DW1000 HRP Starter Pack – First Steps

General Information

The In-Circuit High Resolution Positioning-series (**HRP**) is a system for real time localization (RTLS). It is based on the *Decawave DW1000 Ultra Wideband (UWB) Low-Power Transceiver*. This starter pack contains all required hardware to build up a highly precise in-door RTLS.

The set includes four DW1000 **HRP** Sticks in a compact USB-Stick format. They can operate either in anchor- or tag-mode. To enable 2D-ranging 3 Sticks are configured as anchors the fourth is used as the tag.

Our Demo Software supports up to **four anchors** and **four tags**. In this configuration our system achieves a refresh rate of the tag's positions up to **100 Hz**. The minimum resolution in position is **2 cm.**

Our Protocol supports up to **180 devices** (anchors or tags).

The In-Circuit **HRP**-system is **not** based on the *DecaWave-DW1000-SW-Stack*. Using two way ranging (TWR) instead of double sided-TWR (DS-TWR) our system achieves much higher refresh rates using the same number of devices.

The **DW1000 HRP Tracker** demo software can be downloaded for free at www.shop.in-circuit.de.

All components are plug & play capable.

Setting up the complete system only takes a few minutes.

Features of the Starter Pack:

- Highly precise in-door RTLS

- Compact design

- Based on the *Decawave DW1000* radio chip

- Up to **2cm** resolution of position

- Up to **100Hz** refresh rate

- Demo software available for free

- Support of up to four anchors and four tags

- Up to **180 modules** possible with our protocol

Content of the Starter Pack:

- 4x DW1000 HRP Stick

- 3x USB power bank 5000mAh

- 1x USB docking station for master tag

- HRP demo software (free download)

For more informationen:
http://www.in-circuit.de/
http://www.radino.cc/

Setup & Operation of the DW1000 HRP Tracker software

Graphical User Interface

The GUI is divided in two parts. The background image/ground plan occupies the most part of the GUI. In this area the ranging is visualized

The left part of the GUI comprises the configuration fields.

1. The settings for the serial connection to the master anchor are located in the upper left corner.
2. Below of that you can find buttons to start ranging and send data to a certain device of the system.
3. The group box *Grid-Coordinates* allows for ground plan clipping.
4. The button *configure modules* opens the detection and configuration menu
5. The group boxes *Anchor & Tags* contain all configured anchors and tags.
6. The group box below provides tools for calibrating the ground plan and other options for the graphic presentation.
7. The buttons *load / save settings* allow for import and export of system settings (background, configuration of anchors and tags).
8. The lower left corner shows coordinates to help positioning the devices in the ground plan.
9. The language can be changed using the drop down menu in the upper right corner.
10. The most part of the GUI is used for visualization
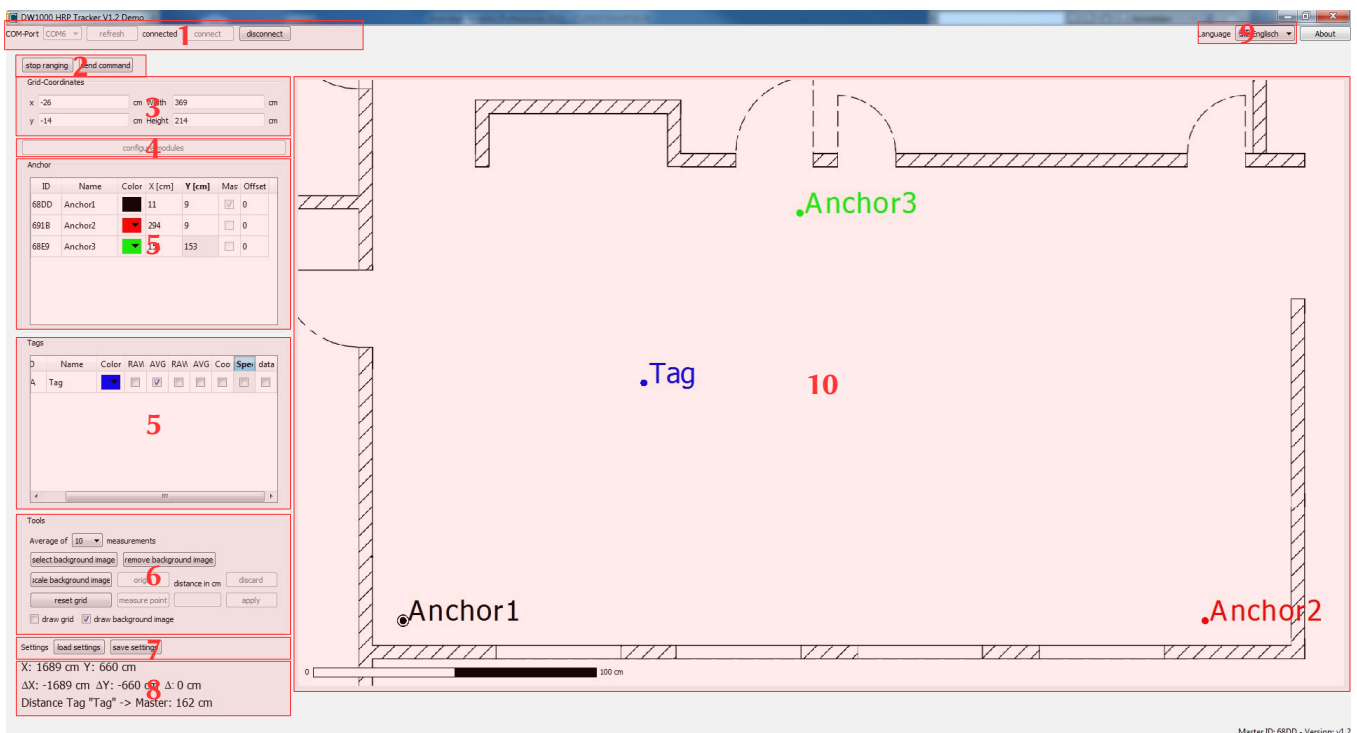
Preparation

