DataFormats

Points of Interest. (GPI extension)

The specifications used for reading and writing the GPI file format can be found here.
https://www.memotech.franken.de/FileFormats/Garmin_GPI_Format.pdf
Herby Franken has more file formats documented.
https://www.memotech.franken.de/FileFormats/

Note: For all people that can read Pascal, have a look at unit 'UnitGPI.pas', that implements this format.

Subclass field

The subclass field can be found in a GPX file created from Basecamp, or Mapsource. But also in the trip files in field **mUdbDataHndl.**
Data that can found in the subclass field.

- MapSegment
- RoadId
- Begin/Shaping point/Via point
- Lat/Lon values

See: Subclass for RoutePoints in Garmin GPX.pdf

Trip File format

Notes:

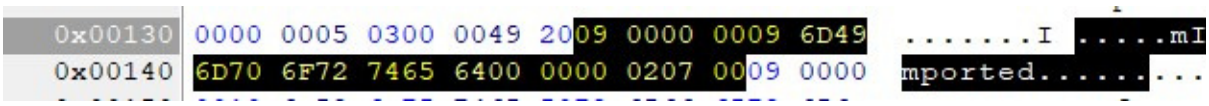
- For all people that can read Pascal, have a look at unit 'UnitTripObjects.pas', that implements this format.
- '0x' is used for Hexadecimal notation. E.G. 0x0A = 10

The file starts with a header

Field	Size (in Bytes)	Sample Value	Description
ID	4	'TRPL'	Identifier of the format. Always 'TRPL'
SubLength	4	0x0007 9A03 498179	Size of the sub elements. Filesize minus 8. (ID + SubLength?)
HeaderLength	1	0x0A 10	Previously, when 0x09 was considered a terminator, this field was considered to be the size of the header. But that no longer seems likely. It could also be Datatype 0x0a. Always 10.
TotalItems	4	0x0000 0014 20	Nr of items in this trip file

Structure of an item

Field	Size (in Bytes)	Sample Value	Description
Initiator	1	0x09	Marks the start of an item. Note: Previously this field was considered to be a terminator of the preceding field. But programming proved it was more likely an initiator.
NameLen	4	0x0000 0009	Length of the name field, immediately following.
Name	Varies	'mImported'	Name of this item. Contains only ANSI characters (1 byte per character). E.G. no international characters, as can be found in string types, that take up 4 bytes for every character.
ValueLen	4	0x0000 0002	Length of the value, including the datatype
Datatype	1	0x07	See the list of datatypes. (0x07 is a Boolean)
Value	Varies	0x00	The size varies according to the datatype. For a Boolean field it is always 1 byte.

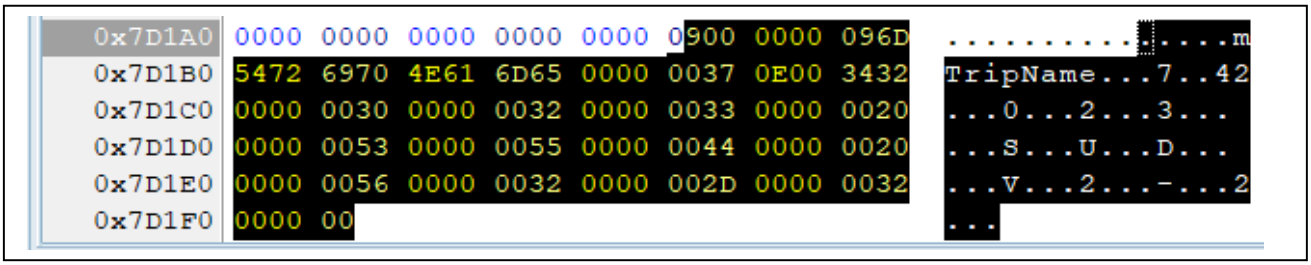


Known datatypes:

