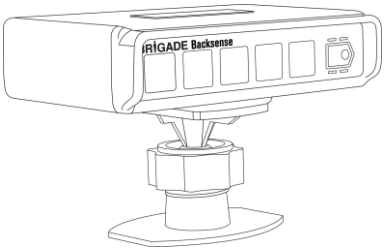
BS-8000
BS-7030, BS-7045, BS-7060

Backsense®
Radar Object Detection Systems

Installation & Operation Guide



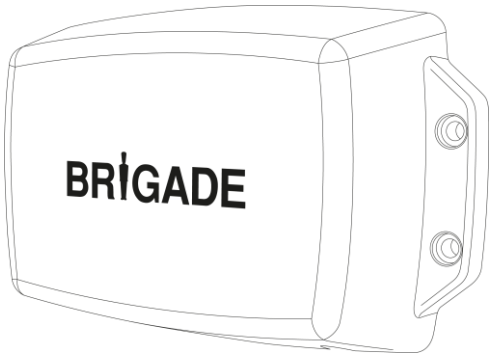


Table of Contents

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. They detect stationary and moving objects, providing the driver with in-cab visual and audible warnings – alerting the operator whose attention cannot be focused on all risk areas. Backsense® works effectively in harsh environments and in poor visibility including darkness, smoke, fog and dust.

It is imperative that Brigade Backsense® 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 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, obeying traffic and local regulations and continuing to use his/her 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 in a proper and lawful manner.

1.1 Detection Ranges

There are four available Backsense® systems available:

Model Name	Detection Length		Length of each Detection Zone		Detection Width		Nominal Tolerance	
	[m]	[ft]	[m]	[ft]	[m]	[ft]	[m]	[ft]
BS-7030	3	10	0.6	2	2.5	8	±0.25	±1
BS-7045	4.5	15	0.9	3	3.5	12	±0.25	±1
BS-7060	6	20	1.2	4	4.5	15	±0.25	±1
BS-8000	3 - 30 (10)*	10 - 98 (33)*	1 - 26 (2)*	3 - 85 (7)*	2 - 10 (7)*	7 - 33 (23)*	±0.25	±1

* Default setting

BS-7030, 7045 & 7060 each has a fixed detection length and width. The length is divided into five equal detection zones. The buzzer and trigger output activate in all zones on detection.

BS-8000 uses the same fundamental operation as all the above systems but the settings are fully configurable: Detection length, detection width, zones length, blind length, blind width, blind zones, trigger output length and buzzer starting zone. Refer to section "4 Configurable System Model BS-8000".

1.2 Object Detection Capability

Warning

- **There is no detection of objects or part 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. Same 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. The vertical angle is 12°. Both angles are symmetrically perpendicular to the sensor front surface.
- 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 second.
- After turning on the power the system takes around 6 seconds to be active. Time from standby to active state is less than 0.2 second.

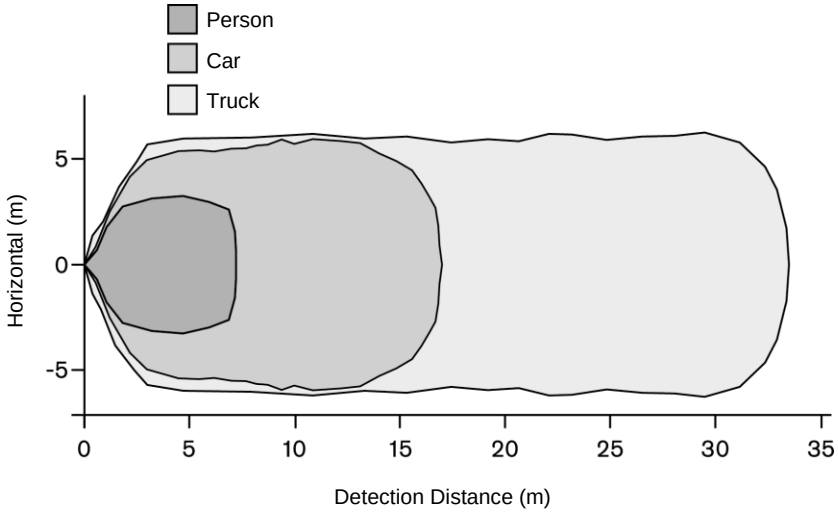
Notes:

- 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 so this system might not be a suitable solution. Brigade therefore recommends adding a Brigade Backscan® System based on ultrasonic sensing technology, which offers better detection at close ranges as applicable.
- Brigade Backsense® system is not affected if multiple systems are operating in the same area or on the same vehicle, even if they are installed in close proximity with overlapping detection ranges.

Tip: Brigade Backsense® detection is generally better when there is relative speed between the sensor and the objects.

1.2.1 Detection Pattern

1.2.1.1 Horizontal Pattern



1.2.1.2 Vertical Detection Area

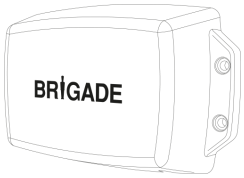
1.2.2 Factors Influencing the Detection of Objects

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 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.

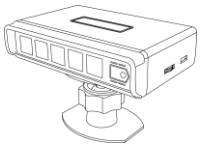
- **Size**: Larger surfaces are detected better than smaller surfaces. If there are small and large objects in the detection area, the smaller object might only register in Detection Zones closer to the sensor.
- **Material**: Metal is detected better than non-metal materials, e.g. wood, plastic.
- **Surface**: 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.
- **Weather conditions**: Dense dust or very strong rain or snowfall will reduce the detection capability.

2 Contents

System	Sensor	Display	Cable	Software	Connectivity
BS-7030	BS-7XXXS	BS-7030D	BS-09DCX	-	-
BS-7045		BS-7045D			
BS-7060		BS-7060D			
BS-8000	BS-8000S	BS-8000D		CD	USB Cable



Sensor
BS-7XXXS or BS-8000S



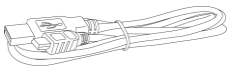
Display
BS-7030D / BS-7045D / BS-7060D / BS-8000D

Sensor Fixing Kit
BS-FIX-01

Extension Cable 9m
BS-09DCX

Configurable system includes additional:

Software CD



USB Cable
(USB standard type A plug to mini-B plug)

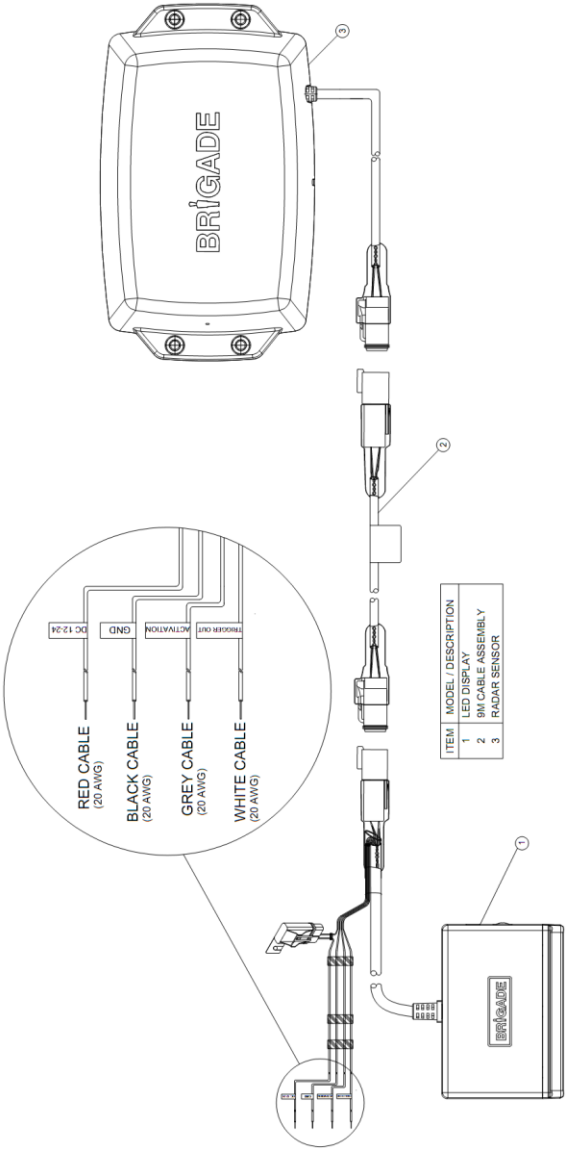
Optional items (not included):

Extension Cables 5m (16ft) or 9m (29ft)
BS-05DCX or BS-09DCX

Adjustable Sensor Bracket
BKT-017

3 Hardware Installation

3.1 System Connectivity



3.2 Installation Site

The installation site should be relatively flat without excessive deviation and larger than the detection range of the intended Backsense® System. This will enable a basic setup, configuration and testing.

