Installation Guide Backsense® Radar Obstacle Detection Systems

Models: BS-8000, BS-7030, BS-7045, BS-7060

Contents

		Page
1.0	**Introduction**	3
1.1	System Functionality	3
1.2	Detection Distances	3
2.0	**System Components**	4
3.0	**Hardware Installation**	4
3.1	Installation Site	4
3.2	Sensor Mounting	4
3.3	Display Mounting	4
3.4	Cable	5
4.0	**Initial System Power Up and Test**	5
5.0	**Configurable System - BS-8000**	5
5.1	Configuration Tool software installation	5
5.1.1	System requirements	6
5.1.2	UI Overview	6
5.1.3	Main Menu	6
5.2	Connecting to the system	6
5.2.1	Com Port	7
5.2.2	Connect Sensor	7
5.3	Detection Zone Setup	7
5.3.1	View Detection Zone	8
5.3.2	Setup Detection Zone	8
5.3.3	Detection Area Length	9
5.3.3.1	Detection Zone Length setup	9
5.3.3.2	Quick Zones Detection Area Length (D.A.L.)	9
5.3.3.3	Detection Zone Width	9
5.3.3.4	Trigger Output Length	10
5.3.3.5	Buzzer Starting Zone	10
5.3.4	Blind zone setup	11
5.3.4.1	Selecting blind zone cells	12
5.3.5	Writing settings to display	12

Appendix I – System Connectivity	15
Appendix II – Configuration Tool software installation	16
Appendix III – Daily Maintenance	20
Appendix IV – Specifications	21
Appendix V - Mounting Dimensions	22
Appendix VI FCC Statement:	23

1.0 Introduction

Brigade's Backsense FMCW radar systems are designed to detect people and objects in blind spots, significantly reducing accidents. 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 danger areas. Backsense works effectively in harsh environments and in poor visibility including darkness, smoke and fog.

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 adheres 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 accidents.

The system is intended to aid the operator, who must still concentrate on operating the vehicle, obey traffic and local regulations and continue to use his/her own training, senses and other vehicle aids, such as mirrors, as would be done 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 System Functionality

The Brigade Backsense® uses Frequency Modulated Continuous Wave (FMCW).

FMCW differs from pulsed radar in that an electromagnetic signal that is continuously transmitted. The frequency of the signal changes over time, generally in a sweep across a set bandwidth. Backsense® bandwidth is 24.068 – 24.218GHz.

1.2 Detection Distances

The four available systems are as follows:
* - Default settings

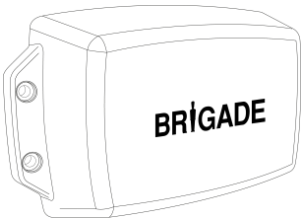
Model (Part No.)	Length (m)	Each Zone Length (m)	Width (m)	Minimum Tolerance (m)
BS-7030 (4527)	3.0	0.6	2.5	±0.25
BS-7045 (4528)	4.5	0.9	3.5	±0.25
BS-7060 (4529)	6.0	1.2	4.5	±0.25
BS-8000 (4530)	3.0 – 30.0 *(10.0)	1.0 – 26.0 *(2.0m)	2.0 – 10.0 *(7.0m)	±0.75

BS-7030, 7045 & 7060 have fixed detection length and width divided into five equal detection zones. The buzzer and trigger output activate in all zones on detection. Stationary objects are detected from the start of the detection area up to 1.2m of the sensor. Any stationary object will not be detected inside 1.2m – 0.2m of the sensor unless the object or vehicle moves; detection to alert will take less than 0.2sec. **Any object closer than 0.3m will not be detected.**

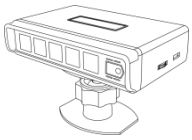
The **BS-8000** uses the same fundamental operation as all the above systems but detection zone, blind zone, trigger length and buzzer starting zone are all configurable. Refer to section 5.0.

2.0 System Components

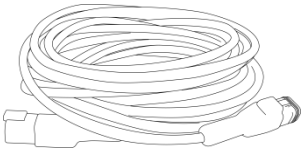
Sensor



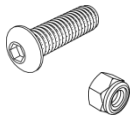
Display



Extension Cable



Fixing Kit

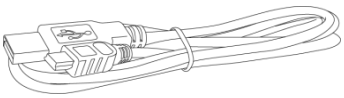


x4

Configurable system: as above and including

Software CD

Mini USB Cable



SYSTEM	SENSOR	DISPLAY	CABLE	SOFTWARE	CONNECTIVITY
BS-7030 (4527)	BS-7XXXS (4542)	BS-7030D (4531)	BS-09DCX (4551)	-	-
BS-7045 (4528)	BS-7XXXS (4542)	BS-7045D (4532)		-	-
BS-7060 (4529)	BS-7XXXS (4542)	BS-7060D (4533)		-	-
BS-8000 (4530)	BS-8000S-S	BS-8000D (4534)		CD (4553)	USB CBL (4554)

3.0 Hardware Installation

Refer to the vehicle manufacturers bodybuilder guidelines for installation procedures and connectivity in all applications. Ensure the positive connections are fused at source. System connections are shown in the table below. Connect red and black to ignition and ground, grey connected to the activating trigger (e.g. reverse) and white is a ground output trigger which is active under detection (customisable on the BS-8000 system).

System Connections	
RED	Ignition +12/24v
BLACK	Ground
GREY	Activation trigger
WHITE	Ground trigger output

3.1 Installation Site

The installation site, for calibration purposes, must be relatively flat without excessive deviation. Flat does not necessarily mean level; a sloping flat area may be acceptable as long as the vehicle does not lean excessively.

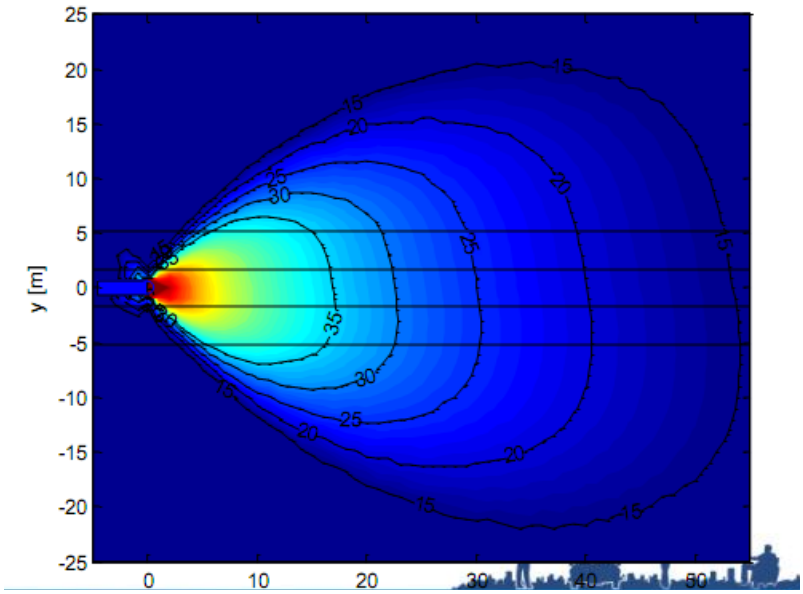
3.2 Sensor Mounting

The sensor should be mounted in the upright position (Brigade logo in normal orientation) avoiding detection of the ground and any vehicle furniture where possible. This is critical on the non-configurable systems where obstacles can be ignored in the configurable system.
The horizontal angle of the detection zone is 110° ±10°.and the vertical 12°±2°.

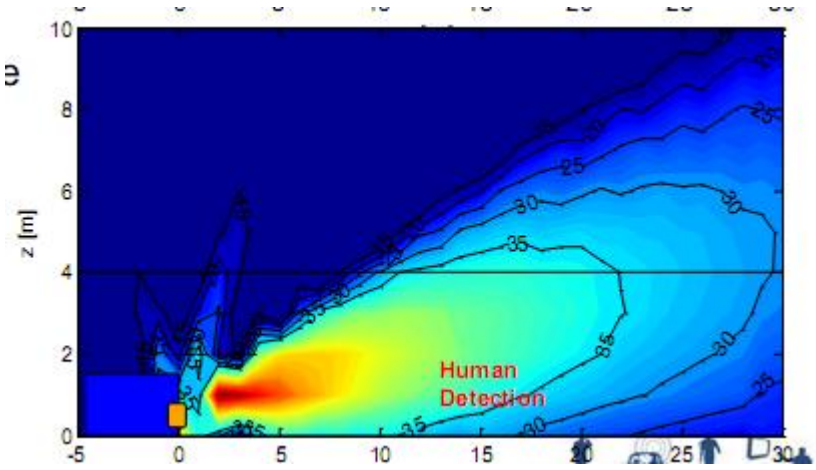
[INSERT DIAGRAMS CONTAINING DETECTION PATTERNS]

