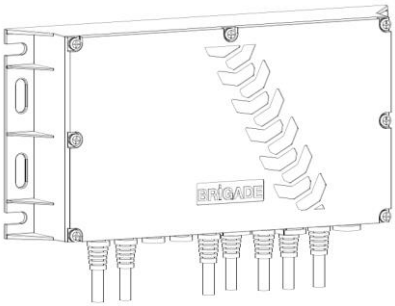
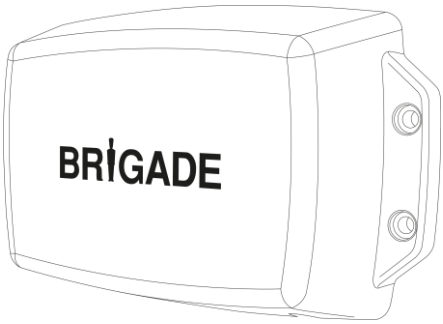
BS-9001-OSD

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 and is designed to detect people and objects in blind spots, significantly reducing collisions. Backsense® detects both stationary and moving objects and works effectively in harsh environments with poor visibility including darkness, smoke, fog and dust.

Backsense® On Screen Display system combines object detection information from Brigade's BS-9000 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® OSD-022 ECU is capable of connecting to up to 2 BS-9000 radar sensors and up to 2 Backeye® cameras. The system is fully configurable to enabling 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		Detection Width		Nominal Tolerance	
	[m]	[ft]	[m]	[ft]	[m]	[ft]
BS-OSD-022	2.5 – 30	8 – 98	2 – 10	7 – 33	±0.25	±1

Additional detection, blind and alerting parameters are configurable within the system including: Detection Zone length Blind Zone width, Blind Cell activation, Trigger Output lengths and Audible Alert starting zones. Blind Zone length is fixed. 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.**
- Object detection **between approx. 0.3m to 1.3m from the sensor requires a minimum relative speed** of around 2km/h between the object and sensor. The same requirements apply for re-detection of objects after a stationary condition.
- Brigade Backsense® radar beam angle has a 120° horizontal angle out to the maximum designated width and symmetrically perpendicular to the sensor front surface. The vertical angle is 12°.
- 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 in less than 0.5 seconds.
- After application of power, the system takes around 9 second to complete the power up routine as detailed in section 4.1. Time from standby to active state is less than 0.5 seconds.

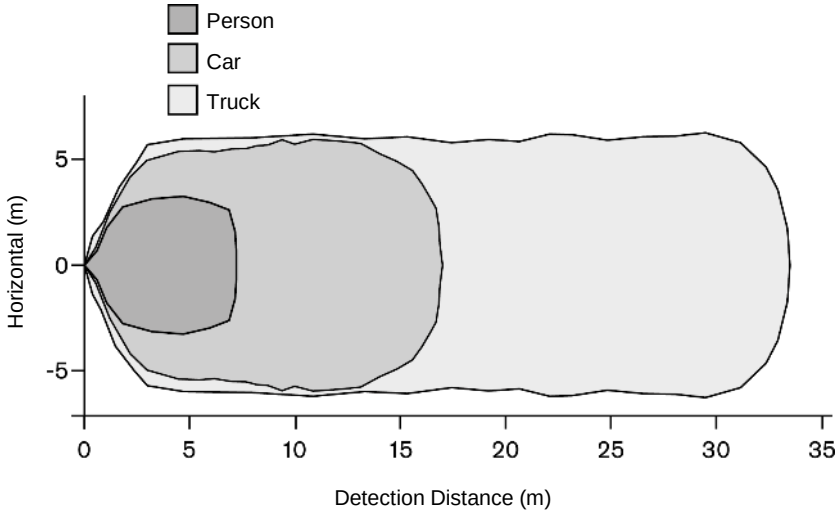
Notes:

- For distances below 1.3m (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® systems remain unaffected when multiple sensors are operating in the same area or on the same vehicle. Close proximity and overlapping detection areas cause no adverse effect on Backsense’s detection properties.

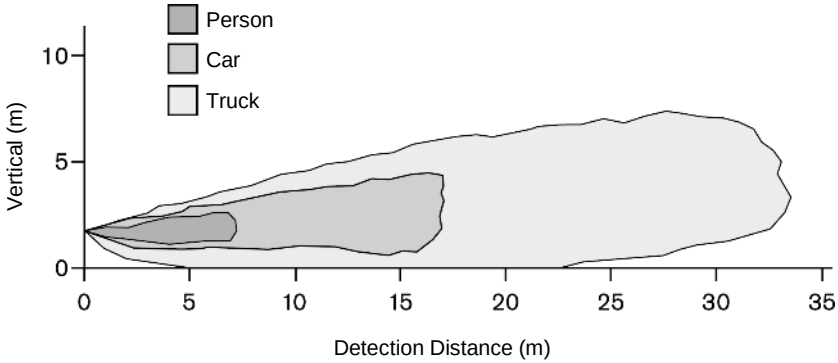
Tip: Brigade Backsense® detection is generally better when there is relative speed between the sensor and the objects and when the direction of approach is perpendicular to the sensor front face.

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

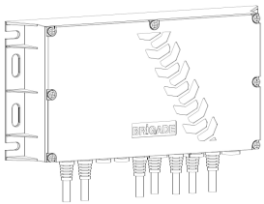
Brigade Backsense® shares in principle the advantages and limitations of all radar-based systems when compared to other sensing technologies. In general, it can reliably detect most objects in most environmental conditions such as dirt, dust, rain, snow, sun, fog, darkness, acoustic noise, mechanical 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 back from the object to the sensor. If an object does not reflect enough electromagnetic energy back to the sensor it will not be detected.

In the case where there are multiple objects in the detection area at various distances and/or angles, the sensor will detect up to 8 of the closest objects (based on radius), which are the most important 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.

