



TOPOSENS

Toposens TS3-Visualizer Operation Manual and Documentation

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Document Version

Revision	Date	Changes
V 1.0	07/2020	Initial release

PRELIMINARY PROTOTYPE



The Software is delivered as a development snapshot and is thus considered a prototype. Future iterations of Toposens products are not to be compared to this software!

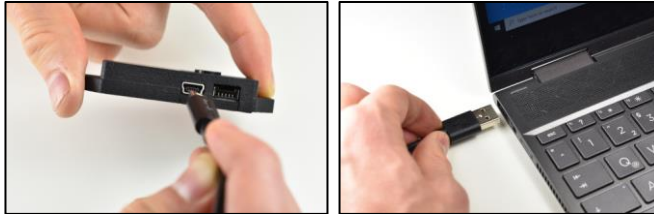
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Preparations

Connect TS3 to your PC with the USB Mini-B cable. The drivers should be downloaded and installed by windows automatically. If the drivers can not be installed automatically, please visit: <https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers> to download the UART-Bridge-Drivers of the TS3-UART Chip.



Startup Settings

Upon starting the Toposens_Dev_Visualizer the user is presented with a dialog window to configure the graphical settings and controls of the application. The windowed mode and a resolution of 1280x720 with Very Low graphical settings is recommend. The visualizer is based on the Unity-Games-Engine.

Screen Resolution

The drop down menu provides the available resolutions.

Windowed and full screen resolutions are changing depending on selection.

1280 x 720
640 x 480
720 x 480
720 x 576
800 x 600
1024 x 768
1152 x 864
1280 x 720
1280 x 768
1280 x 800
1280 x 960
1280 x 1024
1360 x 768
1366 x 768
1400 x 1050
1600 x 1024

Graphics Quality

The drop down menu provides the fidelity configurations.

This selection should be set to Very Low.

Very Low
Very Low
Low
Medium
High
Very High
Ultra

Select Monitor

Only relevant for full screen and if multiple Screens available.

Display 1 (Left)
Display 1 (Left)
Display 2 (Right)

Input Configuration

The keyboard bindings can be configured.

Not recommended!

Control	Primary	Secondary
Horizontal (+)	right	d
Horizontal (-)	left	a
Vertical (+)	up	w
Vertical (-)	down	s
Press	left ctrl	Left Mouse

Double-click an entry to change it!

Exit

Close application without starting into visualizer.

Windowed Checkbox

Windowed mode recommended (box checked).

If the box is unticked, the application will start into full screen mode.

Quit

Same as Exit

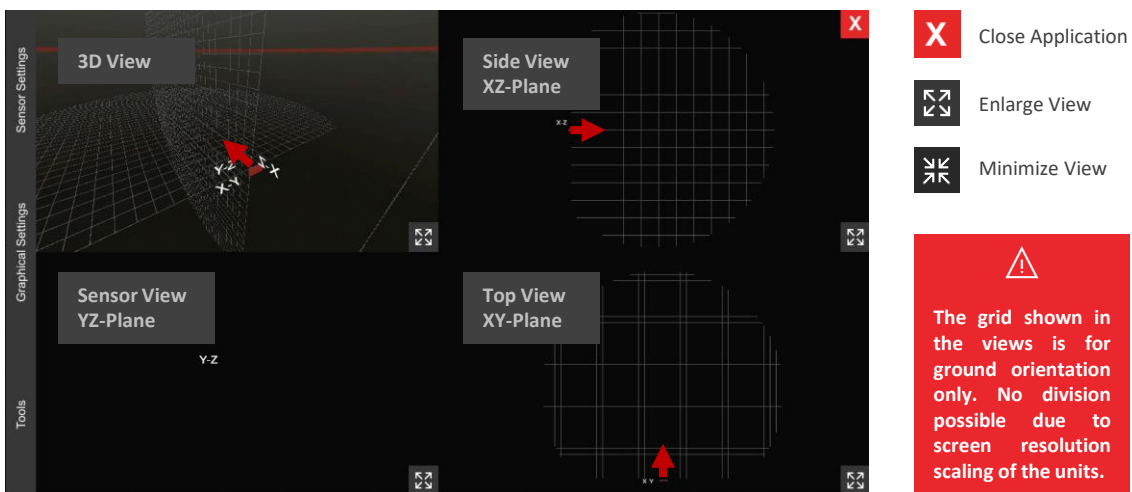
Play!

