

CONTENTS

CONTENTS	1
TABLE OF FIGURES	2
THEORY OF OPERATION	3
PRODUCT DESCRIPTION	4
1 DELIVERY	4
2 LABELS LOCATION	4
2.1 IDENTIFICATION LABEL	4
2.2 SERIAL NUMBER	4
3 SETTINGS	4
SAFETY PRECAUTIONS	5
CABLING	6
PARAMETERS DESCRIPTION	7
1 DISTANCE “MOVEMENT”	7
2 DISTANCE “PRESENCE”	7
3 MAXIMUM RELAY HOLD TIME	7
4 SENSITIVITY SETTING	7
5 SELF-MONITORING	7
6 RF CHANNEL	7
CONFIGURATION – TUNE UP	8
1 ENCODER 1	8
2 ENCODER 2	8
LED INDICATOR	9
1 IN NORMAL OPERATION	9
2 WHEN THE SELF-MONITORING DETECTS AN ERROR	9
INSTALLATION GUIDE	9
1 GENERAL	9

2 ASSEMBLY AND MOUNTING	9
3 KEY POINTS	10
4 DETECTION ZONE	12
5 IMPACT OF THE TILT ANGLE	12
6 SPECIFIC INSTALLATION CASES	13
6.1 CURVED LINE	13
6.1.1 Situation	13
6.1.2 Best practices	14
6.2 INSTALLATION ON A HORIZONTAL POLE	15
COUNTING FUNCTION	15
WHAT TO TRY IF...	15
TECHNICAL FEATURES	16
WARRANTY	16
DECOMMISSIONING	17
FURTHER INFORMATION	17
1 LEGAL NOTIFICATION	17
2 VERSION	17
3 THE MANUFACTURER:	17

TABLE OF FIGURES

FIGURE 1: DELIVERY	4
FIGURE 2:TMA-122 HV RADAR CONNECTOR - WEIPU SP2112/P7	6
FIGURE 3: TMA-122 LV AND MV RADAR CONNECTOR - WEIPU SP1712/P9	6
FIGURE 4: FRONT FACE	8
FIGURE 5: ENCODERS & LEDs	8
FIGURE 6: FRONT FACE WITH/WITHOUT STICKER	8
FIGURE 7: BRACKET ELEMENTS	9
FIGURE 8: BRACKET ASSEMBLY	10
FIGURE 9: BRACKET POSITION, PARALLEL TO THE TRAFFIC	10
FIGURE 10: 45° TILT ANGLE	10
FIGURE 11: VIEW FROM THE FRONT OF THE SIGNAL HEAD: RADAR IS LEANING	10
FIGURE 12: TRAFFIC LIGHT IS ON THE LEFT SIDE FROM THE CARS	11
FIGURE 13: VIEW FROM BEHIND - INSTALLATION SET WHEN THE TRAFFIC LIGHT IS ON THE LEFT SIDE FROM THE CARS.	11
FIGURE 14: PAY ATTENTION TO OBSTACLES	11
FIGURE 15: SIDE MOVEMENTS	11
FIGURE 16: STATIONARY + MOVEMENT ZONE (0-10 M) / MOVEMENT ZONE (0-60 M), H = 3,5 M, 45°TILT ANGLE.	12
FIGURE 17: IMPACT OF THE TILT ANGLE	13
FIGURE 18: DETECTION AXIS ON CURVED ROAD	13
FIGURE 19: STOP LINE AT AN ANGLE	14
FIGURE 20: RADAR INSTALLATION AT THE LEFT SIDE OF THE VEHICLES	14
FIGURE 21: HORIZONTAL POLE – OVERVIEW	15
FIGURE 22 : TMA-122 ON A HORIZONTAL POLE, NOT TILTED	15

THEORY OF OPERATION

The TMA is a microwave sensor for traffic management (traffic data collection, intersection management, warnings, public lighting management), available in different configurations according to the applications.



intersection The TMA-122 is a microwave sensor for intersection management. The output consists of 2 relays which can be triggered on movement and/or when vehicles stop at the stop line. The product can count the vehicles which are passing the stop line.