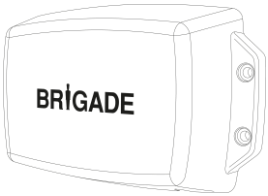
- **Size**: Larger surfaces are detected better than smaller surfaces. If there are small and large objects in the detection area, the smaller object might only register in Detection Zones closer to the sensor.
- **Material**: Metal is detected better than non-metal materials, e.g. wood, plastic.
- **Surface**: 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-9001-OSD)



ECU
BS-OSD-022

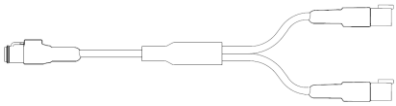


Radar Sensor
BS-9000

Extension Cable 9m
BS-09DCX

Network Power Input Cable
BS-02PIC

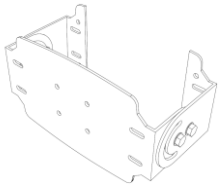
2x 120Ω Network Terminator
BS-00NT



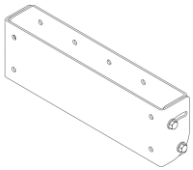
3x Network Y Cable
BS-00NYC

2.2 Optional items (not included)

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



Adjustable Sensor Bracket
BKT-017

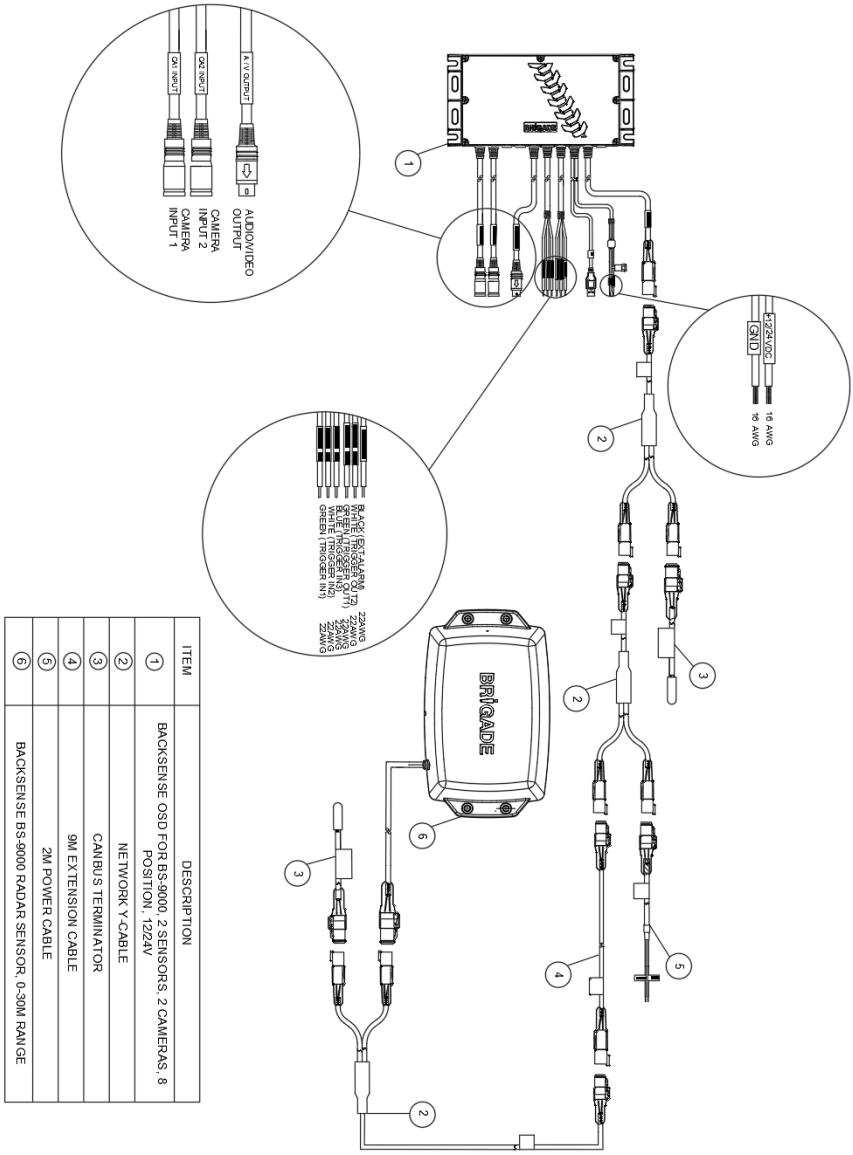


Low Profile Adjustable Sensor Bracket
BKT-018

3 Hardware Installation

3.1 System Connectivity

The diagram below shows the recommended setup for Brigades BS-9001-OSD system. Other system configurations are possible depending on the application.



ITEM	DESCRIPTION
①	BACKSENSE OSD FOR BS-9000, 2 SENSORS, 2 CAMERAS, 8 POSITION, 12/24V
②	NETWORK Y-CABLE
③	CANBUS TERMINATOR
④	9M EXTENSION CABLE
⑤	2M POWER CABLE
⑥	BACKSENSE BS-9000 RADAR SENSOR, 0-30M RANGE

3.2 Installation Test Site

The system test site should be relatively flat without excessive deviation and must be larger than the detection range of each sensor in the intended Backsense® system. This will enable a basic setup, configuration and testing of the installed system.

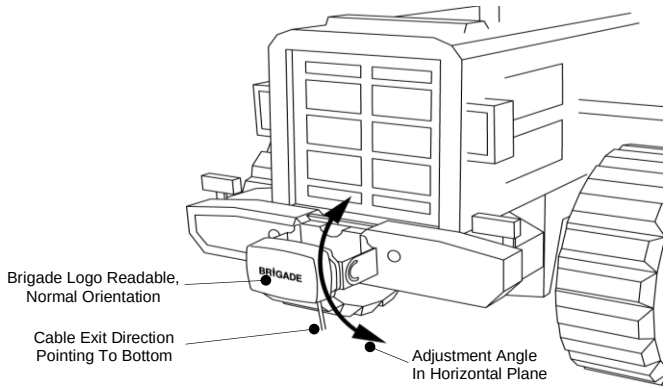
3.3 BS-OSD-022 ECU Installation

The Backsense® ECU must be installed in a dry location inside the vehicle cabin, close to the monitor used with the system. If the vehicle cabin is liable to ingress of liquids or other foreign objects which could 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 no it cannot become damaged during machine operation.

3.4 Camera and Monitor Installation

Backsense® BS-OSD-022 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.

3.5 Sensor Mounting and Location



3.5.1 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.

3.5.2 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.

3.5.3 Vehicle Overhang into Detection Area

The vehicle mounting locations should avoid detection of any overhang or furniture 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 120° horizontal angle to the maximum designated width and a vertical angle of 12°, 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.

3.5.4 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 plane, 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	9
0.5m	20	7
0.7m	28	5
0.9m	35	4
1.1m	43	3
1.3m	51	2
1.5m	59	0

3.5.5 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.

3.6 System Cables

Cables should be run in conduit and along suitable cable runs throughout the vehicle. A 24mm hole is required to pass the BS-9000 Radar sensor connectors through.

Note:
- 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.

