AUSTRALASIA

PRODUCT MANUAL

AGD332

Sign Activation Radar

AGD-SYSTEMS.COM.AU

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Sign Activation Radar

INTRODUCTION

PRODUCT AND TECHNOLOGY

The 332 detector is a true ranging FMCW radar designed for OEM integration into Vehicle Actuated Sign (VAS) applications.

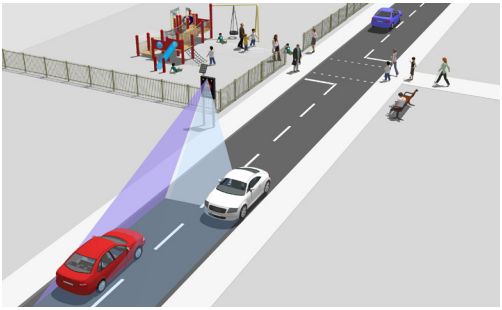
Operating in the 24GHz K-band, the 332 offers an accurate speed measurement while discriminating between advancing and receding traffic.

Technical advancements allow for extremely low power consumption while maintaining vehicle detection distances up to 180 metres.

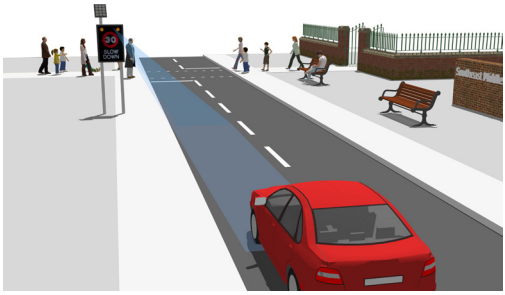
KEY FEATURES

- Target speeds reported based upon multiple configurable parameters
- Range to target up to 180 metres
- Speed measurement 11kph - 160kph (4kph - 160kph low speed mode)
- Bi-directional discrimination
- Dynamic frame rate for further reduction in power consumption (Patent pending)
- Two independent FET switched outputs
- RS232 serial communications for configuration and data output

TYPICAL APPLICATIONS



Sign Activation - Speed



Sign Activation - Warning

AGD AUSTRALASIA

INTRODUCTION

PRODUCT OVERVIEW IMAGE

AGD332

Sign Activation Radar

PRODUCT VARIANTS

PRODUCT NO.	DESCRIPTION
332-100-000	Sign Activation Radar/12V/24.2GHz/RS232
332-101-000	Sign Activation Radar/12V/24.125GHz/RS232 (FCC)

PRODUCT OVERVIEW

The 332 radar has taken the powerful feature rich experience from the low power AGD331. Using the latest power saving technology, the radar's design is a unique pulsed, frequency modulated transceiver linked to a 32bit ARM Cortex M4 processor. This helps deliver market leading radar performance while maintaining extremely low power usage.

Traditional Continuous Wave (CW) Doppler radars for sign driving applications have no ranging capability. The 332 contains filter-down technology from AGD enforcement products, this furnishes the radar with a full multi-target acquisition platform, accurate range measurement, and adjustable output rate of targets. To the VAS designer, this simply means the system power is more efficiently managed by the ability to select the area of interest accurately (regardless of vehicle size).

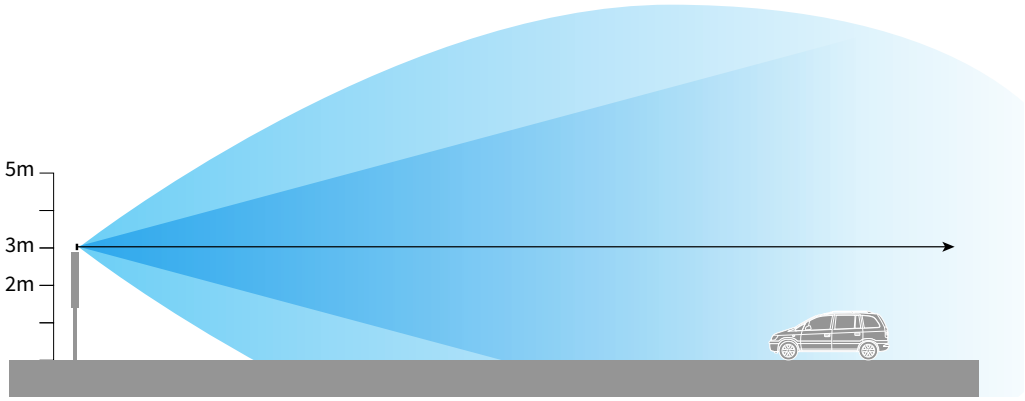
Designed to be simple to use and quickly deployed with a variable sign solution, the 332 range and low speed can be set-up via an RS232 serial interface.

INSTALLATION

PHYSICAL INSTALLATION

The radar should be mounted on a firm structure at the recommended mounting height of 2m to 5m. For optimum performance the radar should be situated on a pole adjacent to the carriageway with an unobstructed view of the advancing traffic. The radar should point down the road towards the furthest point of detection. The front face of the radar should be vertical i.e. perpendicular to the road before you begin site specific adjustments.

The relatively wide beam profile of the 332 ensures good detection coverage of single or dual lane approaches with relatively little adjustment of the sign in relation to the direction of approaching targets. The recommended mounting height of the radar within the sign is between 2-5 meters with the optimum
being 3 metres.



