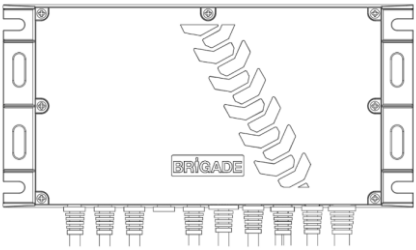
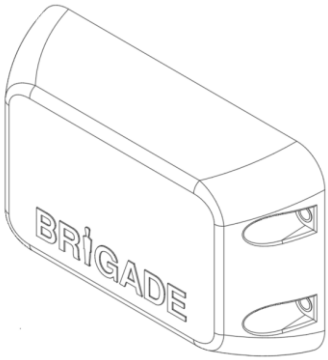
Brigade

BS-OSD-H43

Backsense®
Radar On-Screen Display System

Installation & Operating Guide





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1 Introduction

Brigade's Backsense® uses FMCW (Frequency Modulated Continuous Wave) radar system technology to detect solid objects (e.g., vehicles, machinery, barriers) in blind spots, significantly reducing collisions.

Backsense® detects both stationary and moving objects, providing the driver with in-cab visual and audible warnings. Backsense® works effectively in harsh environments with poor visibility, including darkness, smoke, fog, and dust.

Important Characteristics: Backsense radar systems provide solid object detection (e.g. vehicles, machinery, barriers and other inanimate objects) within a specified detection range. A person or an object with low reflective properties may not be detected if one or more objects with greater reflective properties are also located within the detection zone. Backsense radar systems should not be solely relied upon to detect people or animals. If this is required, consider the addition of Brigade's AI people detection cameras.

Backsense® On Screen Display system combines object detection information from Brigade's BS-9100 radar sensors with images from Backeye® camera and monitor systems, providing the driver with in-cab visual and audible warnings overlaid on to camera images on-screen. This combination of object detection warnings and video images allows the machine operator to view all pertinent information in a single location reducing the number of systems he would otherwise need to monitor.

The Backsense® BS-OSD-H43 ECU is capable of connecting to up to 4 BS-9100 radar sensors and up to 3 Backeye® cameras. The system is fully configurable to enable a range of Radar/camera implementations.

It is imperative that any Brigade Backsense® system is fitted and commissioned by competent and trained technicians. The installer is responsible for the fitness for purpose of the overall system and must adhere to relevant regulations and legislation. Operators of the vehicle or machine to which the Brigade Backsense® System is fitted must be made fully aware of how to interpret the system so they will not be distracted by or rely completely on it. Distraction can cause collisions.

The system is intended as an aid only. The operator must still concentrate on operating the vehicle or machine, obeying traffic and local regulations. Vehicle or machine operators must continue to use their own training, senses and other vehicle aids such as mirrors, as if the system were not in place. Nothing removes the responsibility of the operator to operate the vehicle or machine in a proper and lawful manner.

1.1 Detection Range

Backsense® detection range is fully configurable enabling customisation to suit a multitude of applications Minimum and maximum limits for detection range are detailed in the table below:

Model Name	Detection Length		Length of each Detection Zone		Detection Width		Nominal Tolerance	
	[m]	[ft]	[m]	[ft]	[m]	[ft]	[m]	[ft]
BS-OSD-H43	2.5 - 60 (10)*	8 - 197 (33)*	0.5 - 58 (2)*	2 - 190 (7)*	2 - 16 (7)*	7 - 52 (23)*	±0.25	±1

* Default setting

Additional detection, blind and alerting parameters are configurable within the system including Detection Zone length, Detection Zone Width, Blind Zone Length, Blind Zone width, Blind Cell activation, Trigger Output Zones and Audible Alert starting zones. Refer to section 5.3 for more information.

1.2 Object Detection Capability

Warning

- **There is no detection of objects or parts of an object closer than approx. 0.3m to the sensor.**
- Brigade Backsense® radar beam has a 140° horizontal angle out to the maximum designated width and symmetrically perpendicular to the sensor front surface. The vertical angle is 16°.
- All dimensions for detection of objects are nominal and vary significantly depending on many parameters. For more details, see section “1.2.2 Factors Influencing the Detection of Objects”.
- An object will cause a detection alert (while triggered and in active mode) in less than 0.23 second.
- After power-on, the system takes around 16 seconds to complete the power up routine including self-test as detailed in section 4.1.

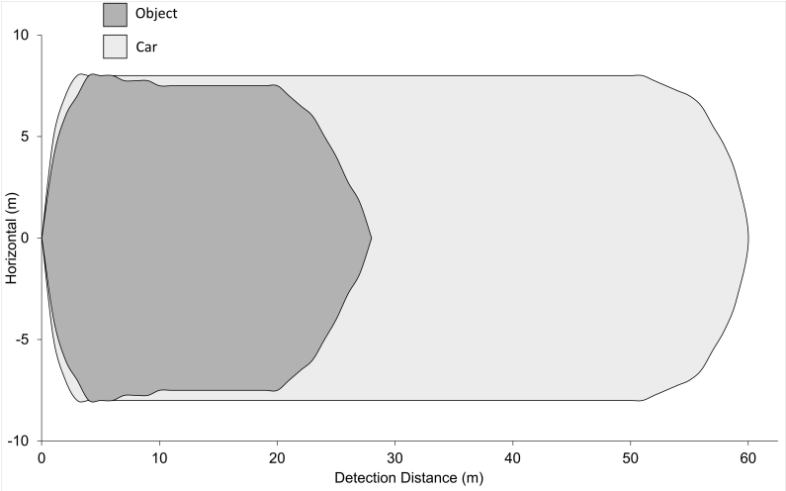
Notes:

- For distances below 1.5m (detection with relative speed only) or below 0.3m (no detection) the space covered in general by radar systems is very small. In this scenario, Backsense® may not be the most suitable solution and therefore Brigade recommends adding an additional or alternative detection system depending on the vehicle’s application. For example, Brigade Backscan® based on ultrasonic sensing technology, offers superior detection at close ranges.
- Brigade Backsense® system is not affected when multiple sensors are operating in the same area or on the same vehicle, even if they are installed in close proximity and with overlapping detection areas.
- Independent detection of target objects can be achieved when there is a minimum range separation of 0.8m and velocity difference of >0.7m/s between each.

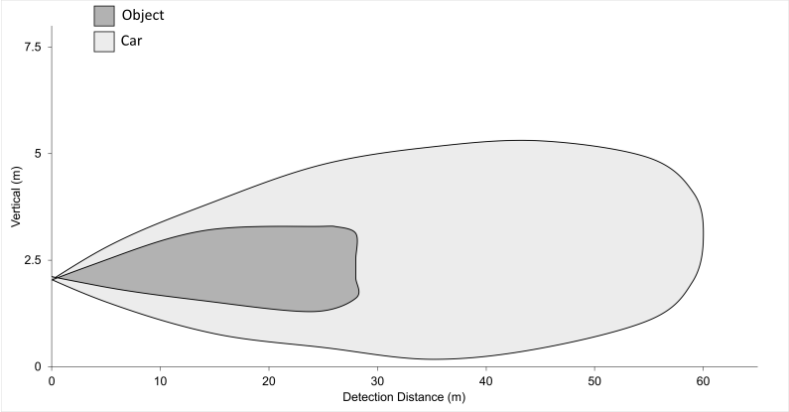
Tip: Brigade Backsense® detection is generally better when there is relative speed between the sensor and the objects and when the direction of approach is perpendicular to the sensor front face.

1.2.1 Detection Pattern

1.2.1.1 Horizontal Pattern



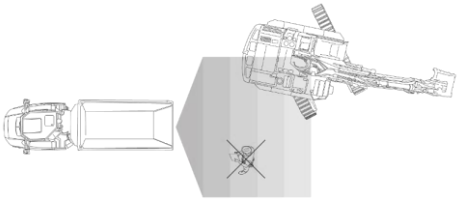
1.2.1.2 Vertical Detection Area



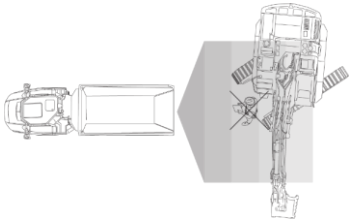
1.2.2 Factors Influencing the Detection of Objects

Brigade Backsense® shares in principle the advantages and limitations of all radar-based systems when compared to other sensing technologies. In general, it can reliably detect most objects in most environmental conditions such as dirt, dust, rain, snow, sun, fog, darkness, acoustic noise, mechanical vibration, electromagnetic noise or similar.
However, there are some occasions when an object could stay undetected. Radar works on the principle of line of sight and relies on some of the electromagnetic energy transmitted by the sensor being reflected from the object to the sensor. If an object does not reflect enough electromagnetic energy back to the sensor it will not be detected.

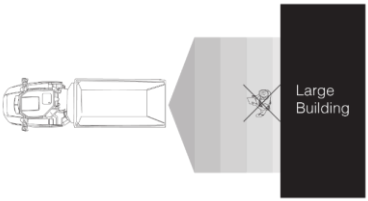
Optimal detection performance will be achieved in a clean open field environment when a target is present.
In other environments, detection of objects with lower reflective properties is not reliable. While radar is effective in broad detection and tracking, smaller objects like pedestrians in crowded areas can present a challenge for all radar systems as their radar cross-section can be lower than that of larger objects with high reflective properties, making them harder to detect.

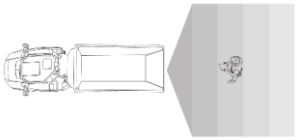


A person or an object with low reflecting properties may not be detected if one or more larger objects with high reflecting properties are located within the detection zone.



A person or an object with low reflecting properties may not be detected if located close to a larger object with high reflecting properties.





An example of a person or an object with low reflecting properties being detected in a clear open field.

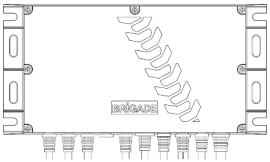
Note: We recommend that this Backsense system is used in conjunction with Brigade's AI People detection cameras.

In the case where there are multiple objects in the detection area at various distances and/or angles, the sensor detects the closest object, which is the most important one for collision avoidance.
The object properties, location and direction are key influences in determining if an object is detected or not. The influencing factors are listed below.

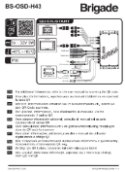
- **Size**: Larger surfaces are detected better than smaller surfaces. If there are small and large objects in the detection area, the smaller object might only register in Detection Zones closer to the sensor.
- **Material**: Metal is detected better than non-metal materials, e.g. wood, plastic.
- **Surface**: A smooth and solid surface is detected better than rough, uneven, porous, fragmented or liquid surfaces, e.g. bushes, brick work, gravel, water.
- **Shape**: A flat object is better detected than a complex shape. Variation in relative location and direction can influence detection significantly.
- **Angle**: An object facing directly towards the sensor (perpendicular, orientation head on to the sensor) is detected better than an object that is located towards the edges of the detection area or at an angle.
- **Distance**: An object closer to the sensor is better detected than one that it is further away.
- **Relative speed to sensor**: Detection is better if there is a relative speed between object and sensor.
- **Ground condition**: Objects on flat, mineral material ground are better detected than on rough or metal surfaces.
- **Environmental conditions**: Dense dust, heavy rain or snowfall will reduce the detection capability.

