AGD **318**

TRAFFIC CONTROL RADAR

PRODUCT MANUAL

AGD **Touch-setup**
WIFI 3-CLICK TOUCH-SETUP

AGD PTY
AUSTRALASIA

PRODUCT SOLUTIONS FOR
INTELLIGENT TRAFFIC SYSTEMS

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TRAFFIC CONTROL RADAR

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AGD **Touch-setup**
WIFI 3-CLICK TOUCH-SETUP

safer, greener, more efficient

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Introduction

AGD **318**
TRAFFIC CONTROL RADAR

PRODUCT & TECHNOLOGY

This product has been designed for a variety of strategic dynamic detection requirements. The radars' advanced detection algorithms make it suitable for both urban and inter-urban detection applications.

The 318 radar is a frequency modulated continuous wave, FMCW, radar that operates in the 24GHz band.

KEY FEATURES

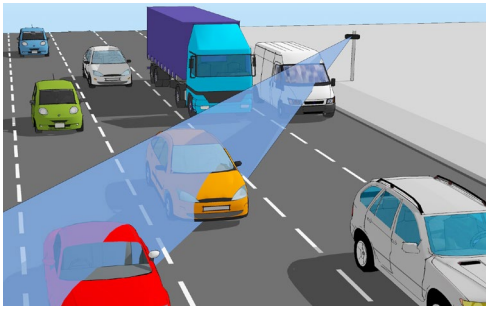
- Speed measurement from 4 kph to 300 kph across multiple lanes (depending on variant)
- Target range measurement from 6-150 metres (depending on variant)
- Can discriminate between approaching and receding traffic
- Connect and commission using AGD Touch-setup via laptop, tablet or smart phone
- Custom designed planar antenna
- Ease of integration to host system
- Optional radar internal target simulation for self-test

Introduction

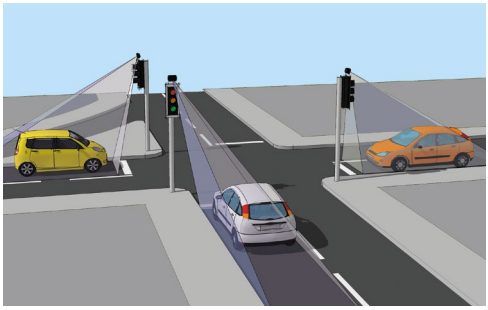
AGD **318**
TRAFFIC CONTROL RADAR

TYPICAL APPLICATIONS

Sign activation

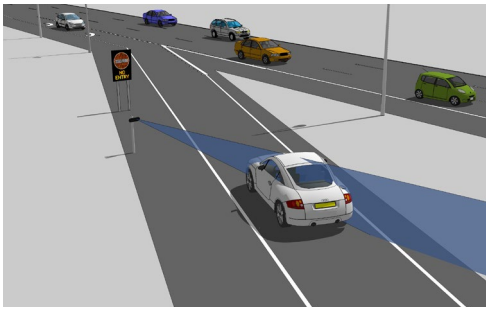


Multi-lane highway via comms output

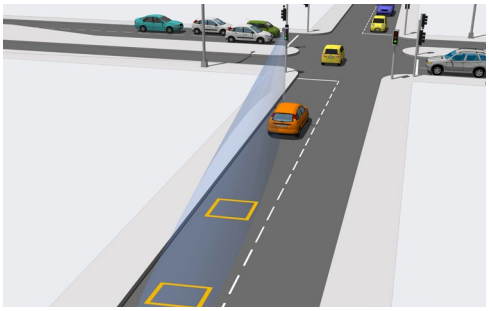


Single lane detection for traffic control

Dual line detection for rail



Wrong direction detection for highways

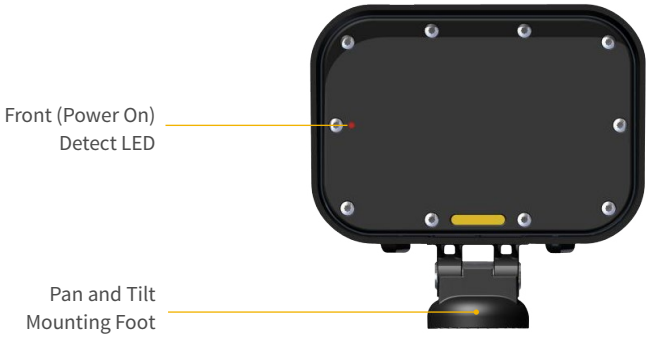


MOVA IN & X loop replacement

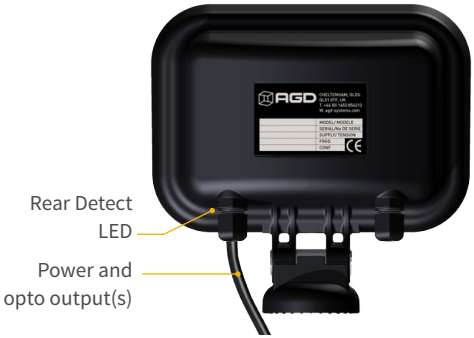
AGD **318**
TRAFFIC CONTROL RADAR

PRODUCT OVERVIEW

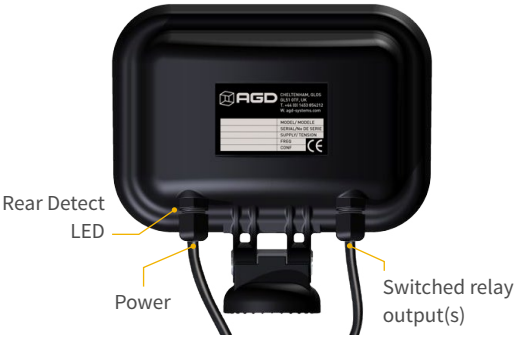
The product is available in a number of build variants, with varying operating voltages and output configurations.



12/24V version (Opto variant)



230V version (Relay variant)



12/24V version (Serial comms variant)

230V version (Serial comms variant)

Introduction

AGD **318**
TRAFFIC CONTROL RADAR

PRODUCT VARIANTS

Product No.	Description
318-300-000	Multi-application radar / 230V / 24.174GHz / RS422 Speed & Count output / 5m lead
*318-301-002**	**Multi-application radar / 230V / 24.174GHz / Dual Relay output / 5m lead*
*318-303-001**	**Multi-application radar / 230V / 24.174GHz / Single Relay output / 5m lead*
318-304-022	Multi-application radar / 230V / 24.174GHz / Dual Relay output / WiFi / 5m lead
318-305-021	Multi-application radar / 230V / 24.174GHz / Single Relay output / WiFi / 5m lead
318-500-000	Multi-application radar/ 12/24V / 24.174GHz / RS422 Speed & Count output / 5m lead
*318-501-002**	**Multi-application radar / 12/24V / 24.174GHz / Dual Opto output / 3m lead + mating lead*
*318-502-002**	**Multi-application radar / 12/24V / 24.174GHz / Dual Opto output / 5m lead*
*318-503-001**	**Multi-application radar / 12/24V / 24.174GHz / Single Opto output / 3m lead + mating lead*
*318-504-001**	**Multi-application radar / 12/24V / 24.174GHz / Single Opto output / 5m lead*
318-508-000	Multi application radar / 12/24V / 24.174GHz / RS422 Speed & Count output / 5m lead / Self Test Option
318-510-000	Multi-application radar / 12/24V / 24.124GHz / RS422 Speed & Count output (International Variant)
318-511-022	Multi-application radar / 12/24V / 24.174GHz / Dual Opto output / Wi-Fi / 3m lead + mating lead
318-512-022	Multi-application radar / 12/24V / 24.174GHz / Dual Opto output / WiFi / 5m lead
318-513-021	Multi-application radar / 12/24V / 24.174GHz / Single Opto output / WiFi / 3m lead + mating lead
318-514-021	Multi-application radar / 12/24V / 24.174GHz / Single Opto output / WiFi / 5m lead

*Items marked *italic are now obsolete and no longer available for purchase*

PRODUCT OVERVIEW

Developed from enforcement-grade technology, the AGD 318 is a 'smart' non-intrusive alternative to wear & tear prone loop and magnetometer detection in single-lane environments. This device improves safety and efficiency in MOVA 'In' and 'X' detection, System D and Double Extension applications and in cyclist, HGV and bus detection as well as differentiation 'green wave' applications. Installation and setup is cost-effective, as 318's are mounted on existing poles - no road closures for loop cutting or cable channelling – plus they're maintenance free too. The 318 has opto-outputs which are easily integrated into controllers and are subject to the standout benefit of AGD Touch-setup. This allows the configuration of multiple units at ground level or the comfort of a vehicle – a great saving in time and exposure to traffic risk. In addition to this, the AGD318 can also be utilised for multi-lane reporting, sign activation and wrong direction detection in highways applications (depending on variant).

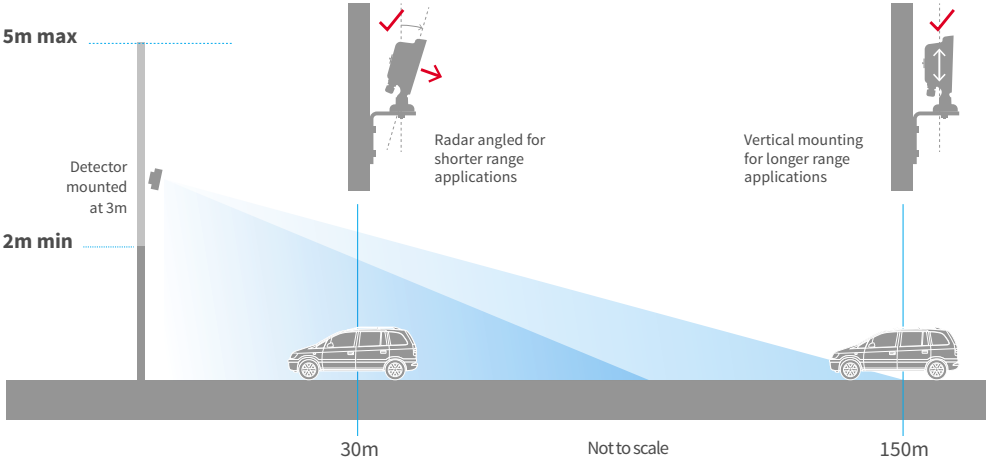
AGD **318**
TRAFFIC CONTROL RADAR

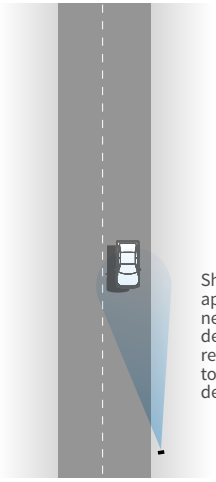
PHYSICAL INSTALLATION

Mount the radar on a firm structure within a recommended height range of 2m-5m. For optimum performance the radar should be situated on a pole adjacent to the carriageway with an unobstructed view of advancing traffic. Point the radar down the road towards the furthest point where vehicle detection is required. The front face of the radar should be vertical i.e. perpendicular to the direction of traffic flow before site specific adjustments are made.

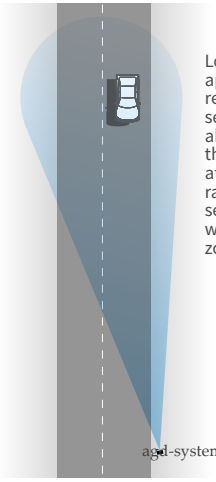
The radar has a relatively narrow field of view allowing good vehicle detection coverage of single lanes with low range settings or dual lane approaches at the longer (>40m) range settings.

Radars are supplied factory programmed to be used for a specific mounting angle (0º for WiFi versions, 22º for all other variants). This angle is the angle that the radar points across the road from the direction of the road. The 'angle' tool on the GUI may be used to query or set the angle.





Shorter range applications that need single lane detection require reduced sensitivity to narrow the detection zone.



Longer range applications require increased sensitivity to be able to detect the targets at the longer range. Increased sensitivity settings widen the detection zone.

ELECTRICAL INSTALLATION

Overview

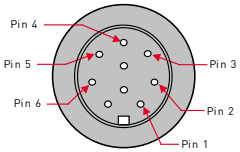
The AGD318 is available in a wide range of supply voltages and wiring configurations. Output options are simple single opto/relay output or as dual opto/relay output with added functionality.

12/24V ac/dc - Single Opto Output – Multi-pin Connector or Flying Lead

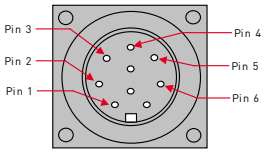
The output is an SPCO (SPDT) Opto-isolator, with the impedance state of the opto being the same for a detect state or power off condition. Connection is via a Buccaneer Series PX0728/S 9 Pin connector (as opposite, with pins 7, 8 and 9 not connected) or a 5m flying lead.

The pin-out of the connector and detector functions are shown in the tables below.

Pin view of multi-pin connector



Pin view of bulkhead connector



Single Cable 12/24V ac/dc Supply Wiring (1m lead with multi-pin connector)

Wire Colour	Pin No.	Function	Power Off	Power On - No Detect	Power On - Detect
Red	1	12/24V (+) — or 24V ac	-	-	-
Black	2	0V — or 24V ac	-	-	-
	3	Not connected	-	-	-
White	4	Opto 1 Common	-	-	-
Yellow	5	Opto 1 Output	N/O	N/C	N/O
Blue	6	Opto 1 Output	N/C	N/O	N/C
	7,8 & 9	Not Connected	-	-	-

ELECTRICAL INSTALLATION

Single Cable 12/24V ac/dc Supply Wiring (5m flying lead)				
Wire Colour	**Function**	**Power Off**	**Power On - No Detect**	**Power On - Detect**
Red	12/24V (+) — or 24V ac	-	-	-
Black	0V — or 24V ac	-	-	-
Green	Earth / Ground	-	-	-
White	Opto 1 Common	-	-	-
Yellow	Opto 1 Output	N/O	N/C	N/O
Blue	Opto 1 Output	N/C	N/O	N/C

230V ac Single Relay Output – 5m Flying Leads

The detector is powered by 230Vac and it is essential that the detector is connected to the correct power supply. The detector is supplied with two 5m flying leads. One is the power supply for the detector and the other is the signal output and the correct cables should be identified before connection (please refer to product overview diagrams on P.5 for detail). The 318 is classified as a double insulated product and therefore the supply cable is two core (live/neutral).

