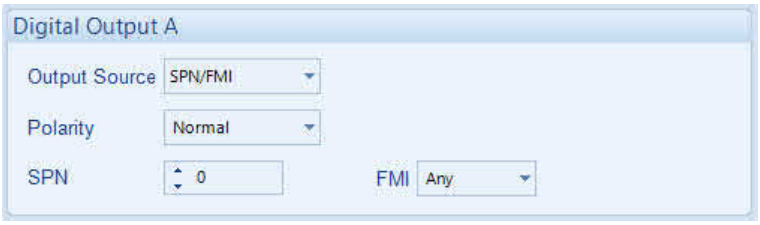
3.4.1.3 DM1 SIGNAL

Configures the output to operate upon the condition of a selected *DM1 Signal*, often called *Indicator Lamps*.



Parameter	Description
Polarity	***Normal:*** Output active when the selected signal is active. ***Inverted:*** Output active when the selected signal is NOT active.

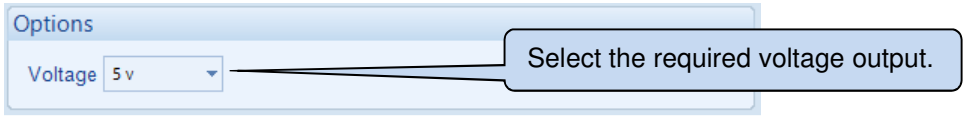
3.4.1.4 SPN/FMI



Parameter	Description
Polarity	***Normal:*** Output active when the selected FMI is present for the selected SPN. ***Inverted:*** Output active when the selected FMI is NOT present for the selected SPN.
SPN	Suspect Parameter Number to test.
FMI	Failure Mode Indicator to test for.

3.4.2 VOLTAGE REFERENCE OUTPUT

Voltage Reference Output is provided to supply external devices (sensors). Consult the device operator manual for specifications of this output.

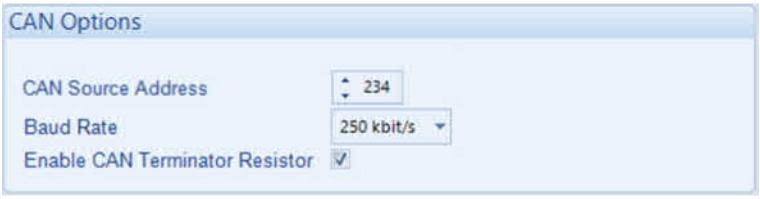


3.5 CAN

This section is further divided into subsections.

3.5.1 CAN OPTIONS

New Image when SA is added



Parameter	Description
CAN Source Address	The Source Address (SA) that the TSC1 and DM3 (Clear DM2 DTCs) messages are sent from.
Baud Rate	Select the Baud Rate of the CAN interface to connect to (250 kbit/s or 500 kbit/s)
Enable CAN Terminator Resistor	A CAN network must be terminated at the extreme ends of the CAN cable. For full flexibility, ehb SMARTdisplay 050 has a switchable internal 120 Ω termination resistor. ☐: Internal termination resistor is disabled. Useful for when the device is located 'in the middle' of the CAN network, and when a termination resistor is located elsewhere. ☑: Internal termination resistor is enabled. Ensure the device is located 'at the end' of the CAN network and that an external termination resistor is not also fitted to 'this end' of the CAN network.

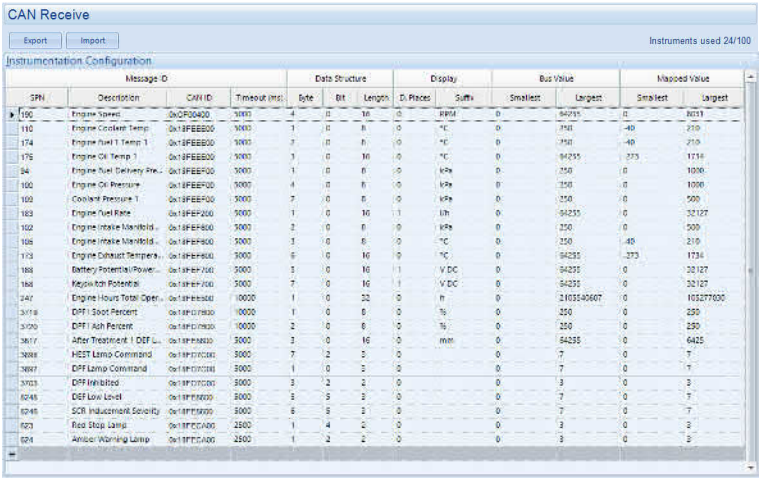
3.5.2 CAN RECEIVE

⚠NOTE: Factory settings assume J1939 *default priority* for the configured messages and *Source Address 00* for the transmitting device. For other values, amend the *CAN ID* as required.

Provides a flexible system for receiving and processes CAN messages with 29-bit Identifiers. Up to 100 (one hundred) SPNs are supported.

Factory settings (shown below) include a list of commonly required, predefined SPNs that may be changed, deleted or added to by the system installer.

To reload Factory Settings, select *File* | *New* | *Exxx* then select the E050 configuration version relevant to your controller version. Write this configuration to the device to restore it to Factory Settings.

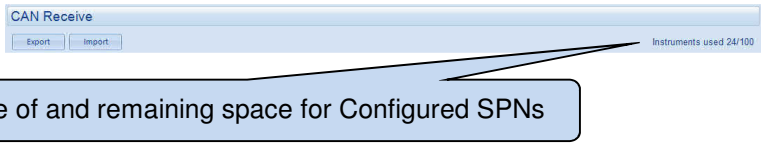


3.5.2.1 IMPORT AND EXPORT

Allows *Instrumentation Configuration* to be saved to a file. This eases the function of copying the items to other projects.

Parameter	Description
Export	Exports the Instrumentation Configuration to a file.
Import	Imports Instrumentation Configuration items from a previously created file.

