



USER MANUAL - DOS048-004

AMG Microwave

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USER MANUAL - DOS048-004

1. Introduction and Summary

The purpose of this document is to provide a short technical description of the DOS048-004 radar.

The following, are the main topics developed by the document:

- General description of radar and of its operating principles
- Features and specifications of the RF module
- Description of signal processing
- Description of Input / Output signals
- Mechanical characteristics of the radar
- Product performance

2. Abbreviations

FMCW	Frequency Modulated Continuous Wave
FSK	Frequency Shift Keyed
VCO	Voltage Controlled Oscillator
FFT	Fast Fourier Transform
DSC	Digital Signal Controller



3. General description

3.1 DOS048-004 shortcut

The DOS048-004 is a low consumption K band pedestrian presence sensor. It operates in FSK mode at 24.125GHz with a pulse frequency of 100 kHz and pulse width emission of 3μs. Two low frequency signals are created by the FSK; their phase difference indicates the distance of the moving target. The gap between the two FSK frequencies is around 300 kHz.

A DSC generates pulse signal control, samples the two Doppler signals and updates 4 open collector outputs. The software is based on FFT where an analysis of the activity is done according to the distance.

The antenna aperture is greater than 90 degrees, four sensors are enough for omnidirectional detection and a switch selects the address of the sensor.

Power supply: 12 V @ 16mA

3.2 Measuring principle

The phase measure between two Doppler signals produced by two different radar frequencies, can measure the distance between the target and the radar.

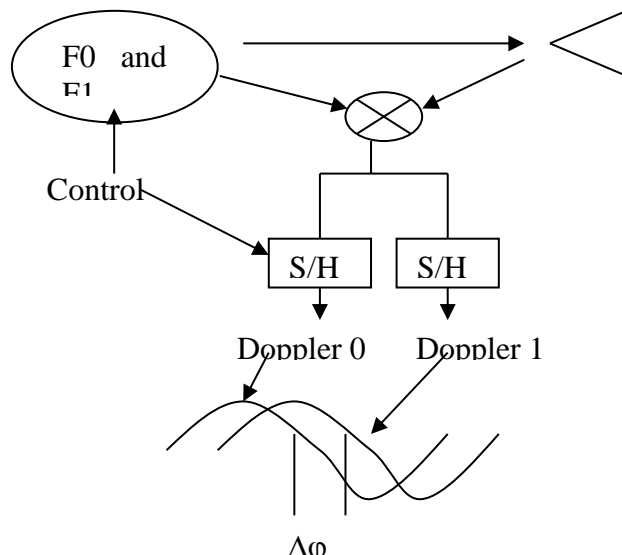


Figure 1. FSK radar schematics

$$\Delta\varphi = \frac{4\pi}{\lambda_1} D - \frac{4\pi}{\lambda_0} D = \frac{4\pi D \Delta F}{c}$$

Where D is the distance, ΔF the frequency difference and c the speed of light

In this device the Doppler signal enables the measuring of speed and, with the help of FSK, allows the measuring of distance.



3.3 System description

The radar operates in the 24 GHz ISM band. Four independent radars can be connected in series by a web of multi-wire planar cables/ribbon cables with 12 points. Each radar monitors an area of 90 degrees over a distance of 0 to 35m. The distance detection area can be programmed by the user.

In the 8-pin HARWIN connector we have: the 12v power supply, 4 TOR/digital outputs and a UART communication bus.

A digital/TOR (on-off control) output is short-circuited if its corresponding radar detects the movement of a pedestrian in his beam.

The link is used to program or to receive all information of speed and distance.

