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3 INTRODUCTION



data collection



bikes

The TMA-3B3 is the combination of a microwave radar and a light emitting sensor, designed for bicycles counting on bicycle lane. The output consists of a serial interface. The unit can be delivered with a solar panel and with an additional cabinet containing a battery, a modem and a solar regulator. An SD card reader is available as an option.

4 PRODUCT DESCRIPTION

4.1 DELIVERY



Figure 1: content of the delivery

4.2 LABELS LOCATION

4.2.1 Identification label



Figure 2: identification label

4.2.2 Radar serial number



Do not remove the labels

5 SAFETY PRECAUTIONS

Only skilled and instructed persons should carry out work with the radar product. Experience and 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.
- Opening the outer casing is deemed dangerous and will void all warranties.
- Ensure the radar is mounted correctly and the screws and bolts of both radar and bracket are firmly tightened. The radar needs to point to the region of interest for proper detection.
- Ensure the radar is configured properly.

6 THEORY OF OPERATION

1. Unpack the unit and check the following items are in the box (please refer to Figure 1, p. 3):
 - A. Radar/lidar with rear side connectors and mounting bracket
 - B. Additional cabinet with solar regulator and modem
 - C. USB AB cable
 - D. Battery 100 Ah (optional)
 - E. Solar panel 95 W with mounting bracket (optional)
 - F. User's guide
 - G. Power supply & communication cable
2. Place the unit on the field and align it to the traffic (see title 9, p. 5).
3. Install the additional cabinet (B) on the same pole.
4. Place the battery (D) in the cabinet and connect it.
5. Mount the solar panel (E) according to the instructions (see title 15, p. 16).
6. Connect the cable from the radar to the additional cabinet.
7. Connect the cable from the solar panel to the additional cabinet.

7 CABLING

LV (12-16 V DC)		
PIN nr	Color	Function
1	RED	Power ~ (AC), + (DC)
2	BLUE	N/A
3	BLACK	Power ~(AC), - (DC GND)
4	BROWN	RS-232 - GND
5	WHITE or PURPLE	COM relay 1
6	GREY	NC relay 1
7	YELLOW	NO relay 1
8	GREEN	RS232 – Rx radar (Tx PC)
9	PINK or ORANGE	RS232 – Tx radar (Rx PC)

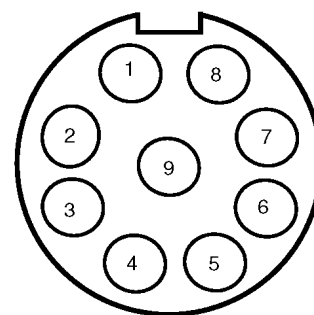


Figure 3 : TMA-3B3 LV radar connector - Weipu SP1712/P9

USER'S OUTPUTS

Resistive load: 30 V AC 0.3 A - 60 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 the power source before maintenance intervention.

8 INSTALLATION GUIDE

8.1 DIRECTION DETECTION

The TMA-3B3 measures in both directions, and associates a + sign for the approaching objects and a – sign for the receding ones. We recommend to install the radar so that the approaching direction is the direction with the largest volume of cyclists.

8.2 CHOICE OF THE INSTALLATION LOCATION

- The TMA-3B3 is designed to measure on dedicated bicycle paths only. It is not able to count the bicycles in mixed traffic situations.
- Select a free-flowing section to perform the counting, where targets are not supposed to stop in the sensor beam. Proximity of intersections is not advised. A bloc of measurements with the same time stamp corresponds to the case where a target stopped for some time in the "laser" beam. Currently this is not filtered out and generate a "long" target that is then sliced in so many bicycles.
- The sensor measures both directions. If the bicycle path is one-direction, install the radar in the way it detects the approaching direction.
- Max. measurement distance of the sensor: about 6 m (angle 45°). This results in a maximum width "D" of 4 m, see Figure 4.
- Max. width of the bicycle path: 4 m, offset included.
- Avoid obstacles like tree branches or leaves in the beam of the sensor.

8.3 PHYSICAL INSTALLATION

- **Offset:** distance between the pole and the near edge of the bicycle lane (perpendicular to the bicycles direction)
- **Distance:** distance between the pole and the far edge of the bicycle lane (perpendicular to the bicycles direction).
This distance (D) is equal to the Width (W) of the bicycle path plus the Offset (O)
 $D = W + O$
- **Height:** distance between the ground and the low edge of the radar bracket

- Recommended installation' height according to offset, for a 2 m wide bicycle lane and 15° vertical angle:

	O(FFSET)		
	0 m	1 m	2 m
H(HEIGHT)	1.4 m	1.75 m	2.10 m

- Horizontal angle: 45° (towards the bicycles direction)
- Vertical angle (inclination towards the ground): The light emitting beam must "cut" the cyclists, at the waist level or higher. An installation at 0° (horizontal installation) is possible.
- Fix the screws.