Twin Cable 230V ac Supply Wiring (5m flying lead)					
Cable	**Wire Colour**	**Function**	**Power Off**	**Power On - No Detect**	**Power On - Detect**
Power	Brown	230V ac Live	-	-	-
	Blue	230V ac Neutral	-	-	-
Signal	Red	Relay 1 Common	-	-	-
	Blue	Relay 1 Contact	N/C	N/O	N/C
	Green	Relay 1 Contact	N/O	N/C	N/O

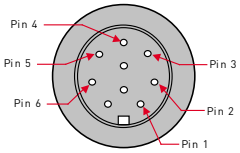
ELECTRICAL INSTALLATION

12/24V ac/dc Dual Opto Output – Multi-pin Connector or Flying Lead

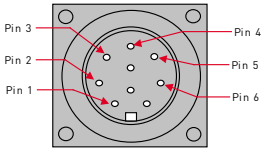
The output is an DPDT Opto-isolator, with the impedance state of the opto being the same for a detect state or power off condition. Connection is via a Buccaneer Series PX0728/S 9 Pin connector (as opposite) or a 5m flying lead.

The pin-out of the connector and detector functions are shown in the tables below.

Pin view of multi-pin connector



Pin view of bulkhead connector



Single Cable 12/24V ac/dc Supply Wiring (1m lead with multi-pin connector)

Wire Colour	Pin No.	Function	Power Off	Power On - No Detect	Power On - Detect
Red	1	12/24V (+) — or 24V ac	-	-	-
Black	2	0V — or 24V ac	-	-	-
	3	Not connected	-	-	-
White	4	Opto 1 Common	-	-	-
Yellow	5	Opto 1 Output	N/O	N/C	N/O
Blue	6	Opto 1 Output	N/C	N/O	N/C
Green	7	Opto 2 Common	-	-	-
Brown	8	Opto 2 Output	N/O	N/C	N/O
Violet	9	Opto 2 Output	N/C	N/O	N/C

Single Cable 12V dc/24V ac/dc Supply Wiring (5m flying lead)

Wire Colour	Function	Power Off	Power On - No Detect	Power On - Detect
Red	12/24V (+) — or 24V ac	-	-	-
Black	0V — or 24V ac	-	-	-
	Not connected	-	-	-
White	Opto 1 Common	-	-	-
Yellow	Opto 1 Output	N/O	N/C	N/O
Blue	Opto 1 Output	N/C	N/O	N/C
Green	Opto 2 Common	-	-	-
Brown	Opto 2 Output	N/O	N/C	N/O
Violet	Opto 2 Output	N/C	N/O	N/C

ELECTRICAL INSTALLATION

230V ac Dual Relay Output – 5m Flying Leads

The detector is powered by 230Vac and it is essential that the detector is connected to the correct power supply. The detector is supplied with two 5m flying leads. One is the power supply for the detector and the other is the signal output and the correct cables should be identified before connection (please refer to product overview diagrams on P.5 for detail). The 318 is classified as a double insulated product and therefore the supply cable is two core (live/neutral).

Twin Cable 230V ac Supply Wiring (5m flying lead)

Cable	Wire Colour	Function	Power Off	Power On - No Detect	Power On - Detect
Power	Brown	230Vac Live	-	-	-
	Blue	230Vac Neutral	-	-	-
Signal	White	Relay 1 Common	-	-	-
	Yellow	Relay 1 Output	N/O	N/C	N/O
	Blue	Relay 1 Output	N/C	N/O	N/C
	Red	Relay 2 Common	-	-	-
	Green	Relay 2 Output	N/O	N/C	N/O
	Black	Relay 2 Output	N/C	N/O	N/C

Opto-Isolator and Relay Ratings

The opto-couplers in both the single output and dual output variants are rated as follows;

- Max current 100mA
- Max voltage 100V
- Max on-state impedance 25 Ohms

The switched outputs on the 230V variants are relays and are rated as follows:

- Max current 500mA
- Max voltage 230V ac
- Min. whetting load 100mA @ 12V dc

In addition, the relay outputs are protected by a protection device which limits current to 0.5A and has a serial impedance of approximately 15 Ohms.

ELECTRICAL INSTALLATION

Applying Power

- Make sure the power supply is the correct voltage, which can be found on the label on the unit.
- Connect the unit to the supply.
- Once powered, the front and rear LEDs should flash five times whilst the radar performs its self-check routines.

Upon power up, owing to the nature of the equipment's power supply, high initial currents can be drawn. Please ensure the supply is protected as follows:

230V models: This product must be protected by a 3A circuit breaker.

12/24V Models: This product must be protected by a 1A circuit breaker or in-line fuse.

Power Supply Tolerances

The voltage tolerances of supply are as follows:

dc : 10.8-29V

LV ac : 18-30V

HV ac : 230V ± 20%

Typical Power Consumption

- 12V dc - 240mA (550mA peak)
- 24V dc - 160mA (400mA peak)
- 24V ac - 450mA (900mA peak)
- 230V ac - 30mA (2500mA peak)

The installation of this equipment MUST conform to the latest edition of the IEE Wiring Regulations (BS7671).

FAILSAFE OPERATION

The internal connection to the radar module is constantly monitored to ensure it is transmitting at the correct frequency. A loss of communication with the radar or the incorrect transmit frequency, will result in the OPTO drives being driven to the fail-safe state. The state the OPTO outputs are driven to correspond to the power-off state as highlighted in the wiring tables.

CONNECTING

AGD318 is configured using AGD WiFi Touch-setup. This is a simple, 3 step process, allowing the end user to connect and configure the unit via browser on their laptop, tablet or mobile device using a browser window.

This step-through process describes the actions required to connect to the radar.

If you require instruction on connecting to an AGD318 using Bluetooth, please refer to the Technical Resource section (P.37) for further detail

CONNECTING WIFI

Connecting Wifi

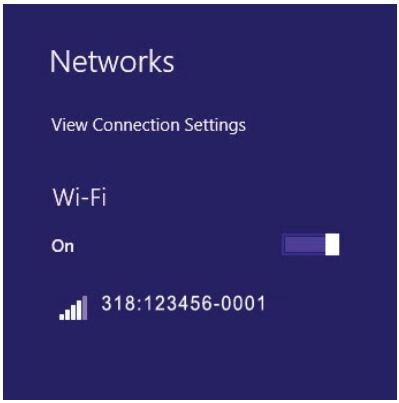
Upon powering up, wait for the LED on the rear of the unit to flash 5 times, this signifies that the firmware has correctly started.

Search for the unit and identify the unit by its **serial number: 318:XXXXXX-XXXX** (the 'X' denotes the S/N)

Click 'connect' and input the default password:

AGD318:XXXXXX-XXXX (the 'X' denotes the S/N) *please note that this is case sensitive and contains special characters*

The LED on the rear of the radar should now be illuminated blue to show that WiFi is successfully connected. Your device should also show as connected on it's WiFi network tab.



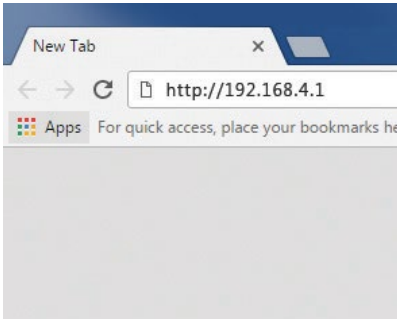
CONNECTING A DEVICE

Complete Wifi connection step as above.

Launch a browser on your smartphone, tablet or laptop (Modern versions of: Internet Explorer, Google Chrome and Safari are all supported - 2018 onwards).

In the address bar of your browser, enter the **'IP Address': http://192.168.4.1**

You will be presented with your initial AGD Touch-setup page.

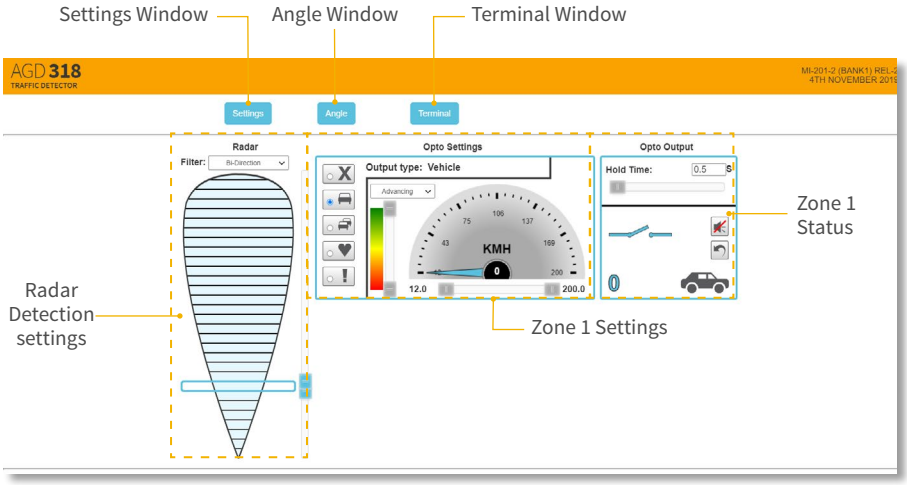


Configuration

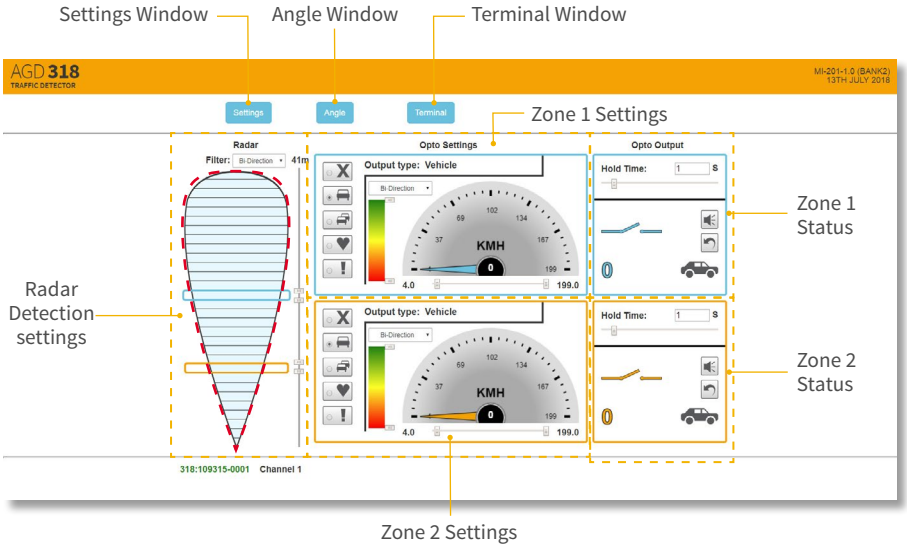
WIFI USER INTERFACE

Image below shows typical display for both single and dual output AGD318 radar. The function of each of the below items is explained in further detail below.

Single Output Version:



Dual Output version:



Configuration

WIFI USER INTERFACE

Settings Window

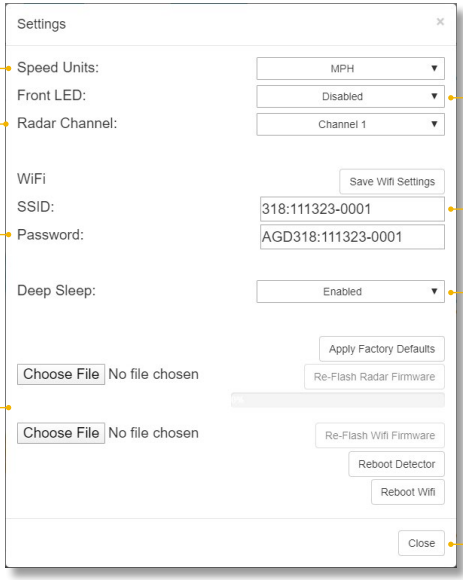
Clicking on the **'Settings Page'** opens the following pop up window:

Speed Units - Choose from MPH or KPH

Radar Channel - Please refer to Technical Resource Section for further details

WiFi Password - AGD do not recommend changing default password (AGD318:XXXXXX-XXX, where X indicates serial no.) as unit requires return to base in the event of forgotten password

Radar and WiFi Firmware Update - Please contact AGD Technical Support for further information



Front LED - Enables or disables the front LED illuminating upon valid target detection

WiFi SSID - Can be amended to include site specific information (WiFi will require a reconnect if amendments are made)

WiFi Deep Sleep - Turns the WiFi off after 24 hours (default enabled)

Close - Saves changes and closes 'Settings' pop up window

Angle Window

This window can be used to amend the detection angle of the AGD318 radar. Under normal circumstances (depending upon installation location) it is not normally required to alter this setting.

If the AGD318 is installed with a large offset from the carriageway, or the detection zone has a large curvature, then adjustment may be required.

If there are any queries regarding this setting, please contact AGD Technical Support for advice.

Mounting Angle - 0º -30º
(in 1º increments) Default = 0º

Terminal Window

This window is used to input specific commands into the AGD318. Raw radar data is also outputted in black area of the window.

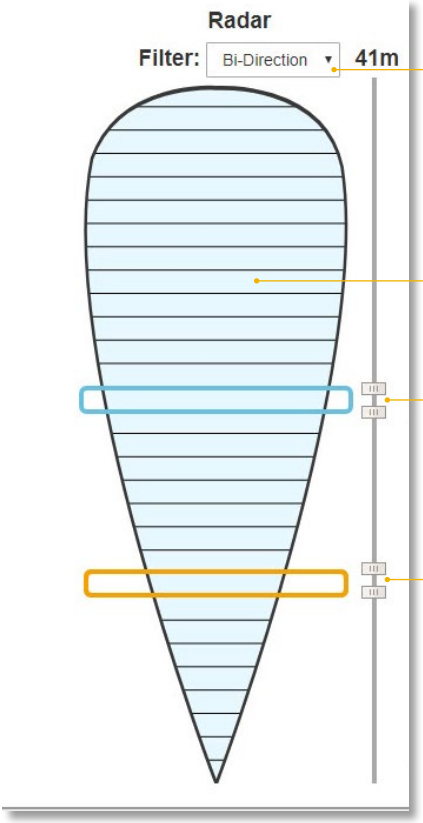
Usage of this window lends itself to debugging/ technical assistance. As such, end user operation is not recommended, unless directed otherwise by AGD Systems.