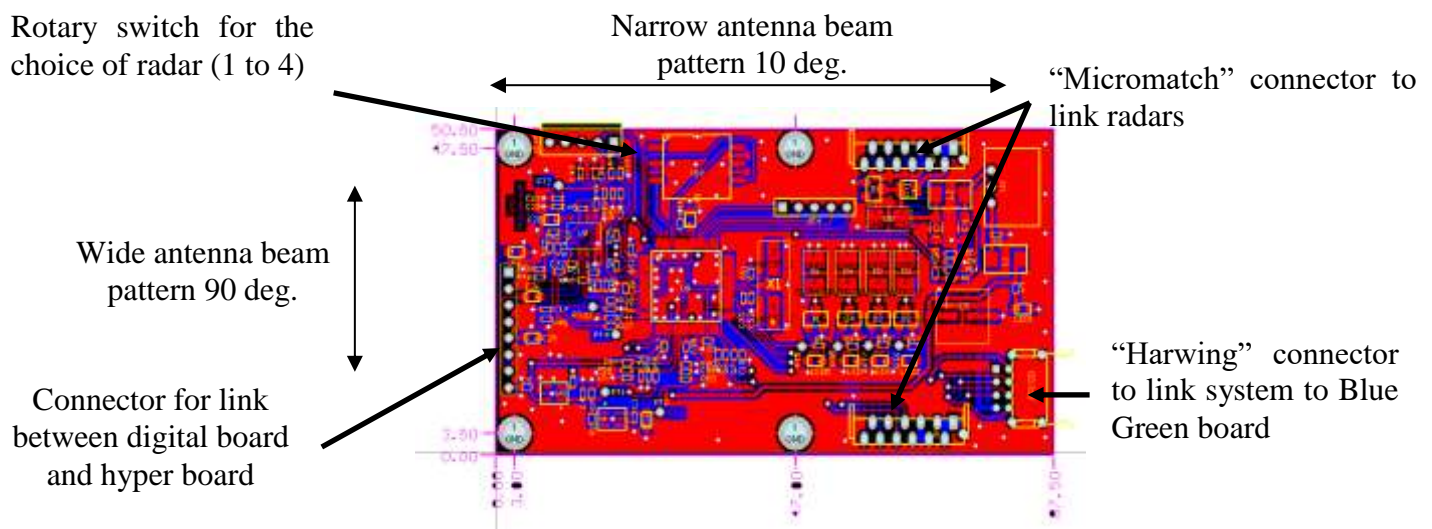


Figure 2. Radar and connectors diagram

All 4 radars detect simultaneously. Each radar can trigger an alarm. The customer PC board can read the characteristics of the target: speed, distance, power.



3.4 Specifications

Section	Description	Min	Typ.	Max.	Unit
Transmitter	Frequency (1)	24.05		24.250	GHz
	Emission peak power			8	dBm
	Emission average power		-12		dBm
	Emission time		1		us
	Emission frequency		10		kHz
Antenna	Antenna gain		12		dB
	Vertical -3dB aperture		100		Deg.
	Horizontal -3dB aperture		7		Deg.
Supply	Tension	8		30	V
	Power supply per radar for 12V		12		mA
Mechanical	Dimensions LxWxH		93x74x30		mm
Environmental	Operating temperature	-30		70	°C
	Storing temperature	-50		80	°C
Analog outputs	TOR output		Open drain		
	IDS current			0.9	A
	VDS tension			30	V
Serial communication	RX and TX in LVTTTL		3.3		V
	Logic		Positive		
	Debit		9600		Bits/s
	Number of bits		8		Bit
	Parity		Without		
Performance	Control flow		Without		
	Speed range	1		56	km/h
	Speed resolution		0.2		km/h
	Speed accuracy		NA		
	Distance range	0		50	m
	Distance resolution		1		m
	Distance accuracy		10		%
	Detection distance for 1m ²		30		m
	Response time	1			s

(1) : For Europe from 24.15 GHz to 24.25 GHz

(2) : For the USA from 24.075 GHz to 24.175 GHz



3.5 Antenna diagram

Transmission and reception antenna have the same diagram.