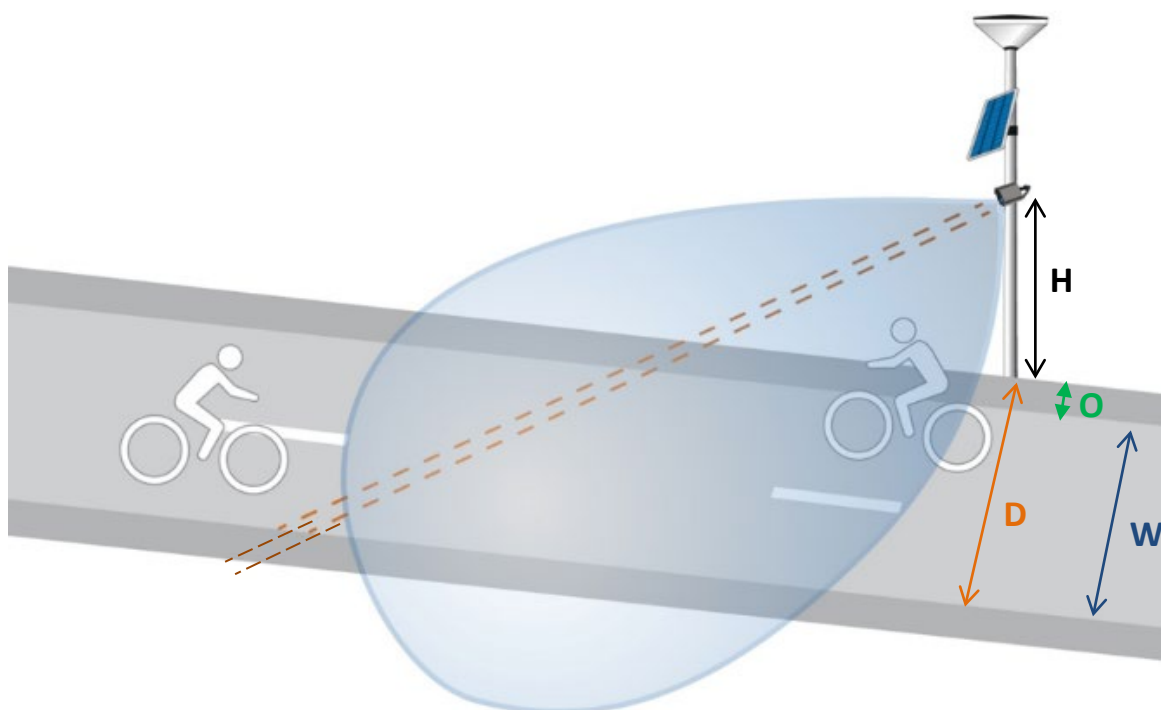


Figure 4: installation, general overview

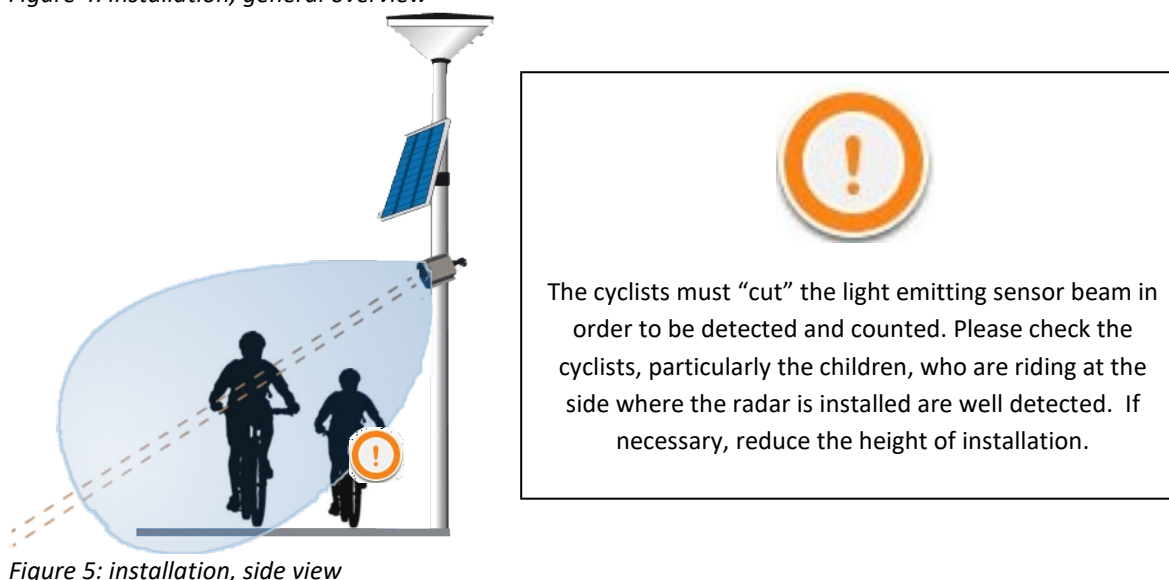


Figure 5: installation, side view

8.4 PRECISION IN FUNCTION OF THE INSTALLATION HEIGHT, OFFSET AND WIDTH OF BICYCLE PATH

The higher the radar is installed, the larger vertical angle of the radar to detect the cyclists and therefore the smaller the detection Distance (D). Figure 6 shows in green the possible combinations of Offsets and Width at installation height of 2 m for a high degree of precision (97 % or more). The orange area shows the combinations of Offsets and Width for which the detection precision will drop below 97 %.

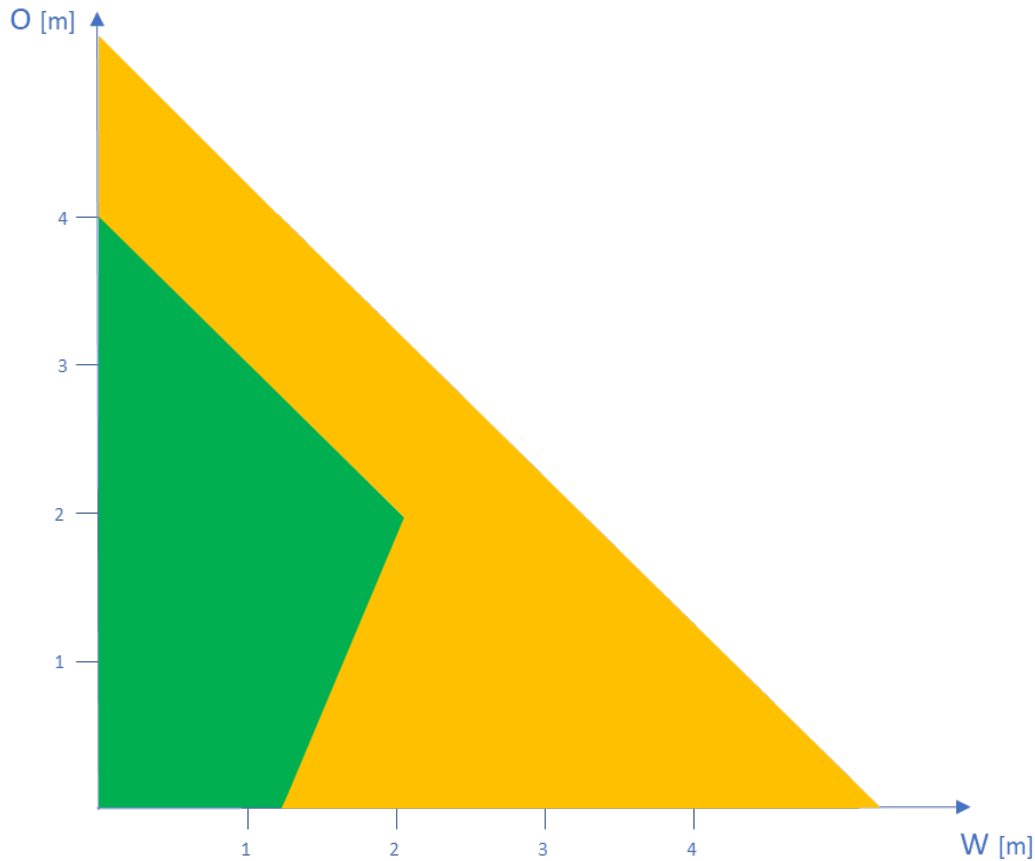


Figure 6: precision in function of offset (O) and width of bicycle path (W) for an installation height (H) of 2 m

The detector beam needs to point towards the head or the body of the cyclists, not the legs. Therefore, when placing the detector higher, the light beam of the detector needs to be directed towards the ground at a larger angle. The angle and therefore the maximum distance of detection is therefore a function of the height of the installation, the Offset (O) and the Width (W) of the bicycle path.

The maximum detection Distance D as shown in Figure 4 is 4 m. At an Offset value of zero meter, the maximum width of the bicycle path is equal to 4 meters, which is in such particular case equal to the maximum Distance D.

