m'X | TELEMATICS
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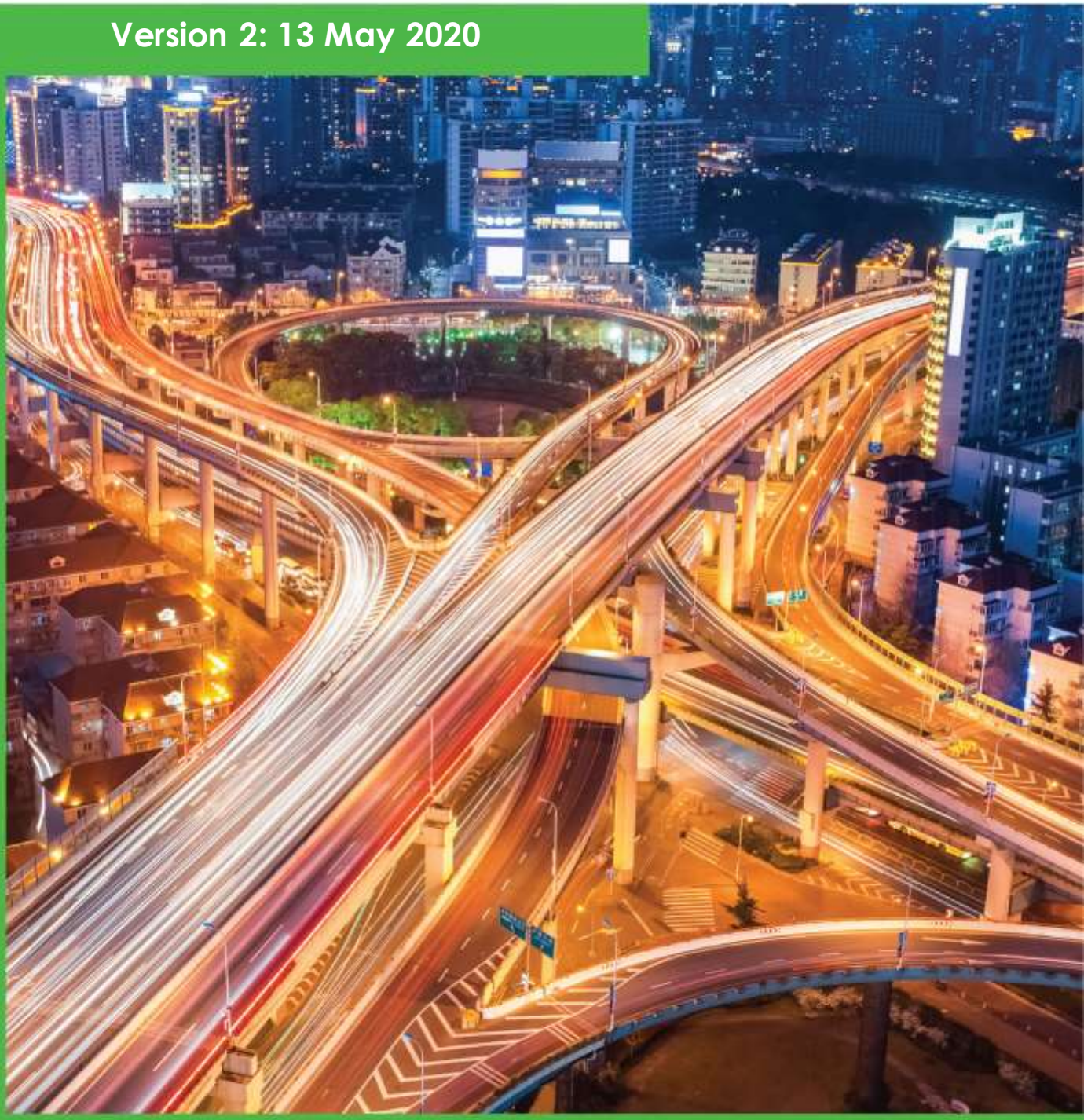

Application Note

On-board Geofence space calculations

Audience

The audience for this application note is MiX Telematics internal support and operations staff, as well as channel partner support staff that may be tasked with creating and loading on-board geofences.

