PMX TCR

User Manual

Rev. 03

This user manual is intended for persons responsible for the installation, configuration and maintenance of PMX Radar Counters with the alternative PMX firmware.

The reader is supposed to have a basic technical understanding of traffic monitoring systems and LoRaWAN networks.

Please note that this manual is specific to PMX Firmware V1.2 and may not be applicable to other versions of the firmware.

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Safety Instructions

Read this manual carefully before attempting to install the device

Failure to observe recommendations included in this manual may be dangerous or cause a violation of the law. The manufacturer, PMX Systems AG will not be held responsible for any loss or damage resulting from not following these instructions.

- A professional must perform all electrical installations. Electrical installations require the expertise of skilled professionals to ensure compliance with safety standards and optimal functionality.
- The device is not intended to be used as a safety measure. PMX Systems AG disclaims any responsibility for damages resulting from inaccurate readings or malfunctions.
- LPWAN technology, with its inherent limitations, is vulnerable to jamming attacks. Therefore, it is critical that this device not be used for life-safety applications.
- To prevent deep discharge and damage to the integrated NiMH battery in TCR-SLE, TCR-SLI or PCR2-ODS devices, it's essential to charge the battery with the provided USB charging adapter when the device is not in use or disconnected from a solar panel. Regular charging ensures the battery remains in optimal condition.
- Do not shock or vibrate the unit.
- To clean the device, wipe it with a soft, damp cloth. Wipe dry with another soft, dry cloth. Do not use detergents or alcohol to clean the device.

Disposal note in accordance with Waste from Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU

This product and all its components must not be disposed of with household or industrial waste. You are required to dispose of the product at the end of its life in accordance with the requirements of RoHS 2012/19/EU to protect the environment and reduce waste through recycling. For more information and how to dispose of the device, please contact your local certified waste disposal service. The sensors contain NiMH batteries that must be disposed of separately.

Introduction

Congratulations on purchasing a PMX LoRaWAN Radar Counter!

PMX TCR offers incredible versatility and performance, making it ideal for applications as diverse as people counting, traffic statistics, or other applications that require anonymous object counting.

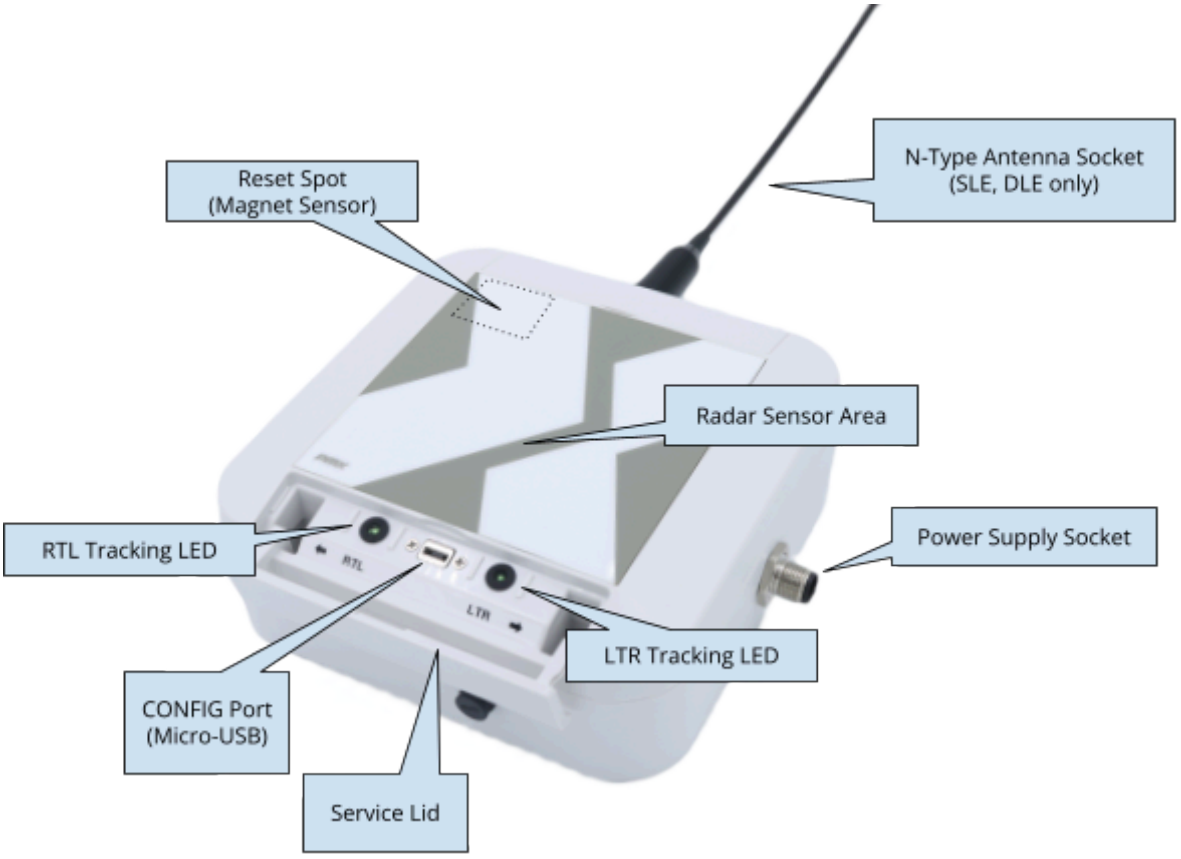
These counters are capable of categorising counted objects into up to four different groups using speed and object size filters. A key feature of PMX TCR counters is their ability to periodically transmit count values to a LNS (LoRaWAN Network Server).

TCR-SLE or TCR-SLI models include a built-in solar charger and temperature-controlled NiMH backup battery. The battery capacity allows the counter to operate for up to four consecutive foggy days without the need for external power. This feature makes solar powered models ideal for remote locations where access to electricity may be limited or unavailable.

For fixed installations where external power is available, such as street lights, the TCR-DLE or TCR-DLI models can be used. These models do not have the internal solar charger and batteries included.In fixed installations with access to external power, like street lights, the TCR-DLE and TCR-DLI models are suitable options. These models lack an internal solar charger and batteries due to the availability of external power.

PMX TCR systems boast flexible installation capabilities, enabling them to adapt to diverse locations. From bustling urban areas with intense traffic to remote regions lacking access to electricity, they can be effortlessly deployed to gather crucial data. Their versatility ensures compatibility with various settings, delivering a comprehensive and accurate monitoring solution.

Get to Know Your PMX TCR



Radar Sensor Area
Radar antennas are behind the "X-Label". Keep the front clean and free from obstacles. Don't put stickers or paint on that area as it could disturb radar signals.

RTL Tracking LED
RTL LED is on when an object from the right is currently tracked

LTR Tracking LED
LTR LED is on when an object from the left is currently tracked

CONFIG-Port
Use this MicroUSB-Port to configure the device using a USB-to-MicroUSB Cable (not supplied)

Power Supply Socket
8-Pin M12 socket for device power.

Magnet Sensor
Hold a magnet to the device's top left corner to issue a restart without opening the device.

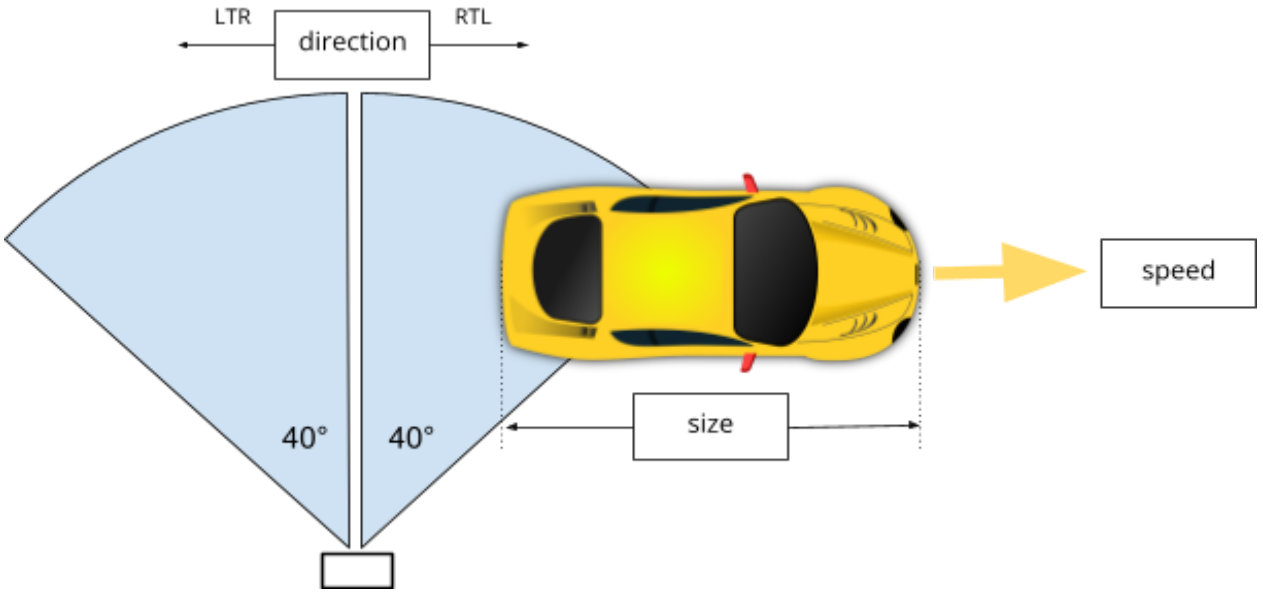
External Antenna Socket (Optional)
Some PMX TCR types are equipped with an N-Type Antenna Socket to mount a long range antenna for creator LoRaWAN coverage in remote locations.

Object Detection

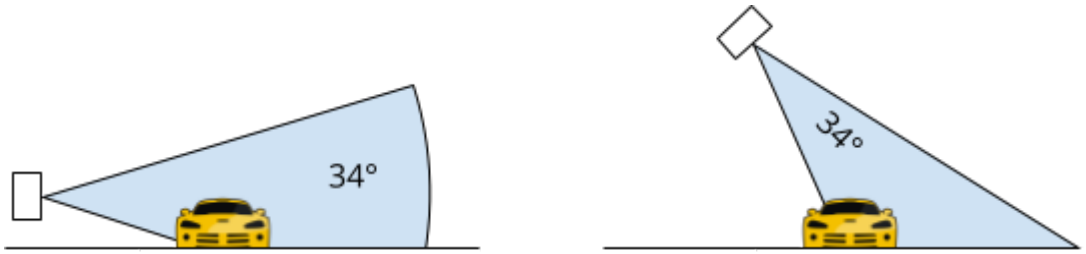
PMX TCR Counters are side-mounted radar sensors that can anonymously count objects from both directions. Multiple objects can be detected simultaneously (PRO feature).

The sensor detects objects passing left to right (LTR) or right to left (RTL). An object must pass through two zones (sectors) in the sensor's radar beam, an approach zone and a receding zone. Each zone has an angle of approximately 40°. **When the combined length of a vehicle and its trailer exceeds the length of two zones, the entire object is considered a single unit. Vehicles with trailers are counted as one, and their total length includes the trailer and the towing vehicle.**

The direction of motion must be parallel to the sensor.



Once the sensor zones have been traversed, the object detection module within the firmware can calculate the object's dimensions, velocity, and direction.

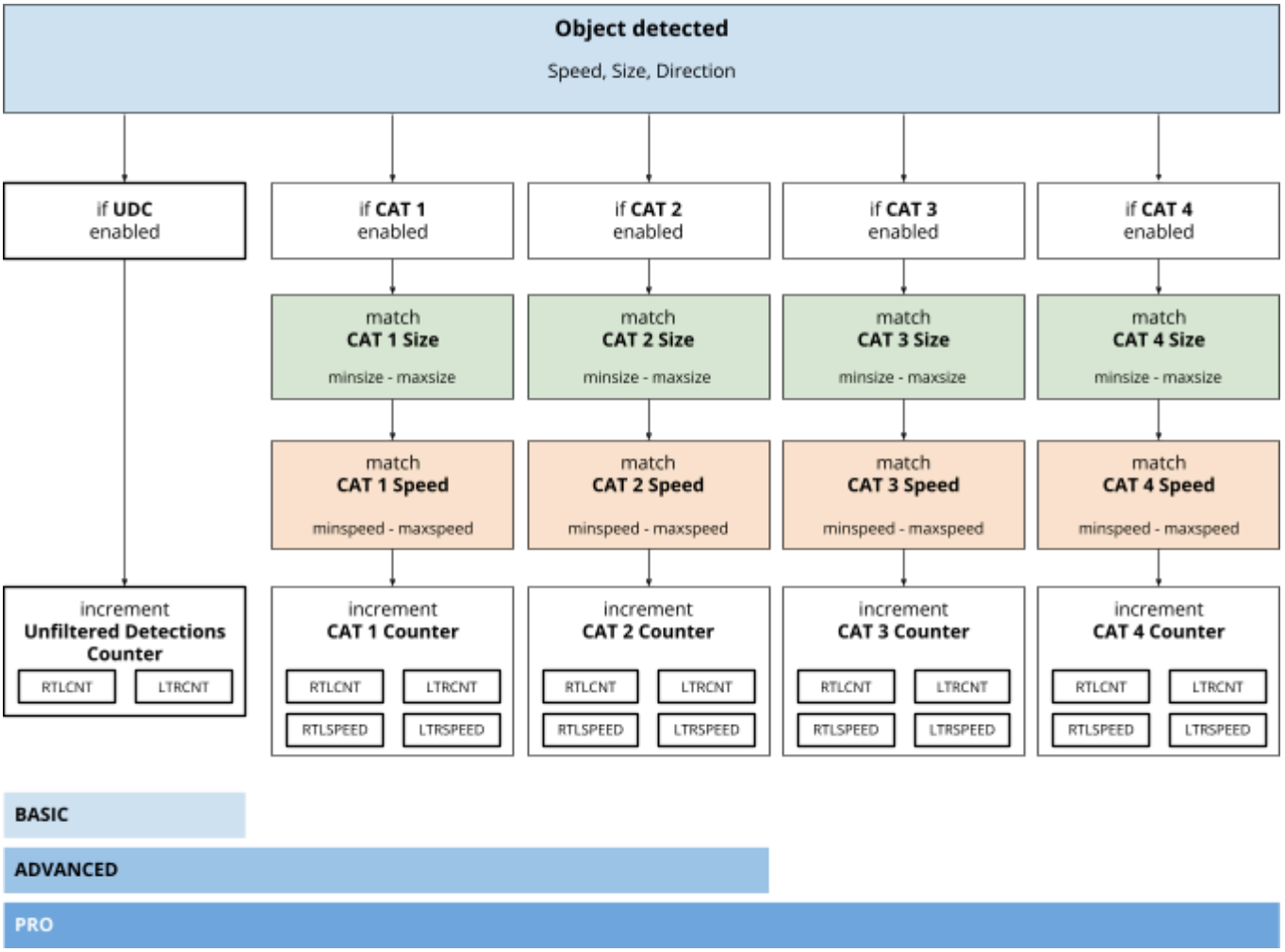


Make sure the object is moving through the radar beam, which is 80° (+/-40°) horizontal and 34° vertical.