Assuming that the minimum height of the saddle is 1m and that the minimum height of the cyclists' heads is 1.6m, the maximum Width W of the bicycle path with Offset zero is 1.25 m as shown in Figure 6 for an installation height at 2m.

For an installation height at 2.5m, the maximum Width W of the bicycle path with Offset zero is 0.35 m as shown in Figure 7.

For an installation height at 1.4 m, the maximum Width W of the bicycle path with Offset zero is 4 m as shown in Figure 8.

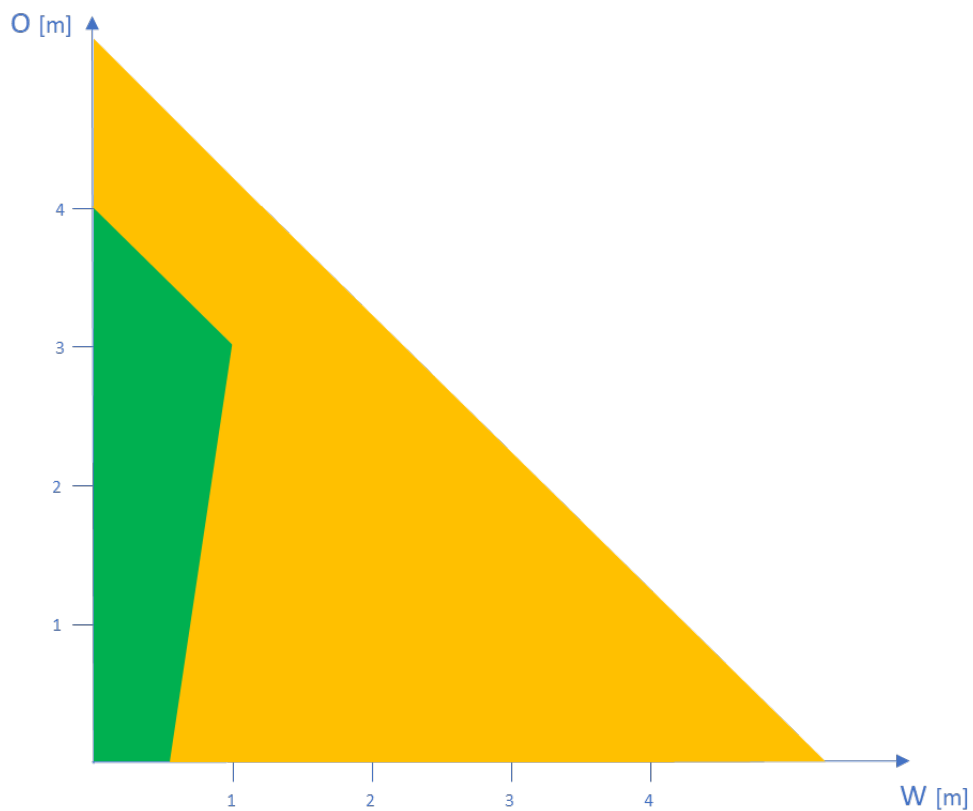


Figure 7: precision in function of offset (O) and width of bicycle path (W) for an installation height (H) of 2.5 m

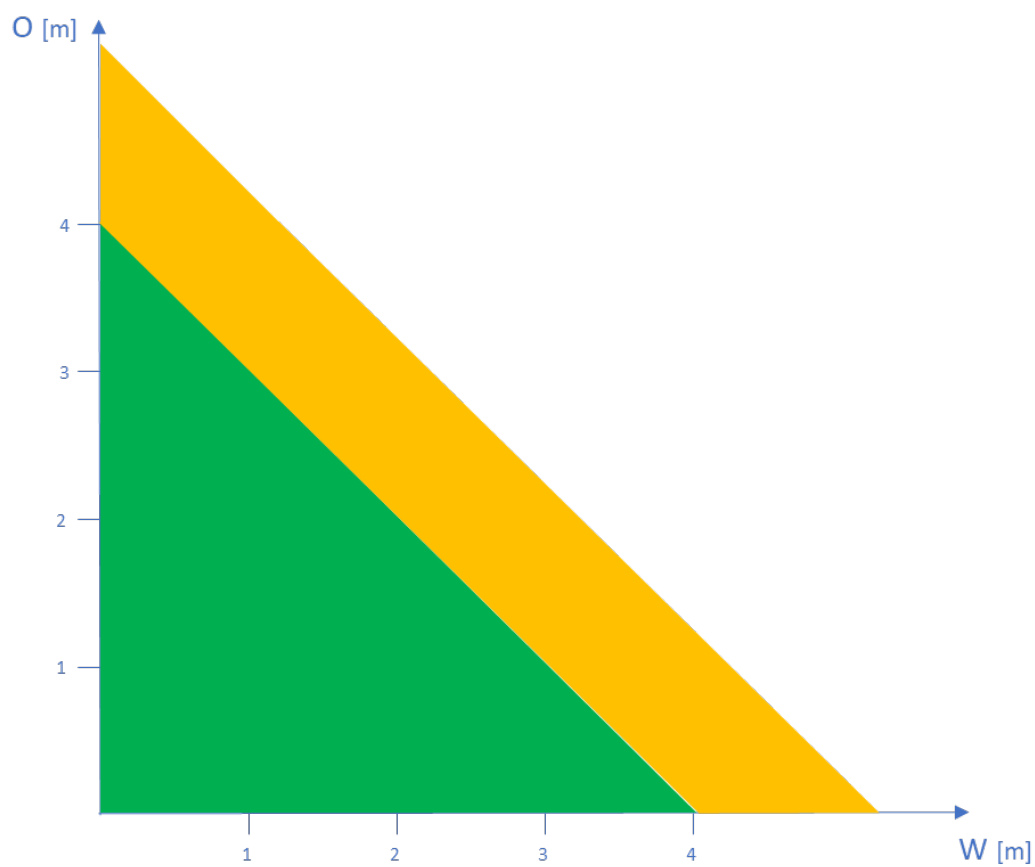


Figure 8: precision in function of offset (O) and width of bicycle path (W) for an installation height (H) of 1.4 m

9 ADDITIONAL CABINET

9.1 CONTENTS

The cabinet includes a modem (1), an optional battery (3) and a solar regulator (2).

The modem can be replaced by an optional SD card reader.