3.5.2.2 SPNS USED



Shows the usage of and remaining space for Configured SPNs

3.5.2.3 MESSAGE ID

NOTE: Message *Priority* forms part of the *Message ID.* Ensure to check the *Priority* of the message being sent by the CAN 'transmitting device' to allow correct configuration of the *Message ID*.

Describes the PGN and SPN to receive.

Parameter	Description
SPN	J1939 Suspect Parameter Number to display.
Description	Free text string to describe the instrument.
CAN ID	29-bit CAN Message Identifier to receive. *CAN ID* must match exactly the full ID of the message to be received in the standard J1939 29-bit (Extended) format.
Timeout (ms)	Should the specified message not be received for the duration of *Timeout,* an alarm is raised.

3.5.2.3.1 STRUCTURE OF THE J1939 29-BIT MESSAGE ID

Byte 1	Byte 2	Byte 3	Byte 4
Priority, Data Page	PDU Format	PDU Specific	Source Address
8 bits (3 unused)	8 bits	8 bits	8 bits

Byte 1 – Priority and Data Page

Byte 1 is an 8-bit byte however three bits are unused.

Byte 1							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used			Priority (0 to 7)			Reserved	Data Page

The following table is used to simplify determination of the value for Byte 1.

NOTE: *Data Page* is most commonly zero (0). However, ensure to check the documentation of the CAN transmitting device.

Priority	Value of Byte 1 when Data Page=0	Value of Byte 1 when Data Page=1
0	0x00 (0)	0x01 (1)
1	0x04 (4)	0x05 (5)
2	0x08 (8)	0x09 (9)
3	0x0c (12)	0x0d (13)
4	0x10 (16)	0x11 (17)
5	0x14 (20)	0x15 (21)
6	0x18 (24)	0x19 (25)
7	0x1c (28)	0x1d (29)

Byte 2 and Byte 3 – PDU Format and PDU Specific

The *PDU Format* value details the specific or broadcast address. The interpretation of *PDU Specific* changes based on the *PDU Format* value:

- Where *PDU Format* is between 0x00 and 0xEF (0 and 239), the message is referred to as Peer-to-Peer (P2P), *PDU Specific* contains the destination address.
  The destination address is the device that is expected to act upon the message. Other devices may read the message but are not expected to act upon it.

- Where *PDU Format* is between 0xF0 and 0xFF (240 and 255), the message is referred to as a *Broadcast* message, intended to be received by any device. In this case, *PDU Format and PDU Specific* together indicate the parameter group.

- The PGN is the *Data Page*, *PDU Format* and *PDU Specific* together and is usually referred to in Hexadecimal.

Byte 4 - Source Address

The *Source Address* is used to indicate the specific application on the network where the CAN message has been sent from. Every network application must have a unique ID (253 addresses are available (0 to 253).

3.5.2.4 DATA STRUCTURE

Details where in the 8 Byte data packet the specified SPN is to be found.

Parameter	Description
Byte	Byte number (1 to 7) where the SPN is found.
Bit	Which bit of the specified Byte that the SPN starts.
Length	Length of the data in bits.

3.5.2.5 DISPLAY

Details where in the 8 Byte data packet the specified SPN is to be found.

Parameter	Description
D.Places	How many decimal places to include in the displayed value after the processing of the value according to *Bus Value* and *Mapped Value* settings.
Suffix	Free text entry of the *Suffix* (typically the units) of the display. This is displayed along with the instrumentation value. Example showing two instruments with *Suffix* of *kPa* and *ºC* 

3.5.2.6 BUS VALUE AND MAPPED VALUE

Parameter	Description
Bus Value Smallest Bus Value Largest	Details the smallest and largest values that are expected to be received in the CAN data.
Mapped Value Smallest Mapped Value Largest	Details how the Displayed Values relate to the received *Bus Values.* For example: *Bus Value* 0 to 240. *Mapped Value* -40 to 210. This configures the device to display *-40* when the value *0* is received and to display *215* when the value *255* is received. Values in between are linearly interpolated.

3.5.2.7 ADDITIONAL EXAMPLES

PGNs often requested to be received are listed in the following sections.

3.5.2.7.1 ALTERNATIVE UNITS

Depending upon user preferences alternative units are sometimes required. The table below includes common SPNs with non-metric units.

Instrumentation Configuration Message ID				Data Structure			Display		Bus Value		Mapped Value	
SPN	Description	CAN ID	Time-out (ms)	Byte	Bit	Length	D.Places	Suffix	Smallest	Largest	Smallest	Largest
100	Oil Pressure	0x18FEEF00	5000	4	0	8	1	PSI	0	250	0	1450
110	Coolant Temp	0x18FEEE00	5000	1	0	8	0	ºF	0	250	-40	410
174	Fuel Temp	0x18FEEE00	5000	2	0	8	0	ºF	0	250	-40	410

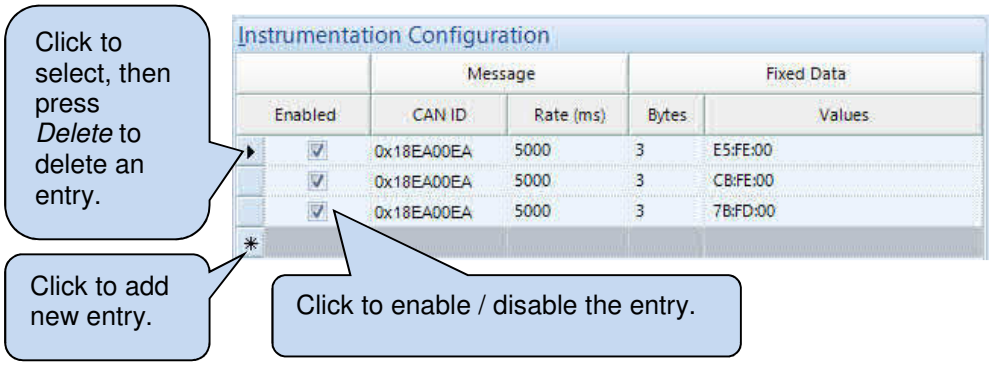
3.5.2.7.2 PARAMETERS FROM ENGINE ECU

NOTE: The listed *CAN ID*s below assume *Message Priority 6* and transmitting *Source Address 00.* For other values, amend the *CAN ID* as required.