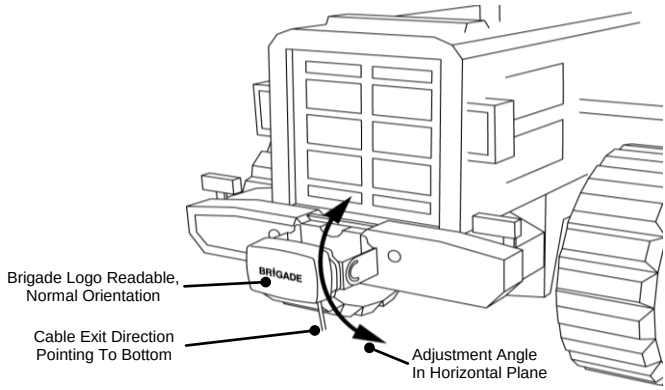
3.3 Electrical Connections

Refer to the vehicle manufacturer or bodybuilder guidelines for installation procedures and connectivity in all applications. Ensure the positive supply connections are fused at source. The system connections are shown in the table below:

- Red cable to non permanent power supply e.g. ignition.
- Black cable to ground.
- Grey cable to the activating trigger, e.g. reverse. This Activation Input changes the system status between standby and active.
- White cable is a trigger output to activate secondary functions or devices. The white cable is switch to ground (black cable) when an object is detected within the detection area. For example a secondary device could be a Brigade bbs-tek® white sound® alarm or a light beacon to send a warning into the detection area. Simply connect the device to the power supply, same non permanent as the red cable is connected to, and the white cable as a negative connection. For electrical loading limits see section “6 Specifications”. On the BS-8000 system, the distance when the trigger output is activated can be configured.

System Connections		
RED	Vehicle non permanent power supply	System supply (3A blade fuse) (Range +12V to +24V)
BLACK	Ground	Supply negative
GREY	Activation Input	Trigger from vehicle, high active (Range above +9Vdc, up to supply voltage)
WHITE	Trigger Output	Switched to Ground when active (Loading up to 0.5A)

3.4 Sensor Mounting and Location



3.4.1 Sensor Direction

The sensor should be mounted in the 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

The 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 location should avoid detection of any overhang or furniture, when installing a non-configurable system. This is also recommended for the configurable system where possible. Such objects will cause false alarms (for exceptions see section “1.2 Object Detection Capability”, paragraph “Warning”). Any vehicle object in the detection area has to be avoided. 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 configurable Backsense® System can be configured using the Blind Area setup to ignore objects in the detection area, see section “4.3.11 Blind Area Setup”.

3.4.4 Mounting Angle

Brigade recommends mounting the radar on a bracket (available from Brigade, see section “2 Content”), which can be adjusted for angle in the horizontal plane, This will enable a simple adjustment to optimise the performance. See below suggested vertical angle mounting depending on the 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

Depending on the model of the Brigade Backsense® system and the required mounting height of the sensor either the angle needs to be adjusted or the distance to ground level must be longer than the detection length selected.

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 Area Setup of the configurable Backsense® System might resolve or compensate for mounting location issues, enabling off-centred or angled installations (see section “4.3.11 Blind Area Setup”).

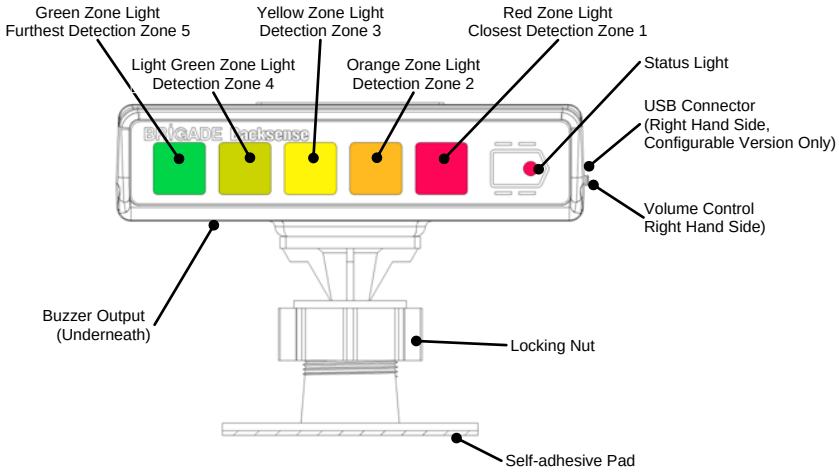
3.5 Cable

Cables should be run in conduit and along suitable cable runs throughout the vehicle. A 24mm hole is required to pass the 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.

3.6 Display

The display should be mounted so the vehicle operator has good visibility in all environments and situations. The display should be fixed in a suitable location in line with any current legislation/regulations.
The base is fixed to the display with a keyway locking method and locked with a machine screw. The base can be separated from the display by removing the screw and sliding back and down if the display is used for any flush mounting.
The base has a self-adhesive pad applied for mounting e.g. on the dashboard. Additional drilling and fixing with screws may be required in some applications.
The neck is adjustable in all directions up to 30° and is secured with a locking nut. Locking nut should only be tightened by hand and excessive torque should be avoided. The volume is adjustable from 65 to 90dB measured at 1m distance.



Function	Location	Zone Lights or Status Light flash frequency	Buzzer alert Interval
System off (not powered or Configuration Tool in connected state BS-8000 only)	Status Light	off	off
System power on Self Test (after applying power supply)	all Zone Lights	constant for 1 second	constant for 1 seconds
	Status Light	red / constant for 5 seconds	
System Standby (after Self Test)	Status Light	red / constant	off
System Active and no object detection (via Activation Input)	Status Light	green / constant	off
Detection in Zone 5 (Furthest Detection Zone)	**Green** Zone Light	constant	1.5 times per second
Detection in Zone 4	Green & **Light Green** Zone Lights	constant	2 times per second
Detection in Zone 3	Green & Light Green & **Yellow** Zone Lights	constant	2.5 times per second
Detection in Zone 2	Green & Light Green & Yellow & **Orange** Zone Lights	constant	3 times per second
Detection in Zone 1 (Closest Detection Zone)	Green & Light Green & Yellow and Orange & **Red** Zone Lights	constant	constant
System Error occurred with System Active	all Zone Lights	constant for 5 seconds	constant for 5 seconds
	Status Light	red / 1 time per second	
System Error with System Active	Status Light	red / 1 time per second	0.5 seconds, repeated in 5 seconds
System Error with System Standby	Status Light	red / 1 time per second	off

BS-7030, 7045 & 7060 each has a fixed detection length and width. The length is divided into five equal detection zones. The buzzer and trigger output activate in all zones on detection.