Figure 9: cabinet, outside

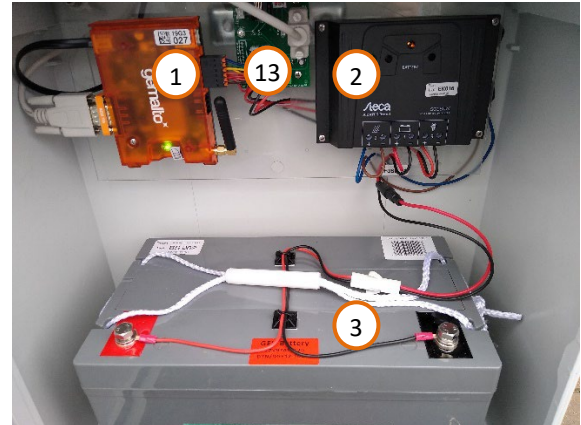


Figure 10: cabinet, inside

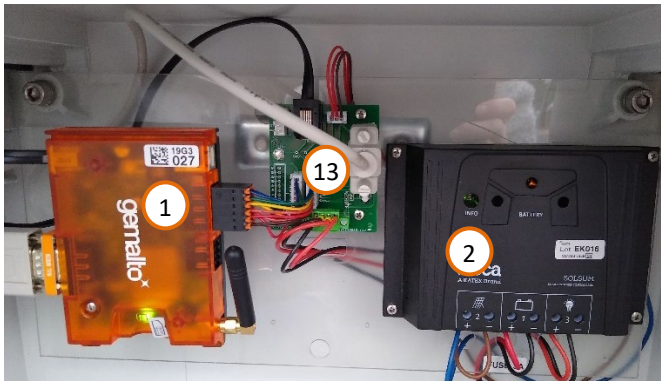


Figure 11: cabinet, inside - connection

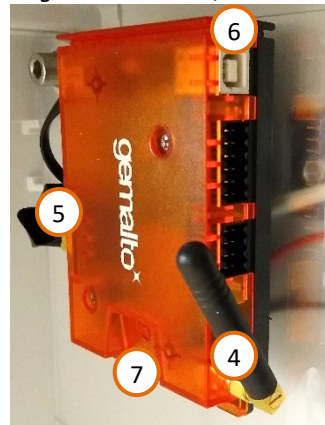


Figure 12: modem

Legend:

- 1: modem
- 2: solar regulator
- 3: battery (12 V 100 Ah, optional)
- 4: modem antenna
- 5: modem socket to the radar
- 6: modem configuration socket
- 7: SIM card slot
- 8: radar socket
- 9: power socket
- 10: clamps
- 11: SD card reader (optional)
- 12: USB-B connector for radar configuration with optional SD card reader
- 13: DB9 communication connector for RS-232

The modem can be replaced by an optional SD card reader. Make sure that you choose an industrial quality SD card that can be used in a sufficiently wide temperature range. The box then looks like this:

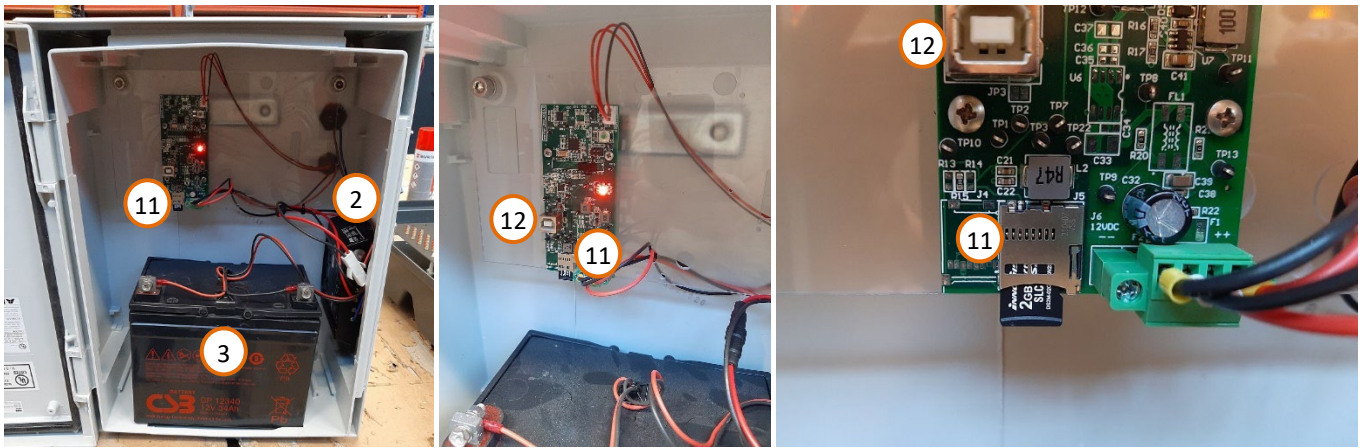


Figure 13: cabinet with SD card reader

9.2 SETUP

1. Install the cabinet at the foot of the pole, under the TMA-3B3. Insert collars with the right diameter in the clamps (10) on the backside of the cabinet.
2. Insert a SIM card in the slot (Figure 10, p. 9, mark 7) or an SD card in the reader (Figure 13, mark 11).
3. Plug the solar panel (see Title 11) or the power source for the battery (12 V) in the below connector backside (Figure 14 & Figure 15, p. 10, mark 9) :
4. Plug the radar in the upper connector backside (Figure 14 & Figure 15, p. 10, mark 8)

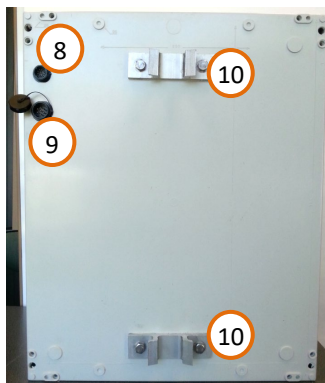


Figure 14: cabinet, backside

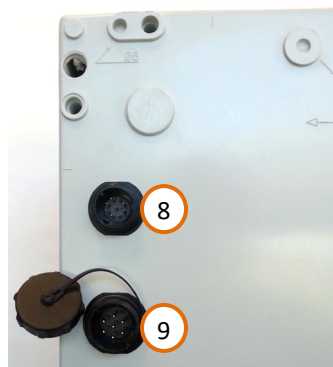


Figure 15 : cabinet, power connections

10 RADAR SETTINGS

10.1 COMMUNICATION

- The TMA-3B3 can be configured by serial communication (115200 bauds 8N1).
- It needs to be disconnected from the modem (Figure 11, item 13) and connected to a PC equipped with a serial port (or via an USB-Serial (RS-232) adapter).
- For the cabinets equipped with an optional SD card reader, the configuration is made through de USB-B connector (Figure 13, item 12).
- Please note that the modem should be reconnected to the TMA-3B3 after its configuration.