2 Contents

2.1 Standard System Contents (BS-OSD-H43)



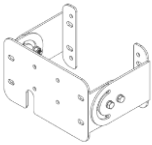
ECU
BS-ECU-H43



Quick Start Guide

Fixing Kit

2.2 Optional items (not included)



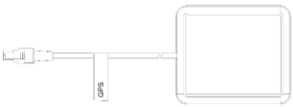
Adjustable Sensor Bracket
BKT-023

Radar Sensor
BS-9100

2x Network Y Cable
BS-00NYC

2x 120Ω Network Terminator
BS-00NT

Extension Cables 2m, (6ft) 5m (16ft), 9m (30ft) or 25m (82ft)
BS-02DCX, BS-05DCX, BS-09DCX or BS-25DCSX

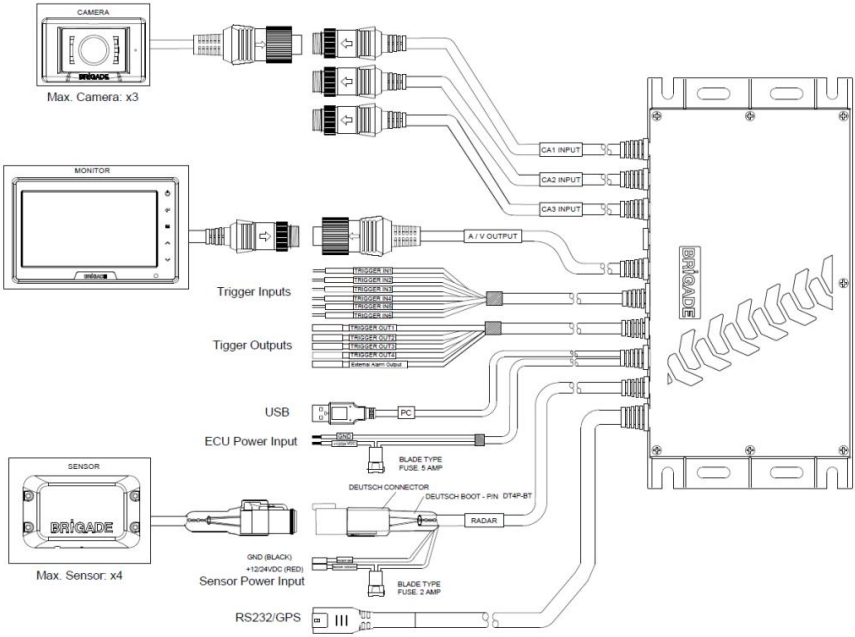


MDR GPS Antenna
MDR-ANT-GPS-03

3 Hardware Installation

3.1 System Connectivity

The diagram below shows the typical/recommended setup for a system comprising of Brigade's BS-OSD-H43 ECU. Other system configurations are possible depending on the application.



3.2 Installation Test Site

It is recommended that the system test site is flat and clear of large objects within the detection range of each sensor in the intended Backsense® system. This will ensure optimal conditions for a basic setup, configuration and testing of the installed system.

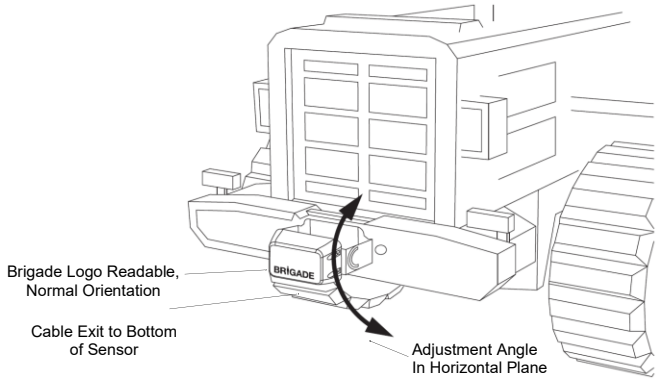
The Backsense® ECU must be installed in a dry location inside the vehicle cabin. If the vehicle cabin is liable to ingress of liquids or other foreign objects which may cause damage to the ECU, then a protective enclosure should be fitted or other steps taken to avoid such damage. The ECU may be installed in any orientation but must be mounted to a flat surface using a minimum of 4 fixings. The sides of the ECU enclosure feature re-enforced, slotted flanges designed to accept an M5 screw. Suitable washers must be used under screw heads to spread the load and avoid damaging the mounting flange.

ECU USB cable must be accessible for configuration purposes. The cable and plug should be protected after configuration so that no debris can enter and cannot be damaged during machine operation.

3.3 Camera and Monitor Installation

Backsense® BS-OSD-H43 has been designed to work in conjunctions with Brigade's Elite range of camera and monitor systems however installation may vary depending upon equipment selection. The monitor should be mounted so the vehicle operator has good visibility in all environments and situations. The monitor should be fixed in a suitable location in line with any current legislation/regulations.
Refer to the Installation guidelines for the chosen equipment to ensure that best practices are followed. Any unused connectors on the ECU must be suitably insulated to protect against ingress of liquids or other foreign objects which could cause damage.

3.4 Sensor Mounting and Location



3.4.1 Sensor Direction

Each sensor should be mounted in an upright position with cable exit on the sensor pointing downwards. The Brigade logo on the front of the sensor should be in readable, normal orientation when standing in the required detection area, see image above. The front of the sensor should have line of sight to all areas where objects should be detected.

3.4.2 Sensor Fixing

Each unit is supplied with four M5x30mm screws and four M5 polymer locknuts for mounting purposes. The recommended torque is 6Nm or 50 inch/lbs.

3.4.3 Vehicle Overhang into Detection Area

The vehicle mounting locations should avoid detection of any overhang or object where possible. Such objects will cause false alarms (for exceptions see section 1.2, "Object Detection Capability", paragraph "Warning"). The detection area of the Brigade Backsense® radar beam has a 140° horizontal angle to the maximum designated width and a vertical angle of 16°, see section "1.2.1 Detection Pattern" for details.
The system can be configured using the Blind Area setup to ignore objects in the detection area, see section for 5.3.8 details.

3.4.4 Mounting Angle

Brigade recommends mounting the radar sensors on brackets (available from Brigade, see section 2.2), which can be adjusted for angle in the horizontal axis, enabling performance

optimisation. See below for suggested vertical angle vs sensor installation height on the vehicle.
Depending on the vehicle, working environment and typical objects to be detected, an adjustment of a few degrees around the suggested values can improve the detection performance or avoid false alarms.

Installation height on vehicle (to sensor centre point)		**Adjustment angle in upward direction from the horizontal plane**
[m]	[in]	[°]
0.3m	12	0.5
0.5m	20	0.5
0.7m	28	0.5
0.9m	35	0.5
1.1m	43	0.5
1.3m	51	0
1.5m	59	0

3.4.5 Offset to Vehicle Centre Line Mounting

If the Brigade Backsense® System is fitted off-centre or at an angle to the vehicle centre line, the detection area (see section “1.2.1 Detection Pattern”) is likely to be incorrect or misaligned with the vehicle width or direction of travel.
Using the Blind Zone configuration might resolve or compensate for mounting location issues, enabling off-centred or angled installations, see section 5.3.8 for details.

3.5 System Cables

It is recommended to protect cables using conduit and fit along existing cabling on the vehicle.A 24mm hole is required to pass the BS-9100 Radar sensor connectors through.
Fitment considerations should include:

- Allow a reasonable bending radius when folding excess cabling or for the routing of the cable.
- Avoid tight bends close to the connectors.
- Avoid pulling on the connector.
- Ensure all cables are fitted into suitable protective conduit
- Ensure cabling and connectors are fitted away from sources of excess heat, vibration, movement and water or dirt.

3.6 Recommended Network Layouts and Limitations

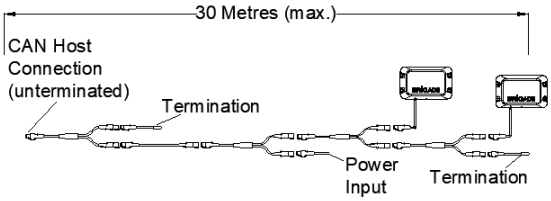
Backsense® System installation must adhere to a strict network topology to ensure reliable communications between the BS-OSD-H43 ECU and BS-9100 radar sensor(s).
The network topology must represent a bus featuring 120Ω termination at both ends. The BS-9100 sensor(s) must be connected to the bus via Network Y-Cable only. The user must not install any extension cable between the sensor and the Y-Cable. Examples for good and bad network arrangements are show below:

3.7 Good Network Arrangement

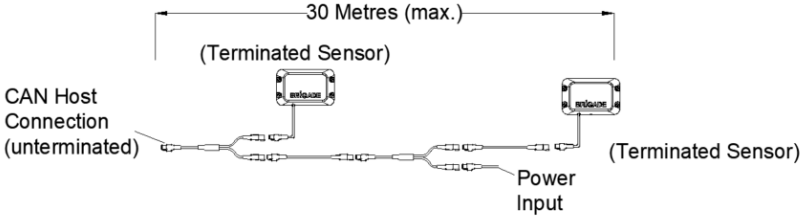
Good Network Topology Includes:

- 120Ω Termination at both ends
- Bus Length limited to 30m between terminations
- Power input position balanced depending on the sensor’s physical distribution on the bus. This should be optimised to minimise voltage drop over the cable for each sensor.

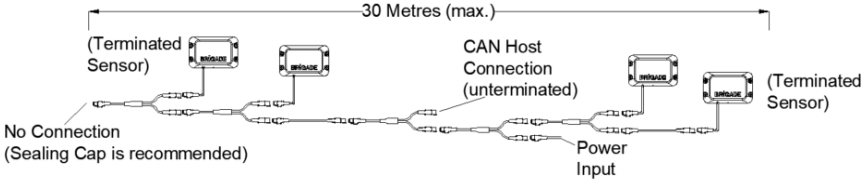
- No extension cables installed between the sensor and the Y-Cable. Only sensor tail cable to Y-Cable is allowed.



Example 1 (Good), host connection at end of bus



Example 2 (Good), host connection in middle of bus using terminated sensors



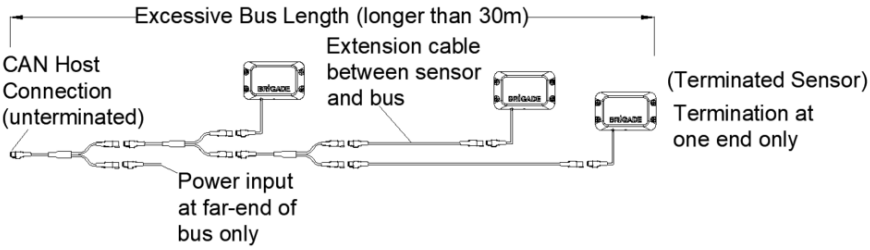
Example 3: (Good) Two terminated sensors with host connection in middle of bus

3.8 Bad Network Arrangement

Bad Network Topology may include:

- Long bus length >30m.
- Non-bus configuration (e.g. star, mesh etc.).
- Termination missing at both ends of network.
- Omission of Network Terminator cable.
- Extension cable between non-terminated sensor and Y-Cable.
- Connection to more than 8 sensors on single bus. (not shown)
- Connection to other CAN nodes, (not shown below).