This application note should be read in conjunction with:

- On-board Geofences – Quick Start Guide
- On-board Geofences – Product Information Guide

Background and Purpose

MiX Fleet Manager offers the recording of real-time speeding violations in a large amount of geofenced areas.

FM on-board computers (running DDR version E15.02.23.x), MiX 4000 and MiX 6000 units have an increased capacity of storing geofence speed zones (up to 15,000 poly-points). These speed zones can be used for real-time, detailed over speeding events providing accurate and efficient driver speed control in any geographical area. While this number of poly-points is theoretically possible, we have found that in practice it is not normally achievable, and that the actual number of geofences and poly-points that can be accommodated is dependent on a number of factors.

Going forward, a more meaningful question than "how many poly-points can the OBC accommodate?" is ***"Can the OBC accommodate all my customer's on-board geofence requirements?"*** This application note clarifies the capacity of the FM, MiX 4000 and MiX 6000 OBC to store geofences, and explains how the capacity can be calculated with reliable accuracy to answer this question.

What is the available space for on-board geofences?

The place on the OBC where on-board geofences are stored is referred to as the "*extended config*". The total available space in the extended config equals 60KB (61,440 bytes). This space is shared by the following:

1. Driver lists
2. CAN and Serial scripts
3. Locations used in @Location events
4. State Line Crossing data used for IFTA reporting (North America only)
5. On-board geofences

As a result of the extended config being used for multiple purposes, it is important to understand that it is rare for the entire 60KB of space to be available for on-board geofences. It is further necessary to understand that the space used by points 1-4 in the above list is variable depending on how customers use the solution, and that the space consumed before any on-board geofences are added to the extended config can vary from vehicle-to-vehicle. In a typical fleet, it is possible that all vehicles assigned to the same config group will have the same space utilization; however variation at the vehicle level is possible.

How can the actual space available for on-board geofences be determined?

The most reliable way to determine the actual space available for on-board geofences is to know the size of data contained in the extended config once all non-geofence features have been enabled, and then subtracting that from 60KB. This can be established by querying the "Loaded config size" from the database. For example, if the loaded config size is 9,440 bytes:

Available space in extended config = 61,440 bytes – 9,440 bytes = 52,000 bytes

This means that there would be 52,000 bytes available for on-board geofences.

How much space does an on-board geofence require?

Not all geofences are created equal. In MiX Fleet Manager the following types of geofences (Locations) can be created: Circle, Rectangle, Polygon, and Polyline. Due to the different geometrical shapes, the space needed to define different types of geofences on-board an OBC varies. *Polylines are excluded from the discussion in this document since they cannot be used to record real-time speed violations.*

The firmware uses a compressed format to store many geofences in extended config in a way that allows them to be evaluated efficiently. No matter how the geofences are drawn by end users, the evaluation algorithms requires each shape to be surrounded by the smallest possible rectangular container. This container is automatically generated and is of no concern to end users, but it helps to understand that any shape consists of two pairs of coordinate points depicting the NE and SW corners of a rectangular container. Each pair of these coordinates requires 8 bytes.

For circles and rectangles, these NE/SW corners requiring 8 bytes are sufficient for the firmware to evaluate the geofence and are included in the overhead per geofence[1]. The **overhead** per geofence is **20 bytes**.

For polygons, however, **additional poly-points** are required to define the geofence:

If the size of a polygon geofence is less than 2.5 km wide on either side:

- Poly-points: 2 x 2 bytes = 4 bytes per point (this is the most common scenario)

If the size of a geofence exceeds 2.5 km in width on either side then the overhead per poly-point increases to 8 bytes per point due to a higer resolution being necessary to ensure accuracy:

- Poly-points: 2 x 4 bytes = 8 bytes

Each geofence also requires **additional overhead** for storing **acronyms** and **threshold value pairs** (e.g. speed limits) of **44 bytes** (4 bytes for the acronym list + {5 acronyms * 8 bytes per acronym}).