1. Unpack the unit and check the following items are in the box:
 - A. Radar with rear side socket
 - B. Cable with connector
 - C. Mounting bracket
 - D. User's guide and tune up procedure
2. Set the encoders according to your choice for the different parameters (see "Tune up procedure"). For specific TMA configurations, the setup is made through RS-232. The encoders are then inoperable.
3. Place the sticker on the front face.
4. Assemble the unit with the bracket (see "Tune up procedure").
5. Place the radar on the field according to configuration and to the specific tune-up procedure.
6. Connect the cable according to CABLING, p. 6.
7. Power the radar.
8. The LEDs will come on when a vehicle is detected and matches the conditions of the chosen parameters.

PRODUCT DESCRIPTION

1 DELIVERY

Some configurations may have a different cable and/or bracket. See tune up procedure for more details.



Figure 1: delivery

2 LABELS LOCATION

2.1 IDENTIFICATION LABEL



2.2 SERIAL NUMBER



**Do not remove
the labels**

3 SETTINGS

Depending on the TMA configuration chosen, the settings are either done using 2 encoders with 16 positions each or using RS-232 serial communication. See “Tune Up Procedure” for the parameter settings.

SAFETY PRECAUTIONS

Only skilled and instructed persons should carry out work with the radar product. Experience and knowledge about safety procedures in the following areas may be relevant:

- Working with mains power
- Working with modern electronic and electric equipment
- Working at height
- Working at the roadside or highways

Please follow these safety precautions:

- Make sure the electricity supply is within the range shown on the label and the manual of the product.
- All connections must be made whilst the power supply is switched off.
- Ensure the wiring is correct as shown in the manual before switching on the power supply.
- Never use a damaged radar or cable.
- Opening the outer casing is deemed dangerous and will void all warranties.
- Ensure the radar is mounted correctly. The screws and bolts of both radar and bracket must be firmly tightened. The radar needs to point to the region of interest for proper detection.
- Ensure the radar is configured properly.

WARNING: For the HV version of the radar, a Residual Current Device (RCD), also known as the Residual Current Circuit Breaker (RCCB), with a tripping current not exceeding 30 mA must be installed in the supply circuit.

CABLING



CAUTION: positive security/fail safe relays - contacts given for powered radar.

LV (12-60 V DC – 10-30 V AC) & MV (21-75 V DC – 15-54 V AC)		
PIN nr	Color	Function
1	RED	Power ~ (AC), + (DC)
2	BLUE	Do not connect
3	BLACK	Power ~(AC), - (DC GND)
4	BROWN	NC relay 2
5	WHITE / VIOLETT	COM relay 1
6	GREY	NO relay 1
7	YELLOW	NC relay 1
8	GREEN	COM relay 2
9	PINK / ORANGE	NO relay 2

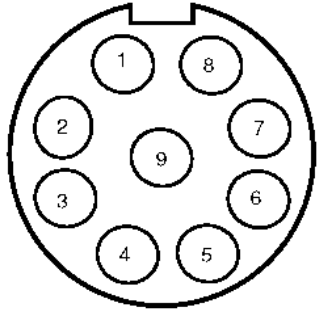


Figure 3: TMA-122 LV and MV radar connector - Weipu SP1712/P9

HV (100-240 V AC)		
PIN nr	Color	Function
1	BLUE	~ Power Supply
2	BROWN	~ Power Supply
3	YELLOW/ GREEN	EARTH
4	WHITE	COM relay 1
5	GREY	NO relay 2
6	YELLOW	COM relay 2
7	PURPLE	NO relay 1

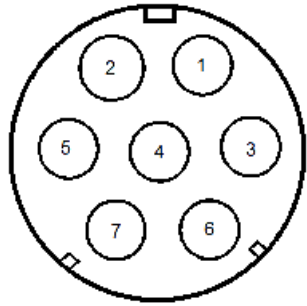


Figure 2: TMA-122 HV radar connector - Weipu SP2112/P7

USER'S OUTPUTS

Resistive load: 30 V AC 0.3A - 60 V DC 0.3A
 Option 250 V relay: 250 V AC – 30 V DC – 0.3 A

REMARKS

- Make sure the plug is fully inserted in the socket and the cap is firmly tightened on the socket.
- Please disconnect the radar from power before maintenance intervention.

PARAMETERS DESCRIPTION

Depending on the chosen TMA configuration, the settings are made using two encoding wheels with 16 positions each and/or using an RS-232 link.