Starts application



View Controls and Perspectives

The sensors coordinate axes are combined into three two dimensional planes and one three-dimensional space. The red arrow indicates the sensor position in the 0-point of the coordinate grids. The visualizer provides 4 different perspectives of the same scene. All view windows are updated in real-time with the same data, provided by the sensor. Each view can be enlarged to fill the entire application window by clicking on the enlarge button and vice versa by clicking on the minimize view button.



3D View		
External view of the sensor data		
Controls	Mouse: Right Click	Hold right mouse button in the 3D view window to rotate camera. Note: Sometimes a second click is necessary for release.
	Mouse: Movement	Rotation of camera if right mouse button is held down.
	Keyboard: W	Move forwards
	Keyboard: S	Move backwards
	Keyboard: A	Move left
	Keyboard: D	Move right
	Keyboard: Q	Move down
	Keyboard: E	Move up
Keyboard: Shift	2x movement speed	

Side View XZ-Plane
The XZ Plane view of the sensor ignores the Y-coordinate axis of the sensor data. The resulting view can be described as side or vertical view.

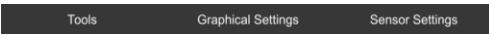
Top View XY-Plane
The XY Plane view of the sensor ignores the Z-coordinate axis of the sensor data. The resulting view can be described as top or horizontal view.

Sensor View YZ-Plane
The YZ Plane view of the sensor ignores the X-coordinate axis of the sensor data. The resulting view can be described as the sensor view or sensor perspective.

No controls available for plane views.



Menu Access



The sidebar gives access to the menus of the visualizer. The corresponding menu will appear on screen. A click into the data view area of the visualizer hides the menu. Please keep in mind that very low resolution configurations could lead to missing parts of the user interface.

Sensor Settings

The sensor settings can be accessed by clicking on the **Sensor Settings** Tab located on the sidebar.

The image shows a sidebar menu on the left with three categories: **Sensor Settings**, **Graphical Settings**, and **Tools**. The **Sensor Settings** category is expanded, showing a sub-menu with three items: **Connection Setup**, **Load/Save Settings**, and **Sensor Settings**. Red arrows point from these sub-menu items to detailed callout boxes on the right.

Menu Item	Description	UI Elements
Connection Setup (visible in all Menues)	The drop down menu provides all available COM-Connections. Please make sure to select the COM-Port of the sensor by checking the device manager after plugging in the sensor.	COM53 (selected), COM53, ...
	Opens the COM-Port selected in the drop down menu.	Connect
Load/Save Settings	Opens the dialogue window to load previously saved sensor and visualizer configurations via drop down selection. To save configurations into the <i>AppData\LocalLow\Toposens</i> Folder, the visualizer has to have write permissions.	Open Saved Settings, Default Config (dropdown), Cancel, Open
	Opens the dialogue window to save and name the current settings.	Save Settings, Enter Setting's Name..., Cancel, Save
Sensor Settings	<p>For more information see TS3-Parameter Documentation</p> <p>Sensor settings can be configured via slider or keyboard arrow keys. The last slider used can be adjusted stepwise with the arrow keys.</p> <p>Meta-Data output by the sensor when connected.</p> <p>Suggested Configurations can be loaded by clicking on the corresponding buttons. Current settings will be overwritten.</p>	<p>Number of Pulses: 5, Peak Window: 1, Echo Rejection: 3</p> <p>Values Read on Reconnect: Firmware Version: 10, External Temp: 32.92 °C, Humidity: 21.76 %, Last ACK Received: 0000009 C0000</p> <p>Suggested Configurations: Config 1, Config 2, Config 3</p>



Graphical Settings

The graphical settings can be accessed by clicking on the **Graphical Settings** – Tab located on the sidebar. The graphical configurations apply to all visible points, displayed by the visualizer and are saved by the save settings dialogue that can be found in the “Sensor Settings” – Tab.

The image shows a sidebar with three tabs: **Sensor Settings**, **Graphical Settings**, and **Tools**. The **Graphical Settings** tab is active, showing a control panel with the following settings:

- Connection Setup:** Connect button, COM53 dropdown.
- Graphical Settings:**
 - Voxel Lifetime:** 0.30 s slider.
 - Voxel Max. Size:** slider.
 - Voxel Relative Size:** slider.
 - Voxel / Tile:** Full Voxel dropdown.
 - Voxel Colour:** Distance dropdown.