Object categorization using speed and size filters

Up to four filter counters (**CAT1-CAT4**) are available for categorising objects based on size and speed. These filters have predefined settings suitable for most applications (see Appendix A). However, users can enable/disable or modify these filters through the CLI or LoRaWAN Downlinks.

Additionally, there's an Unfiltered Detections Counter (**UDC**) that increments with every object detection. This can be useful in "catch-all applications" or when categorization isn't necessary.



All Counters can hold values up to 65535 (16Bit). After a successful uplink, counters are cleared.

Measure Intervals

The measurement interval is the time period during which objects are counted and classified. By default, this interval is set to 10 minutes, indicating that the collected data represents the sum of all counts within the last 10 minutes.

To simplify comparisons with other IoT sensors or to ensure synchronised operation of multiple PMX TCRs, measurement intervals are aligned to the full hour.

In other words, measurement intervals always start at the full hour, such as 1:00, 2:00, 3:00, etc.

Available interval values

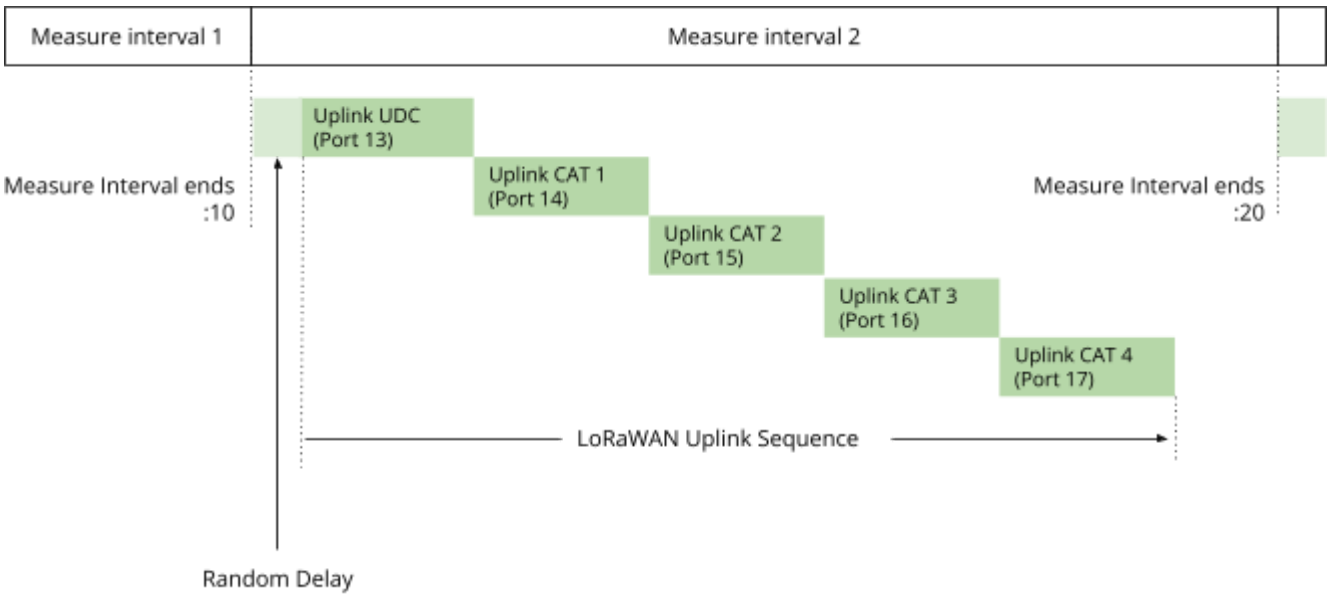
Interval Period [min]	2[1]	3	4	5	6	**10**	12	15	30	60
Intervals / h	30	20	15	12	10	**6**	5	4	2	1
Min Daily LoRaWAN Uplink Transmissions (if only UDC enabled)	720	480	360	288	240	**144**	120	96	48	24
Max Daily LoRaWAN Uplink Transmissions (if all filters enabled)	3600	2400	1800	1440	1200	**720**	600	480	240	120

[1] It is recommended to use 10 minute intervals. It is not recommended to set the interval to less than 3 minutes due to the duty cycle limits in the LoRaWAN standard. This could result in unpredictable behaviour.

LoRaWAN Uplink Sequence

While the data acquisition is synchronous, the LoRaWAN data communication is asynchronous with a random delay added. Thanks to the timestamp in the payload that always shows the exact time of the end of the interval, delays or repeated uplinks are not an issue and can be ignored.

Just use the UTC timestamp in the payload in your application.



The payload format for UDC and filter categories is identical, so you only need to write one payload decoder for all counters. The port number can be used to differentiate between individual counters.

Please have a look at our detailed PMX TCR LoRaWAN Payload Description document.

Ports

LoRaWAN port numbers are used to identify the different types of data being sent from a LoRaWAN device to a network server. Each port number is associated with a specific type of data.

In the context of the PMX TCR counters, there is an uplink for each enabled counter. If all categories are enabled, you will see 5 counter uplinks from the device. However, the payload format of each counter is identical, allowing you to write only one payload decoder for all counters.

PMX TCR counters send an uplink for each enabled filter category. Additionally there is a counter for registering all detections without a filter.

If all *Filters Categories* and the *Unfiltered Detections Counter* are enabled, you will see 5 uplinks from the device that are sent in a sequence with approximately 10s delay between packets

However, the payload format of the individual uplinks is

Uplinks	**Port used**
Unfiltered Detections Counter (UD)	**13**
Filter Category 1 Counter (CAT1)	**14**
Filter Category 2 Counter (CAT2)	**15**
Filter Category 3 Counter (CAT3)	**16**
Filter Category 4 Counter (CAT4)	**17**

Payload Format

PMX TCR counter payloads are 10 bytes long and include a header (A2) as an prefix, the measurement interval end time, counter values, speed averages, and device supply voltage. It is identical for all counters. For more information, see the detailed **PMX TCR Payload Description**.

Byte #	0	1	2	3	4	5	6	7	8	9
Field	**HEAD**	**HH**	**MM**	**LTR_CNT**		**LTR_SPD**	**RTL_CNT**		**RTL_SPD**	**VOLT**

A counter payload of **A2 14 0A 03 E8 32 04 4C 34 32** in hexadecimal would include the following data:

A2 It's a **counter payload V2**
14 0A Measure interval ended at **20:10 UTC**
03 E8 LTR direction counted **1000 objects** in the last measure interval
32 The average speed of those 1000 objects was **50 km/h**
04 4C RTL direction counted **1100 objects** in the last measure interval
34 The average speed of those 1100 objects was **52 km/h**
32 The devices power supply voltage was **5.0V**

Please see PMX TCR LoRaWAN Payload Description.pdf for details on how to implement payload decoders.

Preparation

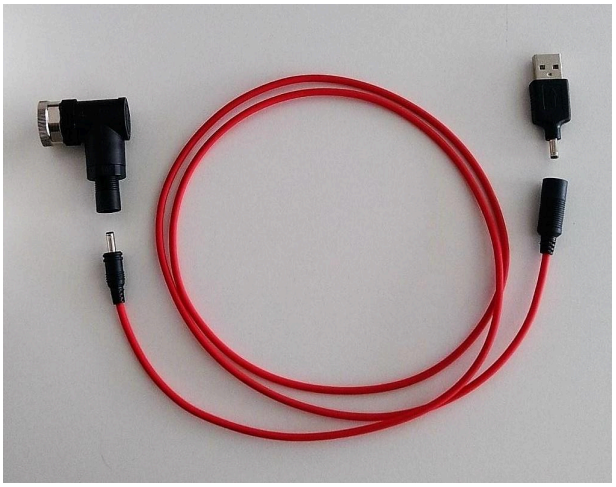
This chapter contains information on the proper location of the PMX TCR traffic counter. The units can be operated either directly next to the road or elevated and looking down from a height of 3m. We recommend using a laser measuring tool or laser pointer to align the unit correctly.

Charge the battery immediately! (Solar models only)

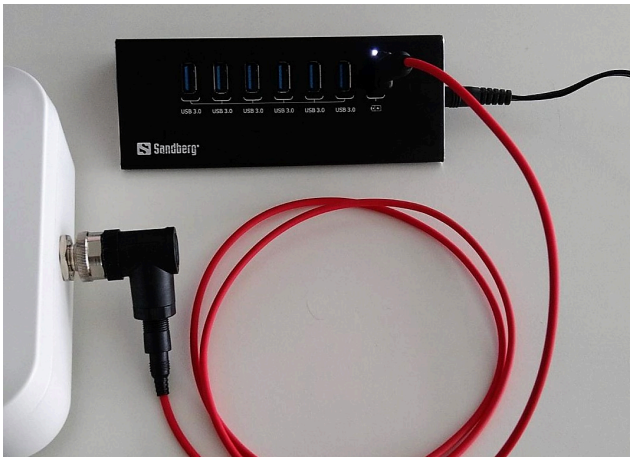
If you have purchased a PMX TCR with a built-in SBX Solar Charger (TCR-SLE or TCR-SLI), you should connect the unit to a USB Power Charger immediately. This prevents the integrated NimH battery from getting damaged by deep discharge.

Until the unit is installed outdoors, it should be charged using the included USB adapter. This will keep the battery fresh and prevent deep discharge damage.

Insert the plug of the **SOL_EXT4** cable into the socket of the **M12SOL** adapter. Then connect the USB adapter plug to the other end.

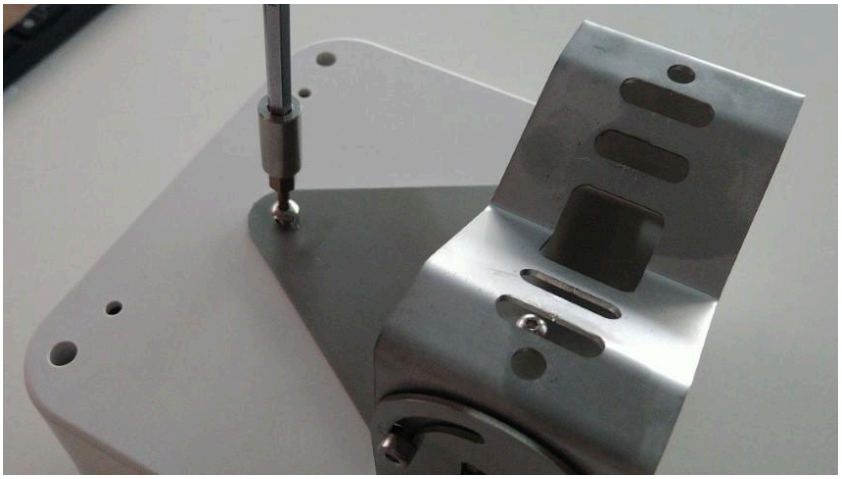


Connect the USB adapter to a USB port on your PC or (better) to a USB hub. Changing at a low rate will keep the battery ready for installation.



MT80-15

The MT80-15 is used to attach the PMX TCR to a mast. The bracket is made of stainless steel and can be attached around the mast using hose clamps or metal hoops.



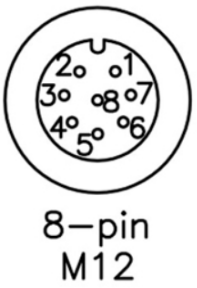
Carefully tighten the MT80-15 holder with the supplied screws. Use a 25 HEX screwdriver for that.
Warning: Use only the supplied screws as longer screws may damage the enclosure (blind holes!)

M12SOL Adapter Plug (Solar models only)

Solar powered PMX TCR (TCR-SLE or TCR-SLI) comes with the M12SOL Solar Adapter Plug.

Important: The M12 connectors have a coding notch (A Coding)

1. Before connecting the plug, ensure the pins are aligned.
2. Rotate the plug, ensuring the notch aligns with the socket's pin.
3. Manually insert the plug with care.
4. Hand-tighten the knurled screw (ring) gently.



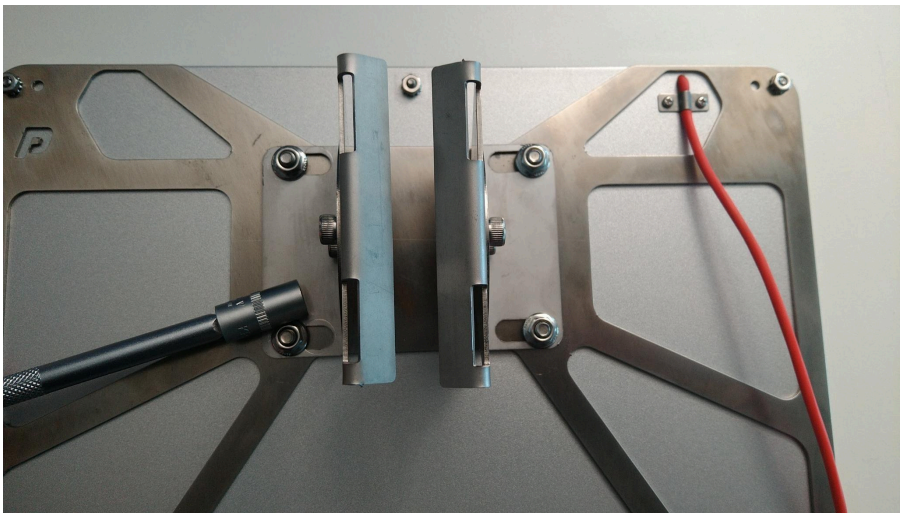
Important :

- The M12 connectors have a coding notch (A Coding)
- Always utilize two fingers to rotate the ring.
- Refrain from attempting to turn the black case.
- Avoid employing tools, as the pins or plastic components are susceptible to breakage.
- Should you encounter resistance requiring more force than anticipated, double-check the coding and pins to ensure accuracy.