15 dB	Truck
20 dB	Passenger Car
25 dB	Motorbike
30 dB	Bicycle
35 dB	Human

Horizontal Detection



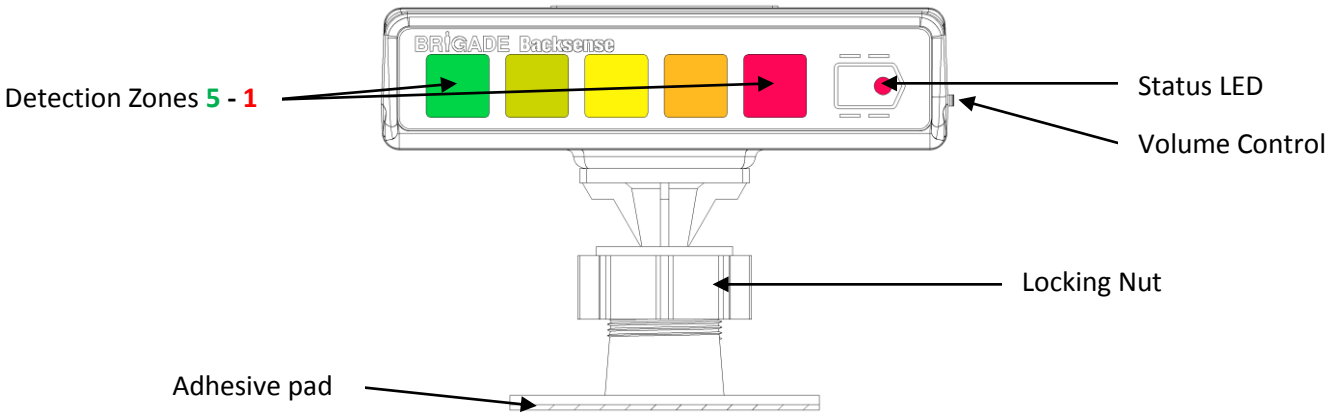
Vertical detection



3.3 Display

The display should be mounted where the vehicle operator has good visibility in all environments. 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 a machine screw for fixing. An adhesive pad is included to fix the base to the dashboard, drilling and fixing with screws maybe required in some applications. The neck is adjustable in all directions up to 30° and is secured with a locking nut. The volume is adjustable from 65-90dB.



3.4 Cable

Cables should be run in conduit and along suitable cable runs throughout the vehicle. **Allow a reasonable radius when folding excess cabling.** Note: a 24mm hole is required to pass the connectors through.

DESCRIPTION AND LED COLOUR		FLASH FREQUENCY	ALERT FREQUENCY	FUNCTION
ZONE 5	GREEN	CONSTANT	1.5Hz	-
ZONE 4	LIGHT GREEN	CONSTANT	2Hz	-
ZONE 3	YELLOW	CONSTANT	2.5Hz	-
ZONE 2	ORANGE	CONSTANT	3Hz	-
ZONE 1	RED	CONSTANT	CONSTANT	-
STATUS LED	RED	CONSTANT	-	SYSTEM IN STANDBY
STATUS LED	GREEN	CONSTANT	-	SYSTEM ACTIVE
STATUS LED	FLASHING RED	1Hz	-	SYSTEM ERROR. SYSTEM NOT ACTIVATED
ALL ZONES ON STATUS FLASHING	- -	- 1Hz	CONSTANT FOR 5 SECONDS	SYSTEM ERROR. SYSTEM ACTIVATED

4.0 Initial System Power Up and Test

Once the sensor and display are installed, wired, and connected, power should be applied to test correct system operation. Upon power up, the display will go through its self-test by illuminating all LEDs and sounding the buzzer then the green power LED will be the only light illuminated. When reverse is selected, applying power to the activation cable, the power LED turns red, check the system is operating correctly in an open field with no obstructions. If all the detection LED's are lit, check for any obstruction which may be detected by the sensor. If possible move the sensor so it is not detecting the object(s). If it is not possible to relocate the sensor, then consult Brigade.

5.0 Configurable System - BS-8000

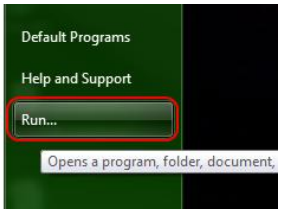
Section 5.0 – 5.4 covers the setup of the configurable Backsense®, BS-8000.

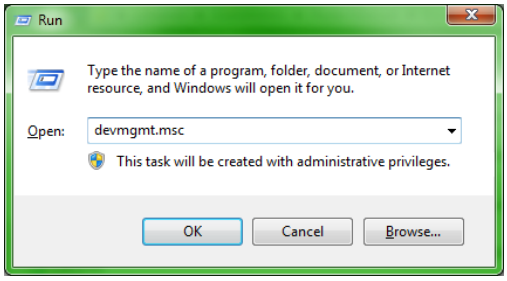
5.1 Configuration Tool software installation

The installation files can be found on the CD supplied with the BS-8000 kit (CD-BS8000-00 (4553)). Run the setup file to install the configuration tool. *Refer to Appendix II for installation instruction.*
A USB to serial port driver is required to communicate between the PC and display. This is included on the CD and should be installed before connection can be made.

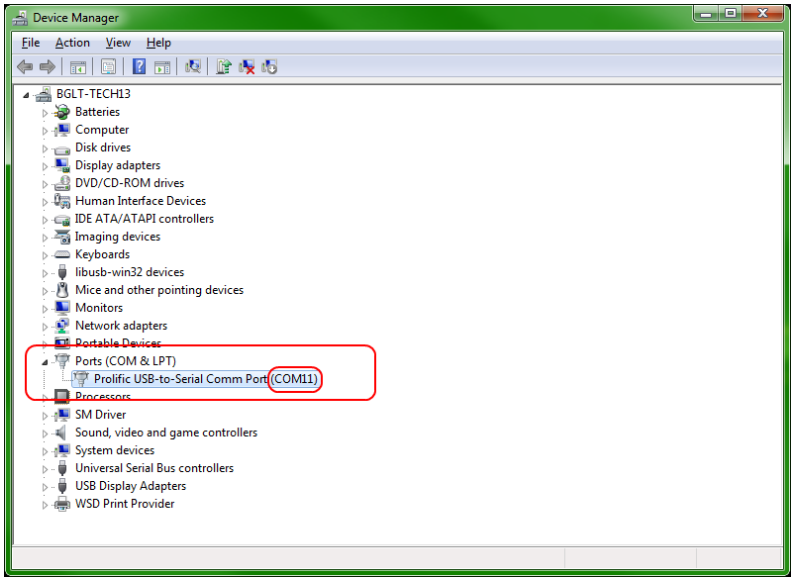
Once installed connect the display to the PC using the provided USB cable *(the display should be powered but does not need to be activated)*. To check the COM port number you are using you will need to open Device Manager on the PC.

Click Windows> Run… . In the dialogue box opened, type 'devmgmt.msc' and press enter; this will open the Device Manager.





Click 'Ports (COM & LPT)' and check 'Prolific USB-to-Serial Comm Port (COM##)' the COM## number in brackets is the port the display is currently connected to. Refer to section 5.2.1 Com Port Selection

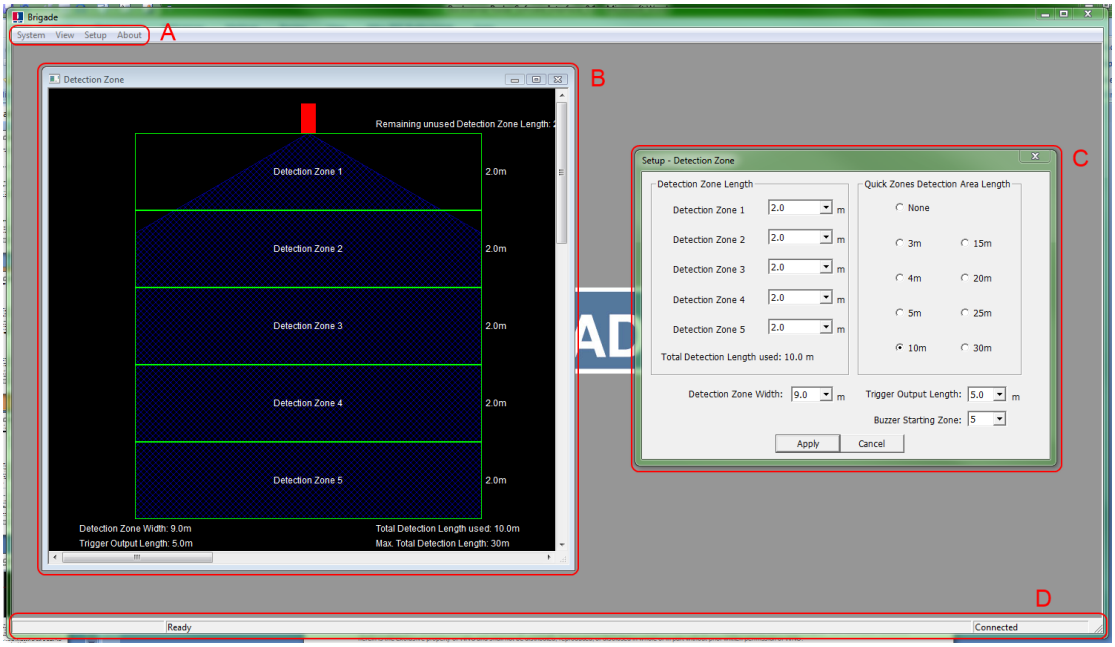


5.1.1 System requirements

The Configuration Tool is designed for Microsoft Window 7 (32-bit) environment and requires USB 2.0 Type-A connector. In order to connect LED display, a USB cable (type-A (Male) to Mini-B (Male)) should be used. This is supplied with the BS-8000 kit.

5.1.2 User Interface Overview

This application provides multiple sub-windows. The users can manipulate in different windows view or change the configuration. The application outline is shown below.

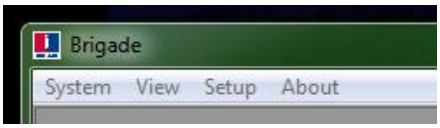


Menu (A) opens different windows to setup the corresponding function; Detection Zone, Blind Zone & Buzzer Starting Zone etc.