Please Note: Powering the BUS at one end may result in a voltage drop across the cable (depending on cable length), contributing to Bad Network Topology



Example 3 (Bad), Incorrectly placed termination (middle of bus)

3.9 Electrical Wiring Connections

Refer to the vehicle manufacturer or bodybuilder guidelines for installation procedures and connectivity in all applications. Electrical wiring connections for Backsense® BS-OSD-H43 are detailed below however the installer must also consider the installation of any supporting monitor and the BS-9100 radar sensor(s):

- Red cable to non-permanent power supply e.g. ignition. (12V/24V)
- Black cable to ground.
- Green cable (Trigger In 1) to activation trigger signal, (e.g. reverse or another vehicle signal).
  This activation input changes the status of Sensor 1 from standby to active
- White cable (Trigger In 2) to activation trigger signal, (e.g. reverse or another vehicle signal)
  This activation input changes the status of Sensor 2 from standby to active.
- Blue cable (Trigger In 3) to activation trigger signal, (e.g. indicator or another vehicle signal)
  This activation input changes the status of Sensor 3 from standby to active.
- Yellow cable (Trigger In 4) to activation trigger signal, (e.g. indicator or other vehicle signal) This activation input changes the status of Sensor 4 from standby to active.
- Brown cable (Trigger In 5) to the activation trigger for camera 2.
  This activation input changes the monitor display source from Camera 1 (default) to Camera 2. Trigger In 5 can be activated via a relay connected to Trigger Out if camera activation based on object detection is required.
- Orange cable (Trigger In 6) to the activation trigger for camera 3.
  This activation input changes the monitor display source from Camera 1 (default) to Camera 3. Trigger In 6 can be activated via a relay connected to Trigger Out if camera activation based on object detection is required.

- Green cable (Trigger Out 1) is a trigger output to activate secondary functions or devices. The Trigger Out 1 cable is switched to ground (black cable) when an object is detected within a pre-configured zone in the detection area of Sensor 1
- White cable (Trigger Out 2) is a trigger output to activate secondary functions or devices. The Trigger Out 2 cable is switched to ground (black cable) when an object is detected within a pre-configured zone in the detection area of Sensor 2
- Blue cable (Trigger Out 3) is a trigger output to activate secondary functions or devices. The Trigger Out 2 cable is switched to ground (black cable) when an object is detected within a pre-configured zone in the detection area of Sensor 3
- Yellow cable (Trigger Out 4) is a trigger output to activate secondary functions or devices. The Trigger Out 2 cable is switched to ground (black cable) when an object is detected within a pre-configured zone in the detection area of Sensor 4
- Orange cable (External Alarm Output) is a trigger output to activate secondary functions or external alarm devices.

  Please note: Output Trigger Voltage will match with system input voltage.

  Examples of secondary devices which could be connected to the Green or White cables (Trigger Out 1 or Trigger Out 2) could be: a Brigade bbs-tek® white sound® alarm, a light beacon to send a warning into the detection area(s) or an automotive relay for switching higher loads

Secondary output devices or any external alarm must be independently fused and connected to the same power supply (non-permanent for red cable detailed above) as the BS-OSD-H43 ECU The respective Trigger Out cable (Green, White, Blue or Yellow) provides the negative connection. For electrical loading limits see section 7 for details.

Electrical Connection Table		
RED	Non-permanent power supply	System supply (5A blade fuse) (Range +12V to +24V)
BLACK	Ground	Supply negative
GREEN	Trigger Input 1 (Sensor 1 Activation)	Trigger from vehicle, activehigh (Range above +9Vdc, up to supply voltage)
WHITE	Trigger Input 2 (Sensor 2 Activation)	Trigger from vehicle, high active (Range above +9Vdc, up to supply voltage)
BLUE	Trigger Input 3 (Sensor 3 Activation)	Trigger from vehicle, high active (Range above +9Vdc, up to supply voltage)
YELLOW	Trigger Input 4 (Sensor 4 Activation)	Trigger from vehicle, high active (Range above +9Vdc, up to supply voltage)
BROWN	Trigger Input 5 (Camera 2 Activation)	Trigger from vehicle, high active (Range above +9Vdc, up to supply voltage)
ORANGE	Trigger Input 6 (Camera 3 Activation)	Trigger from vehicle, high active (Range above +9Vdc, up to supply voltage)
GREEN	Trigger Out 1 (Sensor 1 Detection)	Switched to Ground when active (Loading up to 0.5A)
WHITE	Trigger Out 2 (Sensor 2 Detection)	Switched to Ground when active (Loading up to 0.5A)
BLUE	Trigger Out 3 (Sensor 3 Detection)	Switched to Ground when active (Loading up to 0.5A)
YELLOW	Trigger Out 4 (Sensor 4 Detection)	Switched to Ground when active (Loading up to 0.5A)
ORANGE	External Alarm Output	Switched to Ground when active (Loading up to 0.5A)

3.10 Camera and Monitor Connections

Camera and monitor connection may vary depending on equipment selection. Brigade can provide a range of adaptors to ease installation where required, contact Brigade Technical help for further details.
Recommended camera and monitor connections are detailed below:

- CA1 INPUT connector to default (configurable) camera source.
- CA2 INPUT connector to second (configurable) camera source
- CA3 INPUT connector to third (configurable) camera source
- A/V OUTPUT connector to in-cab display

Brigade's Backeye® range of Elite cameras (e.g. BE-800C) are recommended for use as default and secondary cameras. These must be connected to the BS-OSD-H43 ECU via Elite Camera Cable(s) (with push-fit connector).PAL and NTSC formats are supported however both default and secondary cameras must operate on the same signal format.

Brigade Backeye® range of Elite monitors (e.g. BE-870LM) are recommended for use with the BS-OSD-H43 ECU and will connect directly without adaptation. BS-OSD-H43 ECU supports single view images only.

Camera & Monitor Connection Table		
CA1 INPUT	Default Camera	Standard PAL / NTSC (both CVBS and AHD) 12V powered camera. Video and Audio support
CA2 INPUT	Second Camera	Standard PAL / NTSC (both CVBS and AHD) 12V powered camera. Video and Audio support
CA3 INPUT	Third Camera	Standard PAL / NTSC (both CVBS and AHD) 12V powered camera. Video and Audio support
A/V OUTPUT	Monitor Output	PAL / NTSC (both CVBS and AHD) Video and Audio Output with Overlaid object detection warnings

3.11 Sensor Connector

Backsense BS-OSD-H43 supports connection to Brigade BS-9100 Radar sensors only. No other radar sensor connections are permitted. Sensor network connections are detailed below:

- SENSOR connector to Radar sensor network, consisting of up to 4 BS-9100 sensors, independently powered and fused as detailed in section 3.12

Sensor Connection Table		
SENSOR	BS-9100 Radar Network	CAN High and CAN Low connections. No connection to Radar Power or Ground
RED	Non-permanent power supply	Sensor supply (2A blade fuse supplied in separated small fixing paper bag) (Range +12V to +24V)
BLACK	Ground	Sensor Supply negative

3.12 Power Source

Each component of the Backsense® system must be separately fused but powered from the same switched power source detailed in section 3.9.
System components requiring individual fuses include:

- BS-OSD-H43 ECU
- BS-9100 Sensor Network, (via a single dedicated Brigade power cable)
- Display Monitor
- Secondary devices connected to Trigger Outputs 1, 2 and 3 (if applicable)
- External warning alarm connected to Trigger Output 4 (if applicable)

Only one power input to the BS-9100 sensor network is permitted (via dedicated Brigade power cable only) and must be suitably positioned within the network to ensure that loading from all sensors is balanced and excessive voltage drops are avoided.

The BS-9100 sensor network must be adequately powered under all operating conditions. The installer must verify that any volt drop throughout the network does not cause the supply at the sensor to drop below the minimum recommended value during operation, (see BS-9100 Installation and Operating Guide for details)

The table below details the maximum fuse rating for each of the above elements of the system:

Power & Fusing for 12V and 24V systems		
System Component	Maximum Fuse Rating	Notes
BS-OSD-H43	7.5 Amp	Automotive Blade type fuse
BS-9100 Sensor Network	2 Amp	Fuse is supplied in the fixing kit
Display Monitor	3 Amp	Example rating for BE-870LM. Actual rating depends on monitor selection.
Secondary Device	1 Amp	Installer to supply this fuse
External Warning Alarm	1 Amp	Installer to supply this fuse

4 System Operation

4.1 Initial System Power Up

Once the system is fully installed and connected, power must be applied to test correct operation. On power up, the system will go through its self-test by displaying all connected camera from CA 1 to CA 3, then 8 coloured indicators on the monitor screen in red and by sounding an audible alert (through both the monitor's speaker and any external alarm connected to the Ext-Alarm Trigger). After that, the audible alert test will cease. The 8 red indicators will change colour to green and show all camera channels resolutions and leaving the system in standby and the image from CA 1 only on the screen.
The machine operator must verify that all self-test functions described here are completed successfully at each power-on of the system. Any malfunction of the system should be reported to the appropriate responsible person.

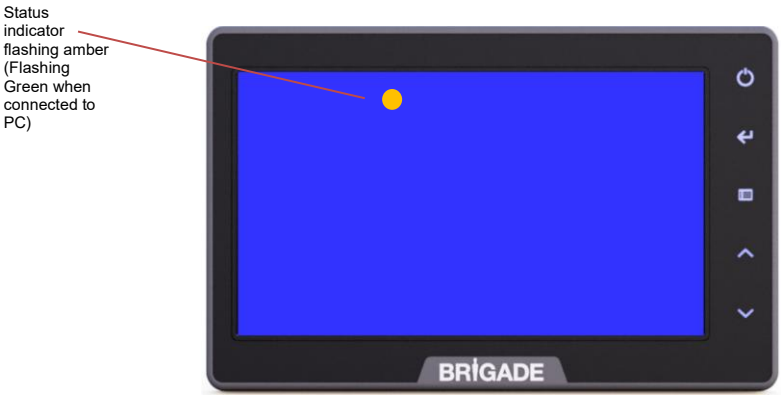
Note: Depending on equipment selection, the power-ON and boot time of the display monitor, a monitor and camera fitted with a longer boot time may not display the system self-test diagnostic summary after power-on.

The OSD ECU only detects cameras with start-up (Power to Video) time less than 800ms during power on self-test to show camera channels, resolution and frame rate. However, normal functionality is not affected post diagnostic self-test.

Depending on the camera and monitor settings, the ECU "Power to Ready" time will up to 16 seconds.

4.2 Standby mode, Camera selection and triggering

When the system is in standby mode, the machine operator will not be alerted to any radar detections and the display monitor will continue to show images from the connected camera(s) Each radar sensor is individually triggerable enabling the user to activate either one independently or both at the same time. When either or both sensor(s) are triggered, their respective detection indicator(s) will be shown on the screen, overlaid on top of the currently selected camera image. When there are no objects detected by an activated sensor, (or the detected objects fall into a pre-configured blind zone) the corresponding on-screen indicator will be shown un-filled with a white outline only. This is illustrated in the image below.



Camera view will change at any time by activating the Trigger input. (e.g. reverse gear is selected to apply power to the activation input).

4.3 Object Detection Alert

The user is alerted to object detection from the sensor network via coloured indicators located on the screen and by an audible alert (through both the monitor's speaker and any external alarm connected to the Ext-Alarm Trigger). The colour of the indicators and the pulse rate of the audible alert are linked to each other and vary within 5 different zones according to the distance between the sensor(s) and the detected object. When 2 sensors are used in a system, the audible alert function (including monitor's speaker and any external alarm connected to the Ext-Alarm Trigger) is shared across both. Therefore, the sensor detecting an object in the closest zone will have priority of the audible alert function.

Trigger output(s) may also be activated during object detection, depending on system configuration. The images below illustrate the typical alerting characteristics of a 2-sensor system

On screen indicator for Sensor 1 (object detection in the Yellow zone)

On screen indicator for Sensor 2 (no objects detected or objects are in blind zone)

Pulsed audible alert for object in Yellow detection zone

)))))))))

On screen indicator for Sensor 1 (object detection in the Yellow zone)

On screen indicator for Sensor 2 (object detection in the Red zone)

Constant audible alert for object in Red detection zone

))))))))))))

4.4 System Commissioning

Whilst the Backsense® BS-9100 sensor can detect multiple objects simultaneously, the machine operator will be alerted to the closest object to the sensor only, (excluding those falling into pre-configured blind zones).