The *DW1000 HRP Tracker* demo software can be downloaded for free at www.shop.in-circuit.de.
Simply download the ZIP-file and unpack it at your desired path. The software has been tested on a 64 Bit Windows 7 machine.
Prior to usage, the serial *CP2102-driver* has to be installed if needed. It is available online from numerous suppliers.

DW1000 HRP Starter Pack
First Steps

Setup & Operation of the DW1000 HRP Tracker software

Quick start quide

Connecting to the master anchor
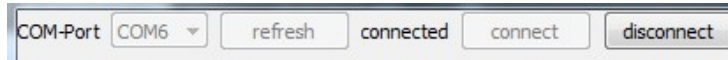
Connect the master anchor to the computer using the provided USB docking station. Then start the software *DW1000 HRP Tracker*. Set the serial COM-Port of the master Anchor in the upper left corner of the GUI. If the COM-Port does not appear in the drop down list, it can be refreshed by click the r*efresh* button. Clicking *connect* will open the COM-Port*, disconnect* will close it.

Loading a background image

A scaled ground plan of the room where the localization will take place should be chosen as a background image. The localized positions of the tags will be presented in this ground plan. To load a ground plan, click *select background image*. The software supports the image formats BMP, JPEG and PNG.
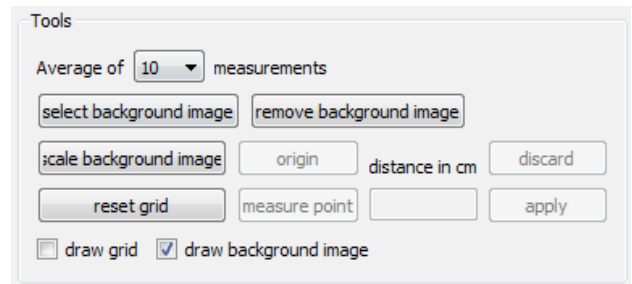

Notice: The background image will not be drawn until the connection to the master anchor is established.
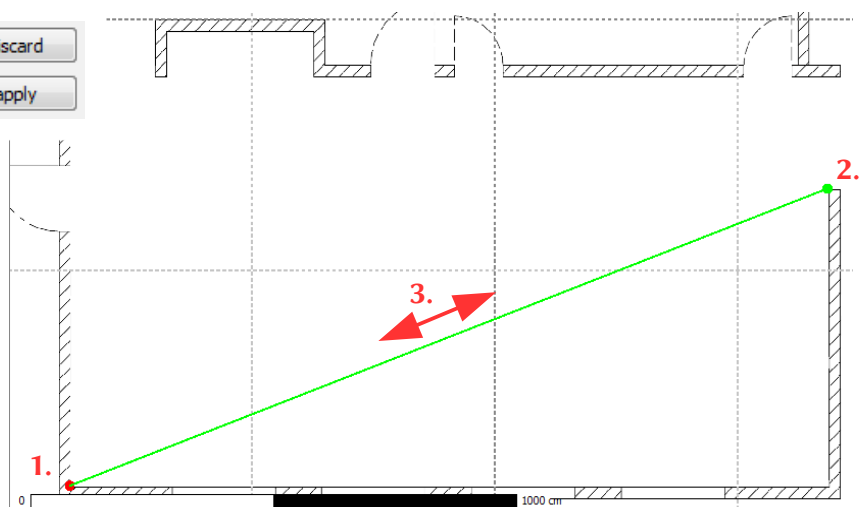
Scaling the background image