There are two view **windows (B)**; one is for Detection Zone, another is for Blind Zone. The view windows provide the visual picture in the corresponding setup. Most of the configuration and the information will be shown in the view window. Each view window has a related **configuration window (C)**. User can set the desired configuration by the window. The detail will be depicted in later chapter. **Status bar (D)** shows the status including tip information, connection state etc.

5.1.3 Main Menu

The Main menu includes four options; '*System*', '*View*', '*Setup*' and '*About*'.



System is used to control the connection between application and system, reading and writing the configuration to and from the system, loading/saving the configuration from/to file and Close active window or Exit the program.

View opens the Detection Zone and Blind Zone windows.

Setup opens the configuration windows for the Detection Zone and Blind Zone.

About provides version information for the Configuration Tool.

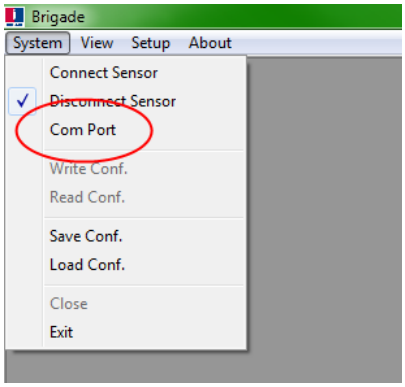
5.2 Connecting to the system

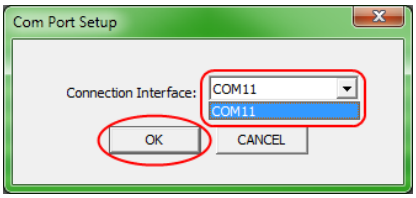
Connect the display to the PC with the Mini USB cable provided in the BS-8000 (4553) kit.

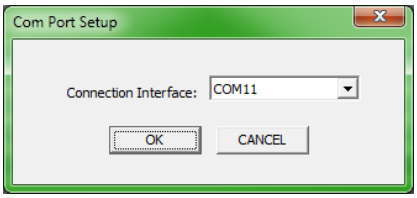
5.2.1 Com Port Selection

Before the tool connects to the display, the correct com port must be selected. Section 5.1 describes how to find the correct port number.

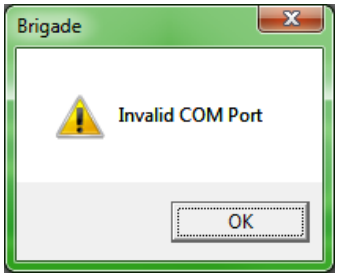
Click 'System> Com Port'. This will open the Com Port Setup window (This may take a several seconds whilst the PC checks available com ports). Select the com port required from the drop down list and click 'OK'.





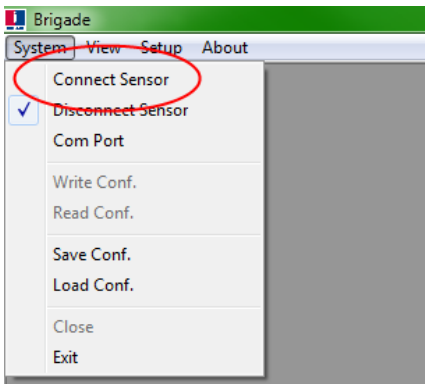


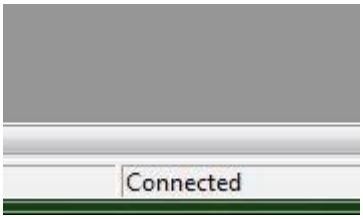
Com Port setup needs to be run every time the configuration tool is opened or you will get the error message shown.



5.2.2 Connect Sensor

Click 'System> Connect Sensor'. Once connected, the Status Bar will display 'Connected' at the bottom right of the main window.



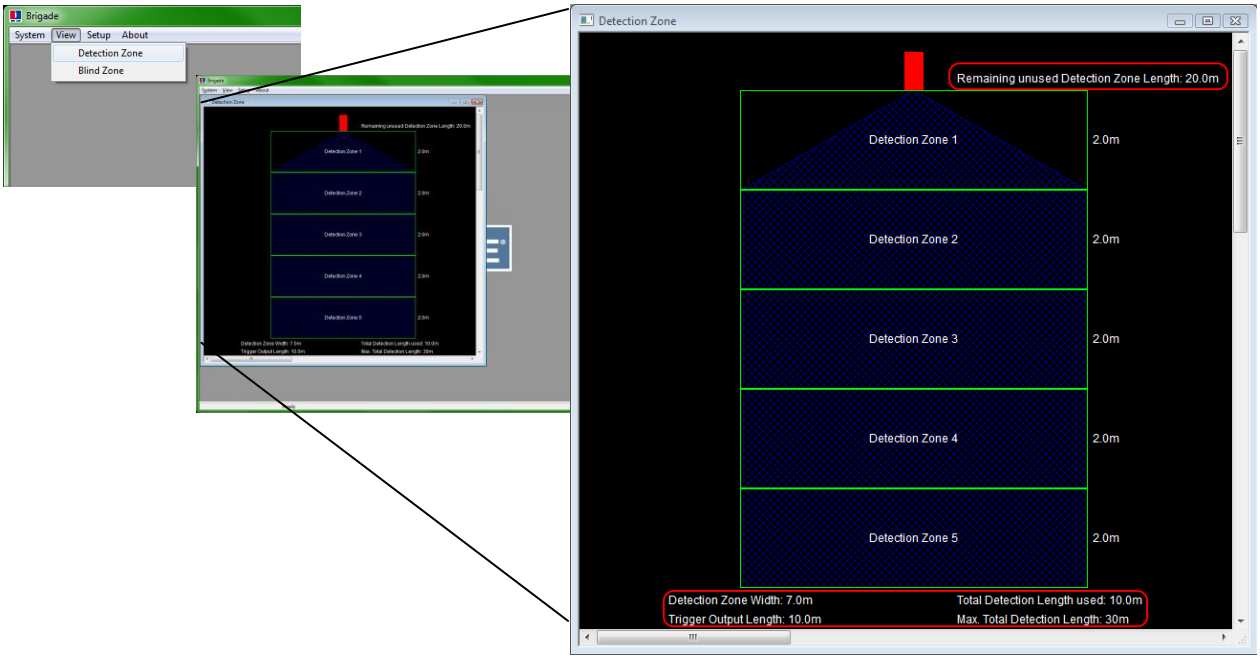


5.3 Detection Zone Setup

Note: when setting up the detection zone and blind zones all dimensions are approximate.

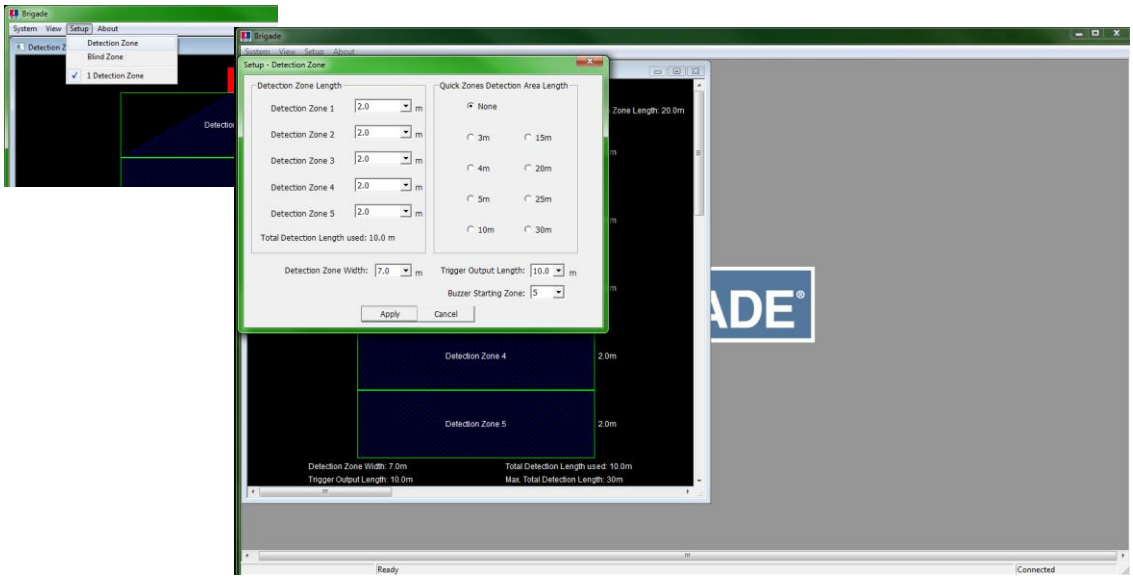
5.3.1 View Detection Zone

Clicking View> Detection Zone will open the 'Detection Zone' 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 5 zones equally divided into 2m as shown below.



5.3.2 Setup Detection Zone

Clicking Setup> Detection Zone will open the 'Setup – Detection Zone' window. This is used to configure Detection Zone Length, Detection Zone Width, Trigger Output Length and Buzzer Starting Zone.