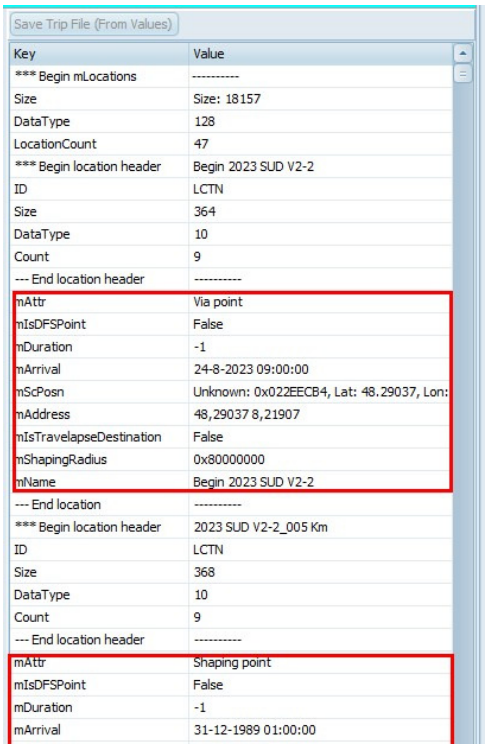
Note: This list might not be complete. Not all datatypes have been decoded completely.

ID	Type	Size in bytes	Description
0x01	Byte	1	Data type for integer values 0-255. Mostly used for enums. Fields containing only some discrete values. Examples: mDayNumber mRoutePreference mTransportationMode
0x03	Cardinal	4	A cardinal is, in Pascal terms, a 4 byte unsigned integer. Range: 0-4294967295 Examples: mTotalTripTime mDuration mShapingRadius mAttr (Only values seen are 0 and 1, so this could also have been a Byte Field!) A special use case of the type is a Date/Time Field. It defines the nr. of seconds starting from: 1989,12,31,00,00,00,00. It looks like a Unix date/time with a different base date/time. mTripDate mArrival
0x04	Single	4	A float field. (Can hold decimal values) It supports approximately 7 digits of precision in a range from 1.18×10^{-38} to 3.4×10^{38}. Examples mTotalTripDistance
0x07	Boolean	1	True or False. Examples: mPreserveTrackToRoute mIsDisplayable mAvoidancesChanged mImported etc.
0x08	Version	8	Defines the version. Consist of 2 cardinals Values seen: **Major**: 0x0000 0004 **Minor**: 0x0700 0000 for XT and 0x1000 0000 for XT2
0x08	ScPosn	16	Defines the position, in GPS coordinates of a location (Via, or Shaping) Consists of 4 cardinals: **Length**: Always 0x0000 000C = 12 **Unknown**: values seen: 0x022EECB4, 0x02F0FF04. When creating a trip file this field can be set to zeroes. Recalculation on the XT(2) will set the correct value. **Lat:** **Lon:** See below how to read these numbers.
0x0a	Prefix	Varies	The lists mLocations and mAllroutes have a 'prefix' block. For more info see mLocations and mAllroutes.

0x0b	UdbHandle	Varies	Block describing UdbDirs. See mAllroutes.
0x0e	String	Varies	Type used for strings. Strings are stored as UCS4 chars. 4 bytes for every character. From sample below: 0x09: inititiator 0x 0000 0009: Length of 'mTripName' 'mTripName' 0x0000 0037: Length of Value + Datatype. 0x0e: Datatype 0x0034: Nr of bytes for this string.(Divide by 4 to get #chars) 0x3200 0000 = '2' 0x3000 0000 = '0' Etc. More info: https://docwiki.embarcadero.com/Libraries/Athens/en/System.UCS4Char



ID	Type	Size in bytes	Description
0x80	List	Varies	A list is a type that can contain sub items. A good example is 'mLocations'.