BS-8000 uses the same fundamental operation as all the above systems but the settings are fully configurable: Detection length, detection width, zones length, blind length, blind width and blind zones, trigger output length and buzzer starting zone. Refer to section “4 Configurable System Model BS-8000”.

3.7 Initial System Power Up and Test

Once the sensor and display are installed and connected, power should be applied to test correct system operation. On power up, the display will go through its self-test by sounding the buzzer and illuminating the Status Light red and all Zone Lights. After about 5 seconds only the Status Light should show red colour. When the activation input becomes active (e.g. reverse gear is selected to apply power to the activation input) the status light turns green and the system is in detection mode. Check the system is operating correctly in an open area with no obstructions.

If the display indicates an error mode (see section “3.6 Display”) check section “3.8 Error States” for possible resolutions.
If any or all of the Zone Lights remain constantly lit, 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). If it is not possible to relocate the sensor, then it may be necessary to install the BS-8000 or consult Brigade for advice, see section “3.4.3 Vehicle Overhang into Detection Area”.
If the system is working as described, follow the section “5 Testing and Maintenance”. Add the results from the test procedure in section 5, the configuration data (BS-8000 only) and this installation and operation guide to the vehicle documentation accessible for the relevant people.

3.8 Error States

If the display shows an error state (see section “3.6 Display”) check for the following potential issue below. If the error is resolved the display will return automatically after a few seconds and the self test to normal operation.

- 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 for damage on connectors and cable.
- CAN communication error with sensor.
  Cable is routed or system is installed too close to an electric noise source in vehicle.
  Action: Try to relocate affected part of the system.
- Data corruption in sensor.
  Action: Consult Brigade for advice.

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. Therefore, follow the section “5 Testing and Maintenance”.

4 Configurable System Model BS-8000

This section covers the setup of the configurable Brigade Backsense® model BS-8000.

4.1 PC System Requirements

The system requires a PC with a USB 2.0 Type-A connector, which will connect a computer to the programming interface connector located on the display. A USB cable with USB standard type A plug to mini-B plug should be used, which is included with the BS-8000.
The Configuration Tool is compatible with Microsoft Windows 7 & 8 (32-bit or 64-bit version) operating system.

4.2 Software Installation

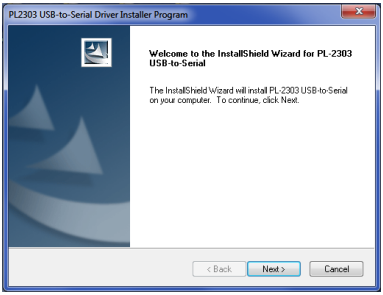
The software installation requires two steps. First, the installation of a USB to serial port driver and second the installation of the Configuration Tool itself. The installation files can be found on the CD supplied with the BS-8000.

4.2.1 USB to Serial Port Driver Installation

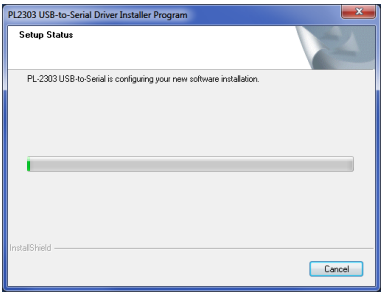
A USB to serial port driver is required to communicate between the PC and the BS-8000. This driver is included on the CD and should be installed before any cable connection is made to a PC.

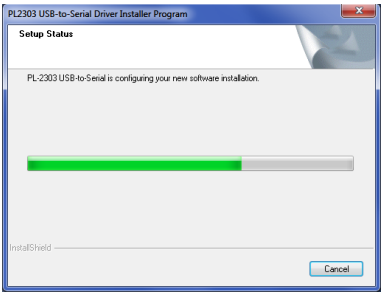
Insert and access the CD ROM, go to folder “Driver” and double click and run “PL2303_Prolific_DriverInstaller_v1.9.0”.

Click “Next >”

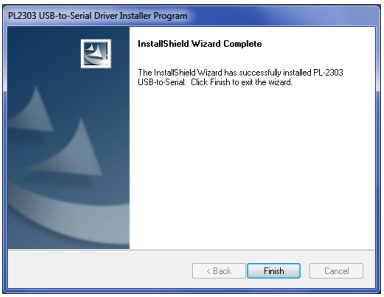


The installation progress will be shown as in both windows below:





Once the installation is complete, click “Finish”:



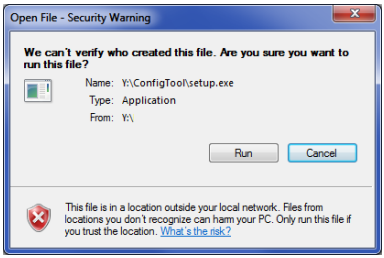
In case there are any issues with the driver installation further information can be found on the CD ROM, folder “Driver”, document “PL2303 Windows Driver User Manual v1.9.0.pdf”.

If there is doubt whether the installation has been successful, follow sections “4.3 Using the Configuration Tool Software” and “4.3.1 Identifying COM Port Number” to check for correct installation and port properties.

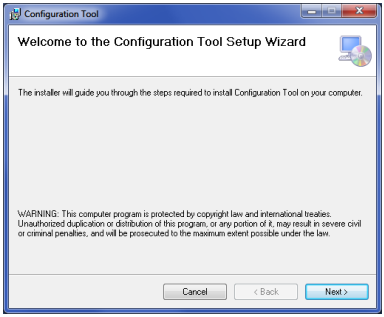
4.2.2 Configuration Tool Software Installation

Insert and access the CD ROM, go to folder “ConfigTool” and double click and run the file “setup”.

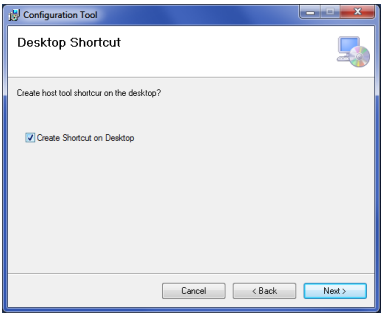
In some cases you may have a digital signature warning. Click “Run” to continue with the installation. If unsure or your user rights are not permitting the installation, refer to your IT department or a person with reasonable PC skills.



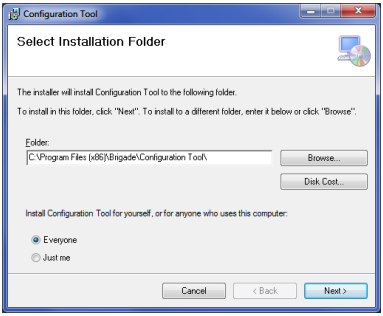
Click “Next >”



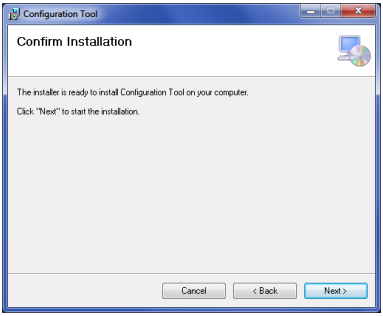
Check the tick-box to create a desktop icon and click “Next >”.



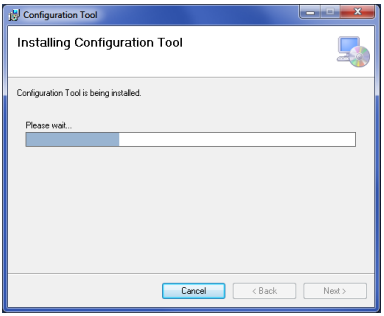
Change or confirm the installation folder location is correct and click “Next >”. The default location is shown below.