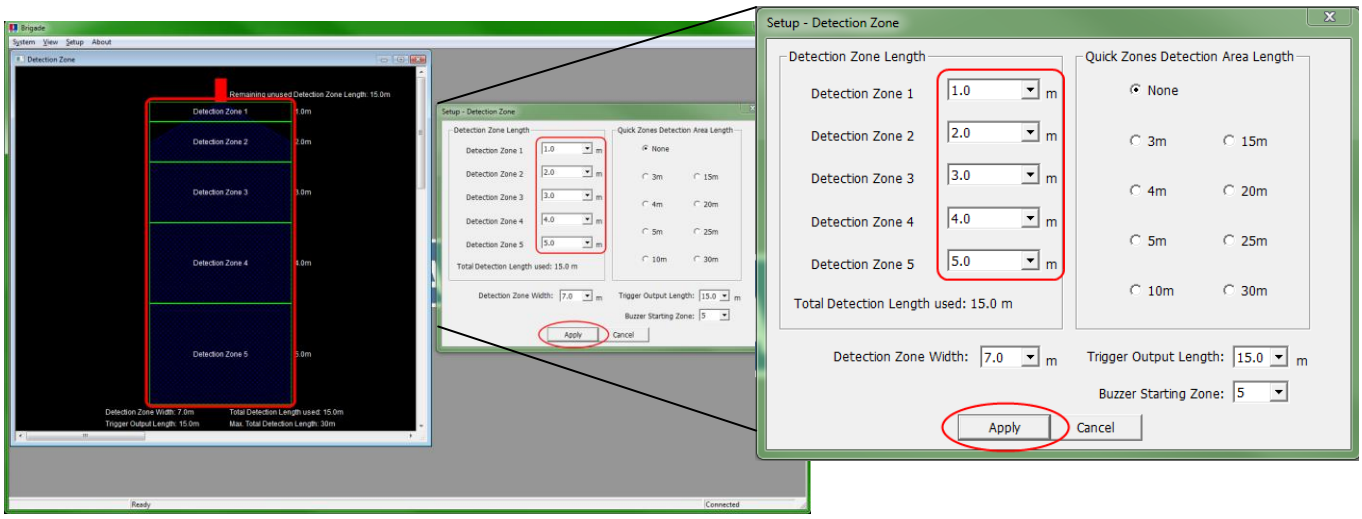


5.3.3 Detection Area Length

The detection area length can be set in two ways, Detection Zone Length or Quick Zones Detection Area Length.

5.3.3.1 Detection Zone Length Setup

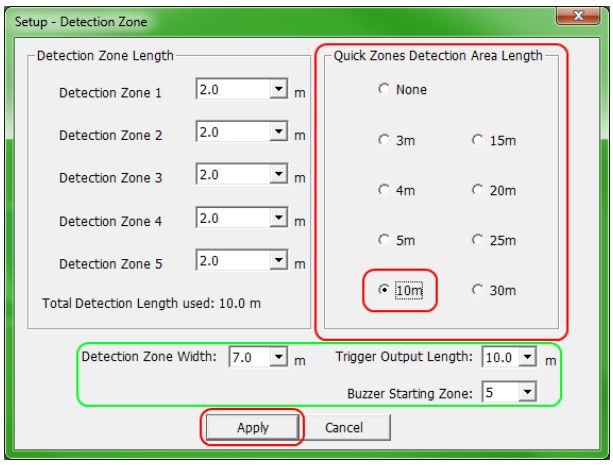
This is used to setup each of the five zones individually. Each zone has a range from 1.0m to 26.0m. The combined total length will not exceed 30m. The image below shows zones setup from 1.0m to 5.0m giving a total of 15.0m detection. Clicking Apply after selection will change the preview shape

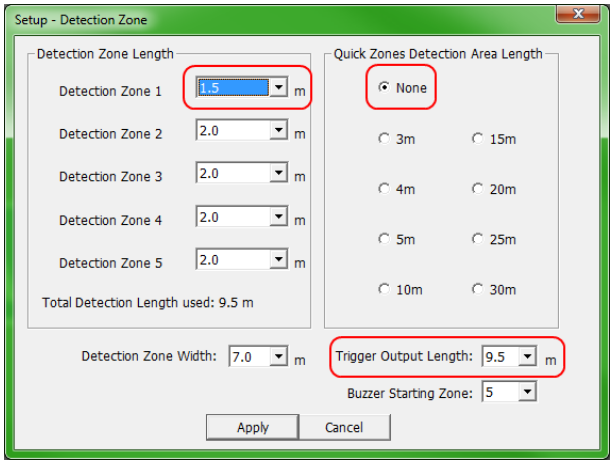


5.3.3.2 Quick Zones Detection Area Length

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 must be setup manually. If one of the detection zones length is changed, the Quick Zones Detection Area Length will return to 'None'.

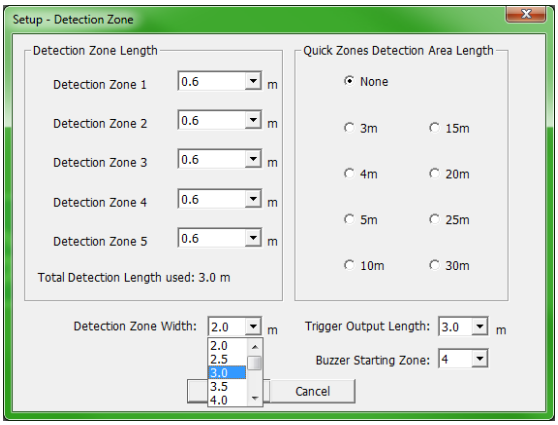
Note: the trigger output length will automatically reduce if the total detection length has been shortened.





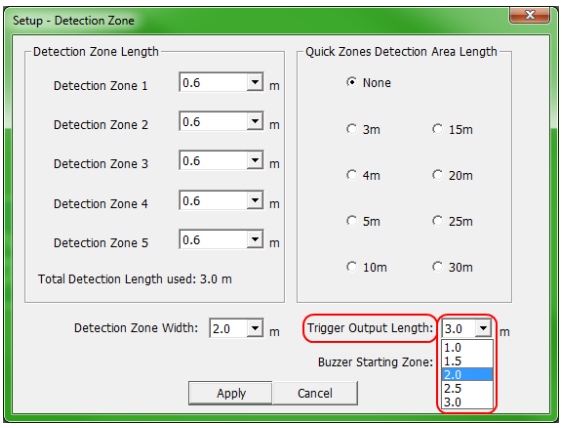
5.3.3.3 Detection Zone Width

Detection zone width ranges from 2.0m to 10.0m. This will set the overall width of the detection to suit the application as required. For example, the detection width would generally be set to approximately the same width as the vehicle. Select the required detection zone width from the drop down box and click 'Apply'.



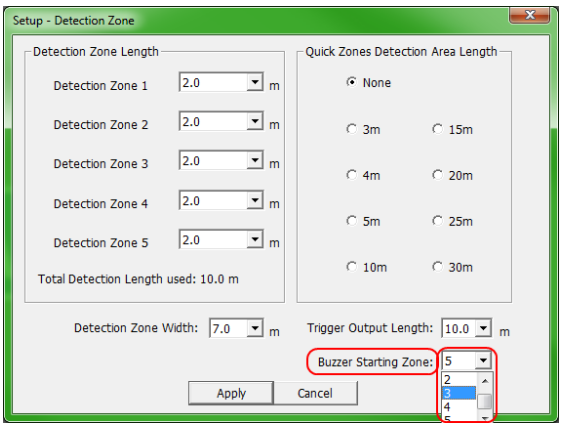
5.3.3.4 Trigger Output Length

The trigger output length is set at the point where you want the trigger output to **start**. 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. Select the required trigger output length from the drop down box and click 'Apply'.



5.3.3.5 Buzzer Starting Zone

The buzzer starting zone is set at the point where you want the display's buzzer to **start** sounding. The example below shows the Detection Zone Length at 10.0m with the Buzzer Starting Zone being set at 3.0m. This means the display will show illuminated warnings only until the detected object is within 3.0m of the sensor, at this point the buzzer will sound. Select the required buzzer starting zone from the drop down box and click 'Apply'.

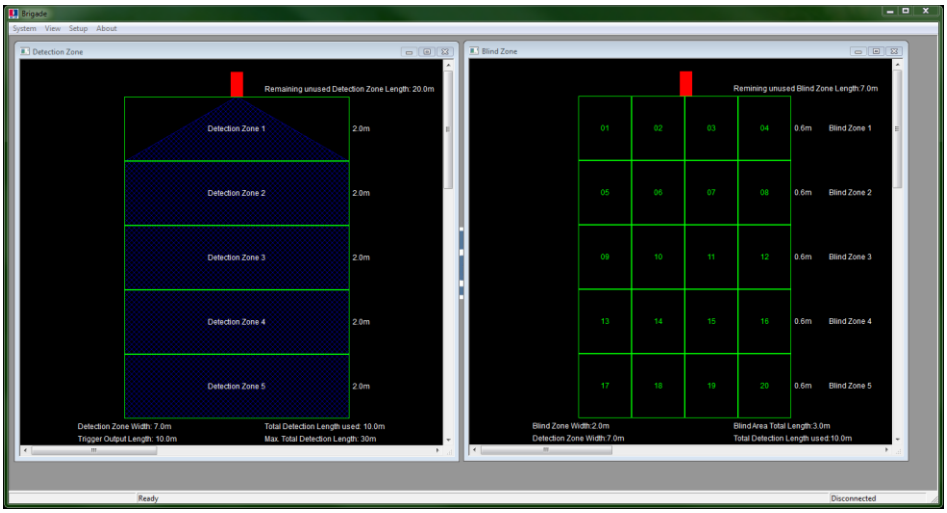


5.3.4 Blind zone setup

With the BS-8000, blind zones inside the detection area can be set up to ignore areas inside the detection pattern. These can be set at different sizes and selected individually to accommodate varied applications.