Instrumentation Configuration Message ID				Data Structure			Display		Bus Value		Mapped Value	
SPN	Description	CAN ID	Time-out (ms)	Byte	Bit	Length	D.Places	Suffix	Smallest	Largest	Smallest	Largest
987	Protect Lamp	0x18FECA00	2500	1	0	2	0		0	3	0	3
3038	Malfunction Lamp MIL	0x18FECA00	2500	1	6	2	0		0	3	0	3

3.5.3 CAN TRANSMIT

Provides ehb SMARTdisplay 050 with a flexible system for transmitting up to 20 (twenty) CAN messages.
This is provided to send fixed CAN messages for 'requesting' the ECU to transmit certain PGNs. One such example is Engine Running Hours.
A corresponding entry in *CAN Receive* is required to receive and convert the SPNs within the requested PGN.



3.5.3.1 IMPORT AND EXPORT

Allows the Instrumentation Configuration to be saved to a file. This eases the function of copying the items to other projects.

Parameter	Description
Export	Exports the Instrumentation Configuration to a file.
Import	Imports Instrumentation Configuration items from a previously created file.

3.5.3.2 MESSAGE

Describes the PGN and SPN to send.

Parameter	Description
CAN ID	**NOTE: *Source Address* of the sending application (ehb SMARTdisplay 050) forms part of the Message *CAN ID.* Ensure to check the requirements of the receiving device (typically the Engine ECU) to ensure the Source Address used is compatible. For further details see section entitled *29-bit CAN ID* elsewhere in this document.** 29-bit CAN Message Identifier to send.
Rate (ms)	The rate at which the message is cyclically sent.

3.5.3.2.1 29-BIT CAN ID

NOTE: *Source Address* of the sending application (ehb SMARTdisplay 30) forms part of the *29-bit CAN ID.* Ensure to check the requirements of the receiving device (typically the Engine ECU) to ensure the Source Address used is compatible.

The following CAN ID is used to request a PGN be sent by the ECU. As the engine ECU is *usually* Source Address 00, PDU Specific in the *Request* message is 00.

CAN ID	Description
0x18EA00EA	Priority 6, PDU Format 0xEA, PDU Specific 0x00. Source Address 0xEA (decimal 234).

3.5.3.3 FIXED DATA

Details the data packet sent to ECU when requesting a PGN be sent. Three bytes of data follow which detail the PGN being requested.

Parameter	Description
Bytes	Number of Data Bytes in the message.
Values	The data to send. This is the PGN being requested.

3.5.3.4 FACTORY SETTINGS

Factory Settings of ehb SMARTdisplay 050 include the following CAN Transmit entries to request PGNs be sent by the ECU.

PGN REQUESTED			Rate (ms)	Fixed Data	
				Bytes	Values
0xFD7B	AT1S	After Treatment 1 Service (DPF Soot and Ash Levels)	5000	3	7B FD 00
0xFECB	DM2	Diagnostic Message 2 (List of Previously Active DTCs)	5000	3	CB FE 00
0xFEE5	HOURS	Engine Hours, Revolutions	5000	3	E5 FE 00

3.5.3.5 ADDITIONAL EXAMPLES

PGNs often requested to be transmitted are listed below.

3.5.3.5.1 29-BIT CAN ID

The following CAN ID is used to request a PGN be sent by the ECU. Three bytes of data follow which detail the PGN being requested.

CAN ID	Description
0x18EA00EA	Priority 6, PDU Format 0xEA, PDU Specific 0x00. Source Address 0xEA (decimal 234).

3.5.3.5.2 RATE AND FIXED DATA

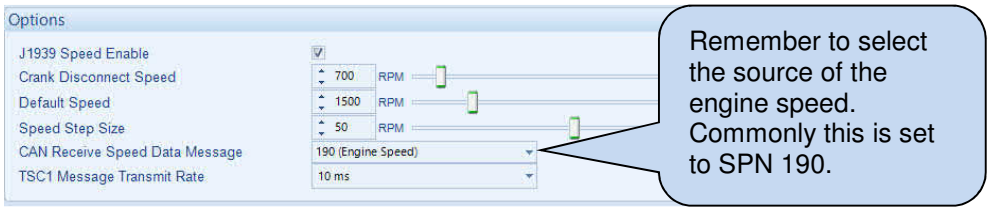
The following Rate, Bytes and Values must be entered to the *CAN Transmit* configuration to request the PGNs be sent.

PGN REQUESTED			Rate (ms)	Fixed Data	
				Bytes	Values
0xFEB3	LFII	Fuel Information (Liquid)	5000	3	B3 FE 00
0xFEE9	LFC1	Fuel Consumption (Liquid)	5000	3	E9 FE 00

3.5.4 SPEED CONTROL

NOTE: When enabled, speed control messages are sent using J1939 TSC1 (PGN 0) only. Alternative methods of speed control are not available.