Red arrows point from these settings to a detailed explanation table on the right:

Graphical Settings	
Duration a sensor coordinate point is displayed. Higher values result in more points being accumulated over time.	
  Example for different lifetime configurations.	
Maximum size a coordinate point can have. Sizes of the displayed points are based on the relative volume value of the received echo.	
  Example for different max. size configurations.	
Relative size difference between points with different volume values.	
  Example for different relat. size configurations.	
Dropdown menu to chose between points being displayed as cubes or flat tiles.	
  Example for “Full Voxel” and “Tile” configuration.	
Dropdown menu to chose coloring mode of the displayed points. Either distance colored or depending on relative echo signal amplitude.	
  Example for “Distance” and “Echo Intensity” coloring configuration.	



Tools

The tools can be accessed by clicking on the **Tools** - Tab located on the sidebar. The tool settings are saved by the save settings dialogue that can be found in the "Sensor Settings" – Tab.

Capture Points - Tool

The visualizer is able to save the sensor data into a text file for further processing and analysis. This save feature can be accessed in the "Tools" – Tab .

Capture Points

Function to save data stream from the sensor in different formats.
⚠ Visualizer is not modifying the point data. Save feature only.

Drop down menu to select the capture type. Raw-Data is the unformatted data stream. Parsed Points is formatting the data into a table format.

Dropdown to chose different time stamp formats. Every received frame is timestamped.

Drop down to select an automatic stop of the captured data.

Folder-Path to save position of the captured file. File-Name not

Starting the capturing process with the current settings will prompt a comment window. Comments are added to the top of the *.txt file. When capturing is ongoing the button changes to the color red and is now used to stop the capture process. If a capture time is defined, capturing ends automatically.

Connection Setup
Disconnect | COM53

Capture Points
Capture Type: Raw Data
Time Stamp Type: No Time Stamp
Capture Time: Manual
Path To Capture File: C:/Users/user/Desktop/Filename.txt
Start Point Capture

Markers
Marker Size: [Slider]
Add Marker

Tools

Raw Data + No Time Stamp

```

1 Number of waves: 2,
2 Filter Size: 1,
3 Threshold Delta: 6,
4 S00000P0000X01329Y00291Z--0574V00031E
5 S00000P0000X01327Y00290Z--0580V00030E
6 S00000P0000X01327Y00283Z--0583V00030E
7 S00000P0000X01326Y00285Z--0583V00030E
8 S00000P0000X01321Y00292Z--0593V00030E
9 S00000P0000X01321Y00292Z--0593V00030E

```

Raw Data + Time Stamp (ms)

```

1 Number of waves: 2,
2 Filter Size: 1,
3 Threshold Delta: 4,
4 14 S00000P0000X01315Y00292Z--0559V00031P0000X013...E
5 51 S00000P0000X01305Y00313Z--0606V00031P0000X013...E
6 88 S00000P0000X01319Y00294Z--0584V00031E
7 122 S00000P0000X01317Y00297Z--0597V00031P0000X013...E
8 157 S00000P0000X01328Y00289Z--0618V00024P0000X013...E
9 194 S00000P0000X01317Y00295Z--0589V00031E
10 228 S00000P0000X01311Y00300Z--0599V00031E

```

Unix Time Stamp

```

Unix Time (ms)
1594288032394
1594288032429
1594288032456
1594288032565
1594288032597
1594288032597

```

ISO 8601 Time Stamp

```

ISO 8601 Time
2020-07-09T09:47:25.7126146+02:00
2020-07-09T09:47:25.7476681+02:00
2020-07-09T09:47:25.7819739+02:00
2020-07-09T09:47:25.8161616+02:00
2020-07-09T09:47:25.8507982+02:00
2020-07-09T09:47:25.8855441+02:00

```

Parsed Points + No Time Stamp

```

1 Number of waves: 2,
2 Filter Size: 1,
3 Threshold Delta: 7,
4 X Y Z V
5 1325 294 -580 31
6 1322 297 -585 31
7 1320 297 -588 31
8 1321 296 -588 31
9 1324 279 -590 31

```

Parsed Points+ Time Stamp (ms)

```

1 Number of waves: 2,
2 Filter Size: 1,
3 Threshold Delta: 4,
4 Time (ms) X Y Z V
5 0 1315 301 -593 31
6 0 1329 -320 -743 27
7 27 1320 297 -592 31
8 61 1314 308 -591 31
9 61 1323 -306 -758 27
10 97 1331 281 -567 31

```

Millisecond Time Stamp

```

Time (ms)
11
46
113
214
249
284

```

Without time stamp the parsed point list can not be differentiated into individual frames.