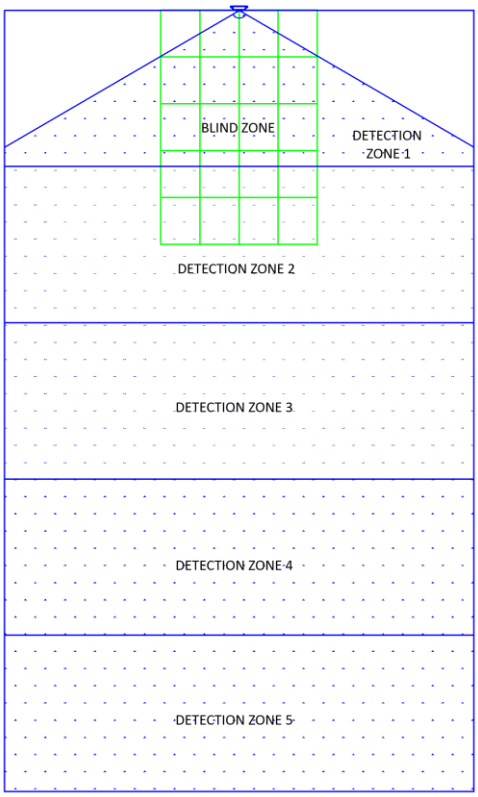
The image below (a) shows the Detection Zone view and Blind Zone view side by side in the configuration tool. The second image (b) shows the actual relationship between the two images displayed in the tool.

(a)

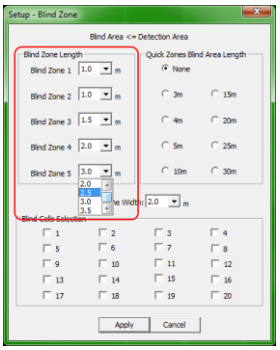


In the image below the blind zone area is set to a 3.0m x 2.0m box in front of the sensor. This box, no matter how big, is divided into 5 zones, each zone containing 4 cells. The zones can vary in length if manual configuration is preferred or required (c). If the 'Quick Zones Blind Area Length' option is used (d) then all zones will be equally split over the full blind zone area.

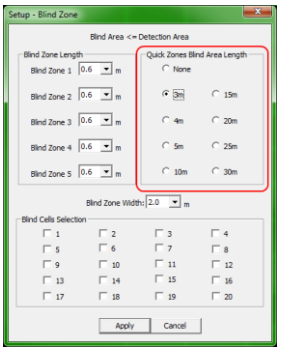
(b)



(c)

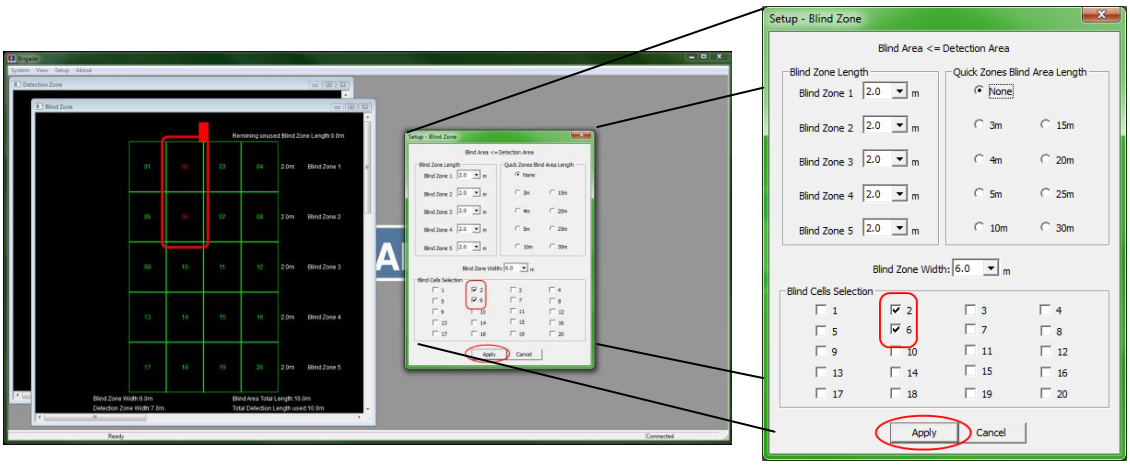


(d)



5.3.4.1 Selecting blind zone cells

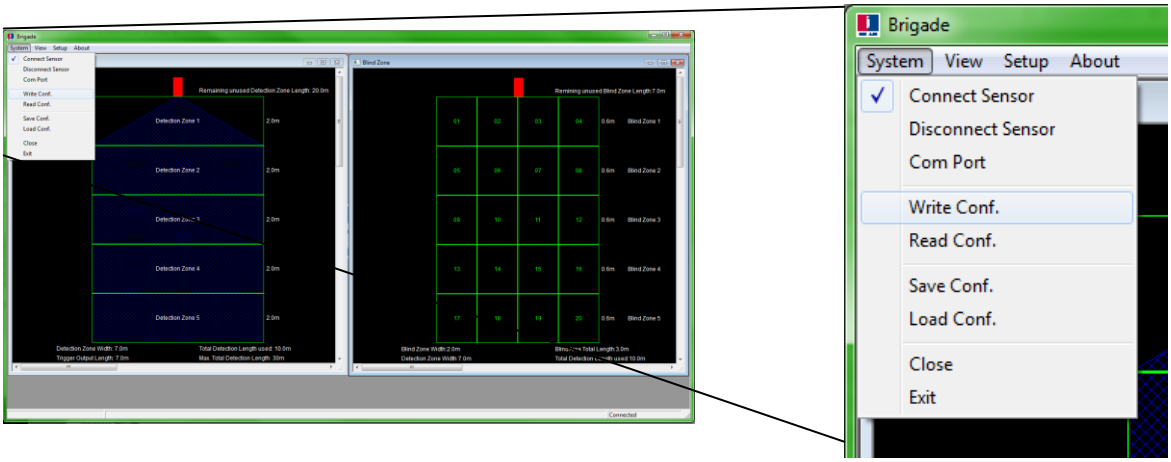
Once the blind zone area has been decided, each cell can be selected individually to remove the area from the detection zone. Any object in the red selected area will now be ignored if detected.
Each cell is selected in the setup window using the tick boxes shown. The tick boxes directly correspond to the cells shown in the Blind Zone window. Once selected, click 'Apply' and the cell text will turn red, indicating the area has been selected. To remove a selected cell, simply un-tick the corresponding box and click Apply.



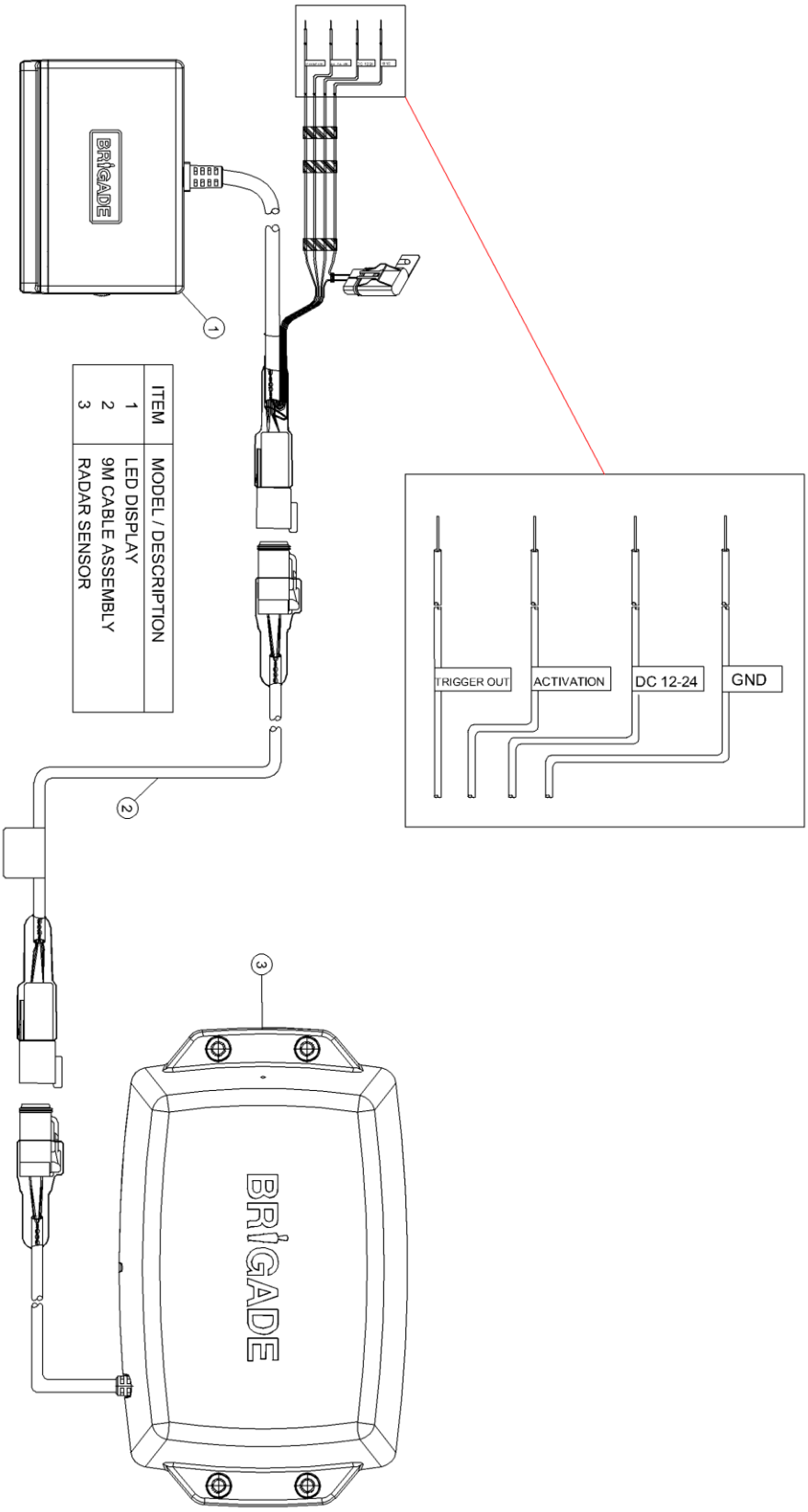
Ensure each blind zone is thoroughly checked for correct operation with the vehicle stationary and in motion.