The radars front face should be 90^{0} to the road surface, inclines in the road surface should be catered for by adjusting the 332 radars mounting angle.

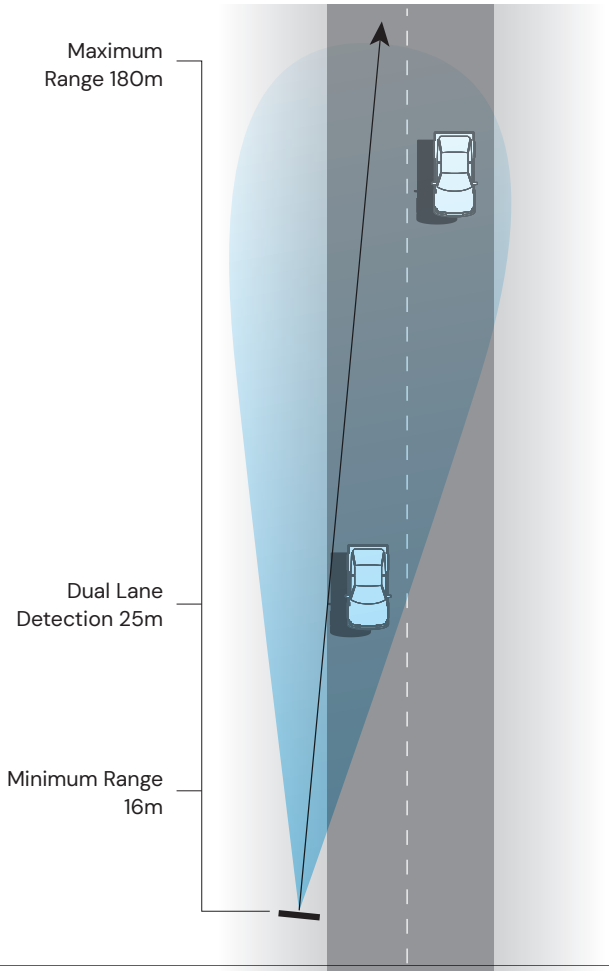
INSTALLATION

PHYSICAL INSTALLATION

The 332 is a true range measuring radar that allows the user to select the range that target starts reporting on tracked targets.

Each target needs to return sufficient signal in order for the radar to track its range. A target return amplitude is related to its Radar Cross Section (RCS) which is in part related to the reflecting area of the target. Targets that have a larger RCS will return a larger signal than those with a smaller RCS.

For example: If the detection range is set at 80 metres then all targets that return enough reflective power before this point will be tracked. Only when the target reaches 80 metres will the detection be reported, allowing for accurate actuation of the sign at the correct range.



PIN NO.	FUNCTION	POWER OFF	POWER ON - DETECT	POWER ON - NON Detect
1	+5.5 to 15Vdc	-	-	-
2	OVdc / RS232 GND / Switched GND	-	-	-
3	RS232 TX	-	-	-
4	RS232 RX	-	-	-
5	Switched Output 1 (FET1)	N/O	N/O	N/C
6	Switched Output 2 (FET2)	N/O	N/O	N/C
7	OVdc / RS232 GND / Switched GND	-	-	-

Power

The radar is powered using a DC voltage in the range of 5.5 – 15Vdc. The power is applied to terminals 1 and 2 located at the bottom of the radar.

Power consumption whilst detecting 15.6mA @ 12V.

Power consumption whilst not detecting with default dynamic frame rate set 11.2mA @12V (see page 15 for further detail)

Low-speed variant power consumption 27.8mA @ 12V (in low-speed mode).

* Please note that terminal 2 and 7 also serves as the RS232 GND connection and the 0V potential for FET 1 and 2 switched outputs.

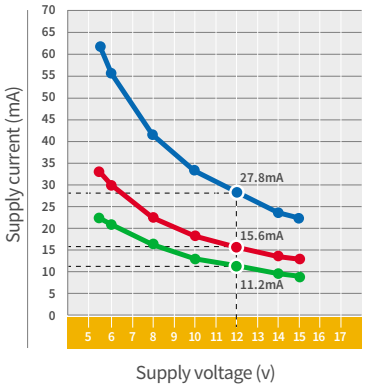


FIG 1: SUPPLY CURRENT **VS.** SUPPLY VOLTAGE

KEY:

- **Low-Speed Variant (in low-speed mode)**
- **Standard Variant Detect**
- **Standard Variant Non-detect (default DFR)**

Power-Up Sequence

Upon initialisation from power-up or *REBOOT! the LED will flash five times to indicate the radar has powered-up correctly.

FET Switched Outputs

The switched outputs are implemented using field effect transistors (FET) operating in pull down mode and connected to 0V.

The FETs are protected by overvoltage circuitry so the outputs are rated at:

Max Voltage 15V
Max Current 50mA

All connections should be made to the unit before applying power.

SYSTEM HARDWARE OVERVIEW

POWER AND COMMUNICATION

RS232 UART Interface

A UART interface is provided that uses RS232 voltage levels on the terminal connector:

Default UART Settings

PARAMETER	SETTINGS
Baud rate	115200
Data bits	8
Parity	None
Stop bits	1
Flow control (handshaking)	None
Transmit delay	0

Communications can be established with the 332 Radar using CA-293 (FTDI USB-232 converter) cable assembly supplied separately. It should be connected as follows:

FTDI Wire Colour	331 Terminal Connection	Function
Black, White or Green	Ov / GND	Ov
Brown	TXD	TXD
Violet	RXD	RXD

Please note: The board attached to CA-293 switches Tx and Rx functions ready for PC connectivity. If a different FTDI USB-232 converter cable is used you might have to switch Tx and Rx functions manually by swapping the violet/brown wires.