Command - used to input specific commands to AGD318 radar

Raw AGD318 radar data displayed here

RADAR DETECTION SETTINGS

An important part of the set-up and configuration of the radar are the three items highlighted in the window below. There are three components to this window:



There are three components to this window:

The **'direction filter'** applies a global setting to the direction of the traffic the radar will process and see. When using a dual zone radar looking for targets in both directions, then this will have to be set to bi-directional. Directional filters for detection will then be set in the individual 'zone 1' or 'zone 2'. When looking for targets in just one direction, (whether that is a single or dual zone) this filter can be set here to the direction of interest (advance or recede).

The **'radar footprint'**, or the item on the diagram that looks like a balloon, displays targets by illuminating the segments as detections are displayed at that range. It is important to note that if the direction filter above is set to a single direction (either advancing or receding) only the targets travelling in the selected direction will be shown in the radar footprint. The radar footprint represents a zone size of 70 metres and 150 metres for the single and dual zone radars respectively.

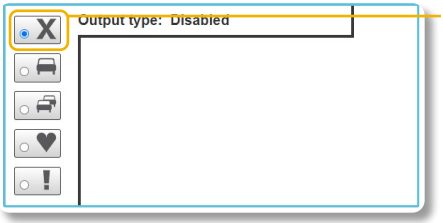
The **'opto activation zone'** is adjustable using the upper and lower sliders. The area of interest (the range and size of zone a valid detection and associated output is required within) can be adjusted down to a minimum of two metres. It is advised that the zone is strategically placed and kept small for the most accurate detection.

Notes:

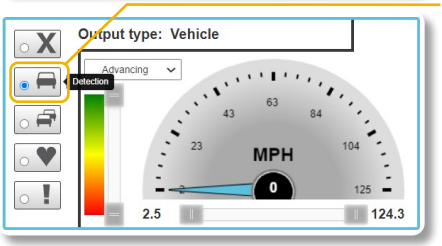
- The radar will provide a valid output for any target seen inside the opto activation zone (depending on other parameters set). For example, if the zone size to 10-50 metres and selected bi-directional target detection, a valid contact closure / output for the length of time that any target(s) going in either direction within the 10-50 metre range would occur.
- When looking for accurate target detection at precise range(s) within the beam, setting a small window of activation can help mitigate any potential false detects.

ZONE SETTINGS

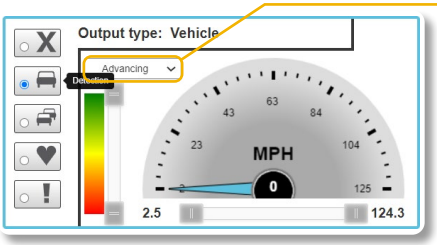
These options allow independent control over Zone 1 (or 2) output settings.



'Disabled' – The output is disabled and performs no function.



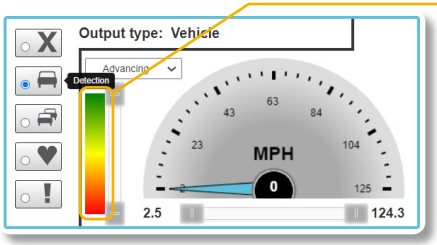
'Vehicle Detect Output' – When selected, the zone being currently configured will be set to detect moving targets (pedestrians, cyclists and vehicles). The type of targets detected are then filtered by using the following adjustable parameters:



'Direction' – Sets the direction of travel you are interested in filtering.

Bi-directional (as set here) will allow targets travelling in both directions through the filter.

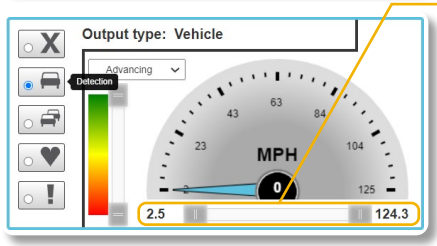
Settings available: Advance, Recede and Bi-directional.



'Sensitivity' – Sets the level of sensitivity the radar uses to filter targets.

Moving the top slider down filters out larger stronger reflective targets. Moving the bottom slider up filters out smaller weaker reflective targets

Settings available: 10 – 100%



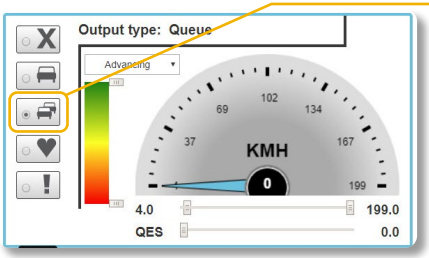
'Detection Speed Adjustment' – Adjusts the upper and lower speed thresholds for detection.

e.g - Here, any target travelling between 4kph and 200kph is valid and is let through the filter.

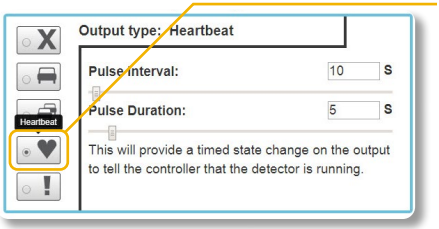
Settings available 2.5-124.3mph (4-200kph).

**The speed sliders can be adjusted using a regular dragging motion with mouse / touchpad. By clicking on the slider and selecting it you can also adjust the speed in 0.1 increments using a keyboards arrow keys, enabling accurate selection of speed.*

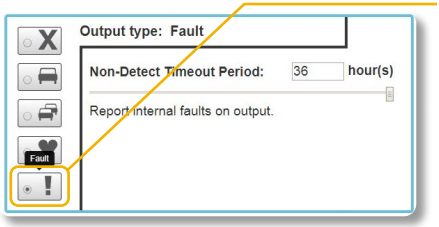
ZONE SETTINGS



'Queue' - The queue mode is enabled and multiple parameters surrounding this operation are now available. Refer to 'Queue Detection Operation' to configure this mode.

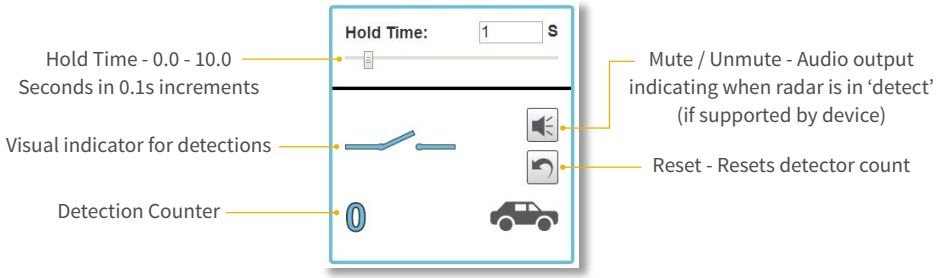


'Heartbeat' – The detector is able to use its secondary output (if available) to act as a heartbeat to allow a controller or auxiliary system to monitor the health of the radar. Pulse interval and duration are both adjustable.

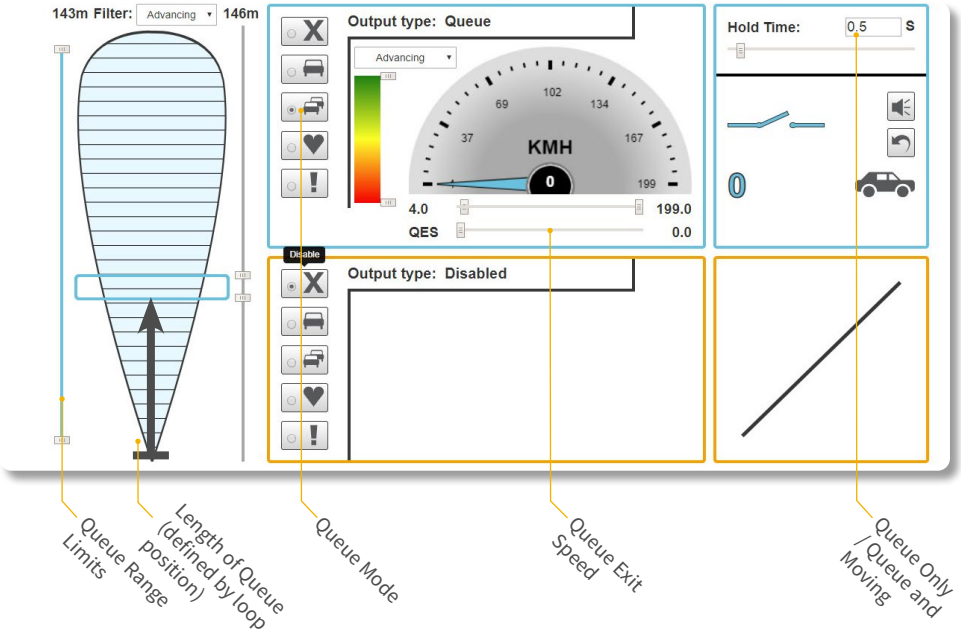


'Fault' – This value can be set and then the screen navigated away from. If the detector sees no valid targets or detections for a period as defined by the user (default value: 36 hours) then the output(s) of the radar are driven to a permanent detect state.

Zone Status



QUEUE DETECTION OPERATION



QUEUE DETECTION PARAMETERS

Loop Position:

- Defines the position at which a queue is detected

Queue Range Limits:

- Limits the range over which the queue function searches for tracked targets. (Useful to avoid side roads or pedestrian area)
- Setting this as large an area as possible is desired
- Default value is full radar range

Queue Exit Speed (QES):

- A queue is cleared only when tracked targets are detected in the loop at a speed greater than or equal to the Queue Exit Speed
- Default Value is Zero

Hold Time

- If the hold time is 'ZERO' then the OPTO is only turned 'ON' when a queue is detected
- If the hold time is 'NON-ZERO' then the OPTO is turned 'ON' when a queue is detected and when targets are moving in the loop

QUEUE DETECTION MODE OPERATION

QUEUE DETECTION MODE OPERATION

The queue detection mode is used to hold an output on when traffic has 'queued' back to a certain point.

Viewing the image, the loop has been placed at a customer defined point. It is important that the radar has visiblity before and after this point as demostrated in the diagram.

A queue is detected when:

- Tracked targets stop **on or beyond the loop**
- Comparable to occupancy but also includes vehicles queueing beyond the loop

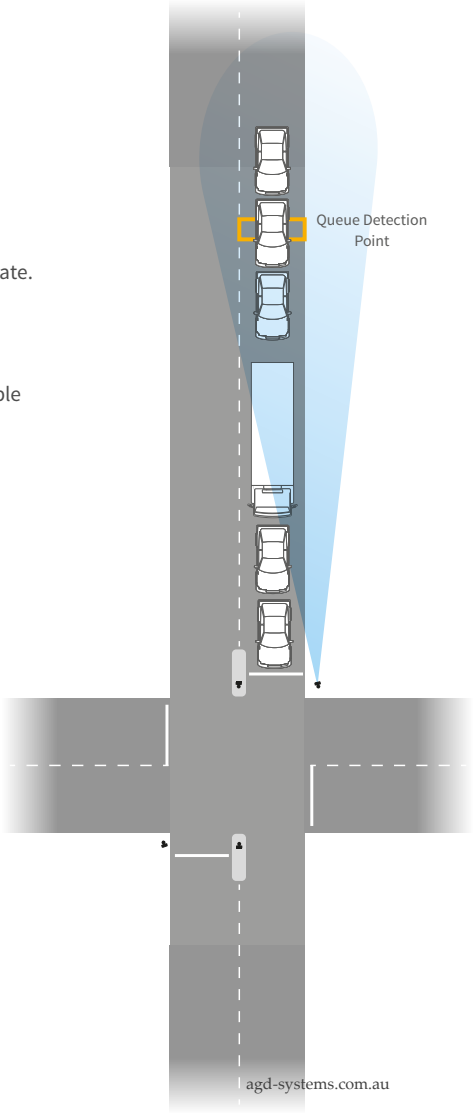
A queue is cleared when:

- Tracked targets move **in front of the loop** followed by movement **in the loop** (prevents a cyclist for example from dropping the queue state.

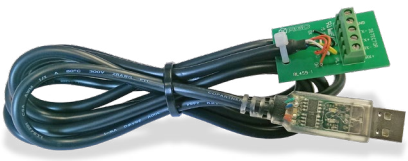
QUEUE DETECTION CONSIDERATIONS

The following items are important in choosing a suitable mounting location for the radar:

- Clear Line of Sight:
- Radar offset to side or positioned higher may improve performance
- Single carriageway only
- Approaching traffic only
- Targets must be visible beyond the loop
- Targets must be visible in front of the loop
- Avoid side turns within the radar footprint



CONNECTION DETAILS - RS422 VARIANT (SERIAL COMMS UNIT)



Communications can be established to the Serial Comms version of the AGD 318 Radar by using the CA-250 cable assembly or a third party USB to RS422 Converter.

A UART interface is provided that uses RS422 voltage levels on the communications connector. At power-on a Boot-loader program is executed and uses a fixed Baud rate of 115200,N,8,1. The Boot-loader executes the main application code which uses a default baud rate of 460800 8 data bits with odd parity. The Baud rate of the application code may be changed using the *BAUD command to speeds of up to 921600. The baud rate settings are saved into non-volatile memory of the radar ready for the next time the radar is powered on.

The serial interface default setup during normal operation is shown in the table below.

The RS422 provides the primary output of the radar in the form of ASCII messages.

DEFAULT UART SETTINGS	
Parameter	**Value**
Baud rate	460800
Data bits	8
Parity bits	odd
Stop bits	1
Flow control	None

Single Cable 12Vdc/24Vac/dc RS422 Supply Wiring (5m Flying lead)		
Wire Colour	**Function**	**Host Equipment**
Red	12/24V (+) — or 24V ac	
Black	0V — or 24V ac	
Green	Earth/Ground	Earth/Ground
Yellow	RS422 Y (TX+)	RS422 A (RX+)
Blue	RS422 Z (TX-)	RS422 B (RX-)
Brown	RS422 B (RX-)	RS422 Z (TX-)
White	RS422 A (RX+)	RS422 Y (TX+)

POWER SUPPLY

At 12Vdc the current consumption of the radar is typically 240mA.