5.3.5 Writing settings to display

Once the configuration is complete, the settings are then uploaded to the display.
Click 'System> Write Conf.' , this will upload the configuration to the display. Done-Note: There is no easily recognisable indication to show download progress to the system memory. The 'connected' icon on the right of the status bar momentarily changes to 'Writing…' to indicate the upload is in progress, this is not always visible.



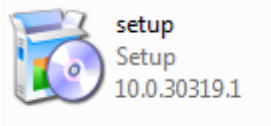
Appendix I – System Connectivity



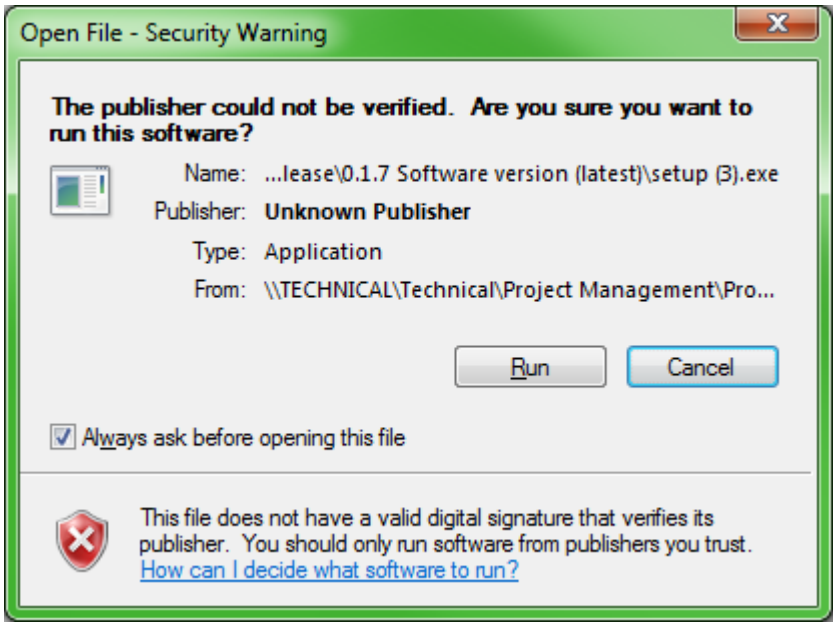
ITEM	MODEL / DESCRIPTION
1	LED DISPLAY
2	9M CABLE ASSEMBLY
3	RADAR SENSOR

Appendix II – Configuration Tool software installation

Double click 'setup'.

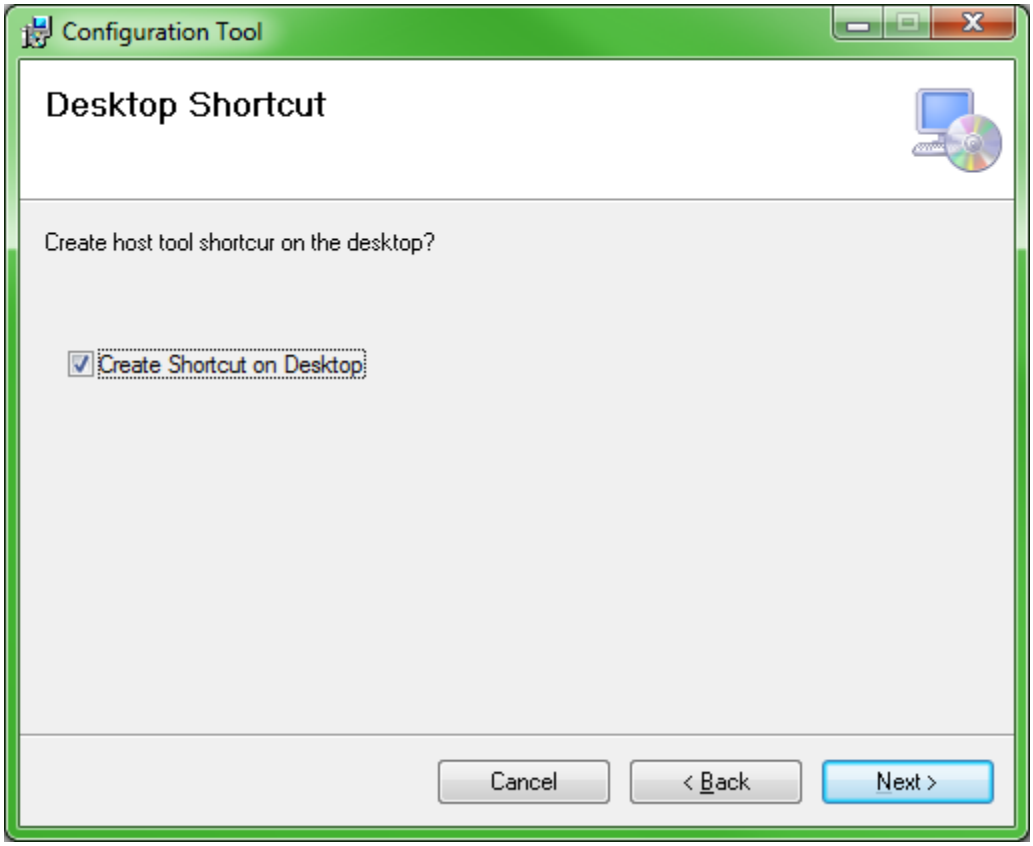


In some cases you may have a signature warning. Click 'Run' to continue with the installation. If unsure please refer to you IT department.

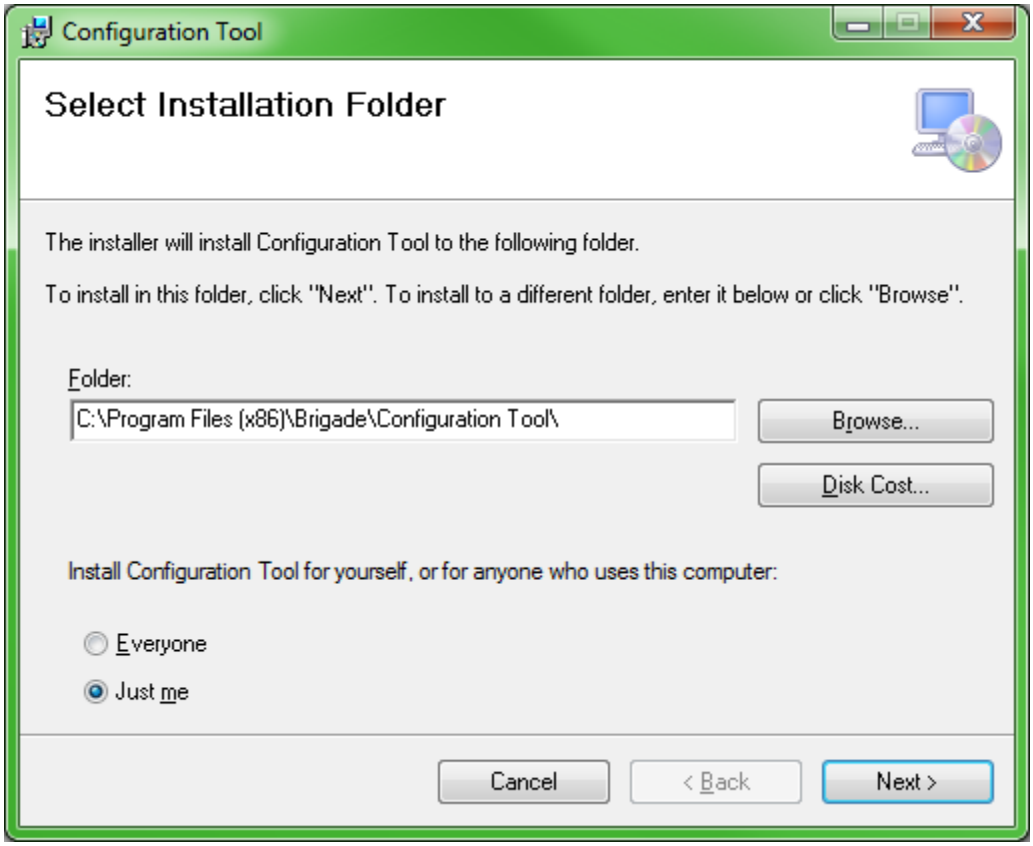


Click 'Next >'.