Solar Kit

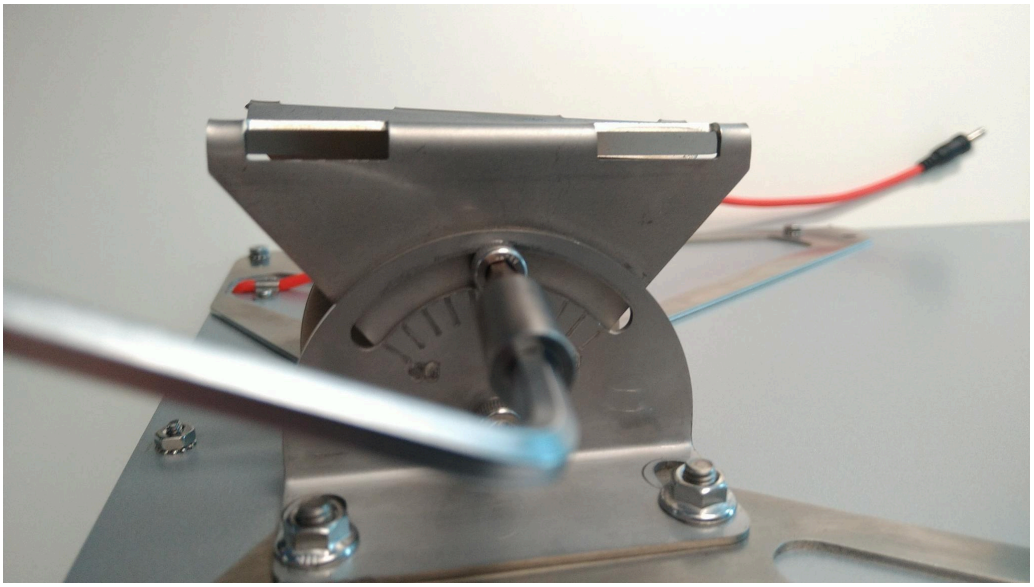
Our 17W or 9W solar kits come pre-assembled and ready to install.

Adjust to pole diameter



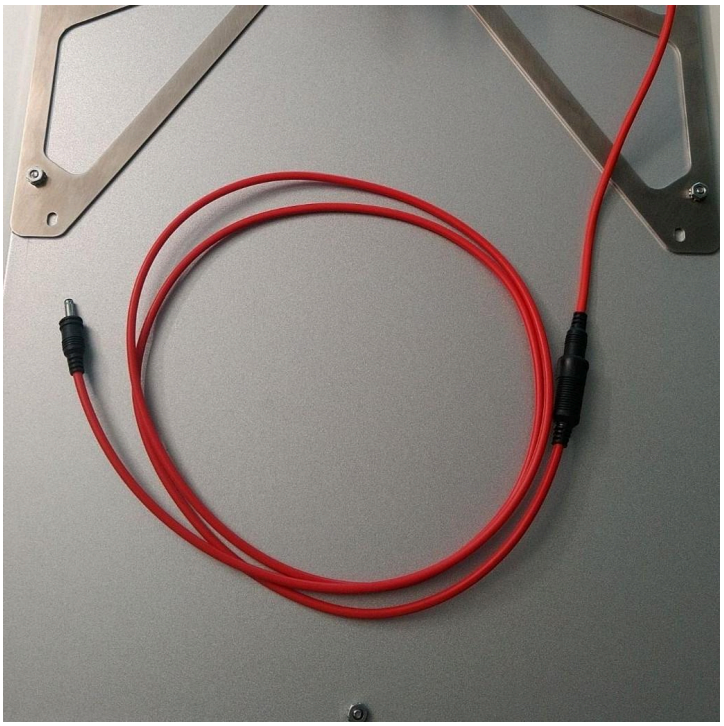
To ensure a perfect fit, modify the SOLMT bracket to match the diameter of your pole.

Adjust azimuth



You can change the angle of the solar panel to harvest more solar energy. Or you can fix the panel in a vertical position so that no snow or dust can remain on it.

Extend the cable (optional)



Using extension cables provides a secure and optimal positioning for solar-powered PMX TCR traffic counters, enabling easy installation and maintenance of solar panels.
Extension cables can be re-ordered from your SP:

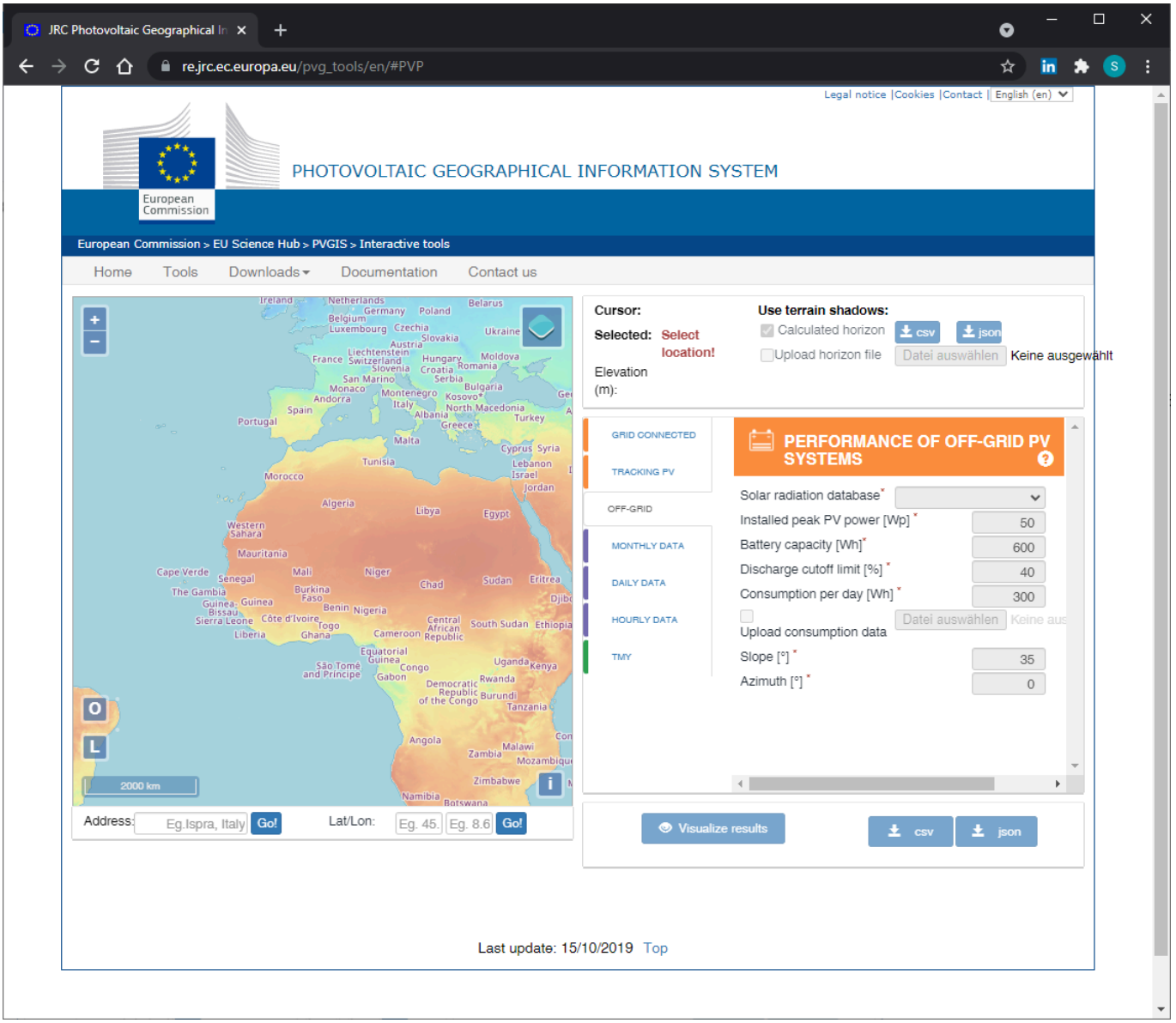
SOL-EXT4 1.25m

SOL-EXT10 3.0m

PVGIS

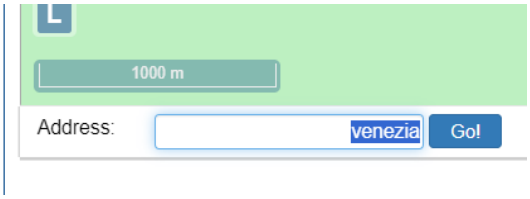
The [Photovoltaic Geographical Information System (PVGIS)] is a useful tool for simulating off-grid solar systems, particularly for understanding the runtime of autonomous systems. It facilitates the simulation of systems like the PMX TCR-SLE or PMX TCR-SLI when paired with a solar panel. This simulation capability provides insights into the system's performance and energy generation potential, allowing for informed decisions regarding the installation of PMX TCR Counters.

Important: Weather models used are based on statistical values from the past. Reality can of course differ in case of weather extremes.



1. Location

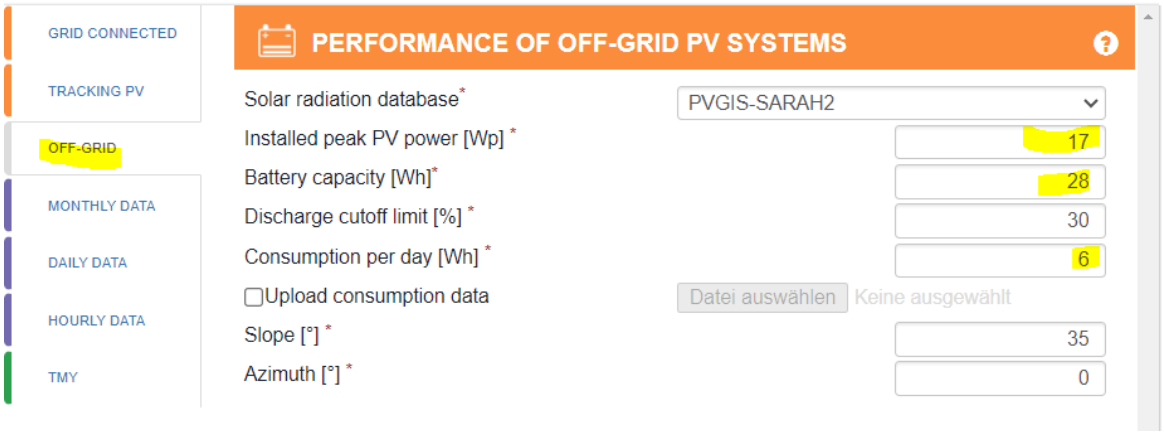
Open [PVGIS] and enter the location where you plan to install the PMX TCR counters Solar panel.



2. Enter Off-Grid Data

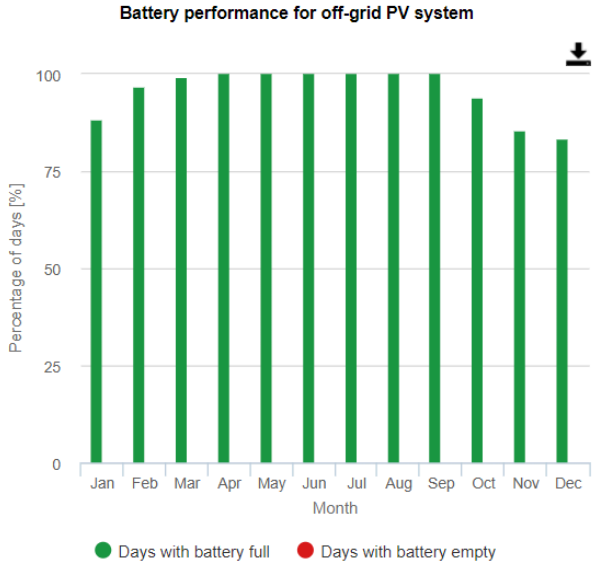
Enter the typical data of a solar powered PMX TCR:

- Intallead Peak PV: **17 W** when using **SOL17-KIT**, **9 W** when using the **SOL9-KIT**
- Battery capacity: **28 Wh** for TCR-SLE or TCR-SLI
- Consumption: **6 Wh** for TCR-SLE or TCR-SLI



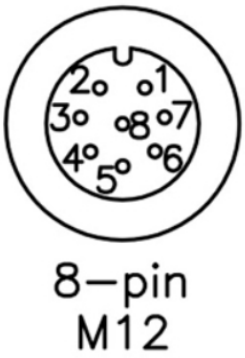
3. Optimise

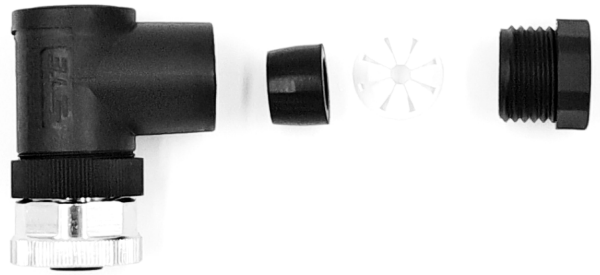
Optimise solar panel or location or parameters. You might need a bigger panel or other power source for your planned location.