RADAR COMMANDS AND CONFIGURATION

RADAR COMMAND OVERVIEW

Commands can be used to control the operation of radar. These are sent over the RS232 UART Link.

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

Operator	Operation
=	Set a parameter to a value e.g.
?	Respond with value or values
^	Set default value for parameter
$	Provide help on the command
!	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>**

Communication Tasks

The operation of the 332 radar has been optimised as a low power device with minimal processing overhead. It is good practice to not 'overrun' the communication line with repeated send commands when the radar is operational.

Command requests to store settings are written to EEPROM each time they are sent from the host system, repeated sending of commands will erode the lifetime capacity of the radars non-volatile memory.

RADAR COMMANDS AND CONFIGURATION

COMMAND LIST

COMMAND	SUFFIXES	DESCRIPTION	DEFAULT	LOWER LIMIT	UPPER LIMIT	COMMENTS
AGD	-	Shows detector type & version information	-	-	-	Reports radar model and version information
*BAUD	? = ^ $	Baud rate for RS232	115200	9600	460800	Baud rates: 9600 115200 230400 460800
*CHAN	? = ! $	Set channel of radar	1	1	4	Comments = When co-locating the 332 it is important to ensure each radar is operating on a separate channel
*COUNTDIR	? = ^ $	Enquire / set the direction of vehicle count	A	-	-	A = Advancing R = Receding B = Bi-Directional
*DEFAULTS	! $	Set all radar parameters to their default values	-	-	-	-
*DEFAULTSTATS	! $	Resets the number of target detections as reported by *STATUS? command	-	-	-	-
*DFR	? = ^	Dynamic frame rate. When set to a value >1, if the radar does not detect a potential target it will not transmit again for the set number of frames	2	0	20	This is used to further reduce power consumption. See page 15. Note: *DFR is NOT available when operating in low speed mode (*OM=LS)
*HELP	? $!	Displays all user commands	-	-	-	-
*HOLDTIME	? = ^ $	The time the switched output is held on after the target has left the detection zone setting global to both outputs	500	10	2000	Values are in milliseconds
*LED	? = ^ $	Enquire / set the operation of the LED on the rear of the unit.	ON	OFF	ON	*LED=0 turns off LED *LED=1 turns on LED
*MM	? ^ $ =	Targets reporting method 1 = Fastest target 2 = Oldest valid tracked target 3 = Average Speed of oldest tracked target	2	1	3	-
*MONITOR	? = ^ $	Switched output 1 will produce a constant demand if no target is seen for the duration of the monitor time	0	0	72	Hours where 0 is off
*MS	? = ^ $	Message type 02 = dd(10fps) 06 = *Sddd (10 fps) 09 = *Sddd (5fps) 12 = *ddd,D Where D is A for advancing and R is for receding	12	02	12	-

RADAR COMMANDS AND CONFIGURATION

COMMAND LIST

COMMAND	SUFFIXES	DESCRIPTION	DEFAULT	LOWER LIMIT	UPPER LIMIT	COMMENTS
*OUT1	? = ^ $	Controls switched output 1 Mode = detect / disabled Low speed threshold High speed threshold Maximum range Direction = A / R / B	– – – – – –	– – 11kph 12kph 40m –	– – 159kph 160kph 180m –	*OUT1 = detect, 11, 160, 180, A<CR> *OUT1=disabled<CR> Note: The Low Speed Threshold can be reduced to 4kph using the *OM command. When *OM is changed the radar will set the LST to the lowest available speed.
*OUT2	? = ^ $	Controls switched output 2 Mode = detect / disabled / count Low speed threshold High speed threshold Maximum range Direction = A / R / B	– – – – – –	– – 11kph 12kph 40m –	– – 159kph 160kph 180m –	*OUT2 = detect, 11, 160, 180, A<CR> *OUT2 = count *OUT2 = disabled Note: The Low Speed Threshold can be reduced to 4kph using the *OM command. When *OM is changed the radar will set the LST to the lowest available speed.
*OUT3	? = ^ $	Controls RS232 output Mode = detect / disabled Low speed threshold High speed threshold Maximum range Direction = A / R / B	– – – – – –	– – 11kph 12kph 40m –	– – 159kph 160kph 180m –	*OUT3 = detect, 11, 160, 180, A<CR> *OUT3 = disabled Note: The Low Speed Threshold can be reduced to 4kph using the *OM command. When *OM is changed the radar will set the LST to the lowest available speed.
*OM	? = ^ $	Change the Operating Mode from Normal Speed to Low Speed.	NS	LS	NS	*OM=NS (normal low speed threshold of 11kph) *OM=LS (low speed threshold down to 4kph) Note: LS mode uses more power (see power and communication section for more information) and *DFR functionality is not available.
*REBOOT	! $	Forces firmware to restart	–	–	–	–
*STATUS	? $	Gives a detailed report showing firmware version, run time, output settings, hold time, baud rate and radar temperature	–	–	–	–
*SU	? = ^ $	Changes the radar's speed unit *SU = K<CR> #SU = K	K	–	–	K = KPH M = MPH
*TEMP	? $	Reports the temperature of the radar processor in Degrees Celsius.	–	–	–	–
*TS	? = ^ $	Simulates a target to test all outputs *TS=1<CR> #TS=1	0	0	1	FET 1 and 2 are set to a permanent detect (low impedance) state RS232 streams constant 88mph / 88kph using current message output setting (*MS)
*ZEROSPEED	? = ^ $	Enables or disables the outputting of a zero speed message to shut down sign after holdtime has expired	1	0	1	*Zerospeed=0 disables the output of 0 speed as the unit exits detect state *Zerospeed=1 enables the output of 0 speed