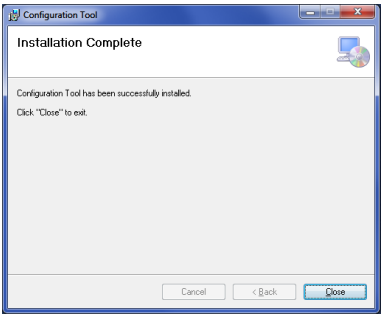
Confirm installation by clicking “Next >”:



The installation progress will be shown as displayed below:



Once the installation is complete, click “Close”:



Desktop Icon shown below:

4.3 Using the Configuration Tool Software

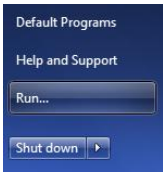
Connect the display to the PC using the provided USB cable to the USB connector located on the display.

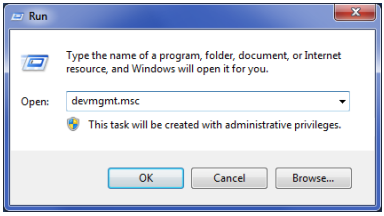
Note: Before connection is made ensure Brigade Backsense® is powered and activated - Status Light on the display should show constant green.

4.3.1 Identifying COM Port Number

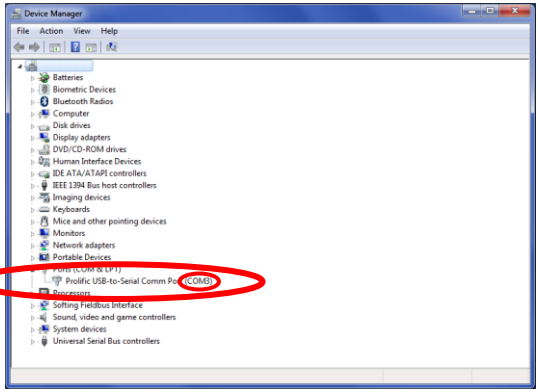
To check the COM port number you are using for the connected Brigade Backsense® on the PC you will need to open Windows “Device Manager”.

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.



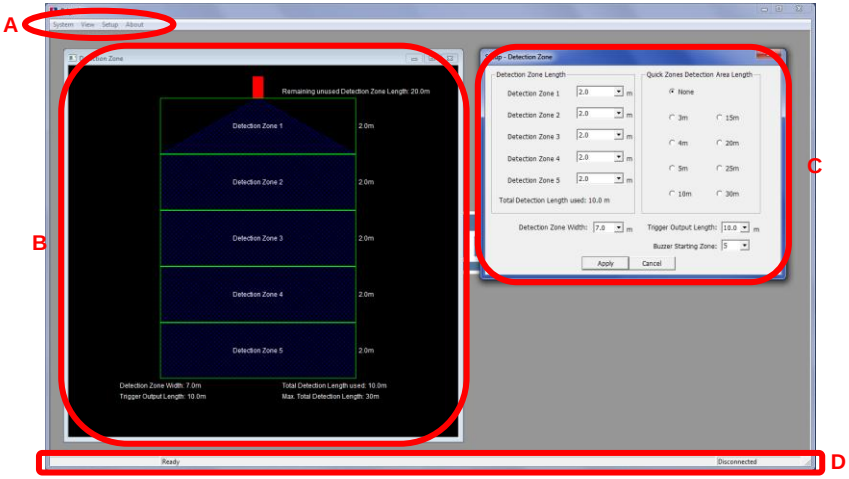


In the Device Manager window click “Ports (COM & LPT)” and check “Prolific USB-to-Serial Com Port (COM##)”. The “##” represents the number of the port through which the display is currently connected to the PC. Note this number as it is needed later in section “4.3.4 Connecting to the Brigade Backsense® System“. In the image below the number is shown as “8” but this can vary.



4.3.2 User Interface Overview

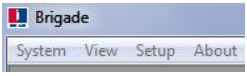
The Configuration Tool provides multiple sub-windows. The sub-windows are used either to view or to set up the configuration. The typical application is outlined below.



Menu area highlighted with letter “A” opens different windows to either view, change or activate the corresponding function.
For the detection area definition there is one view sub-window (see above marked with “B”), showing the graphical representation of the detection area and one setup sub-window (see above marked with “C”) to enter the values. For the blind zone function, there is also one for view and one for setup (not shown above). Most of the key configurations are repeated in the view windows. More details are provided in the following sections.
Status bar marked with “D” shows the multiple status information, e.g. of the connection state.

4.3.3 Main Menu

The Main menu includes four options for “System”, “View”, “Setup” and “About”.



System menu is used to control the connection between the Configuration Tool and Brigade Backsense® System for reading and writing the configuration to and from the system, loading and saving the configuration data from/to a file, closing the active view window or exiting the program.
View opens the Detection Zone and Blind Zone view windows.
Setup opens the setup windows for the Detection Zones and Blind Zones.
About provides version information for the Configuration Tool and LED Display software.

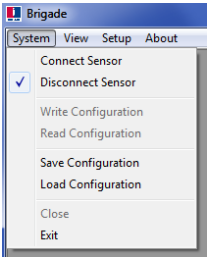
4.3.4 Connecting to the Brigade Backsense® System

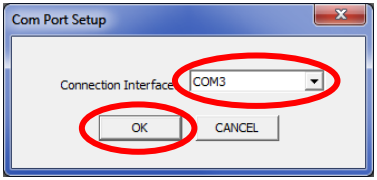
Connect the display to the PC with the USB cable provided in the Brigade Backsense® System BS-8000.

Note: **Before** connection is made ensure Brigade Backsense® **is powered and activated** - Status Light on the display should show constant green.

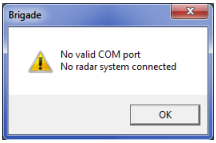
Before connecting the Configuration Tool to the display, the correct com port must be selected. Section “4.3.1 Identifying COM Port Number” describes how to find the correct port number.

In menu area click “System” then “Connect Sensor”. This will open the Com Port Setup window (this may take several seconds whilst the PC checks available COM ports). The COM port indentified before should be used by selecting it from the drop down list and then click “OK”**.**



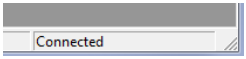


Com Port setup needs to be run every time the Configuration Tool is opened. If the incorrect COM port is selected the below error window will be shown:



Once connected an automatic read is executed and a configuration window will be shown:

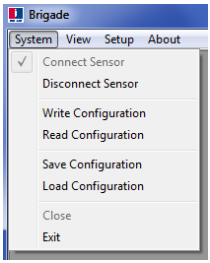
The Status Bar will display “Connected” at the bottom right of the main window:



The Status Light on the display will be off while the Configuration Tool is in connected state.

4.3.5 Disconnecting from Brigade Backsense® System

Before physically disconnecting the USB cable from the display or PC a **“disconnect” function in the Configuration Tool must be completed**. Click in menu area “System” and then “Disconnect Sensor”, see image below. The tick option shows the current state of the data connection.



Warning

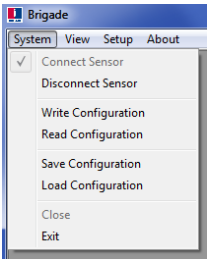
- **If the Brigade Backsense® System is physically disconnected from the USB cable or the PC while the Configuration Tool is in a connected state a power cycle of the system is required for recovery (disconnect the system from the power supply, e.g. switch ignition off then on again; re-activate cycle via the activation input alone does not recover the system).**
- **All written configuration data will be deleted in such a case.**

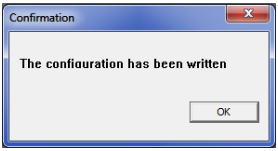
4.3.6 Writing Configuration to the Brigade Backsense® System

Make sure the Configuration Tool is in connected state. Once all the required configurations are complete all the settings can be programmed into the Brigade Backsense® System. Click in the menu area “System” then “Write Configuration”; this will upload the configuration to the Brigade Backsense® System. Once configuration is written a confirmation window will appear, click “OK”. See images below.

