PMX Firmware for TCR

Factsheet

Rev. 05

PMX Firmware for TCR is an alternative firmware for TCR counters. While the original firmware is still maintained, this product brings you dramatically improved accuracy, stability, and ease of use.

PMX Systems' new firmware team used a Model-Based Software Engineering (MBSE) approach to create an alternative firmware. The firmware includes a state-of-the-art radar signal analysis algorithm (MBR) with counting performance never before seen on a TCR device and the latest Semtech LoRaWAN stack supporting the LoRaWAN V1.1 Standard.

Upgrade older Parametric TCR with Hardware Rev. 03/04/05 (Gen1, Gen2) to the latest analytics performance. With our new licensing model you pay only for what you are using.

This document describes the installation of the new PMX Firmware for TCR as well as the licence activation.

PMX Systems AG, Lerchenfeldstrasse 3, 9014 St.Gallen, Switzerland
www.pmx.systems

Introduction

The alternative PMX firmware for TCR provides a more application-centric experience, tailoring capabilities to specific use cases. It also allows older Parametric TCR counters (G1 and G2) to be upgraded with the latest model-based analytics performance, extending their life and value.
However, the PMX firmware is NOT an update and does not share a single line of code with the original Parametric firmware. You can still use the Original firmware for TCR.

PMX Firmware vs. Original Firmware

This table shows the main differences between the original firmware and the alternative PMX Firmware for TCR.

	PMX Firmware 1.0	TCR FW 2.2.x
Radar Detection Algorithm	**MBR**	Parametric FFR
Minimal Configuration	**3 Step Quick Setup**	Set speed class, distance to lanes and radar sensitivity. Register device to LNS
Measure intervals available	1,2,3,4,6,10,12,15,20,30,60 min **synchronized**	1,2,3,4, ... 1440 min non-synchronized
Filter categories	Up to 4	Up to 4
All detections counter	**yes**	no
Interval Synchronisation	**yes**	no
LoRaWAN Stack	Semtech LoRaMAC **V4.7.0**	Semtech LoRaMAC V4.4.7
LoRaWAN Standards	**1.0.4 / 1.1.0 FCntDwn ERRATA RP2-1.0.3**	1.0.3 v1.0.3revA
LoRaWAN Keys	DevEUI, **JoinEUI,** AppKey, **NwkKey**	DevEUI, AppEUI AppKey
LoRaWAN Regions	EU868, AS923, AU915	EU868, AS923, AU915, US915
Device Class	**Class A only**	Class A or Class C
Device ID Payload Version	**d2 (new)**[1]	be02
Counters Payload Version	a2 (identical)	a2
Config Payload Version	**c2 (new)**	c1

[1] See PMX TCR LoRaWAN Payload Description for more details on the firmware formats.

Firmware Installation

Prerequisites

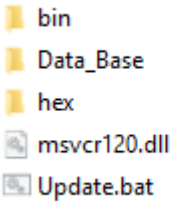
To perform a firmware update, you will need

- 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 TCR Enclosure

Download the PMX Firmware for TCR

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

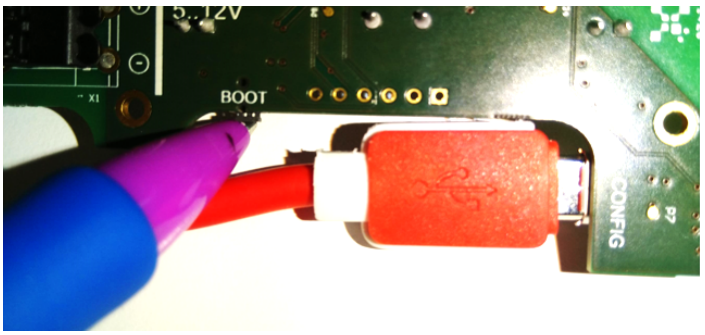
Download and extract the ZIP-Archive to a local folder.