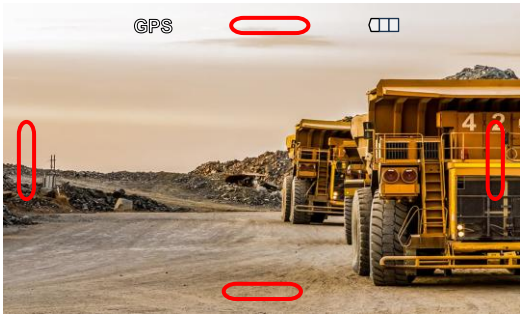
After initial power on and system testing, the installer must check the system is operating correctly in an open area with no obstructions.
If any coloured detection indicators remain on-screen, check for any obstruction in the detection area, which may be detected by the sensor and remove it. If this is not possible as the object is part of the vehicle, move the sensor so it is not detecting such object(s) or re-configure the system to apply a blind zone around that object. See sections 3.4.3 and 5.3.8 for further details.
If the system is working as described, follow the section 5.
Provide a copy of the results from the test procedure in section 5, configuration data, and a copy of this manual to the end user.

4.5 Error States

4.5.1 Radar Sensor Error

In the event of a total sensor error all 4 indicators will simultaneously flash red on the monitor screen at a rate of around 1 flash per second. The audible alert will sound every 6 seconds (through both the monitor's speaker and any external alarm connected to the Ext-Alarm Trigger).
When 3 sensors are in an error state and one sensor is functioning correctly then the on-screen indicator for the working sensor will show normal operation whilst the remaining 3 indicators will flash red.

On screen indicators flash red in 4 positions to notify the user of total sensor error



Slow pulsed audible alert for sensor error

))))))))))

4.5.2 Fault Finding of Radar Errors

- To troubleshoot a system error, the following checks can be made to determine the issue. Corrective action can then be taken for the system to automatically return to normal operation. Please note: This list is not exhaustive. Sensor CAN ID incorrectly configured.
  Action: Unplug all sensors and check CAN ID's one-by one against system configuration.
- Sensor or extension cable not connected.
  Action: Check all connectors are plugged together fully.
- No data connection between sensor and display.
  Action: Check for damage on connectors and cable or a sensor issue
- No power connection to sensor.
  Action: Check BS-9100 sensor fuse. Check for damage on connectors and cables.
- CAN communication error with sensor.
  Action: Check that CAN termination plugs are installed in BS-9100 network
  Action: Verify network arrangement follows the guidelines in section 3.7
  Action: Try to relocate affected part of the system if cable is routed too close to electrical noise source from vehicle.
- Data corruption in sensor.
  Action: Consult Brigade for advice.

4.5.3 Errors caused by Operating Environment

The Brigade Backsense® Systems cannot self-diagnose potential sensor detection issues caused by the build-up of ice, dirt, mud, heavy rain or immersion in water, which may impede system performance. To avoid poor system performance, routine maintenance should be carried out as per section 6.

4.5.4 Camera Errors

Loss of a selected camera signal will result in a black screen image transmitted to the display monitor. Additional cameras that are not in an error state will remain working and all object detection and alerting functions will continue as normal

4.6 System Operation Summary

The table below provides a quick reference summary of the system operation

System Status	Overlay Segment State	OSD Background
System Off (not powered or under configuration via PC application)	Off	No video output
System powered (self-test mode)	After cycling through camera inputs All Red for 2 seconds Then (after self-test is complete) All Green for 1 second and all 3 Cameras resolutions shown	Cycle through camera inputs 1, 2 & 3. “Black” (if camera input is not used)
System Standby (after self-test)	All overlay segments are Off except for “Standby” status indicator in “Amber” (1 time / second)	OSD colour background to be "Black”.
System Active, No Object Detection (whilst triggered), no fault / error	Applicable overlay segment is Off but with “Grey” outline only.	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)
Detection in Zone 5	Dark Green	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)
Detection in Zone 4	Light Green	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)
Detection in Zone 3	Yellow	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)
Detection in Zone 2	Orange	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)
Detection in Zone 1	Flashing Red, (2 times / second)	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)
System / Sensor Error occurred, e.g., fault / error message transmitted from radar sensor, loss of heartbeat message	Applicable overlay segment is Off but with red flashing outline (2 times / second)	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)

Receipt of 0x390 CAN ID (whilst triggered)	Applicable overlay segment is Off but with red flashing outline. (1 time / second)	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)
Dynamic detection mode enabled	(When enabled via PC SW) showing the applicable threshold levels. Trigger input should be active. Applicable overlay is displayed containing: Threshold level 1:  Threshold level 2:  Threshold level 3:  (constant) grey graphics with black outline.	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)
GPS/GNSS mode enabled, and data is <u>OK</u>	When enabled via PC SW. Trigger signal should not affect this indicator. Applicable overlay containing “**GPS”**. (constant) white text.	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)
GPS/GNSS mode enabled, and data is <u>NOT OK</u>	When enabled via PC SW. Trigger signal should not affect this indicator. Applicable overlay containing “**No GPS”**. (Flashing 1 time / second) white text if the GPS module is connected with correct Baud rate. Red text if the GPS is not connected or connected with wrong baud rate.	Triggered Camera Input (prioritised) Or “Black” (if camera input is not used)

Note 1: Audible alert behaviours are dependent on system configuration and on the detection status of other BS-9100 sensors connected to the system.

Note 2: Detection, blind and alerting settings are configurable including: Detection area length, detection zone length and width, blind zone length, blind cell activation, trigger output lengths and audible alert starting zones. Blind zone length is fixed. Refer to section 5.3 for more information.

4.7 Diagnostic messages

The OSD ECU transmits real time object detection warning and diagnostic data via CAN interface to allow users to log this information using dedicated data recording devices. Message parameters are as follows.

4.7.1 The ECU transmits CAN data log messages when object detection (within configured zones) occurs and /or a system/sensor error occurs.

4.7.2 Complies with CAN 2.0A Base Frame Format (11-bit Identifier).

4.7.3 The CAN output message (used for data logging purposes) contains a fixed CAN message ID “0x5X0” for each sensor.
For example: 0x510, 0x520, 0x530, 0x540, 0x550, 0x560, 0x570, 0x580 in line with the configured sensor ID 0x310, 0x320, 0x330, 0x340, 0x350 etc.

4.7.4 CAN data rate is 500 kbps Baud Rate (Non-Configurable).

4.7.5 Maximum of 4 sensors, 1 host and data 1 logger may be connected to the bus at any time.

4.7.6 CAN message data is formatted with “Intel Standard”, Little Endian bit arrangement.

4.7.7 Example data log. CAN message after DBC file is loaded

Timestamp	Channel	Direction	Frame Name	Frame Id	Frame Type	Data Length	Data
00.00:00:00.0000000	CAN 1	Rx	ECU_MSG_550	0x550	Std. Frame	8	0x48 0x78 0x06 0x1A 0x2D 0x03 0x0D 0x0B

Signals

Signal Name	Value	Units
ID350_Not_Used_Byte7	0	
ID350_GNSS_Hour	11	Hour
ID350_Not_Used_Byte6	0	
ID350_GNSS_Minute	13	Minute
ID350_Sensor_Error1	No Error	
ID350_Sensor_Error2	No Error	
ID350_Sensor_Error3	No Error	
ID350_Sensor_Error4	No Error	
ID350_GNSS_Month	3	Month
ID350_Not_Used_Byte4	0	
ID350_Detection_Warning	Zone 2	
ID350_Dynamic_Detection	Speed Threshold 2 Active	
ID350_Speed_Signal_Source	GNSS	
ID350_Speed	26	Km/h
ID350_Not_Used_Byte2	0	
ID350_GNSS_Date	6	Date
ID350_Coordinates_Y	-2	m
ID350_Coordinates_X	18	m

4.7.8 Data log. message structure is shown below.

Detection Data	Data Field Start		Data Length	Message Resolution	Physical Value		Byte Value	
	Byte	Bit	(No. Bits)		Min	Max	Min	Max
Co-ordinates X Distance in front of sensor (m)	0	0	8	0.25m	0m	60m	0x00	0xF0
Co-ordinates Y Distance Left/Right of sensor (m) Note: total width is -8m to +8m.	1	0	5	0.25m	0m	16m	0x00	0x10
Not Used	1	5	3	N/A	N/A	N/A	N/A	N/A
GNSS – Date 0 = data is not available	2	0	5	1	0	31	0x00	0x1F
Not Used	2	5	3	N/A	N/A	N/A	N/A	N/A
Speed Speed (km/h) (Data from GNSS receiver module, speed pulse input or another interface)	3	0	8	1	0	255	0x00	0xFF
Speed Signal Source 0 = Speed Signal Not Configured 1 = GNSS 2 = Speed Pulse Input 3 = Speed Signal Not Available (Failed)	4	0	2	1	0	3	0x00	0x03
Dynamic Detection 0 = Dynamic detection not enabled. 1 = Speed Threshold 1 Not Active 2 = Speed Threshold 1 Active 3 = Speed Threshold 2 Active	4	2	2	1	0	3	0x00	0x03
Detection Warning 0 = No Warning 1 = Zone 1 2 = Zone 2 3 = Zone 3 4 = Zone 4 5 = Zone 5	4	4	3	1	0	5	0x00	0x05
Not used	4	7	1	N/A	N/A	N/A	N/A	N/A
GNSS – Month	5	0	4	1	1	12	0x01	0x0C
Sensor Error 4 0 = No Error 1 = CAN Error	5	4	1	1	0	1	0x00	0x01

Sensor Error 3 0 = No Error 1 = Temperature Error (>135°C)	5	5	1	1	0	1	0x00	0x01
Sensor Error 2 0 = No Error 1 = MMIC Error	5	6	1	1	0	1	0x00	0x01
Sensor Error 1 0 = No Error 1 = Voltage Error (low/high)	5	7	1	1	0	1	0x00	0x01
GNSS - Timestamp (Minutes)	6	0	6	1	0	59	0x00	0x38
Not used	6	6	2	N/A	N/A	N/A	N/A	N/A
GNSS - Timestamp (Hours)	7	0	5	1	0	23	0x00	0x17
Not used	7	5	3	N/A	N/A	N/A	N/A	N/A

5 Backsense OSD Radar Sensor Configuration Tool

5.1 PC System Requirements

A PC with a USB 2.0 A-Type connector is required to enable connection to the BS-OSD-H43 ECU The Backsense OSD Radar Sensor Configuration Tool is compatible with Microsoft Windows 7, 10 & 11 (32-bit or 64-bit version) operating systems.

5.2 Software Installation

The software installation requires two steps; first, the installation of a USB to serial port driver and second the installation of the Backsense OSD Radar Sensor Configuration Tool I itself. The installation files can be downloaded from www.brigade-electronics.com and should be installed as per standard practice.

5.2.1 USB to Serial Port Driver Installation

A USB to serial port driver is required to communicate between the PC and the BS-OSD-H43 ECU. This driver should be installed before any cable connection is made to the PC.
Users must install CP210x USB to UART Bridge VCP Drivers. Please download the latest drivers from www.silabs,com The version installed should support the PC operating system version.