The parameters described here are for the TMA-122 configuration. Other parameters may apply to other TMA configurations.

See further in this document, p. 8 for the parameters setting.

1 DISTANCE “MOVEMENT”

The TMA-122 detects the approaching movement at a distance of about 60 meters from the installation point. It is possible to limit this distance to 20 m with encoder 1 (see p. 8). When an approaching movement is detected in this area, the radar toggles the relay 2. When there is no vehicle or only stopped vehicle(s) (no movement), the relay is not activated.

Vehicles moving away from the sensor are not detected.

2 DISTANCE “PRESENCE”

The TMA-122 detects the approaching moving and stopped vehicles at a distance of 10 or 15 m from the installation point. When a movement is detected in this area, the radar toggles the relay 1 and tracks the vehicle. It holds the relay activated as long as the vehicle is in the detection area, be the vehicle moving or not.

Vehicles moving away from the sensor are not detected.

3 MAXIMUM RELAY HOLD TIME

This setting defines the maximum hold time for the relay. After this time, the radar will reset the relay, regardless of the presence of a vehicle.

4 SENSITIVITY SETTING

The factory setting fulfills the requirements of the majority of the installations. If the position or the size of the detection area is not satisfactory, change first the position of the radar (tilt angle and/or height of installation).

5 SELF-MONITORING

The self-monitoring monitors the following parts of the hardware:

- Micro-wave device (VCO)
- Mixers
- Analogic format channel
- Analogic/digital converter
- Micro-processor oscillator
- Code running

When a failure is detected, the relays are permanently actuated and the LEDs flashing show an error code (see further, p. 9). The radar is reset after 1 hour.

6 RF CHANNEL

This parameter allows to shift the radar's frequency. If two units face each other, they must be put on different channels, so they don't interfere with each other.

CONFIGURATION – TUNE UP

You can set different parameters through 2 encoders allowing 16 positions each.

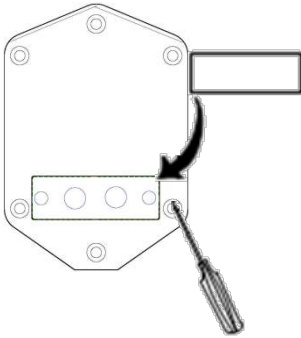


Figure 4: front face

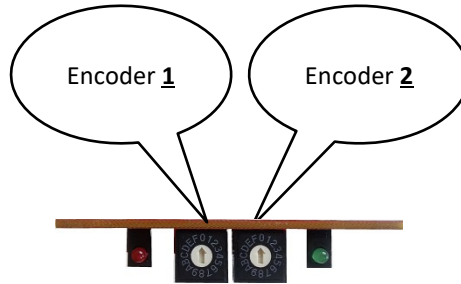


Figure 5: encoders & LEDs

1 ENCODER 1

Besides red LED, at the left facing the housing

Parameter	Value															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Encoder position																
Distance "movement" (relay 2)	60 m								20 m							
Distance "presence" (relay 1)	10 m				15 m				10 m				15 m			
Max. relay hold time (min)	2	4	8	16	2	4	8	16	2	4	8	16	2	4	8	16

Factory setting = 0

2 ENCODER 2

Besides green LED, at the right facing the housing

Parameter	Value															
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Encoder position																
Sensitivity	Normal								Low							
Self-monitoring	Active				Inactive				Active				Inactive			
RF channel	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4

Factory setting = 0

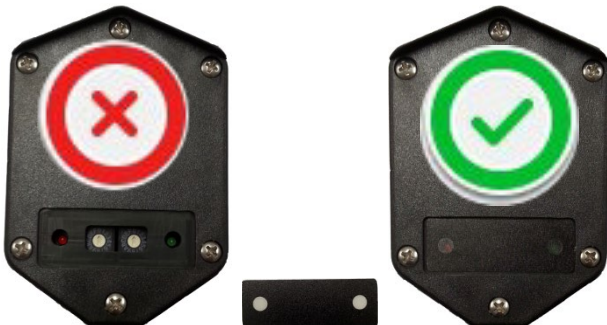



Figure 6: front face with/without sticker



Once you have set the requested radar parameters, place the sticker on the front face to guarantee its water tightness.

ATTENTION: manufacturer's warranty does not cover radars without sticker!