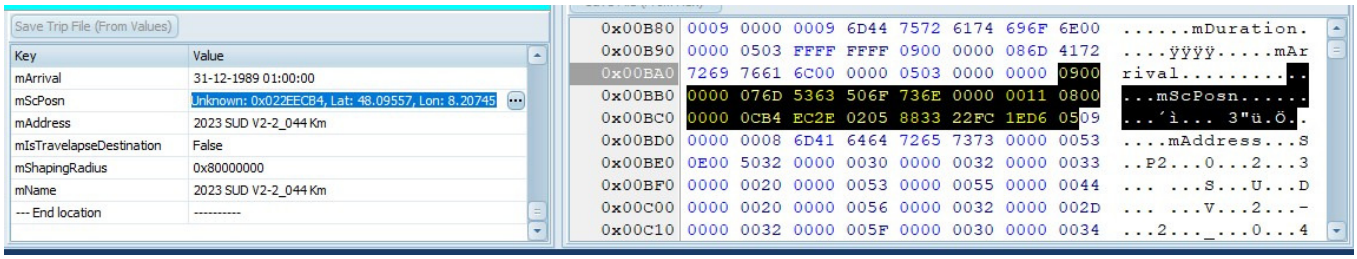


The locations are preceded by a block describing the total block. (*** Begin mLocations)
Then for every location a block describing 1 location (*** Begin location header)
The marked portions are all basic data type items.
mAttr = Cardinal
mIsDFSPoint = Boolean
…
mName = String

How to read the Lat/Lon values.

The Lat Lon values can be found in mScPosn and UdbDir (Sub item of mUdbDataHndl) fields.

Sample:



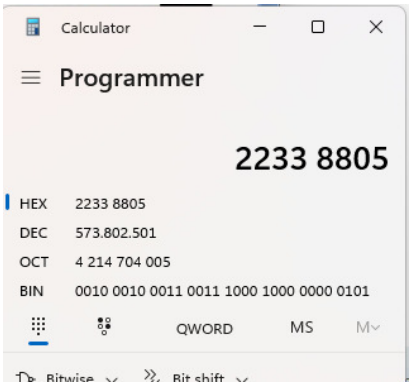
In this sample:
0x0588 3322 corresponds to Lat: 48.09557. Read the Hex value from Right to Left. (Little-Endian)

1) Convert the Hexadecimal value to Decimal = 573802501 (Using Windows calculator in Programmer mode)
2) Divide by 4294967296 (2^32) = 0.13359880563803
3) Multiply by 360 = 48.0955700296909
4) Round to 6 digits = 48.09557

0xFC1E D605 corresponds to Lon: 8.20745

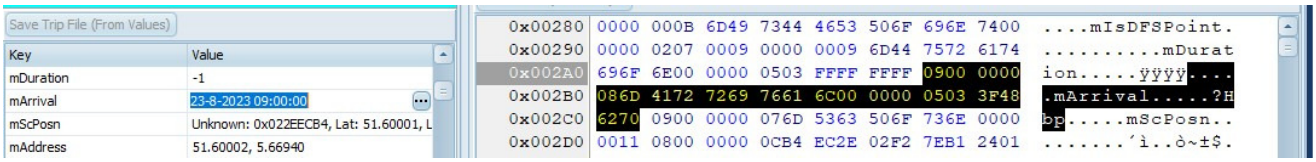
1) Convert the Hexadecimal value to Decimal = 97918716
2) Divide by 4294967296 (2^32) = 0,0227984776720405
3) Multiply by 360 = 8.20745196193457
4) Round to 6 digits = 8.20745

Using Windows calculator. Remember the hex values have to be read from Right to Left!



How to read the DateTime values.

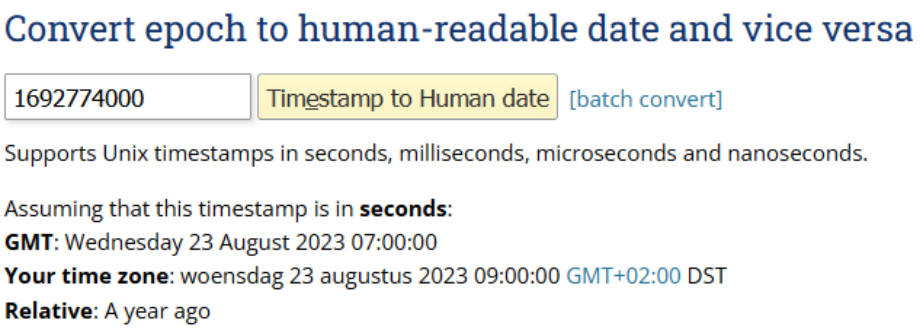
The date time format as used in mArrival can be decoded like this.