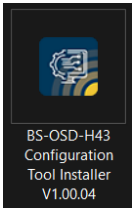
5.3 Operation

5.3.1 PC connection

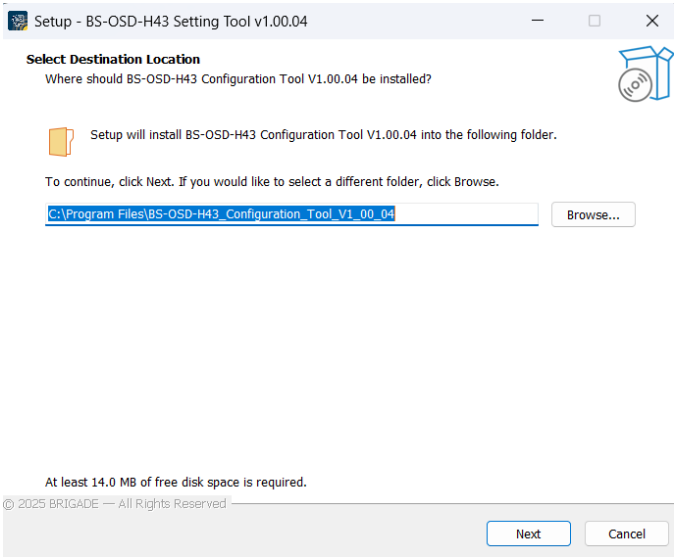
Ensure that the Backsense® system is powered and then connect the BS-OSD-H43 ECU to the PC the via the USB connector labelled “PC”.

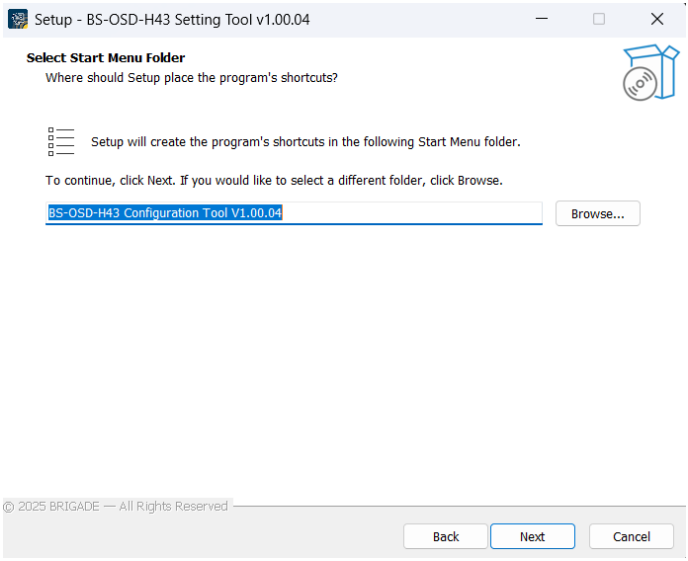
5.3.2 Running the application

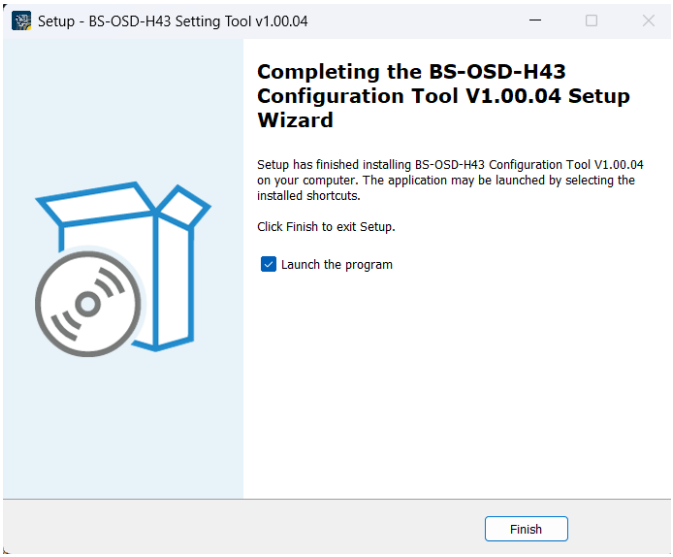
Open the Backsense® OSD Radar Sensor Configuration Tool by running the installer file with the icon as below. This will guide to install the Configuration Tool for the BS-OSD-ECU

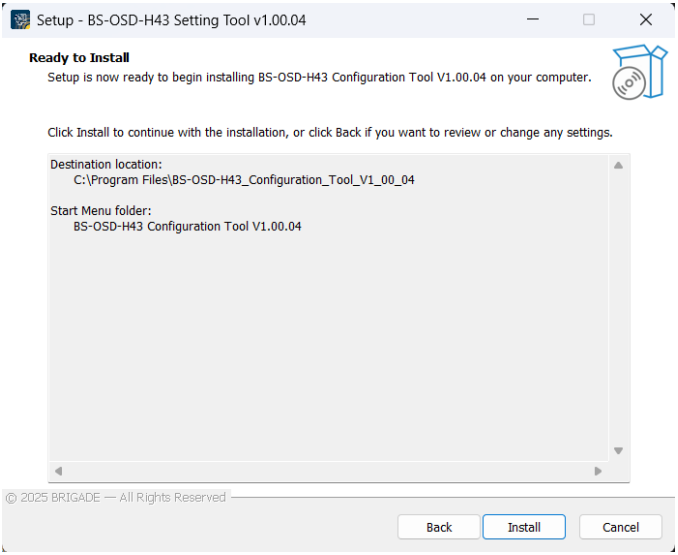


The installation screens are below:

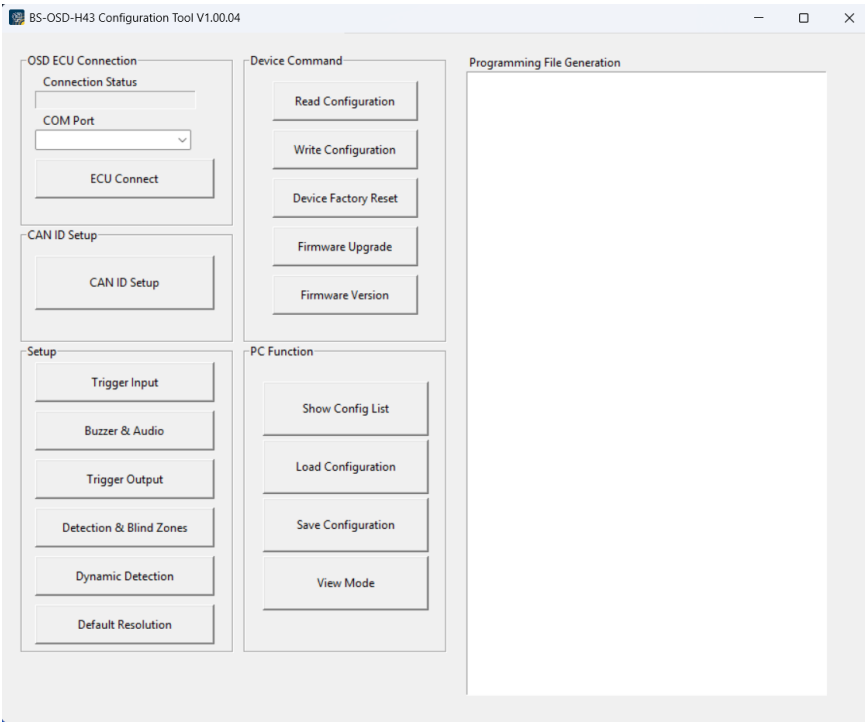






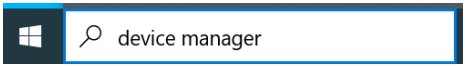


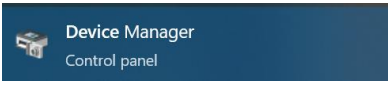
Once installation is done, it will show the Main Control Window. The Main Control Window shows connection status of Backsense® OSD ECU as well as information relating to connected BS-9100 sensors, various buttons for configuration windows and the Programming File Generation window.



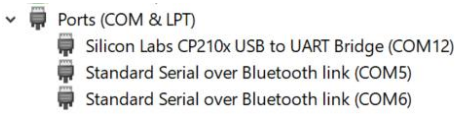
5.3.3 Identifying COM Port Number

The communication port number should show automatically in the COM Port drop-down of the main control window. In the event that there are multiple COM port numbers shown, it is possible to check the COM port number of the connected BS-OSD-H43 ECU by opening the Windows “Device Manager”.
On the right side of Windows Start button (typically on the bottom left on the screen) and type ‘device manager’ and click “Device Manager” which shown automatically; this will open the Device Manager.



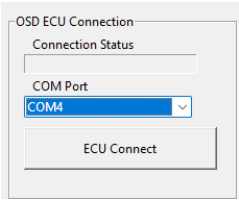


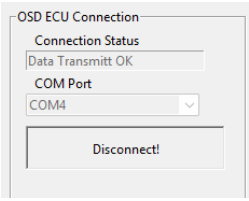
In the Device Manager window click “Ports (COM & LPT)” and check “Silicon Labs CP210x USB to UART Bridge (COM##)”. The “##” represents the number of the port through which the display is currently connected to the PC. In the image below the number is shown as “12” but this can vary.

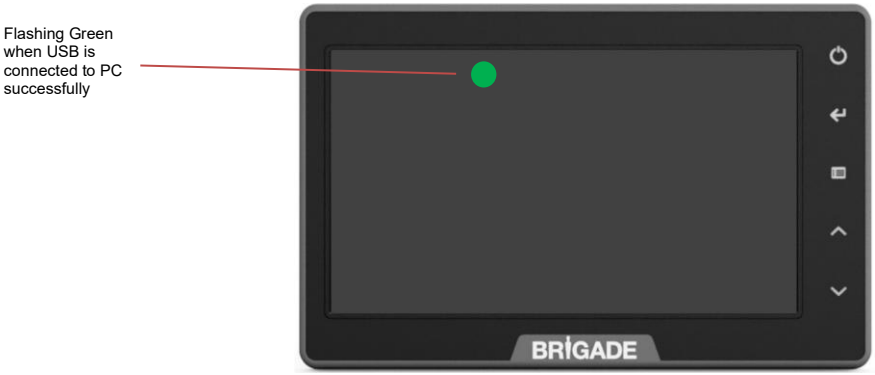


5.3.4 ECU Port Connection (ECU Connect)

When the COM port number for the BS-OSD-H43 ECU is established, press the ECU Connect button. The Connection Status field will display the message “Data Transmit OK” and the ECU Connect button will change to show “Disconnect!”



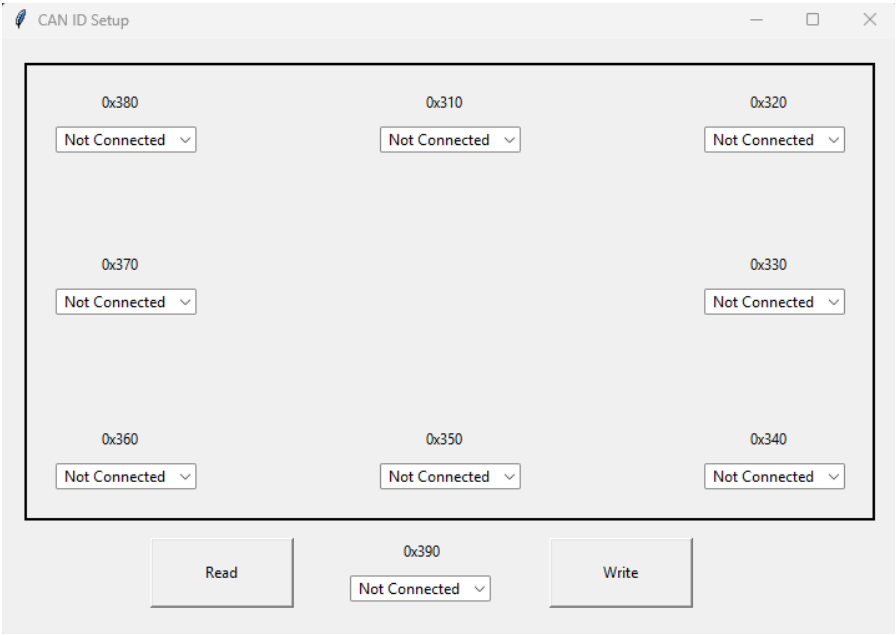




5.3.5 BS-9100 Sensor CAN ID (Connected Sensors)

The CAN ID of each connected BS-9100 radar sensor dictates the on-screen location of the coloured indicator related to that sensor.