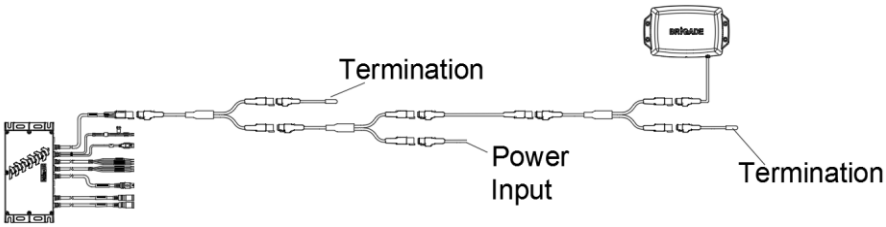
3.7 Recommended Network Layouts and Limitations

Backsense® System installation must adhere to a strict network topology to ensure reliable communications between the BS-OSD-022 ECU and BS-9000 radar sensor(s).
The network topology must represent a bus featuring 120Ω termination at both ends. The BS-9000 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:

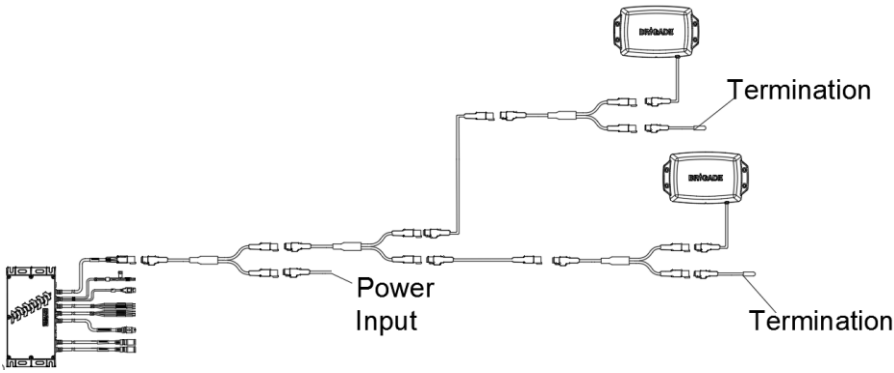
3.8 Good Network Arrangement

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

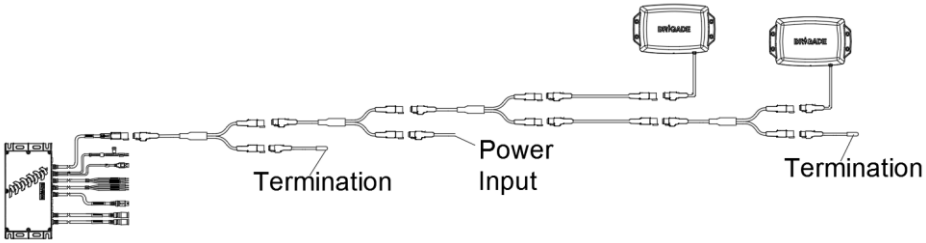


Example 2 (Good), host connection in middle of bus

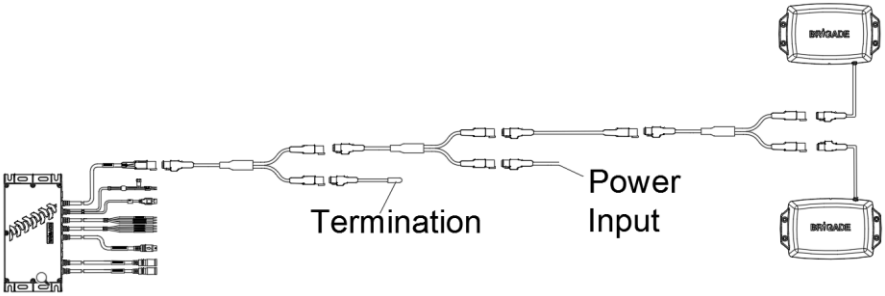
3.9 Bad Network Arrangement

Bad Network Topology may include:

- Long bus length >30m.
- Non-bus configuration (e.g. star, mesh etc.).
- Power at one end only (resulting in possible voltage drop in cable).
- Termination missing at both ends of network.
- Omission of Network Terminator cable.
- Extension cable between sensor and Y-Cable.
- Connection to more than 2 sensors on single bus.
- Connection to other CAN nodes, (not shown below).



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



Example 4 (Bad), Single termination only and extension cable between sensor and bus.

3.10 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-022 are detailed below however the installer must also take into account the installation of any supporting monitor and the BS-9000 radar sensor(s):

- Red cable to non-permanent power supply e.g. ignition.
- Black cable to ground.
- Green cable (Trigger In 1) to activation trigger signal, (e.g. reverse or other 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. indicator or other vehicle signal) This activation input changes the status of Sensor 2 from standby to active. For systems using only 1 BS-9000 sensor, Trigger In 2 must be insulated and not connected or used.
- Blue cable (Trigger In 3) to the activation trigger for secondary camera. This activation input changes the monitor display source from Camera 1 (default) to Camera 2 (secondary). Trigger In 3 can be activated via a relay connected to Trigger Out 1 or Trigger Out 2 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 Radar 2
  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 beacons to send a warning into the detection area(s) or an automotive relay for switching higher loads
- Blue cable (Ext-Alarm) is a trigger output to activate an external tonal alarm whose function is to warn the machine operator of object detection when operating in noisy environments.
  The Ext-Alarm Trigger cable is switch to ground (black cable) when an object is detected within pre-configured zone(s) in the detection area of either Sensor1 or Sensor 2.

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-022 ECU The respective Trigger Out cable (Green, White or Blue) 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, high active (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 (Camera 2 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	External Alarm Trigger (Audible Alert via Ext' Alarm)	Switched to Ground when active (Loading up to 0.5A)

3.11 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 camera source.
- CA2 INPUT connector to secondary (optional) 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-022 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-022 ECU and will connect directly without adaptation. BS-OSD-022 ECU supports single view images only.