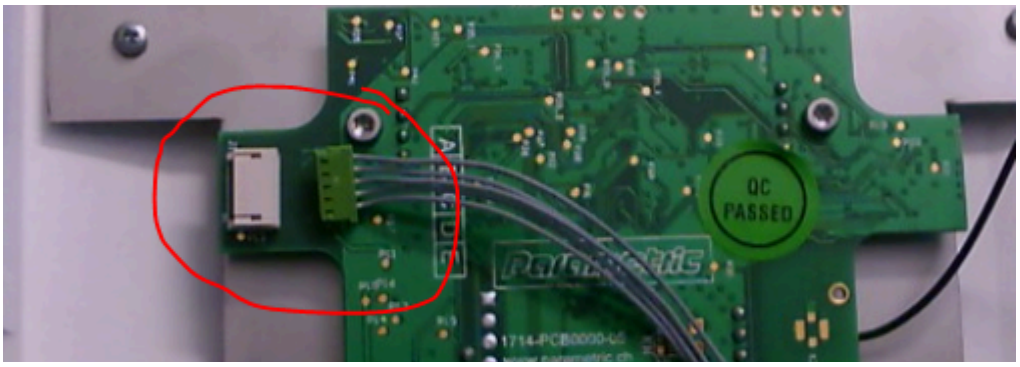
Enable DFU Mode

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

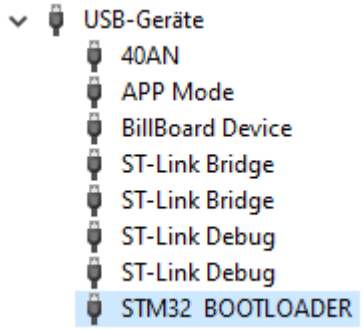
The DFU mode is activated by pressing and holding the BOOT button on the motherboard and then connecting the USB cable on the PC side.



If your 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.

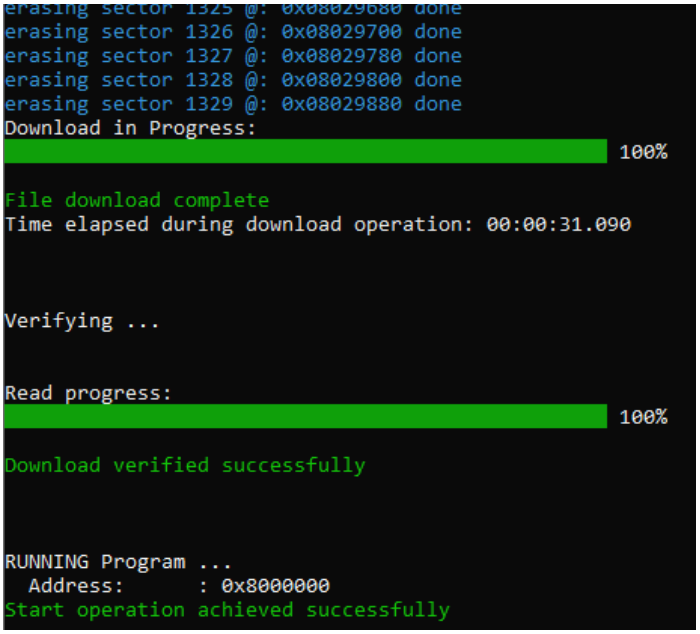


Once DFU mode is enabled, Windows 10 or Windows 11 should automatically install a device driver (STM32 BOOTLOADER) to communicate with the device in DFU mode.



Start the Update

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



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

Licence Plans

With our new licensing model for TCR counters, we prioritise flexibility and value for our customers:

- **Pay only for what you use**: Choose the licences that align with your specific applications, avoiding unnecessary costs for unused features.
- **Flexibility in application**: Easily adapt to changing needs by activating or deactivating licences as your requirements evolve.
- **Node-locked licensing**: Licences are tied to a specific TCR counter, ensuring secure and controlled usage.
- **Free firmware updates**: Enjoy ongoing enhancements and improvements to your counter's performance without additional costs.

Upgrade Your TCR Counter: Unleash Advanced Features with a License Key

Even without a licence installed, the upgrade to the new PMX firmware for TCR brings a number of benefits, including improved performance and the advanced MBR algorithm for accurate counting of slow objects such as pedestrians.

To activate the ADVANCED or PRO features you'll need a licence key. This key is unique to your specific device and can be obtained from PMX Systems AG or your local Solution Partner.

Simply tell your TCR's serial number, specify whether you need an ADVANCED or PRO licence, and you will get the corresponding licence key after payment. This key will then be used to unlock the selected features on your TCR counter, enabling you to tailor its capabilities to your specific needs.