The image below illustrates the range of available on-screen indicator locations vs the BS-9100 radar sensor CAN ID required for each one.



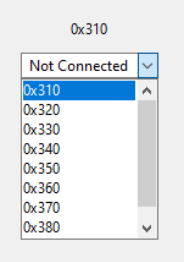
The Connected Sensors area of the Main Control Window enables the user to view and reconfigure the CAN ID values of up to 4 connected BS-9100 sensors. Pressing the Read button will show the CAN ID's in the Registration field

As default, BS-9100 sensors are manufactured and shipped with a reserved CAN ID of 0x390, (see BS-9100 Installation and Operating Guide for further details).

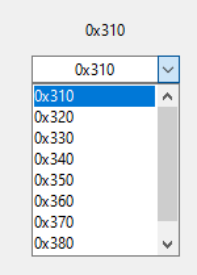
System installers must re-configure the CAN ID of each sensor from 0x390 to one of the available ID values in the range 0x310 to 0x380. Sensors must be re-configured one at a time so that 2 sensors with the same CAN ID are never connected to the system at the same time. Please refer to BS-9100 user manual for ID configuration.

The procedure for changing the CAN ID of a connected BS-9100 is as follows:

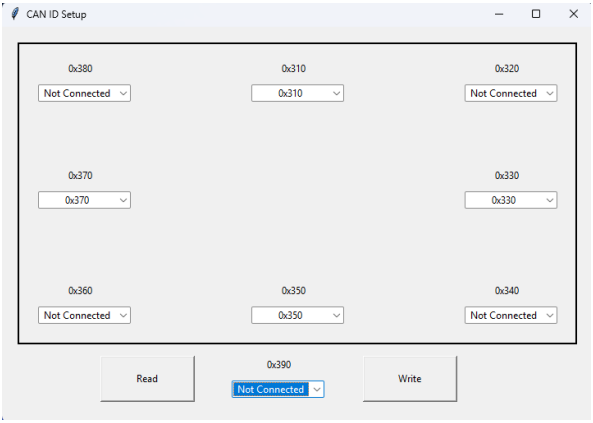
1. Connect single sensor to the system. Disconnect second sensor (if applicable)
2. Press “Refresh” to view current CAN ID of connected BS-9100 sensor
3. Highlight the CAN ID to be changed in the “Registration” window



4. Choose the desired CAN ID for the sensor (from the range 0x310 – 0x380) under the “0x31x” as below



5. Press “Write”
6. The Registration window will now show the new CAN ID value written to the sensor



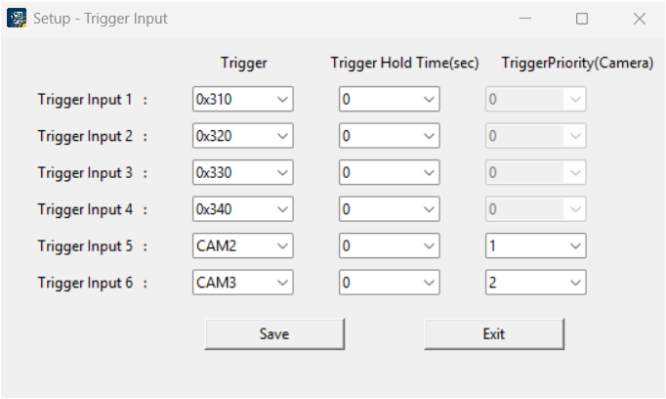
7. The BS-OSD-ECU will reset
8. The power supply to the re-configured sensor must be disconnected and re-connected before the sensor is used for object detection.
9. Repeat from step 1 for second sensor if applicable

5.3.6 Activation Trigger Configuration (Trigger Input)

CAN ID values of connected BS-9100 radar sensors can be assigned to Trigger In 1 to Trigger In 6 to activate each sensor and on-screen indication when either of these trigger inputs are activated.
The Trigger Input window enables the user to assign the CAN ID of each connected sensor to each Trigger via drop-down selection boxes.

The sensor with CAN ID assigned to Trigger 1 is designated “Sensor 0x310”.
The sensor with CAN ID assigned to Trigger 2 is designated “Sensor 0x320”.
These sensor designations are referred to when configuring subsequent detection and alerting parameters. Values are for reference only; they can be configured using the drop-down menu.

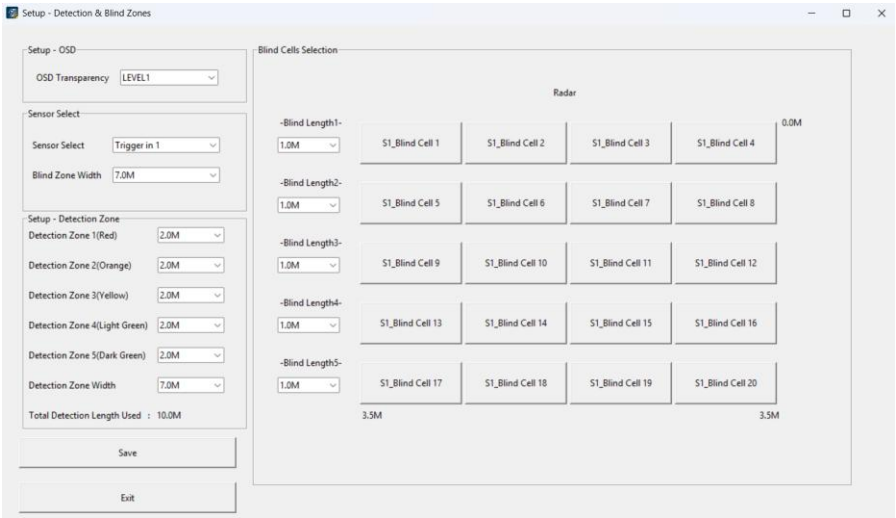
For systems using only 1 radar sensor, the CAN ID value assigned to Trigger Input 2 is irrelevant however that Trigger Input wire must be insulated and not used during operation as detailed in section 3.9.

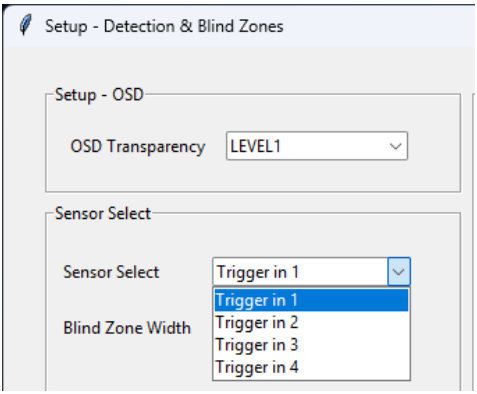


After CAN ID assignment is completed, the user must press the Save button. If the Exit button is pressed, the configuration will not be saved!

5.3.7 Detection Zone Configuration (Detection & Blind Zones)

The Detection & Blind Zones window enables the user to configure the detection area of each connected sensor from the maximum (60m x 16m), into five individual zones.
The user must first select the radar to be configured from the drop-down menu in the Sensor Selection area. The available sensors are denoted by the references Trigger In 1 to Trigger In 6 (as opposed to their CAN ID values) as detailed in section 5.3.6. See image below.



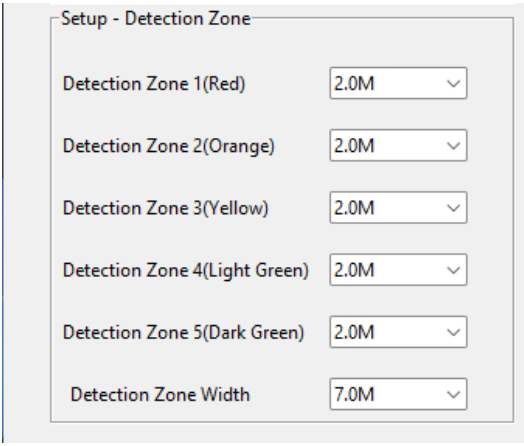


Each zone may have a length from 0.5m to 58.0m selectable via drop-down menus. The combined total length cannot exceed 60m and will prompt a warning message to appear if this configurations over 60m in length are attempted.
The 5 detection zones represent different alerting colours for on-screen indicators as detailed in section 4.6
Detection Zone Width ranges from 2.0m to 16.0m with a dependency on the total detection length of all 5 detection zones. The Detection Zone Width is selectable from the drop-down menu shown in the image blow. For applications where the radar sensor is centrally mounted at the front or rear of the vehicle, Detection Zone Width would generally be set to

approximately the same width as the vehicle. For other applications (e.g. side or corner mounting), alternative values for detection zone width may be desired.

Note: Brigade Backsense® automatically adjusts the minimum Detection Width to a higher value for a longer Detection Length.

Zone Length (m)	Min Zone Width (m)
3.0 – 4.9	2.0
5.0 – 5.4	2.5
5.5 – 7.4	3.0
7.5 – 9.9	3.5
10.0 – 12.5	4.0
12.6 – 14.9	4.5
15.0 – 17.4	5.0
17.5 – 20.4	6.0
20.5 – 60.0	7.0



After Detection & Blind Zone setup is completed, the user must press the Save button. If the Exit button is pressed, the configuration will not be saved!

5.3.8 Blind Zone Configuration (Detection & Blind Zones)

The Backsense® system enables the user to configure Blind Cells inside the Detection Area for which detected objects are ignored. The Blind Zone width can be configured between 2.5m to 16m wide and is divided equally into 4 cells. Blind Zone length can also be configured between 0.5m to 58m from the front face of the sensor and is divided equally across 5 cells giving a total of 20 available blind cells to choose from.
Blind Cells may be selected individually to accommodate a varied range of applications. Both the Detection Area and the Blind Area is symmetrical along the same centre line.
The Blind Cells Selection area of the Detection and Blind Zones window is arranged so that the cells nearest the top (numbers 1 to 4) represent the position closest to the sensor. Cells nearest the bottom (numbers 17 to 20) are furthest from the sensor. Once the Blind Zone width has been decided, each Cell can be selected individually to remove it from the Detection Area. Any object in the selected Blind Cells will now be ignored if detected.

Blind Cells are selected by clicking on the desired cell number. To remove a selected cell, simply click again to de-select. The maximum number of blind cells that may be configured is 10.

The image below shows an example of a 1m x 3.5m (each blind cell is 1m x 1.75m) Blind Area with 2 cells (to the immediate front of the sensor) selected for blinding.

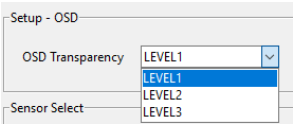
After Detection & Blind Zone setup is completed, the user must press the Save button. If the Exit button is pressed, the configuration will not be saved!