Reverse polarity protection is included in the design. The radar can take a large current during power up that is of the order of amps which only lasts for ~1ms and as such should not affect most applications.

A thermal fuse with a 750mA rating has been installed to protect against electrical short circuit fault conditions.

Dual Cable 230Vac RS422 Supply Wiring			
	Wire Colour	**Function**	**Host Equipment**
Power	Brown	230Vac Live	
	Blue	230Vac Neutral	
Signal	Red	RS422 A (RX+)	RS422 Y (TX+)
	Blue	RS422 B (RX-)	RS422 Z (TX-)
	Yellow	RS422 Z (TX-)	RS422 B (RX-)
	White	RS422 Y (TX+)	RS422 A (RX+)
	Green	Earth/Ground	Earth/Ground

RADAR INSTALLATION & ALIGNMENT

This section details the multi-lane highway application for the serial comms variant of the radar.

For best detection performance the radar must be setup correctly. Failure to do so can result in inaccurate or false detections.

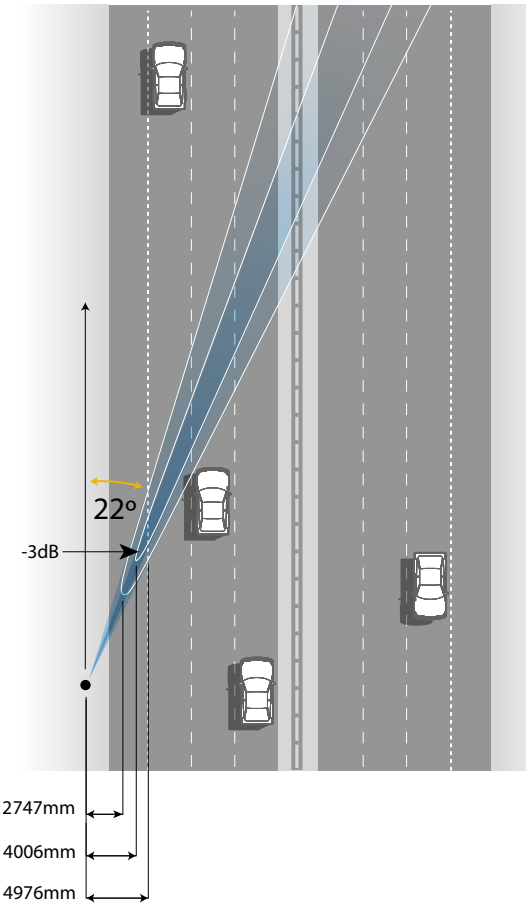
SYSTEM INTEGRATION

The 318 has been designed to output a target message stream when a target is detected by the radar. When there is no target only the heartbeat message will be sent (if turned on). The radar is designed to send data and not make decisions on incidents that may be specified. (Other data message formats are available or can be made available for these purposes and you should consult with AGD on your specific application.) It is the responsibility of the host system to ensure that the correlation of the target speed/range data from the radar satisfies the fit for purpose requirement.

RADAR MOUNTING ANGLE

Radars are supplied factory programmed to be used for a specific mounting angle, usually to 22 degrees. This angle is the angle the radar points across the road from the direction of the road (see diagram). The command *ANGLE may be used to query or set the angle. This angle is used by the radar to adjust the speed the radar measures to the actual target speed and therefore it is important the radar is setup with the correct angle. If the radar is setup with an angle that is less than the mounting angle then the radar will measure speeds that are larger than the vehicles true speed, while if the angle is greater than the mounting angle the radar will measure speeds that are less than the vehicles true speed.

The radar transmits a radio beam across the road that has a horizontal beam width of ~7 degrees. The vertical beam width of the radar beam is relatively large at 28degrees so although the radar should be made level this is not crucial for correct operation. For a fixed camera installation often the radar is mounted relatively high (~3m) and in this case it is desirable to point the radar more down towards the ground. In this application careful consideration of the radar beam and its shape is required to ensure that all the lanes of the road are covered.



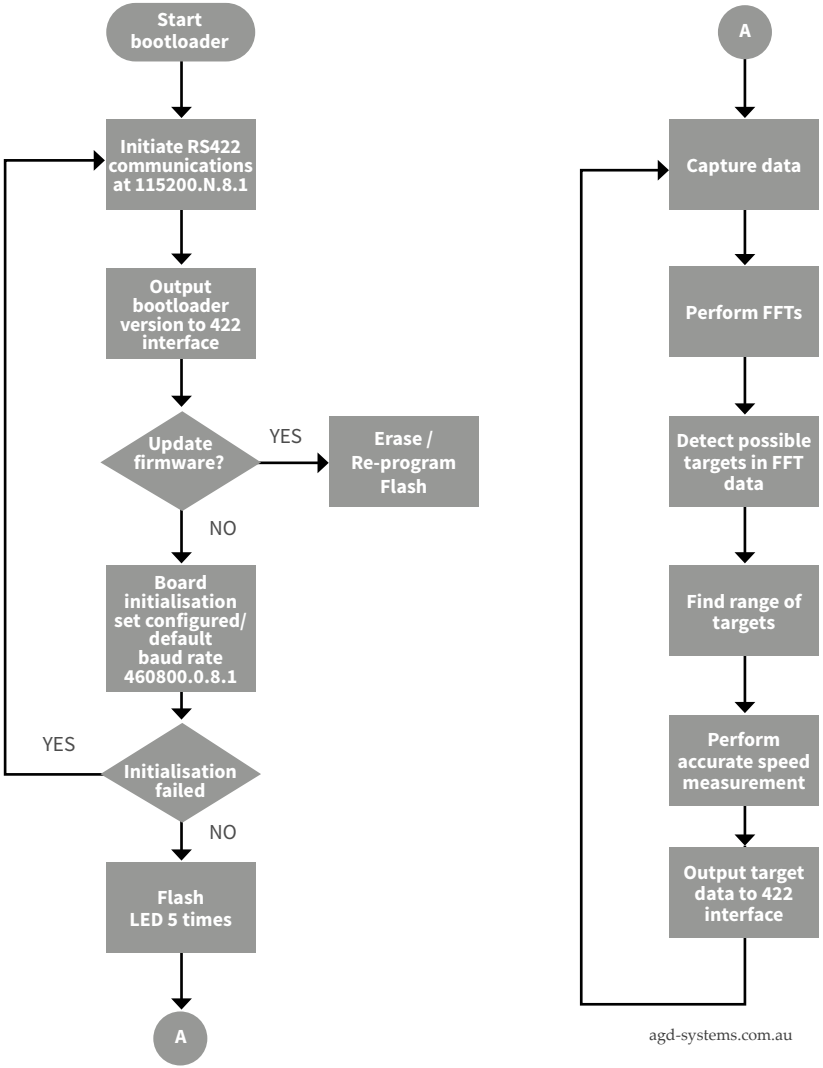
MOUNTING HEIGHT

The radar should be mounted at a height of between 2 and 5 metres.

OVERVIEW (SERIAL COMMS VERSION ILLUSTRATED)

At power-on the radar executes a Boot-loader program which communicates at a fixed Baud rate of 115200, no parity, 8 data bits and 1 stop bit over the RS422 interface. The Boot-loader provides facilities for erasing the Flash and updating the firmware.

The radar uses a real time operating system and is continuously performing a number of tasks simultaneously using a time multiplexing method. The Boot-loader and the main data capture processing task flow diagram are shown below.



Radar Performance - Serial Comms Unit Only

AGD **318**
TRAFFIC CONTROL RADAR

RADAR PERFORMANCE

SIGNAL TO NOISE (DETECTION RANGE)

A series of radar techniques have been used in the 318 to maximise the signal to noise ratio for a given target. The range performance of the 318 is tested at manufacture by simulation to ensure operation over the range 6 to 70m.

RANGE MEASUREMENT

The range resolution is largely a function of the bandwidth. The range is reported in units of metres. The range of a target is reported to the nearest 0.1m. The range accuracy of any particular measurement is dependent on the signal to noise ratio of the received signals. These can vary by a large amount.

SPEED MEASUREMENT

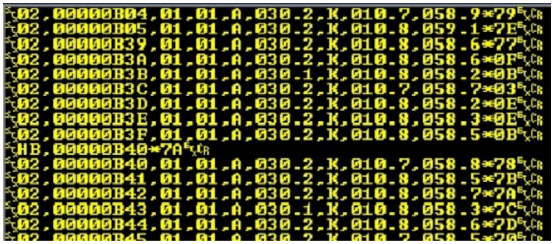
The speed measurement is fully instrumented over the range 12 to 300kph in both directions. The speed measurement is reported to the nearest 0.1kph and is corrected for the 22° mounting angle as its default setting. The angle can be adjusted with the appropriate command. The speed is reported in kph and there is an option to convert the speed reading to mph with the appropriate command. Currently, a lower limit of 12kph has been implemented.

Frame Rate

The frame rate of the radar is the rate at which the radar takes speed and range measurements, this is greater than 40 frames/sec.

TYPICAL RADAR OUTPUT

The following image shows the typical output from the 318 displaying the ‘Target detect’ and ‘Heart-beat’ messages.



Radar Commands - Serial Comms Unit Only

RADAR COMMAND OVERVIEW

Commands are used to control the operation of the radar. These are sent over the RS422 UART link.

Commands are immediately followed by an operator that indicates the required action. Not all operators are supported for all commands. Where an operator is used and it is not supported the radar will respond with a warning message. The table shows the operators that are used by the radar.

Operator	Operation
=	Set something to a value e.g. *DIR=A<CR> sets detect direction to approaching
?	Respond with value or values
^	Set default value for parameter
$	Provide help on the command e.g. *DIR$<CR>
!	Do something e.g. *REBOOT! Reboots the radar

Command Operators

Where a command is used to enquire or set a radar parameter the radar will respond in a set way. The radar will respond with a hash, #, followed by the command name, operator used and then the value of parameter or parameters.

For example

***DIR=A<CR>** **Radar responds with #DIR=A<CR>**

***DIR?<CR>** **Radar responds with #DIR?A<CR>**

Radar Commands - Serial Comms Unit Only

AGD **318**
TRAFFIC CONTROL RADAR

RADAR COMMAND LIST

Command	Type	Function	Default Value	Min Value	Max Value	Units, Resolution or Values
AGD		Provides the firmware version				
*ANGLE	?/=/^	Enquire / set the radar mounting angle	22.0	0	30	Degrees
*BAUD	? / =	Enquire / set the BAUD rate of the radar. The programmed value is stored in non-volatile memory and is used the next time the radar is powered on. *BAUD=<baud>,<flow_control>, <parity>,<number_of_data_bits> e.g. *baud=115200,0,NONE,8	baud 460800 flow control 0 parity ODD number of data bits 8	 2400 0 NONE 7	 921600 1 EVEN 8	Baud rate values: 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 flow control: 0 = no control 1 = flow control number of data bits: 7,8
*CD	? / = ('=' for AGD only)	Enquire / set the Calibration Date and calibration certification number. Format is: DD,MM,YYYY, certificate_no e.g. *CD? #CD?04,12,2012,31800001		1 1 2012 31800001	31 12 2100 31899999	DD MM YYYY Certificate_no
*CHAN	?/=	Enquire / Set the transmit channel	1	1	2	
*CRC32	?	Calculates and verifies the 32 bit CRC code and data checksums.				
*DIR	?/=/^	Enquire / set the radar direction detection mode. The programmed value is stored in non-volatile memory and is used the next time the radar is powered on.	B	A	R	A = Approaching R = Receding B = Bi_directional N = No Detection
*ETPn (n=1 or 2)	?/=/^	Enquire / Set an Event Trigger Point at a defined range.	20	6 (0 = off)	149	1 metre
*ETPnLST (n=1 or 2)	?/=/^	Enquire / Set the optional Event Trigger Point Low Speed Threshold.	12	12	299	KPH Units change depending on speed units (see *SU)
*ETPnHST (n=1 or 2)	?/=/^	Enquire / Set the optional Event Trigger Point High Speed Threshold.	300	13	300	KPH Units change depending on speed units (see *SU)
*ETPnDIR (n=1 or 2)	?/=/^	Enquire / Set the optional Event Trigger Point Direction. NOTE: The *DIR command must also be set to allow the required Event Trigger Point direction otherwise the event will not be triggered.	B	A	R	A = Approaching R = Receding B = Bi-directional

Continued overleaf

Radar Commands - Serial Comms Unit Only

AGD **318**
TRAFFIC CONTROL RADAR

RADAR COMMAND LIST (CONTINUED)

Command	Type	Function	Default Value	Min Value	Max Value	Units, Resolution or Values
*ETPnLPT (n=1 or 2)	?/=/^	Enquire / Set the optional Event Trigger Point Low Threshold Power (target amplitude)	55	55	109	dB (ref Target amplitude values in Target Detect message)
*ETPnHPT (n=1 or 2)	?/=/^	Enquire / Set the optional Event Trigger Point High Power Threshold (target amplitude)	110	56	110	dB (ref Target amplitude values in Target Detect message)
*HBP	?/=/^	Enquire / set the heart beat period in seconds. Setting the value to zero turns off the heartbeat message. The programmed value is stored in non-volatile memory and is used the next time the radar is powered on.	60	5 (0=off)	600	1 Second
*HELP		List all commands along with command help information.				
*LED	?/=/^	Enquire/Set the front LED function.				On Off Detect
*LS	?/=/^	Enquire/Set the low speed detection threshold	12	4	12	KPH Units change depending on speed units (see *SU)
*MSG	?/=/^	Enquire / Set the message type displayed on the output	2	2	3	2 = Target Detect Message 3 = Event Trigger Point message
*REBOOT	!	Force a reboot of the radar				
*SN	?	Read the serial number. The serial number includes a checksum calculated using the XOR function (‘reference page 12’) of all the characters in the serial number up to and including the ‘*’ character.				
*SU	? / =	Enquire / set the speed units used in the messages. The programmed value is stored in non-volatile memory and is used the next time the radar is powered on.	K	K	M	K = KPH M = MPH
*TEXT	? / =	read / write free-form text to non-volatile memory. *TEXT=<string> Space for 64 characters is reserved in non-volatile memory but 2 characters are reserved for NULL termination and ‘\r’ character.			62	characters
*THRESHOLD	?/=/^	Enquire/Set the power threshold level	55	55	110	Caution: Setting value high will make the radar deaf to targets. Setting low will introduce Noise.
*TS (HARDWARE OPTIONAL)	=	Uses the internal Target Simulator to simulate a target. *TS=<target number><dir>		1	12	Target Number (see target simulator section)dir = A or R
*VER	?	Provides the product number, firmware version and date.				