Note: 1 mph = 1.6093 kph

RADAR COMMANDS AND CONFIGURATION

OUTPUT CONFIGURATION STRING

Using the terminal application via the RS232 it is possible to set up both switched outputs as independent triggers by adding values to *OUT command string. The string will need a carriage return for the setting to be committed to memory.

*Command	Switched Output	Operator	Mode	,	LST	,	HST	,	Maximum Range	,	Direction

PREFIX	MINIMUM	MAXIMUM	DEFAULT	NOTES
*Command	-	-	-	*OUT - followed by switched output you require
Switched Output	1	3	-	Identifies which output you set *OUT1 = FET1 *OUT2 = FET2 *OUT3 = RS232
Operator	-	-	=	= Set a parameter to a value e.g. *LS=50<CR> ? Respond with value or values ^ Set default value for parameter $ Provide help on the command ! Do something e.g. *REBOOT! Reboots the radar
Mode	-	-	-	Function of Switch output Detect Count (*OUT 2 only) Disabled
LST	7 mph 11 kph	98 mph 159 kph	-	Minimum speed the radar will report on
HST	8 mph 12 kph	99 mph 160 kph	-	Maximum speed the radar will report on
Maximum Range	40m	180m	-	The maximum range that the radar will report targets.
Direction	-	-	A	A = Advance R = Recede B = Bidirectional

Please note: The minimum LST and HST is reduced to 4kph and 5kph if a low-speed variant is used, only when operating in the low-speed mode.

Example: ***OUT1 = detect, 30, 50, 70, A<CR>**

Will set FET output 1 to detect targets between 30 and 50 (mph or kph depending on the value of *SU) up to a range of 70 metres when they are advancing towards the radar.

Example: ***OUT1=disabled<CR>**

Will disable FET output 1 from operation in RS232 mode. However, the output can still be set using SW1 and SW3.

Example: ***OUT2=count<CR>**

Will enable the count function on FET output 2 only, and will also provide a count data line in the RS232 output.

RS232 OUTPUT MESSAGE

The speed of a single target of interest can be reported using the RS232 connection. This is typically used to display the actual speed of a target as it approaches the sign.

The ***OUT3** command allows the user to filter which target to report by it's speed, range and direction.

In the case of multiple valid targets at any one time, the ***MM** command allows the user to decide which target to report:

***MM=2 (default, recommended)**

report the valid target that's been tracked for the longest period of time.

e.g. a valid target travelling at 32kph will be reported even if a new 50kph target is seen 3 seconds later.

***MM=3**

Report a smoothed speed of the target that's been tracked for the longest period of time.

e.g. a valid target travelling around 32kph (±2kph) will have its average speed reported over the duration it's been tracked, even if a new 50kph target is seen 3 seconds later.

***MM=1 (not recommended)**

report the valid target with the fastest speed, regardless of distance from the sign or duration of the track.

e.g. a valid target travelling at 32kph will no longer be reported when a new 50kph target is seen 3 seconds later.

The ***MS** command controls the format of a reported message & the rate at which they are sent (these selected formats are backwards-compatible with the AGD330 sign-activation radar):

COMMAND	OUTPUT FORMAT	OUTPUT UPDATE RATE (FRAMES PER SECOND)	EXAMPLE – 30KPH ADVANCING TARGET	EXAMPLE – 160KPH RECEDING TARGET
*MS=2	dd<CR>	10	30<CR>	160<CR>
*MS=6	*Sddd<CR>	10	*S030<CR>	*S160<CR>
*MS=9	*Sddd<CR>	5	*S030<CR>	*S160<CR>
*MS=12	*ddd,A<CR>	10	030,A<CR>	160,R<CR>

RADAR COMMANDS AND CONFIGURATION

RADAR COUNT OUTPUT

The count functionality of the radar is available in two formats. It can be presented as a digital pulse on *OUT2 only (it cannot be configured to be output on *OUT1), and it can be viewed / read from the RS232 data string *OUT3.

Configuration using RS232

The count function can be activated using the *OUT2=COUNT command (detailed in the 'Radar Command List')

With the 'Count' set, it is then possible to set the radar to count advancing, receding or bi-directional targets. These are distinguished on the FET 2 digital output by the length of pulse and in the RS232 string with either a *C,A<CR> for an advancing target, or *C,R<CR> for a receding target.

Vehicle Count Principle of Operation

The range at which vehicles are counted in both advancing and receding directions has been carefully tested and calibrated and is a non adjustable value. The distance for advancing is 20 metres and the distance for receeding is 40 metres.