Warning

- **Make sure a Configuration Tool disconnection is performed before removing the USB cable from the display or PC. See details in section “4.3.5 Disconnecting from Brigade Backsense® System”.**

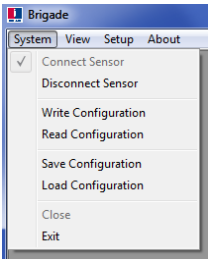




4.3.7 Reading Configuration from the Brigade Backsense® System

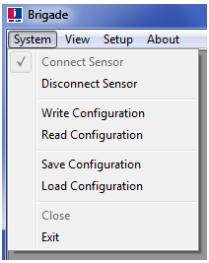
Make sure the Configuration Tool is in connected state. In menu area, click “System” then “Read Configuration”. This will read the configuration from the display. This is useful if a configuration needs to be modified, copied from one system to another or stored in a file for any future use. Once configuration has been read, a confirmation is displayed. See images below.

Note: When Brigade Backsense® System is connected to the Configuration Tool, see section “4.3.4 Connecting to the Brigade Backsense® System” an automatic reading of the configuration is executed.



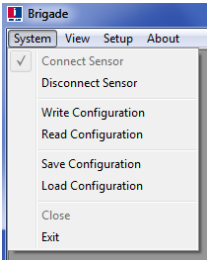
4.3.8 Saving Configuration to a File

All settings in the Configuration Tool can be saved to a file at any point of time with or without being connected to the system. The saved file is in a format that can only be read from the Configuration Tool.
Click in menu area “System” then “Save Configuration”. This opens a window for the selection of the save location and file name.



4.3.9 Loading Configuration from a File

All settings in the Configuration Tool can be loaded from a previously saved file. The loading function is supported whether or not the Brigade Backsense® System is connected. Any current settings in the Configuration Tool will be lost.
Click in menu area “System” then “Load Configuration”. This opens a window for selection of the load location and file name.

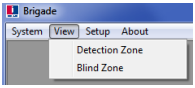


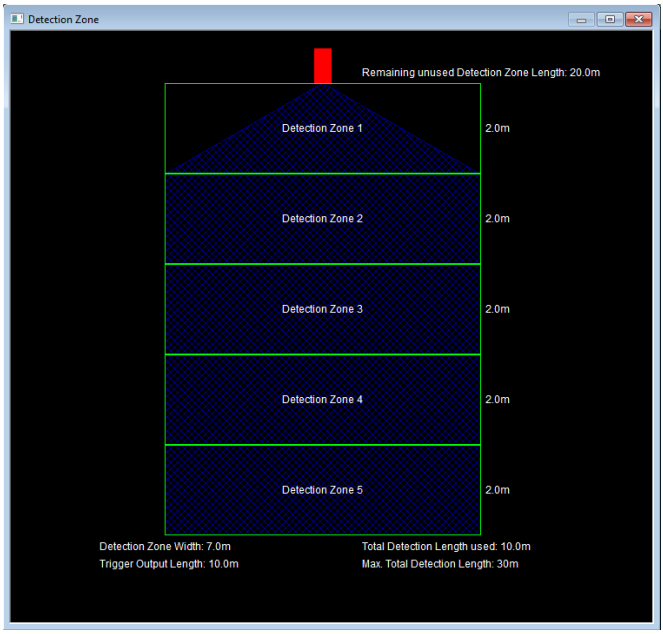
4.3.10 Detection Area Setup

Note: When setting up the detection zone and blind zones all dimensions are approximate. All dimensions for detection of objects are nominal and can vary significantly depending on many parameters. For details, see section “1.2.2 Factors Influencing the Detection of Objects”.

4.3.10.1 View Detection Zones

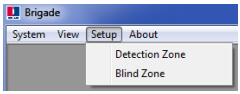
In menu area, click “View” and then “Detection Zone” to open the “Detection Zone” view window. This window displays the current detection length and width divided into zones. The default configuration for a BS-8000 is 10m x 7m with all 5 zones equally divided into 2m as shown below.

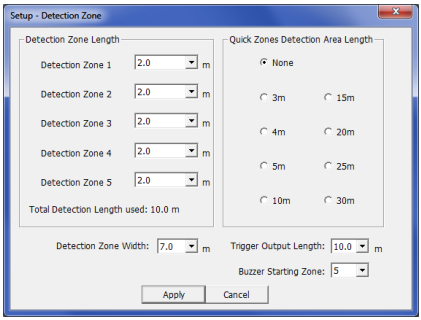




4.3.10.2 Setup Detection Zones

In menu area click “Setup” then “Detection Zone” to open the “Setup - Detection Zone” configuration window. This is used to configure each “Detection Zone Length”, “Quick Zones Detection Area Length”, “Detection Zone Width”, “Trigger Output Length” and “Buzzer Starting Zone”.



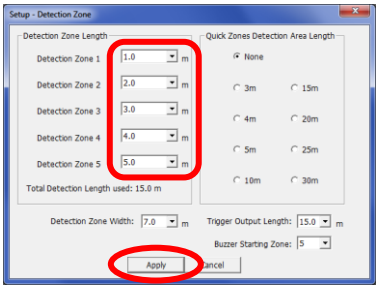


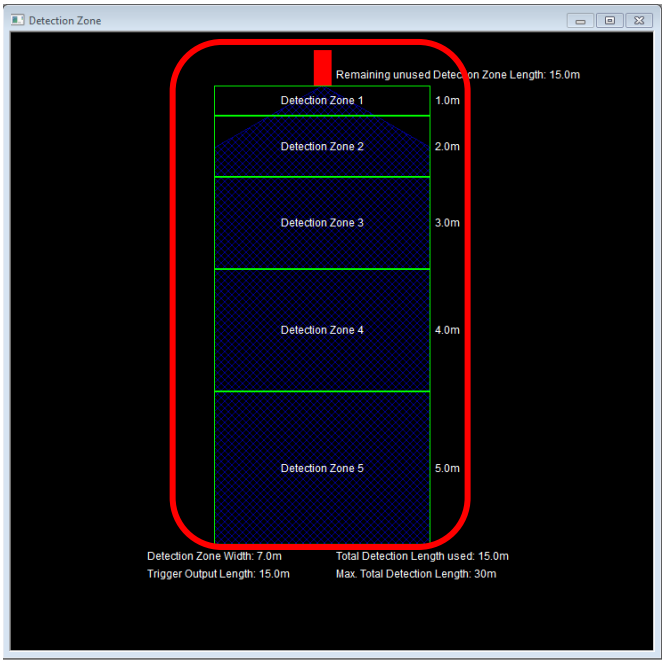
4.3.10.3 Detection Area Length

The detection area length can be set in two ways; setting each zone individually via the “Detection Zone Length” or via “Quick Zones Detection Area Length”.

4.3.10.4 Detection Zone Length Setup

This is used to set up each of the five zones individually. Each zone has a range from 1.0m to 26.0m selectable via the pull down menus. The combined total length will not exceed 30m. The image below shows zones setup from 1.0m to 5.0m giving a total of 15.0m detection. Clicking “Apply” after selection will change the shape displayed in the related view window.