Warning

- **An object in a Blind Cell can mask an object further away from sensor. Such masking is typically in line of sight from the sensor location but may affect surrounding areas.**
- **Ensure each blind zone has been checked thoroughly for correct operation with the vehicle both stationary and in motion.**

5.3.9 On Screen Display Transparency (Detection & Blind Zones)

Transparency of on-screen detection indicators may be configured from one of 3 levels using the OSD Transparency drop-down box. The approximate transparency percentages are detailed in the table below.

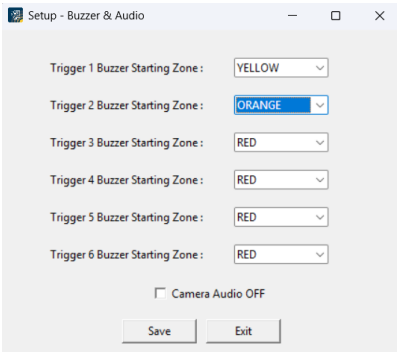


OSD Transparency Configuration	Approximate Percentage of Transparency
Level 1	0%
Level 2	25%
Level 3	50%

OSD Transparency configures all on-screen indicators. Individual configuration per on-screen indicator is not permitted.

5.3.10 Audible Alert Configuration (Buzzer & Audio)

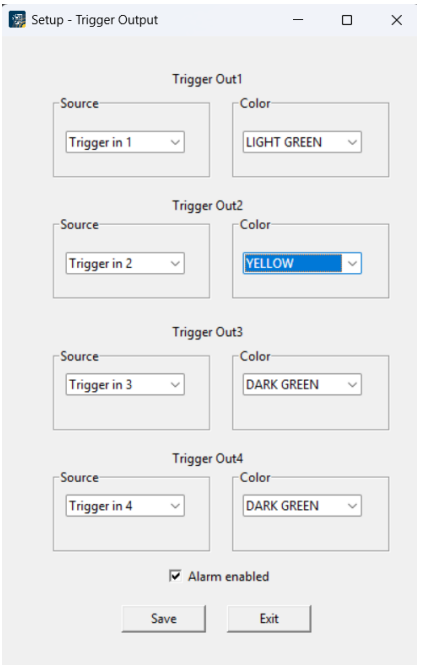
The Backsense® audio alert function may be configured to begin in any of the 5 detection zones for each connected BS-9100 sensor.
The Buzzer & Audio window enables the user to select (via drop-down boxes), the zones at which objects detected by Triggers would cause the audio alert to commence. These are referred to as the Buzzer Starting Zones.
Users wishing to silence the audio from all cameras connected to the system may do so my selecting the Camera Audio Mute check box.
The example below shows the Buzzer Starting Zone configured to the Yellow zone for Sensor 1 and Orange zone for sensor 2 In this example, whilst the on-screen indicators would alert the machine operator to detections in all 5 zones for each sensor, the audible alert will only sound when an object is detected in either the Yellow, Orange or Red zones of Sensor 1 or the Orange or Red zones of Sensor 2



After Buzzer Starting Zone selections are completed the user must press the Save button. If the Exit button is pressed, the configuration will not be saved!

5.3.11 Trigger Output Configuration (Trigger Output)

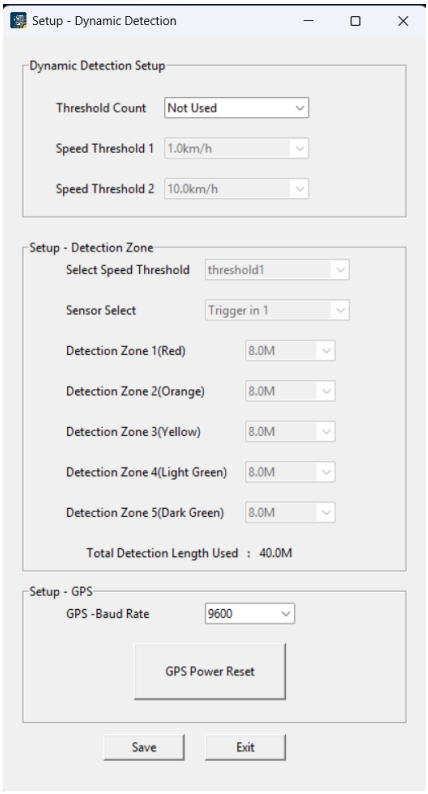
The Trigger Output window enables the user to select (via drop-down boxes), the starting zones at which object detected by Sensor 1 and Sensor 2 would activate Trigger Out 1 and Trigger Out 2.
The example below shows Sensor 1 Trigger Out 1 Starting Zone set to Light Green and Sensor 2 Trigger Out 2 Starting Zone set to Yellow. In this example, whilst the On-Screen Indicators would alert the machine operator to detections in all 5 zones for each sensor (and audible alert will perform as configured), Trigger Out 1 will only activate when an object is detected in either the Light Green, Yellow, Orange or Red zones of Sensor 1. Trigger Out 2 will only activate when an object is detected in either the Yellow, Orange or Red zones of Sensor 2.



Alarm Enable - Trigger Output External Alarm which is configurable and switched to ground when an object is detected within pre-configured zone(s) in the detection area of the configured sensor in Setup – Buzzer & Audio.

After Trigger Out Starting Zone selections are completed the user must press the Save button. If the Exit button is pressed, the configuration will not be saved!

5.3.12 Dynamic Detection



There are 2 speed thresholds that can be defined which allow the detection zone length to change when the registered speed crosses the threshold via GPS signal. GPS Baud Rate (Default 9600) can also be changed when using different GPS modules.

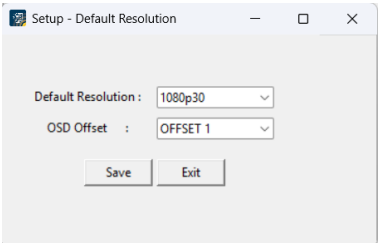
Note: GPS may not be available immediately after cold start or in areas with low/no GPS coverage. The ECU will revert to the setting for the highest speed/long range as a failsafe.

For example:
No Speed Threshold Total zone length:10m
Speed Threshold 1: 25km/h Total zone length:30m
Speed Threshold 2: 50km/h Total zone length:60m

Vehicle Speed	Speed Threshold	Total detection zone length
15km/h	-	10m
30km/h	1	30m
60km/h	2	60m
No GPS	2	60m

After selections are completed, the user must press the Save button. If the Exit button is pressed, the configuration will not be saved!

5.3.13 Default Resolution



There has 2 Default Resolutions (1080P30 / 1080P 25) can be chosen for video output when there has no camera connected.

There has 3-step OSD offset function

- Offset 1: 100% OSD output.
- Offset 2: Shifted 5% inward of the display monitor.
- Offset 3: Shifted 10% inward of the display monitor.

5.3.14 Reading a previously configured BS-OSD-H43 ECU

Configuration settings previously written to an BS-OSD-H43 ECU may be read back by pressing the Read Configuration button. This is useful if a configuration needs to be copied from one system to another or stored in a file for any future use. Once configuration has been read back from an ECU, the values will appear in each of the separate configuration windows, (Trigger Input, Detection & Blind Zones, Buzzer & Audio, Trigger Output)

5.3.15 Writing configuration parameters to a BS-OSD-H43

Once all the required configurations are complete all settings can be programmed into the Brigade Backsense® System by pressing the Write Configuration button. This will upload the configuration to the Brigade Backsense® System.

5.3.16 Device Factory Reset

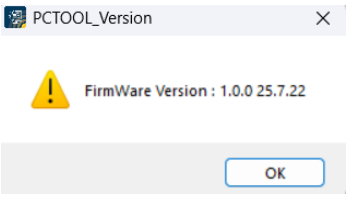
The BS-OSD-H43 can be reset to the original, default configuration by pressing the Device Factory Reset button within the OSD menu.

5.3.17 Firmware Upgrade

There has Firmware upgrade. (Brigade internal use)

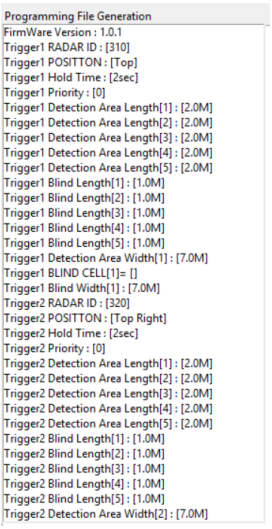
5.3.18 Firmware Version

The Firmware Version will show like below.



5.3.19 Viewing the Programming File (Programming File Generation)

The Programming File contains all the parameters that have been selected in the Backsense® OSD Radar Sensor Configuration Tool.
The Programming File is available to view in the right-hand window of the main screen and is updated when users press Save in each of the configuration sub menus. Example Programming File is shown below.



Note 1: Configuration settings will always be shown for Sensor 2 even when the installed system only utilises one BS-9100 sensor. For 1 sensor systems, Trigger In 2 must be isolated as detailed in section 3.9.

5.3.20 Load configuration file from PC

All settings in the Backsense® OSD Radar Sensor Configuration Tool can be loaded from a previously saved file. The loading function is supported irrespective of whether the Brigade Backsense® System is connected or not. Any current settings in the Backsense® OSD Radar Sensor Configuration Tool will be lost.
Press the Load Configuration button in the PC Function area. A window will open for location and selection of the previously saved configuration file. Select the desired configurations file and press Open. The parameters from the selected file will be displayed in text format in the Programming File Generation window.

5.3.21 Save configuration file to PC

All settings in the Backsense® OSD Radar Sensor Configuration Tool can be saved to a file at any point in time with or without being connected to the system.
Press the Save Configuration button in the PC Function area. A window will open enabling the user to navigate to the desired location and choose the name for the file to be saved. The file will be saved in both txt format. Configuration files must not be edited outside of the Backsense® OSD Radar Sensor Configuration Tool.

6 Testing and Maintenance

6.1 Operator Instructions

This information is addressed to the operator of the vehicle where a Brigade Backsense® System is installed:

1) Backsense® is intended as an Object Detection System and should not be relied upon as your primary defence for the safe operation of the vehicle. It is a driver aid intended to contribute to established safety programmes and procedures to ensure a safe operation of the vehicle in relation to objects, and not to replace such measures.
   It remains the driver's responsibility to ensure the proper and safe operation of the vehicle or machine.
2) Drivers should not attempt to reconfigure the Backsense® detection area; this should only be performed by technically trained operators when the vehicle is stationary.
3) Testing and inspection of the system should be carried out in accordance with this manual. The driver or operator is responsible for ensuring the Brigade Backsense® System is working as intended.
4) Operators using this equipment are strongly recommended to check the system is working properly at the beginning of every shift.
5) Improved safety depends on the proper function of this product in conformance with these instructions. It is necessary to read, understand and follow all instructions received with the Brigade Backsense® System.
6) The Brigade Backsense® System for object detection is intended for use on commercial vehicles and machinery equipment. Correct installation of the system requires a good understanding of vehicle electrical systems and procedures along with proficiency in installation.
7) Keep these instructions in a safe place and refer to them when maintaining and / or reinstalling the product.
8) Drivers and machine operators must be trained on the Backsense system, including detection limitations of radar detection systems and factors influencing its performance, prior to use.

6.2 Maintenance and Testing

This information is addressed to the operator for maintenance and testing of a vehicle with the Brigade Backsense® System installed. This is also to familiarise the operator with the detection area and behaviour of the system. More frequent inspections should be performed in cases where:

- The vehicle is operating in a particularly dirty or harsh environment.
- The operator has reason to suspect the system is not working or has been damaged.