FET 2 Digital Output

FET 2 in count mode will only pulse 'ON' once per frame to represent a vehicle count, the length of the pulse allows the data to be extracted from the FET 2 output:

35ms 'Pulse' = 1 advancing target counted this frame

55ms 'Pulse' = 1 receding target counted this frame

75ms 'Pulse' = 1 advancing AND 1 receding target counted this frame

Count Accuracy

Free flow, moderate and heavy flow studies have returned an average accuracy of >93%. When the radar is operating in OM=LS mode looking at slow moving traffic, the accuracy will be reduced depending upon variables such as gaps between vehicles.

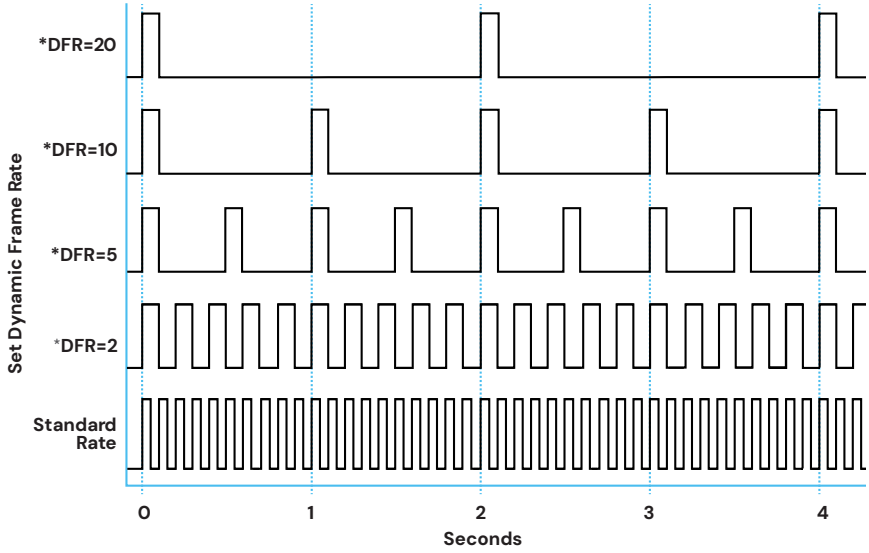
RADAR COMMANDS AND CONFIGURATION

DYNAMIC FRAME RATE (PATENT PENDING)

Dynamic frame rate is used to reduce the power consumption of the 332 whilst no valid targets are being detected. It does this by reducing the number of times the transmitter looks for a target per second, after the 332 has not detected a target for 1 second. You can set the dynamic frame rate anywhere from 0 to 20 with a default value set at 2 by entering the *DFR command. Once a target is detected the transmitter will start operating at its standard rate (10Hz) and will continue to do so until the 332 does not detect a valid target for 1 second.

The dynamic frame rate entered could impact the distance at which a target is seen, the higher the dynamic frame rate the longer it could take to spot another potential target. See table below

DYNAMIC FRAME RATE	ADDITIONAL MAX DELAY TIME (SECONDS)	TYPICAL CURRENT CONSUMPTION @12V (MA)
Standard Rate	0.1	15
*DFR=2 (Default)	0.2	10.5
*DFR=5	0.5	7.8
*DFR=10	1.0	6.9
*DFR=20	2.0	6.5



FIRMWARE UPDATE

The 332 radar is designed to be re-flashable with firmware updates. Please contact AGD technical support for further instruction.

The radar has an update/frame rate of 10Hz (ie a response time of 100ms), can we not decrease the update rate and save more power?

Yes, more power can be saved but the radar has been optimised for use on both urban and high-speed roads. A vehicle travelling at 130kph (80mph) will produce a detection distance latency of about 4m at 10Hz which is of the order of the user range setting intervals. However, the 332 does have a feature to decease the frame rate (*DFR command). Dynamic frame rate reduces the power consumption of the 332 whilst no valid targets are being detected. It does this by reducing the frequency that the transmitter looks for targets when the 332 has not detected a valid target for longer than 1 second (see page 15).

What is the advantage of an FMCW radar over normal sign activation radars that are based on speed detection by simple Doppler only?

An FMCW radar is a much more complicated radar architecture that allows the speed and the range of the target to be measured. This ensures that the sign is always activated at the same target distance. It is one of the main drawbacks with traditional low cost radars that you may have the sign activating at 140m for a truck and only 60m for a small car. Additionally, the set activation distance is almost completely unaffected by rain and fog etc with an FMCW radar compared to a traditional Doppler radar.**

**There are some additional explanatory notes on performance invariance owing to weather.

The radar I currently use sometimes has a large delay in detection of an approaching vehicle and hence sign-activation when a large target is receding in the adjacent carriageway. Is this improved with the 332?

The 332 radar processes many targets simultaneously so the detection distance for the oncoming vehicle can be detected even when there are large receding targets.

Why is the ability to set a reliable sign activation distance so important?

If the detection distance is too short the driver has no response time to absorb the sign's message. If the detection distance is too large the sign is illuminated for a longer duration and hence more power is used which can be critical in low power applications. You need the sign to be on for just the right duration and at the right distance for the value of the sign message to be delivered to the driver. This distance will vary with the site and with the sign message.

Why is the LED on the 332 flashing repeatedly or intermittently?

The operational voltage supply range for the radar is 5.5 to 15Vdc (nominal 12Vdc). It is possible, especially in solar & battery based installations that the voltage supply level can fall outside the specified limits. Operation of the radar is not guaranteed outside these limits and incorrect operation can be manifest in an erratic or flashing LED state. Please check the voltage supply and reconnect the radar.