External Power Supply (DC models only)

This connector is used to connect the TCR to power supply units, external batteries or solar panels provided by the customer.The DC-Powered PMX TCR (TCR-DLE or TCR-DLI) includes a M12P field-installable connector equipped with screw terminals. This connector enables customers to conveniently connect external power sources, such as power supply units, batteries, or solar panels, to the TCR.





Pin	Signal		Purpose
1	**V-**	**0V Radar Mainboard**	**Option A: 5-12V/1APower Supply**
2	**V+**	**5-12V Radar Mainboard**	
3			not used
4			not used
5			not used
6			not used
7	**VS-**[2]	**Solar Charger 0V Input**	**Option B: 5-12V/1A Interrupted Power Supply**
8	**VS+**[3]	**Solar Charger 5-20V Input**	**Option C: 3rd party power source**

Option A

TCR runs on an external 5-12V DC power source, capable of driving up to 1A. Suitable for street lamps with continuous power. This option is available on all models.

[2] Available with Solar models only
[3] Available with Solar models only

Option B

The TCR's internal batteries are recharged by an external power source that provides a voltage ranging from 5 to 12 volts DC. This feature is particularly beneficial for streetlamps that are turned off during the daytime. This option is available on solar powered devices only.

Option C

TCR can be charged by many alternative power sources that can about 2Wh per day:

- Solar panels: steady power, inexpensive, and easy to install.
- Wind turbines: less reliable due to intermittent wind.
- Fuel cells: reliable but more expensive. Good for outdoor applications in the North
- External batteries: convenient but require regular recharging.

Important: Input Voltage must not exceed 20V and ripple voltage should be below 150mVpp
Option C is available on solar powered devices only.

Quick Setup

Configuring PMX TCR is now very easy with new AI-based Autoconfig and Autosens functionality. With the PMX firmware for TCR, you no longer need to set distances, speeds and sensitivity.
All you need to do is select the correct speed class and enter the LoRaWAN keys.

Prerequisites

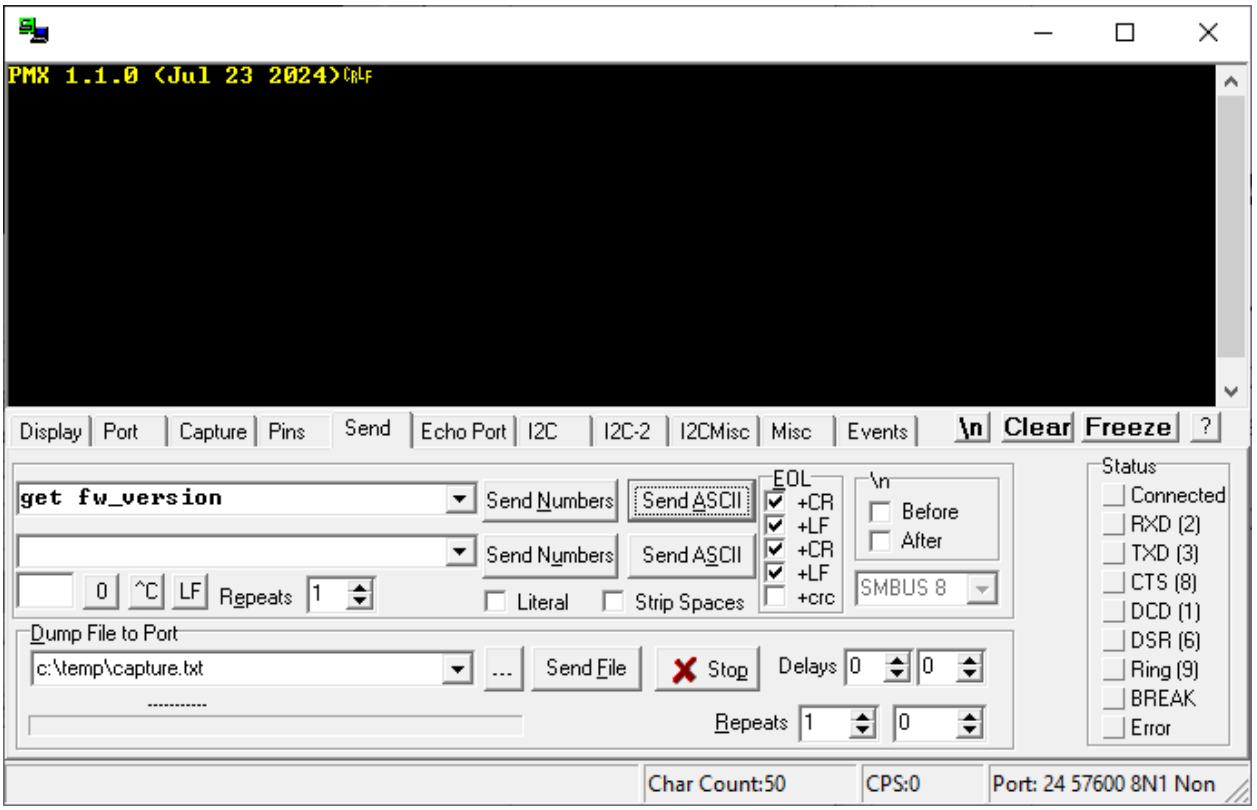
USB-to-MicroUSB cable

Initial setup is done with an USB cable connected to the CONFIG port and a PC. We recommend using a high quality cable not longer than 1m.

Windows should automatically install a device driver and you will find the device in the device manager under section serial ports (COM ports). If not please refer to our FAQ Section.

Terminal Emulation Software

Install a terminal emulation software such as RealTerm (Windows) to open the COM Port and send/receive commands to/from the device. All commands are sent with carriage return (CR) + line feed (LF) appended.



Serial Port Settings:

- Baudrate is set to 115200.
- Data Bits are set to 8.
- Parity is set to None.
- Stop Bits are set to 1.
- Append CRLF (Check +CR and +LF)

To make these changes permanent, always use the **save** command.
Apply new settings by restarting the unit. You can do this with the **Restart** command, by holding a magnet over the reset spot, or by disconnecting/connecting the cable.

Activate licence (Optional)

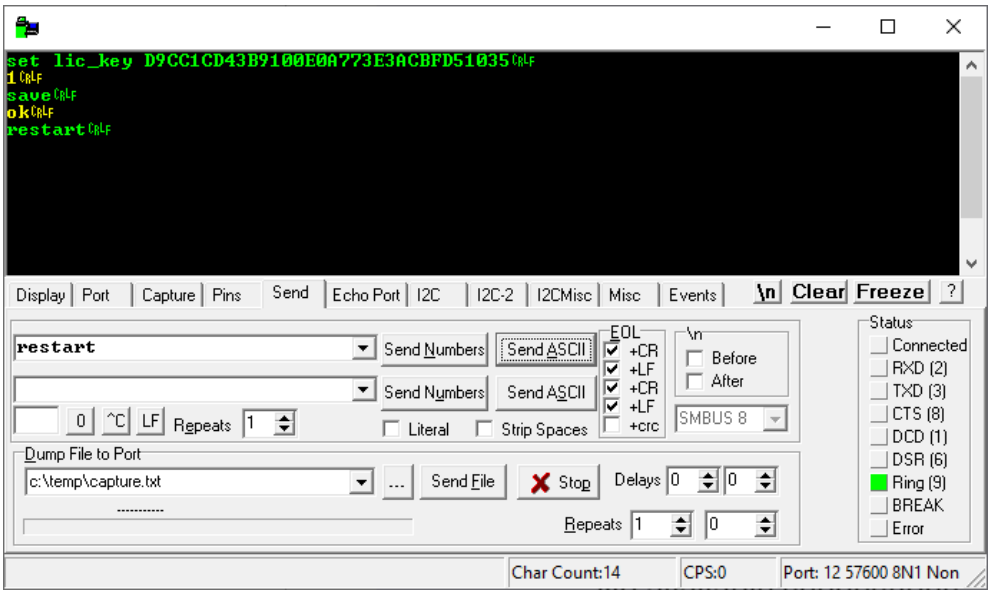
NOTE: If you purchased a new PMX TCR skip this step as your devices comes with a pre-installed licence

If you are updating an older Parametric TCR, use a terminal emulation software and a USB cable to connect to your TCR's CONFIG port to activate the licence.

1. Transfer the Licence Key by using the **set lic_key** CLI command.
   The command returns the new function level if the licence is valid.

Return code	Functionality
0	BASIC Features activated
1	ADVANCED Features activated
2	PRO Features activated

2. Use command **save** to permanently install the licence on the device



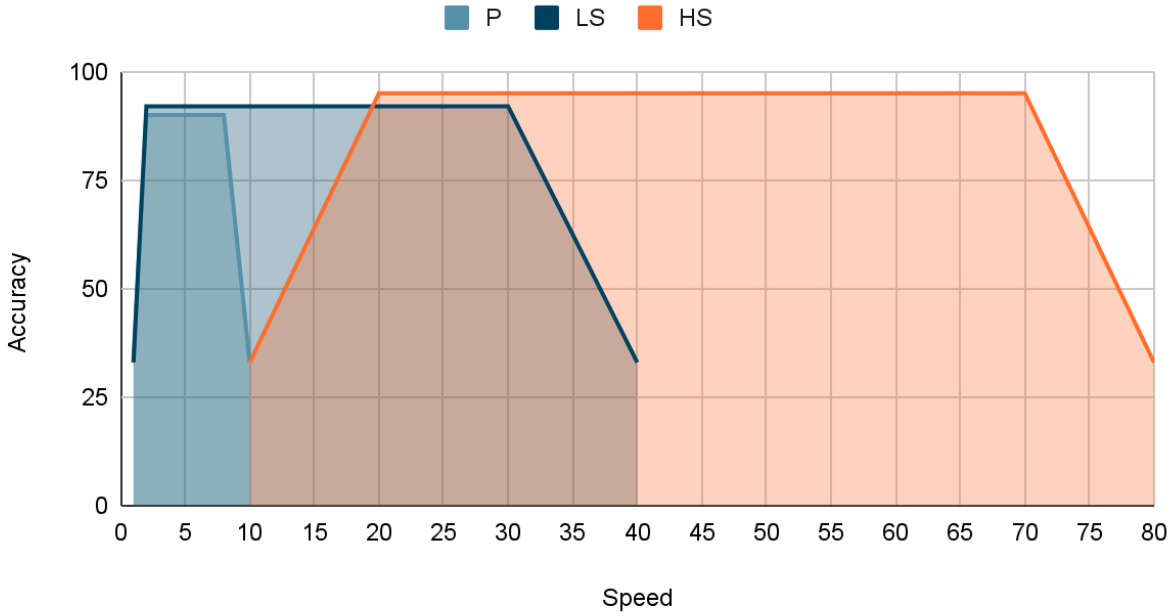
Commands

Commands used to verify or install a licence key.

CLI Commands	Returns	Description
`get lic_key`	`key[32]`	Get the Licence Key string currently saved on the device.
`set lic_key [key]`	`0,1,2`	Activate a licence key for that device by appending the 32 characters long HEX-String to the set lice_key command. The command returns: ● 0: BASIC features ● 1: ADVANCED features ● 2: PRO features Please **save** and **restart** after installing a licence.
`get fu_level`	`0,1,2`	Check the current feature level. The command returns: ● 0: BASIC features ● 1: ADVANCED features ● 2: PRO features

Speed Class

Doppler radar counters use dynamic sampling rates and adaptive electronic amplifiers to accurately measure the speed of objects. To achieve good counting accuracy, it is important to choose the appropriate speed class for your application. PMX TCR counters can scan either slow motion with higher resolution or fast motion up to 80 km/h. **It is therefore essential to choose the right compromise between speed and resolution.**

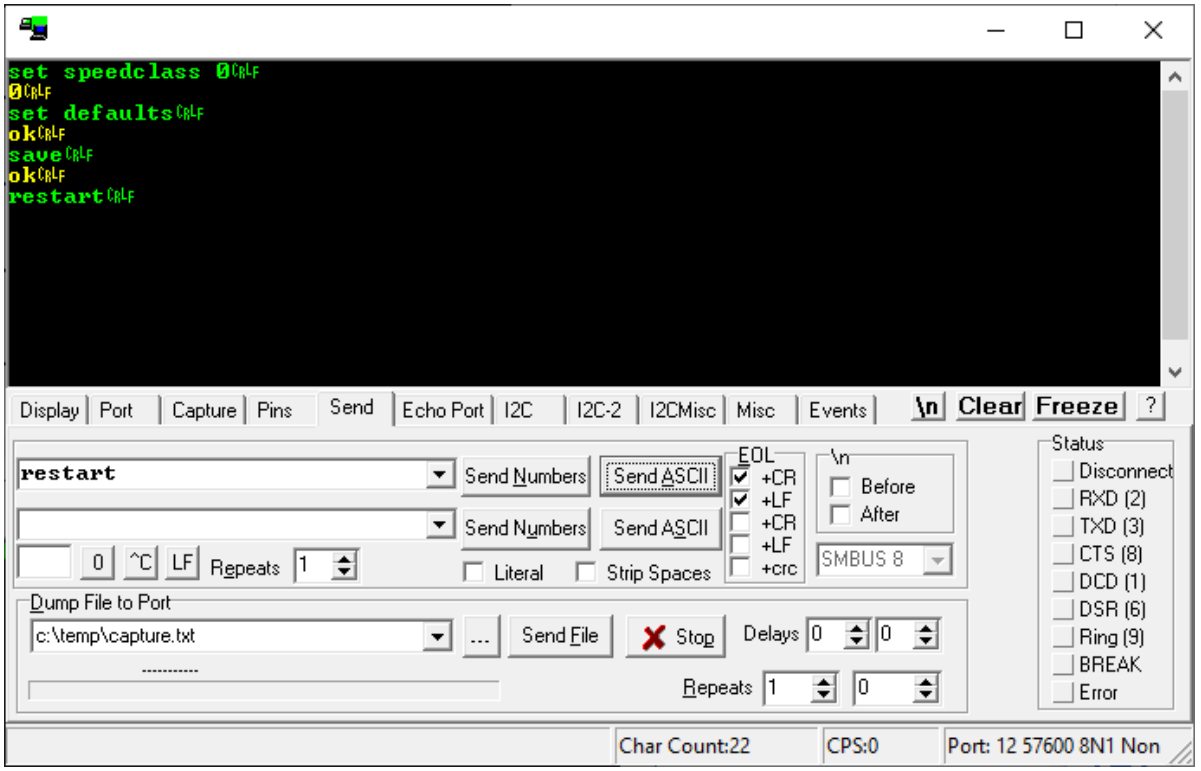


Speed Class	CLI Command	Used for	Counters available
P	`set speedclass 0`	Pedestrians 2-10 km/h	Unfiltered Detections Counter (UD)
LS [4]	`set speedclass 1`	Low Speed Traffic 2-40 km/h	Unfiltered Detections Counter (UD) Filter Category 1 Counter (CAT1) Filter Category 2 Counter (CAT2)
HS [5]	`set speedclass 2`	High Speed Traffic 10-80 km/h	Unfiltered Detections Counter (UD) Filter Category 1 Counter (CAT1) Filter Category 2 Counter (CAT2) Filter Category 3 Counter (CAT3) Filter Category 4 Counter (CAT4)

[4] a 60-day trial period applies. After that, an ADVANCED or PRO licence must be active.
[5] a 60-day trial period applies. After that, a PRO licence must be active.