The key is node-locked to your device and is permanent. You can still update your PMX Firmware in the future without installing a new licence key.

Special offer for Parametric GmbH Customers

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 contact sales@pmx.systems and provide the device's serial number.

PMX Firmware Licence	BASIC[2]	ADVANCED	PRO
Functionality level	0	1	2
Speed Classes			
0: Pedestrians (2-10 km/h)	●	●	●
1: Low Speed (2-40 km/h)	-	●	●
2: High Speed (10-80 km/h)	-	-	●
Object Sizes	0.3-2m	0.3-3m	0.3-30m
Counting Functionality			
MBR Algorithm	●	●	●
AI Autoconfig	●	●	●
Bidirectional Counting	●	●	●
Totalizer	●	●	●
AI Autosens	-	●	●
Multitarget Tracking	-	●	●
Category 1 Filters	-	●	●
Category 2 Filters	-	●	●
Category 3 Filters	-	-	●
Category 4 Filters	-	-	●
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	●	●	●
Total Counter Uplink	●	●	●
Category 1 Uplink	-	●	●
Category 2 Uplink	-	●	●

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

PMX Firmware Licence	BASIC[2]	ADVANCED	PRO
Category 3 Uplink	-	-	●
Category 4 Uplink	-	-	●
Maintenance			
CONFIG Port (USB)	●	●	●
LoRaWAN Config Downlinks	●	●	●
Firmware Updates (DFU)	●	●	●
Regular Price	Free (no licence required)	CHF 120	CHF 280

Quick Setup

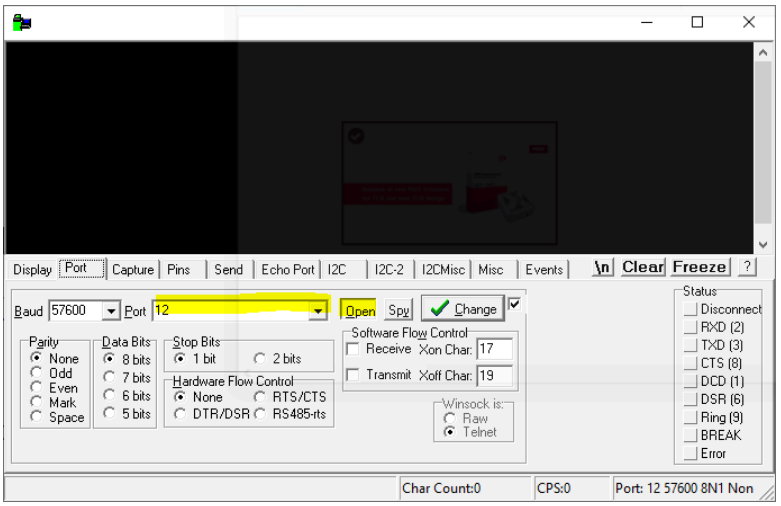
Configuring TCR counters is now very easy thanks to the new AI-based Autoconfig and Autosens functionality. With the PMX firmware for TCR, you no longer need to set distances, speeds and sensitivity.
All you need to do is select the correct speed class and enter the LoRaWAN keys.

Step 1 - Install a Licence Key

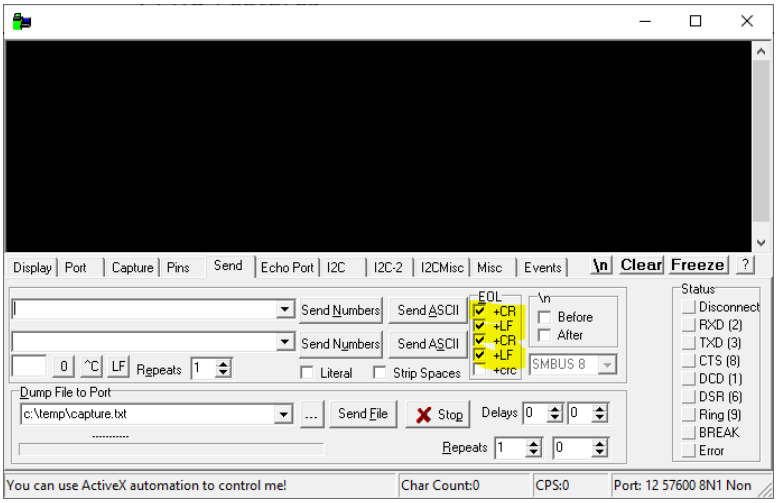
NOTE: If you purchased a new PMX TCR skip this step as your devices comes with a pre-installed licence