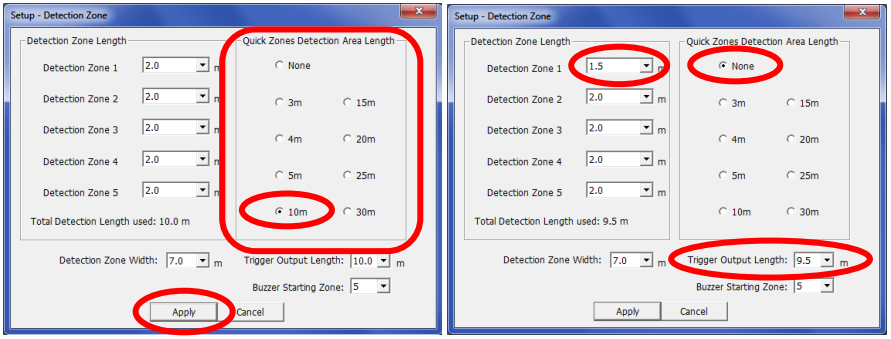




4.3.10.5 Quick Zones Detection Area Length

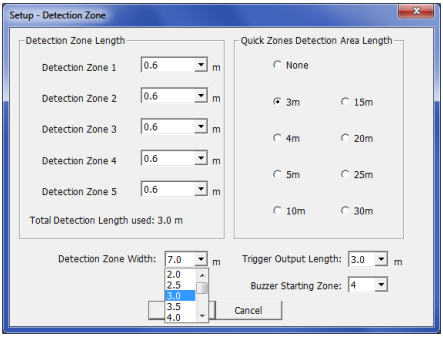
There are eight “Quick Zones”, these are preset zones and can be selected by clicking the appropriate check box next to the desired distance. Using this option will set the total length and create five equal zones. This does not affect the width, trigger output length or buzzer starting zone, these still should be set up manually as required.
If one of the Detection Zones Length is changed, the Quick Zones Detection Area Length will return to “None”. See below the image on the left before and highlighted on the right after the “Detection Zone 1” has manually been changed.

Note: The trigger output length will automatically reduce if the total detection length has been shortened.



4.3.10.6 Detection Zone Width

Detection Zone Width ranges from 2.0m to 10.0m with a dependency on the selected “Total Detection Length”. This will set the overall width of the detection to suit the application as required. Select the required detection zone width from the drop down box and click “Apply”. For example, the detection width would generally be set to approximately the same width as the vehicle.

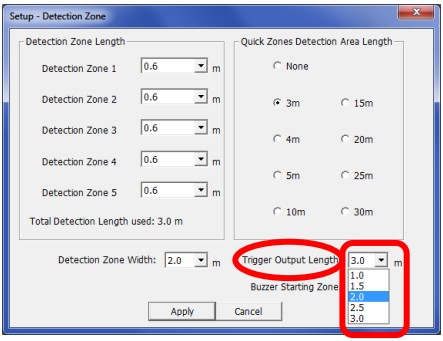


Note: Brigade Backsense® automatically adjusts the minimum Detection Width to a higher value for a longer Detection Length.

Detection Zone Length [m]	Limits for Detection Zone Width [m]
3 to 4	2 to 10
4.5 to 5	2.5 to 10
5.5 to 7	3 to 10
7.5 to 9.5	3.5 to 10
10 to 12.5	4 to 10
13 to 14.5	4.5 to 10
15 to 17	5 to 10
17.5 to 20	6 to 10
20.5 to 30	7 to 10

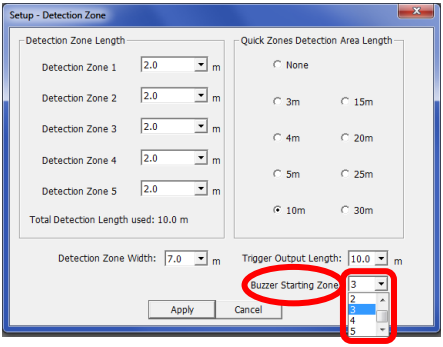
4.3.10.7 Trigger Output Length

The Trigger Output Length is set at the point where you want the trigger output to start in the detection area. Select the required Trigger Output length from the drop down box and click “Apply”. The range is from 1m to the selected Total Detection Length.
For example below shows a 3m detection length with the Trigger Output Length set at 2.0m (highlighted). The LED display will illuminate and beep at the start of detection (3.0m) but the trigger output would not activate until the detected object moves within 2.0m of the sensor.



4.3.10.8 Buzzer Starting Zone

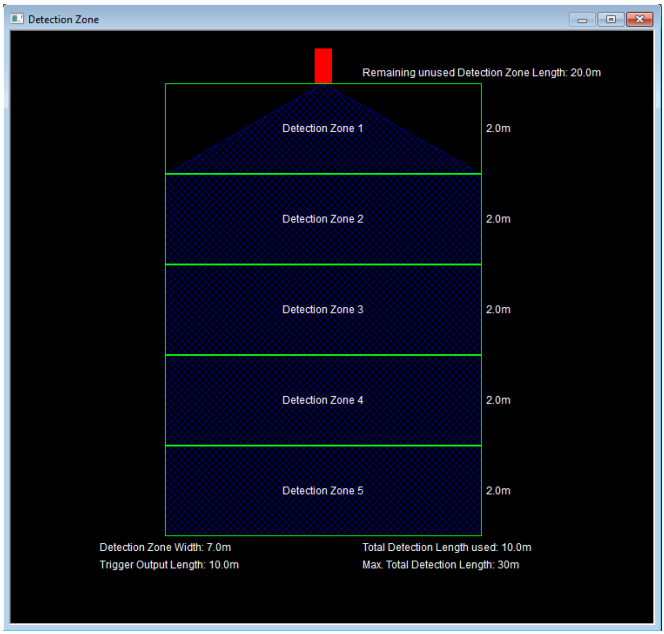
The Buzzer Starting Zone is set at the point where the display's buzzer will start sounding. Select the required buzzer starting zone from the drop down box and click "Apply".
The example below shows the Detection Zone Length at 10.0m with the Buzzer Starting Zone being set for Detection Zone 3. This means the display will show only illuminated Zone Light warnings until any detected object is within Detection Zone 3 and the yellow Zone Light is active. At this point the buzzer will sound.

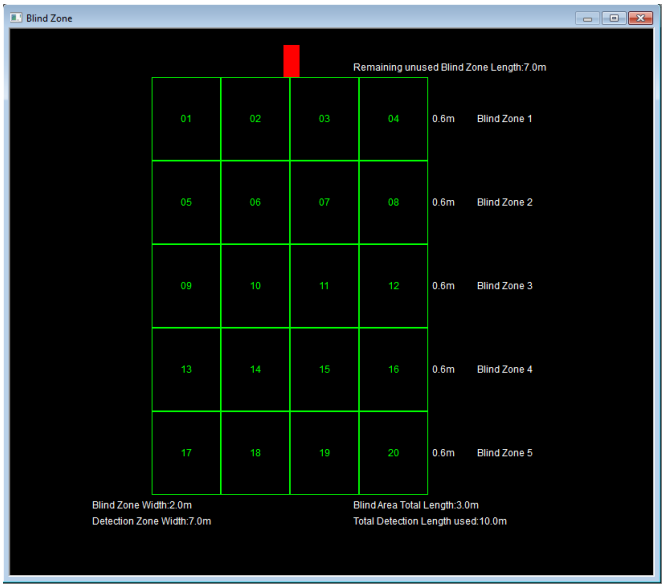


4.3.11 Blind Area Setup

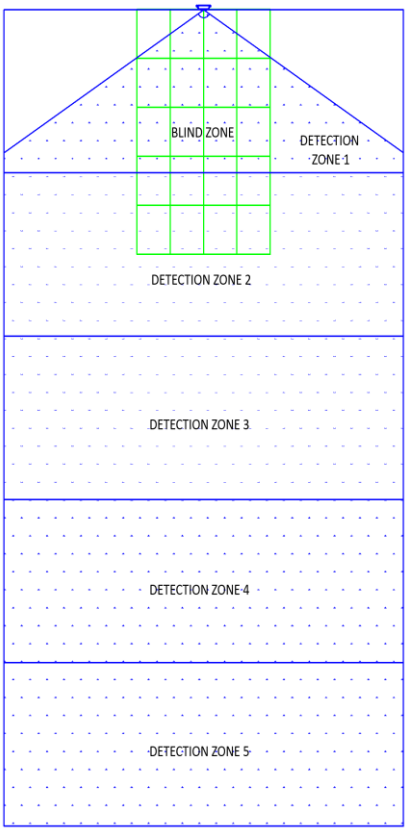
4.3.11.1 Relationship between Blind Area and Detection Area

The Brigade Backsense® BS-8000 can set Blind Cells inside the Detection Area to be ignored. These can be set at different sizes and selected individually to accommodate varied applications. Both the Detection Area and the Blind Area is symmetrical along same centre line.
The image below shows an example of the view windows for a larger Detection Area (10m x 7m) compared to a smaller Blind Area (3m x 2m) side by side in the Configuration Tool.