Camera & Monitor Connection Table		
CA1 INPUT	Default Camera	Standard PAL / NTSC 12V powered camera. Video and Audio support
CA2 INPUT	Secondary Camera	Standard PAL / NTSC 12V powered camera. Video and Audio support
A/V OUTPUT	Monitor Output	PAL / NTSC Video and Audio Output with Overlaid object detection warnings

3.12 Sensor Connector

Backsense BS-OSD-022 supports connection to Brigade BS-9000 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 2 BS-9000 sensors, independently powered and fused as detailed in section 3.13

Sensor Connection Table		
SENSOR	BS-9000 Radar Network	CAN High and CAN Low connections. No connection to Radar Power or Ground

3.13Power Source

Each component of the Backsense® system must be separately fused but powered from the same switched power source detailed in section 3.10.
System components requiring individual fuses include:

- BS-OSD-022 ECU
- BS-9000 Sensor Network, (via a single dedicated Brigade power cable)
- Display Monitor
- Secondary devices connected to Trigger Outputs 1 & 2 (if applicable)
- External warning alarm connected to Trigger Output 3 (if applicable)

Only one power input to the BS-9000 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-9000 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-9000 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-022	5 Amp	Automotive Blade type fuse
BS-9000 Sensor Network	1 Amp	Installer to supply this fuse
Display Monito	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

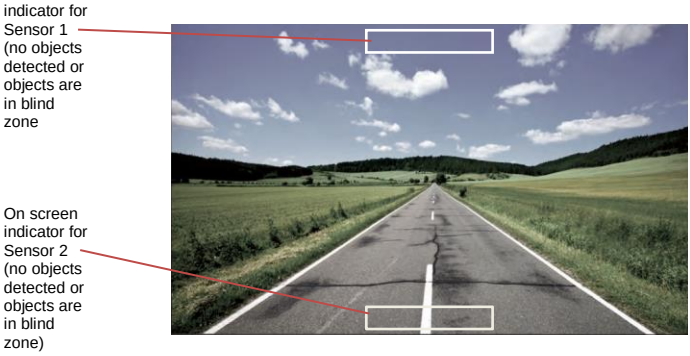
4 System Operation

4.1 Initial System Power Up

Once the system is fully installed and connected, power should be applied to test correct operation. On power up, the system will go through its self-test by displaying 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). 5 seconds after power-on, the audible alert test will cease. The 8 red indicators will disappear around 4 seconds later leaving the system in standby and the image from Camera 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 may eclipse the initial part of the self-test function.

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.

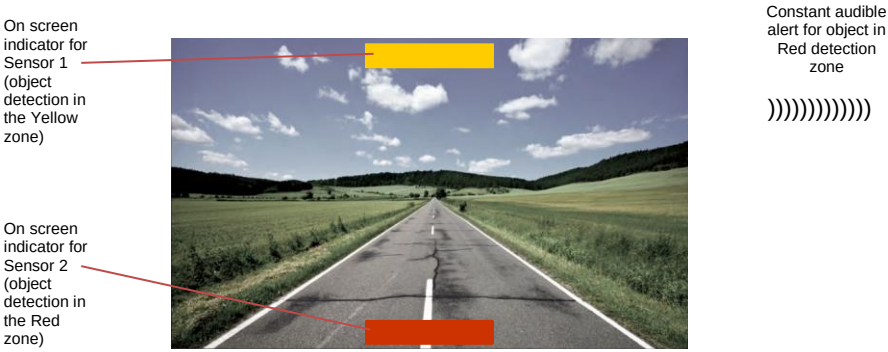


Camera views may be changed from CA1 to CA2 at any time by activating the Trigger 3 Input (e.g. reverse gear is selected to apply power to the activation input).

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 take precedence 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



4.4 System Commissioning

Whilst the Backsense® BS-9000 sensor is capable of detecting 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 in the area of that object. See sections 3.5.3 and 5.3.8 for further details.
If the system is working as described, follow the section 6.
Add the results from the test procedure in section 6, as well as the configuration data and this installation and operation guide to the vehicle documentation accessible for the relevant people.

4.5 Error States

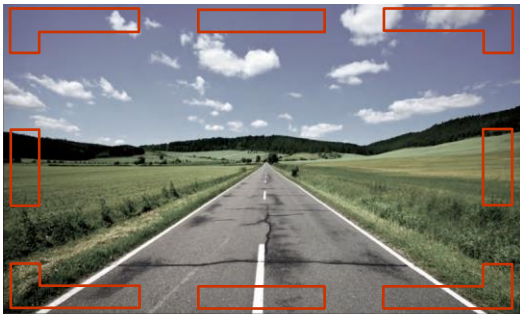
4.5.1 Radar Sensor Error

In the event of a total sensor error all 8 indicators will simultaneously flash red on the monitor screen at a rate of around 1 cycle 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 one sensor is in an error state and the second sensor is functioning correctly then the on-screen indicator for the working sensor will show normal operation whilst the remaining 7 indicators will flash red.

Slow pulsed audible alert for sensor error

))))))))))

On screen indicators flash red in 8 positions to notify the user of total sensor error



4.5.2 Fault Finding of Radar Errors

To resolve a system error, the following potential issue must be checked. The system will return to normal operation automatically when all errors have been resolved

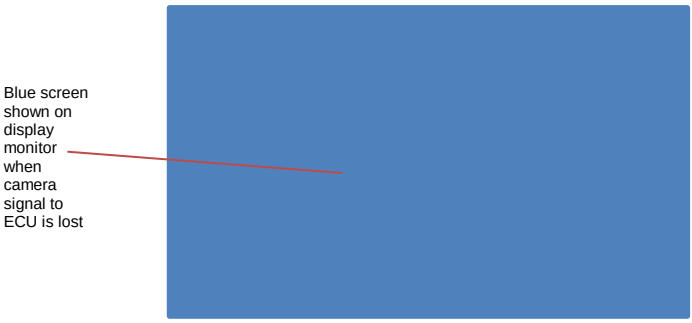
- Sensor CAN ID incorrectly configured.
  Action: Unplug all sensors and check CAN ID's one-by one against system configuration.
- Sensor or extension cable not connected.
  Action: Check all connectors are plugged together fully.
- No data connection between sensor and display.
  Action: Check for damage on connectors and cable.
- No power connection to sensor.
  Action: Check BS-9000 sensor fuse. Check for damage on connectors and cables.
- CAN communication error with sensor.
  Action: Check that CAN termination plugs are installed in BS-9000 network
  Action: Verify network arrangement follows the guidelines in section 3.8
  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 blue 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 provide a quick reference summary of the system operation

Function	On Screen Indicator	Audible Alert & External Alarm Trigger	Trigger Output
System off (not powered)	OFF	OFF	OFF
System power on Self-Test (after applying power supply)	All ON (8 Locations) Red for 6 seconds.	Constant for 2 second	OFF
System Standby (after Self-Test)	OFF	OFF	OFF
System Active and no object detection (via Activation Input)	ON for activated sensor(s) White outline only.	OFF	OFF
Detection in Zone 5 (Furthest Detection Zone)	ON per activated sensor **Dark Green**	1.5 times per second[1]	Configuration dependant[2]
Detection in Zone 4	ON per activated sensor **Light Green**	2 times per second[1]	Configuration dependant[2]
Detection in Zone 3	ON per activated sensor **Yellow**	2.5 times per second[1]	Configuration dependant[2]
Detection in Zone 2	ON per activated sensor **Orange**	3 times per second[1]	Configuration dependant[2]
Detection in Zone 1 (Closest Detection Zone)	ON per activated sensor **Red**	Constant[1]	Configuration dependant[2]
System Error with system in Standby	OFF	OFF	OFF
System Error for all sensors whilst Active	Red Flashing (8 Locations) 1 time per second.	1 time per every 6 seconds	OFF
System Error for 1 sensor with 2 sensors Active	Red Flashing (7 Locations) 1 time per second. Non-error sensor operates as normal	1 time per every 6 seconds. Audible alert for non-error sensor operates as normal	Error sensor: OFF Non-Error Sensor: ON

Note 1: Audible alert behaviours is dependent on system configuration and on the detection status of other BS-9000 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.