If you updated an older Parametric TCR sse a terminal emulation software such as RealTerm (Windows) and a USB cable to connect to your TCR's CONFIG-Port to activate the licence

1. Open RealTerm and open the COM port of the newly connected TCR



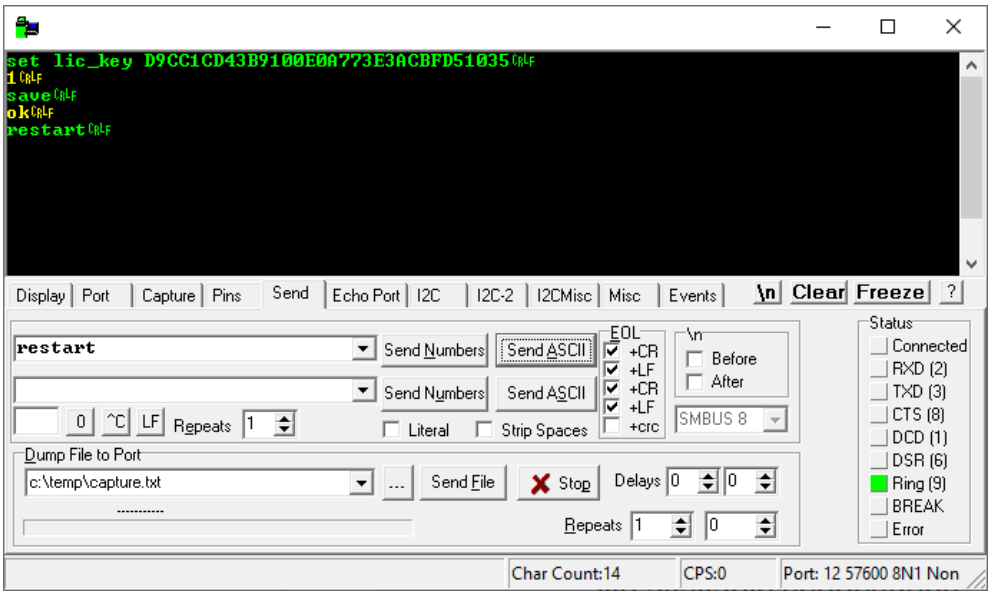
2. Append CR+LF to your commands



3. Transfer the Licence Key by using the **set lic_key** command. The command returns the new function level:

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

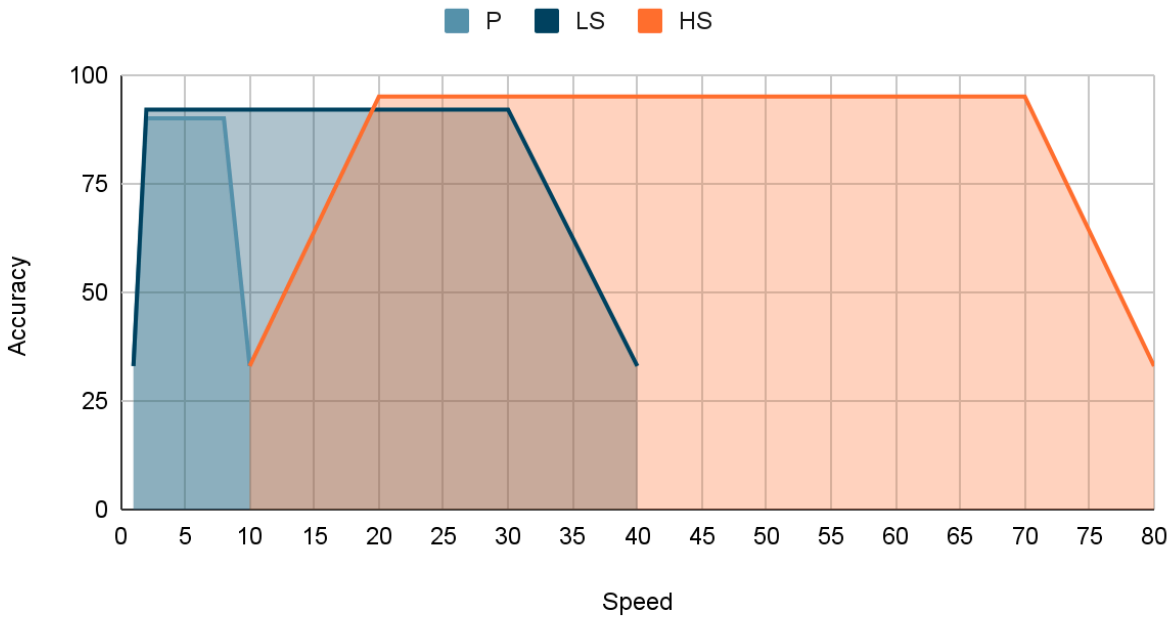
4. Use commands **save** and **restart** to permanently install the licence