10.2 ICOMSOFT TMA-3B3

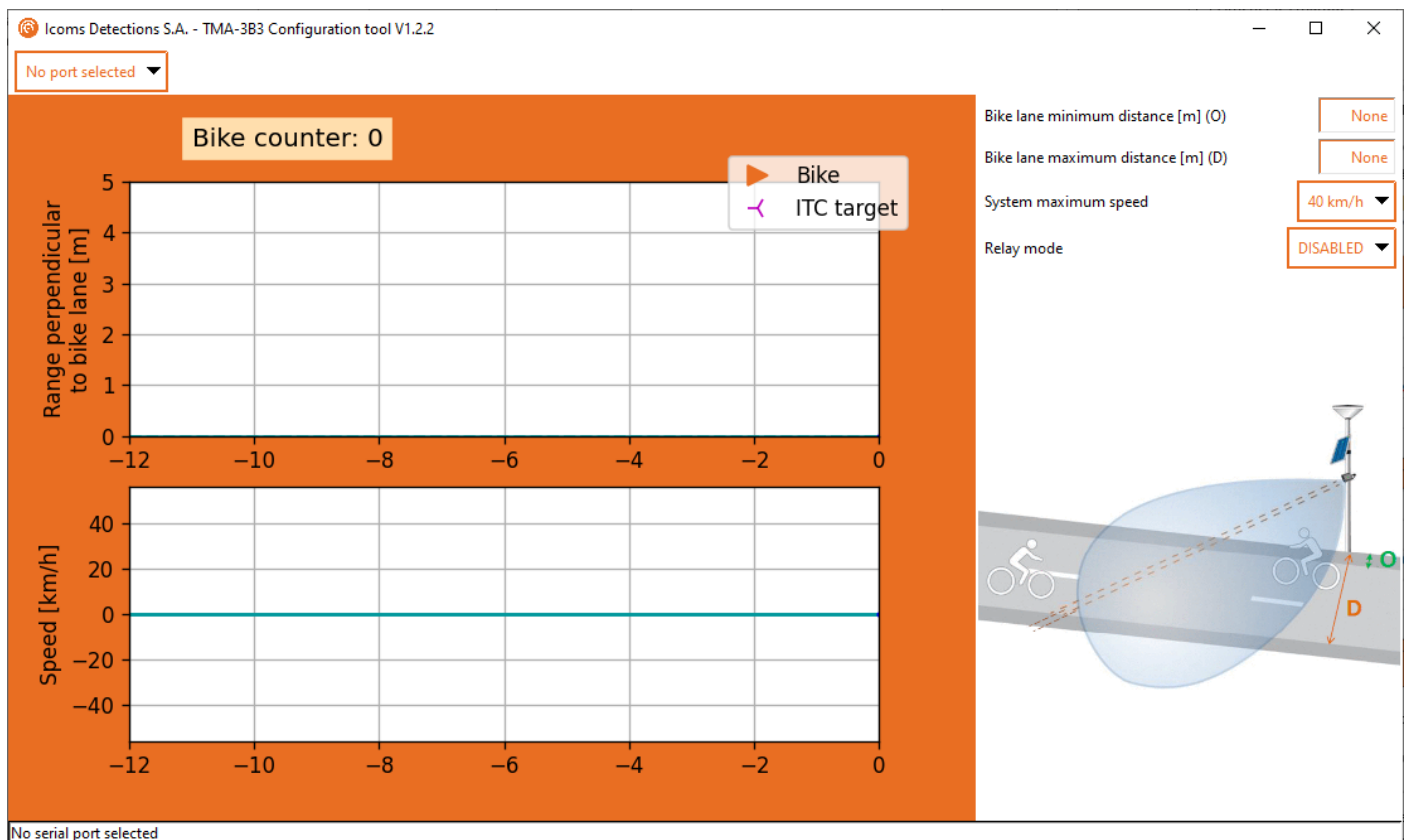
You can download de software here: <https://www.icomsdetections.com/docs/downloads.html>



10.3 CONFIGURATION OF THE RADAR USING THE ICOMSOFT TMA-3B3

Firstly, power on the radar.

Secondly, launch the software by executing the tma3b3config_Vx.y.z.exe program (x, y and z refer to the version numbers). It will open a DOS window and will take some time to launch the Graphical User Interface (GUI), please be patient while the software starts up.

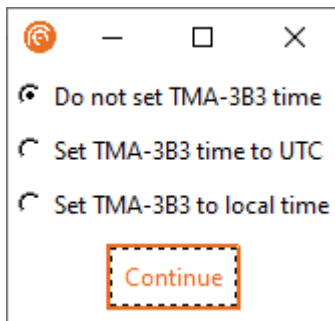


Screenshot 1: IcomSoft TMA-3B3 GUI when first opened

10.3.1 Step 1 – serial communication and time setting

Select the serial port your PC uses to communicate with the radar, the software will launch the communication once the port selected.

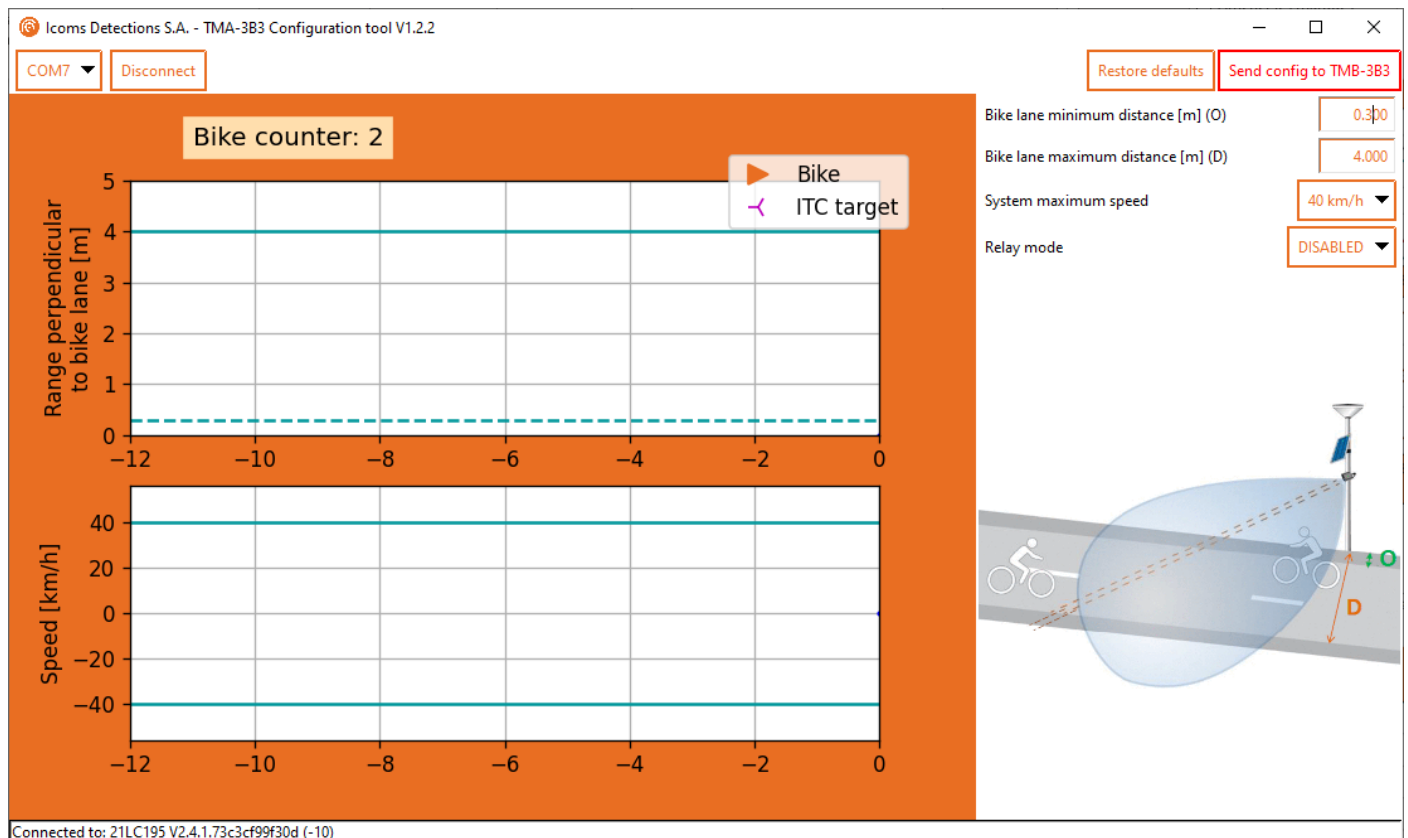
If the clock of the radar is not set, the software will ask whether to set the time of the device. This setting is only necessary for radars with memory card (SD card).