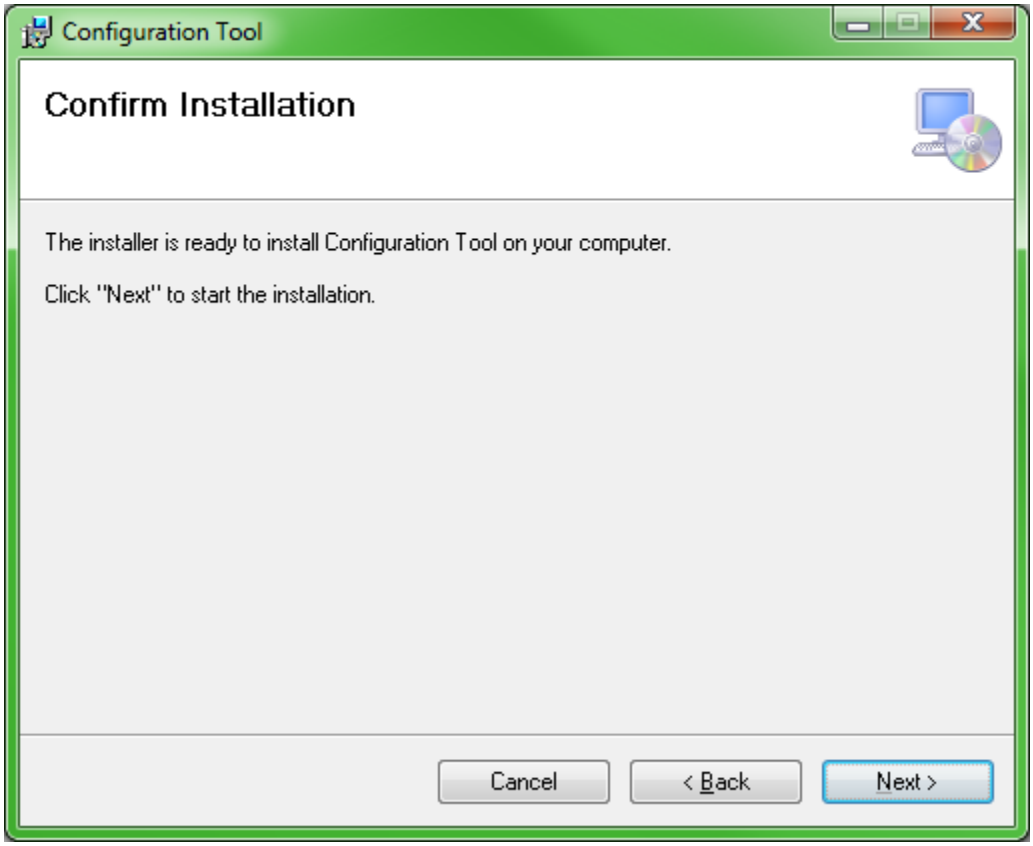
Check the tick-box to create a desktop icon and click ‘Next >’.



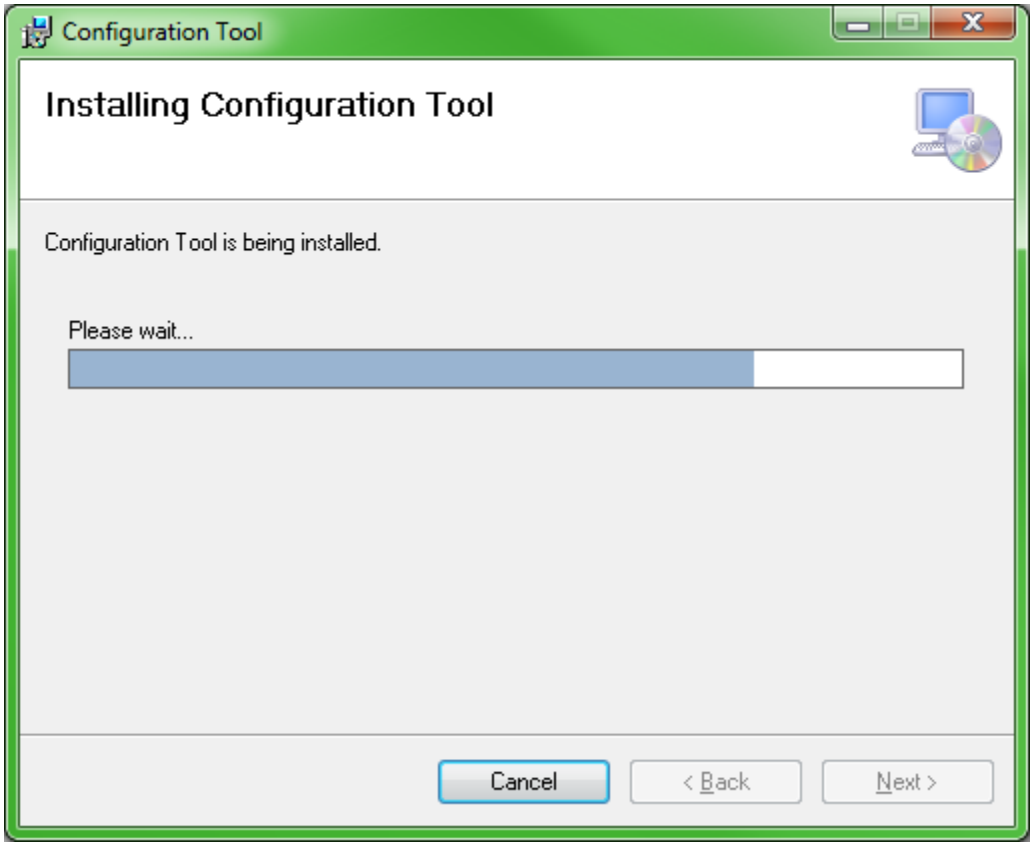
Confirm the installation folder location is correct and click ‘Next >’. *The default location is shown below.*



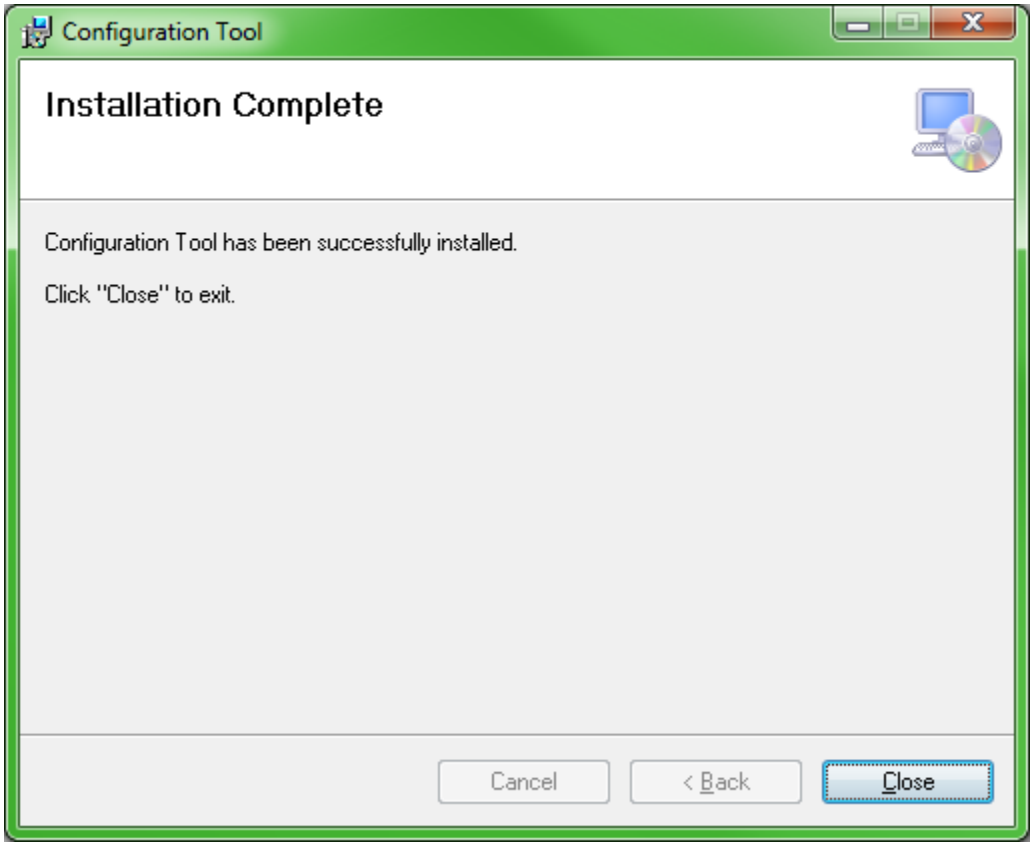
Confirm installation by clicking ‘Next >’.



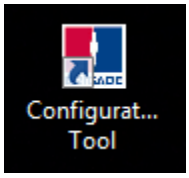
The installation progress will be shown as displayed below.



Once the installation is complete click ‘Close’.



Desktop Icon shown below.