For more information how to use the console please see CLI Reference Manual.

Step 2 - Select a Speed Class

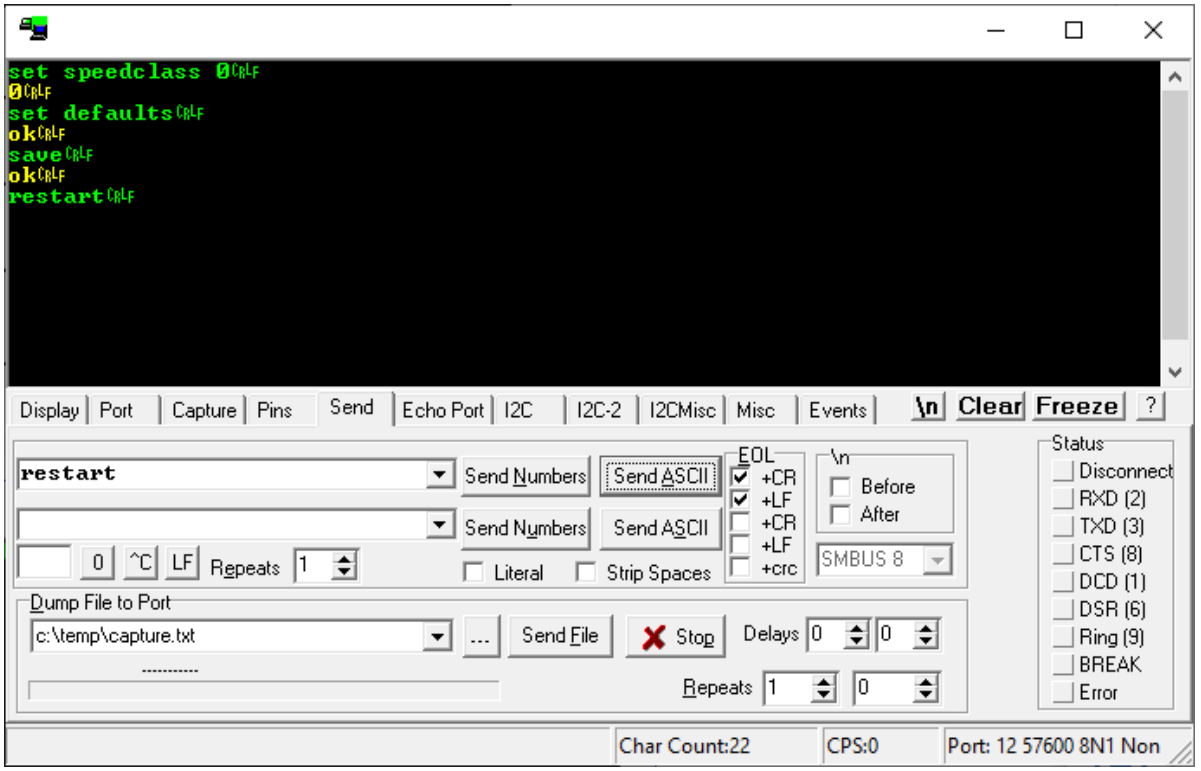
To achieve good counting accuracy, it is important to select a speed class suitable for your application. TCR sensors can scan either slow motion with higher resolution or fast motion up to 80 km/h.