Use **set defaults** to load factory defaults. See APPENDIX A - Factory Defaults

Always send **save** and **restart** to permanently apply new settings.



Commands

Commands used to modify the speed class.

CLI Commands	Returns	Description
`get speedclass`	`0-2`	Read current Speed Class from the device
`set speedclass [s]`	`0-2`	Change the Speed Class in the device. Append **0** for P, **1** for LS, **2** for HS. This setting requires a device reboot. **Note: Switching to LS or HS requires an appropriate Licence activated.**

LoRaWAN Keys

The PMX firmware for TCR is shipped with Semtech's latest LoRaWAN stack, which supports LoRaWAN 1.1 with LoRaWAN 1.0.4 as a fallback.

Important:
PMX TCR are class A devices that can be registered as LoRaWAN 1.0.4 or LoRaWAN 1.1 nodes.

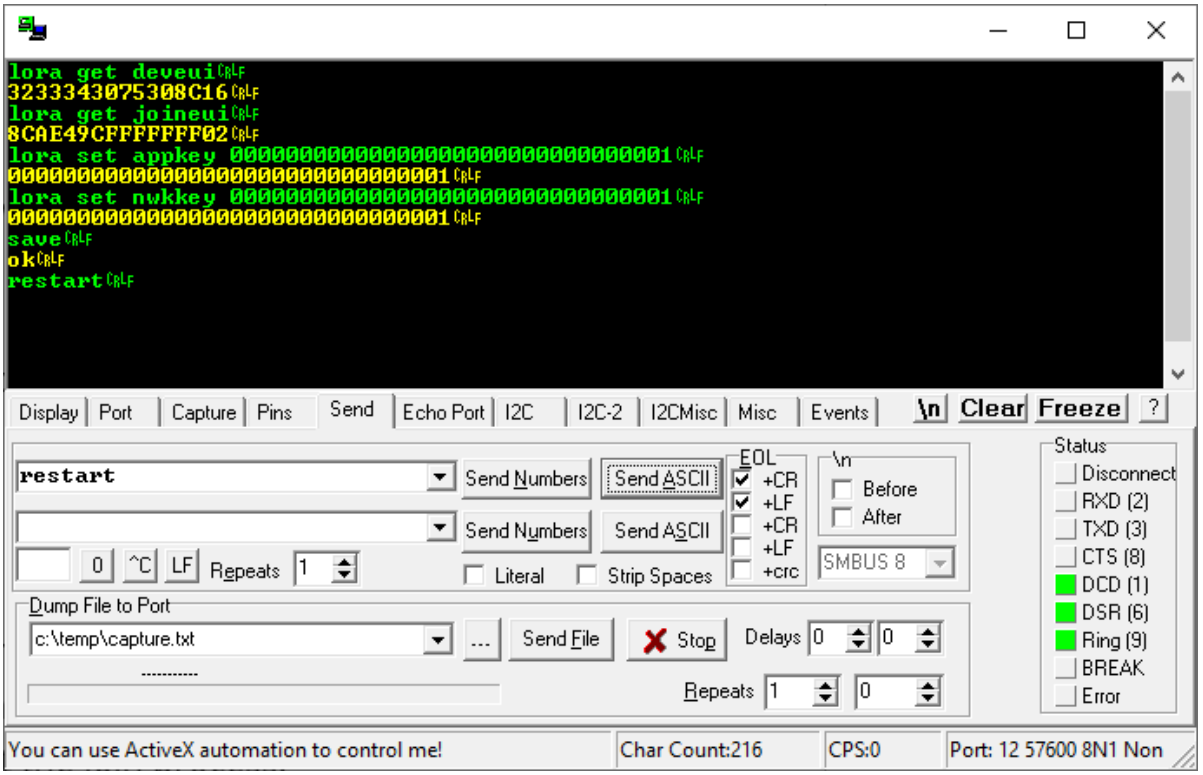
DevEUI and JoinEUI are device specific and should not be user changed.

A typical setup session is below.

1. Get the DevEUI using the **lora get deveui** command
2. Get the JoinEUI using the **lora get joineui** command
3. Set a random AppKey using the **lora set appkey** command followed by
4. Set a random NwkKey using the **lora set nwkkey** command

   Important! When you plan to use LoRaWAN 1.0.4 set the Nwkkey to the same value as the Appkey. Otherwise the device won't join the network.

5. Always use **save** to permanently save changes to the ROM.
6. Switch to your LNS console (Loriot.io, TTN, ...) and enter the above keys.
7. Send a **lora reset** to clear the context memory on the device and let the device join the network.



Commands

Following CLI commands are used to handle LoRaWAN.

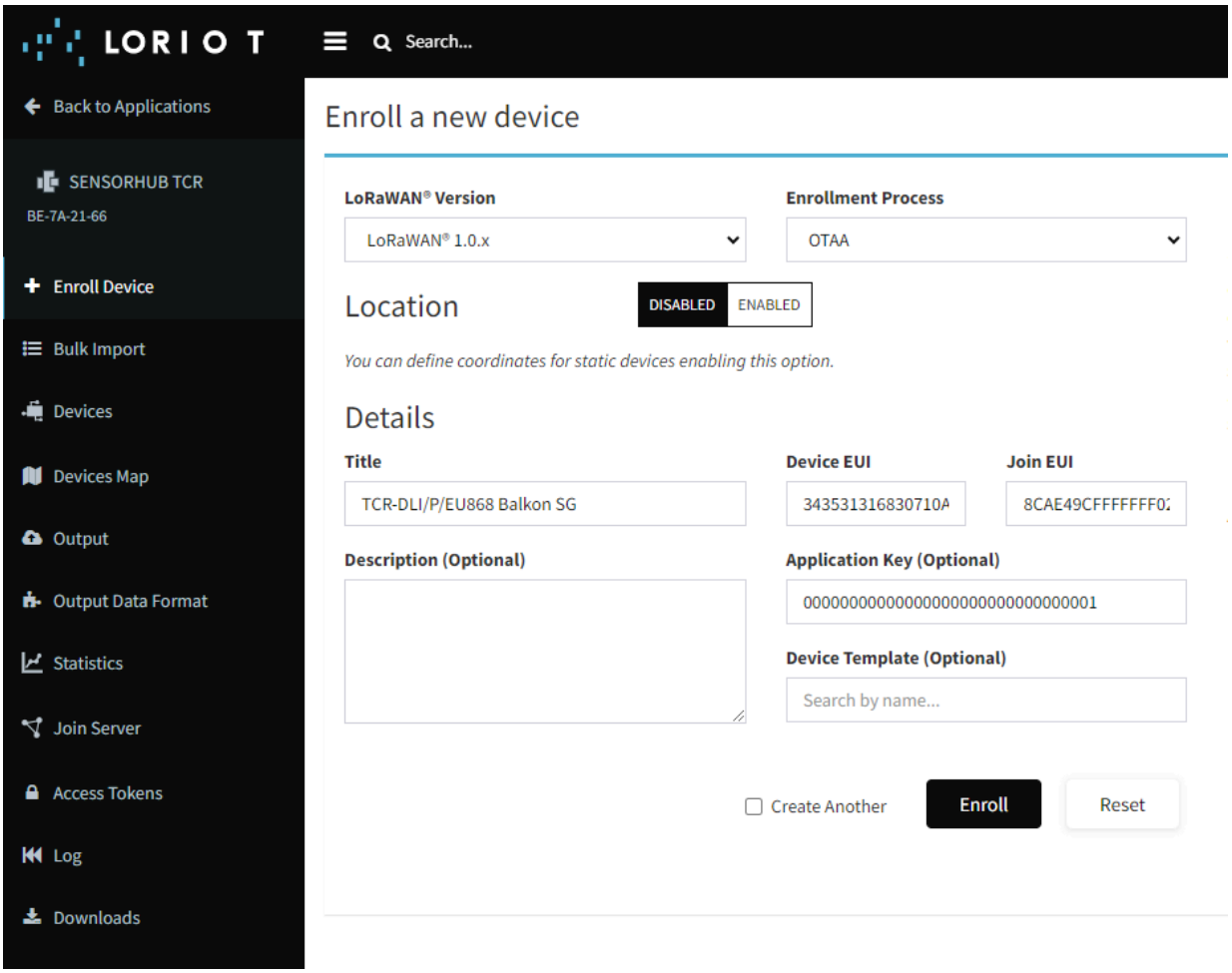
CLI Commands	Returns	Description
`lora get deveui`	`hexstr[16]`	Read the DevEUI (16 chars Hex-String)
`lora get joineui`	`hexstr[16]`	Read the JoinEUI (16 chars Hex-String)
`lora set joineui [hex16]`	`hexstr[16]`	Overwrite the JoinEUI (16 chars Hex-String)
`lora get appkey`	`hexstr[32]`	Read the AppKey (32 chars Hex-String)
`lora set appkey [hex32]`	`hexstr[32]`	Overwrite the AppKey (32 chars Hex-String)
`lora get nwkkey`	`hexstr[32]`	Read the NwkKey (32 chars Hex-String) **Important: Used for LoRaWAN 1.1 only. Set to the same value as AppKey when using 1.0.4**
`lora set nwkkey [hex32]`	`hexstr[32]`	Overwrite the NwkKey (32 chars Hex-String) **Important: Used for LoRaWAN 1.1 only. Set to same value as AppKey when using 1.0.4**
`save`	`ok`	Apply changes
`lora reset`	`ok`	Clear LoRaWAN Context Memory and force a rejoin. **Important:** **All LoRaWAN context data including FCnt, DevNonce will be reset to initial state. You may need to reset LoRaWAN context on your LNS too.**

Device Registration

Loriot.io (Recommended)

PMX Systems AG recommends using Loriot.io server products based on our experience with their stability, ease of use and support. A free community server is also available to start.

This chapter shows how to register a PMX TCR on your Loriot.io network server using the keys from the previous step.

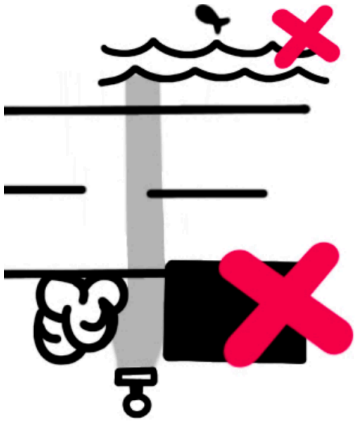


Installation

Important rules

To achieve optimum counting accuracy and noise immunity, the following aspects must be carefully respected.

Avoid obstacles

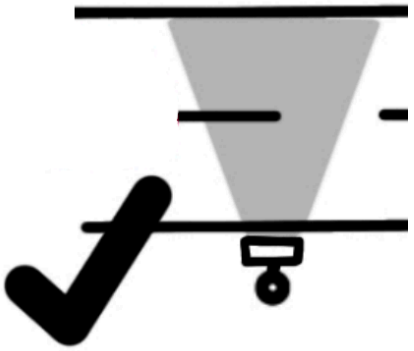


Make sure there are no obstacles such as walls, street signs, shrubberies, trees in the field of view.

The sensors require an unobstructed view of approximately 130 (+/- 65°) on each side to track approaching and receding objects.

Avoid water as the device might detect big waves.

Be as lateral as possible



TCRs are side-looking radars that detect motion from both directions simultaneously. The motion should be linear. Place the sensor parallel (+/- 2°) to the direction of motion.

Stay away from curves, intersections, driveways, and entrances.

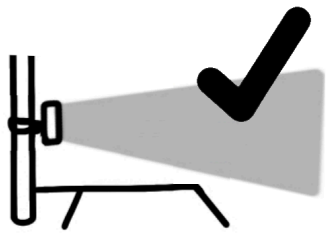
Find a straight stretch of road where objects are constantly passing, not accelerating or decelerating.

Elevated Mounting (Recommended)

Mount the PMX TCR on a pole in an elevated position 3-4m above the ground. This will prevent vandalism and road dust pollution.

The counter should face the centerline of the track or road, which can be achieved by using the MT80 tilt bracket. Please ensure the maximum distance to objects does not exceed 8m.

Side Mounting



Side mounting may also be an option. It is sometimes used for temporary installations.

We recommend a mounting height of 1.2-1.5m above the ground.
The line of sight should be completely horizontal.

Because the radar cannot see through objects, side mounting may cause slightly lower counting accuracy in two-way traffic.

Installing the Counter

When mounting the counter to a pole or mast, employ pipe clamps or metal straps of an appropriate length to ensure the security of the MT80-15 bracket.

Once the bracket is secured to the pole, adjust the sensor's angle so that it points directly towards the center of the street or walkway. Consider using a laser pointer to establish a precise vertical line from the front of the sensor to the street's surface.

Installing the Solarpanel

Mount the solar panel in a place where it gets enough sunlight during the day. Use pipe clamps or metal straps of suitable length to secure the bracket to the pole.

Advanced Configuration

This chapter covers advanced configuration options for the system. These options are not necessary for basic operation of the system, but they can be used to customize the system to meet specific needs.