10.3.2 Step 2 – range and maximum speed configuration

Please note that the displayed ranges are given perpendicular to the bike lane direction. This means that the installation angle of 45° is already taken into account in the calculations and the settings.

1. First set the min and max range values for the detection. The values should be close to the ones that would be measured by tape measure.
2. If the default maximum speed is not large enough, change the maximum detection speed to 55 km/h. The trade-off for a larger maximum speed is a shorter detection distance (D) of maximum 3.3 meters instead of 4 meters.



Screenshot 2: detection range configuration

10.3.3 Step 3 – Relay mode

10.3.3.1 Description

When switching on the relay feature, the internal relay is activated every time a bicycle is detected.

- The relay can be either linked to counting events or to “ITC” events (fast counting in the incoming direction, see section 11.3.3.3).
- When the relay is linked to counting events:
 - One click of the relay per bicycle counted (one click = temporary closure of the “NO” output).

- This click occurs when the target is validated by the TMA-3B3. This validation takes place when the target leaves the radar detection zone (which extends approximately from the installation point up to ~ 8 m from it). Compared to the cut-off point of the laser beam, approaching targets will therefore be taken into account more quickly than receding targets. If the radar detection is not validated, the validation of the target seen by the laser is done after a timeout of 9 seconds.
- When the relay is linked to “ITC” events:
 - One click of the relay per approaching bicycle detected by the TMA-3B3 (one click = temporary closure of the “NO” output).
 - This click occurs when the target is validated by the TMA-3B3.
- A minimum duration of 100 ms (configurable) during which the state of the relay does not change, is guaranteed for both "active" and "inactive" times.
- If more targets are detected than the relay can output given the time constraint described above, they are added to a queue until they can be issued to the relay.
- The size of this queue is fixed at 10 (configurable, parameter 041). If the queue size grows beyond the maximum size, corresponding targets will be ignored (to allow limitation of the detection rate and as protection against possible abnormal situations).
- The relay will not be energized in the inactive state (for consumption reasons) but can be configured in positive security if desired.
- The relay will make a click at start-up (to be able to easily check its operation). All other clicks will take place for counting only.

10.3.3.2 Counting

Set the “Relay mode” to “Counting” to trigger the relay every time a bicycle is detected

10.3.3.3 .ITC (Intelligent Traffic Control) messages

The ITC feature will not only trigger the relay every time a bicycle is detected, it will also send an additional ITC message will be sent on the RS-232 communication channel.

10.3.3.3.1 ITC messages description

ITC messages

- Are meant for traffic management applications in need of messages sent quickly or after a fixed delay after the target has crossed the laser beam.
- Can be separated from the counting messages by looking to the “detection type” field of the message (see “12.3 Detection types”).
- Are available only for incoming targets (targets that are approaching the detector when they are measured).
- Should not be considered for the counting application of the TMA-3B3 as they will be followed by a standard counting message corresponding to the same target (immediately, or a few seconds after the fast message).
- Are deactivated by default.

10.3.3.3.2 Activation of the ITC messages

To activate the ITC messages, set the “Relay mode” to “ITC”.