Without any adjustments, the program will interpret one pixel of the background image as one square centimeter. Thus 100 pixels in the image correspond to 1 meter. If the scale of the background image differs, it needs to be adjusted. To do so, all you need to know is the distance of two random points in the room, the length of a wall or a room diagonal. The larger the used distance, the more accurate the scaling. Clicking *scale background image* (group box: *Tools*) unlocks the needed buttons.

After Clicking on *origin* (**1**), you can mark the starting point of the known distance by clicking the corresponding location in the ground plan. A red dot will appear which can be moved several times by clicking somewhere else in the plan. As soon as the origins location is marked correctly, click on *measure point* to set the end of the known distance in the same manner(**2**). Then enter the linear distance of these two points in the corresponding text box (**3**). The button *apply* will adjust the grid to fit the set scale (**4**).
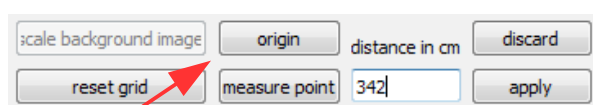
1. set origin
2. set measure point
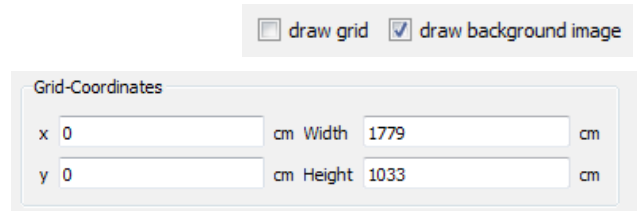**3.** enter distance
4. apply changes

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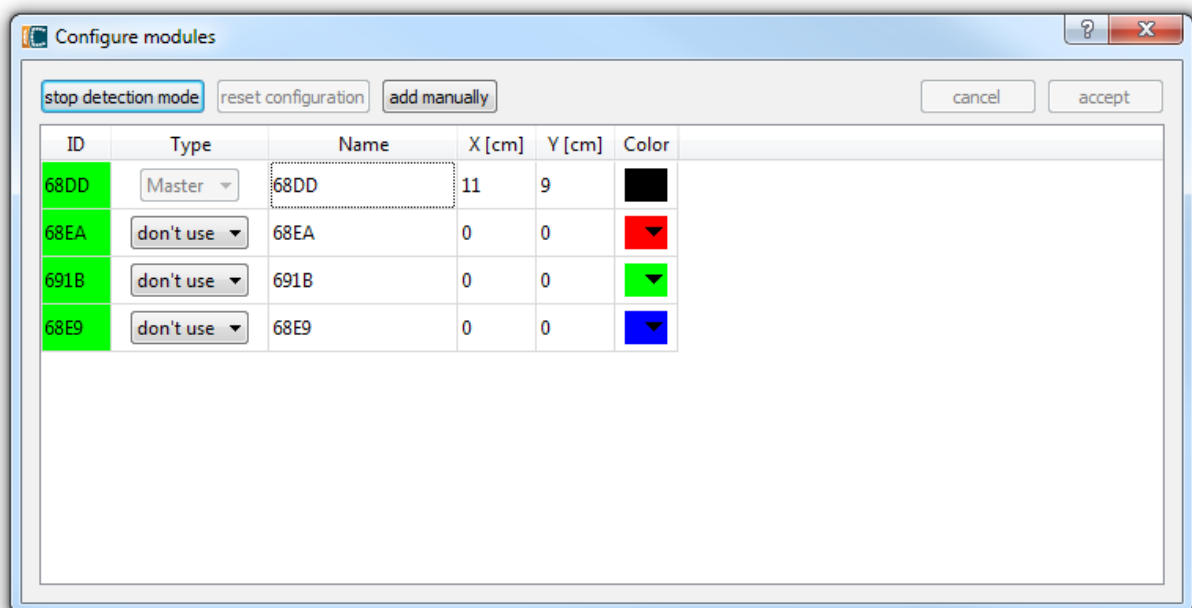
Quick start quide

Appearance

The visibility of the background image and grid can be switched with the check boxes *draw grid* and *draw background* .