The Hex value 0x3F48 6270 corresponds to August 23, 2023 09:00:00 Basically this value defines the nr. of seconds since 1989/12/31 00:00:00

1) Convert hex to integer. Again use Windows Calculator.
   1061708400
2) Add the constant This is the nr. of seconds on 1989/12/31 00:00:00 since
   631065600 1970/01/01 00:00:00
3) Resulting in Nr of seconds since 1970/01/01 00:00:00
   1692774000 August 23, 2023 09:00:00 = Unix Date Time

For converting seconds to date time you can use the website: https://www.epochconverter.com/



Note: You may notice a difference (usually an hour) that is likely caused by daylight savings.
On the XT you may see 08:00, while in Basecamp/Tripmanager it is 09:00

Items seen in trip files on the XT

Name	DataType	Description
mPreserveTrackToRoute	0x07	Set to true for trips created from a track.
mParentTripId	0x03	See mParentTripName
mDayNumber	0x01	?? Always 0xFF 255. May be used for sorting?
mTripDate	0x03	?? Always 0xFFFF FFFF
mIsDisplayable	0x07	If set to False deletes the trip from the device at next start.
mAvoidancesChanged	0x07	?? Always False. May be changes after modifying avoidances?
mIsRoundTrip	0x07	?? Always False
mParentTripName	0x0E	Can be used together with mParentTripId to group the trips.
mOptimized	0x07	?? Always False
mTotalTripTime	0x03	Contains Time in seconds of trip. After recalculation by XT
mImported	0x07	Set to False to fix the RUT behaviour.
mRoutePreference	0x01	0x00 = Faster Time 0x01 = Shorter Distance 0x04 = Direct 0x07 = Curvy Roads
mTransportationMode	0x01	0x01 = Automotive 0x09 = MotorCycling 0x0A = Off Road
mTotalTripDistance	0x04	Contains Distance in meters of trip. After recalculation by XT.
mFileName	0x0E	File name on device. 0:/.System/Trips/<1234567890>.trip If a file is saved by importing. It is the timestamp of saving. See 'How to read the DateTime values'.
mLocations	0x80	A list of Begin, Via / Shaping points and End point. See 'mLocations'
mPartOfSplitRoute	0x07	?? Always False
mVersionNumber	0x08	Apparently the version nbr. Only value seen for XT is: 0x04000000 / 0x00000007
mAllRoutes	0x80	Is the result of the calculation. It contains a list of mUdbDataHndle and UdbDir. See 'mAllRoutes'
mTripName	0x0E	TripName. This is the name of the route in BaseCamp.