LED INDICATOR

1 IN NORMAL OPERATION

- The red LED shows the state of the relay 2.
- The green LED shows the state of the relay 1.

2 WHEN THE SELF-MONITORING DETECTS AN ERROR

The two LEDs blink quickly (2 or 4 quick flashes followed by a 1 sec break, depending on the detected error):

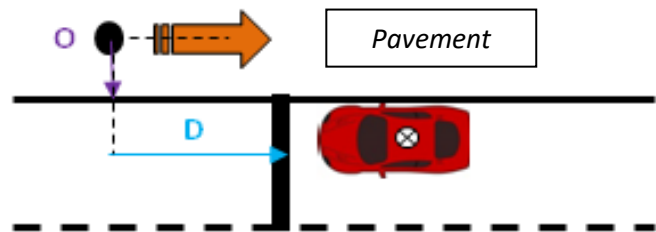
1. Type 1 failure: Code execution and internal micro-controller state consistency. If a problem is detected, the system is reset.
2. Type 2 failure: Micro-controller oscillator monitoring. If a problem is detected, the system enters in "fault mode". The LEDs show a code by blinking twice followed by a 1 second pause.
3. Type 3 failure: Microwave oscillator and receiver chain. If a problem is detected, the LEDs show a code by blinking four times followed by a 1 second pause.

The reset takes 1,500 milliseconds.

INSTALLATION GUIDE

1 GENERAL

- Installation' height: min. 3.5 m - max. 4.5 m
- **Offset** between pole and the roadside (O): max. 2 m
- **Distance** between pole and the stop-line (D): min. 2 m



2 ASSEMBLY AND MOUNTING

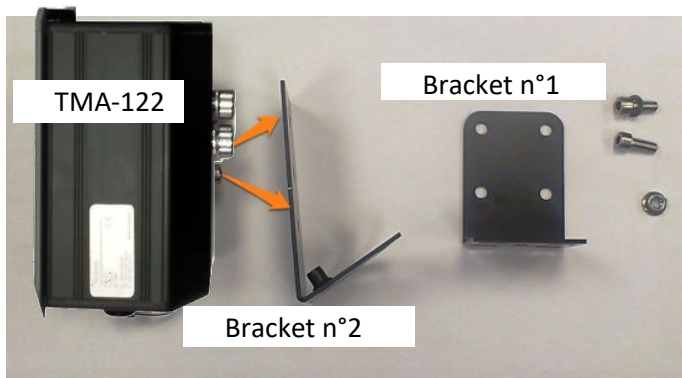


Figure 7: bracket elements

1. Set the appropriate parameter values with the encoders **and place the sticker!**

- Place the upper right screw to assemble bracket n°2 with bracket n° 1, with the upper right screw, allowing bracket nr 2 to rotate.



Figure 8: bracket assembly

- Fix the radar on bracket n°2 (see Figure 7).

- Once you are behind the radar, place the second screw in the lower right hole. Don't tighten it completely. The radar bracket n°1 must be parallel to the approaching lane. See orange arrow example on Figure 9.



Figure 9: bracket position, parallel to the traffic

- Incline the radar bracket n°2 in direction to the pavement until the notch appears (Figure 10).

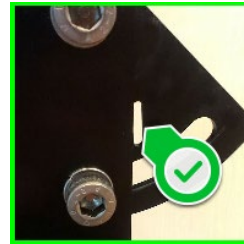


Figure 10: 45° tilt angle

- Firmly tighten the screws.



Figure 11: view from the front of the signal head: radar is leaning

3 KEY POINTS

- The tilt angle** must be in direction of the pavement, which means the side where the traffic light is. When you are in front of the radar: if the traffic light is on the right side of the vehicles, the housing of the radar has to be inclined to the right (Figure 9 & Figure 11). If the traffic light is on the left side of the vehicles, the housing of the radar has to be inclined to the left (Figure 12 & Figure 13).



Figure 12: Traffic light is on the left side from the cars

Figure 13: view from behind - installation set when the traffic light is on the left side from the cars.



- **Installation on a horizontal pole:** don't tilt the radar (see p. 15).

- Pay attention that the signal head or other obstacle is **not obstructing** the radar front face (Figure 14).