*TS COMMAND & HARDWARE SELF-TEST (OPTION)

This function is a hardware build option.

The radar has a built in hardware based target simulator. This command is used to perform a self-test using this built in target simulation hardware. There are twelve targets that maybe simulated in either receding or approaching directions

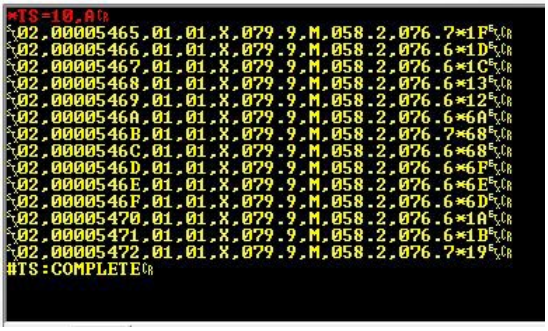
The format of the command is: ***TS=<Target Number>,<Direction><CR>**

The target parameters for each target are shown in the table below.

Target Number	Speed(MPH)	Range (Metres)	Distance travelled in beam (metres)
1	50	17	25
2	80	17	10
3	120	17	10
4	190	17	10
5	50	34	25
6	80	34	10
7	120	34	10
8	190	34	10
9	50	58	25
10	80	58	10
11	120	58	10
12	190	58	10

E.g. Self-test as follows; ***TS=10,A**

Radar Response



*TS COMMAND & HARDWARE SELF-TEST (CONTINUED)

When in Advance Mode the radar will only accept and report simulated targets that are advancing. If a recede simulated target is requested the radar processing will reject the target as 'wrong direction' and only the

#TS:COMPLETE<CR>

message will be sent as confirmation that the simulation has been completed. When in Recede mode vice versa.

It is recommended that the system uses the following pass/fail criteria for acceptance to specification for a radar self-test. It is also recommended that after power-up of the radar, the host system calls the radar self-test function to simulate at least one approaching and one receding target. When in Bi-Directional mode the radar will report both advancing and receding simulated targets.

Parameter	Pass Criteria
Direction	100% correct
Speed	≤ ± 1.0mph
Target Range	≤ ± 1.0m
Target Amplitude	N/A
Checksum	100% correct

The hardware target simulator is fully independent of the radar measurement system. This is used to verify the operation of the radars measurement circuitry. The self-test does NOT operate automatically on power-up of the radar. During simulation the microwave front end is disconnected from the ADC to avoid any possible interference with the simulation.

The radar self-test function can be called at any time using the *TS command.

The *TS command calls a pre-loaded simulated test target condition. There is a selection of pre-loaded test target conditions as set out.

To distinguish real targets from simulated targets the radar inserts an X or a Y in the direction fields of all related messages produced.

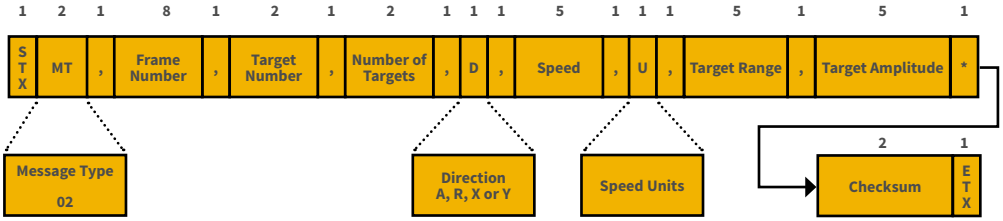
Message Formats - Serial Comms Unit Only

AGD **318**
TRAFFIC CONTROL RADAR

TARGET DETECT MESSAGE

TARGET DETECT MESSAGE

This message is sent after the radar has established that a vehicle has entered the radar's beam.
The numbers above the boxes in the diagram below indicate how many bytes are used for each field.
The Target Detect Messages are enabled with the command **'*MSG=2'**

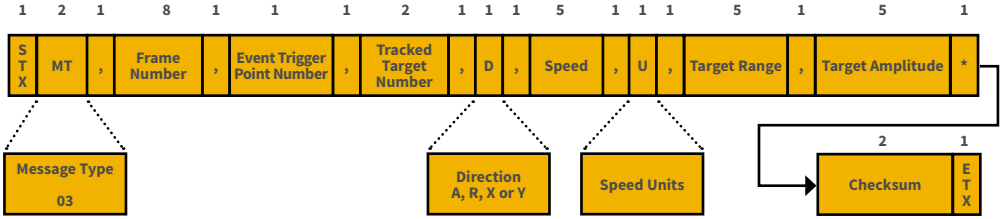


Name	Size / Bytes	Value	Notes
STX	1	2	Start of message byte
MT	2	02	Message type
,	1	','	Comma
Frame Number	8	XXXXXXXX	Frame number in hexadecimal format
,	1	','	Comma
Target Number	2	XX	Target number
,	1	','	Comma
Number of Targets	2	XX	Total number of targets in the current frame
,	1	','	Comma
Direction	1	'A' = Approaching Target 'R' = Receding Target 'X' = Simulated approaching target 'Y' = Simulated receding target	Direction the target is travelling.
,	1	','	Comma
Speed	5	'DDD.D'	Target speed to one decimal place in decimal format
,	1	','	
Speed Units	1	'M'=MPH 'K'=KPH	The speed units used for the measurement
,	1	','	Comma
Target Range	5	'DDD.D'	Target range in metres
,	1	','	Comma
Target Amplitude	5	'DDD.D'	Target power amplitude in dB
*	1	'*'	Asterisk
Checksum	2	'XX'	Checksum in hexadecimal format (reference checksum calculation)
ETX	1	3	End of message byte

EVENT TRIGGER POINT MESSAGE

EVENT TRIGGER POINT MESSAGE

This message is sent when a target passes a defined Event Trigger Point. The Event Trigger Point is defined with the '*ETPn' command and can be qualified with speed, range and target amplitude.
The Event Trigger Point messages are enabled with the command **'*MSG=3'**

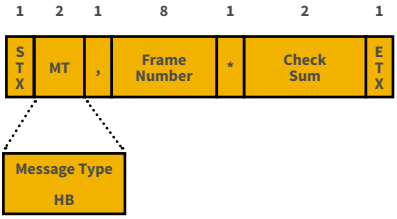


Name	Size / Bytes	Value	Notes
STX	1	2	Start of message byte
MT	2	03	Message type
,	1	','	Comma
Frame Number	8	XXXXXXXX	Frame number in hexadecimal format
,	1	','	Comma
Event Trigger Point Number	1	X	Event trigger point number (1 or 2)
,	1	','	Comma
Tracked Target Number	2	XX	The identity of the tracked target
,	1	','	Comma
Direction	1	'A' = Approaching Target 'R' = Receding Target 'X' = Simulated approaching target 'Y' = Simulated receding target	Direction the target is travelling.
,	1	','	Comma
Speed	5	'DDD.D'	Target speed to one decimal place in decimal format
,	1	','	
Speed Units	1	'M'=MPH 'K'=KPH	The speed units used for the measurement
,	1	','	Comma
Target Range	5	'DDD.D'	Target range in metres
,	1	','	Comma
Target Amplitude	5	'DDD.D'	Target power amplitude in dB
*	1	'*'	Asterisk
Checksum	2	'XX'	Checksum in hexadecimal format (reference checksum calculation)
ETX	1	3	End of message byte

RADAR EVENT MESSAGES

HEART BEAT MESSAGE

This message is sent each time the heart period expires. The heart beat message period is controlled using the *HBP command. The heart beat period is measured in seconds.



Heart Beat message format

Name	Size / Bytes	Value	Notes
STX	1	2	Start of message byte
MT	2	‘HB’ = Heart Beat	Message type
,	1	‘,’	Comma
Frame Number	8	XXXXXXXX	Frame number in hexadecimal format
*	1	‘*’	Asterisk
Checksum	2	‘XX’	Checksum in hexadecimal format (reference checksum calculation)
ETX	1	3	End of message byte

CHECKSUM CALCULATION

The unsolicited messages and the Serial Number output by the 318 contain a checksum. The checksum is performed as an exclusive OR (XOR) sum of each of the characters in the message excluding the header and termination characters. The checksum is then appended to the message as a 2 character hexadecimal number.

e.g. Consider a Heartbeat message prior to the header and termination

HB,00001334*

'H' = 0x48

'B' = 0x42

An XOR operation on these two characters results in 0x0A which is then used in the XOR with the next character (',' = 0x2C) and so on until all of the characters have been summed.

The visualisation of this 'summing' is shown below:

H	B	,	0	0	0	0	1	3	3	4	*	CHECKSUM
0x48	0x42	0x2C	0x30	0x30	0x30	0x30	0x31	0x33	0x33	0x34	0x2A	09

The result is appended to the message following the '*' character and the message is transmitted with the 'STX' and 'ETX' characters.

STXHB,00001334*09ETX

UPDATING APPLICATION CODE

The 318 contains Bootloader firmware resident in Non-volatile memory which allows the main application firmware to be updated over the Comms port. The Bootloader firmware is completely independent from the main application so it is always possible to re-load code.

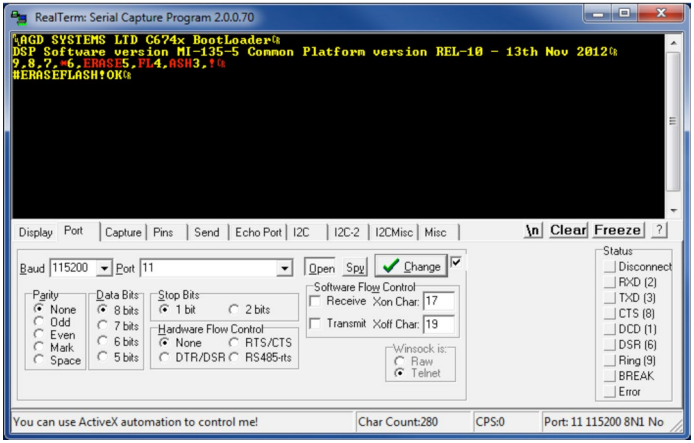
- Configure a terminal communications port to a baud rate of 115200, No Parity, 8 data bits and 1 stop bit. AGD recommends using RealTerm as this allows delays to be inserted after End of Line transmissions.
- Power on the radar with the comms cable attached to the PC. The Bootloader version information is displayed and a countdown is started to boot the main application.

Before the countdown reaches zero type the command:

***ERASEFLASH!**

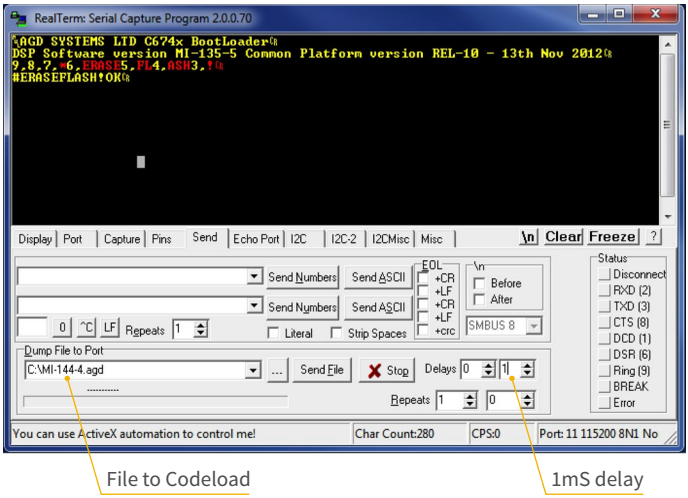
The response is:

#ERASEFLASH!OK

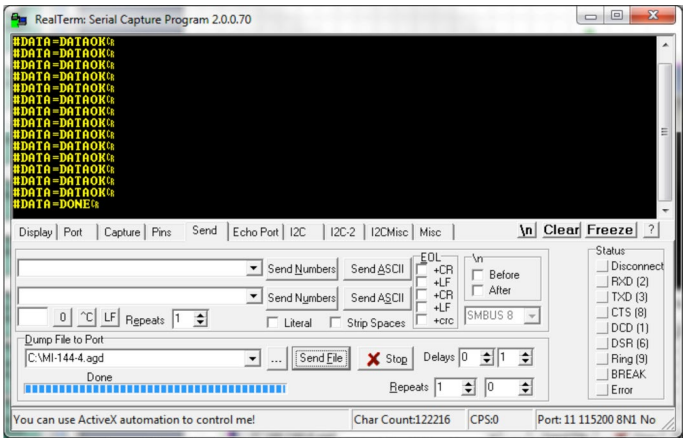


UPDATING APPLICATION CODE

- Send the application file over the port. AGD recommends inserting a delay of 1ms between each line as shown in the following screen-shot



- The Bootloader responds with #DATA=DATAOK for each line of the file. The final response at the end of the file transmission is #DATA=DONE

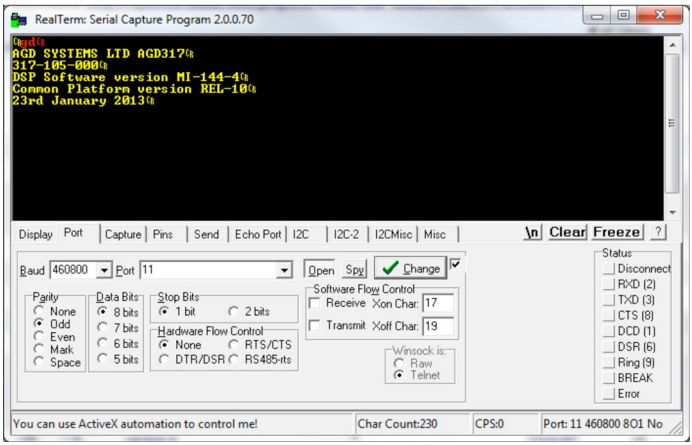


- To load the main application type

  *LOADAPP!