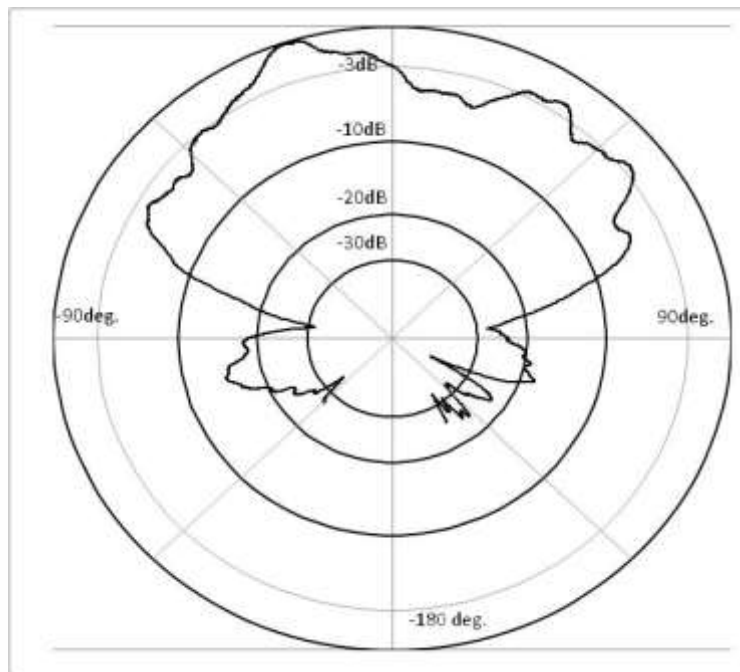


Figure 3. Vertical (elevation) plan diagram, with plexi glass plate

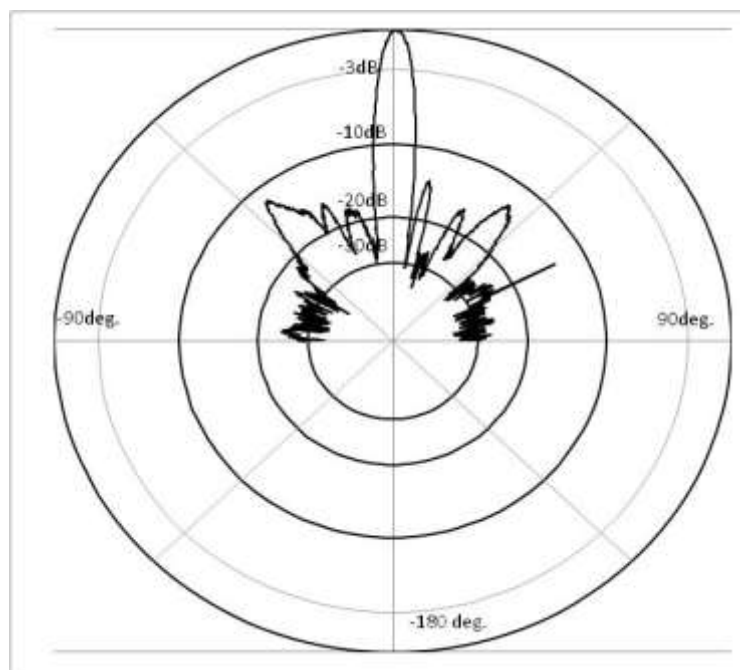


Figure 4. Horizontal (azimuth) plan diagram, with plexi glass plate



4. Hardware

4.1 DOS048-004

DOS048-004 is an OEM radar module formed by two parts: the first is composed by a board with power supply and processor. The second, a board with the microwave part.

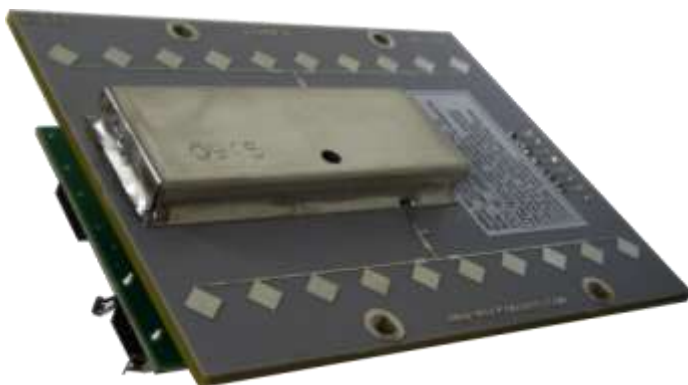


Figure 5. DOS048-004

4.2 Hardware architecture

The radio board has the following functions:

- A VCO tuned for 24 GHz ISM band
- A radio amplifier
- A mixer
- A low frequency amplifier

The processing board consists of the following:

- A supply
- An UART interface
- A processor
- A low frequency amplifier
- 2 connectors for neighbors' sensors
- 1 connector for customer PC board