The total geofence overhead therefore is 20 bytes (basic overhead) + 44 bytes[2](additional overhead) = **64 bytes**. For polygons, add the additional Poly-points based on the shape & size.

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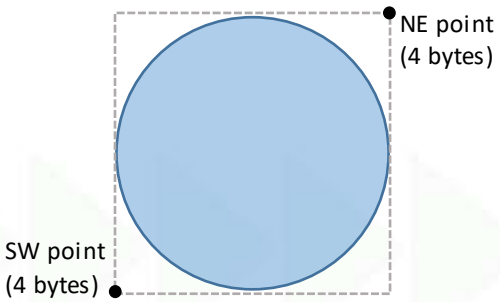
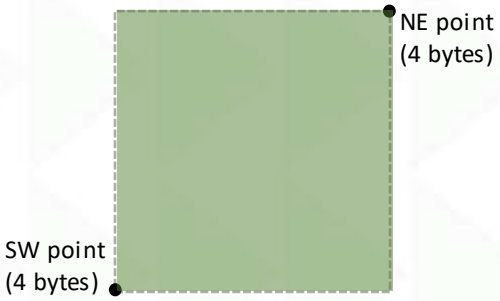
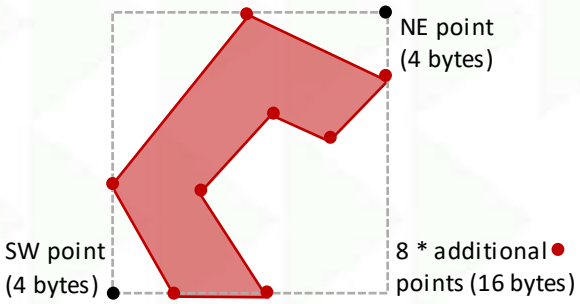
[1] **Note:** When the size of a geofence exceeds 2.5km in width on either side, then the overhead per poly-point increases to 4 bytes due to a higher resolution being necessary to ensure accuracy.

[2] **Note:** Further optimization of the list of acronyms is possible to reduce this part of the overhead, but requires an unconfirmed amount of development time.

Examples:

	**Circle** Basic overhead = 20 bytes Threshold values = 44 bytes Total space requirement = **64 bytes** (Circles uses only the NE/SW corners {2 x 4 bytes} and are included in the geofence overhead of 20 bytes)
	**Rectangle** Basic overhead = 20 bytes Threshold values = 44 bytes Total space requirement = **64 bytes** (Rectangles uses only the NE/SW corners {2 x 4 bytes} and are included in the geofence overhead of 20 bytes)
	**Polygon** (example size < 2.5km width) Basic overhead = 20 bytes Threshold values = 44 bytes Additional Poly-points = 8 * 2 = 16 bytes Total space requirement = **80 bytes** (Polygons uses the NE/SW corners {2 x 4 bytes} that are included in the geofence overhead of 20 bytes as well as the additional Poly-points {8 x 2 bytes = 16 bytes})

Will the OBC accommodate all my geofences?

If only circles and/or rectangles are used and assuming 52,000 bytes are available in extended config for on-board geofences, then 812 geofences can be accommodated:

52,000 / 64 = 812 geofences.

If any polygons are used then count the total number of locations (all types) and the number of polygon points (used to define polygons only). To determine whether the OBC will accommodate all your geofences calculate:

*Space needed = (Total locations * 64 bytes) + (Total polygon points * 2 bytes)*

If Space needed > available space then your locations will not fit.

To resolve scenarios where space needed > space available:

- Reduce the number of locations by combining them. One large polygon is more space-efficient than multiple small ones.
- Reduce the number of polygon points by optimizing the drawn geofences.
- Reduce the space used by other things in extended config.

Conclusion

When we rephrase the question “how many poly-points can the OBC accommodate?” to rather ask, ***“Can the OBC accommodate all my customer’s on-board geofences?”,*** then we can use the methods described in this document to do the necessary calculations in order to answer the question. Where necessary MiX CSO support can provide access to the tools needed to determine the remaining available space in the extended config.