Detection Zone
Remaining unused Detection Zone Length: 20.0m
Detection Zone 1
2.0m
Detection Zone 2
2.0m
Detection Zone 3
2.0m
Detection Zone 4
2.0m
Detection Zone 5
2.0m
Detection Zone Width: 7.0m
Trigger Output Length: 10.0m
Total Detection Length used: 10.0m
Max. Total Detection Length: 30m


Blind Zone
Remaining unused Blind Zone Length:7.0m
01
02
03
04
0.6m
Blind Zone 1
05
06
07
08
0.6m
Blind Zone 2
09
10
11
12
0.6m
Blind Zone 3
13
14
15
16
0.6m
Blind Zone 4
17
18
19
20
0.6m
Blind Zone 5
Blind Zone Width:2.0m
Detection Zone Width:7.0m
Blind Area Total Length:3.0m
Total Detection Length used:10.0m

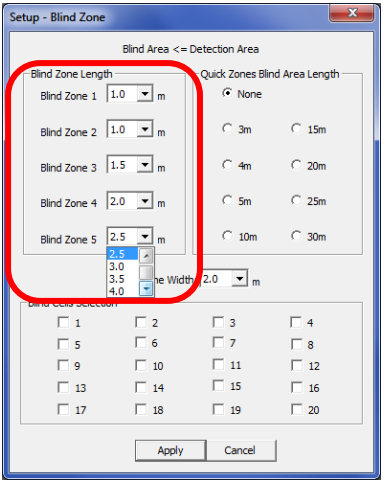
The next image shows the actual relationship between the two images set in the Configuration Tool.

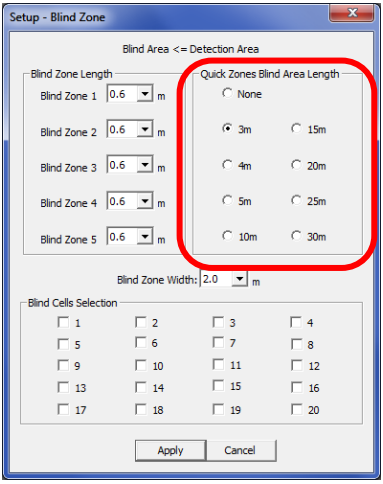


In the image above the Blind Zone Area is set to a 3.0m x 2.0m in front of the sensor. The Blind Zone Area is divided into 5 zones in length by 4 cells in width.

4.3.11.2 Blind Area View and Setup

The zones can vary in length if manual configuration is required (see below on the left). If the “Quick Zones Blind Length” option is used then all zones will be equally split over the full Blind Zone Length (see below on the right).
The Blind Zone Width can be set via the pull down menu.



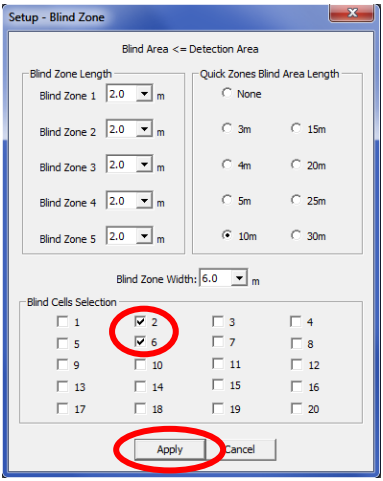


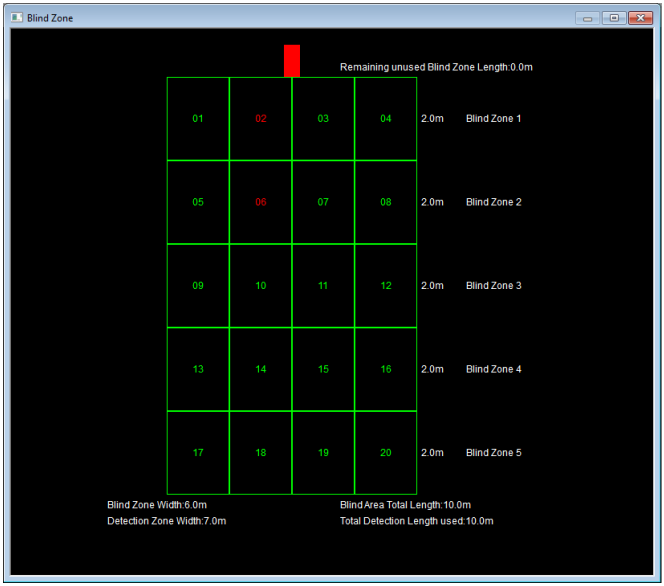
4.3.11.3 Selecting Blind Zone Cells

Once the Blind Zone Area has been decided, each Cell can be selected individually to remove the area from the detection zone. Any object in the selected Blind Cells will now be ignored if detected.
Each Cell is selected in the setup window using the tick boxes shown. The tick boxes directly correspond to the Cells shown in the Blind Zone view window. Once selected, click “Apply” and the Cell text will turn red in colour, indicating the area has been selected, see images below. To remove a selected cell, simply un-tick the corresponding Cell and click “Apply”.

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.**


Setup - Blind Zone
Blind Area <= Detection Area
Blind Zone Length
Blind Zone 1 2.0 m
Blind Zone 2 2.0 m
Blind Zone 3 2.0 m
Blind Zone 4 2.0 m
Blind Zone 5 2.0 m
Quick Zones Blind Area Length
None
3m
15m
4m
20m
5m
25m
10m
30m
Blind Zone Width: 6.0 m
Blind Cells Selection
1 2 3 4
5 6 7 8
9 10 11 12
13 14 15 16
17 18 19 20
Apply
Cancel


Blind Zone
Remaining unused Blind Zone Length:0.0m
01 02 03 04 2.0m Blind Zone 1
05 06 07 08 2.0m Blind Zone 2
09 10 11 12 2.0m Blind Zone 3
13 14 15 16 2.0m Blind Zone 4
17 18 19 20 2.0m Blind Zone 5
Blind Zone Width:6.0m
Detection Zone Width:7.0m
Blind Area Total Length:10.0m
Total Detection Length used:10.0m

5 Testing and Maintenance

5.1 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 a safe operation of the vehicle in relation to surrounding persons and objects.
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.
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) Store these instructions in a safe place and refer to them when maintaining and / or reinstalling the product.

5.2 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 of any accumulation of dirt, mud, snow, ice or any other debris.
2) Visually inspect the Sensor and Display and verify that they are securely attached to the vehicle and are not damaged.
3) Visually inspect the system's cables 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 is clear of obstacles and is larger than the detection range of the installed Brigade Backsense® System.