Figure 14: pay attention to obstacles

- Vehicles that enter within the stop-line zone (0-10m) from the side (**perpendicular approach**) may not be detected (Figure 15). To validate a measure, the radar needs:
 - to track an approaching movement at a minimum distance of 8 meters;
 - to measure an approaching movement above 8 km/h during a minimum of 100ms (the minimum speed can vary within the detection zone).



Figure 15: side movements

4 DETECTION ZONE

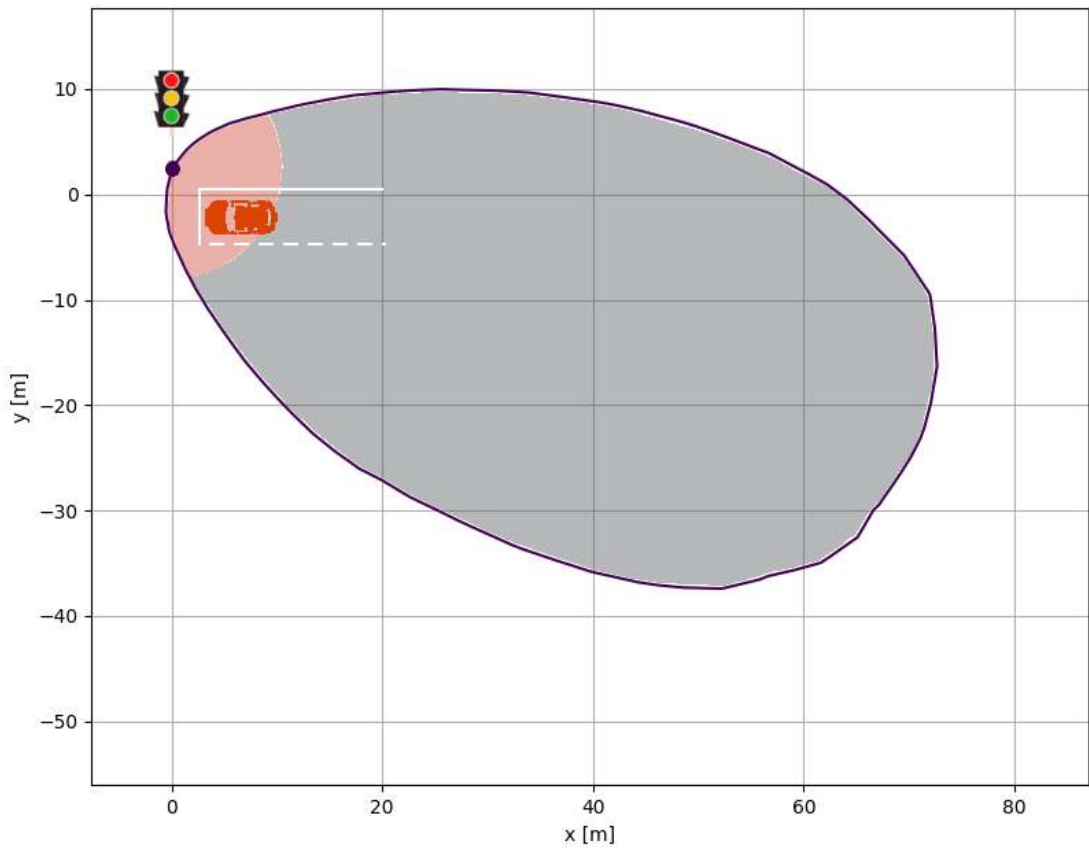
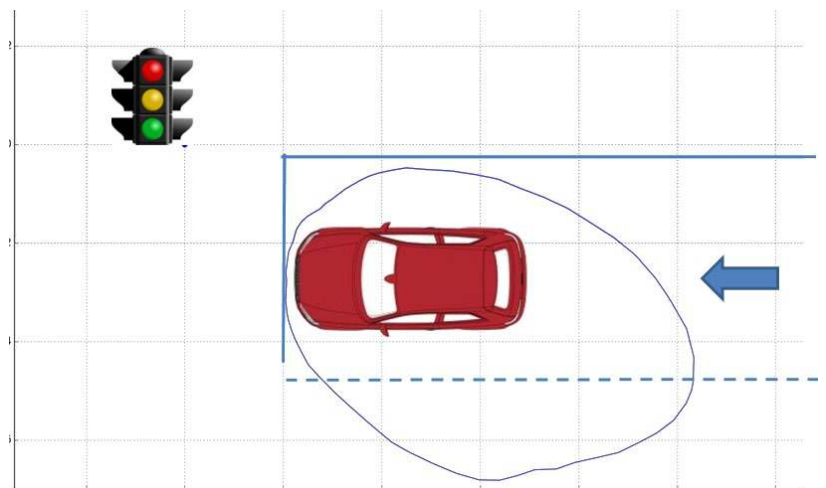