3.5.4.1 OPTIONS



Parameter	Description
J1939 Speed Enable	☐: Speed control is disabled. All other options are 'greyed out' and are unavailable. ☑: Speed control is enabled. Review and configure the remaining Speed Control options.
Crank Disconnect Speed	TSC1 Speed Control messages are continuously sent to the engine ECU based upon the measured engine speed: ***Engine Speed<=Crank Disconnect Speed:*** TSC1 message includes the value of 0. ***Engine Speed>Crank Disconnect Speed:*** TSC1 messages include the value for engine speed based upon *Default Speed* setting and any user applied adjustments (i.e. Speed Raise/Speed Lower controls).
Default Speed	Speed the engine is initially requested to run at.
Speed Step Size	The size of step changes when increasing or decreasing engine speed by fascia button pressed or external input activation.
CAN Receive Speed Data Message	Select the source of the CAN instrument used to indicate engine speed. Typically, this is from SPN 190 (EEC1 – Engine Speed).
TSC1 Message Transmit Rate	Transmit Rate of the TSC1 CAN message used to control engine speed.

3.5.4.2 TSC1 MESSAGE CONFIGURATION

Parameter	Description
Engine Override Control Mode (SPN 695)	The override control mode defines which sort of command is used: ***Override disabled:*** Disable any existing control commanded by the source of this command. ***Speed control:*** Govern speed to the included "desired speed" value.
Engine Requested Speed Control Conditions (SPN696)	This mode tells the engine control system the governor characteristics that are desired during speed control. The four characteristics defined are: ***Transient Optimized for driveline disengaged and non-lockup conditions:*** This speed governor gain selection is adjusted to provide rapid transition between speed setpoints. RPM overshoot and undershoot may be greater than what is seen when the "speed control characteristic" is set to be stability optimized ***Stability Optimized for driveline disengaged and non-lockup conditions:*** This control condition has been optimized to minimize rpm overshoot and undershoot given an expected plant consisting of the engine and its accessory loads. This gain adjustment is not intended to compensate for driveline characteristics. This characteristic is most appropriate when no driveline is connected ***Stability Optimized for driveline engaged and/or in lockup condition 1 (e.g., vehicle driveline):*** This control condition has been optimized to minimize rpm overshoot and undershoot given a more complex plant. For instance, the more complex plant would contain the engine, its accessory loads and the driveline characteristics. As an example, the driveline characteristics might include the effective spring mass relationship of pumps, tires, clutches, axles, driveshafts, and multiple gear ratios. This characteristic is most appropriate when a driveline is engaged ***Stability Optimized for driveline engaged and/or in lockup condition 2 (e.g., PTO driveline):*** This speed control characteristic is available for applications requiring compensation for more than one driveline characteristic. It has been optimized to minimize rpm overshoot and undershoot given a more complex plant of the second variety. This more complex plant would again contain the engine, its accessory loads and a second driveline characteristic unique from the one described in speed control characteristic.

Parameter	Description
Override Control Mode Priority (SPN 897)	***Highest priority:*** Used for situations that require immediate action by the receiving device in order to provide safe vehicle operation (i.e., braking systems). This level of priority should only be used in safety critical conditions ***High priority:*** Used for control situations that require prompt action in order to provide safe vehicle operation. An example is when the transmission is performing a shift and requires control of the engine in order to control driveline reengagement. ***Medium priority:*** Used for powertrain control operations which are related to assuring that the vehicle is in a stable operating condition. An example is when the traction control system is commanding the engine in order to achieve traction stability. ***Low priority:*** Used to indicate that the associated command desires powertrain control but is needed for function which improves the driver comfort which may be overridden by other devices. An example is cruise control or the non-critical part of a transmission shift to a new gear.
Transmit Rate (SPN 3349)	This parameter indicates the transmission rate at which the sending device transmits the TSC1 message. The engine adjusts its timeout for TSC1 messages accordingly.
Control Purpose (SPN 3350)	State signal which indicates which control mode the sending device is using to generate the TSC1 command. Available options are: ***Accelerator Pedal/Operator Selection*** ***Cruise Control*** ***PTO Governor*** ***Road Speed Governor*** ***Engine Protection*** ***Temporary Power Train Control (Original use of TSC1 Command)***
Counter and Checksum Enabled	☐: Counter (SPN 4206) and Checksum (SPN 4207) are NOT included in the TSC1 message. ☑: Counter (SPN 4206) and Checksum (SPN 4207) are included in the TSC1 message transmitted by the device.

3.5.4.2.1 TSC1

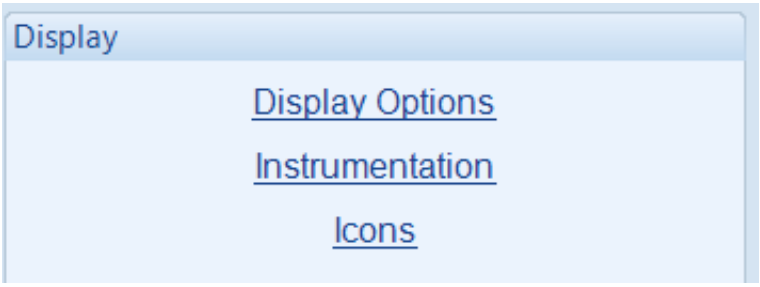
The complete TSC1 Message is as follows.

PGN 0 (0x0000) – Transmitted from ehb SMARTdisplay 050 to the engine ECU (when configured to do so).

SPN	Name	Pos'n	bits	Offset	Scaling
695	Engine Override Control Mode	Byte 0, bit 0	2	N/A	N/A
696	Engine Requested Speed Control Conditions	Byte 0, bit 2	2	N/A	N/A
897	Override Control Mode Priority	Byte 0, bit 4	2	N/A	N/A
898	Engine Requested Speed	Byte 1, bit 0	16	0	0.125 /bit
518	Engine Requested Torque	Byte 3, bit 0	8	-125	1 /bit
3349	TSC1 Transmission Rate	Byte 4, bit 0	3	N/A	N/A
3350	TSC1 Control Purpose	Byte 4, bit 3	5	N/A	N/A
4191	Engine Requested Torque High Resolution	Byte 5, bit 0		N/A	N/A
4206	Message Counter	Byte 7, bit 0	4	N/A	N/A
4207	Message Checksum	Byte 7, bit 4	4	N/A	N/A