Speed Class	Example Applications	Counters (Filter Defaults: speed, size)
P	Pedestrians 2-10 km/h	Total Counter (2-10 km/h, 0.3-2.0m)
LS	Low Speed Traffic 2-40 km/h	Total Counter (2-40 km/h, 0.3-3.0m) Cat 1 Counter (2-10 km/h, 0.3-2.0m) Cat 2 Counter (10-40 km/h, 1.0-3.0m)
HS	High Speed Traffic 10-80 km/h	Total Counter (10-80 km/h, 0.3-30.0m) Cat 1 Counter (10-40 km/h, 1.5-3.0m) Cat 2 Counter (10-80 km/h, 3.0-6.0m) Cat 3 Counter (10-80 km/h, 6.0-8.0m) Cat 4 Counter (10-80 km/h, 8.0-25.0m)

Use the CLI and send the **set speedclass** command followed by **0, 1** or **2** for **P**, **LS** or **HS**.

Then **set defaults** to load the settings appropriate for the speed class followed by **save** and **restart**.



Step 3 - LoRaWAN Provisioning

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.

Note! TCR is a Class A device that can be registered as LoRaWAN 1.0.4 or LoRaWAN 1.1 node.

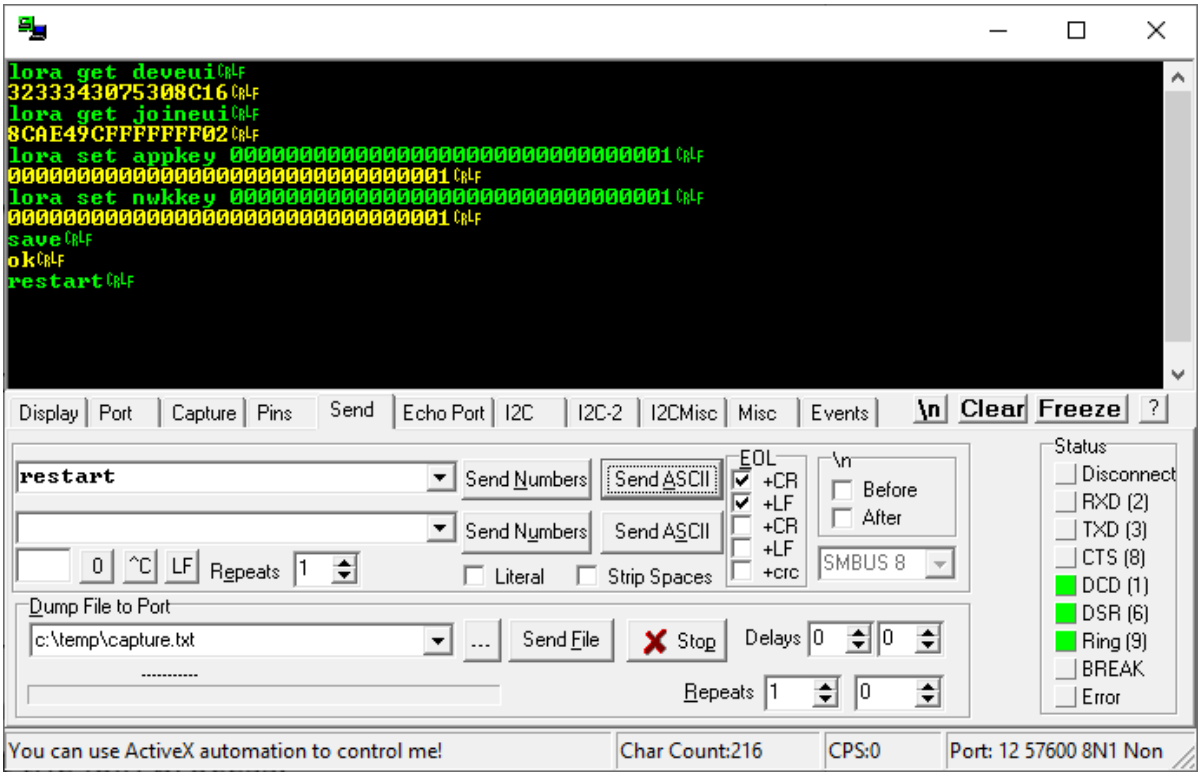
DevEUI and JoinEUI are device specific and should not be changed by the user.