Figure 16: stationary + movement zone (0-10 m) / movement zone (0-60 m), H = 3,5 m, 45°tilt angle.

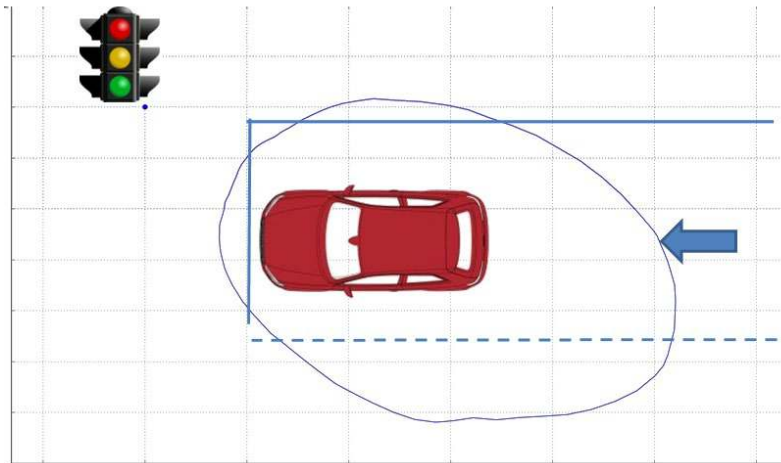
This drawing shows the theoretical radar lobe for vehicles approaching around 50 kmh. Different “stop-line” length zones can be set: 10 or 15 m; the approaching zone length is about 60 m for a car and can be limited to 20 m.

5 IMPACT OF THE TILT ANGLE

Set the tilt angle to 10° away from the standard tilt angle in direction of the pavement.



Standard tilt angle of 45°



Set the tilt angle to 10° away from the standard tilt angle in direction of the traffic lane.

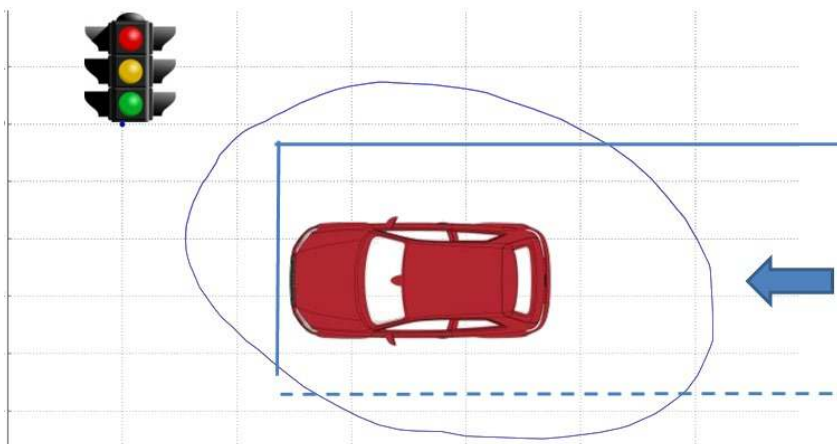


Figure 17: impact of the tilt angle

6 SPECIFIC INSTALLATION CASES

The installation position must be adapted when the road and/or the trajectory of the vehicles does not follow a straight line or when the radar is installed on a horizontal pole.

6.1 CURVED LINE

6.1.1 Situation



Figure 18: detection axis on curved road

The road is here rapidly moving away from the detection axis (materialize by the orange line on Figure 18).