5 Backsense OSD 2 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-022 ECU The Backsense OSD 2 Radar Sensor Configuration Tool is compatible with Microsoft Windows 7 & 10 (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 2 Radar Sensor Configuration Tool l 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-022 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. The version installed should support the PC operating system version.

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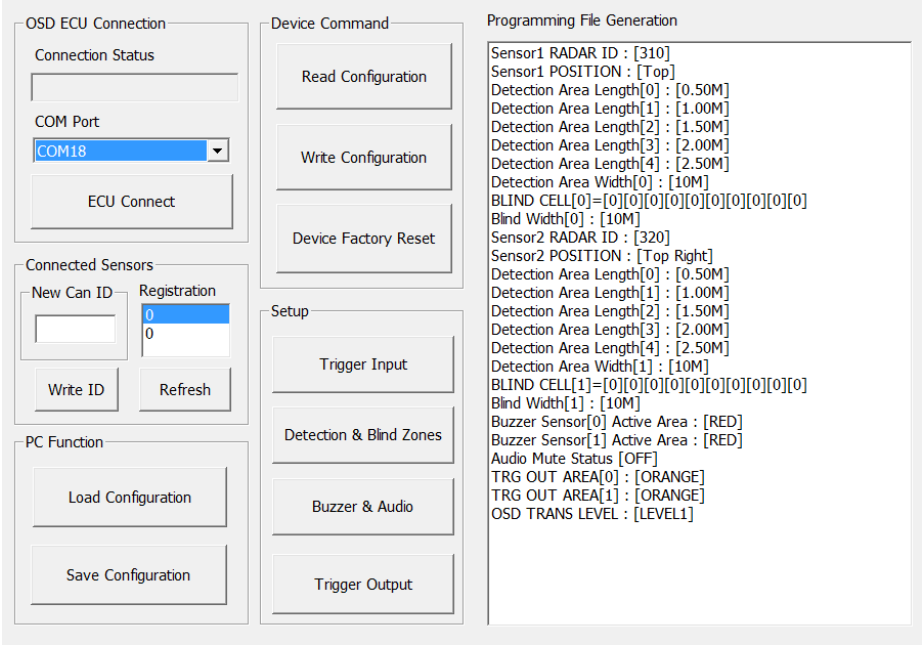
5.3 Operation

5.3.1 PC connection

Ensure that the Backsense® system is powered and then connect the BS-OSD-022 ECU to the PC the via the USB connector labelled “PC”.

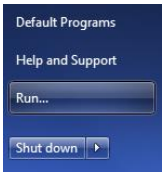
5.3.2 Running the application

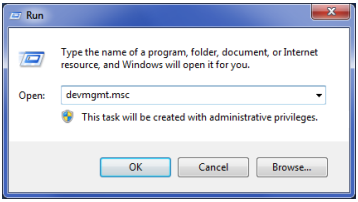
Open the Backsense® OSD 2 Radar Sensor Configuration Tool by running the executable file with the icon as below. This will open the Main Control Window.
The Main Control Window shows connection status of Backsense® OSD ECU as well as information relating to connected BS-9000 sensors, various buttons for configuration windows and the Programming File Generation window.



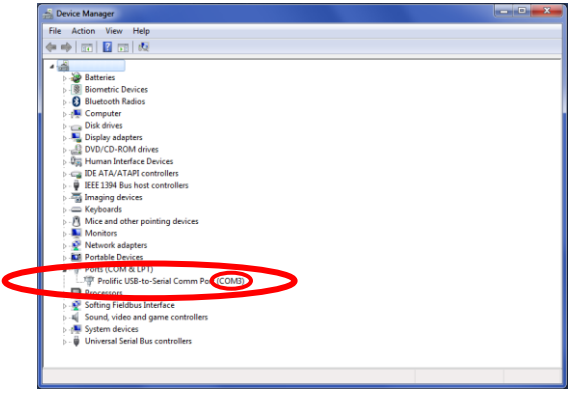
5.3.3 Identifying COM Port Number

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-022 ECU by opening the Windows “Device Manager”.
Click Windows Start button (typically on the bottom left on the screen) and select “Run…”. In the “Run” dialogue box, type ‘devmgmt.msc’ and click “OK”; this will open the Device Manager.



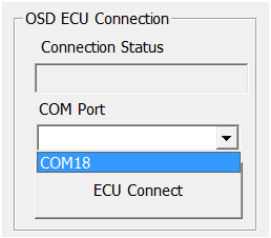


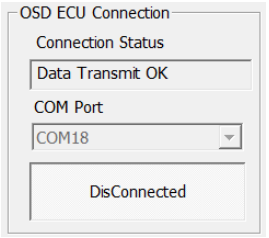
In the Device Manager window click “Ports (COM & LPT)” and check “Silicon Labs CP210x USB to UART Bridge (COM##)”. The “##” represents the number of the port through which the display is currently connected to the PC. In the image below the number is shown as “8” but this can vary.



5.3.4 ECU Port Connection (ECU Connect)

When the COM port number for the BS-OSD-022 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-9000 Sensor CAN ID (Connected Sensors)

The CAN ID of each connected BS-9000 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-9000 radar sensor CAN ID required for each one.

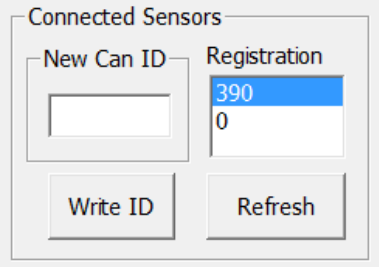
The Connected Sensors area of the Main Control Window enables the user to view and reconfigure the CAN ID values of up to 2 connected BS-9000 sensors. Pressing the Refresh button will show the CAN ID's in the Registration field

As default, BS-9000 sensors are manufactured and shipped with a reserved CAN ID of 0x390, (see BS-9000 Installation and Operating Guide for further details).