Appendix III – Daily Maintenance

Detach this page and place with daily operator maintenance procedures

Safety Message to Operators of Vehicles with Backsense™ Systems

1. The Backsense™ system is intended as an Object Detection System and should not be relied upon as your first line of defence for the safe operation of the vehicle. It should be used in conjunction with established safety programs and procedures to augment the safe operation of the vehicle, ground personnel, and adjacent property. Should the system become inoperative, it could jeopardize the safety or lives of those who depend on the system for safety.
2. Testing and inspection of the system in accordance with these instructions and record of the results should be listed on the daily maintenance report. The units installed on operating vehicles must be tested each day prior to the vehicle's operation. Results of this test must be recorded in the maintenance log.
3. People operating this equipment **MUST** check for proper operation at the beginning of every shift or safety inspection period.
4. People's lives depend on the proper installation of this product in conformance with these instructions. It is necessary to read, understand and follow all instructions shipped with the product.
5. Failure to follow all safety precautions and instructions may result in property damage, serious injury, or death.
6. The Backsense™ Object Detection System is intended for commercial use. Proper installation of a back-up aid requires a good understanding of truck electrical systems and procedures, along with proficiency in the installation.
7. Store these instructions in a safe place and refer to them when maintaining and/or reinstalling the product.

Testing and Maintenance

IMPORTANT: A walk around test shall be performed regularly to verify proper function of the system and to familiarize the operator with the zone of detection. More frequent inspections should be performed when:
The vehicle is operating in a particularly dirty or harsh environment.
The operator has reason to suspect the system has been damaged.
This test should be performed with two people, one who remains in the cab (the operator), and one who walks through the sensor field to the rear of the vehicle (the assistant).

1. Clean the black sensor surface of any accumulation of dirt, mud, snow, ice, or debris.
2. Visually inspect the attached wiring and cable and verify that they are properly secured, not chafing or dangling free where they could become snagged and damaged. Inspect the Radar Sensor and Operator Display Module and verify that they are securely attached to the vehicle.
3. Start the vehicle, set the park brakes, and place the vehicle in reverse.
4. Verify the green “POWER” light is illuminated on the in-cab display.
5. The area to the rear of the vehicle should be clear of obstacles for a distance of 8 meters. If the display shows any indicator other than the green light then there are objects to the rear of the vehicle that will interfere with the test. Move the vehicle to a clear area and proceed.
6. The assistant should move to the rear of the vehicle and to the side so that he is in sight of the operator's mirrors. He should begin ½ meter (20”) to the rear of the rearmost part of the vehicle. As the assistant walks towards the centreline of the vehicle parallel to the rear, the external backup alarm will activate, signifying the sensor has detected him. Upon hearing the backup alarm the operator should verify that all of the display LED" s are lit and the audible alarm is quickly pulsing. Note: If an external backup alarm is not connected, the operator will notice a detection only by the display LED" s and buzzer operation and communicate the detection or lack of detection to the assistant as the assistant moves through the area to the rear of the vehicle.
7. The assistant should continue walking through the area at the rear of the vehicle noting the area that detection occurs.
8. Now walk from the centre of the rear of the vehicle straight back, away from the vehicle. When the alarm quits sounding the detection limit has been reached.
9. Move halfway back and remain still for a few seconds, the alarm should continue to sound, demonstrating the system’s ability to detect a still object.
10. The assistant should walk the complete rear of the vehicle noting the detection edges of the entire coverage area.
11. After the test the assistant needs to communicate to the operator the details on where detection started and stopped to the rear of the vehicle.

Appendix IV - Specifications

SENSOR SPECIFICATIONS (Typical)

Model:	BS-7030S, BS7045S, BS-7060S and BS-8000S
Transmitter:	Frequency Modulation Continuous saw tooth Waveform - FMCW
Connector:	Deutsch DT06-4S-CE06
Sealing:	Encapsulated to protect from dust and moisture to IP69K.
Housing Material:	Black Textured ASA+PC
Dimensions:	220 x 130 x 50mm
Weight:	700gm (including pigtail cable)
Operating Temperature:	-40°C to +85°C
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.

DISPLAY SPECIFICATIONS (Typical)

Model:	BS-7030D, BS7045D, BS-7060D and BS-8000D
Housing Material:	ABS777E
Dimensions:	100 x 70 x 25mm
Weight:	300gm (including pigtail cable)
Mounting:	Supplied with 3M VHB tape fixed to base. Screw may be required to fix base in some applications.

ELECTRICAL SPECIFICATIONS

Input Voltage:	9-32VDC, over voltage protected to 36V
Input current:	<0.4 amp maximum
Polarity:	Negative ground, Polarity protected to 150V
Power Connection:	Available through display connector
Activation Input:	0-32v (Active above 9vdc, inactive below 7vdc)
Trigger Output:	Active State: switched to ground, over current protected to 1 amp sink maximum.
Inactive State:	High impedance

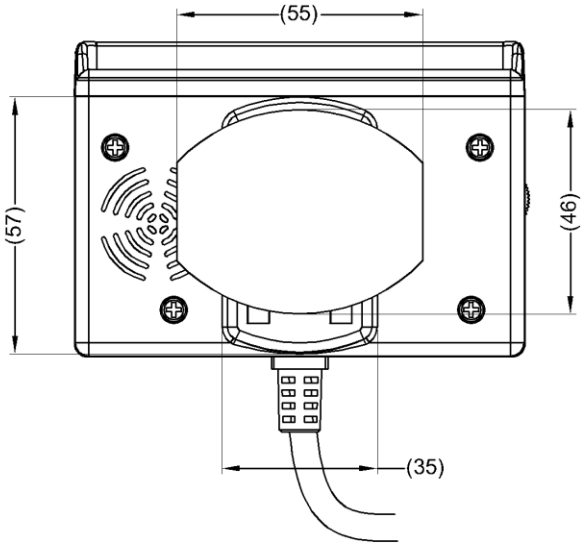
OPERATING CHARACTERISTICS

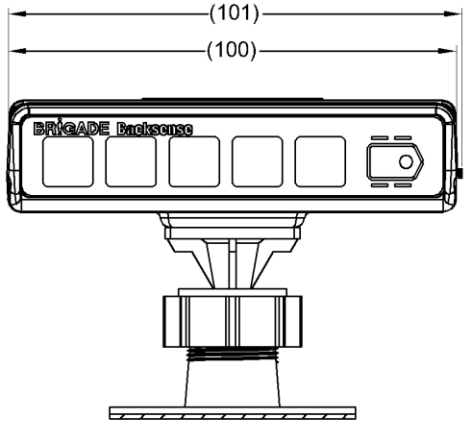
Maximum Range:	30m
Fixed Ranges:	6.0m, 4.5m, 3.0m
Programmable Ranges:	3-30m
Warning Ranges:	5 zones divided into programmed range
Minimum Resolution:	1.2m

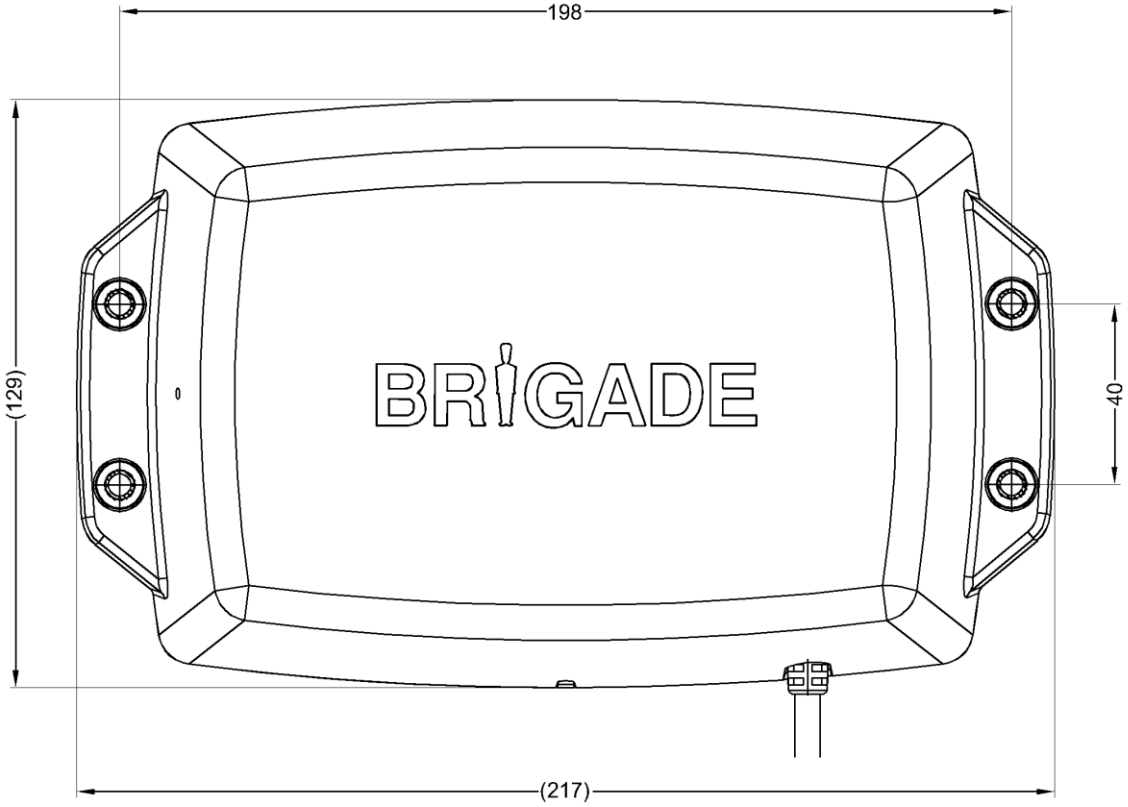
COMMUNICATION

Physical Layer:	CAN 2.0B, 250 KB/s
Protocol Layer:	SAE J1939 Extended
Data Update Rate:	70 ms

Appendix V – Mounting Dimensions







Appendix VI FCC Statement:

Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party

responsible for compliance could void the user's authority to operate this equipment.

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.