UPDATING APPLICATION CODE

- Change the BAUD rate for the main application to 460800, ODD parity, 8 data bits and 1 stop bit (if using RealTerm you need to hit the 'Change' button after changing the settings.
- Type AGD to confirm the code version



BLUETOOTH OPTO VARIANT

THE LIVEWIRE™ GRAPHICAL USER INTERFACE (GUI)

To install the 318 Livewire™ interface visit: **www.agd-livewire.com**
Login/register and follow the on screen instructions.

LIVEWIRE REQUIREMENTS

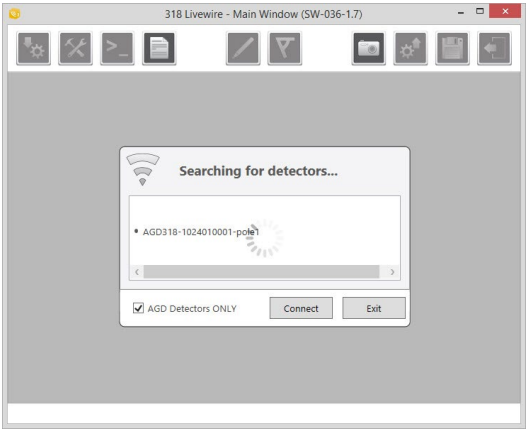
- A Laptop or tablet running…
  - Windows XP SP3
  - Windows Vista SP1 or later
  - Windows 7
  - Windows 8
- Microsoft .Net Framework 4
- An AGD-certified Bluetooth Dongle (MS-076)

QUICK START

1) Connect the AGD-certified Bluetooth dongle.

2) Launch the software from your Desktop/Start menu by clicking the 318 Livewire icon.
   - The application will search for all 318 detectors within range and will display these once discovered

3) Select the desired 318 unit from the list and click continue.

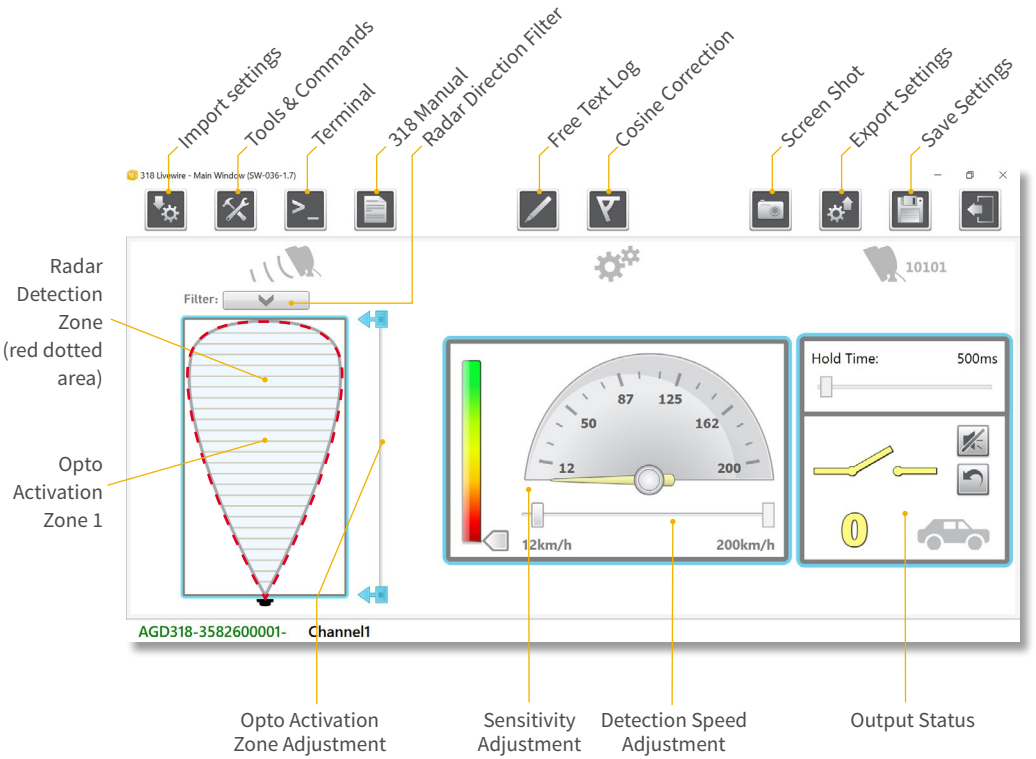


Note that if this is the first time that the radar has been connected to, then the name shown will be the radars serial number. This can be changed to a personal preference from within the tools menu (once connected).

Once connected a blue light will illuminate on the back of the 318 detector and its settings will be downloaded. The relevant settings interface will then be displayed. This interface may vary dependent upon the variant of 318 connected to.

Technical Resource

BLUETOOTH SINGLE OPTO USER INTERFACE

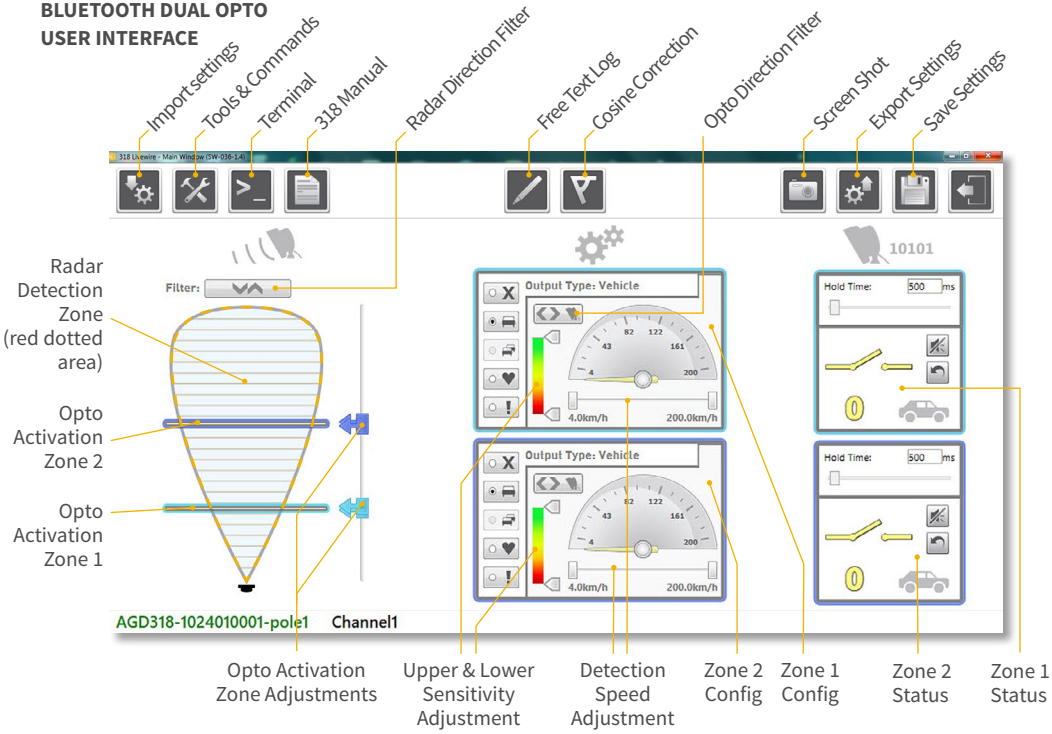


SETTINGS SUMMARY

Item	Description	Note
No.of Outputs	**One Opto-Isolator**	
Low Range Threshold	6 - 70m	Default 6m
High Range Threshold	6 - 70m	Default 70m
Low Speed Threshold	4 - 200kph	Default 12kph
High Speed Threshold	200kph	Fixed
Direction	Advance / Recede / Bidirection	Default Advance
Sensitivity Adjustment	High / Medium / Low	Default High
Hold Time	0 To 10,000mS	Default 500mS

Technical Resource

BLUETOOTH DUAL OPTO USER INTERFACE

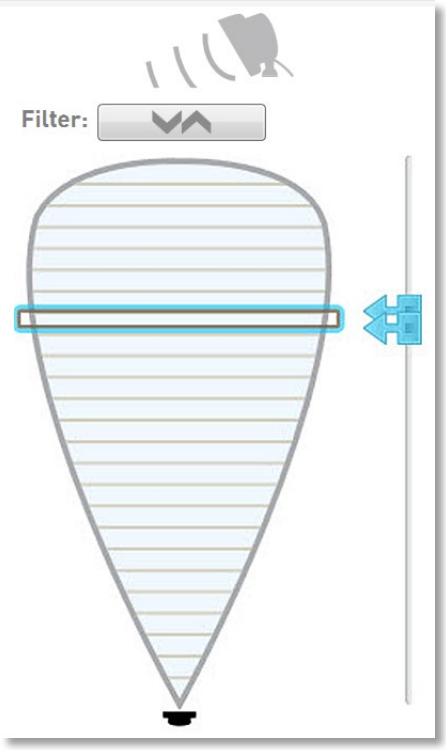


SETTINGS SUMMARY

Item		Description	Note
No.of Outputs		**Two Opto-Isolator**	
Zone 1	Low Range Threshold	6 – 150m	Default 6m
	High Range Threshold	6 – 150m	Default 70m
	Low Speed Threshold	4 – 200kph	Default 12kph
	High Speed Threshold	4 – 200kph	Default 200kph
	Direction	Advance / Recede / Bidirection	Default Advance
	Sensitivity Adjustment	10 – 100%	Default 100%
	Hold Time	0 To 10,000mS	Default 500mS
	Zone Operation	Active or Off	Default Active
Zone 2	Low Range Threshold	6 – 150m	Default 6m
	High Range Threshold	6 – 150m	Default 40m
	Low Speed Threshold	4 – 200kph	Default 10kph
	High Speed Threshold	4 – 200kph	Default 200kph
	Direction	Advance / Recede / Bidirection	Default Advance
	Sensitivity Adjustment	10 – 100%	Default 60%
	Hold Time	0 To 10,000mS	Default 500mS
	Zone Operation	Active or Off	Default Active
Fault O/P		Yes	Option for Zone O/P
Heartbeat		Yes	Option for Zone O/P
Front LED			Default off

DETECTION ZONE SET-UP

An important part of the set-up and configuration of the radar are the three items highlighted in the window below.



There are three components to this window:

The **'direction filter'** applies a global setting to the direction of the traffic the radar will process and see. When using a dual zone radar looking for targets in both directions, then this will have to be set to bi-directional. Directional filters for detection will then be set in the individual 'zone 1' or 'zone 2'. When looking for targets in just one direction, (whether that is a single or dual zone) this filter can be set here to the direction of interest (advance or recede).

The **'radar footprint'**, or the item on the diagram that looks like a balloon, displays targets by illuminating the segments as detections are displayed at that range. It is important to note that if the direction filter above is set to a single direction (either advancing or receding) only the targets travelling in the selected direction will be shown in the radar footprint. The radar footprint represents a zone size of 70 metres and 150 metres for the single and dual zone radars respectively.

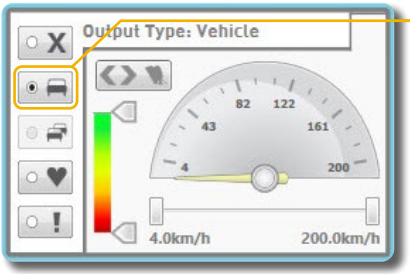
The **'opto activation zone'** is adjustable using the upper and lower sliders. The area of interest (the range and size of zone a valid detection and associated output is required within) can be adjusted down to a minimum of two metres. It is advised that the zone is strategically placed and kept small for the most accurate detection.

Notes:

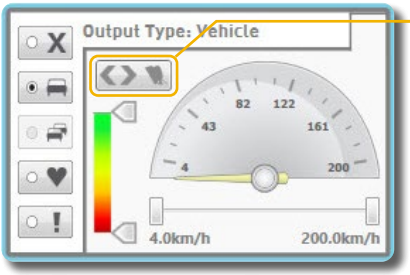
- The radar will provide a valid output for any target seen inside the opto activation zone (depending on other parameters set). For example, if the zone size to 10-50 metres and selected bi-directional target detection, a valid contact closure / output for the length of time that any target(s) going in either direction within the 10-50 metre range would occur.
- When looking for accurate target detection at precise range(s) within the beam, setting a small window of activation can help mitigate any potential false detects.

OPTO ACTIVATION ZONE 1 (OR 2) CONFIGURATION PARAMETERS

Function of the settings in the OPTO activation zone 1 (or 2) windows, when **'Vehicle Detect Output'** is selected:



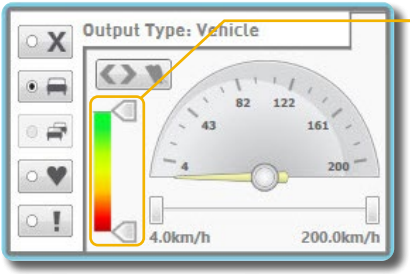
'Vehicle Detect Output' – When selected, the zone being currently configured will be set to detect moving targets (pedestrians, cyclists and vehicles). The type of targets detected are then filtered by using the following adjustable parameters:



'Direction' – Sets the direction of travel you are interested in filtering.

Bi-directional (as set here) will allow targets travelling in both directions through the filter.

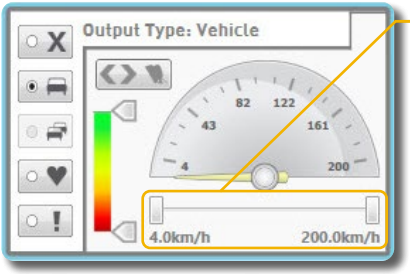
Settings available: Advance, Recede and Bi-directional.



'Sensitivity' – Sets the level of sensitivity the radar uses to filter targets.

Moving the top slider down filters out larger stronger reflective targets. Moving the bottom slider up filters out smaller weaker reflective targets

Settings available: 10 – 100%



'Detection Speed Adjustment' – Adjusts the upper and lower speed thresholds for detection.