The road widens and the stop line is not perpendicular to the lane:

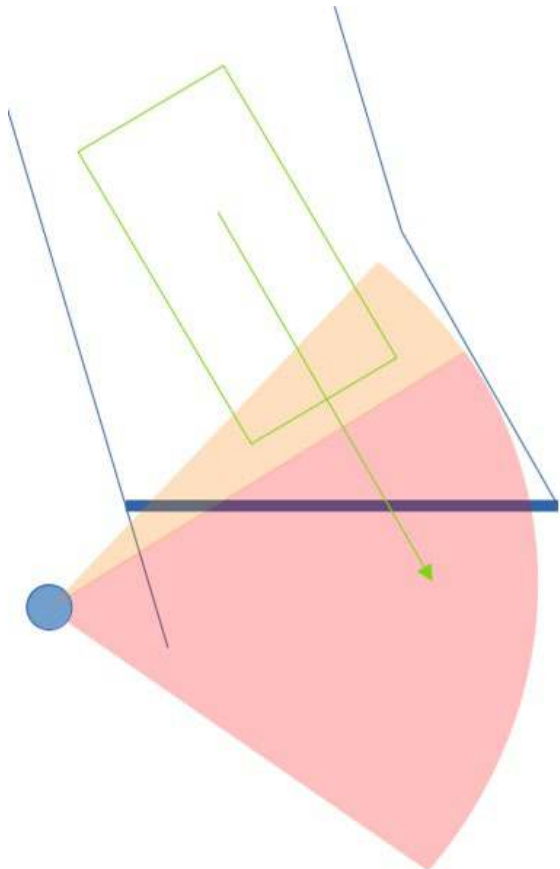


Figure 19: stop line at an angle

On the Figure 19 sketch, you can observe that, according to the trajectory, the angle at which the vehicle enters the lobe might be 90°. In this case, the vehicle won't be detected.

6.1.2 Best practices

In such a configuration, it is advised to install the radar at the left side of the vehicles.



Figure 20: radar installation at the left side of the vehicles

6.2 INSTALLATION ON A HORIZONTAL POLE

When the radar is installed on a stem in line with approaching vehicles, it must be installed **vertically**, and not tilted 45 ° as for a roadside installation.



Figure 21: horizontal pole – overview

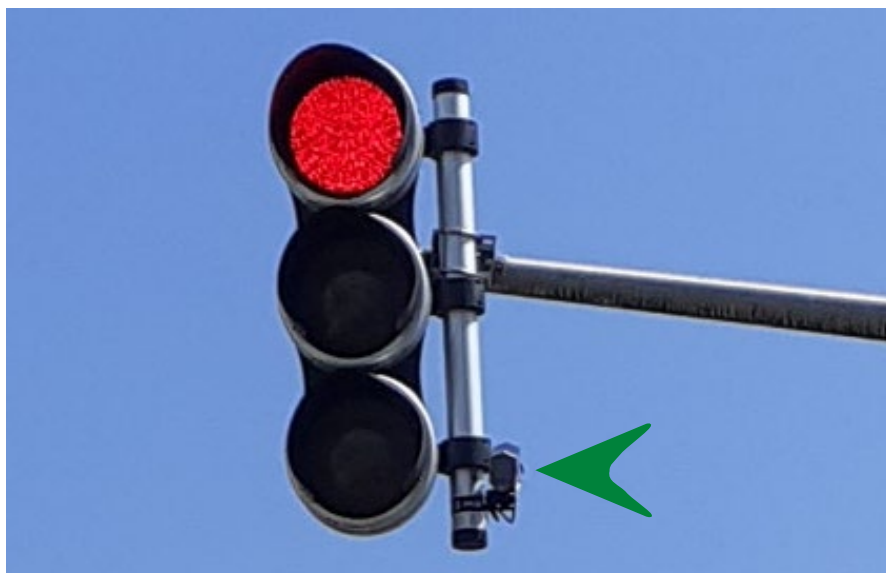


Figure 22 : TMA-122 on a horizontal pole, not tilted

COUNTING FUNCTION

The relay 1 toggles from [detection] -> [no detection] each time a vehicle passes the stop line.

WHAT TO TRY IF...

- The 60-meter range of the “movement only” zone is not reached:
 - Check if the bracket n°1 is well parallel to the traffic lane;
 - If there is a curb in the street, turn slightly the bracket n°1 in direction of the curb to move the detection zone.
- If Relay 1 stays closed even after the vehicle left the “stop-line” zone:
 - Check that the vehicles stop minimum 2 meters in front of to the radar pole.