All settings described in this chapter can be changed using the CLI. Some settings can also be changed by sending a **LoRAWAN Downlink message to device port 1.** When changing settings via Downlink, changes are made directly in NV memory. (See the PMX TCR LoRaWAN Payload Description document for more information)

Measuring Interval

The measurement interval is the period of time during which objects are counted and categorised. After a successful data uplink the counters are reset.

The default is 10 minutes. This means that the data collected is the sum of all counts during the last 10 minutes.

Measuring intervals are **synchronised to the full hour**. This means that a measurement sequence always starts at 1:00, 2:00, 3:00, ... This is useful for synchronising traffic data with other IoT sensors or for running multiple TCRs in sync.

Available interval values (all are divisors of 60)

Interval [min]	2[6]	3	4	5	6	**10**	12	15	30	60
LoRaWAN Uplinks	30/h	20/h	15/h	12/h	10/h	**6/h**	5/h	4/h	2/h	1/h

While the data acquisition is synchronous, the LoRaWAN uplink is asynchronous with a random delay added after the measure interval. Thanks to the timestamp in the payload showing the exact time of the end of the interval, delays or repeated uplinks are not an issue and can be ignored. Just use the UTC timestamp in the payload and not the time when the LoRaWAN server received the message.

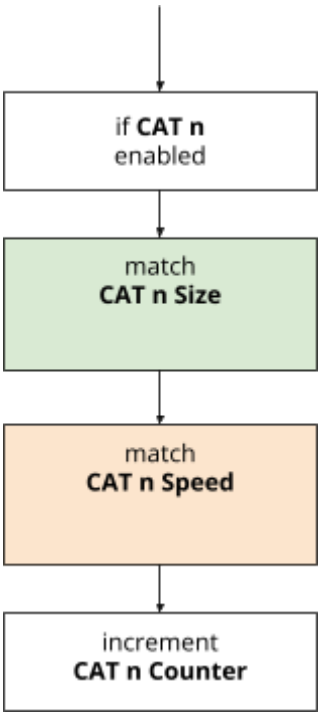
Commands

Commands to change the measuring interval using the CLI or remotely via LoRaWAN Downlink.

CLI Commands	**Returns**	**Description**	**LR Downlink**
`get interval`	`[min]`	Read the current interval setting	`C253`
`set interval [min]`	`[min]`	Change the interval setting. Valid arguments include 2,3,4,5,6,10,12,15,30,60 min	`C253xxxx`

[6] Setting the interval to less than 3 min could lead to data loss due to LoRaWAN® duty cycle limitations.

Filters



During the object categorization process, size and speed filters play a critical role in evaluating potential matches. These filters are designed to narrow the range of objects under consideration, making the categorization process more efficient and accurate.

The size filter is used to determine whether an object is too large or too small to be a potential match for the category in question. For example, in a traffic counting application, the size filter can be set to exclude objects that are smaller than the average size of a vehicle. This helps ensure that only items that are likely to be a car are counted.

The speed filter is used to determine whether an object is moving too fast or too slow to be a potential match for the category in question. For example, in a bicycle/pedestrian categorization application, the speed filter could be set to exclude objects moving faster than the average speed of a bicycle or pedestrian. This helps to ensure that only objects that are likely to be bicycles or pedestrians are categorized.

If an object passes both the size and speed filters, it is considered a potential match for that category. The corresponding counters are then adjusted accordingly to reflect the presence of the object.

The filter sets used to categorise objects are typically preset based on the most common applications. However, it is possible to change any filter settings to customise the categorization to your own specific needs. This can be useful if you are working with a unique application or if you want to fine-tune the categorization process for your particular dataset.

The following table shows all speed classes and the filter values that are enabled by default

Speed Class	CAT1	CAT2	CAT3	CAT4
P	-	-	-	-
LS	**30-150cm 2-10km/h**	**150-300cm 10-40 km/h**	-	-
HS	**150-300cm 10-80km/h**	**300-600 cm 10-80km/h**	**600-800 cm 10-80km/h**	**800-3000 cm 10-80km/h**

Commands

Commands used to change filter settings or remotely via LoRaWAN Downlink.
Valid arguments for [n] include:

- 1 : filter cat 1
- 2 : filter cat 2
- 3 : filter cat 3
- 4 : filter cat 4

CLI Commands	Returns	Description	LR Downlink
`cat [n] get enabled`	`[ena]`	Check if a counter is enabled. Returns 0 when disabled, 1 when enabled.	`C2[n]1`
`cat [n] set enabled [ena]`	`[ena]`	Enable or disable a counter. Append 0 to disable, 1 to enable the counter. Returns 0 when disabled, 1 when enabled.	`C2[n]1xxxx`
`cat [n] get minsize`	`[cm]`	Returns the minimum object size of the filter in cm.	`C2[n]2`
`cat [n] set minsize [cm]`	`[cm]`	Set the minimum size of an object that should be counted by this category. Returns the new value.	`C2[n]2xxxx`
`cat [n] get maxsize`	`[cm]`	Returns the maximum object size of the filter in cm.	`C2[n]3`
`cat [n] set maxsize [cm]`	`[cm]`	Set the maximum size of an object that should be counted by this category. Returns the new value.	`C2[n]3xxxx`
`cat [n] get minspeed`	`[kmh]`	Returns the minimum speed of this category in km/h	`C2[n]4`
`cat [n] set minspeed [kmh]`	`[kmh]`	Set the minimum speed of an object to be counted in this category. Returns the new minspeed.	`C2[n]4xxxx`
`cat [n] get maxspeed`	`[kmh]`	Returns the maximum speed of this category in km/h	`C2[n]5`
`cat [n] set maxspeed [kmh]`	`[kmh]`	Set the maximum speed of an object to be counted by this category. Returns the new maxspeed.	`C2[n]5xxxx`
`save`	ok	Apply changes	`n/a`
`restart`	-	Restart device with new filter values	`C2EE`

LoRaWAN Region

There are three LoRaWAN available: EU868, AS923, and AU915. Each region has its own set of frequency bands and regulations.

- EU868 is the most widely used LoRaWAN region. It covers Europe, the Middle East, and Africa.
- AS923 covers Asia and the Pacific region
- AU915 covers Australia and New Zealand

Note: PMX Firmware for TCR supports the RP2-1.0.3 LoRaWAN® Regional Parameters

Commands

Commands to change the LoRaWAN region via CLI. (No LoRaWAN downlinks available for security reasons)

CLI Commands	Returns	Description	LR Downlink
`lora get region`	`[rid]`	Returns the active region settings: 1 for EU868 2 for AS923 3 for AU915	`n/a`
`lora set region [rid]`	`[rid]`	Change LoRaWAN. Append 1 for EU868, 2 for AS923, 3 for AU915	`n/a`
`save`	ok	Apply changes	`n/a`
`restart`		Restart device	`n/a`
`get typestr`	`[str]`	Validate your changes by reading the device's type string. The type string should contain the new region, e.g. "TCR-SLE/LS/**AS923**".	`n/a`

LoRaWAN Data Rate

A LoRaWAN data rate is a measure of the speed at which data is transmitted over a LoRaWAN network. LoRaWAN devices can typically support multiple data rates. The choice of data rate depends on the application requirements. For example, an application that requires long range and high reliability may use a low data rate, while an application that requires high throughput may use a high data rate.

Adaptive Data Rate (ADR)

Adaptive Data Rate (ADR) is a feature of LoRaWAN that allows devices to automatically adjust their transmission power and data rate based on the quality of the link to the gateway. ADR can be disabled on most LoRaWAN devices. However, it is not recommended to disable ADR unless you have a specific reason to do so. If you disable ADR, the device will always transmit at the same data rate and power level, regardless of the link conditions. This can lead to reduced network performance.

Commands

Commands to switch off ADR and modify data rate manually using the CLI. (No LoRaWAN downlinks available for security reasons)

CLI Commands	Returns	Description	LR Downlink
`lora get adr`	`[ena]`	Check if Adaptive Data Rate is active. Returns 1 if enabled, otherwise 0.	`n/a`
`lora set adr [ena]`	`[ena]`	Switch ADR on or off by appending 1 or 0.	`n/a`
`lora get dr`	`[dr]`	Check the current data rate. If ADR is enabled, this value is the adjusted data rate. If ADR is disabled, this command returns the current DR setting.	`n/a`
`lora set dr [dr]`	`[dr]`	Set a data rate to use. **No effect when ADR is enabled.**	`n/a`
`save`	ok	Apply changes	`n/a`
`lora reset`	ok	Clear LoRaWAN context and rejoin.	`n/a`

LoRaWAN Confirmed Uplinks

LoRaWAN confirmed uplinks are a type of uplink message that is acknowledged (ACK) by the network. This means that the sender of the message can be sure that the message was received by the network.

PMX TCR Behavior in Confirmed and Unconfirmed Uplink Scenarios

	Confirmed Uplinks Disabled (Default)	**Confirmed Uplinks Enabled**
Uplink Behavior	At the end of the measurement interval, all counter data is transferred in an uplink sequence. The counters are immediately cleared (set to zero).	At the end of the measurement interval, all counter data is transferred in sequence and only cleared when the uplink is acknowledged by the network server.
Pros	Less messages leads to a better overall performance of a LoRaWAN network and lower power consumption of the device.	Acknowledged uplinks help prevent data loss.
Cons	Due to the nature of LoRaWAN, there's no guarantee that every uplink will be received.	If a LoRaWAN gateway responds too slowly, this can lead to connection problems when the device does not receive the ACK in time. We have often experienced this in installations with slow Internet connections or with self-built gateways.

Commands

Commands to switch on confirmed uplinks. (No LoRaWAN downlinks available for security reasons)

CLI Commands	**Returns**	**Description**	**LR Downlink**
`lora get confirmed`	`[ena]`	Check if device sends confirmed uplinks	`C271`
`lora set confirmed [ena]`	`[ena]`	Switch Confirmed uplinks on or off 1 = confirmed uplinks 0 = unconfirmed uplinks	`C271xxxx`
`save`	ok	Apply changes	`n/a`
`restart`	ok	Restart device with new settings	`C2EE`

Device Monitoring

PMX TCR counters feature built-in mechanisms to maintain standalone operation during temporary connectivity loss or power outages. This eliminates the need for users to travel long distances solely for device restarts.

MCU Watchdog

An Independent Watchdog (IWDG) is a safety feature built into the microcontrollers (MCUs) of PMX TCR devices. This separate timer can reset the microcontroller in the event of an unresponsive or stuck state. To activate, the IWDG requires enabling, configuration, and periodic resetting via microcontroller software. All PMX TCR microcontrollers operate with enabled IWDGs.

IPC Watchdog

The IPC Watchdog within PMX TCR devices monitors system stability through the microcontroller's Inter-Processor Communication (IPC) peripheral. It sends periodic signals between processors. If the receiving processor does not receive the signal within a specified time frame, it triggers a system reset.

Join Timeout Reset

PMX TCR counters incorporate a join timeout reset feature to address prolonged interruptions in joining the LoRaWAN network. If a device fails to receive a join accept message from the network server within a predetermined time frame, it automatically resets its join attempt. This proactive approach ensures seamless reconnection, minimizes the impact of temporary connectivity issues, and maintains consistent device communication.

LoRaWAN LinkCheck

- Enables devices to periodically verify network connectivity by transmitting LinkCheck Requests.
- The network responds with LinkCheck Acknowledgements (ACKs).
- If an ACK is absent, the PMX TCR undergoes a restart.
- LinkCheck functionality can be deactivated by setting the interval to zero.

Commands

Commands to modify device monitoring settings using the CLI.

CLI Commands	Returns	Description
`lora get jointimeout`	`[min]`	Get the current LoRaWAN join-procedure timeout in minutes.
`lora set jointimeout [min]`	`[min]`	Overwrite LoRaWAN join-procedure timeout in minutes. Range is 1 min up to 60 mins.
`lora get lci`	`[min]`	Get the current LinkCheck interval in minutes.
`lora set lci [min]`	`[min]`	Overwrite LinkCheck interval level. Append 3-1440 for 3min up to one day. Append 0 to disable the feature.
`save`	ok	Apply changes
`lora reset`	ok	Clear LoRaWAN context and rejoin.

Disable LoRaWAN

When utilizing a PMX TCR as a wired sensor through a USB connection, the LoRaWAN modem can be completely disabled.

Commands

CLI command to enable LoRaWAN modem. (No LoRaWAN downlinks available for security reasons)

CLI Commands	Returns	Description
`lora get enabled`	`[enabled]`	Check if LoRaWAN modem is enabled
`lora set enabled`	`[enabled]`	Enable LoRaWAN modem Append 1 to enable, 0 to disable
`save`	ok	Apply changes
`restart`	-	Restart device

AI Autosens (PRO)

AI Autosens is an advanced algorithm that utilizes artificial intelligence to continuously analyze the background noise level and automatically adjust the radar sensitivity accordingly. This ensures that the PMX TCR can effectively distinguish between relevant traffic data and background noise, even in challenging environments with varying noise levels.

Commands

Commands used to enable AI Autosens using the CLI or remotely via LoRaWAN Downlink.

CLI Commands	Returns	Description	LR Downlink
`radar get autosens`	`[ena]`	Check if AI Autosens is enabled. Returns 1 for enabled, otherwise 0	`C264`
`radar set autosens [ena]`	`[ena]`	Enabled/Disable AI Autosens by appending 1 for enabled or 0 for disabled. **Note: This is a PRO feature.**	`C264xxxx`
`save`	ok	Save changes	`n/a`
`restart`	-	Apply changes	`C2EE`

Radar Sensitivity

Radar sensitivity is crucial in eliminating background noise and ensuring accurate traffic data. The user can adjust the noise sensitivity of PMX TCR devices to adapt to different environments. However, for the most robust and reliable noise reduction, we recommend using the AI Autosens feature.

Commands

Commands used to change radar sensitivity using the CLI or remotely via LoRaWAN Downlink.