Items seen in trip files on the XT2

Name	DataType	Default value	Description
mGreatRidesInfoMap	0x0C	0x0000 0000	Note 2
mAvoidancesChangedTimeAtSave	0x03	Create date time	If set to 0 a message appears 'Avoidances changed'
mTrackToRouteInfoMap	0x0C	0x0000 0000	Note 2
mIsDisplayable	0x07		If set to False deletes the trip from the device at next start.
mIsDeviceRoute	0x07	False	
mDayNumber	0x01		?? Always 0xFF 255. May be used for sorting?
mTripDate	0x03		?? Always 0xFFFF FFFF
mOptimized	0x07		?? Always False
mTotalTripTime	0x03		Contains Time in seconds of trip. After recalculation by XT
mTripName	0x0E		TripName. This is the name of the route in BaseCamp.
mVehicleProfileGuid	0x0E	dbcac367-42c5-4d01-17aa-ecfe025f2d1c	Only value seen
mParentTripId	0x03		See mParentTripName
mIsRoundTrip	0x07		?? Always False
mVehicleProfileName	0x0E	'zūmo Motorcycle'	
mAvoidancesChanged	0x07		?? Always False. May be changes after modifying avoidances?
mParentTripName	0x0E		Can be used together with mParentTripId to group the trips.
mVehicleProfileTruckType	0x01	0x07	
mVehicleProfileHash	0x03	135656608	
mRoutePreferences	0x80	Loc cnt * 0001	Note 3
mImported	0x07		Set to False to fix the RUT behaviour.
mFileName	0x0E		File name on device. 0:/.System/Trips/<1234567890>.trip If a file is saved by importing. It is the timestamp of saving. See 'How to read the DateTime values'.
mExploreUuid	0x0E	New Guid	For every trip created a new GUID must be created, or the trip will not be listed.
mVersionNumber	0x08		Apparently the version nbr. Only value seen for XT2 is: 0x04000000 / 0x00000010
mRoutePreferencesAdventurousHillsAndCurves	0x80	Loc cnt * 0x0001	Note 3
mTotalTripDistance	0x04		Contains Distance in meters of trip. After recalculation by XT.
mVehicleId	0x03	0x01	
mRoutePreferencesAdventurousScenicRoads	0x80	Loc cnt * 0001	Note 3
mAllRoutes	0x80		Is the result of the calculation. It contains a list of mUdbDataHndle and UdbDir. See 'mAllRoutes'
mRoutePreferencesAdventurousPopularPaths	0x80	Loc cnt * 0001	Note 3
mPartOfSplitRoute	0x07		?? Always False
mRoutePreference	0x01		0x00 = Faster Time 0x01 = Shorter Distance 0x04 = Direct 0x07 = Curvy Roads
mShowLastStopAsShapingPoint	0x07	False	
mRoutePreferencesAdventurousMode	0x80	Loc cnt * 0001	Note 3
mTransportationMode	0x01		0x01 = Automotive 0x09 = MotorCycling 0x0A = Off Road
mLocations	0x80		A list of Begin, Via / Shaping points and End point. See 'mLocations'

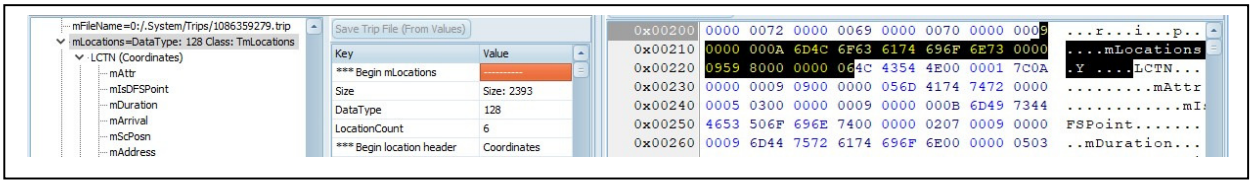
The default value is used when creating a trip file.

Notes on the XT2 items

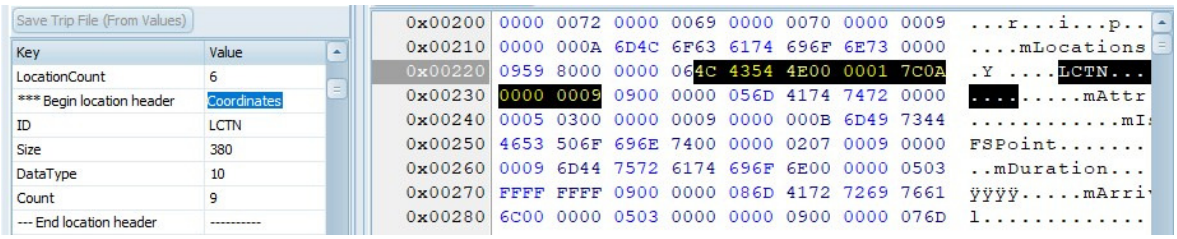
1. **mPreserveTrackToRoute** does not appear on the XT2
2. **mGreatRidesInfoMap** and **mTrackToRouteInfoMap** introduce 0x0c as datatype. The only value seen is 0x0000 0000.
   This value could also have been represented by datatype 0x03 (Cardinal) So I suspect that these items can have more data. Maybe only activated when using Tread?
3. **mRoutePreferences, mRoutePreferencesAdventurousHillsAndCurves, mRoutePreferencesAdventurousScenicRoads, mRoutePreferencesAdventurousPopularPaths and mRoutePreferencesAdventurousMode** have datatype 0x80, suggesting that they are lists. The first 4 bytes define the nr of items, followed by 2 bytes per route section. It appears to be related to the nr of **mUdbHandles**. So if you hav**e 4 mUdbHandles,** the list is like this**:**
   0x0000 0004 0001 0001 0001 0001
   0001 = Faster time, 0002 = Shorter distance etc.?
   It appears these items are used when trips are created/modified with the Tread app. See the XLSX file: **Route Preferences.xlsx** for an overview of the values found for the various route preferences set up.
   The default values used when creating trip files are accepted by the XT2.