By adjusting the values in the *text boxes* inside the group box *Grid-Coordinates* the visible area of the background image can be changed. The text boxes *x* and *y* set the lower left corner of the background's visible area, based on the **origin** set before. *Width* and *Height* define the absolute horizontal and vertical size of the visible background area. The unit is cm.

Identification of devices in range

Up to this point only the master anchor is defined in the software. At least two more anchors and one more Tag need to be configured to execute 2D-ranging. Devices can be detected automatically. By clicking *configure modules* (main window), you open the configuration menu. There, click *run detection mode* to start the automatic detection of modules in communication range of the master anchor. As soon as additional **DW1000 HRP-Sticks** are powered up, they appear in the list below. Wait for all devices to appear in the list, then leave the detection mode by clicking *stop detection mode.*

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Configuration of the devices

The first column in the *Configure modules*-window shows the ID of every detected device. It is equal to the last four digits of the device's serial number, printed onto the device's label.
The value in the second column defines whether the module is used as anchor, tag or if it stays unused. The master anchor's type can not be changed.
In the third column an individual name can be set to identify the devices in the ground plan.
The next two columns (*X* & *Y*) show the coordinates of the devices in the room. In case of the anchors, they can be set now (if known) or later by dragging them in the ground plan.
In the last column you can chose a color for the representation of the device in the ground plan
If all values have been set, you can save the configuration and leave the menu by clicking *accept*.
Clicking *cancel* will discard all changes and leave the menu.
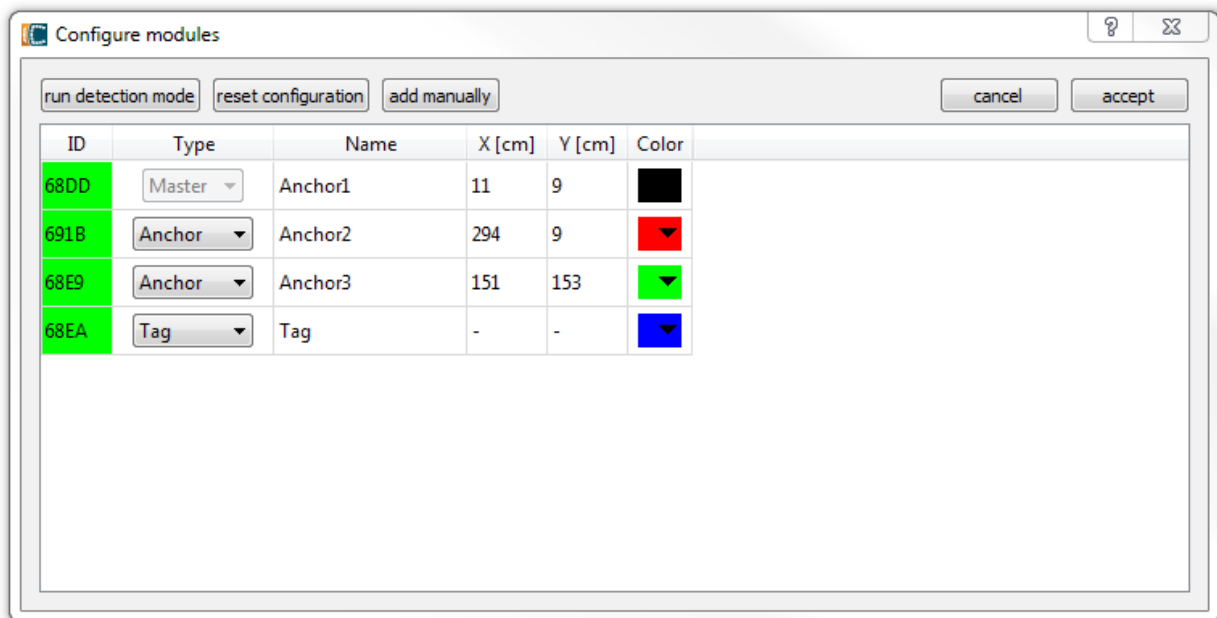
Note on using the software with less than 4 devices:
2D-ranging requires at least 3 anchors and one tag. Nevertheless it is possible to use the **DW1000 HRP Tracker** with a minimum of two devices (1 anchor & 1 tag). In this special case two dummy anchors have to be defined to reach the minimum number of devices. By clicking add manually a dummy device is being created. It is defined as an anchor automatically. After creating two dummy anchors the menu can be closed as described above.
If there are less than three real anchors defined, there will only be circles displayed in ranging mode representing the tags distance to the anchor/s. Calculating an unambiguous tag position is impossible.