A typical configuration session is as follows.

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.

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.



FAQ

What are the advantages of the PMX Firmware?

PMX Systems' new firmware team used a Model-Based Software Engineering (MBSE) approach to create an alternative firmware for TCR counters that dramatically improves accuracy, stability, and ease of use.

PMX firmware enhancements include:

- Speed measurement and size estimation with up to 95% accuracy
- Easy setup without having to find the right settings with AI Autoconfig
- Oversized vehicle counting is no longer a problem
- High immunity to interference through model-based object analysis
- Newest Semtech LoRaWAN Stack V4.7.0 now supports latest LoRaWAN Specification 1.1
- Customise TCR Counter capabilities with licence upgrades
- Compatible with TCR Hardware Rev. 03/04/05 (Gen1, Gen2)

After the update my TCR does not join the network. What can I do?

1. Please make sure you set the nwkkey to the same value as the appkey when using the LoRaWAN 1.0.4 protocol.
2. Check the LoRaWAN region by using the “get typestr” CLI command
3. Clear the LoRaWAN context memory by using the “lora reset” command

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 an ADVANCED licence.

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

The ADVANCED licence is required to count people and bicycles individually. Groups can be formed to analyse and count objects up to 40km/h according to their length and speed.
If you purchase the Slow Traffic and Pedestrians Kit, the ADVANCED licence is pre-installed.

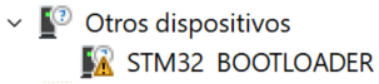
I do have a Smart City Application. Which licence should I use?

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.

Can I still use the Legacy Firmware for TCR?

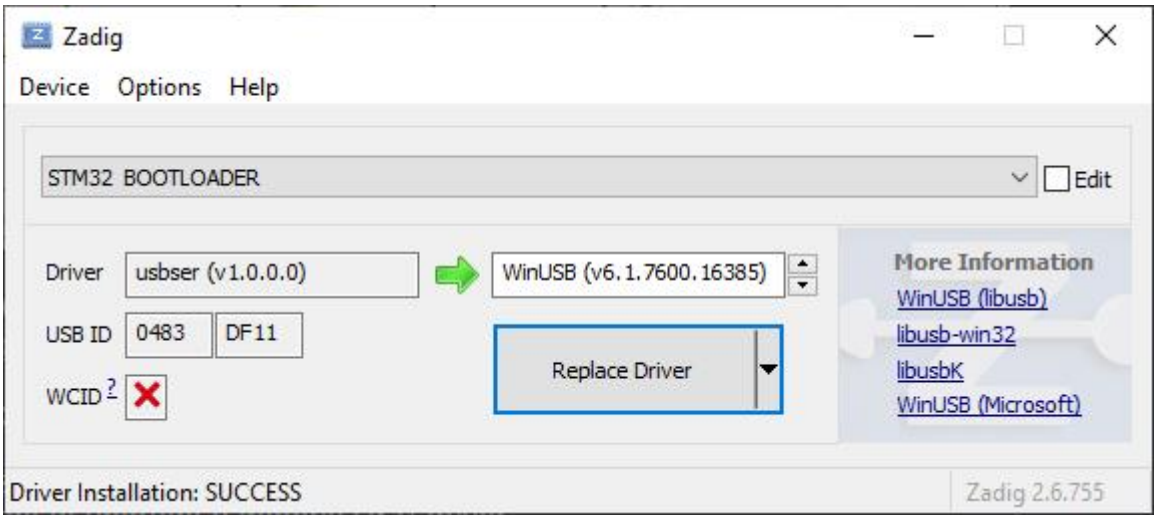
Yes. You are free to install and use the original TCR Firmware developed by Parametric GmbH that comes without the licensing model.

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

Revision history

Rev	Date	Changes
00	2024-06-15	Initial release
01	2024-06-17	Added DFU instructions
02	2024-06-19	Added Initial Configuration
03	2024-06-20	Added Filter Defaults
04	2024-07-12	Improved FAQ and licence key registration description
05	2024-07-15	Added “what's new section”