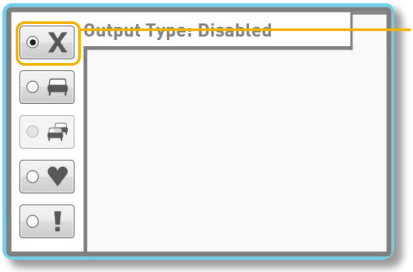
e.g - Here, any target travelling between 4kph and 200kph is valid and is let through the filter.

Settings available: 4-200kph.

**The speed sliders can be adjusted using a regular dragging motion with mouse / touchpad. By clicking on the slider and selecting it you can also adjust the speed in 0.1 increments using a keyboards arrow keys, enabling accurate selection of speed.*

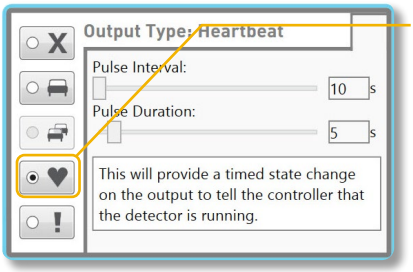
OPTO ACTIVATION ZONE 1 (OR 2) CONFIGURATION PARAMETERS

Function of the settings in the OPTO activation zone 1 (or 2) windows, when **'Output Type: Disabled'** is selected:



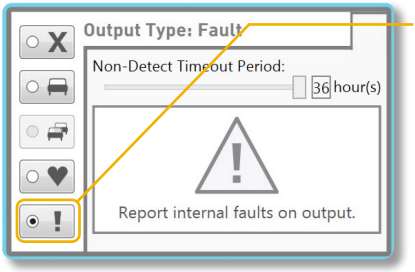
'Disabled' – The output is disabled and performs no function

Function of the settings in the OPTO activation zone 1 (or 2) windows, when **'Output Type: Heartbeat'** is selected.



'Heartbeat' – The detector is able to use its secondary output* to act as a heartbeat to allow a controller or auxiliary system to monitor the health of the radar. Pulse interval and duration are both adjustable.

Function of the settings in the OPTO activation zone 1 (or 2) windows, when **'Output Type: Fault'** is selected:



'Fault' – This value can be set and then the screen navigated away from. If the detector sees no valid targets or detections for a period as defined by the user (default value: 36 hours) then the output(s) of the radar are driven to a permanent detect state.

Troubleshooting

PHYSICAL INSTALLATION

What height should the AGD318 be mounted at?

The AGD318 has a recommended mounting height of between 2-5m (from ground level).

Is there a recommended angle that the AGD318 should be set to?

The 318should be carefully aligned for optimum performance and is best achieved under light traffic conditions. For the majority of installations where the carriageway is level, the declination can be quickly set by depressing the detector by 9º from the vertical as indicated on page 7.

The detector should be panned to point at the centre of the carriageway at the furthest point at which detection is required. For a dual carriageway approach the detector should be aligned with the road markings separating the two lanes. The LED on the detector should be observed during alignment to ensure the onset of detection occurs at the correct point.

Will AGD318 operate correctly with obstructions?

All radar units are designed to operate with a clear 'line of sight'. Any obstructions may result in loss of performance or false detections. The BR-129 height extension bracket should be implemented where required to avoid potential obstructions from traffic light heads.

Troubleshooting

CONNECTING / COMMISSIONING

How many lanes of traffic can the AGD318 detect vehicles in?

The AGD318 can detect targets in up to 2 lanes of bi-directional traffic. It is not able to discriminate which lane a target is traveling in.

What is the maximum range of the AGD318?

AGD318 is configurable to allow detection up to 150m (depending on variant). These functions are available via the AGD Touch-setup 'Settings' page.

Can the AGD318 detect vehicles in both directions?

Yes, the AGD318 can be configured to detect either bi-directional, advancing or receding only traffic.
For example; this function is regularly deployed on traffic signals where the control of two-way traffic across a single lane, such as 'shuttle working bridges' is required.

What speeds can the AGD318 detect vehicles at?

The AGD318 has a selectable low speed threshold of either 8 kph (default) or 4 kph. A detection output will only be activated if the target is traveling above the selected limit.

If two AGD318's are facing each other (i.e. shuttle working on a bridge) can their radar signals interfere with the opposing unit?

Yes. Any radar unit has the potential to interfere with another unit operating within the same band (frequency). To overcome this, the AGD318 has the option of 2 user selectable channels (via AGD Touch-setup) to minimize any potential interference between units.

Can the AGD318 detect bicycles?

Yes, the AGD318 will detect bicycles travelling above the low speed threshold. However, as a bicycle is a smaller target than a motor vehicle, detection range may be reduced.

Why can't a simple hand-wave test be carried out on the AGD318, the same as could be done on previous models?

The AGD318 employs a planar antenna and detection and tracking algorithm software that is optimised only for the profile of moving vehicles. Waving a hand in front of the AGD318 does not produce a suitable profile which the unit would recognise as a valid target and will be ignored. This is very good for filtering out unwanted targets such as moving tree branches close to the detector.

Radar Characteristics

AGD **318**
TRAFFIC CONTROL RADAR

The radar has been designed to have a specific set of functional characteristics which make it suitable for range & speed measurements of multiple targets.

RADAR ANTENNA

The antenna design is a planar patch array with the following performance;

Parameter	Specified	Notes
Horizontal Beam-width	7˚	-3dB
Vertical Beam-width	28˚	-3dB
Side-lobe Suppression	>15dB	
E-Field	Vertical	Plane Polarised

OPERATING FREQUENCY BAND AND POWER

The transmitter is interlocked as a closed loop system with the hardware processor. This enables full monitoring of the transmitter frequency which ensures the transmission remains in the intended transmission band. The design confidence means that the nominal centre frequency of the transmission shall remain within a 10MHz window for the required 7 years for a radar functioning normally.

The change in 'frequency' with temperature is measured to be <64KHz/˚C

The radar frequency and power is as follows;

Parameter	Specified	Notes
Centre Frequency (channel 1)	24.174GHz*	
Centre Frequency (channel 2)	24.223GHz*	
Power	<100mW eirp	
Field Strength	Typically 750m V/m	At 3m
ITU Code	44M0FXN	

*Proposed channels for FCC variant, channel 1 - 24.099GHz, channel 2 - 24.148GHz.

FREQUENCY MODULATION

The radar is an FMCW radar where the Frequency Modulation (FM) characteristics give the radar a transmit bandwidth of 44MHz. The FM is such that it is symmetric about the centre frequency of the band it is operating in.

The change in transmit 'bandwidth' with temperature is measured to be typically 30KHz/˚C. The stability of the bandwidth over time is anticipated being better than 3% in the first year and lower for each subsequent year.

Radar Characteristics

AGD **318**
TRAFFIC CONTROL RADAR

FREQUENCY VARIANTS

Several versions of this product are available at frequency options which are for use in different geographic regions related to the radio requirements of that specific jurisdiction as follows;

Frequency Variant	EU Country of Use	Other Countries	Notes
24.174GHz / 24.223GHz	No current restrictions within the EU	TW, TR, QT, AU, NZ, US*, ZA	*for US special build variant required. *Proposed channels for FCC variant, channel 1 - 24.099GHz, channel 2 - 24.148GHz.

These products may not be used in the following geographic regions;

Restriction Type	EU Country	Other Countries
Relevant 24GHz Band not allocated		
Licence Required for Use	none currently identified	
Frequency Allocated but EIRP too high		

It is important to note that this table is updated from time to time. Please contact AGD for latest information if your intended country of use is not currently represented.

(Note: Countries are listed by their ISO 3166 2 letter code)

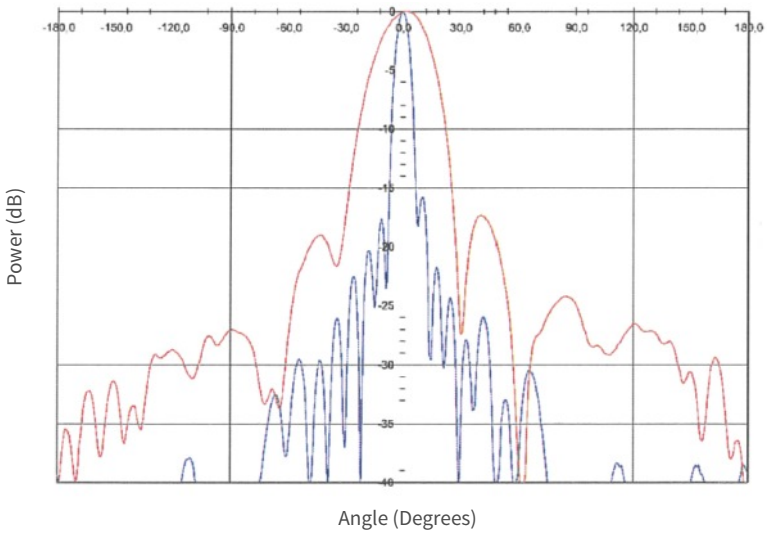
The Bluetooth frequency and power is as follows:

Frequency range (MHz): 2400-2483.5
Highest EIRP power in the range (dBm): 8.00

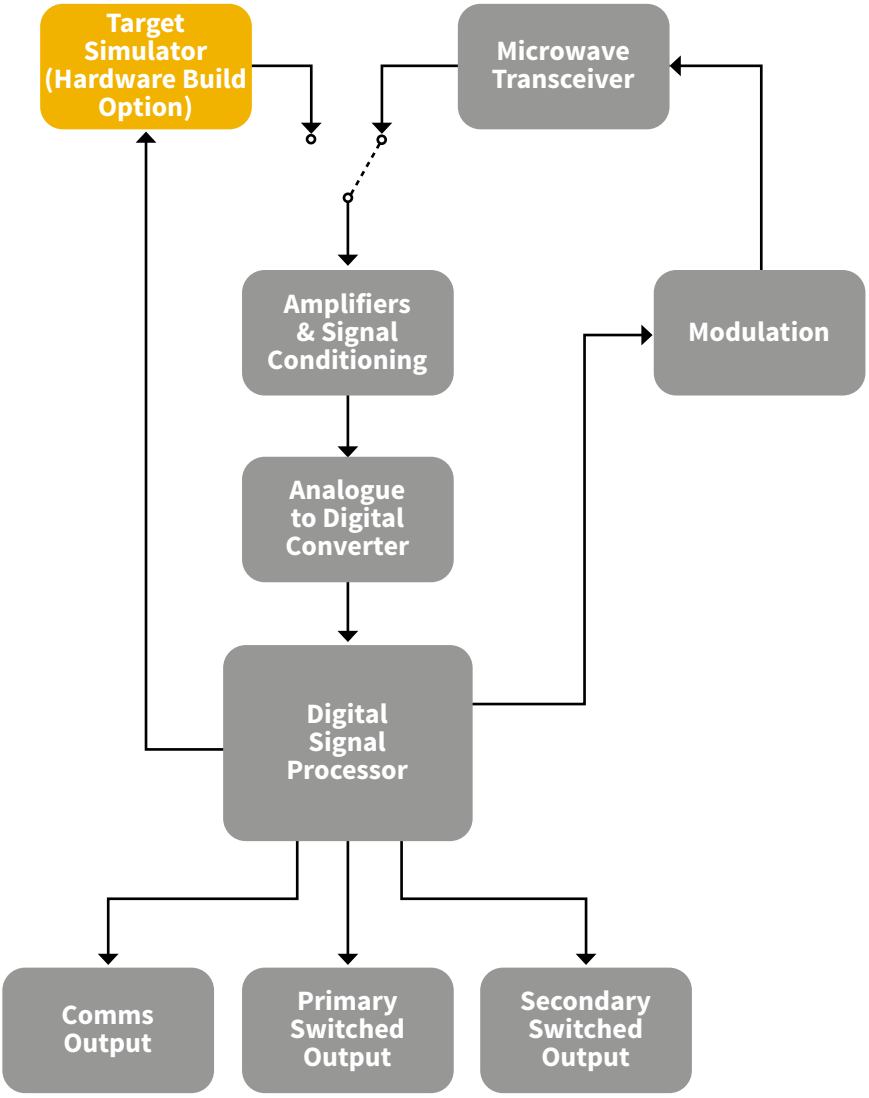
The WI-FI frequency and power is as follows:

Frequency range (MHz): 2412-2472
Highest EIRP power in the range (dBm): 18.52

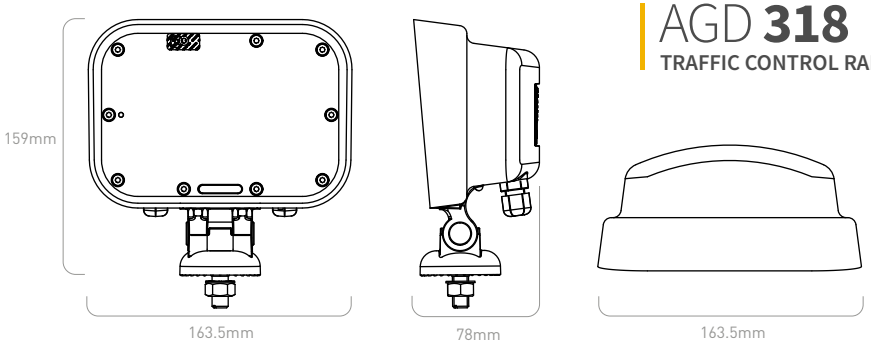
ANTENNA PLOTS



SYSTEM HARDWARE OVERVIEW



Technical Specifications



AGD **318**

TRAFFIC CONTROL RADAR

SPECIFICATIONS

Technology	FMCW Radar
Radiated Power	<100mW EIRP
Centre Frequency	24.174GHz (channel 1) - 24.223GHz (channel 2)
Bandwidth	44MHz
Range	6 to 150m (depending on variant)
Mounting	M10 Pan / Tilt Bracket
Mounting Height	2 - 5m nominal
Speed Range	4 to 300 kph (depending on variant)
Weight	0.7 Kg nominal
Housing Material	UV Stable Polycarbonate
Housing Finish	Self coated black
Sealing	IP65
Operating Temperature	-20°C to +60°C
Power	2.7W at 12V dc (225mA)
Power Supply	12Vdc, 24Vac/dc, 230Vac depending on model
Radar Output	Opto, Relay or RS422
EMC Specification	ETSI EN 301 489 and BS EN 50293
Radio Specification	ETSI 300.440, FCC CFR47 Part 15.245*
MTBF	20 years

*For US special build variant required

Owing to the Company's policy of continuous improvement, AGD Systems Limited reserves the right to change their specification or design without notice.