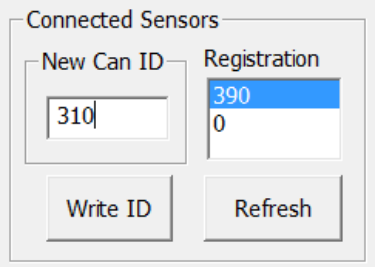
System installers must re-configure the CAN ID of each sensor from 0x390 to one of the available ID values in the range 0x310 to 0x380. Sensors must be re-configured one at a time so that 2 sensors with the same CAN ID are never connected to the system at the same time.

The procedure for changing the CAN ID of a connected BS-9000 is as follows:

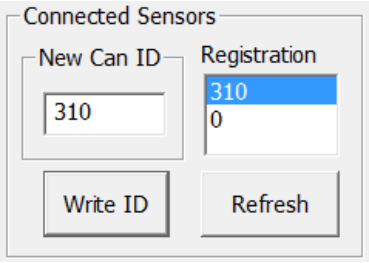
1. Connect single sensor to the system. Disconnect second sensor (if applicable)
2. Press “Refresh” to view current CAN ID of connected BS-9000 sensor
3. Highlight the CAN ID to be changed in the “Registration” window



4. Enter the desired CAN ID for the sensor (from the range 0x310 – 0x380) into the “New CAN ID” window



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



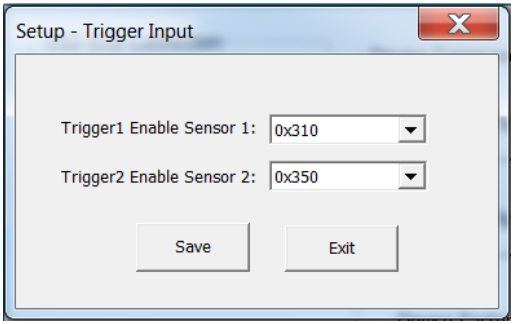
7. The BS-OSD-ECU will reset
8. The power supply to the re-configured sensor must be disconnected and re-connected before the sensor is used for object detection.
9. Repeat from step 1 for second sensor if applicable

5.3.6 Activation Trigger Configuration (Trigger Input)

CAN ID values of connected BS-9000 radar sensors must be assigned to Trigger In 1 & Trigger In 2 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 1”.
The sensor with CAN ID assigned to Trigger 2 is designated “Sensor 2”.
These sensor designations are referred to when configuring subsequent detection and alerting parameters.

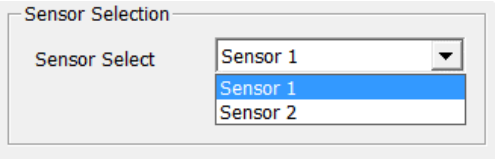
For systems using only 1 radar sensor, the CAN ID value assigned to Trigger Input 2 is irrelevant however that Trigger Input wire must be insulated and not used during operation as detailed in section 3.10.



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)

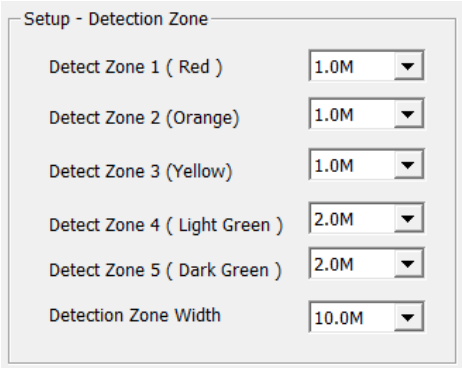
The Detection & Blind Zones window enables the user to configure the detection area of each connected sensor from the maximum (30m x 10m), into five individual zones.
The user must first select the radar to be configured from the drop-down menu in the Sensor Selection area. The available sensors are denoted by the references Sensor 1 and Sensor 2 (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 28.0m selectable via drop-down menus. The combined total length cannot exceed 30m and will prompt a warning message to appear if this configurations over 30m 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 10.0m 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.

Total Detection Area Length [m]	Limits for Detection Zone Width [m]
2.5 - 4	2 to 10
2.5 – 7	4 to 10
2.5 – 12.5	6 to 10
2.5 – 17	8 to 10
17 to 30	10

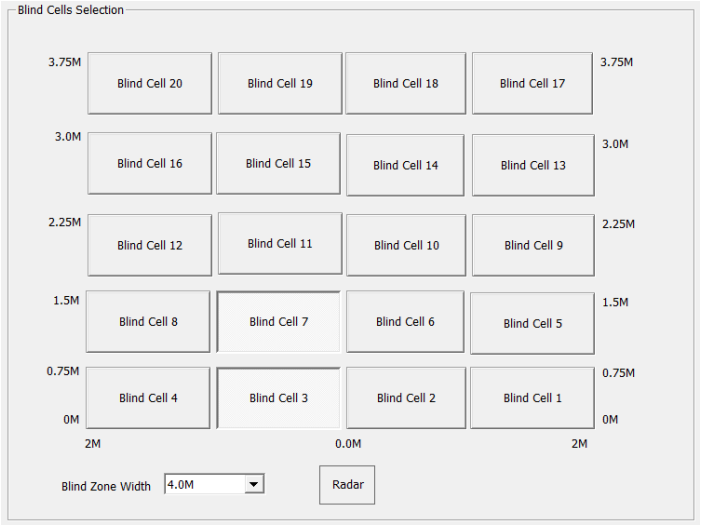


After Detection & Blind Zone setup is completed, the user must press the Save button. If the Exit button is pressed, the configuration will not be saved!

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 2m to 10m wide and is divided equally into 4 cells. Blind Zone length is fixed at 3.75m from the front face of the sensor and is divided equally across 5 cells of 0.75m each, 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 same centre line.
The Blind Cells Selection area of the Detection and Blind Zones window is arranged so that the cells nearest the bottom (numbers 1 to 4) represent the position closest to the sensor. Cells nearest the top (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 4m x 3.75m Blind Area with 2 cells (to the immediate left of the sensor and forward) 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

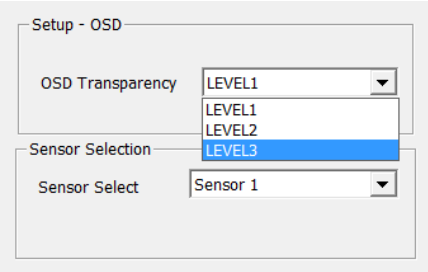
- **An object in a Blind Cell can mask an object further away from sensor. Such masking is typically in line of sight from the sensor location but may affect surrounding areas.**
- **Ensure each blind zone has been checked thoroughly for correct operation with the vehicle both stationary and in motion.**

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.