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Placement of the anchors in the ground plan

All defined anchors are represented by colored dots in the ground plan, after the configuration menu has been closed. The master Anchor is displayed with an additional ring. The anchors name is being listed next to the dot. At the beginning, all anchors are located in the origin of the grid unless, their positions have already been defined during configuration. They can be placed by drag&drop with the left mouse button. While the left mouse button is pressed, the program displays the cursor's position in relation to the set origin in the lower left corner (*X & Y*), as well as the moved distance. A left-click in the ground plane shows the absolute position of the cursor and zeroes the distance display. Now you can measure distances in relation to the last left-click by moving the cursor while holding the right mouse button. Using these aids, all anchors should be placed in the ground plan according to their real positions in the room.
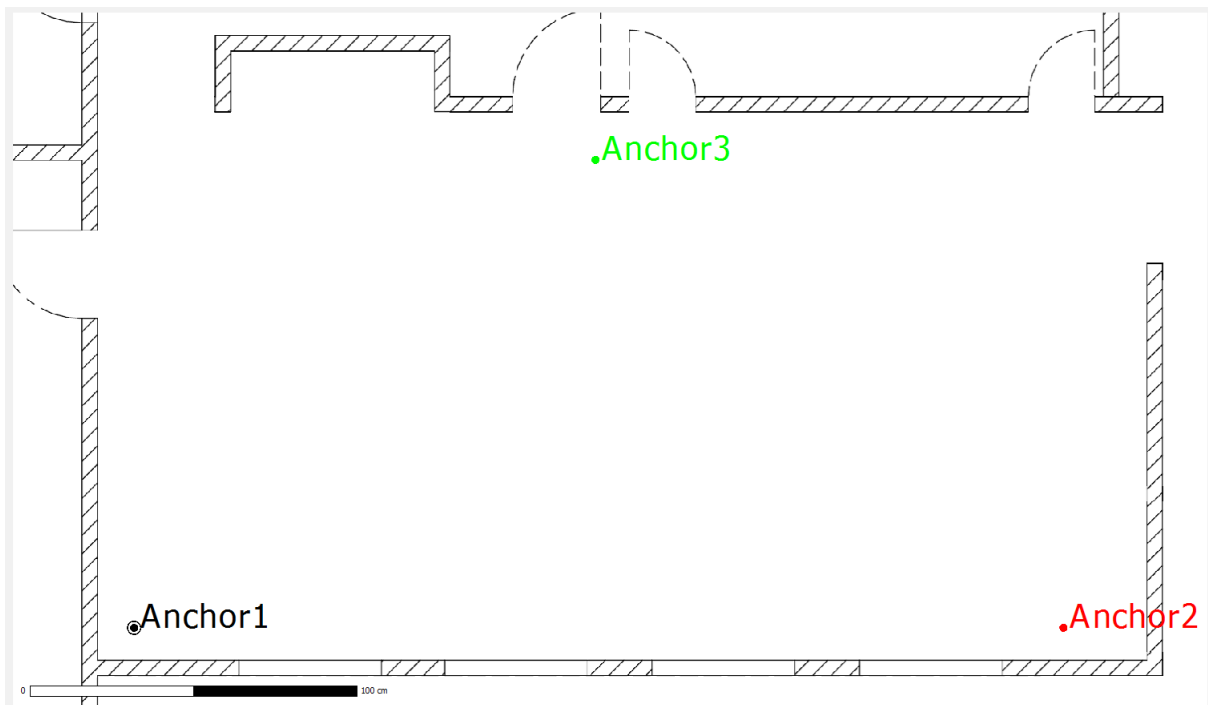
Alternatively you can change the anchor's positions by directely entering their coordinates (X/Y) in the corresponding fields in the *Anchor* group.