mLocations

mLocations itself only contains a Size and the location count.



Sample values: **Size**: 0x0959 = 2393, **DataType** 0x80, **LocationCount**: 0x06
Every Location starts with a Location Header



Sample values: ID: 'LCTN', Size: 0x0000 017C = 380 DataType: 0x0A, Count: 0x0000 0009
Next a list of 'Count = 9' items: (For XT2 the count is usually 10)

Item	DataType	Description
mShapingCenter	0x08	XT2 specific. Only value seen: 0x0000 0008 0000 0080 0000 0080
mAttr	0x03	0x0000 0000 = Via Point (Also used for Begin and End point) 0x0000 0001 = Shaping Point 0x0000 0002 = Shaping Point XT(2) (Shape route/Tread app)
mIsDFSPoint	0x07	?? Always False
mDuration	0x03	?? Always 0xFFFF FFFF
mArrival	0x03	Used as 'Departure Date/Time'. The first Location determines the sort order within the Trip Planner See: 'How to read Date Time values'
mScPosn	0x08	Specifies the LAT/LON values. See 'Known datatypes 0x08'
mAddress	0x0E	A description of the point that the XT uses for displaying. A known issue is that Via/Shaping sometimes get renamed on the XT. Possible fixes: - Setting the subclass in the GPX to 0x00ff - Setting a value for this item.
mIsTravelapseDestination	0x07	?? Always False
mName	0x0E	The name of the Location

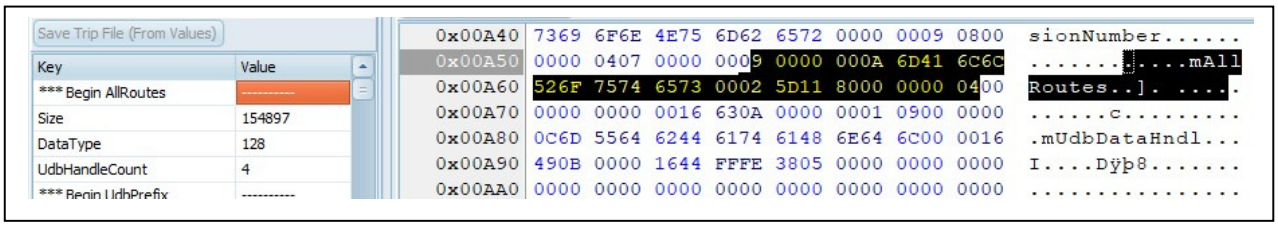
mAllroutes

This list contains the result of the calculation. This data has only partly been decoded, but it is likely that it also contains references to Map data. Even if it would be possible to decode it completely then it still would not be very useful, because the logic needed to calculate the routes is not available.

- If a calculated route from Basecamp is sent to the XT(2) then this list contains the unmodified route. Provided a few conditions are met, like the same map, same transportation mode etc.
- If a route is sent without all the Ghost Points, Subclasses etc. the XT(2) will recalculate the route upon importing, and this list will contain the result of the calculation. For example routes created by MRA.
- If, for some reason, the XT(2) recalculates the route, the result will likely not be the same as initially created in BaseCamp/MRA.

It is therefore desirable to be able to compare the mAllroutes with the original route. What has been decoded is sufficient to achieve that.