Parsed points of the same frame have the same timestamp value.

Millisecond time stamp records time with start of capturing process defined as 0 ms.



Markers - Tool

The visualizer is able to place user defined markers into the scene views. Those markers can be used to measure approximate distances. They have no option for interaction with the sensor scene. Placed markers can be saved/loaded in the "Sensor Settings" - Tab.

Sensor Settings

Connection Setup
Disconnect COM53

Capture Points
Capture Type: Raw Data
Time Stamp Type: No Time Stamp
Capture Time: Manual
Path To Capture File: C:\Users\user\Desktop\Filename.txt
Start Point Capture

Graphical Settings

Markers
Marker Size: [Slider]
Add Marker

Distance Measure
Sensor [Dropdown] Point A:
Sensor [Dropdown] Point B:
Distance:

Tools

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Markers

⚠ Marker position measures not calibrated to real life distances

Adds a Marker into the view of the visualizer. Markers are Lettered from A-Z restarting at A if limit reached. Only 5 Markers can be placed simultaneously. Marker Size adjustable via slider.

Markers can be moved via drag and drop in the plane view the interaction takes place. To delete a marker drag the marker and press „Backspace“ on keyboard.

Distance Measure

Markers can be selected via drop down menu. If a marker is selected its global coordinates are displayed (Sensor = 0 coordinate). A second drop down menu can be used to measure distances between two drop down entries.

The sensor position is always selectable.

The „Distance“ entry is calculating the relative distance between two selected entries.

Marker Size: [Slider]
Add Marker

Distance Measure
Marker A: 120.1, 52.5, 100.0 cm
Marker B: 49.5, -60.1, 100.0 cm
Distance: 132.88 cm

Marker A [Dropdown]
Sensor [Dropdown]
✓ Marker A
Marker B


Marker measurements and real life distances can and will vary.



Known Issues:

The visualizer is intended as a development tool to view raw data and to configure the sensor. Some issues may occur.

Crashes

The application can freeze if the following situations occur:

- If the sensor is physically disconnected during the visualization process.
- If the serial connection is already used by another application.
- If the computer is in hibernate and woken up.
- If settings are applied too fast/randomly.
- If Visualizer is closed without disconnecting the sensor

In this case the Task-Manager is needed to close the application. All unsaved configurations will be lost. Those issues are related to the legacy serial connection provided by Microsoft Windows and can differ on Linux systems.

Lag

The application can lag if the following situations occur:

- If the system which is running the visualizer application has no dedicated graphics unit. In those cases reduce resolution and/or switch between windowed and full screen mode.
- If the number of points displayed simultaneously on screen gets too high for the system running the visualizer to handle.
- If the serial connection is passed through, e.g. if the visualizer is running on a virtual machine.
- If the environment is noisy. In those cases the visualizer is fine, the sensor is reducing the framerate to avoid noise.

Lagging visualization will be noticeable either by update issues (framerate issues) or by a time delay between environmental changes in front of the sensor and the visualization on screen. The point data will be buffered by the operating system (e.g. Windows) while the visualizer is not able to process new data.

Connection/Disc Access Issues

To install the drivers of the sensor and to save configurations and captured data, the user has to have certain administrative rights. If the save features are not needed, the administrative rights can be revoked after the sensor driver is installed.

Interaction Issues

Due to the prototype character of the sensor / visualizer usability testing was limited. The following bugs are known:

- If the 3D-View is not enlarged, it is possible to move the mouse outside of the window while turning the camera. This will lead to a "mouse release" bug which keeps turning the camera, even after releasing the right mouse button. Right-Click into the 3D-View window to release the mouse.
- If markers are saved in a configuration, the letters continue from the last known marker even if no markers are present.
- If markers are placed while a view is enlarged, they are showed multiple times. Minimize and enlarge the view to fix this issue.
- Markers can not be interacted with in 3D-View.
- If the screen resolution is set too low, menu items won't fit on screen.
- If screen resolution is set too high, text could be hard to read.
- The close button can be unresponsive. Close application via Task-Manager or by closing the window directly if in windowed mode.
- On some systems, the application has to be active to update data. If the application is interacted with, all data received in the meantime will be displayed at once. This can crash the application.

Measurement Issues

Due to the prototype character of the sensor / visualizer accuracy is limited. The following bugs are known:

- Depending on the sensor configuration, the point cloud coordinates are offset. (Sensor side).
- The grid displayed on screen is not scaled to a certain division and can change depending on the chosen resolution.