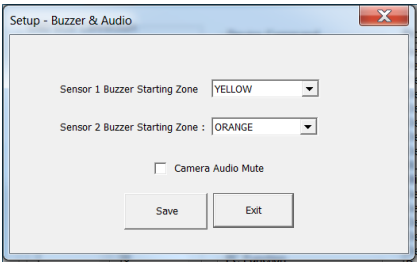
OSD Transparency Configuration	Approximate Percentage of Transparency
Level 1	0%
Level 2	25%
Level 3	50%

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



5.3.10 Audible Alert Configuration (Buzzer & Audio)

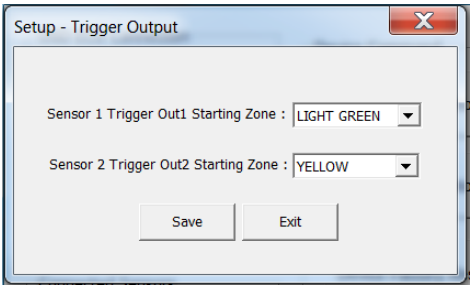
The Backsense® audio alert function may be configured to begin in any of the 5 detection zones for each connected BS-9000 sensor.
The Buzzer & Audio window enables the user to select (via drop-down boxes), the zones at which objects detected by sensor 1 and sensor 2 would cause the audio alert to commence. 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.



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 Reading a previously configured BS-OSD-022 ECU

Configuration settings previously written to an BS-OSD-022 ECU may be read back by pressing the Read Configuration button. This is useful if a configuration needs to be modified, 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)

5.3.13 Writing configuration parameters to a BS-OSD-022

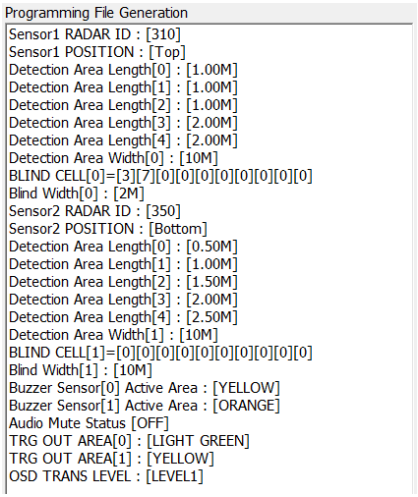
Once all the required configurations are complete all settings can be programmed into the Brigade Backsense® System by pressing the Write Configuration button. This will upload the configuration to the Brigade Backsense® System.

5.3.14 Device Factory Reset

The BS-OSD-022 may be reset to the original, default configuration by pressing the Device Factory Reset button.

5.3.15 Viewing the Programming File (Programming File Generation)

The Programming File contains all the parameters that have been selected in the Backsense® OSD 2 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-9000 sensor. For 1 sensor systems, Trigger In 2 must be isolated as detailed in section 3.10.

5.3.16 Load configuration file from PC

All settings in the Backsense® OSD 2 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 2 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.

5.3.17 Save configuration file to PC

All settings in the Backsense® OSD 2 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 and .cfg formats. Configuration files must not be edited outside of the Backsense® OSD 2 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) The Brigade 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 an aid to contribute in conjunction with other established safety programs and procedures to ensure safe operation of the vehicle in relation to surrounding persons and objects. Drivers and operators should not attempt to reconfigure the Backsense® system. This must only be carried out by technically trained operators when the vehicle is stationary.
2) 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.
3) Operators using this equipment are strongly recommended to check the system's proper operation at the beginning of every shift. If this is not possible the system should be assumed as faulty until this can be done.
4) 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.
5) 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.
6) Keep these instructions in a safe place and refer to them when maintaining and / or reinstalling the product.

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) The location of the test should ensure the area in front of the sensor or sensors where multiple sensors are installed are clear of obstacles and larger than the detection range of the installed Brigade Backsense® System.

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-9001-OSD	
	[m]	[ft]
Detection Area length	2.5 - 30	8 – 98
Each Detection Zone length	0.5 – 28	2 - 92
Detection Area Width	2 - 10	7 - 33
Nominal tolerance	±0.25m / 1ft	
Radar beam angle	Horizontal 120° out to the maximum designated width Vertical 12° (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-9000 sensor and BS-OSD-022

Physical layer	CAN bus 2.0A Base Frame Format
Protocol layer	Proprietary Protocol. See BS-9000 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)
Mounting	Integral mounting flanges accept M5 screw (not supplied)

Sensor Specifications

Transmitter	Frequency Modulated Continuous Wave (FMCW)
Frequency and bandwidth	24.05GHz to 24.25GHz
Dimensions (all in mm)	217 x 129 x 50
Connector	Manufacturer Deutsch Part Number DT06-4S-CE06 (female)
Cable length	1.0m / 3ft 3in
Weight	0.7kg (including pigtail cable)
Operating temperature	-40°C to +85°C
IP protection	Sensor: IP69K (Protected from dust & strong water jets) Connector: IP68 (Protected from dust &immersion into water)
Vibration	8.3G
Shock	100G all three axes
Mounting	Four 5.2mm diameter holes on 198mm horizontal centres, and 40mm vertical centres. Unit is supplied with M5x30mm 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. 0.27 at 12Vdc / typ. 0.14A at 24Vdc Max. 2.0A at 9Vdc when connected to 2x BS-9000, 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
ECE Regulation No. 10
ISO 16750
ISO 13766
EN 13309
FCC

Brigade Electronics
BS-XXXX

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.

EU Declaration of Conformity

Product Types:
Brigade Backsense Radar Obstacle Detection System BS-9000

Manufacturer:
Brigade House, The Mills, Station Road, South Darenth, DA4 9BD, UK

This declaration of conformity is issued under the sole responsibility of Brigade Electronics.