TROUBLE SHOOTING

The 332 radar can be re-flashed. What does this mean?

There is a development plan to include new features in the radar going forward. Customers who use a current version of 332 will not be disadvantaged by not having access to these new features. Re-flashing means we can email new application code that can be uploaded into the 332 radar over the RS 232 link which will enable new functions as they are available. There is no requirement for the customer to return the hardware to AGD for upgrade.

The sign has been EMC tested and the radar has a CE mark. If I put the radar on the sign will that be enough to legally put this on the market in the EU?

This is not a safe assumption to make. There are special directives and associated specifications in the EU regarding radio devices (radar is classed as a radio device) and care should be taken on building a file for conformity. AGD has good experience on this and can give guidance or your usual Notified Body will give you independent advice on your required test documentation, Declaration of Conformity and product labelling etc.

The accuracy of the speed measurement appears very good in the documentation is this likely to be the same for real targets?

The real world is a complex place and there are several known effects that can affect the speed accuracy. For a single target at 50m travelling directly towards the radar with a speed of 60kph will return a speed reading from the radar of 60kph ±3 with close to 100% confidence level. If the vehicle is quite close to the radar such that it is starting to 'pass' the sign, the vehicle is no longer travelling directly towards the radar and an angle is formed between the direction of travel of the target and the boresight of the radar. In this case the speed of the target is effectively reduced at the radar by the cosine of this angle. Additionally, if the radar is used on a dual carriageway two vehicles in the adjacent lanes at similar distances travelling at a speed difference <8kph will have their speeds merged by the radar. In this specific case, the speed output of the radar will be between the two vehicle speeds.

The radar has a high speed measurement specification of 160kph (99mph). What happens for targets travelling above this speed?

For targets travelling above the upper speed threshold limit there will be no output from the radar in normal operation. The radar will 'see' the target but not in a meaningful way that will allow the radar to make an output.

If we need the radar to output for targets over 160kph (100mph) is there anything that can be done?

The radar has been optimised for low power and as a result the speed processing task has been restricted to keep the processing overhead low. The upper threshold for speed could be increased but at the expense of current consumption. This change is not a simple internal radar setting and would require a revision to the radar operational firmware.

TROUBLE SHOOTING

How accurate is the speed measurement?

The speed measurement algorithm in the 332 radar is a cut-down version of the speed measurement algorithm used in high grade speed enforcement radars manufactured by AGD. The 332 radar outputs the speed of the target to the nearest integer. It is rounded to the nearest integer from a calculation of more significant figures. Each radar is calibrated with a tolerance of +/-3kph using AGD's traceable calibration equipment. Calibration results are available upon request for each serial numbered radar.

The target range measurement is treated in the same way as the speed measurement.

RADAR CHARACTERISTICS

Radar Antenna

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

PARAMETER	SPECIFIED	NOTES
Horizontal beam-width	33˚ approx	-3dB
Vertical beam-width	33˚ approx	-3dB
Side-lobe suppression	16dB	Minimum
E-Field	Vertical	Plane polarised

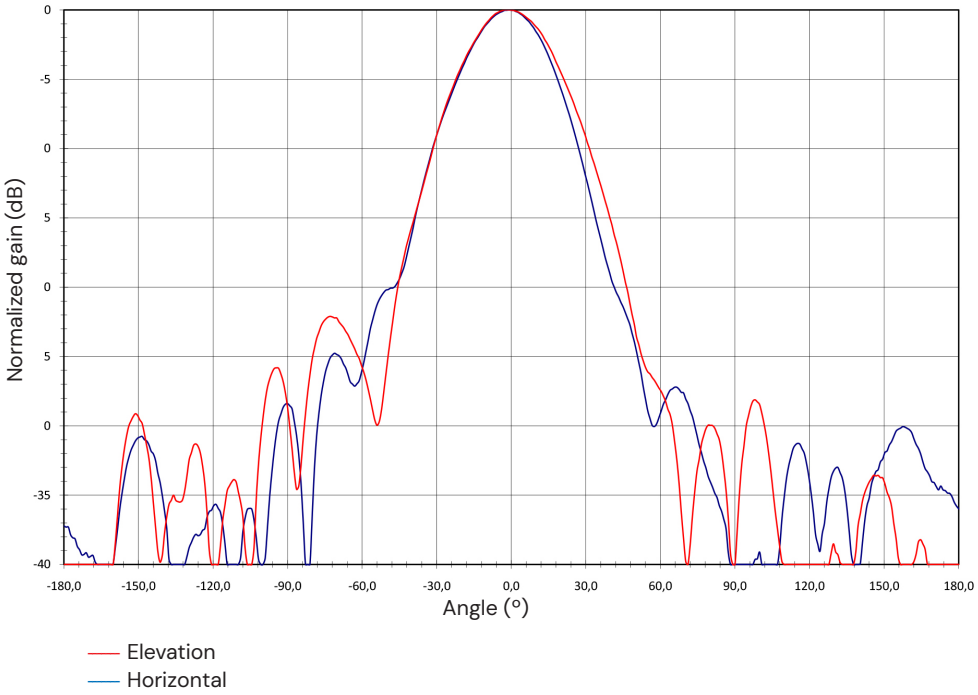
Operating Frequency Band and Power

The standard variant radar frequency and power is as follows:

PARAMETER	SPECIFIED	NOTES
Transmit centre frequency (CHAN1)	24.163GHz	FCC compliant variant - 24.088GHz
Transmit centre frequency (CHAN2)	24.188GHz	FCC compliant variant - 24.113GHz
Transmit centre frequency (CHAN3)	24.213GHz	FCC compliant variant - 24.138GHz
Transmit centre frequency (CHAN4)	24.238GHz	FCC compliant variant - 24.163GHZ
Transmit bandwidth	14MHz	
Transmit power EIRP	<100mW	
Field strength	<500mV/m	@ 3m
ITU code	13M3FXN	

RADAR CHARACTERIISTICS

ANTENNA PLOTS



RADAR CHARACTERIISTICS

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
EU Compliant - 24.200GHz	No current restrictions within the EU	AU, NZ, ZA*, KR*, TR	*May require local approval
FCC Compliant - 24.125GHz	IE, UK, BE, DK, ES, FI, EL, IT, NL, PT, SE, NO,	USA, CA, BR*, „ QT, AUca NZ, US, ZA, KR, VN	FCC compliant variant *May require local approval

This table is periodically updated: if the required country is not shown please enquire on availability.

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		
Frequency allocated but EIRP too high	none currently identified	

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.

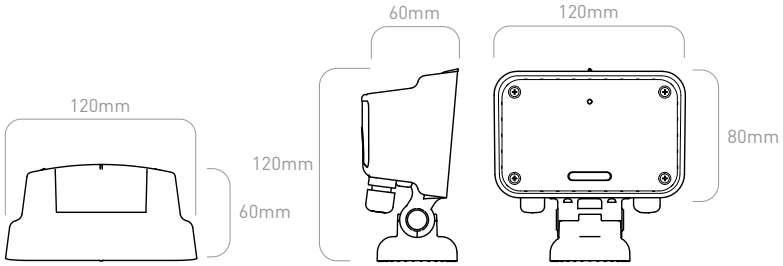
(Note: Countries are listed by their ISO 3166 2 letter code)

TECHNICAL SPECIFICATIONS

PRODUCT DIMENSIONS

AGD332

Sign Activation Radar



SPECIFICATIONS	
Description	Sign-Activation Radar
Technology	FMCW Doppler Radar
Frequency	24.15GHz to 24.25GHz (EU) / 24.075GHz to 24.175GHz (FCC)
Mounting Height	2-5m nominal (optimum 3m)
Range/Zone	Up to 180m (dependent on sign mounting and user selection)
Low Speed Threshold	11 to 160kph or 4 to 160kph (depending on the selected mode)
Direction	Advance / Recede / Bidirectional
Operating Temp	-20°C to +60°C
Power Supply	5.5/15V dc
Current	Detect: 15.6mA nominal @12Vdc Non-Detect: 11.2mA nominal @12Vdc Low Speed Mode: 27.8mA nominal @12Vdc
Housing Material	UV Stable Polycarbonate
Housing Finish	Self Coated Black
Detect Outputs	x2 FET Switched / x1 RS232
Weight	300g nominal
User Adjustments	Full configuration of all parameters via RS232
Approvals	EN 301 489, EN 50293, EN 300 440, FCC CFR47 Part 15.245, RSS-210, AS/NZS 4268

ACCESSORIES

923

Target Simulator

MS-226

USB - RS232 Converter

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

RoHS COMPLIANT

Restriction on Hazardous Substances

AGD
PRODUCT SOLUTIONS FOR
INTELLIGENT TRAFFIC SYSTEMS

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Declaration of Conformity
Certificate No: UKCA-084 Issue: 1

We AGD SYSTEMS LTD
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UNITED KINGDOM

declare that the DoC is issued under our sole responsibility and belongs to the following product:(s)

Equipment Model Type(s): 332-1xx-xxx

Equipment Description: Sign-Activation Radar

conform with the relevant UK Statutory Instruments (and their amendments):

The Radio Equipment Regulations 2017 (SI2017/1206)

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (SI 2012/3032)

and that the following standards have been applied:

EMC:	EN 50293:2012 EN301 489-51 V2.1.0 EN 301 489-1 V2.1.1
Safety:	EN 62368-1:2014/AC:2015, EN 50556:2011 EN 62479:2010
Spectrum	EN300 440 V2.2.1
ROHS	EN IEC 63000:2018