3.6 DISPLAY

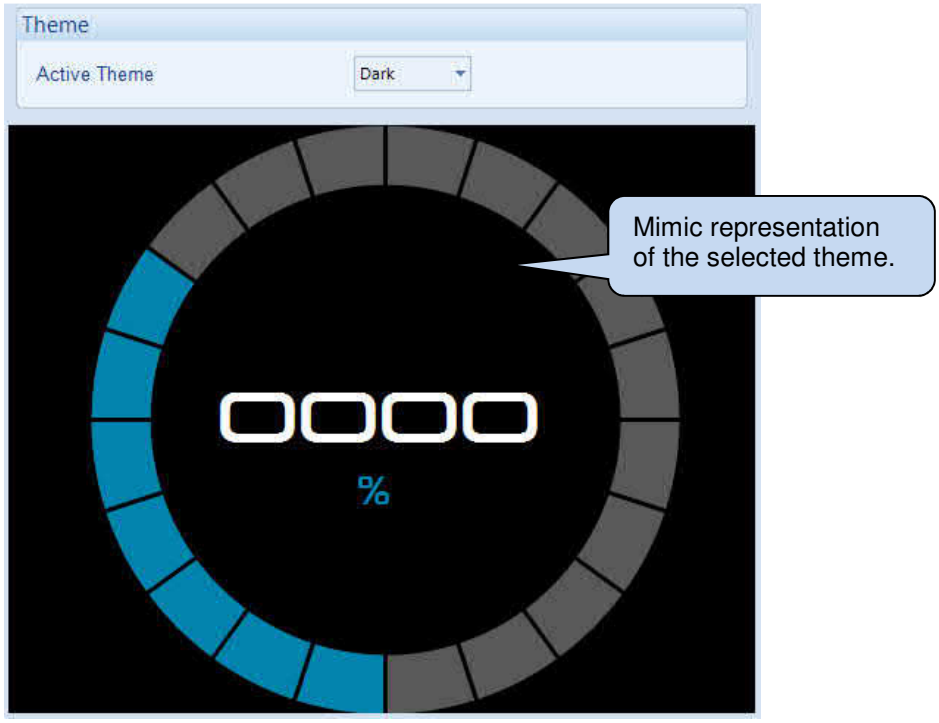
This section is further divided into subsections.



3.6.1 DISPLAY OPTIONS

Parameter	Description
Display Screen Number on Module	Where multiple instrumentation screens are configured, displaying the screen number may ease display navigation. The number appears at the bottom of the *Icons* display. Example **1/2** means that there are two instrumentation displays available and the first one is being viewed.
Display Engine Lamps on Module	Displays the Malfunction Indicator Lamps (MIL) at the top of the *Icons* display area. This includes the lamps from the DM1 message for: *Red, Amber, Malfunction, Protect*. Their exact meaning depends upon the configuration of the device (typically the engine ECU) transmitting them. Example: ● ● ● ● This shows the Shutdown Lamp active, with all other lamps inactive.

3.6.2 THEME

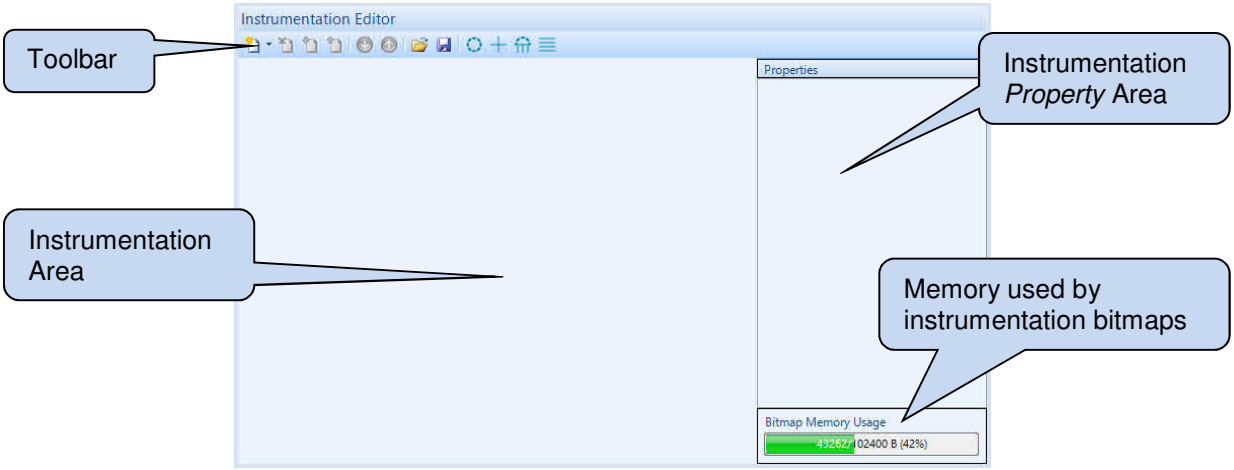


Parameter	Description
Active Theme	***Light:*** Display theme is lighter, optimised for viewing in bright ambient conditions. ***Dark:*** Display theme is darker, optimised for viewing in darker conditions such as in poorly lit engine rooms.