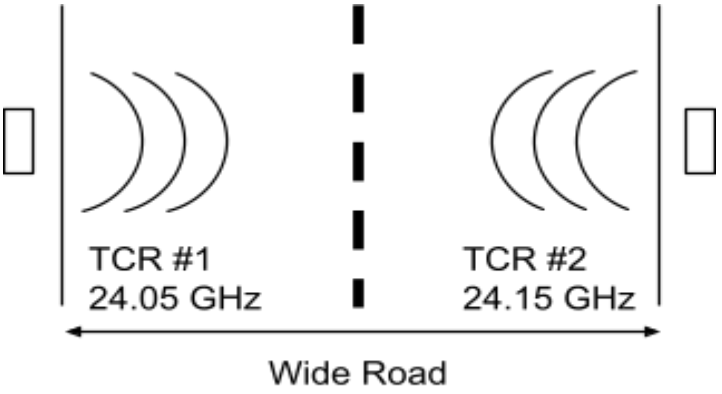
CLI Commands	Returns	Description	LR Downlink
`radar get sens`	`[sens]`	Get the current sensitivity level from 0-100%	`C263`
`radar set sens [sens]`	`[sens]`	Set the current sensitivity level from 0-100%	`C263xxxx`
`save`	ok	Save changes	`n/a`
`restart`	-	Apply changes	`C2EE`

Radar Channel

To prevent interference when multiple radars are present in the field of view, PMX TCR employs a radar transceiver capable of operating at customizable frequencies. Alarm systems, automatic street lamps, and door openers are a few examples.

One application that necessitates altering the radar frequency of a PMX TCR is traffic counting on very wide roads.

Directly across the road, two TCRs are installed. Each device keeps track of traffic flowing in a single direction. However, one of the devices must be switched to channel 2 for this to function.



Commands

Commands used to change radar channels using the CLI or remotely via LoRaWAN Downlink.

CLI Commands	Returns	Description	LR Downlink
`radar get channel`	`[ch]`	Get the current radar channel setting. Returns 1 or 2.	`C262`
`radar set channel [ch]`	`[ch]`	Set the device to another radar channel. Append 1 or 2. **Note: This is a pro feature.**	`C262xxxx`
`save`	ok	Apply changes	`n/a`
`restart`	-	Restart device	`C2EE`

Disable Radar

Users can disable the radar sensor to save energy.

Commands

Commands used to disable the radar using the CLI or remotely via LoRaWAN Downlink.

CLI Commands	Returns	Description	LR Downlink
`radar get enabled`	`[ena]`	Check if radar sensor is enabled	`C261`
`radar set enabled [ena]`	`[ena]`	Enable radar sensor if it has been disabled before. Append 1 to enable, 0 to disable	`C261xxxx`
`save`	ok	Apply changes	`n/a`
`restart`	-	Restart device	`C2EE`

PIN Lock

Device settings can be locked to prevent unauthorized alterations via the USB Config Port. This is useful in environments with multiple users or when maintaining settings integrity is essential. It ensures the device operates as intended by preventing accidental changes.

Commands

CLI command to lock access to settings. (No LoRaWAN downlinks available for security reasons)

CLI Commands	Returns	Description
`get locked`	`locked`	Check access to settings have been locked.
`lock [pin]`	ok	Disable access to device settings by using the lock command followed b a 4-digit number 0000-9999 **Important: Note this PIN for later access to the device**
`unlock [pin]`	ok	Enable access to device settings.

Only the manufacturer can unlock devices that have been locked by mistake. To do this, the user must be able to prove that they are the owner and contact PMX Support with a purchase contract or similar.

Pro Features

Pro features provide increased functionality, improved performance and more flexibility. We introduced Pro features in the PMX firmware for the PMX TCR so that the counters can be used for simple applications, such as pedestrian counting, without the complexity of a full traffic statistics application. This makes it easier to set up and users only pay for what they use.
You'll need a licence key to activate the Pro features. This key is unique to your specific device and can be obtained from PMX Systems AG or your local PMX Solution Partner.

60-Day Trial

All **newly purchased PMX TCR** units come with a 60-day trial of the PRO features. This trial period allows you to explore the full potential of the PMX TCR and see how it can benefit your operation. I
During the trial period, you will have access to the following PRO features:

- Higher Speed Classes (LS and HS)
- Cat 1, Cat 2, Cat 3, and Cat 4 Counters
- Advanced Reporting and Analytics

Install a licence key during the trial period to keep the PRO features active. This can be done using a LoRaWAN Downlink.

The following list shows the features available at each feature level.

Licence Type	**BASIC**[7]	**ADVANCED**	**PRO**
Feature level	0	1	2
Speed Classes			
P: Pedestrians (2-10 km/h)	●	●	●
LS: Low Speed (2-40 km/h)	-	●	●
HS: High Speed (10-80 km/h)	-	-	●
Object Size Range	0.3-2m	0.3-3m	0.3-30m
Counting Functionality			
MBR Algorithm	●	●	●
AI Autoconfig	●	●	●
Bidirectional Counting	●	●	●
Unfiltered Detections Counter	●	●	●
AI Autosens	-	●	●
Multitarget Tracking	-	●	●
Filter Category 1	-	●	●

[7] PMX Firmware installed on a TCR, no licence activated

Licence Type	BASIC[7]	ADVANCED	PRO
Filter Category 2	-	●	●
Filter Category 3	-	-	●
Filter Category 4	-	-	●
Advanced Speed Statistics	-	-	●
Oversize Objects	-	-	●
Max Concurrent Objects	1	2	4
LoRaWAN Connectivity			
LoRaWAN Regions supported	EU868, AS923, AU915		
LoRaWAN 1.1.0 / 1.0.4	●	●	●
TimeSync	●	●	●
LinkChecks	●	●	●
Confirmed Uplinks	●	●	●
Unconfirmed Uplinks	●	●	●
Device ID Uplink	●	●	●
UDC Uplink (Port 13)	●	●	●
CAT1 Uplink (Port 14)	-	●	●
CAT2 Uplink (Port 15)	-	●	●
CAT3 Uplink (Port 16)	-	-	●
CAT4 Uplink (Port 17)	-	-	●
Maintenance			
CONFIG Port (USB)	●	●	●
LoRaWAN Config Downlinks	●	●	●
Lifetime Firmware Updates (DFU)	●	●	●
Licence Downlink	●	●	●

Getting a licence

All-in-One Counting Kits

When you purchase one of the new PMX Radar Counting Kits, the PMX TCR comes with the appropriate licence pre-installed and activated at a very attractive price.

SKU		**Pre-installed Licence**
TCR-SLE-K/LS	**PMX TCR Low Speed Kit, DC**	ADVANCED
TCR-SLE-K17/LS	**PMX TCR Low Speed Kit, Solar 17W**	ADVANCED
TCR-SLE-K/HS	**PMX TCR Smart City Kit, DC**	PRO Licence
TCR-SLE-K17/HS	**PMX TCR Smart City Kit, Solar 17W**	PRO

Upgrading a Parametric TCR

PMX Systems AG acquired the intellectual property rights to the Parametric Radar Counting Technology on January 1, 2024.

PMX is committed to providing ongoing service and support to former Parametric customers during the 24-month warranty period and provides repair services beyond that period.

If you purchased a TCR GEN2 Counter from Parametric GmbH or a reseller after 1/1/2022, you are entitled to a free permanent PRO licence.

To request a free licence key for your Parametric TCR, please use the licence request form on our website and provide the device's serial number(s).

Note: You can still download and use the Legacy Firmware developed by Parametric from the Download Archive.

Lifetime Free Firmware Updates

A licence key is node-locked to your device and is permanent.

You will be able to update your PMX Firmware in the future without buying a new licence key. Firmware updates can be downloaded for free from Downloads Archive.

Maintenance

LED Blink Codes

Left LED (RTL)	Right LED (LTR)	Status	Cause
Off	Off	Active	PMX TCR is counting
On	On	Starting	PMX TCR is initialising
On	Off	RTL Tracking	Tracking an object coming from the right
Off	On	LTR Tracking	Tracking an object coming from the left
Both flash synchronous (2Hz)		LoRaWAN TX Error	No ACK received to Join or Confirmed Uplink
Both flash synchronous (10Hz)		DFU	Firmware Update in progress. This happens only once after you upload a new firmware and the device starts for the first time with the new firmware. Do not disconnect from power while the LEDs blink very fast.
Both flash alternately		DP Error	The device profile is invalid or an attempt has been made to tamper with the device.

Device Status Informations

This chapter describes further commands that can help monitor device status or find errors in configuration.

Generic

CLI Commands	Returns	Description
`get typestr`	`[typestr]`	Returns the device type TCR-[Hardware]/[Speed Class]/[Region] Examples: TCR-SLE/LS/AS923 TCR-DLI/HS/EU868 TCR-EU868-LS (Parametric Gen 1 Devices) **Note:** **this type string can be used to reorder a pre-configured device**
`get serial`	`[serial]`	Returns the device's unique serial number, which is also printed on the type label on the device.
`get fu_level`	`[level]`	Get the features level. Returns 0 if no licence is installed and BASIC features are active. Returns 1 for ADVANCED and 2 for PRO features.
`get fw_version`	`[fwstr]`	Get information about the installed firmware. This returns a string starting with “PMX 1.x.x” followed by the build date.
`get status`	`[str]`	Get more information about the device's status. Use this command before contacting support.
`get trial`	`[h]`	The trial period remaining is displayed in hours. 1440 hours indicate that the PRO features will be available for another 60 days. It is recommended to install a license key before the trial period expires to continue enjoying the PRO features. If a license key is not installed, the device will revert to its basic functionality.
`get locked`	`[locked]`	Check if device settings have been locked with a PIN. (See PIN Lock)
`get sbx_voltage`	`[mv]`	For devices with a solar charging unit (TCR-SLE and TCR-SLI only), the command will return the battery voltage level in millivolts (mV). If the device does not have a solar charging unit, the command will return 0.

Counters and Filters

Commands to monitor counters.

CLI Commands	Returns	Description
`get last_speed`	`[kmh]`	Returns the speed value of the last object detection in km/h. Negative values indicate left-to-right motion. This command is useful for tuning the category filters because you can monitor the detections before filtering.
`get last_size`	`[cm]`	Returns the measured object size in cm of the last detection.
`get ltr_objs`	`[cnt]`	Get the number of currently tracked objects from the left. Returns 0 if no object is currently tracked.
`get rtl_objs`	`[cnt]`	Get the number of currently tracked objects from the right. Returns 0 if no object is currently tracked.
`udc get enabled`	`[ena]`	Check if the unfiltered detections counters are enabled
`udc get ltr`	`[cnt]`	Get all left-to-right counts
`udc get ltrspeed`	`[kmh]`	Get average speed of all left-to-right counts
`udc get rtl`	`[cnt]`	Get all right-to-left counts
`udc get rtlspeed`	`[kmh]`	Get average speed of all right-to-left counts
`cat [n] get enabled`	`[ena]`	Check if the filter category is enabled. n: 1-4
`cat [n] get ltr`	`[cnt]`	Get left-to-right counter value of a specific filter category n: 1-4
`cat [n] get ltrspeed`	`[kmh]`	Get the average speed of all left-to-right objects matching this category filter. n: 1-4
`cat [n] get rtl`	`[cnt]`	Get get right-to-left counter value of a specific filter category filter n: 1-4
`cat [n] get rtlspeed`	`[kmh]`	Get the average speed of all right-to-left objects matching this category filter. n: 1-4

LoRaWAN

Commands to monitor the LoRaWAN connection.

CLI Commands	Returns	Description
`lora get status`	`[str]`	Get more information on LoRaWAN status. Use this command before contacting support.
`lora get snr`	`[snr]`	Get the signal-to-noise ratio (SNR) of the last LoRaWAN ACK. This can be useful for identifying noisy environments or weak gateways.
`lora get rssi`	`[rssi]`	RSSI stands for Received Signal Strength Indicator. A higher RSSI value indicates a stronger signal, while a lower RSSI value indicates a weaker signal.
`lora get fcnt`	`[fcnt]`	FCnt (frame counter) is a 16-bit counter value that is included in every message sent between a LoRaWAN device (end node) and the network server.

Updating the firmware

The device firmware can be updated over USB, allowing you to keep your device up to date with the latest developments.

Prerequisites

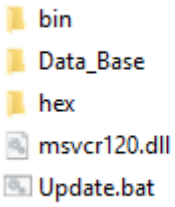
To perform a firmware update, you will need

- a Windows 10 or Windows 11 PC (sorry, no Mac, no Linux, no ChromeOS)
- a USB to micro-USB cable
- a Philips screwdriver to open the PMX TCR Enclosure

Download the PMX Firmware for TCR

Download the latest firmware from the Download Archive. For security reasons, we ask you to provide an email address to gain access to our shared drives.

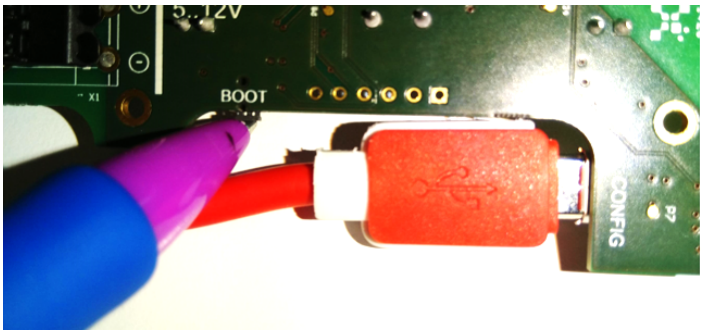
Download and extract the ZIP-Archive to a local folder.