If any of the following tests fail, follow the fault finding guidance in section "3.7 Initial System Power Up and Test" of the installation guide.
For the following tests, the operator requires objects to be placed in the detection area or an assistant (to observe the display indications).

5) Activate the Brigade Backsense® System (ensure the vehicle cannot move) and verify the Status Light is illuminated constant green on the display within less than 7 seconds.
6) If the display shows any of the 5 Zone Lights activated, this indicates there are likely to be one or more objects in the detection area 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 0.4m distance from the sensor. The display should show the detection alerts via the lit Zone Lights, the buzzer pulsing speed and, if the trigger output is used, the connected device or function. The operator should note down the distance at which each detection zone is activated and if it is in line with the installed system or 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. All Zone Lights except for red should be constantly active. The red colour Zone Light should stay active for systems covering more than 1.1m distance with the closest detection zone 1.
9) Very close detection awareness: Verify objects less than 0.3m from the sensor are not detected. All the Zone Lights and buzzer output should switch off after less than 3 seconds with only the Status Light remaining illuminated constant green.
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. He 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.

6 Specifications

Operation Characteristics

Detection range	5 zones in equal (fixed range systems) or configurable lengths							
Model name	BS-8000		BS-7030		BS-7045		BS-7060	
Type	Configurable (* Default Setting)		Fixed Range					
	[m]	[ft]	[m]	[ft]	[m]	[ft]	[m]	[ft]
Detection length	3 - 30 (10)*	10 - 98 (33)*	3	10	4.5	15	6	20
Each Detection Zone length	1 - 26 (2)*	3 - 85 (7)*	0.6	2	0.9	3	1.2	4
Detection width	2 - 10 (7)*	7 - 33 (23)*	2.5	8	3.5	12	4.5	15
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	≥ 0.25m (1ft) (limitations apply, see section “1.2 Object Detection Capability”)							
Object detection	≤ 0.5second (limitations apply, see section “1.2 Object Detection Capability”)							
Power on to system ready	≤ 6 seconds							
System standby to active	≤ 0.2 second							

Communication between Sensor and Display

Physical layer	CAN bus
Protocol layer	Proprietary Protocol (cannot be integrated or networked with other systems on vehicles)
Max. cable length between display and sensor	30m (98ft)

Sensor Specifications

Transmitter	Frequency Modulated Continuous Wave (FMCW)
Frequency and bandwidth	24.068GHz to 24.218GHz
Dimensions (all in mm)	217 x 129 x 50
Connector	Manufacturer Deutsch Part Number DT06-4S-CE06
Cable length	1.0m / 3ft 3in
Weight	0.7kg (including pigtail cable)
Operating temperature	-40°C to +85°C
IP protection	IP69K (protected from dust and strong water jets / immersion into water) protective housing
Vibration	20G
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 50 inch/lbs
Bracket	Optional, adjustable for vertical angle

Display Specification

Zone Lights	Large and high ambient light visibility Luminance >300cd/m^2
Buzzer	Buzzer volume control wheel Sound pressure level adjustable 65dB(A) to 90dB(A) (at 1m distance), frequency 2800±300Hz
Programming interface	Mini USB socket (configurable version only)
Dimensions (all in mm)	101 x 70 x 29 (with bracket 71)
Connector	Manufacturer Deutsch Part Number DT04-4P-CE02
Cable length	1.5m / 5ft
Weight	0.3kg (including pigtail cable)
Operating temperature	-40°C to +85°C
IP Protection	IP30 (not water protected)
Vibration	20G
Shock	100G all three axes
Mounting	Via bracket adjustable in all direction approximate 30° Base supplied with self-adhesive tape. Possibility to fix base with additional screws (not supplied, drilling required) Removable bracket for flush mount

Electrical Specification

Input voltage	9Vdc to 32Vdc
Input current	typ. 0.62A at 12Vdc / typ. 0.32A at 24Vdc / max. <0.8A
Fuse	3A, automotive (regular size) blade fuse type, located on red power supply cable
Polarity	Negative ground
Vehicle connection	System supply positive, negative, activation input and trigger output 4 single cables exiting at the back of the connector on the end of the display cable
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)

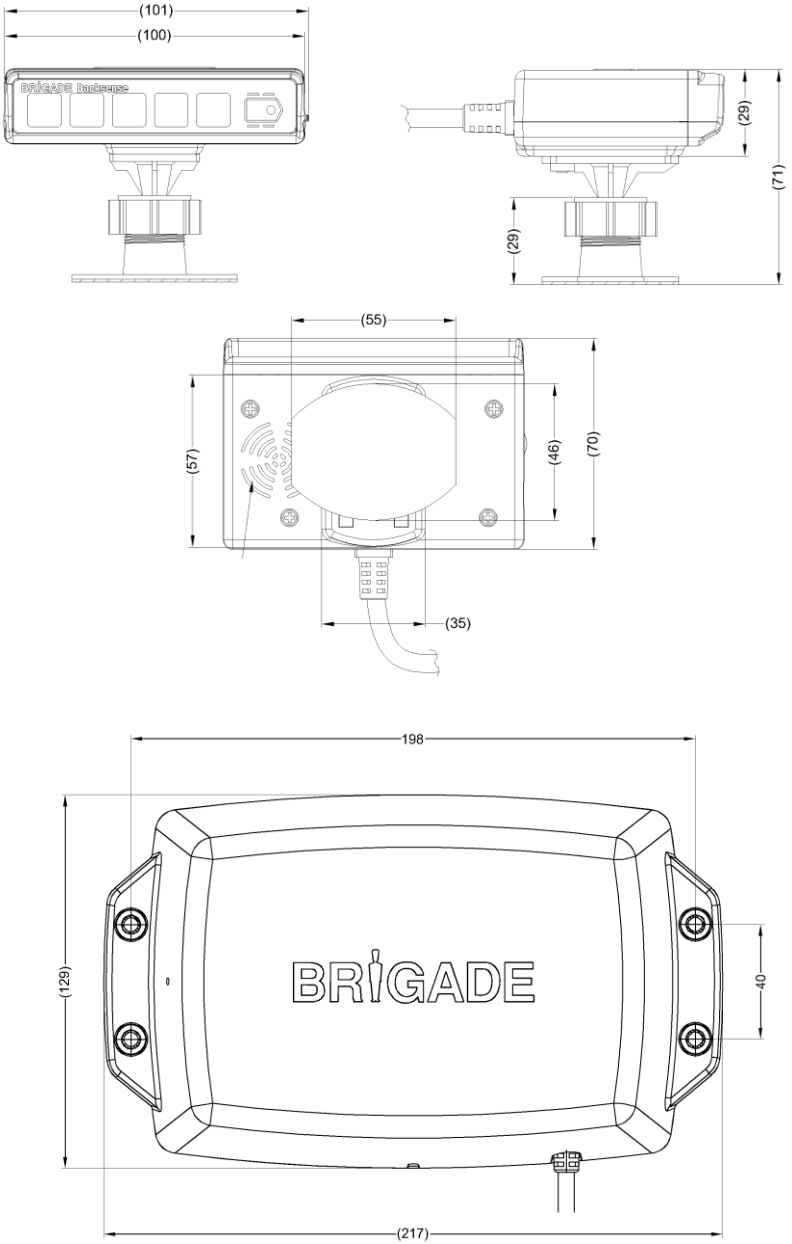
Approvals

CE
ECE Regulation No. 10 Revision 4 (“E-marking”)
ISO 16750
ISO 13766
EN 13309
FCC

Brigade Electronics
BS-7030 / BS-7045 /
BS-7060 / BS-8000 /
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.

7 Mounting Dimensions



8 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.

Aviso legal

Aunque los sistemas 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.

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.

Serial No:	Part No:

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