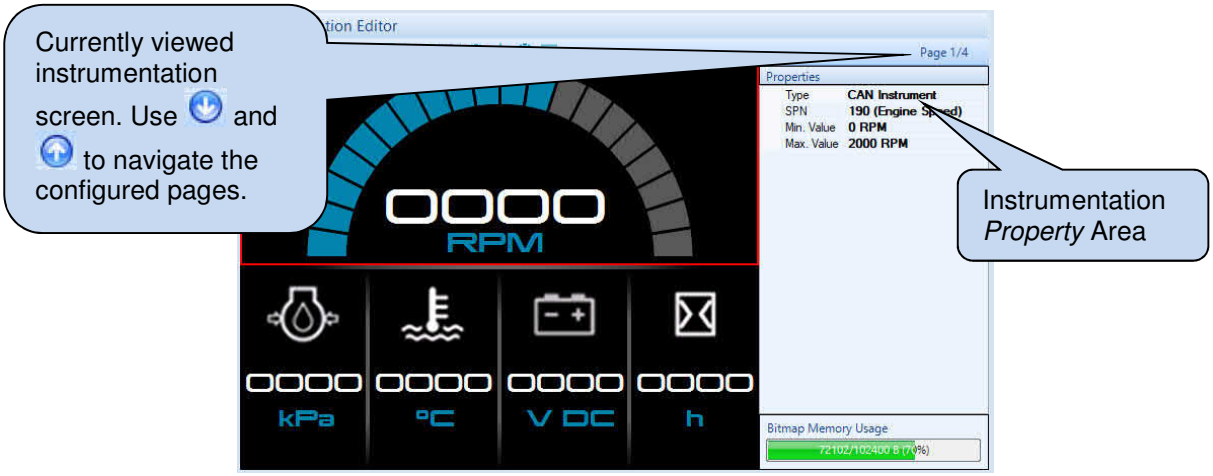
3.6.3 INSTRUMENTATION

Allows the Instrumentation display to be created/edited. Up to 30 (thirty) screens are supported.

Showing an *empty* editor before instrumentation is added.



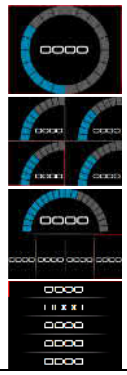
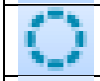
Showing the editor with one instrumentation page added.



3.6.3.1 BITMAP MEMORY USAGE

Where required, the system installer selects bitmap images to provide a graphical description of the instrument. Each image occupies memory space.
This section shows the amount of memory (Bytes) currently utilised by and available for instrumentation *Bitmaps*.

3.6.3.2 TOOLBAR

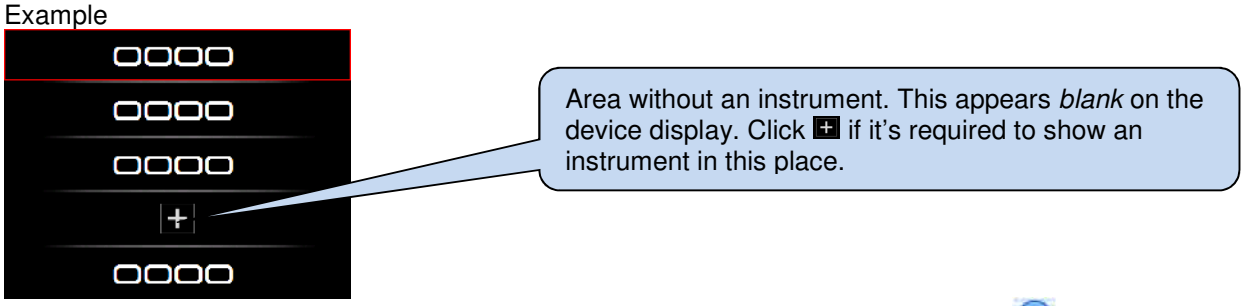
Icon	Description
	Click to select the type of instrumentation page to add. If there are no existing pages, the new page becomes Page 1. When instrumentation pages are already present, the new page is added between 'after' the currently viewed page. ***Single Instrument:*** Single, large display instrument. ***Quad Instrument:*** Four smaller instruments arranged in a 2 X 2 grid. ***Split Screen:*** One full width, half height instrument arranged above four small digital instruments. ***Table View:*** Five digital instruments arranged in a single column. 
	Deletes the current instrumentation screen (after confirmation).
	Moves the currently viewed page down one position in the instrumentation list.
	Moves the currently viewed page up one position in the instrumentation list.
	View the Next Instrumentation Page.
	View the Previous Instrumentation Page.
	Import a previously saved Instrumentation file.
	Save the current Instrumentation page layout and design to file. This is useful if the same instrumentation design is to be used in other device configurations.
	Add a new Single Instrumentation Page.
	Add a new Quad Instrumentation Page.
	Add a new Split Instrumentation Page.
	Add a new Table View Instrumentation Page.

3.6.3.3 CONFIGURING INSTRUMENT PARAMETERS

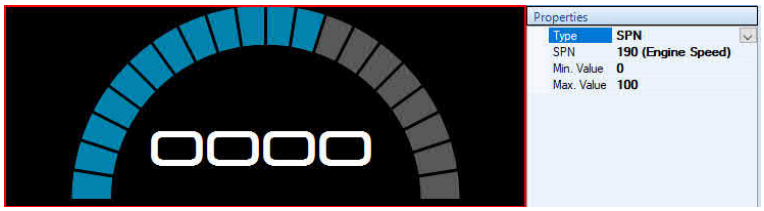
The instrumentation page is blank upon first creating it.

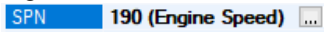
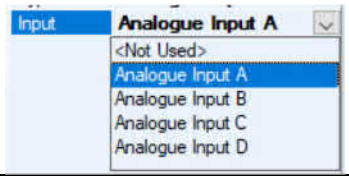
Click  to add an instrument into the area reserved for it. This allows some areas to be kept blank, without an instrument if required.