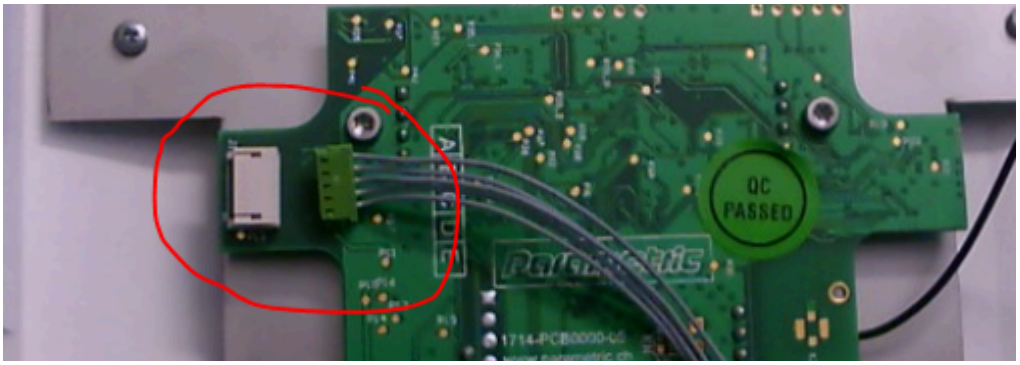
Enable DFU Mode

The TCR comes with pre-installed software that can handle device firmware updates (DFU) over USB.

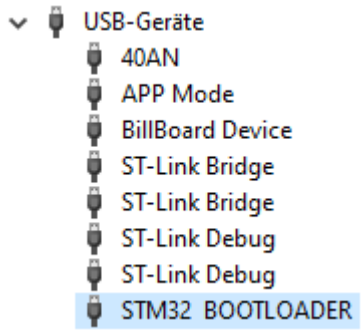
The DFU mode is activated by pressing and holding the BOOT button on the motherboard and then connecting the USB cable on the PC side.



If your PMX TCR is equipped with an SBX solar charger, you must first disconnect the connection cable from the mainboard. Otherwise, the unit will not enter DFU mode.

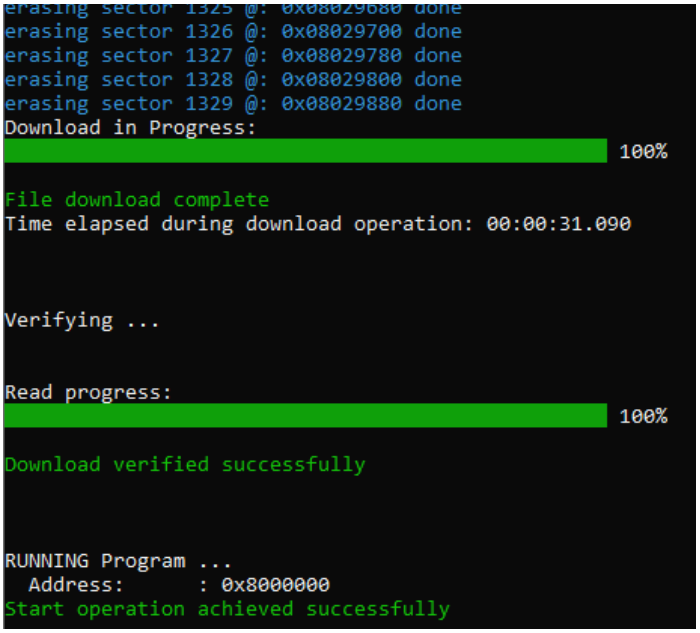


Once DFU mode is enabled, Windows 10 or Windows 11 should automatically install a device driver (STM32 BOOTLOADER) to communicate with the device in DFU mode.



Start the Update

Execute ***Update.bat*** to start the update process.

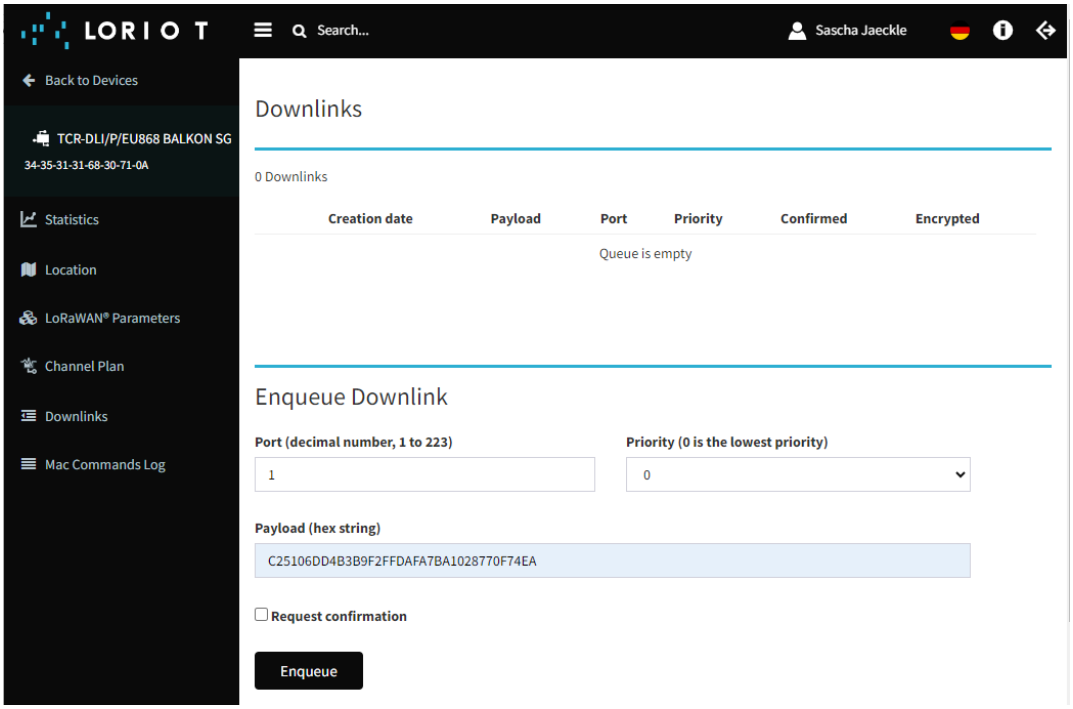


Do not disconnect and wait until you see “Start operation achieved successfully”.

Installing a New License Key Using LoRaWAN Downlink

The new PMX TCR offers a 60-day trial period of its PRO Features. To continue using the PRO Features beyond the trial period, a permanent license key can be sent via a LoRaWAN downlink.

Downlink **C251** followed by 32 hex characters (16 bytes) representing your licence key to **Port 1**.
The following images show how this is done using the Loriot.io LNS.



	Args Hex String	Port	Description
C251		1	Read the current licence key
C251xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	byte[16]	1	Install a new licence key by appending the 16 bytes long key to
C252		1	Read the current feature level Returns: 0000: BASIC features 0001: ADVANCED features 0002: PRO features
C253		1	Read the current speed class setting
C253xxx	0000-0002	1	Change speed class of device 0000: P 0001: LS (Pro Feature) 0002: HS (Pro Feature)
C2EE		1	Restart device with the new settings

FAQ

General questions

What are the advantages of the PMX Firmware?

The new firmware team of PMX Systems did a complete rewrite of the firmware using a model based software engineering (MBSE) approach resulting in an tremendous improvement in speed measurement and lengths estimation accuracy and enabling flexibility in vehicle length.

Improvements of PMX Firmware include:

- Best accuracy possible with such a sensor
- Drastically simplified set-up
- Oversize vehicle counting is no problem anymore
- High interference immunity due to model based analytics
- AI Autosens eliminates the need to adapt sensitivity to the situation
- Newest LoRaWAN Stack V4.7.0 now supports latest LoRaWAN Specification 1.1
- Tailor TCR counter's capabilities with licence upgrades
- Compatible with TCR Hardware Rev. 03/04/05

Can I still use the Legacy Firmware for TCR?

Yes. You are free to install and use the original TCR Firmware developed by Parametric GmbH that comes without the licensing model.

Licensing

I want to count people with a TCR. Which licence should I use?

If only people are to be counted, it is generally sufficient to install the PMX firmware for TCR and select speed class 0. If you want to count people simultaneously from different directions, we recommend installing a LS licence.

I want to count bicycles and people. Which licence should I use?

The LS licence is required to count people and bicycles individually. Groups can be formed to analyse and count objects up to a speed of 30km/h according to their length and speed.
If you purchase the “PMX Slow Traffic and Pedestrians Kit” the LS licence is already pre-installed.

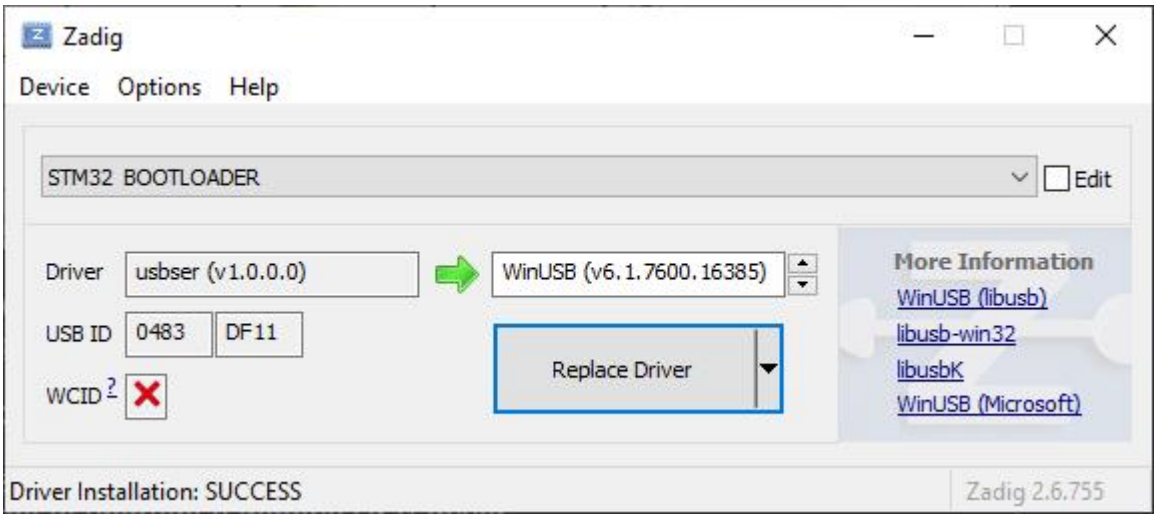
I do have a Smart City Application. Which licence should I use?

Smart City applications typically require full flexibility. On a typical city street, there are bicycles, cars, buses and even heavy goods vehicles.
With the PRO functions, several vehicles can be categorised simultaneously and in up to 4 categories. Even extra-long vehicles are no problem with the new MBR Algorithm introduced with the PMX Firmware.

Firmware Update

Windows 10/11 does not recognize the device. What should I do?

If Windows driver allocation fails you might reinstall the driver with the Zadig tool.
Zadig is a Windows application that install generic USB drivers, such as WinUSB, libusb-win32/libusb0.sys or libusbK, to help you access USB devices. It is also useful to uninstall broken drivers.



1. Download Zadig from https://zadig.akeo.ie

2. Start the Tool and choose Options>List All Devices to show all available USB devices

3. Connect your device while holding the BOOT button (Start DFU Mode)

4. Look for a device with name "STM32 BOOTLOADER" or "STM32 Device in DFU Mode"

5. Select "WinUSB" and press the "Replace Driver" button. Zadig removes the installed driver and installs the generic WinUSB driver.

6. Try the DFU again

APPENDIX A - Factory Defaults

This appendix provides a comprehensive list and enumeration of all production-level defaults for reference. You can reset the unit to these settings using the Set Defaults Command.

Measurement Settings	Default	Unit
Measuring Interval	10	min
Measuring Timeout	120	min
Totalizer	0	on/off

Counter Settings	If SpeedClass = 0 (P)	If SpeedClass = 1 (LS)	If SpeedClass = 2 (HS)	Unit
UDC Enabled	1	1	1	on/off
UDC MinSize	30	30	30	cm
UDC MaxSize	200/300/3000 [8]			cm
UDC MinSpeed	2	2	10	km/h
UDC MaxSpeed	10	40	80	km/h
Filter Category 1 Enabled	0	1	1	on/off
Filter Category 1 MinSize	0	30	150	cm
Filter Category 1 MaxSize	0	150	300	cm
Filter Category 1 MinSpeed	0	2	10	km/h
Filter Category 1 MaxSpeed	0	10	80	km/h
Filter Category 2 Enabled	0	1	1	on/off
Filter Category 2 MinSize	0	150	300	cm
Filter Category 2 MaxSize	0	300	600	cm
Filter Category 2 MinSpeed	0	10	10	km/h
Filter Category 2 MaxSpeed	0	40	80	km/h

[8] UDC MaxSize depends on the installed licence.

Filter Category 3 Enabled	0	0	1	on/off
Filter Category 3 MinSize	0	0	600	cm
Filter Category 3 MaxSize	0	0	800	cm
Filter Category 3 MinSpeed	0	0	10	km/h
Filter Category 3 MaxSpeed	0	0	80	km/h
Filter Category 4 Enabled	0	0	1	
Filter Category 4 MinSize	0	0	800	cm
Filter Category 4 MaxSize	0	0	3000	cm
Filter Category 4 MinSpeed	0	0	10	km/h
Filter Category 4 MaxSpeed	0	0	80	km/h

Radar Settings		**Unit**
Radar Enabled	1	
Radar Channel	1	
Radar Sensitivity	100	%

Licence Type	**BASIC**	**ADVANCED**	**PRO**	**Unit**
Radar AI Autosens	0 (n/a)	1 (enabled)	1 (enabled)	on/off

LoRaWAN Settings		**Unit**
LoRaWAN Enabled	1	
LoRaWAN Confirmed Uplinks	0	
LoRaWAN ADR	1	
LoRaWAN DR	0	-
LoRaWAN DevEUI	(Serial Number)	-
LoRaWAN JoinEUI	8CAE49CFFFFFFF02	-
LoRaWAN AppKey	00000000000000000000000000000001	-
LoRaWAN NwkKey	00000000000000000000000000000001	-

LoRaWAN LinkCheck Interval	720	min
LoRaWAN Join Timeout	30	min

Revisions

Revisions of this user manual

Revision	Date	Changes
00	2024-06-23	Initial release
01	2024-06-25	Added LoRaWAN Config Downlink Information
02	2024-07-30	Added Firmware V1.1 Functionality. Improved text due to customer feedbacks
03	2024-09-14	Added Firmware V1.2 Changes (New device types, new default values)

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