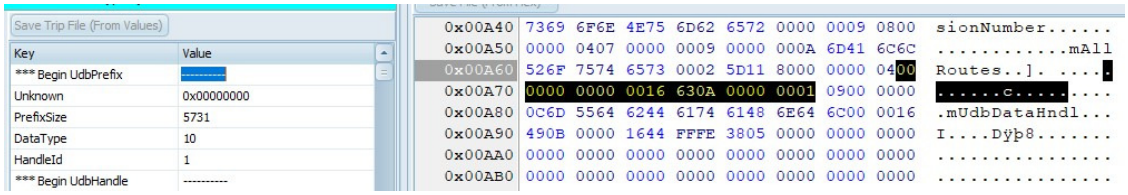
Start of mAllRoutes:



Size: 0x0002 5D11 = 154897
DataType: 0x80 = 128
UdbHandleCount: 0x0000 0004 = 4

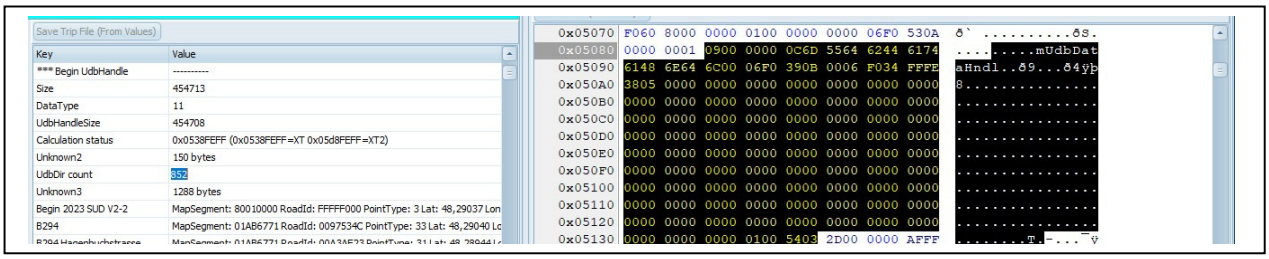
Note: For every trip section an UdbHandle is needed. So if you only have a Begin and End, there is only 1 UdbHandle. If you add 1 via point, there are 2 UdbHandles, for 2 via points there are 3 Udbhandles. Etc.

Each UdbHandle starts with a prefix:



Sample values: **Unknown**: 0x0000 0000, **PrefixSize**: 0x0016 630A = 5731, **DataType:** 0x0A, **HandleId:** 0x0000 0001 (Only value seen)

The beginning of the UdbHandle is fixed.



Sample values: **Size**: 0x0006 F039=454713, **Datatype**: 0x0b, **UdbHandleSize**: 0x0006 F034=454708

Calculation status:
If calculated by the XT it contains 0x0538FEFF and the size of Unknown3 = 1288 bytes.
If calculated by the XT2 it contains 0x05D8FEFF and the size of Unknown3 = 1448 bytes.
When creating a trip file, this field can remain zero, but the correct size for Unknown3 must be allocated.
Notes:

- It might be possible that more variations exist.
- It could be that this field defines a length. 0x05D8 – 0x538=0xA0/160 , 1448-1288=160/0xA0

Unkown2: 150 bytes.
UdbDir count: 0x0354=852
Unknown3: 1288 bytes

Next there are 'UdbDir count = 852' UdbDir's.
An UdbDir is of fixed size, and contains 532 bytes.

Field	Size	Description
SubClass	16	The subclass as can be found in the GPX. The first 2 bytes (RoadClass) are omitted. See 'Subclass for RoutePoints in Garmin GPX.pdf'
Lat	4	See 'How to read the Lat/Lon values'
Lon	4	See 'How to read the Lat/Lon values'
Unknown1	6 x 4	The 1st field always contains: 0x51590469 The 2nd field contains 0xFFFF for SubClass.PointType = 0x03 (=Route point)
Name	121 x 4	String type. Name of the UdbDir. Contains road names. A special value indicates a turn: 0x474E0000

Mapsegment, RoadId and PointType are taken from the SubClass.