- If the distance (offset) between the pole and the traffic lane is too wide, you can incline slightly the radar in direction of the pavement/signal side.

To keep in mind:

- The TMA-122 is not designed to detect on more than a single lane road (approaching traffic).
- Receding traffic within the radar lobe has no effect.
- To get the best result in terms of accuracy, the radar bracket (n°1) must be parallel to the approaching traffic direction.
- The presence (stationary) detection is based on tracking algorithms: the radar needs to detect an approaching movement combined to a decreasing speed to validate the detection. Therefore, cars already parked during the installation won't be detected.
- The radar might be sensitive to pedestrian movement: if a pedestrian crosses the road between the vehicle and the stop-line, it might interfere. Furthermore, if the radar lobe is partly on the pedestrian path, a pedestrian moving or stopping within the detection area might also create a false detection status.

TECHNICAL FEATURES

	TMA-122-LV	TMA-122-MV	TMA-122-HV
Protection level	IP 65		
Power supply	10-30 V AC, 50-60 Hz 12V-60 V DC	15-54 V AC, 50-60 Hz 21-75 V DC	100 V –240 V AC, 50-60 Hz
Power consumption	@12 V DC: < 1.2 W		@220 V AC: < 2 W
User output	<ul style="list-style-type: none"> • 2 inverted relay contacts – Resistive load: 30 V AC 0.3 A – 60 V DC 0.3 A • Option 250 V relay: 250 V AC - 30 V DC – 0.3 A • 2 LED outputs on front face 		
Temperature range	-40° C to +60° C		
Wiring & connectors	Weipu connector		
Operating frequency	24.185 – 24.215 Ghz		
Max. transmit power	< 20 dBm EIRP		
Dimensions	68 x 99 x 119 mm	68 x 99 x 205 mm	
Weight (excl. cable & mounting support)	0,320 kg	0,510 kg	0,543 kg

WARRANTY

Icoms Detections warrants its hardware products to be free from defects in workmanship and materials, under normal use and service, for a period of two (2) years from the date of dispatch from Icoms Detections premises, except for the batteries for which a warranty period of six (6) months applies.

If a product does not operate as warranted during the applicable warranty period, Icoms Detections shall, at its option, either repair the defective unit, or deliver an equivalent product or part to replace the defective item. All products that are replaced become property of Icoms Detections.

The defective product must be returned to Icoms Detections within the applicable warranty period. The defective product must be shipped DDP (delivered duty paid) back to Icoms Detections, wrapped in the original or similar shipping package to ensure that it will not be damaged during transportation. It must be accompanied by appropriate paperwork (ask first for a **Return Material Authorization** number) detailing the nature of the defect experienced.

Icoms Detections shall be under no liability in respect of any defect arising from normal wear and tear, willful damage, negligence, damage due to inappropriate packaging, abnormal working conditions, failure to follow Icoms Detections instructions (whether oral or in writing), misuse, improper installation, alteration or repair without Icoms Detections approval.

DECOMMISSIONING

We encourage customers to send back decommissioned equipment to the manufacturer for recycling. To differentiate between equipment to be recycled and equipment to be repaired, please inform your reseller or the manufacturer about the decommissioned equipment.

Icoms Detections will take care of the recycling for a sustainable end-of-life of the product.

FURTHER INFORMATION

1 LEGAL NOTIFICATION

Hereby, Icoms Detections declares that this TMA range of products is in compliance with the requirements and other relevant provisions of

- Directive 2014/53/EC – all configurations
- FCC Part 15B Class A – LV configuration 12V DC
- IC ICES-003 issue 6 – LV configuration 12V DC

2 VERSION

Issue n°	Date
V 1	June 28, 2019
V 3	September 4, 2019
V 4	October 9, 2020
V 5	December 1, 2020
V 7	August 25, 2021
V 7.1	April 5, 2022
V 7.2	May 19, 2022
V 7.3	October 19, 2022
V 7.4	March, 20, 2023

Comment
First release TMA-122 LMH
LV/MV power supply, heating option
-40° minimum T°
Info on fault types
Generic TMA user's guide, weight & dimensions
Nov. 16, 2021 : numbering of figures
Wire colour changes for the molded cable
Relay 250 V
Added "Decommissioning" section
Simplification

3 THE MANUFACTURER:



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