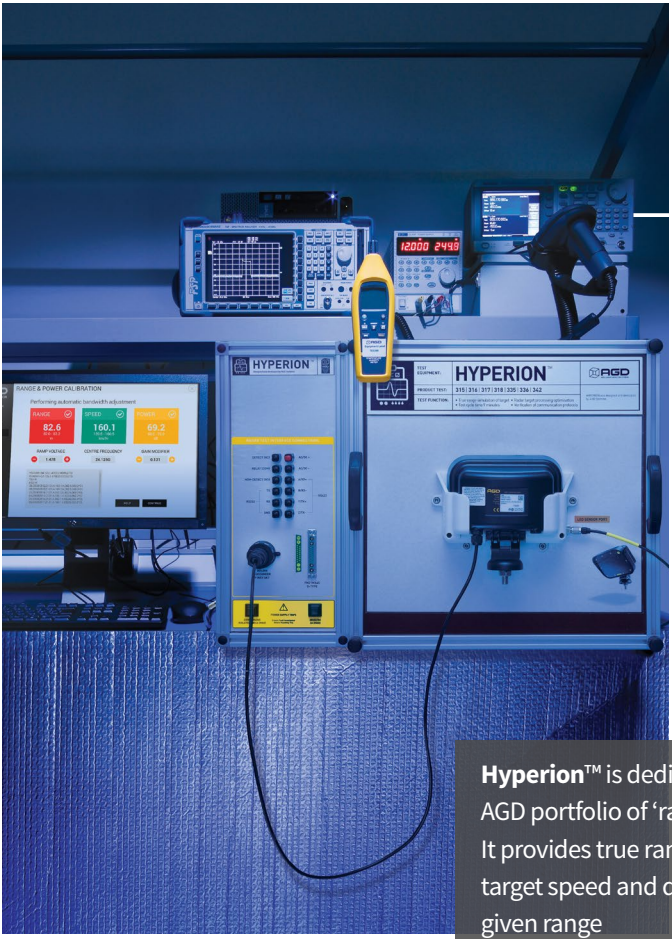
RoHS COMPLIANT
Restriction on Hazardous Substances

REACH COMPLIANCE
Registration Evaluation Authorisation and Restriction of Chemicals

agd-systems.com.au

AGD **HYPERION**™

TEST COMPLIANCE EQUIPMENT



Hyperion™ is a bespoke set of test equipment designed and developed by AGD Systems. It is dedicated to the testing of the AGD portfolio of 'ranging' FMCW vehicle radars. 100% of the 318 units manufactured at AGD are Certified by Hyperion.

The key test functions performed by Hyperion to Certify the premium performance of your Intelligent Detection System are:

- True range simulation of target
- Target speed and direction simulation at a given range
- Radar target processing optimisation
- Transmitted radar frequency modulation measurement
- Verification of interface and communication protocols
- Test cycle time of 9 minutes

The radar test sequences performed by Hyperion on the radar under test provides a thorough examination of the performance of the 318 radar and specifically the ranging measurement capability provided by the FMCW technology deployed. This gives full control of simulated targets' signal size, speed, direction and range.

Optimisation of frequency signals on Hyperion ensures full compatibility with country requirements within the 24GHz radar operating band.

Hyperion™ is dedicated to the testing of the AGD portfolio of 'ranging' FMCW vehicle radars. It provides true range simulation and both target speed and direction simulation at a given range

LIFETIME PRODUCT TRACEABILITY

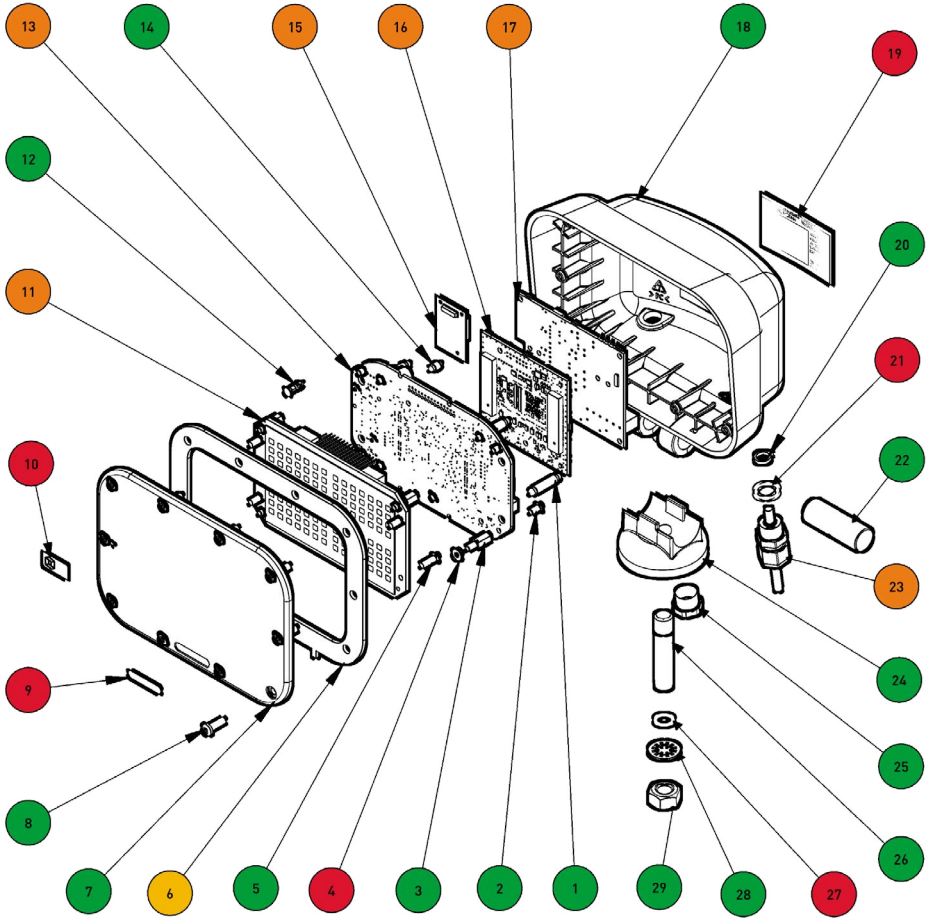
There are clearly defined pass and fail criteria at all stages within the Hyperion test process. The test results in association with the product build revision are recorded on a product serial number basis. The full suite of test measurements is instantly sent to the dedicated product database within the AGD secure server facility, providing full traceability during the product lifetime.

The AGD Certified symbol is your mark of assured performance.

End Of Life – Disposal Instructions (EOL)

AGD **318**
TRAFFIC CONTROL RADAR

318 RADAR TRAFFIC DETECTOR



Item	Qty	Material
1	4	Nylon
2	4	Steel
3	4	Brass
4	4	Vulcanised Fibre
5	4	Steel
6	1	Neoprene
7	1	Polycarbonate
8	10	Steel
9	1	Polyester
10	1	Polyester (Incinerate)
11	1	Electronic Assembly - Mixed metal and printed circuit board
12	2	Nylon
13	1	Electronic Assy
14	3	Nylon

Item	Qty	Material
15	1	Printed Circuit Board
16	1	Electronic Assy
17	1	Printed Circuit Board
18	1	Polycarbonate
19	1	Polyester
20	2	Nylon
21	2	Silicone
22	1	Aluminium
23	1	Metal , Nylon + PVC
24	1	Polycarbonate
25	1	Nylon
26	1	Steel
27	1	Nitrile
28	1	Steel
29	1	Steel

- Reuse / Recycle
- Separate & Recycle
- Downcycle
- Hazardous Recovery
- Non - Recyclable

This document serves as a guideline only for EOL procedures and further guidance may need to be sought from the appropriate authority or agency.

Important

SAFETY PRECAUTIONS

All work must be performed in accordance with company working practices, in-line with adequate risk assessments. Only skilled and instructed persons should carry out work with the product. Experience and safety procedures in the following areas may be relevant:

- **Working with mains power**
- **Working with modern electronic/electrical equipment**
- **Working at height**
- **Working at the roadside or highways**

1. This product is compliant to the Restriction of Hazardous Substances (RoHS - European Union directive 2011/65/EU).
2. Should the product feature user-accessible switches, an access port will be provided. Only the specified access port should be used to access switches. Only non-conductive tools are to be used when operating switches.
3. The product must be correctly connected to the specified power supply. All connections must be made whilst the power supply is off or suitably isolated. Safety must take always take precedence and power must only be applied when deemed safe to do so.
4. No user-maintainable parts are contained within the product. Removing or opening the outer casing is deemed dangerous and will void all warranties.
5. Under no circumstances should a product suspected of damage be powered on. Internal damage may be suggested by unusual behaviour, an unusual odour or damage to the outer casing.
   Please contact AGD for further advice.
6. This device complies with part 15 of the FCC Rules and this radar contains FCC ID: UXS-IVS979.

   • 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.

   • This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance such that the module should not be installed in equipment intended to be used within 20cm of the body.

   • The transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

   • Changes or modifications not expressly approved by AGD Systems Ltd could void the user's authority to operate the equipment.
7. This Product is Compliant with the European Radio Equipment Directive 2014/53/EU.
   There is no restrictions of use within any EU Member state for this product.
   This product is Receiver Category 2.
8. Indicates compliance with all applicable Australian ACMA technical standards and associated record-keeping (including testing) arrangements.

IMPORTANT INFORMATION

LOW POWER NON-IONISING RADIO TRANSMISSION AND SAFETY

Concern has been expressed in some quarters that low power radio frequency transmission may constitute a health hazard. The transmission characteristics of low power radio devices is a highly regulated environment for the assurance of safe use.

There are strict limits on continuous emission power levels and these are reflected in the testing specifications that the products are approved to. These type approval limits are reflected in the product specifications required for a typical geographic area such as those for the EU (ETS300:440), for the USA (FCC part 15c) and for Australia/New Zealand (AS/NZS 4268). The limits adopted in these specifications are typically replicated in many other localized specifications.

The level of safe human exposure to radio transmission is given by the generally accepted guidelines issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This body has issued guidance for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz) which are quoted below.

	Radar and ICNIRP limit comparison			**Typical Informative Limits for Radar Transmission Approval**		
	Radar Transmitted Level (Note 4)	ICNIRP Limit (Table 6)	Exposure Margin	ETS300:440	FCC (part15c)	AS/NZS 4268
Power (mW EIRP)	<100mW (<20dBm)	N/A	N/A	100mW (20dBm)	1875mW (Note 1)	100mW (20dBm)
Max Power Density (mW/cm2)	3.18µW/cm2 at 50cm (Note 3)	<50W/m2 (5mW/cm2) (Note 2)	0.064%	N/A	N/A	N/A
Field Strength (V/m) at 3m	<0.58V/m (5.8mV/cm) (Note 1)	<137V/m (1370mV/cm)	0.42%	0.58V/m (5.8mV/cm) (Note 1)	2500mV/m (25mV/cm)	0.58V/m (5.8mV/cm) (Note 1)

Note 1 Values are calculated conversions for comparison purposes.

Note 2 Other equivalent limits include; Medical Research Council Limit of 10mW/cm2, IACP limit of 5mW/cm2 (at 5cm) and UK CAST limit of 5mW/cm2. . Power density at the radome typically 4µW/cm2. .

Note 3 Calculation is made on the assumption antenna is a point source therefore the actual value is likely to be significantly less than that quoted. Note that a theoretical max level at a 5cm distance (which gives 0.318mW/cm2) is at a point in the field where the radar beam is not properly formed.

Note 4 Comparison for product model 318 operating in the band typically 24.050GHz to 24.250GHz

From the table it can be seen that it is extremely unlikely that a potentially hazardous situation could occur owing to the use of such low power devices.

It is considered to be good practice not to subject humans to radiation levels higher than is necessary. In a works environment where multiple equipment on soak test are to be encountered then it is considered good practice to contain the equipment in an appropriate enclosure lined with radar absorbing material.

Certification

EU Declaration of Conformity

Certificate No: CE-064 Issue: 4

PRODUCT SOLUTIONS FOR
INTELLIGENT TRAFFIC SYSTEMS

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We AGD SYSTEMS LTD
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Staverton
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GL51 0TF
UNITED KINGDOM

as manufacturer hereby declare that the following product(s)

Equipment Model Type(s): 318-3xx-xxx

318-5xx-xxx

Equipment Description: Radar Traffic Detector

conform with the provisions of the following EC Directive(s), including all amendments, and with national legislation implementing this / these directive(s):

2014/53/EU relating to Radio Equipment.

2011/65/EU RoHS Directive

and that the following harmonised standards and Technical Specifications have been applied:

EMC (Art 3.1(b)):	EN50293:2012
	EN301 489-17 V3.2.0
	EN301 489-51 V2.1.0
	EN301 489-1 V2.1.1
Health & Safety (Art 3.1(a)):	EN 60950-1:2006 +A1:2010 +A11: 2011 +A12:2011 +AC:2011 +A2:2013
	EN 50556:2011
	EN 62311:2008
Spectrum (Art 3.2):	EN 300 328 V2.1.1
	EN300 440 V2.2.0
ROHS	EN 50581:2012

Notified Body Element Portland Evergreen 0981

EU type certificate EMT18RED1103V1

Signed  Dated: 17/10/19

For and on behalf of AGD Systems Ltd
P M Hutchinson
Managing Director

safer, greener, more efficient

Registered in England and Wales No. 2666988

agd-systems.com.au

Notes

Disclaimer

While we (AGD Systems) endeavour to keep the information in this manual correct at the time of print, we make no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to the information, products, services, or related graphics contained herein for any purpose.

Any reliance you place on such information is therefore strictly at your own risk. In no event will we be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from loss of data or profits arising out of, or in connection with, the use of this manual.

WARRANTY

All AGD products are covered by a 12 month return to factory warranty. Products falling outside this period may be returned to AGD Systems for evaluation, repair, update or re-calibration, any of which may be chargeable.

AGD PTY AUSTRALASIA
PRODUCT SOLUTIONS FOR
INTELLIGENT TRAFFIC SYSTEMS

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