ID	Name	Color	X [cm]	Y [cm]	Mas	Offset
68DD	Anchor1	■	11	9	☑	0
68EA	Anchor2	▼ (red)	294	9	☐	0
691B	Anchor3	▼ (green)	151	153	☐	0

All settings (anchors and their positions, tags, ground plan) can be exported and imported with *save settings* and *load settings*.

Settings [load settings] [save settings]

X: 119 cm Y: 97 cm

ΔX: 81 cm ΔY: 68 cm Δ: 105 cm
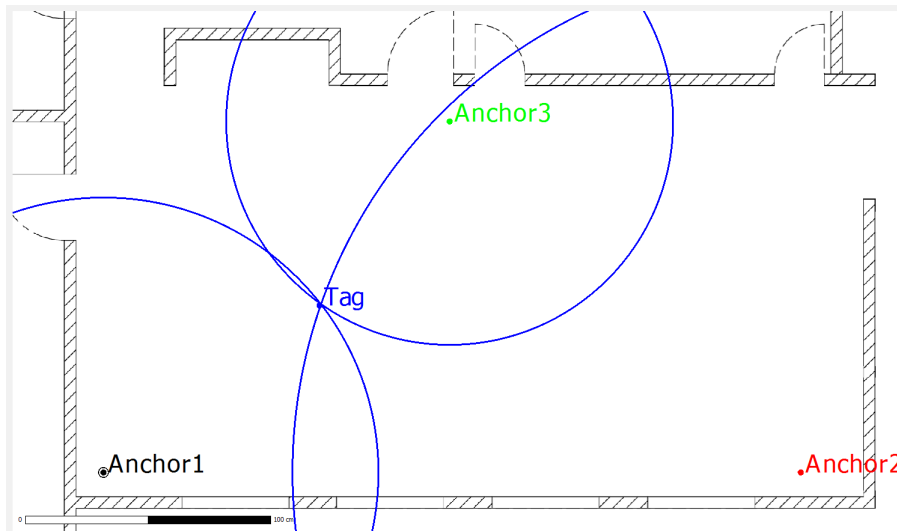
Distance Tag "Tag" -> Master: 22 cm

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Ranging mode

After all configurations have been done, the ranging can be started by clicking *start ranging*.
All defined and present tags should immediately appear in the ground plane, assuming correct configuration.

The group box *Tools* offers the possibility to smooth the tag's movement by calculating the average of the last 1 to 100 measurements. Changing this value effects the presentation of *AVG Pos* and *AVG Dist* (see below).

In the *Tags*-list, you can choose between different presentation options of the tag's positions. Moving the cursor over the column's titles reveals a short explanation of the function.

From left to right the check boxes do the following:
1. *RAW Pos* activates the presentation of the raw position data.
2. *AVG Pos* activates the presentation of the smoothed position data, depending on the number of measurements used to calculate the average position
3. *RAW Dist* activates the presentation of the raw distance circles. If activated, the programm draws a Circle around every Anchor representing the measured distance between it and the tag.
4. *AVG Dist* activates the presentation of the smoothed distance circles. (analogous to 2.)
5. *Coordinates* activates the presentation of the tag's coordinates next to the dot in the ground plan.
6. *Speed* activates the presentation of the tag's speed next to the dot in the ground plan.
7. *Datarate* activates the presentation of the tag's data rate next to the dot in the ground plan.

Via the button *send command* the master tag can send configuration commands to any devices of the system. To demonstrate this feature, the demo software supports commands to switch the RX- and TX-LED of any available device.
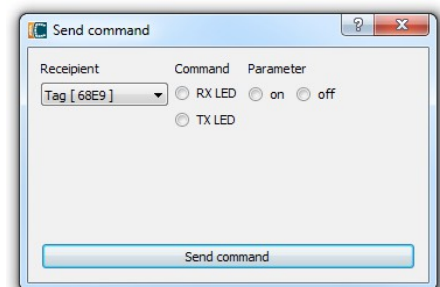
Ordering Information

Article	Ordering number
High Resolution Positioning Starter Pack	902.065
High Resolution Positioning Stick	901.469C001
Powerbank 5000mAh	303.387
Wall power supply 5V 500mA, for mounting the sticks directly on a wall outlet	303.448

RoHS / WEEE compliant

WEEE-Reg.-Nr. DE 17225017
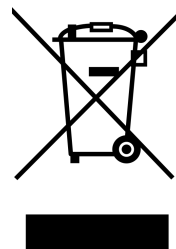
Version	Date	Changes	Editor
A	2018/10/09	Initial version	Klause