Procedure:

1) Clean the sensor housing(s) and camera(s) of any accumulation of dirt, mud, snow, ice or any other debris.
2) Visually inspect the sensor(s) and camera(s) verify that they are securely attached to the vehicle and are not damaged.
3) Visually inspect the system's cables and display monitor as well as possible and verify that they are properly secured and not damaged.
4) Ensure that the location of the test is larger than the detection range of the installed Brigade Backsense® System, and that the area in front of the sensor is clear of obstacles.

If any of the following tests fail, follow the Hardware Installation instructions in section 3 or contact Brigade technical support if still in doubt.
For the following tests, the operator requires objects to be placed in the sensor's detection areas or an assistant (to observe detection and alerting activity).

5) Activate the Brigade Backsense® System (ensure the vehicle cannot move) and verify the self-test routine is completed as described in section 4.1.
6) If the display monitor shows a coloured overlay indicator, then there are likely to be one or more objects in the detection area(s) interfering with the test. Move the vehicle to a clear area and proceed.
7) Verify each detection zone's distance: Starting from the outside of the detection area, the operator should check several points along the centre line of the detection width down to around 0.5m distance from each sensor. The monitor display should show the detection alerts via coloured on-screen indicators, audible alert frequency and if the trigger outputs are used, the connected device or function. The operator should note down the distance at which each detection zone is activated for each sensor and verify that this is in line with the configuration for this vehicle.
8) Close detection behaviour: Verify objects in between 0.3m and 1.3m distance are only detected if they move relative to sensor(s). On Screen indicators should show Orange or Red depending on system configuration.
9) Very close detection awareness: Verify objects less than 0.3m from the sensor are not detected. Coloured on-screen indicators should switch to standby and audible alert should switch off after less than 3 seconds.
10) Similar to the previous tests the operator should scan all the edges of the detection area according to the installed system or configuration for this vehicle. They should note down the detected locations and check if they match with the detection area set when this Brigade Backsense® System was installed on this vehicle.

7 Specifications

Operation Characteristics

Detection range	5 zones in configurable lengths	
Model name	BS-OSD-H43	
	[m]	[ft]
Detection Area length	2.5 - 60	8 – 197
Each Detection Zone length	0.5 – 58	2 - 190
Detection Area Width	2 - 16	7 - 52
Nominal tolerance	±0.25m / 1ft	
Radar beam angle	Horizontal 140° out to the maximum designated width Vertical 16° (symmetrically perpendicular to sensor front surface)	
Distance resolution	≥ 0.5m (~2ft) (limitations apply, see section 1.2 for details).	
Object detection	≤ 0.5second (limitations apply, see section 1.2 for details).")	
Power on to system ready	≤ 9 seconds	
System standby to active	≤ 0.5 second	

Communication between BS-9100 sensor and BS-OSD-H43

Physical layer	CAN bus 2.0A Base Frame Format
Protocol layer	Proprietary Protocol. See BS-9100 Installation and Operating Guide for details
Max. cable length between termination points	30m (98ft approx.)

ECU Specification

On-Screen Indicators	High visibility-coloured indicators. Configurable screen location based on sensor CAN ID. Transparency level is configurable.
Audible Alert	Volume control via display monitor controls. Pulse rate (without volume control) mirrored onto External Alarm Trigger for synchronous warning on peripheral alarm.
Programming interface	USB A plug, (pigtail cable)
Dimensions (all in mm)	193 x 95 x 35 (Excluding pigtail cables)
Connectors	Various – See product drawings
Cable lengths	300mm nominal
Weight	0.5kg (including pigtail cables)
Operating temperature	-40°C to +85°C
IP Protection	IP30 (not water protected)
Vibration	8.3G
Shock	51G all three axes
Mounting	Integral mounting flanges accept M5 screw (not supplied)

Sensor Specifications

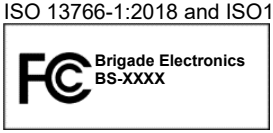
Transmitter	Frequency Modulated Continuous Wave (FMCW)
Frequency and bandwidth	77GHz
Dimensions (all in mm)	160 x 100 x 40
Connector	Manufacturer Deutsch Part Number DT06-4S-CE06 (female)
Cable length	1.0m / 3ft 3in
Weight	0.34kg (including pigtail cable)
Operating temperature	-40°C to +85°C, -40°F to +185°F
IP protection	Sensor: IP69K (Protected from dust & strong water jets) Connector: IP66K, IP67 (Protected from dust and pressurised water jets & immersion into water)
Vibration	8.3G
Shock	51G all three axes
Mounting	Four 5.2mm diameter holes on 147mm (5.79in) horizontal centres, and 43.5mm (1.71in) vertical centres. Unit is supplied with M5 (13/64in) x30mm (1.18in) screws and M5 polymer locknuts for mounting purposes. Recommended torque is 5.6Nm, (50 inch/lbs approx.).
Bracket	Optional, adjustable for vertical angle. See section 2.2

Electrical Specification

Input voltage	9Vdc to 32Vdc
Input current	typ. 0.23 at 12Vdc / typ. 0.12A at 24Vdc Max. 2.0A at 9Vdc when connected to 2x BS-9100, 2x BE-800C with heaters & IR active
Fuse	5A, automotive (regular size) blade fuse type, located on red power supply cable
Polarity	Negative ground
Vehicle connection	System supply positive, negative, activation inputs and trigger outputs 7 pigtail cables exiting from front face of ECU
Activation Input:	Rating 0Vdc to 32Vdc System active above 9Vdc, inactive below 7Vdc
Trigger Output	Active State: switched to ground up to 0.5A Inactive State: High impedance (> 1 MOhm)
Voltage protection	ISO 7637 (over and reverse voltage protection)

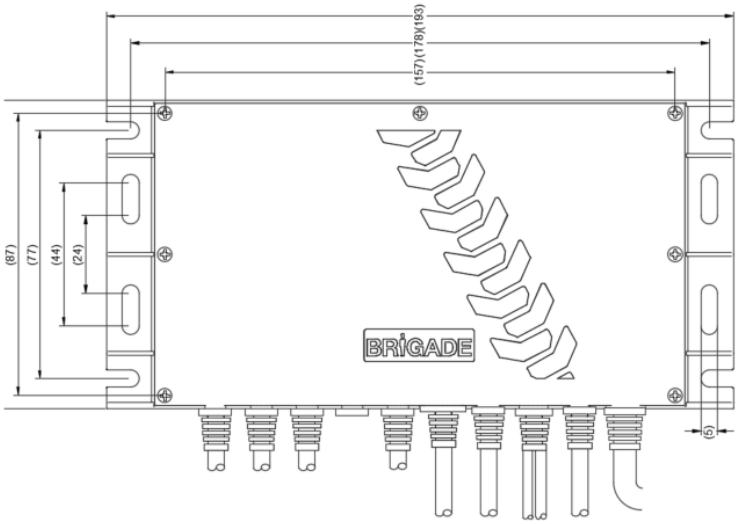
Approvals

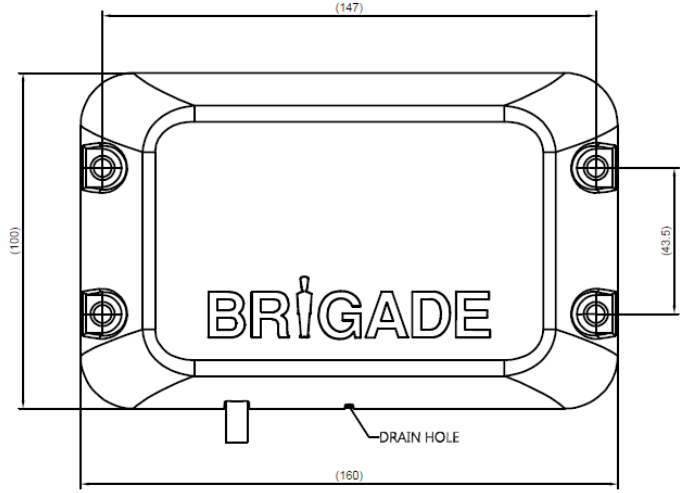
CE
FCC
IC
ECE Regulation No. 10
ISO 16750
ISO 13766-1:2018 and ISO13766-2:2018



This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Any change or modifications not expressly approved by the responsible party responsible for compliance could void the user's authority to operate the equipment.

8 Mounting Dimensions





9 Disclaimer

English
Radar obstacle detection systems are an invaluable driver aid but do not exempt the driver from taking every normal precaution when conducting a manoeuvre.
It remains the driver's responsibility to ensure the proper and safe operation of the vehicle or machine.

Dutch
Radarobstakeldetectiesystemen zijn van onschatbare hulp voor de bestuurder, maar ontneem niet de plicht van de bestuurder om alle normale voorzorgsmaatregelen te nemen bij het uitvoeren van een manoeuvre.
Het blijft de verantwoordelijkheid van de bestuurder om te zorgen voor een juiste en veilige bediening van het voertuig of de machine.

French
Les systèmes radar de détection d'obstacles offrent une assistance précieuse au conducteur, mais ne remplacent en aucun cas la vigilance et les précautions nécessaires lors des manœuvres.
Il appartient au conducteur de s'assurer que le véhicule ou l'équipement est utilisé dans des conditions de sécurité optimales.

Polish
Radarowe systemy wykrywania przeszkód stanowią nieocenioną pomoc dla kierowcy, ale nie zwalniają go z obowiązku zachowania wszelkich normalnych środków ostrożności podczas wykonywania manewru.
Odpowiedzialność za prawidłowe i bezpieczne użytkowanie pojazdu lub maszyny spoczywa wyłącznie na kierowcy.

Spanish
Los sistemas de detección de obstáculos por radar son una ayuda inestimable para el conductor, pero no le eximen de tomar todas las precauciones normales al realizar una maniobra.
Sigue siendo responsabilidad del conductor garantizar el funcionamiento correcto y seguro del vehículo o máquina.

German
Radar-Hinderniserkennungssysteme sind eine unschätzbare Hilfe für den Fahrer, entbinden ihn aber nicht davon, bei der Durchführung eines Fahrmanövers alle üblichen Vorsichtsmaßnahmen zu treffen.
Es liegt in der Verantwortung des Fahrers, den ordnungsgemäßen und sicheren Betrieb des Fahrzeugs oder der Maschine zu gewährleisten.

Italian
I sistemi radar per il rilevamento degli ostacoli sono strumenti preziosi che assistono il conducente durante le manovre, ma non sostituiscono l'adozione delle normali precauzioni di sicurezza.
La responsabilità di garantire il corretto funzionamento e la sicurezza del veicolo o della macchina rimane interamente in capo al conducente.

Portuguese
Os sistemas de deteção de obstáculos por radar são uma ajuda inestimável para o condutor, mas não o dispensam de tomar todas as precauções normais ao efetuar uma manobra.
Continua a ser da responsabilidade do condutor assegurar o funcionamento correto e seguro do veículo ou da máquina.

Turkish
Radar engel tespit sistemleri paha biçilmez bir sürücü yardımcısıdır, ancak sürücüyü bir manevra yaparken her türlü normal önlemi almaktan muaf tutmaz.
Aracın veya makinenin düzgün ve güvenli çalışmasını sağlamak sürücünün sorumluluğundadır.

Specifications subject to change. Sous réserve de modifications techniques. Änderungen der technischen Daten vorbehalten. Specifiche soggette a variazioni. Las especificaciones están sujetas a cambios. Wijzigingen in specificaties voorbehouden. As especificações estão sujeitas a alterações. Спецификация может изменяться. Specyfikacja techniczna może ulec zmianie. Özellikler haber vermeksizin değiştirilebilir.

Serial No:	Part No:

Brigade