4.3 Mechanical Outline

All dimensions are in mm

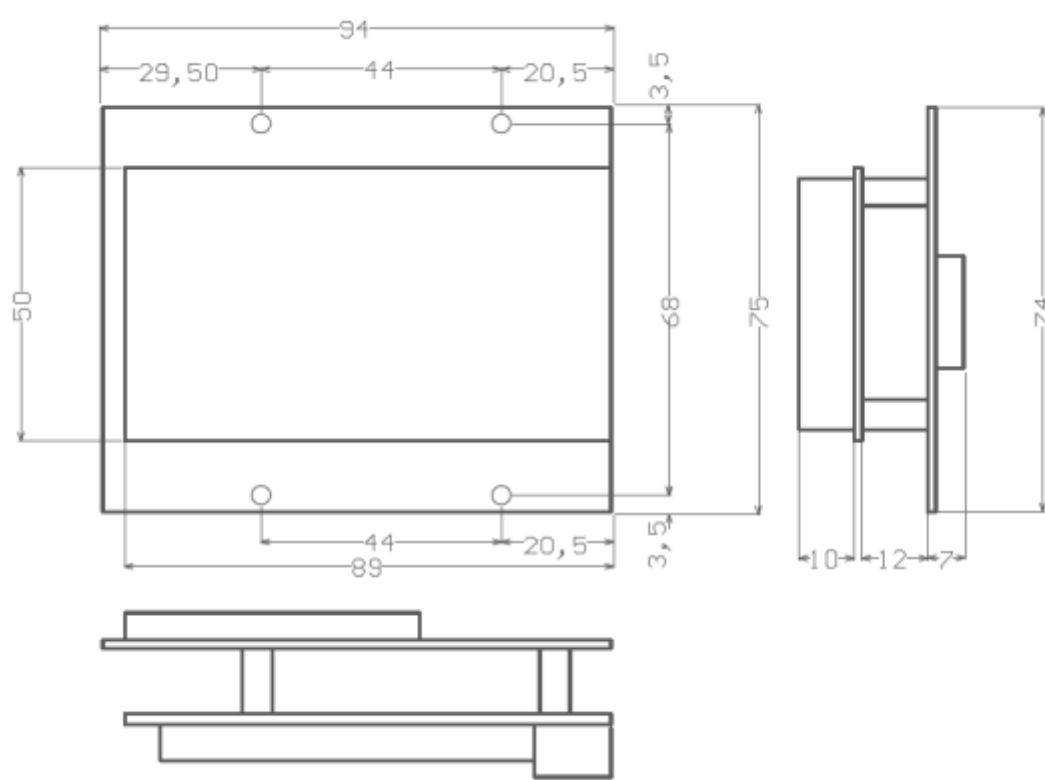


Figure 6. DOS048-004 Mechanical Outline (front, top and lateral)

4.4 Data interfaces and connectors

The “Micromatch” radar connectors link each radar to the next.

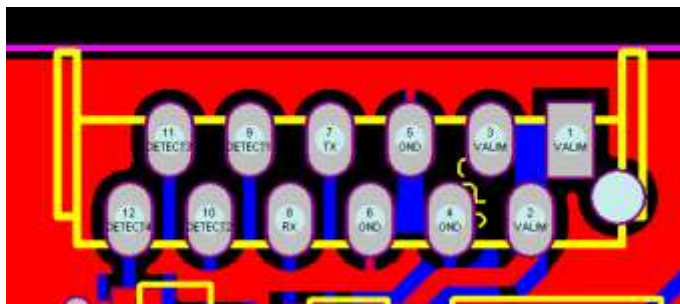


Figure 7 : "Micromatch" connector broaching

Table 1: "Micromatch" connector broaching

Pin	Signal
1, 2, 3	Valim: Supply voltage +12V
4, 5, 6	GND : 0V
7	TX: Data transmission to Blue Green board. LVTTTL level.
8	RX: Data reception from Blue Green plan. LVTT level.
9	DETECT1
10	DETECT2
11	DETECT3
12	DETECT4

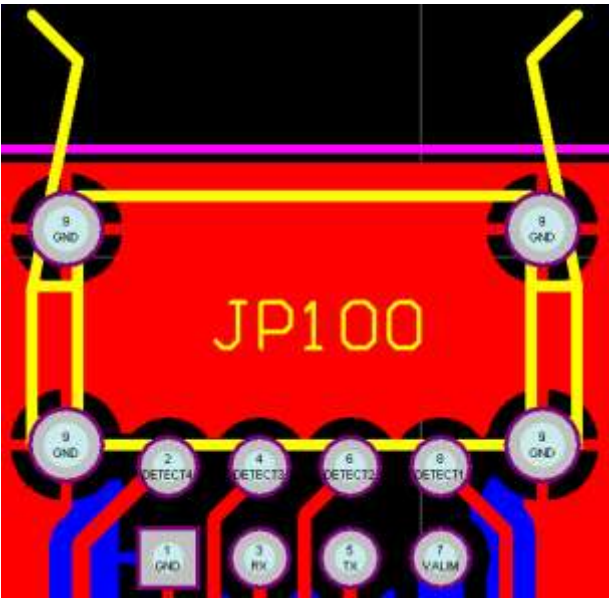


Figure 8 : “Harwin” connector broaching

Table 1 : “Harwin” connector broaching

Pin	Signal
1	GND
2	DETECT4
3	RX: Data reception from Blue Green plan. LVTTTL level
4	DETECT3
5	TX: Data transmission to Blue Green plan. LVTTTL level
6	DETECT2
7	Valim: Supply voltage +12V
8	DETECT1



4.5 Serial links

Each radar is equipped with 2 “Micromatch” connectors of 12 points. The radars are linked to their neighbours by two multi-wire planar cables.

The radars function in slave mode: a “response frame” is returned after the reception of a “command frame”.