UK Approved Body Element Materials Technology Warwick Ltd 0891

UKCA Type certificate: EMA22RER0003

Signed Dated: 25/1/22 Place of issue Glos UK

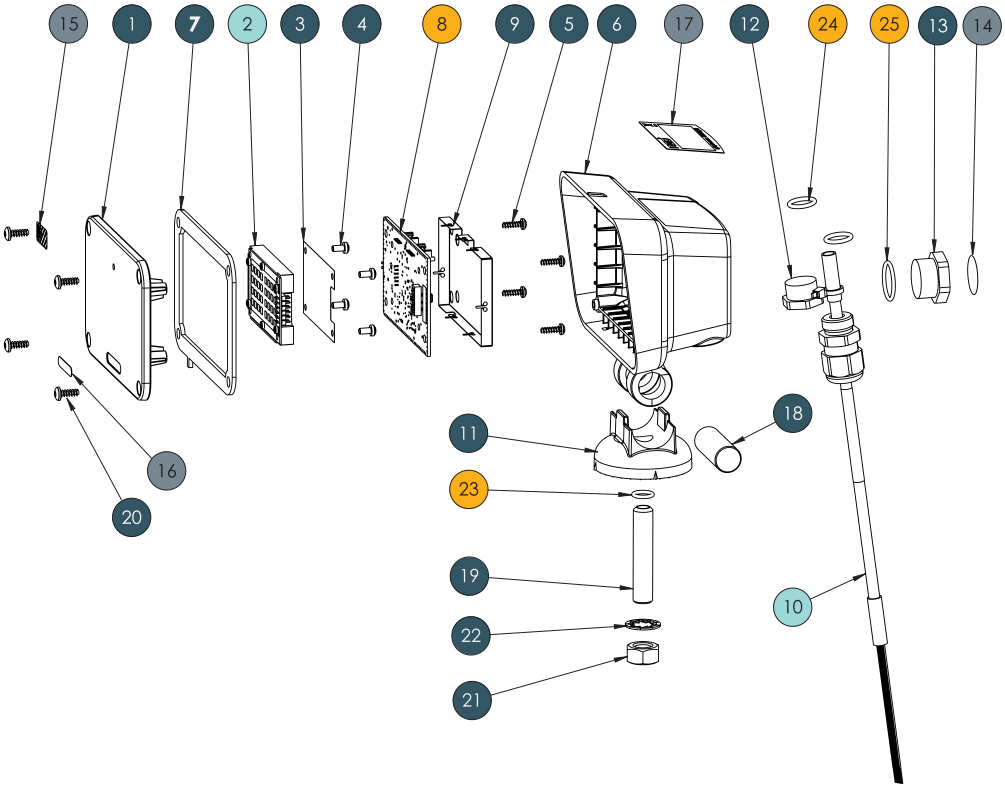
For and on behalf of AGD Systems Ltd
P M Hutchinson Managing Director

safer, greener, more efficient

Registered in England and Wales No. 2666988

END OF LIFE

DISPOSAL INSTRUCTIONS (EOL)



Item	Qty	Material
1	1	Polycarbonate
2	1	Printed Circuit Board
3	1	Polyester
4	4	Stainless Steel
5	4	A2 Stainless Steel
6	1	Polycarbonate
7	1	Neoprene
8	1	Printed Circuit Board
9	1	Nickel Silver
10	1	Metal, PVC, Nylon
11	1	Polycarbonate
12	1	Nylon
13	1	Nylon

Item	Qty	Material
14	1	Polyester
15	1	Polyester
16	1	Polyester
17	1	Polyester
18	1	Aluminium
19	1	Stainless Steel
20	4	A2 Stainless Steel
21	1	Stainless Steel
22	1	Stainless Steel
23	1	Nitrile
24	2	EPDM
25	1	Nitrile Rubber

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

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.

   • 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 Pty Ltd could void the user's authority to operate the equipment.

IMPORTANT

SAFETY PRECAUTIONS (CONTINUED)

7. This Product is Compliant with the European Radio Equipment Directive 2014/53/EU & UK Radio Equipment Regulations 2017 (SI2017/1206)

   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 332 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.

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DISCLAIMER

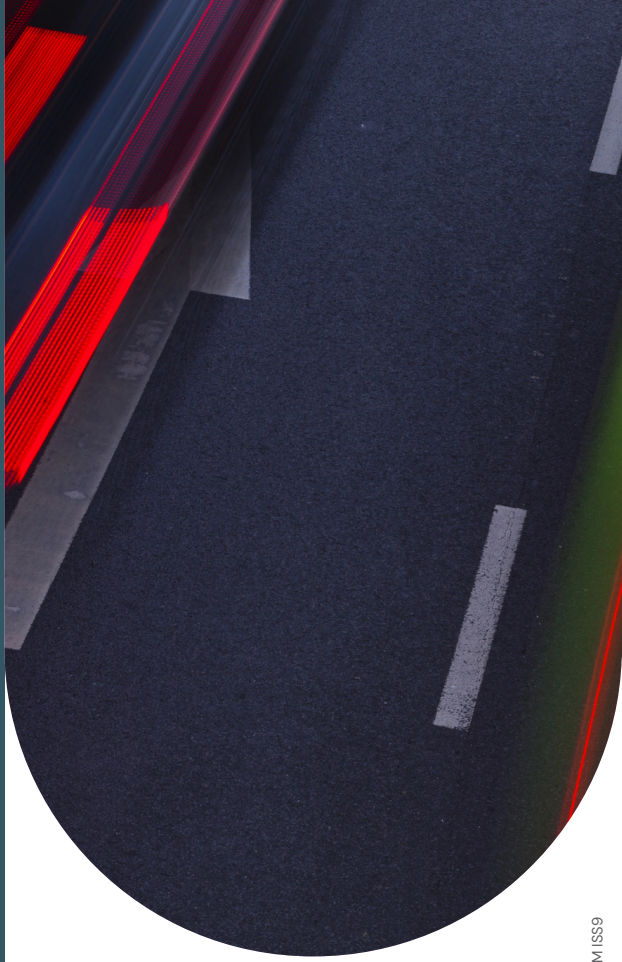
While we (AGD Systems) endeavour to keep the information in this manual correct at the time of download or print, we make no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to the information, products,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

Revision
Issue 9 June 2022



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