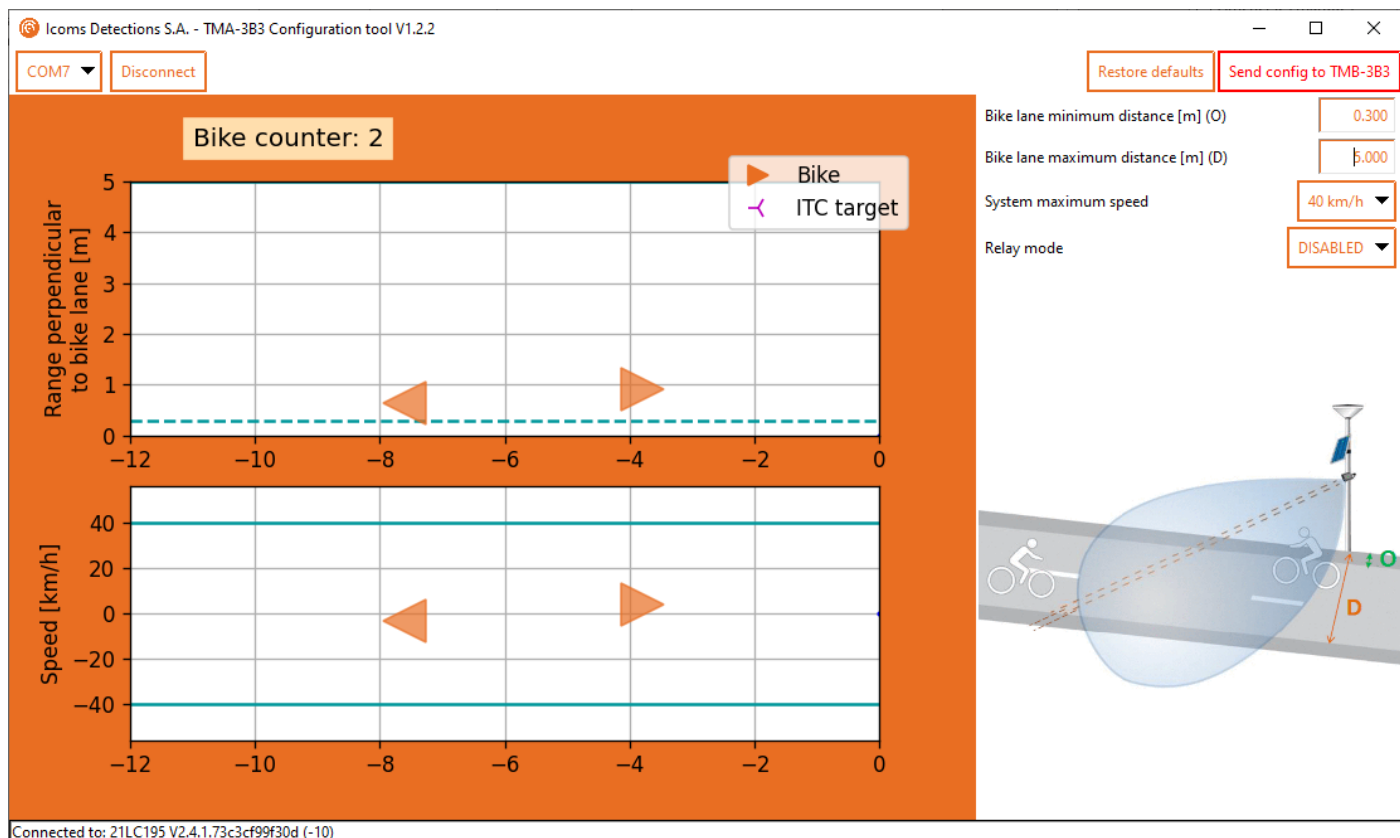
10.3.4 Step 4 – save the settings

Once the limits are set, send them to the radar by clicking the Send config to TMB-3B3 button.

10.3.5 Step 5: Verify the detections in real-time

The configuration is correct when detected bicycles are shown as orange triangles.

- i. Cars and other moving objects beyond the bicycle path should not be detected.
- ii. The upper part of the graph shows the distance between the bicycle and the sensor
- iii. The lower graph shows the measured speed (positive speed = approaching bicycles, negative speed = receding bicycles).



Screenshot 3: object detections displayed on the Graphical User Interface (GUI)

10.3.6 Step 6 – close the software

When everything is OK, close properly the software. This will configure the TMA-3B3 for operation.

10.4 REAL-TIME DATA ON HYPERTERMINAL

It is possible to verify in real time the measurements made by the TMA-3B3. To do so, please follow these steps:

1. Configure first the TMA-3B3 using the software
2. Open a serial port terminal software (like Hyperterminal, Putty, TeraTerm).
3. Type "p 50 8" to see in real time the measurements being sent. The format is **#CNT, SPEED km/h, RANGE m, TIMESTAMP, FUSTYPE** where FUSTYPE consists in debug info from the data fusion routine
4. If this format needs to stay permanent even after a reboot, type "save"
5. Before reconnecting the TMA-3B3 to the modem, type "p 50 121" and then "save" on the command line interface to revert to the machine-to-machine communication protocol.

11 DATA FORMAT

11.1 ENCODED MESSAGES (PARAM 50 121) - MODEM

When the message protocol 121 (encoded message, param 50 121) is selected, measurements are sent in encoded format having the following structure:

Note: this is the format used to communicate with the 3G/4G modems provided as accessories of the TMA-3B3.

11.1.1 Measurement message:

0x02	0x99	MEASUREMENT PAYLOAD	0x03
------	------	---------------------	------

11.1.2 Measurement payload:

Position	Description	Range (default)	Note
1	Measured speed		Km/h
2	Supposed length (not measured)		Decimeters
3	Hundredths of second	0x00 – 0x99	BCD
4	Seconds	0x00 – 0x59	BCD
5	Minutes	0x00 – 0x59	BCD
6	Hour (24h format)	0x00 – 0x24	BCD
7	Day and direction	0x00 – 0x31 (0x80)	See “Day and direction byte”
8	Month	0x01 – 0x12	BCD
9	Vehicle counter LSB	[0, 16M vehicles]	Counter reset at startup
10	Vehicle counter MSB		
11	Vehicle counter MMSB		
12	Perpendicular range LSB	[0, 4000]	Centimeters
13	Perpendicular range MSB		
14	Detection type	1, 2, 3 or 30	See “detection types”
15	Century	0x20	BCD
16	Year	0x00 – 0x99	BCD

Notes:

- The given timestamp is the validation time of the laser detection if available (that is, 80 ms after the target has finished crossing the laser beam, for the default configuration of the device).
- BCD means “binary coded decimal.” Ex. Decimal 42 is encoded as 0x42 (= decimal 66).
- The vehicle counter is reset at each detector reset and loops over itself in case of overflow.

11.1.3 Day and direction byte:

Position	Parameter	Signification if 0	Signification if 1
Bit 7 (MSb)	Direction	Incoming direction	Outgoing direction
Bit 6	Day tens 2 (in BCD)		
Bit 5	Day tens 1 (in BCD)		
Bit 4	Day tens 0 (in BCD)		
Bit 3	Day units 3 (in BCD)		
Bit 2	Day units 2 (in BCD)		
Bit 1	Day units 1 (in BCD)		
Bit 0 (LSb)	Day units 0 (in BCD)		

11.2 ASCII MESSAGES (PARAM 50 100) – SD CARD

When the message protocol 100 is selected, measurements are done according to a semi-colon separated CSV format:

TYP; DATETIME; SPEED; LENGTH

Where:

TYP is the detection type as a 3 digits number (see “12.3 Detection types”)

DATETIME is the timestamp of the measurement under the format:

YYYY/mm/dd HH:MM:SS, hhh

SPEED is the measured speed of the target in km/h (as a fixed length signed number). Decimals are separated by a comma.

LENGTH is the supposed length of the target in m (as a fixed length signed number.)

Note: the TMA-3B3 does not measure bicycles length.

Example:

```
001; 2020/12/31 23:59:59,999; +012,3; +001,8
```

Note: this is the format used to store the data on the optional SD card.

11.3 DETECTION TYPES

- **1:** Detection by association of one radar and one laser measurement.
- **2:** Detection by the laser only.
- **3:** Detection by the radar only.
- **30:** "ITC" detection for incoming targets for traffic management applications. This type of messages should not be considered for counting purposes, as they will be followed by "type 1" messages (immediately or after a few seconds).

12 MODEM CONFIGURATION

Please refer to the separate 3G or 4G modem manual for the list of the most important parameters.

- The modem has settings stored locally. Those settings can be modified by changing the « setup.ini » file accessible via the USB connection to the modem.
- Logs file are stored as well on the modem and can be accessed in the same way as the setup.ini file.
- Please note that the PIN of the SIM card is supposed to be 0000 when the modem is first initialized. If it isn't the desired PIN, the only way to change it is via the « setup.ini » file.
- The red LED on the modem should flash approximately every 4 seconds if the network is OK. A fast blinking indicates "limited network services" (including limitations due to a wrong PIN).