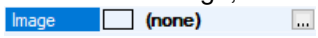
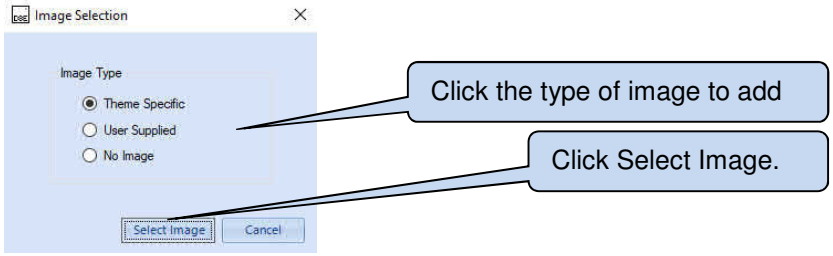
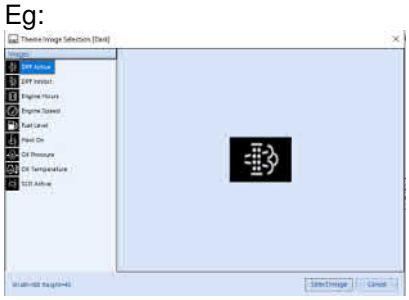
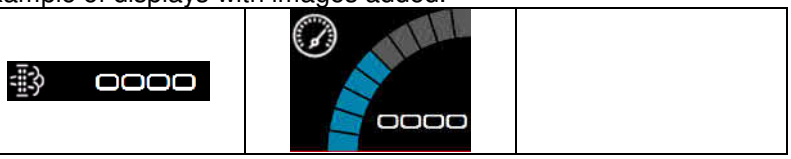
Example



To configure a specific instrument, select the Page the instrument is located on (Next  and Previous ) and then click the instrument. *Properties* displays the instrument settings for viewing and configuration.



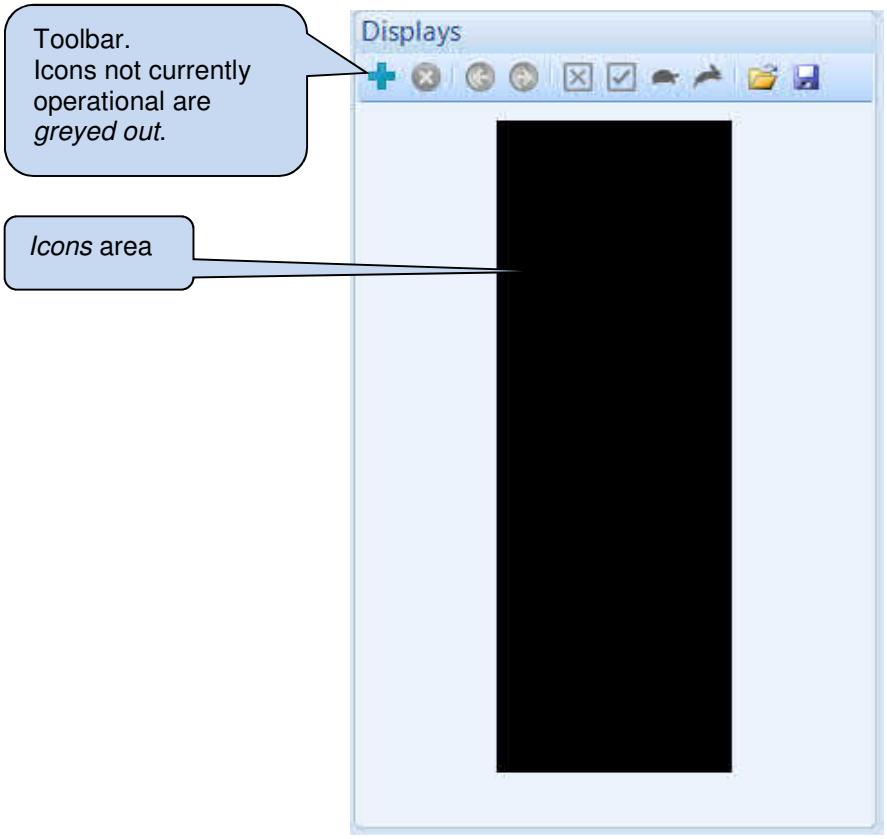
Parameter	Description
Type	Select the Instrument Type. ***Analogue Input:*** The instrument is used to display the value of one of the device's analogue inputs. ***SPN:*** The instrument is used to display the value or one of the configured SPNs received over CAN..
SPN Available when *Type* is set to *SPN*.	To select the SPN used for the instrument, click the property line and then click  e.g.  Now select from the list of previously configured SPNs. SPNs are configured on the *CAN* / *CAN Receive* page of the configuration.
Input Available when *Type* is set to *Input*.	To select the SPN used for the instrument, click the property line, click  and select the input to use. 
Min. Value	The minimum value to be displayed by the instrument. This cannot be lower than the minimum value of the Analogue Input / SPN selected.
Max. Value	The maximum value to be displayed by the instrument. This cannot be higher than the maximum value of the Analogue Input / SPN selected.

Parameter	Description
Image	**NOTE: Several *Theme Specific* images are supplied within ehb Configuration Suite PC Software. Custom images are added using the option *User Supplied* as detailed below.** Allows an image to be displayed for the instrument. To select an image, click the parameter line and then click ...   ***Theme Specific:*** Select one of the predefined images from the currently selected *Theme*. Eg:  Example of displays with images added.  ***User Supplied:*** Select a bitmap (bmp) image to display. ***No Image:*** No image is added to the instrument.