Objects of the declaration:
Radar sensor, cables and termination

The objects of the declaration described above are in conformity with the relevant Union harmonisation legislation: Directive 2014/53/EU

Relevant Harmonised Standards:

- EN301489-1 V2.1.1(2017-02) and EN301489-3 V2.1.0 (2017-03)
- EN300440-2 V1.4.1(2010-08) and EN300440-1 V2.1.1(2017-03)

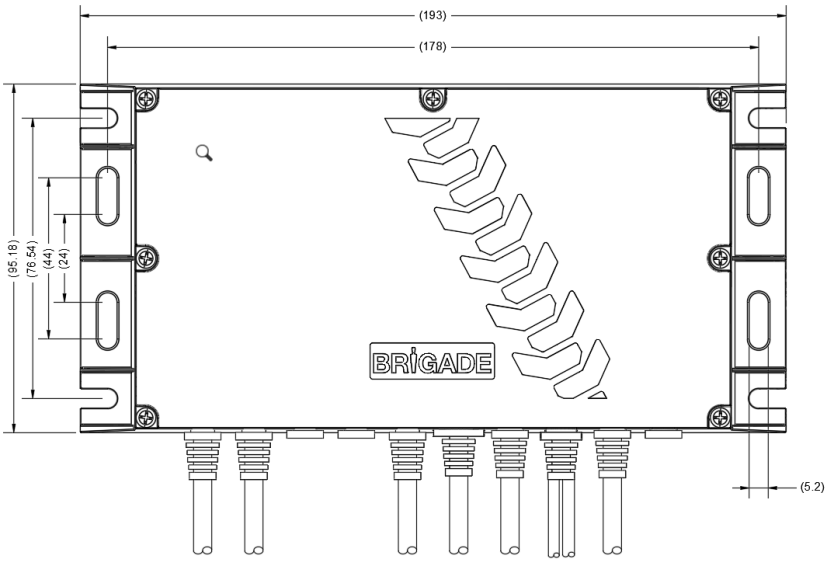
Additional information:

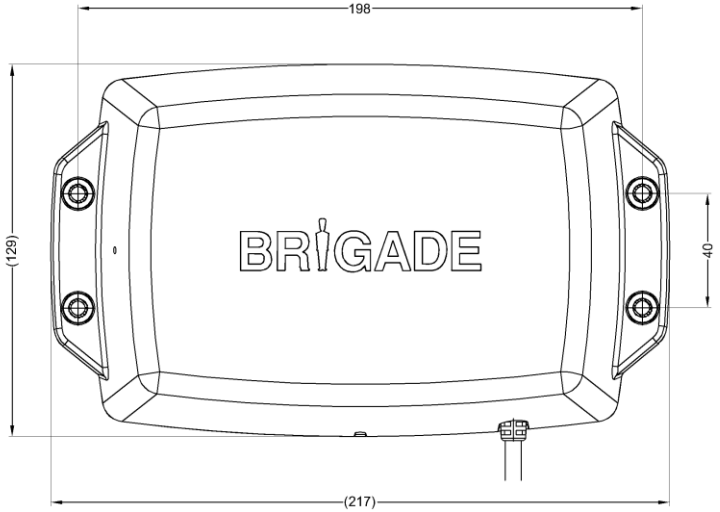
- Operational Frequency Band: 24050MHz – 24250MHz
- Maximum Transmitted Power: 19.20 dBm
- This equipment should be installed and operated with a minimum distance of 20cm between the radar sensor and any human body.

Signed for and on behalf of Brigade Electronics Group PLC
11/01/2018, South Darenth, DA4 9BD, UK

David Wallin, Quality and Standards Manager

8 Mounting Dimensions





9 Disclaimer

Disclaimer

Radar obstacle detection systems are an invaluable driver aid but do not exempt the driver from taking every normal precaution when conducting a manoeuvre. No liability arising out of the use or failure of the product can in any way be attached to Brigade or to the distributor.

Avertissement

Les systèmes de radar à détection d'obstacle sont une aide précieuse pour le conducteur, mais celui-ci doit toutefois prendre toutes les précautions nécessaires pendant les manœuvres. Brigade ou ses distributeurs n'assument aucune responsabilité résultant de l'utilisation ou d'un défaut du produit.

Haftungsausschluss

Radar basierte Hinderniserkennungssysteme sind für den Fahrer eine unschätzbare Hilfe, ersetzen aber beim Manövrieren keinesfalls die üblichen Vorsichtsmaßnahmen. Für Schäden aufgrund der Verwendung oder eines Defekts dieses Produkts übernehmen Brigade oder der Vertriebshändler keinerlei Haftung.

Condizioni di utilizzo

I sistemi di rilevamento ostacoli radar costituiscono un prezioso ausilio alla guida, ma il conducente deve comunque assicurarsi di prendere tutte le normali precauzioni quando esegue una manovra. Né Brigade né il suo distributore saranno responsabili per eventuali danni di qualsiasi natura causati dall'utilizzo o dal mancato utilizzo del prodotto.

Uwaga

Radarowe systemy wykrywania przeszkód stanowią nieocenione wsparcie dla kierowców i operatorów, ale ich posiadanie nie zwalnia użytkowników z zachowania środków szczególnej ostrożności podczas prowadzenia i wykonywania manewrów. Brigade oraz dystrybutorzy produktów nie mogą ponieść żadnej odpowiedzialności prawnej wynikającej ze skutków użytkowania lub awarii produktu.

Aviso legal

Undue los system's de detección de obstáculos por radar constituyen una valiosa ayuda, no eximen al conductor de tomar todas las precauciones normales al hacer una maniobra. Brigade y sus distribuidores comerciales no se responsabilizan de cualquier daño derivado del uso o deun mal funcionamiento del producto.

Declinación de responsabilidad

Os sistemas radar de detecção de obstáculo são uma ajuda incalculável ao motorista, mas não dispensam o motorista de tomar todas as precauções normais ao realizar uma manobra. Nenhuma responsabilidade decorrente do uso ou falha do produto pode de forma alguma ser atribuída ao Brigade ou ao distribuidor.

Verwerping

Radar obstakel detectiesystemen zijn een waardevolle hulp voor de bestuurder, maar ontheffen hem echter niet van de verplichting om het voertuig zorgvuldig te manoeuvreren. Brigade en zijn distributeurs zijn niet aansprakelijk voor schade door gebruik of het niet functioneren van het product.

Ограничение ответственности

Радарные системы обнаружения препятствий является дополнительным средством помощи водителю, но не освобождает от соблюдения водителем всех необходимых мер предосторожности при совершении маневров. Brigade Electronics или распространители продукции не несут ответственности вытекающей из невозможности эксплуатации или неисправности продукции.

Hatırlatma

Radar Obje Algılama Sistemleri sürücünün önemli bir yardımcısı olmakla birlikte, manevra esnasında sürücü bir kaza olmaması için her türlü önlemi almalıdır.
Brigade veya bölgesel dağıtıcıları yapılacak yanlış bir uygulama ve sonucunda oluşabilecek maddi ve/veya manevi kayıplardan sorumlu tutulamaz.

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:

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