13 VANDAL PROOF OPTIONAL HOUSING

A vandal proof additional housing is available as an option:



Figure 16: vandal proof additional housing - front view



Figure 17: vandal proof additional housing - vertical angle adjustment screws

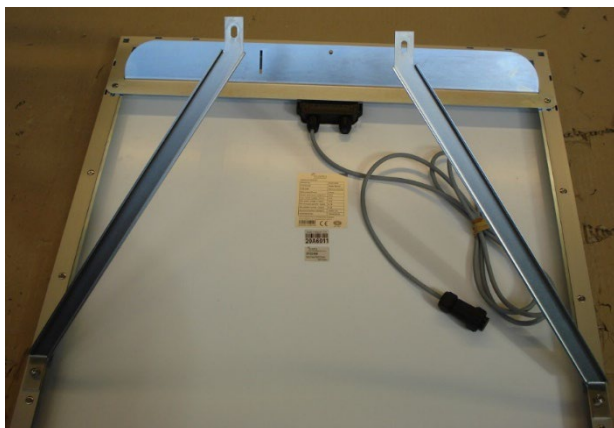
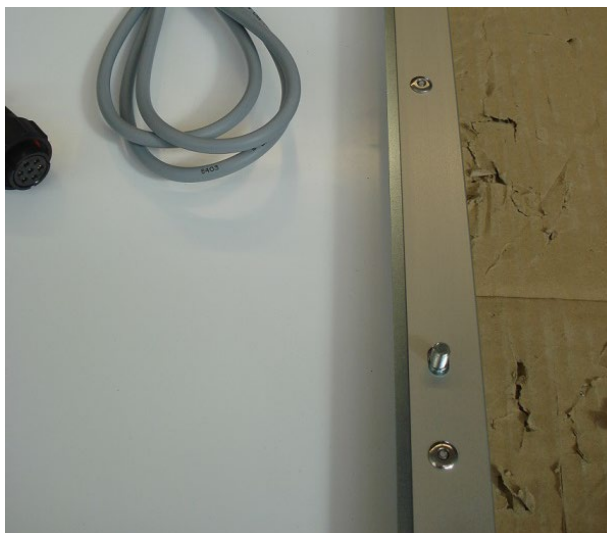
Please ask your reseller for more information.

14 SOLAR PANEL

1. Cut the tie-wraps to untie the 2 supporting slats and the accessories:



2. Fasten the 2 supporting slats with the provided mounting angles/nuts



Pay attention: right and left lats are different!

3. Fasten the pole bracket on the pole and hang the upper part of the solar panel on the bracket



4. Fasten the slats on the lower part of the pole bracket with the provided nuts



5. Fasten the central screw on the upper part with the nut



Please first switch the battery on, before connecting the solar panel.

15 FAQ

What to do if there is no file on the server?

- First check the modem configuration:
 - Check the network (APN, network password) and sim configuration.
 - Check the ftp configuration on the modem (path, login ...).
- Check the ftp and directories configuration:
 - Underscore is not allowed in the host name
 - The ftp must be configured to allow writing of a tmp file and renaming it into csv
- The paths must be properly configured.
- Does the radar measure?
 - Are the radar and modem properly powered?
 - Connect to the radar and check if the measurements are ok.
 - Check param 50 (must be set on 121 to be readable by the modem, on 8 to be human readable).
 - Check other radar parameters.

There is no RS-232 communication between the PC and the radar

- Check the wiring and the connectors.
- Check the terminal emulator software configuration (baud rate, com port number ...).

The timestamp is faulty

- If the modem could not synchronise immediately with its NTP server, the measurements can have a faulty timestamp.

16 TECHNICAL FEATURES

16.1 TMA-3B3

Protection level	IP 65
Power supply	12-16V DC
Power consumption	1.6 W, excl. modem (130 mA @ 12V DC, 20° C)
User output	RS-232
Temperature range	-20° C to +60° C
Dimensions	68 x 99 x 150 mm
Weight	Sensor: 475 g – Mounting bracket: 435 g
Wiring & connectors	Weipu connector
Radar frequency	24.165-24.235 GHz
Light emitting sensor	905 nm
Max transmit power	< 20 dBm EIRP

16.2 MODEM

Dimension	113.5 mm x 75.0 mm x 25.5 mm (excluding antenna and RS-232 connectors)
Weight	120 g
Operating temperature	-30°C to +85°C
Environmental protection	IP 40
Casing	Plastic
Input power options	8-30 V DC (typical 12 V DC)
Current peak	1.2 A (@ 8 V)
Typical average power consumption for an upload period of 1 hour	40 mA @ 12 V Note: Average power consumption varies in function of the configuration and the network
WAN	<ul style="list-style-type: none"> • Region: Global • Five bands UMTS (WCDMA/FDD; 800, 850, 900, 1900 and 2100 MHz) • EDGE/GPRS Class 12 • Quad-band GSM (850, 900, 1800 and 1900 MHz)

17 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 despatch 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, either deliver to the buyer 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 back to Icoms Detections pre-paid, insured and wrapped in the original or similar shipping package to ensure that it will not be damaged during transportation, and must be accompanied by appropriate paperwork (ask first for a **Return Material Authorisation** number) detailing the nature of the defect experienced.

Icoms shall be under no liability in respect of any defect arising from normal wear and tear, wilful 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.

18 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.

19 FURTHER INFORMATION

19.1 LEGAL NOTIFICATION

Hereby, Icoms Detections declares that the TMA range is in compliance with the requirements and other relevant provisions of Directive 2014/53/EC.

The Lidar is classified EN/IEC 60825-1 2014.

The Gemalto modem is in compliance with following requirements:

- RED Directive 2014/53/EU.
- RoHS 2 2011/65/EC
- WEEE 2003/108/EC
- FCC ID: QIPEHS6
- IC: 7830A-EHS6

19.2 VERSION

Issue n°	Date	Author	Comment
V1	25 June, 2018	CBA	First generic version
V1.2	25 June, 2019	CBA/PSP	Gemalto modem, configuration
V2	04 September, 2019	CBA	New TMA-3B3 housing
V3.1	18 may, 2020	CBA	New sketches (housing vers. 2) – vandal-proof additional housing
V3.2	07 October, 2020	EVDB	Update on Command Line Interface
V3.3	19 October, 2020	EVDB	Update on Command Line Interface
V3.4	03 December, 2020	EVDB	Max speed and ITC messages
V3.5	26 April, 2020	EVDB	Software version 1.1.5
V3.5.1	10 November 2021	CBA	Height & figure nr
V3.5.2	April 5, 2022	EVDB	Change in connector cable impacting wire colours
V3.5.3	October 19, 2022	EVDB	Added "Decommissioning" section
V3.6.0	January 5, 2023	EVDB	Screenshots of new software v1.2.2 – SD card reader
V3.6.1	Hanuary 16, 2023	CBA	RS-232 communication

19.3 THE MANUFACTURER:



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