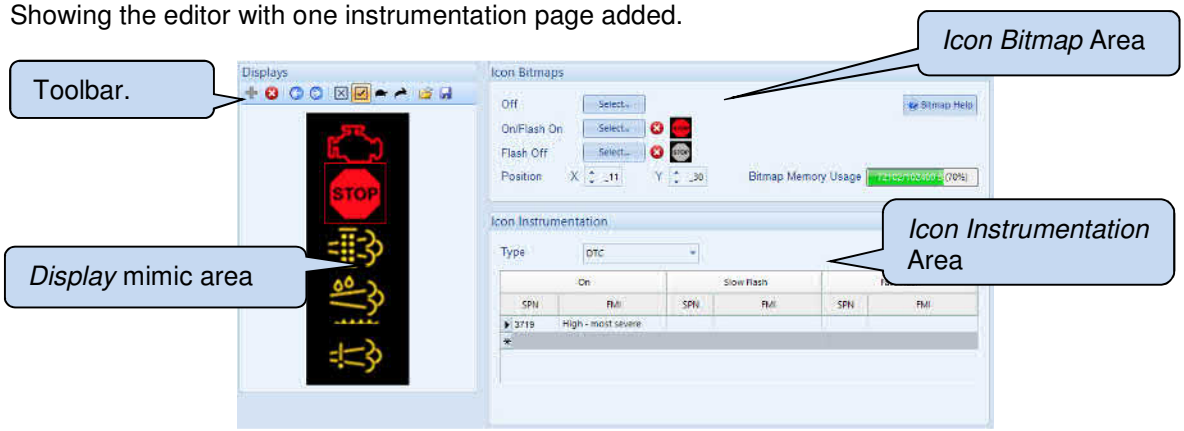
3.6.4 ICONS

Allows the *Icons* display on the ehb SMARTdisplay 050 right hand side to be created/edited.

Showing an *empty* editor before any icons are added. Up to eight (8) are supported.



Showing the editor with one instrumentation page added.

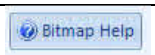
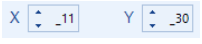


3.6.4.1 DISPLAYS TOOLBAR

Icon	Description
	Click to add a new icon to the display area. Up to eight (8) are supported.
	Click to delete the currently selected icon from the display.
	Select the previous instrument.
	Select the next instrument.
	View the display mimic with all icons in their *Off* state.
	View the display mimic with all icons in their *On* state.
	View the display mimic with all icons in their *Slow Flash* (1 Hz) state.
	View the display mimic with all icons in their *Fast Flash* (2 Hz) state.
	Import a previously saved *Icons* file.
	Save the current *Icons* layout to file. This is useful if the same design is to be used in other device configurations.

3.6.4.2 ICON BITMAPS

This section is used to determine how the icon appears in the display area.

Parameter	Description
Off 	Click *Select* to choose the image to display when this icon is *Off*. For example, this could be a *greyed-out* version of the *On* image or could simply be left *Blank.*
On/Flash On 	Click *Select* to choose the image to display when this icon is *On* (including when flashing).
Flash Off 	Click *Select* to choose the image to display when this icon is *Flashing Off*. For example, this could be a *greyed out* version of the *On* image or could simply be left *Blank.*
	Click *Bitmap Help* to display a reminder of the *Bitmap* requirements. ***Image Format:*** Microsoft Windows™ ".bmp" file. ***Colour Depth:*** 16 bits per pixel. ***Max Size:*** 16 pixels wide, 164 pixels high. Click *OK* to close the reminder and return to the main editor.
Position 	Adjusts the position of the icon on the display. The display mimic is used to verify the screen is as desired.
Bitmap Memory Usage	Where required, the system installer selects bitmap images to provide a graphical description of alarms and operational status. Each image occupies memory space. This section shows the amount of memory (Bytes) currently utilised by and available for instrumentation *Bitmaps.*

3.6.4.3 ICON INSTRUMENTATION

This section is used to determine when the icon appears in the display area.

Parameter	Description
Type	Select the source to check to determine if the image is to be visible. ***DTC:*** Selects a Diagnostic Trouble Code as the source for the icon visibility. ***CAN Instrument:*** Selects one of the defined *CAN Receive* items as the source for the icon visibility.

3.6.4.3.1 DTC

When *Icon Instrumentation Type* is configured to *DTC*, the following parameters are available.
The system allows for up to four entries per icon. Where more than one entry is added, the icon is displayed should any one of the entries be true. i.e. the entries are considered as an OR condition.

Parameter	Description
Instrumentation	Select from the list of previously configured SPNs. The state of this SPN is used to determine icon visibility. SPNs are configured on the *CAN* | *CAN Receive* page of the configuration.
On	Determines when to display the selected *On/Flash On* icon. ***SPN:*** Selects which SPN to test. ***FMI*****:** Select the FMI to act upon.
Slow Flash	Determines when to *Slow Flash* (1 Hz) the selected icon. ***SPN:*** Selects which SPN to test. ***FMI*****:** Select the FMI to act upon.
Fast Flash	Determines when to *Fast Flash* (2 Hz) the selected icon. ***SPN:*** Selects which SPN to test. ***FMI*****:** Select the FMI to act upon.

3.6.4.3.2 CAN INSTRUMENT

When *Icon Instrumentation Type* is configured to *DTC*, the following parameters are available.
The system allows for up to four entries per icon. Where more than one entry is added, the icon is displayed should any one of the entries be true. i.e. the entries are considered as an OR condition.

Parameter	Description
Instrumentation	Select from the list of previously configured SPNs. The state of this SPN is used to determine icon visibility. SPNs are configured on the *CAN* | *CAN Receive* page of the configuration.
On	Determines when to display the selected *On/Flash On* icon. ***Condition:*** Select what condition to test the SPN Value for. ***Values*****:** Select the value to use with the *Condition.* For example: Condition: Equal to (=). Value: 1 Action: The icon is visible when the SPN value is '1'.

Parameter	Description
Slow Flash	Determines when to *Slow Flash* (1 Hz) the selected icon. ***Condition:*** Select what condition to test the SPN Value for. ***Values*:** Select the value to use with the *Condition.* For example: Condition: More Than (>). Value: 128 Action: The icon flashes slowly when the SPN value is more than '128'.
Fast Flash	Determines when to *Fast Flash* (2 Hz) the selected icon. ***Condition:*** Select what condition to test the SPN Value for. ***Values*:** Select the value to use with the *Condition.* For example: Condition: Between. Value: From 10 to 20. Action: The icon flashes slowly when the SPN value is between '10' and '20'.

4 DOKUMENT INFORMATION, HISTORY

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5 IMPRINT

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