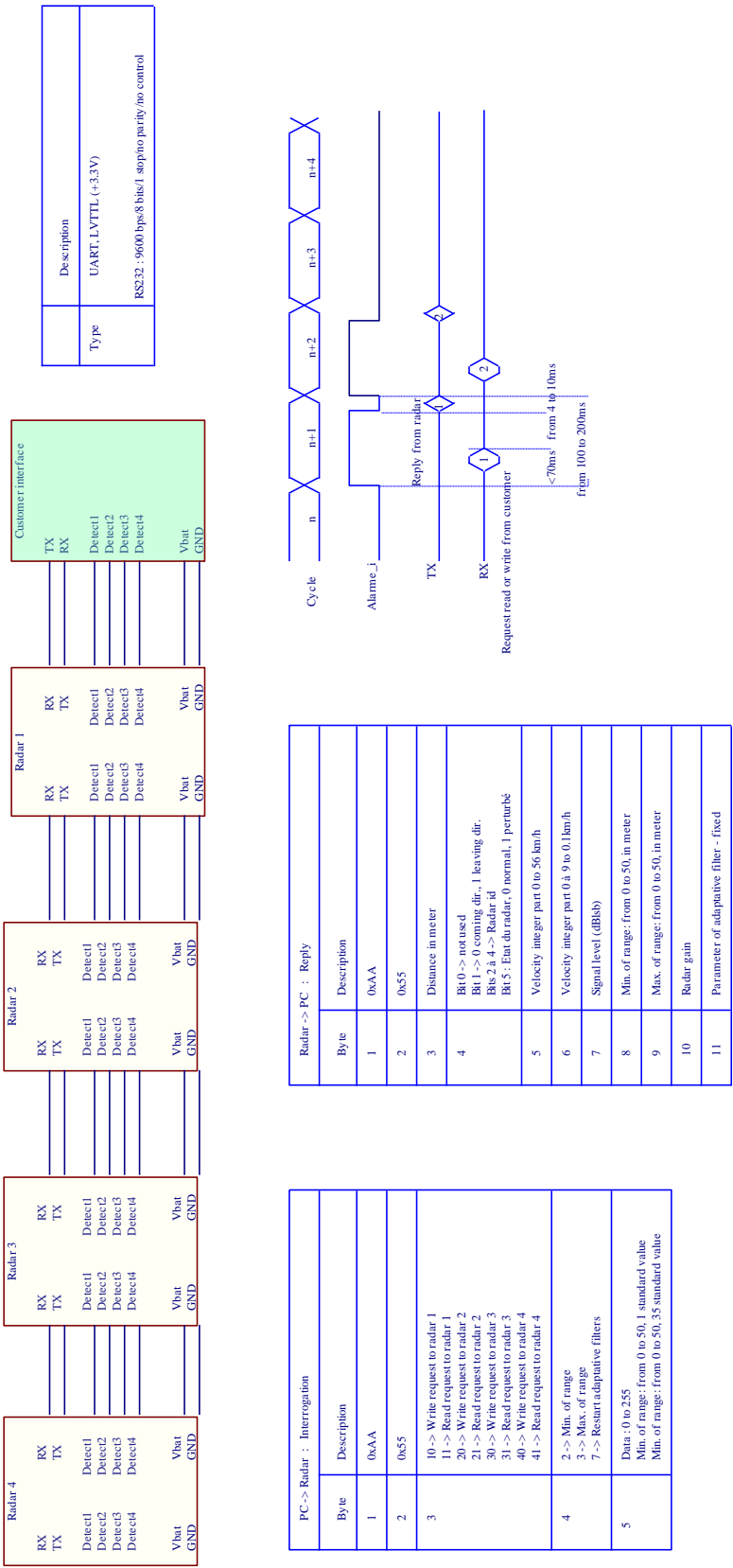


Figure 9. Serial link diagram



5. Designated use

The DOS048-004 is suitable for detection of targets inside a precise area (less than 50m) in a quadrant of 90 degrees and more.

Signal processing with an adaptive filter suppress hazardous detection. The DOS048-004 is designed to detect targets in very adverse operating conditions.

DOS048-004 starts operating as soon as the power supply is on, it does not need particular parameters.

Its consumption is very low, it can be integrated in security systems powered by battery, solar cells or long wire cables.

Typical applications:

- Security
- Sport
- Traffic control



6. Declaration of conformity

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

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

This equipment complies with FCC's radiation exposure limits set forth for an uncontrolled environment under the following conditions:

1. This equipment should be installed and operated such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and user's/nearby person's body at all times.
2. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Changes or modifications not expressly approved by AMG Microwave for compliance could void the user's authority to operate the equipment.

The technical specification of this document is approved by:

AMG Microwave

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